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**Department of Defense
Fiscal Year (FY) 2024 Budget Estimates**

March 2023



Air Force

Justification Book Volume 1 of 4

Research, Development, Test & Evaluation, Air Force

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Air Force • Budget Estimates FY 2024 • RDT&E Program

Table of Volumes

Research, Development, Test & Evaluation, Air Force..... Volume 1
Research, Development, Test & Evaluation, Air Force..... Volume 2
Research, Development, Test & Evaluation, Air Force..... Volume 3
Research, Development, Test & Evaluation, Air Force..... Volume 4

UNCLASSIFIED

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UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Volume 1 Table of Contents

Introduction and Explanation of Contents.....Volume 1 - v
Comptroller Exhibit R-1..... Volume 1 - vii
Master Program Element Table of Contents (by Budget Activity then Line Item Number).....Volume 1 - xxxvii
Master Program Element Table of Contents (Alphabetically by Program Element Title)..... Volume 1 - lv
Summary.....Volume 1 - lxxix
OP8.....Volume 1 - lxxi
Acronyms..... Volume 1 - lxxv
Exhibit R-2s..... Volume 1 - 1

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Fiscal Year (FY) 2024 President's Budget RDT&E Descriptive Summaries Budget Activities March 2023

INTRODUCTION AND EXPLANATION OF CONTENTS

GENERAL

- This document has been prepared to provide information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) program elements and projects in the FY24 President's Budget (PB).
 - All exhibits in this document have been assembled in accordance with DoD 7000.14R, Financial Management Regulation, Volume 2B, Chapter 5.
 - Other comments on exhibit contents in this document:
 - Exhibits R-2/2a and R-3 provide narrative information for all RDT&E program elements and projects within the USAF FY 2024 RDT&E program with the exception of classified program elements. The format and contents of this document are in accordance to the guidelines and requirements of the Congressional committees in so far as possible.
 - The "Other Program Funding Summary" portion of the R-2 includes, in addition to RDT&E funds, Procurement funds and quantities, Military Construction appropriation funds on specific development programs, Operations and Maintenance appropriation funds where they are essential to the development effort described, and where appropriate, Department of Energy (DOE) costs.

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- All exhibits contained in Volumes I, II, and III are unclassified. Classified exhibits are not included in the submission due to the level of security classification and necessity of special security clearances.

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022 Actuals	FY 2023 Less Supplementals Enactment	FY 2023 Supplementals Enactment*	FY 2023 Total Enactment
1	0601102F	Defense Research Sciences	01	U	331,118	406,125		406,125
2	0601103F	University Research Initiatives	01	U	174,048	206,192		206,192
	Basic Research				505,166	612,317		612,317
3	0602020F	Future AF Capabilities Applied Research University Affiliated Research Center (UARC) - Tactical	02	U	74,393	99,901		99,901
4	0602022F	Autonomy	02	U				
5	0602102F	Materials	02	U	214,878	275,945		275,945
6	0602201F	Aerospace Vehicle Technologies	02	U	173,628	199,453		199,453
7	0602202F	Human Effectiveness Applied Research	02	U	139,287	150,771		150,771
8	0602203F	Aerospace Propulsion	02	U	173,665	212,361		212,361
9	0602204F	Aerospace Sensors	02	U	244,612	260,833		260,833
10	0602212F	Defense Laboratories R&D Projects (10 U.S.C, Sec 2358) Science and Technology Management - Major Headquarters	02	U	98,862			
11	0602298F	Activities	02	U	8,891	8,856		8,856
12	0602602F	Conventional Munitions	02	U	142,906	144,303		144,303
13	0602605F	Directed Energy Technology	02	U	109,529	120,947		120,947
14	0602788F	Dominant Information Sciences and Methods	02	U	209,892	271,005		271,005
	Applied Research				1,590,543	1,744,375		1,744,375
15	0603032F	Future AF Integrated Technology Demos	03	U	103,886	163,887		163,887
16	0603112F	Advanced Materials for Weapon Systems	03	U	60,566	49,765		49,765
17	0603199F	Sustainment Science and Technology (S&T)	03	U	17,598	10,662		10,662

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
1	0601102F	Defense Research Sciences	01	U	401,486
2	0601103F	University Research Initiatives	01	U	182,372
	Basic Research				583,858
3	0602020F	Future AF Capabilities Applied Research University Affiliated Research Center (UARC) - Tactical	02	U	90,713
4	0602022F	Autonomy	02	U	8,018
5	0602102F	Materials	02	U	142,325
6	0602201F	Aerospace Vehicle Technologies	02	U	161,268
7	0602202F	Human Effectiveness Applied Research	02	U	146,921
8	0602203F	Aerospace Propulsion	02	U	184,867
9	0602204F	Aerospace Sensors	02	U	216,269
10	0602212F	Defense Laboratories R&D Projects (10 U.S.C, Sec 2358) Science and Technology Management - Major Headquarters	02	U	
11	0602298F	Activities	02	U	10,303
12	0602602F	Conventional Munitions	02	U	160,599
13	0602605F	Directed Energy Technology	02	U	129,961
14	0602788F	Dominant Information Sciences and Methods	02	U	182,076
	Applied Research				1,433,320
15	0603032F	Future AF Integrated Technology Demos	03	U	255,855
16	0603112F	Advanced Materials for Weapon Systems	03	U	30,372
17	0603199F	Sustainment Science and Technology (S&T)	03	U	10,478

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
18	0603203F	Advanced Aerospace Sensors	03	U	50,326	37,917		37,917
19	0603211F	Aerospace Technology Dev/Demo	03	U	98,806	95,267		95,267
20	0603216F	Aerospace Propulsion and Power Technology	03	U	103,219	94,540		94,540
21	0603270F	Electronic Combat Technology	03	U	41,869	31,037		31,037
22	0603273F	Science & Technology for Nuclear Re-entry Systems	03	U		27,031		27,031
23	0603444F	Maui Space Surveillance System (MSSS)	03	U				
24	0603456F	Human Effectiveness Advanced Technology Development	03	U	31,135	15,440		15,440
25	0603601F	Conventional Weapons Technology	03	U	144,116	154,618		154,618
26	0603605F	Advanced Weapons Technology	03	U	29,585	89,024		89,024
27	0603680F	Manufacturing Technology Program	03	U	169,459	270,959		270,959
28	0603788F	Battlespace Knowledge Development and Demonstration	03	U	67,753	55,919		55,919
29	0207412F	Control and Reporting Center (CRC)	03	U				
	Advanced Technology Development				918,318	1,096,066		1,096,066
30	0603036F	Modular Advanced Missile	04	U		75,688		75,688
31	0603260F	Intelligence Advanced Development	04	U	5,795	6,101	1,300	7,401
32	0603742F	Combat Identification Technology	04	U	17,536	13,718		13,718
33	0603790F	NATO Research and Development	04	U	4,114	4,295		4,295
34	0603851F	Intercontinental Ballistic Missile - Dem/Val	04	U	73,897	46,100		46,100
35	0604001F	NC3 Advanced Concepts	04	U	6,900	5,098		5,098
36	0604002F	Air Force Weather Services Research	04	U	3,714			
37	0604003F	Advanced Battle Management System (ABMS)	04	U	262,452	237,332		237,332

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
18	0603203F	Advanced Aerospace Sensors	03	U	48,046
19	0603211F	Aerospace Technology Dev/Demo	03	U	51,896
20	0603216F	Aerospace Propulsion and Power Technology	03	U	56,789
21	0603270F	Electronic Combat Technology	03	U	32,510
22	0603273F	Science & Technology for Nuclear Re-entry Systems	03	U	70,321
23	0603444F	Maui Space Surveillance System (MSSS)	03	U	2
24	0603456F	Human Effectiveness Advanced Technology Development	03	U	15,593
25	0603601F	Conventional Weapons Technology	03	U	132,311
26	0603605F	Advanced Weapons Technology	03	U	102,997
27	0603680F	Manufacturing Technology Program	03	U	44,422
28	0603788F	Battlespace Knowledge Development and Demonstration	03	U	37,779
29	0207412F	Control and Reporting Center (CRC)	03	U	2,005
	Advanced Technology Development				891,376
30	0603036F	Modular Advanced Missile	04	U	105,238
31	0603260F	Intelligence Advanced Development	04	U	6,237
32	0603742F	Combat Identification Technology	04	U	21,298
33	0603790F	NATO Research and Development	04	U	2,208
34	0603851F	Intercontinental Ballistic Missile - Dem/Val	04	U	45,319
35	0604001F	NC3 Advanced Concepts	04	U	10,011
36	0604002F	Air Force Weather Services Research	04	U	
37	0604003F	Advanced Battle Management System (ABMS)	04	U	500,575

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
38	0604004F	Advanced Engine Development	04	U	562,717	220,363		220,363
39	0604005F	NC3 Commercial Development & Prototyping	04	U		97,000		97,000
40	0604006F	Dept of the Air Force Tech Architecture	04	U	24,407	50,000		50,000
41	0604007F	E-7	04	U		426,776		426,776
42	0604009F	AFWERX Prime	04	U		170,860		170,860
43	0604015F	Long Range Strike - Bomber	04	U	2,775,581	3,143,584		3,143,584
44	0604025F	Rapid Defense Experimentation Reserve (RDER)	04	U				
45	0604032F	Directed Energy Prototyping	04	U	15,498	4,269		4,269
46	0604033F	Hypersonics Prototyping	04	U	308,089	114,981		114,981
47	0604183F	Hypersonics Prototyping - Hypersonic Attack Cruise Missile (HACM)	04	U	183,889	423,359		423,359
48	0604201F	PNT Resiliency, Mods, and Improvements	04	U	46,022	12,010		12,010
49	0604257F	Advanced Technology and Sensors	04	U	23,745	12,311		12,311
50	0604288F	Survivable Airborne Operations Center (SAOC)	04	U	91,378	98,213		98,213
51	0604317F	Technology Transfer	04	U	36,574	35,430		35,430
52	0604327F	Hard and Deeply Buried Target Defeat System (HDBTDS) Program	04	U	12,826	141,826		141,826
53	0604414F	Cyber Resiliency of Weapon Systems-ACS	04	U	69,143	43,372		43,372
54	0604534F	Adaptive Engine Transition Program (AETP)	04	U		286,096		286,096
55	0604668F	Joint Transportation Management System (JTMS)	04	U		27,758		27,758
56	0604776F	Deployment & Distribution Enterprise R&D	04	U	39,311	27,586		27,586
57	0604858F	Tech Transition Program	04	U	348,134	370,810		370,810

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
38	0604004F	Advanced Engine Development	04	U	595,352
39	0604005F	NC3 Commercial Development & Prototyping	04	U	78,799
40	0604006F	Dept of the Air Force Tech Architecture	04	U	2,620
41	0604007F	E-7	04	U	681,039
42	0604009F	AFWERX Prime	04	U	83,336
43	0604015F	Long Range Strike - Bomber	04	U	2,984,143
44	0604025F	Rapid Defense Experimentation Reserve (RDER)	04	U	154,300
45	0604032F	Directed Energy Prototyping	04	U	1,246
46	0604033F	Hypersonics Prototyping	04	U	150,340
47	0604183F	Hypersonics Prototyping - Hypersonic Attack Cruise Missile (HACM)	04	U	381,528
48	0604201F	PNT Resiliency, Mods, and Improvements	04	U	18,041
49	0604257F	Advanced Technology and Sensors	04	U	27,650
50	0604288F	Survivable Airborne Operations Center (SAOC)	04	U	888,829
51	0604317F	Technology Transfer	04	U	26,638
52	0604327F	Hard and Deeply Buried Target Defeat System (HDBTDS) Program	04	U	19,266
53	0604414F	Cyber Resiliency of Weapon Systems-ACS	04	U	37,121
54	0604534F	Adaptive Engine Transition Program (AETP)	04	U	
55	0604668F	Joint Transportation Management System (JTMS)	04	U	37,026
56	0604776F	Deployment & Distribution Enterprise R&D	04	U	31,833
57	0604858F	Tech Transition Program	04	U	210,806

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
58	0604860F	Operational Energy and Installation Resilience	04	U	100,839	25,500		25,500
59	0605164F	Air Refueling Capability Modernization	04	U		11,281		11,281
60	0605230F	Ground Based Strategic Deterrent	04	U	2,464,875			
61	0207110F	Next Generation Air Dominance	04	U	1,452,934	1,657,635		1,657,635
62	0207179F	Autonomous Collaborative Platforms	04	U		51,747		51,747
63	0207420F	Combat Identification	04	U		1,866		1,866
64	0207455F	Three Dimensional Long-Range Radar (3DELRR)	04	U		14,490		14,490
65	0207522F	Airbase Air Defense Systems (ABADS)	04	U	10,526	47,465		47,465
66	0208030F	War Reserve Materiel - Ammunition	04	U	3,943	10,288		10,288
67	0304369F	Cyber Capabilities Support Office (CCSO)	04	U	16,949			
68	0305236F	Common Data Link Executive Agent (CDL EA)	04	U	43,881	37,460		37,460
69	0305601F	Mission Partner Environments	04	U	15,819	17,378		17,378
70	0306250F	Cyber Operations Technology Support	04	U	272,404	272,583		272,583
71	0306415F	Enabled Cyber Activities	04	U	23,511	16,728		16,728
72	0708051F	Rapid Sustainment Modernization (RSM)	04	U	90,117	69,000		69,000
73	0808737F	Integrated Primary Prevention	04	U		9,315		9,315
74	0901410F	Contracting Information Technology System	04	U	19,733	14,050		14,050
75	1206415F	U.S. Space Command Research and Development Support	04	U		8,350		8,350
Advanced Component Development & Prototypes					9,427,253	8,360,072	1,300	8,361,372
76	0604200F	Future Advanced Weapon Analysis & Programs	05	U	18,180	9,879		9,879
77	0604201F	PNT Resiliency, Mods, and Improvements	05	U	158,193	176,335		176,335

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
58	0604860F	Operational Energy and Installation Resilience	04	U	46,305
59	0605164F	Air Refueling Capability Modernization	04	U	19,400
60	0605230F	Ground Based Strategic Deterrent	04	U	
61	0207110F	Next Generation Air Dominance	04	U	2,326,128
62	0207179F	Autonomous Collaborative Platforms	04	U	118,826
63	0207420F	Combat Identification	04	U	1,902
64	0207455F	Three Dimensional Long-Range Radar (3DELRR)	04	U	19,763
65	0207522F	Airbase Air Defense Systems (ABADS)	04	U	78,867
66	0208030F	War Reserve Materiel - Ammunition	04	U	8,175
67	0304369F	Cyber Capabilities Support Office (CCSO)	04	U	
68	0305236F	Common Data Link Executive Agent (CDL EA)	04	U	25,157
69	0305601F	Mission Partner Environments	04	U	17,727
70	0306250F	Cyber Operations Technology Support	04	U	
71	0306415F	Enabled Cyber Activities	04	U	
72	0708051F	Rapid Sustainment Modernization (RSM)	04	U	43,431
73	0808737F	Integrated Primary Prevention	04	U	9,364
74	0901410F	Contracting Information Technology System	04	U	28,294
75	1206415F	U.S. Space Command Research and Development Support	04	U	14,892
	Advanced Component Development & Prototypes				9,859,030
76	0604200F	Future Advanced Weapon Analysis & Programs	05	U	9,757
77	0604201F	PNT Resiliency, Mods, and Improvements	05	U	163,156

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
78	0604222F	Nuclear Weapons Support	05	U	29,215	63,906		63,906
79	0604270F	Electronic Warfare Development	05	U	6,849	7,222		7,222
80	0604281F	Tactical Data Networks Enterprise	05	U	122,940	129,941		129,941
81	0604287F	Physical Security Equipment	05	U	8,302	6,897		6,897
82	0604602F	Armament/Ordnance Development	05	U	8,821	5,279		5,279
83	0604604F	Submunitions	05	U	2,954	3,273		3,273
84	0604617F	Agile Combat Support	05	U	26,972	19,252		19,252
85	0604706F	Life Support Systems	05	U	22,335	50,042		50,042
86	0604735F	Combat Training Ranges	05	U	23,218	103,784		103,784
87	0604932F	Long Range Standoff Weapon	05	U	580,365	928,850		928,850
88	0604933F	ICBM Fuze Modernization	05	U	115,200	98,376		98,376
89	0605030F	Joint Tactical Network Center (JTNC)	05	U		2,222		2,222
90	0605031F	Joint Tactical Network (JTN)	05	U				
91	0605056F	Open Architecture Management	05	U	36,157	38,201		38,201
92	0605057F	Next Generation Air-refueling System	05	U				
93	0605223F	Advanced Pilot Training	05	U	182,330	33,621		33,621
94	0605229F	HH-60W	05	U	53,363	58,974		58,974
95	0605238F	Ground Based Strategic Deterrent EMD	05	U		3,614,290		3,614,290
96	0207171F	F-15 EPAWSS	05	U	100,232	67,956		67,956
97	0207279F	Isolated Personnel Survivability and Recovery	05	U		27,881		27,881
98	0207328F	Stand In Attack Weapon	05	U	161,199	263,152		263,152

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line <u>No</u>	Program Element <u>Number</u>	<u>Item</u>	<u>Act</u>	<u>Se</u> <u>c</u>	FY 2024 <u>Request</u>
78	0604222F	Nuclear Weapons Support	05	U	45,884
79	0604270F	Electronic Warfare Development	05	U	13,804
80	0604281F	Tactical Data Networks Enterprise	05	U	74,023
81	0604287F	Physical Security Equipment	05	U	10,605
82	0604602F	Armament/Ordnance Development	05	U	5,918
83	0604604F	Submunitions	05	U	3,345
84	0604617F	Agile Combat Support	05	U	21,967
85	0604706F	Life Support Systems	05	U	39,301
86	0604735F	Combat Training Ranges	05	U	152,569
87	0604932F	Long Range Standoff Weapon	05	U	911,406
88	0604933F	ICBM Fuze Modernization	05	U	71,732
89	0605030F	Joint Tactical Network Center (JTNC)	05	U	2,256
90	0605031F	Joint Tactical Network (JTN)	05	U	452
91	0605056F	Open Architecture Management	05	U	36,582
92	0605057F	Next Generation Air-refueling System	05	U	7,928
93	0605223F	Advanced Pilot Training	05	U	77,252
94	0605229F	HH-60W	05	U	48,268
95	0605238F	Ground Based Strategic Deterrent EMD	05	U	3,746,935
96	0207171F	F-15 EPAWSS	05	U	13,982
97	0207279F	Isolated Personnel Survivability and Recovery	05	U	56,225
98	0207328F	Stand In Attack Weapon	05	U	298,585

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
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99	0207701F	Full Combat Mission Training	05	U	12,064	12,528		12,528
100	0208036F	Medical C-CBRNE Programs	05	U				
101	0303267F	Auctioned Spectrum Relocation Fund	05	U	28,186			
102	0305205F	Endurance Unmanned Aerial Vehicles	05	U				
103	0401221F	KC-46A Tanker Squadrons	05	U	54,145	177,529		177,529
104	0401319F	VC-25B	05	U	407,147	147,932		147,932
105	0701212F	Automated Test Systems	05	U	15,445	16,664		16,664
106	0804772F	Training Developments	05	U	2,482	10,838		10,838
System Development & Demonstration					2,176,294	6,074,824		6,074,824
107	0604256F	Threat Simulator Development	06	U	46,393	21,067		21,067
108	0604759F	Major T&E Investment	06	U	128,708	171,314		171,314
109	0605101F	RAND Project Air Force	06	U	34,698	32,767		32,767
110	0605502F	Small Business Innovation Research	06	U	780,381			
111	0605712F	Initial Operational Test & Evaluation	06	U	12,582	13,926		13,926
112	0605807F	Test and Evaluation Support	06	U	811,032	841,854		841,854
113	0605827F	Acq Workforce- Global Vig & Combat Sys	06	U	271,819	283,995		283,995
114	0605828F	Acq Workforce- Global Reach	06	U	439,459	457,589		457,589
115	0605829F	Acq Workforce- Cyber, Network, & Bus Sys	06	U	432,971	479,423		479,423
116	0605830F	Acq Workforce- Global Battle Mgmt	06	U		3,696		3,696
117	0605831F	Acq Workforce- Capability Integration	06	U	255,914	253,568		253,568
118	0605832F	Acq Workforce- Advanced Prgm Technology	06	U	61,648	67,361		67,361

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
99	0207701F	Full Combat Mission Training	05	U	7,597
100	0208036F	Medical C-CBRNE Programs	05	U	2,006
101	0303267F	Auctioned Spectrum Relocation Fund	05	U	
102	0305205F	Endurance Unmanned Aerial Vehicles	05	U	30,000
103	0401221F	KC-46A Tanker Squadrons	05	U	124,662
104	0401319F	VC-25B	05	U	490,701
105	0701212F	Automated Test Systems	05	U	12,911
106	0804772F	Training Developments	05	U	1,922
	System Development & Demonstration				6,481,731
107	0604256F	Threat Simulator Development	06	U	16,626
108	0604759F	Major T&E Investment	06	U	31,143
109	0605101F	RAND Project Air Force	06	U	38,398
110	0605502F	Small Business Innovation Research	06	U	1,466
111	0605712F	Initial Operational Test & Evaluation	06	U	13,736
112	0605807F	Test and Evaluation Support	06	U	913,213
113	0605827F	Acq Workforce- Global Vig & Combat Sys	06	U	317,901
114	0605828F	Acq Workforce- Global Reach	06	U	541,677
115	0605829F	Acq Workforce- Cyber, Network, & Bus Sys	06	U	551,213
116	0605830F	Acq Workforce- Global Battle Mgmt	06	U	
117	0605831F	Acq Workforce- Capability Integration	06	U	243,780
118	0605832F	Acq Workforce- Advanced Prgm Technology	06	U	109,030

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
119	0605833F	Acq Workforce- Nuclear Systems	06	U	227,425	236,382		236,382
120	0605898F	Management HQ - R&D	06	U	6,644	5,624		5,624
121	0605976F	Facilities Restoration and Modernization - Test and Evaluation Support	06	U	70,788	133,420		133,420
122	0605978F	Facilities Sustainment - Test and Evaluation Support	06	U	30,057	31,561		31,561
123	0606017F	Requirements Analysis and Maturation	06	U	88,259	109,513		109,513
124	0606398F	Management HQ - T&E	06	U	7,263	6,285		6,285
125	0303166F	Support to Information Operations (IO) Capabilities	06	U	537	556		556
126	0303255F	Command, Control, Communication, and Computers (C4) -	06	U	35,340	29,092		29,092
127	0308602F	ENTEPRISE INFORMATION SERVICES (EIS)	06	U	26,004	73,100		73,100
128	0702806F	Acquisition and Management Support	06	U	36,317	49,152		49,152
129	0804731F	General Skill Training	06	U	1,506	871		871
130	0804772F	Training Developments	06	U	2,957			
131	0909999F	Financing for Cancelled Account Adjustments	06	U	17,055			
132	1001004F	International Activities	06	U	2,420	2,593		2,593
133	1206864F	Space Test Program (STP)	06	U	2			
		Management Support			3,828,179	3,304,709		3,304,709
134	0604233F	Specialized Undergraduate Flight Training	07	U	8,333	17,267		17,267
135	0604283F	Battle Mgmt Com & Ctrl Sensor Development	07	U				
136	0604445F	Wide Area Surveillance	07	U	2,687			
137	0604617F	Agile Combat Support	07	U		8,199		8,199

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
119	0605833F	Acq Workforce- Nuclear Systems	06	U	336,788
120	0605898F	Management HQ - R&D	06	U	5,005
121	0605976F	Facilities Restoration and Modernization - Test and Evaluation Support	06	U	87,889
122	0605978F	Facilities Sustainment - Test and Evaluation Support	06	U	35,065
123	0606017F	Requirements Analysis and Maturation	06	U	89,956
124	0606398F	Management HQ - T&E	06	U	7,453
125	0303166F	Support to Information Operations (IO) Capabilities	06	U	
126	0303255F	Command, Control, Communication, and Computers (C4) - STRATCOM	06	U	20,871
127	0308602F	ENTEPRISE INFORMATION SERVICES (EIS)	06	U	100,357
128	0702806F	Acquisition and Management Support	06	U	20,478
129	0804731F	General Skill Training	06	U	796
130	0804772F	Training Developments	06	U	
131	0909999F	Financing for Cancelled Account Adjustments	06	U	
132	1001004F	International Activities	06	U	3,917
133	1206864F	Space Test Program (STP)	06	U	
	Management Support				3,486,758
134	0604233F	Specialized Undergraduate Flight Training	07	U	41,464
135	0604283F	Battle Mgmt Com & Ctrl Sensor Development	07	U	40,000
136	0604445F	Wide Area Surveillance	07	U	8,018
137	0604617F	Agile Combat Support	07	U	5,645

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
138	0604776F	Deployment & Distribution Enterprise R&D	07	U	193	156		156
139	0604840F	F-35 C2D2	07	U	1,085,909	1,032,528		1,032,528
140	0605018F	AF Integrated Personnel and Pay System (AF-IPPS)	07	U	25,582	37,901		37,901
141	0605024F	Anti-Tamper Technology Executive Agency	07	U	50,669	50,066		50,066
142	0605117F	Foreign Materiel Acquisition and Exploitation	07	U	109,249	80,338	37,500	117,838
143	0605278F	HC/MC-130 Recap RDT&E	07	U	43,095	52,940		52,940
144	0606018F	NC3 Integration	07	U	30,077	22,743		22,743
145	0101113F	B-52 Squadrons	07	U	620,115	723,107		723,107
146	0101122F	Air-Launched Cruise Missile (ALCM)	07	U	436	571		571
147	0101126F	B-1B Squadrons	07	U	37,951	20,044		20,044
148	0101127F	B-2 Squadrons	07	U	123,749	101,790		101,790
149	0101213F	Minuteman Squadrons	07	U	111,754	73,650		73,650
150	0101316F	Worldwide Joint Strategic Communications	07	U	11,712	22,708		22,708
151	0101318F	Service Support to STRATCOM - Global Strike	07	U				
152	0101324F	Integrated Strategic Planning & Analysis Network	07	U	28,895	32,062		32,062
153	0101328F	ICBM Reentry Vehicles	07	U	100,463	115,616		115,616
155	0102110F	MH-139A	07	U	15,913	15,922		15,922
156	0102326F	Region/Sector Operation Control Center Modernization Program	07	U	756	406		406
157	0102412F	North Warning System (NWS)	07	U	95	240,159		240,159
158	0102417F	Over-the-Horizon Backscatter Radar	07	U	66,022	12,210		12,210

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
138	0604776F	Deployment & Distribution Enterprise R&D	07	U	
139	0604840F	F-35 C2D2	07	U	1,275,268
140	0605018F	AF Integrated Personnel and Pay System (AF-IPPS)	07	U	40,203
141	0605024F	Anti-Tamper Technology Executive Agency	07	U	49,613
142	0605117F	Foreign Materiel Acquisition and Exploitation	07	U	93,881
143	0605278F	HC/MC-130 Recap RDT&E	07	U	36,536
144	0606018F	NC3 Integration	07	U	22,910
145	0101113F	B-52 Squadrons	07	U	950,815
146	0101122F	Air-Launched Cruise Missile (ALCM)	07	U	290
147	0101126F	B-1B Squadrons	07	U	12,619
148	0101127F	B-2 Squadrons	07	U	87,623
149	0101213F	Minuteman Squadrons	07	U	33,237
150	0101316F	Worldwide Joint Strategic Communications	07	U	24,653
151	0101318F	Service Support to STRATCOM - Global Strike	07	U	7,562
152	0101324F	Integrated Strategic Planning & Analysis Network	07	U	
153	0101328F	ICBM Reentry Vehicles	07	U	475,415
155	0102110F	MH-139A	07	U	25,737
156	0102326F	Region/Sector Operation Control Center Modernization Program	07	U	831
157	0102412F	North Warning System (NWS)	07	U	102
158	0102417F	Over-the-Horizon Backscatter Radar	07	U	428,754

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
159	0202834F	Vehicles and Support Equipment - General	07	U	2,909	14,483		14,483
160	0205219F	MQ-9 UAV	07	U	76,847	145,499		145,499
161	0205671F	Joint Counter RCIED Electronic Warfare	07	U	3,733	1,747		1,747
162	0207040F	Multi-Platform Electronic Warfare Equipment	07	U	27,063	45,895		45,895
163	0207131F	A-10 Squadrons	07	U	33,434	64,593		64,593
164	0207133F	F-16 Squadrons	07	U	221,838	247,536		247,536
165	0207134F	F-15E Squadrons	07	U	231,898	200,139		200,139
166	0207136F	Manned Destructive Suppression	07	U	14,222	16,695		16,695
167	0207138F	F-22A Squadrons	07	U	626,329	559,709		559,709
168	0207142F	F-35 Squadrons	07	U	58,374	65,730		65,730
169	0207146F	F-15EX	07	U	103,950	83,830		83,830
170	0207161F	Tactical AIM Missiles	07	U	31,863	34,536		34,536
171	0207163F	Advanced Medium Range Air-to-Air Missile (AMRAAM)	07	U	49,686	52,704		52,704
172	0207227F	Combat Rescue - Pararescue	07	U	845	863		863
173	0207238F	E-11A	07	U				
174	0207247F	AF TENCAP	07	U	23,685	23,309	2,250	25,559
175	0207249F	Precision Attack Systems Procurement	07	U	14,016	12,722		12,722
176	0207253F	Compass Call	07	U	87,925	50,000		50,000
177	0207268F	Aircraft Engine Component Improvement Program	07	U	111,566	136,087		136,087
178	0207325F	Joint Air-to-Surface Standoff Missile (JASSM)	07	U	114,018	117,198		117,198
179	0207327F	Small Diameter Bomb (SDB)	07	U	31,003	32,713		32,713

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
159	0202834F	Vehicles and Support Equipment - General	07	U	15,498
160	0205219F	MQ-9 UAV	07	U	81,123
161	0205671F	Joint Counter RCIED Electronic Warfare	07	U	2,303
162	0207040F	Multi-Platform Electronic Warfare Equipment	07	U	7,312
163	0207131F	A-10 Squadrons	07	U	
164	0207133F	F-16 Squadrons	07	U	98,633
165	0207134F	F-15E Squadrons	07	U	50,965
166	0207136F	Manned Destructive Suppression	07	U	16,543
167	0207138F	F-22A Squadrons	07	U	725,889
168	0207142F	F-35 Squadrons	07	U	97,231
169	0207146F	F-15EX	07	U	100,006
170	0207161F	Tactical AIM Missiles	07	U	41,958
171	0207163F	Advanced Medium Range Air-to-Air Missile (AMRAAM)	07	U	53,679
172	0207227F	Combat Rescue - Pararescue	07	U	726
173	0207238F	E-11A	07	U	64,888
174	0207247F	AF TENCAP	07	U	25,749
175	0207249F	Precision Attack Systems Procurement	07	U	11,872
176	0207253F	Compass Call	07	U	66,932
177	0207268F	Aircraft Engine Component Improvement Program	07	U	55,223
178	0207325F	Joint Air-to-Surface Standoff Missile (JASSM)	07	U	132,937
179	0207327F	Small Diameter Bomb (SDB)	07	U	37,518

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
180	0207410F	Air & Space Operations Center (AOC)	07	U	87,873	78,889		78,889
181	0207412F	Control and Reporting Center (CRC)	07	U	9,565	6,615		6,615
182	0207417F	Airborne Warning and Control System (AWACS)	07	U	167,956	11,598		11,598
183	0207418F	AFSPECWAR - TACP	07	U	3,678	5,982		5,982
185	0207431F	Combat Air Intelligence System Activities	07	U	17,863	29,704	7,750	37,454
186	0207438F	Theater Battle Management (TBM) C4I	07	U	7,716	5,851		5,851
187	0207439F	Electronic Warfare Integrated Reprogramming (EWIR)	07	U	15,000	15,990		15,990
188	0207444F	Tactical Air Control Party-Mod	07	U	12,779	10,304		10,304
189	0207452F	DCAPES	07	U	4,147	8,049		8,049
190	0207521F	Air Force Calibration Programs	07	U	2,256	2,123		2,123
191	0207522F	Airbase Air Defense Systems (ABADS)	07	U	7,177			
192	0207573F	National Technical Nuclear Forensics	07	U	1,971	2,039		2,039
193	0207590F	Seek Eagle	07	U	30,484	32,853		32,853
194	0207601F	USAF Modeling and Simulation	07	U	16,838	19,283		19,283
195	0207605F	Wargaming and Simulation Centers	07	U	7,535	7,004		7,004
196	0207610F	Battlefield Abn Comm Node (BACN)	07	U	30,953			
197	0207697F	Distributed Training and Exercises	07	U	3,860	4,624		4,624
198	0208006F	Mission Planning Systems	07	U	92,956	98,807		98,807
199	0208007F	Tactical Deception	07	U	13,812	34,574		34,574
200	0208064F	OPERATIONAL HQ - CYBER	07	U	2,037	14,347		14,347
201	0208087F	Distributed Cyber Warfare Operations	07	U	68,152	76,425		76,425

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
180	0207410F	Air & Space Operations Center (AOC)	07	U	72,059
181	0207412F	Control and Reporting Center (CRC)	07	U	17,498
182	0207417F	Airborne Warning and Control System (AWACS)	07	U	
183	0207418F	AFSPECPWAR - TACP	07	U	2,106
185	0207431F	Combat Air Intelligence System Activities	07	U	72,010
186	0207438F	Theater Battle Management (TBM) C4I	07	U	6,467
187	0207439F	Electronic Warfare Integrated Reprogramming (EWIR)	07	U	10,388
188	0207444F	Tactical Air Control Party-Mod	07	U	10,060
189	0207452F	DCAPES	07	U	8,233
190	0207521F	Air Force Calibration Programs	07	U	2,172
191	0207522F	Airbase Air Defense Systems (ABADS)	07	U	
192	0207573F	National Technical Nuclear Forensics	07	U	2,049
193	0207590F	Seek Eagle	07	U	33,478
194	0207601F	USAF Modeling and Simulation	07	U	
195	0207605F	Wargaming and Simulation Centers	07	U	11,894
196	0207610F	Battlefield Abn Comm Node (BACN)	07	U	
197	0207697F	Distributed Training and Exercises	07	U	3,811
198	0208006F	Mission Planning Systems	07	U	96,272
199	0208007F	Tactical Deception	07	U	26,533
200	0208064F	OPERATIONAL HQ - CYBER	07	U	
201	0208087F	Distributed Cyber Warfare Operations	07	U	50,122

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
202	0208088F	AF Defensive Cyberspace Operations	07	U	21,950	16,809		16,809
203	0208097F	Joint Cyber Command and Control (JCC2)	07	U	78,592	79,955		79,955
204	0208099F	Unified Platform (UP)	07	U	89,135	106,916		106,916
208	0208288F	Intel Data Applications	07	U	474	2,130		2,130
209	0301025F	GeoBase	07	U	2,680	2,928		2,928
210	0301112F	Nuclear Planning and Execution System (NPES)	07	U	14,738	16,158		16,158
211	0301113F	Cyber Security Intelligence Support	07	U	5,224	8,972		8,972
218	0301401F	AF Multi-Domain Non-Traditional ISR Battlespace Awareness	07	U	2,463	3,069		3,069
219	0302015F	E-4B National Airborne Operations Center (NAOC)	07	U	22,798	25,701		25,701
220	0303004F	EIT CONNECT	07	U				
221	0303089F	Cyberspace Operations Systems	07	U				
222	0303131F	Minimum Essential Emergency Communications Network (MEECN)	07	U	51,681	35,548		35,548
223	0303133F	High Frequency Radio Systems	07	U				
224	0303140F	Information Systems Security Program	07	U	12,795	70,263		70,263
225	0303142F	Global Force Management - Data Initiative	07	U	435			
226	0303248F	All Domain Common Platform	07	U	60,894	46,540		46,540
227	0303260F	Joint Military Deception Initiative	07	U		2,588		2,588
228	0304100F	Strategic Mission Planning & Execution System (SMPES)	07	U				
230	0304260F	Airborne SIGINT Enterprise	07	U	88,645	109,528		109,528
231	0304310F	Commercial Economic Analysis	07	U	3,632	4,221		4,221

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Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
202	0208088F	AF Defensive Cyberspace Operations	07	U	113,064
203	0208097F	Joint Cyber Command and Control (JCC2)	07	U	
204	0208099F	Unified Platform (UP)	07	U	
208	0208288F	Intel Data Applications	07	U	967
209	0301025F	GeoBase	07	U	1,514
210	0301112F	Nuclear Planning and Execution System (NPES)	07	U	
211	0301113F	Cyber Security Intelligence Support	07	U	8,476
218	0301401F	AF Multi-Domain Non-Traditional ISR Battlespace Awareness	07	U	2,890
219	0302015F	E-4B National Airborne Operations Center (NAOC)	07	U	39,868
220	0303004F	EIT CONNECT	07	U	32,900
221	0303089F	Cyberspace Operations Systems	07	U	4,881
222	0303131F	Minimum Essential Emergency Communications Network (MEECN)	07	U	33,567
223	0303133F	High Frequency Radio Systems	07	U	40,000
224	0303140F	Information Systems Security Program	07	U	95,523
225	0303142F	Global Force Management - Data Initiative	07	U	
226	0303248F	All Domain Common Platform	07	U	71,296
227	0303260F	Joint Military Deception Initiative	07	U	4,682
228	0304100F	Strategic Mission Planning & Execution System (SMPES)	07	U	64,944
230	0304260F	Airborne SIGINT Enterprise	07	U	108,947
231	0304310F	Commercial Economic Analysis	07	U	4,635

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
234	0305015F	C2 Air Operations Suite - C2 Info Services	07	U		7,708		7,708
235	0305020F	CCMD Intelligence Information Technology	07	U	1,663	1,751		1,751
236	0305022F	ISR Modernization & Automation Dvmt (IMAD)	07	U	15,888	13,138		13,138
237	0305099F	Global Air Traffic Management (GATM)	07	U	4,658	4,533		4,533
238	0305103F	Cyber Security Initiative	07	U	279	91		91
239	0305111F	Weather Service	07	U	36,524	56,457		56,457
240	0305114F	Air Traffic Control, Approach, and Landing System (ATCALs)	07	U	15,266	8,367		8,367
241	0305116F	Aerial Targets	07	U	1,488	1,365		1,365
244	0305128F	Security and Investigative Activities	07	U	214	223		223
245	0305146F	Defense Joint Counterintelligence Activities	07	U	8,733	8,328		8,328
246	0305179F	Integrated Broadcast Service (IBS)	07	U	21,335	14,123		14,123
247	0305202F	Dragon U-2	07	U	40,713	20,170		20,170
248	0305206F	Airborne Reconnaissance Systems	07	U	108,291	70,048		70,048
249	0305207F	Manned Reconnaissance Systems	07	U	14,799	14,590		14,590
250	0305208F	Distributed Common Ground/Surface Systems	07	U	24,558	26,901		26,901
251	0305220F	RQ-4 UAV	07	U	82,355	68,801		68,801
252	0305221F	Network-Centric Collaborative Targeting	07	U	17,224	17,564		17,564
253	0305238F	NATO AGS	07	U	19,473	826		826
254	0305240F	Support to DCGS Enterprise	07	U	40,421	28,774		28,774
255	0305600F	International Intelligence Technology and Architectures	07	U	14,473	25,036		25,036

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
234	0305015F	C2 Air Operations Suite - C2 Info Services	07	U	13,751
235	0305020F	CCMD Intelligence Information Technology	07	U	1,660
236	0305022F	ISR Modernization & Automation Dvmt (IMAD)	07	U	18,680
237	0305099F	Global Air Traffic Management (GATM)	07	U	5,031
238	0305103F	Cyber Security Initiative	07	U	301
239	0305111F	Weather Service	07	U	26,329
240	0305114F	Air Traffic Control, Approach, and Landing System (ATCALs)	07	U	8,751
241	0305116F	Aerial Targets	07	U	6,915
244	0305128F	Security and Investigative Activities	07	U	352
245	0305146F	Defense Joint Counterintelligence Activities	07	U	6,930
246	0305179F	Integrated Broadcast Service (IBS)	07	U	21,588
247	0305202F	Dragon U-2	07	U	16,842
248	0305206F	Airborne Reconnaissance Systems	07	U	43,158
249	0305207F	Manned Reconnaissance Systems	07	U	14,330
250	0305208F	Distributed Common Ground/Surface Systems	07	U	88,854
251	0305220F	RQ-4 UAV	07	U	1,242
252	0305221F	Network-Centric Collaborative Targeting	07	U	12,496
253	0305238F	NATO AGS	07	U	2
254	0305240F	Support to DCGS Enterprise	07	U	31,589
255	0305600F	International Intelligence Technology and Architectures	07	U	15,322

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022	FY 2023 Less	FY 2023	FY 2023 Total
					Actuals	Supplementals Enactment	Supplementals Enactment*	Enactment
256	0305881F	Rapid Cyber Acquisition	07	U	4,193	3,739		3,739
257	0305984F	Personnel Recovery Command & Ctrl (PRC2)	07	U	2,473	2,702		2,702
258	0307577F	Intelligence Mission Data (IMD)	07	U	6,169	6,332		6,332
259	0401115F	C-130 Airlift Squadron	07	U	12,383	407		407
260	0401119F	C-5 Airlift Squadrons (IF)	07	U	16,998	3,100		3,100
261	0401130F	C-17 Aircraft (IF)	07	U	15,779	25,387		25,387
262	0401132F	C-130J Program	07	U	18,392	10,060		10,060
263	0401134F	Large Aircraft IR Countermeasures (LAIRCM)	07	U	6,429	2,909		2,909
264	0401218F	KC-135s	07	U	3,461	12,955		12,955
265	0401318F	CV-22	07	U	16,663	10,121		10,121
266	0408011F	Special Tactics / Combat Control	07	U	6,467	6,297		6,297
267	0708055F	Maintenance, Repair & Overhaul System	07	U	26,211	19,892		19,892
268	0708610F	Logistics Information Technology (LOGIT)	07	U	6,870	17,271		17,271
269	0801380F	AF LVC Operational Training (LVC-OT)	07	U				
270	0804743F	Other Flight Training	07	U	5,778	2,214		2,214
271	0808716F	Other Personnel Activities	07	U	4,817			
272	0901202F	Joint Personnel Recovery Agency	07	U	1,759	1,885		1,885
273	0901218F	Civilian Compensation Program	07	U	3,560	4,098		4,098
274	0901220F	Personnel Administration	07	U	3,267	3,191		3,191
275	0901226F	Air Force Studies and Analysis Agency	07	U	1,202	899		899
276	0901538F	Financial Management Information Systems Development	07	U	4,675	5,121		5,121

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2024 Request
256	0305881F	Rapid Cyber Acquisition	07	U	8,830
257	0305984F	Personnel Recovery Command & Ctrl (PRC2)	07	U	2,764
258	0307577F	Intelligence Mission Data (IMD)	07	U	7,090
259	0401115F	C-130 Airlift Squadron	07	U	5,427
260	0401119F	C-5 Airlift Squadrons (IF)	07	U	29,502
261	0401130F	C-17 Aircraft (IF)	07	U	2,753
262	0401132F	C-130J Program	07	U	19,100
263	0401134F	Large Aircraft IR Countermeasures (LAIRCM)	07	U	5,982
264	0401218F	KC-135s	07	U	51,105
265	0401318F	CV-22	07	U	18,127
266	0408011F	Special Tactics / Combat Control	07	U	9,198
267	0708055F	Maintenance, Repair & Overhaul System	07	U	
268	0708610F	Logistics Information Technology (LOGIT)	07	U	17,520
269	0801380F	AF LVC Operational Training (LVC-OT)	07	U	25,144
270	0804743F	Other Flight Training	07	U	2,265
271	0808716F	Other Personnel Activities	07	U	
272	0901202F	Joint Personnel Recovery Agency	07	U	2,266
273	0901218F	Civilian Compensation Program	07	U	4,006
274	0901220F	Personnel Administration	07	U	3,078
275	0901226F	Air Force Studies and Analysis Agency	07	U	5,309
276	0901538F	Financial Management Information Systems Development	07	U	4,279

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line No	Program Element Number	Item	Act	Se c	FY 2022 Actuals	FY 2023 Less Supplementals Enactment	FY 2023 Supplementals Enactment*	FY 2023 Total Enactment
277	0901554F	Defense Enterprise Acntng and Mgt Sys (DEAMS)	07	U	52,707	48,199		48,199
278	1202140F	Service Support to SPACECOM Activities	07	U	6,549	13,418		13,418
999	999999999	Classified Programs	07	U	16,966,755	17,653,475	236,046	17,889,521
	Operational Systems Development				23,061,515	23,805,224	283,546	24,088,770
Total Research, Development, Test and Evaluation, Air Force					41,507,268	44,997,587	284,846	45,282,433

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

Department of the Air Force
 FY 2024 resident's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

Line <u>No</u>	Program Element <u>Number</u>	<u>Item</u>	<u>Act</u>	<u>Se</u> <u>c</u>	FY 2024 <u>Request</u>
277	0901554F	Defense Enterprise Acntng and Mgt Sys (DEAMS)	07	U	45,925
278	1202140F	Service Support to SPACECOM Activities	07	U	9,778
999	999999999	Classified Programs	07	U	16,814,245
	Operational Systems Development				23,829,283
Total Research, Development, Test and Evaluation, Air Force					46,565,356

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Air Force • Budget Estimates FY 2024 • RDT&E Program

Master Program Element Table of Contents (by Budget Activity then Line Item Number)

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
1	01	0601102F	Defense Research Sciences.....	Volume 1 - 1
2	01	0601103F	University Research Initiatives.....	Volume 1 - 17

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
3	02	0602020F	Future AF Capabilities Applied Research.....	Volume 1 - 23
4	02	0602022F	University Affiliated Research Center (UARC) - Tactical Autonomy.....	Volume 1 - 29
5	02	0602102F	Materials.....	Volume 1 - 33
6	02	0602201F	Aerospace Vehicle Technologies.....	Volume 1 - 53
7	02	0602202F	Human Effectiveness Applied Research.....	Volume 1 - 69
8	02	0602203F	Aerospace Propulsion.....	Volume 1 - 89
9	02	0602204F	Aerospace Sensors.....	Volume 1 - 115
10	02	0602212F	Defense Laboratories R&D Projects (10 U.S.C, Sec 2358).....	Volume 1 - 141

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
11	02	0602298F	Science and Technology Management - Major Headquarters Activities.....	Volume 1 - 143
12	02	0602602F	Conventional Munitions.....	Volume 1 - 145
13	02	0602605F	Directed Energy Technology.....	Volume 1 - 157
14	02	0602788F	Dominant Information Sciences and Methods.....	Volume 1 - 167

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
15	03	0603032F	Future AF Integrated Technology Demos.....	Volume 1 - 183
16	03	0603112F	Advanced Materials for Weapon Systems.....	Volume 1 - 197
17	03	0603199F	Sustainment Science and Technology (S&T).....	Volume 1 - 209
18	03	0603203F	Advanced Aerospace Sensors.....	Volume 1 - 213
19	03	0603211F	Aerospace Technology Dev/Demo.....	Volume 1 - 225
20	03	0603216F	Aerospace Propulsion and Power Technology.....	Volume 1 - 237
21	03	0603270F	Electronic Combat Technology.....	Volume 1 - 257
22	03	0603273F	Science & Technology for Nuclear Re-entry Systems.....	Volume 1 - 271
23	03	0603444F	Maui Space Surveillance System (MSSS).....	Volume 1 - 277

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
24	03	0603456F	Human Effectiveness Advanced Technology Development.....	Volume 1 - 279
25	03	0603601F	Conventional Weapons Technology.....	Volume 1 - 295
26	03	0603605F	Advanced Weapons Technology.....	Volume 1 - 305
27	03	0603680F	Manufacturing Technology Program.....	Volume 1 - 311
28	03	0603788F	Battlespace Knowledge Development and Demonstration.....	Volume 1 - 323
29	03	0207412F	Control and Reporting Center (CRC).....	Volume 1 - 335

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
30	04	0603036F	Modular Advanced Missile.....	Volume 2 - 1
31	04	0603260F	Intelligence Advanced Development.....	Volume 2 - 7
32	04	0603742F	Combat Identification Technology.....	Volume 2 - 21
33	04	0603790F	NATO Research and Development.....	Volume 2 - 47
34	04	0603851F	Intercontinental Ballistic Missile - Dem/Val.....	Volume 2 - 53
35	04	0604001F	NC3 Advanced Concepts.....	Volume 2 - 75
36	04	0604002F	Air Force Weather Services Research.....	Volume 2 - 81

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
37	04	0604003F	Advanced Battle Management System (ABMS).....	Volume 2 - 89
38	04	0604004F	Advanced Engine Development.....	Volume 2 - 109
39	04	0604005F	NC3 Commercial Development & Prototyping.....	Volume 2 - 117
40	04	0604006F	Dept of the Air Force Tech Architecture.....	Volume 2 - 123
41	04	0604007F	E-7.....	Volume 2 - 133
42	04	0604009F	AFWERX Prime.....	Volume 2 - 141
43	04	0604015F	Long Range Strike - Bomber.....	Volume 2 - 157
44	04	0604025F	Rapid Defense Experimentation Reserve (RDER).....	Volume 2 - 169
45	04	0604032F	Directed Energy Prototyping.....	Volume 2 - 177
46	04	0604033F	Hypersonics Prototyping.....	Volume 2 - 185
47	04	0604183F	Hypersonics Prototyping - Hypersonic Attack Cruise Missile (HACM).....	Volume 2 - 193
48	04	0604201F	PNT Resiliency, Mods, and Improvements.....	Volume 2 - 201
49	04	0604257F	Advanced Technology and Sensors.....	Volume 2 - 209
50	04	0604288F	Survivable Airborne Operations Center (SAOC).....	Volume 2 - 229
51	04	0604317F	Technology Transfer.....	Volume 2 - 237
52	04	0604327F	Hard and Deeply Buried Target Defeat System (HDBTDS) Program.....	Volume 2 - 255
53	04	0604414F	Cyber Resiliency of Weapon Systems-ACS.....	Volume 2 - 263
54	04	0604534F	Adaptive Engine Transition Program (AETP).....	Volume 2 - 283

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
55	04	0604668F	Joint Transportation Management System (JTMS).....	Volume 2 - 289
56	04	0604776F	Deployment & Distribution Enterprise R&D.....	Volume 2 - 295
57	04	0604858F	Tech Transition Program.....	Volume 2 - 341
58	04	0604860F	Operational Energy and Installation Resilience.....	Volume 2 - 389
59	04	0605164F	Air Refueling Capability Modernization.....	Volume 2 - 397
60	04	0605230F	Ground Based Strategic Deterrent.....	Volume 2 - 403
61	04	0207110F	Next Generation Air Dominance.....	Volume 2 - 415
62	04	0207179F	Autonomous Collaborative Platforms.....	Volume 2 - 427
63	04	0207420F	Combat Identification.....	Volume 2 - 445
64	04	0207455F	Three Dimensional Long-Range Radar (3DELRR).....	Volume 2 - 451
65	04	0207522F	Airbase Air Defense Systems (ABADS).....	Volume 2 - 459
66	04	0208030F	War Reserve Materiel - Ammunition.....	Volume 2 - 469
67	04	0304369F	Cyber Capabilities Support Office (CCSO).....	Volume 2 - 477
68	04	0305236F	Common Data Link Executive Agent (CDL EA).....	Volume 2 - 485
69	04	0305601F	Mission Partner Environments.....	Volume 2 - 499
70	04	0306250F	Cyber Operations Technology Support.....	Volume 2 - 505
71	04	0306415F	Enabled Cyber Activities.....	Volume 2 - 513
72	04	0708051F	Rapid Sustainment Modernization (RSM).....	Volume 2 - 519

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
73	04	0808737F	Integrated Primary Prevention.....	Volume 2 - 527
74	04	0901410F	Contracting Information Technology System.....	Volume 2 - 537
75	04	1206415F	U.S. Space Command Research and Development Support.....	Volume 2 - 547

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
76	05	0604200F	Future Advanced Weapon Analysis & Programs.....	Volume 2 - 553
77	05	0604201F	PNT Resiliency, Mods, and Improvements.....	Volume 2 - 563
78	05	0604222F	Nuclear Weapons Support.....	Volume 2 - 573
79	05	0604270F	Electronic Warfare Development.....	Volume 2 - 597
80	05	0604281F	Tactical Data Networks Enterprise.....	Volume 2 - 609
81	05	0604287F	Physical Security Equipment.....	Volume 2 - 627
82	05	0604602F	Armament/Ordnance Development.....	Volume 2 - 635
83	05	0604604F	Submunitions.....	Volume 2 - 659
84	05	0604617F	Agile Combat Support.....	Volume 2 - 667
85	05	0604706F	Life Support Systems.....	Volume 2 - 685

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
86	05	0604735F	Combat Training Ranges.....	Volume 2 - 695
87	05	0604932F	Long Range Standoff Weapon.....	Volume 2 - 705
88	05	0604933F	ICBM Fuze Modernization.....	Volume 2 - 717
89	05	0605030F	Joint Tactical Network Center (JTNC).....	Volume 2 - 727
90	05	0605031F	Joint Tactical Network (JTN).....	Volume 2 - 735
91	05	0605056F	Open Architecture Management.....	Volume 2 - 743
92	05	0605057F	Next Generation Air-refueling System.....	Volume 2 - 753
93	05	0605223F	Advanced Pilot Training.....	Volume 2 - 761
94	05	0605229F	HH-60W.....	Volume 2 - 769
95	05	0605238F	Ground Based Strategic Deterrent EMD.....	Volume 2 - 779
96	05	0207171F	F-15 EPAWSS.....	Volume 2 - 799
97	05	0207279F	Isolated Personnel Survivability and Recovery.....	Volume 2 - 807
98	05	0207328F	Stand In Attack Weapon.....	Volume 2 - 817
99	05	0207701F	Full Combat Mission Training.....	Volume 2 - 827
100	05	0208036F	Medical C-CBRNE Programs.....	Volume 2 - 841
102	05	0305205F	Endurance Unmanned Aerial Vehicles.....	Volume 2 - 847
103	05	0401221F	KC-46A Tanker Squadrons.....	Volume 2 - 853
104	05	0401319F	VC-25B.....	Volume 2 - 873

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
105	05	0701212F	Automated Test Systems.....	Volume 2 - 881
106	05	0804772F	Training Developments.....	Volume 2 - 893

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
107	06	0604256F	Threat Simulator Development.....	Volume 3 - 1
108	06	0604759F	Major T&E Investment.....	Volume 3 - 9
109	06	0605101F	RAND Project Air Force.....	Volume 3 - 17
110	06	0605502F	Small Business Innovation Research.....	Volume 3 - 21
111	06	0605712F	Initial Operational Test & Evaluation.....	Volume 3 - 25
112	06	0605807F	Test and Evaluation Support.....	Volume 3 - 31
113	06	0605827F	Acq Workforce- Global Vig & Combat Sys.....	Volume 3 - 39
114	06	0605828F	Acq Workforce- Global Reach.....	Volume 3 - 43
115	06	0605829F	Acq Workforce- Cyber, Network, & Bus Sys.....	Volume 3 - 49
116	06	0605830F	Acq Workforce- Global Battle Mgmt.....	Volume 3 - 57
117	06	0605831F	Acq Workforce- Capability Integration.....	Volume 3 - 61

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
118	06	0605832F	Acq Workforce- Advanced Prgm Technology.....	Volume 3 - 67
119	06	0605833F	Acq Workforce- Nuclear Systems.....	Volume 3 - 71
120	06	0605898F	Management HQ - R&D.....	Volume 3 - 75
121	06	0605976F	Facilities Restoration and Modernization - Test and Evaluation Support.....	Volume 3 - 79
122	06	0605978F	Facilities Sustainment - Test and Evaluation Support.....	Volume 3 - 83
123	06	0606017F	Requirements Analysis and Maturation.....	Volume 3 - 87
124	06	0606398F	Management HQ - T&E.....	Volume 3 - 97
125	06	0303166F	Support to Information Operations (IO) Capabilities.....	Volume 3 - 99
126	06	0303255F	Command, Control, Communication, and Computers (C4) - STRATCOM.....	Volume 3 - 103
127	06	0308602F	ENTEPRISE INFORMATION SERVICES (EIS).....	Volume 3 - 109
128	06	0702806F	Acquisition and Management Support.....	Volume 3 - 117
129	06	0804731F	General Skill Training.....	Volume 3 - 125
130	06	0804772F	Training Developments.....	Volume 3 - 127
131	06	0909999F	Financing for Cancelled Account Adjustments.....	Volume 3 - 129
132	06	1001004F	International Activities.....	Volume 3 - 131
133	06	1206864F	Space Test Program (STP).....	Volume 3 - 137

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
134	07	0604233F	Specialized Undergraduate Flight Training.....	Volume 3 - 141
135	07	0604283F	Battle Management Command and Control (BMC2) Sensor Development ARSR-4 Replacement - Hawaii.....	Volume 3 - 163
136	07	0604445F	Wide Area Surveillance.....	Volume 3 - 171
137	07	0604617F	Agile Combat Support.....	Volume 3 - 179
138	07	0604776F	Deployment & Distribution Enterprise R&D.....	Volume 3 - 187
139	07	0604840F	F-35 C2D2.....	Volume 3 - 193
140	07	0605018F	AF Integrated Personnel and Pay System (AF-IPPS).....	Volume 3 - 289
141	07	0605024F	Anti-Tamper Technology Executive Agency.....	Volume 3 - 301
142	07	0605117F	Foreign Materiel Acquisition and Exploitation.....	Volume 3 - 309
143	07	0605278F	HC/MC-130 Recap RDT&E.....	Volume 3 - 317
144	07	0606018F	NC3 Integration.....	Volume 3 - 343
145	07	0101113F	B-52 Squadrons.....	Volume 3 - 351
146	07	0101122F	Air-Launched Cruise Missile (ALCM).....	Volume 3 - 421
147	07	0101126F	B-1B Squadrons.....	Volume 3 - 427
148	07	0101127F	B-2 Squadrons.....	Volume 3 - 439
149	07	0101213F	Minuteman Squadrons.....	Volume 3 - 457

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
150	07	0101316F	Worldwide Joint Strategic Communications.....	Volume 3 - 485
151	07	0101318F	Service Support to STRATCOM - Global Strike.....	Volume 3 - 495
152	07	0101324F	Integrated Strategic Planning & Analysis Network.....	Volume 3 - 503
153	07	0101328F	ICBM Reentry Vehicles.....	Volume 3 - 511
155	07	0102110F	MH-139A.....	Volume 3 - 529
156	07	0102326F	Region/Sector Operation Control Center Modernization Program.....	Volume 3 - 545
157	07	0102412F	North Warning System (NWS).....	Volume 3 - 553
158	07	0102417F	Over-the-Horizon Backscatter Radar.....	Volume 3 - 559
159	07	0202834F	Vehicles and Support Equipment - General.....	Volume 3 - 577
160	07	0205219F	MQ-9 UAV.....	Volume 3 - 585
161	07	0205671F	Joint Counter RCIED Electronic Warfare.....	Volume 3 - 607
162	07	0207040F	Multi-Platform Electronic Warfare Equipment.....	Volume 3 - 613
163	07	0207131F	A-10 Squadrons.....	Volume 3 - 621
164	07	0207133F	F-16 Squadrons.....	Volume 3 - 631
165	07	0207134F	F-15E Squadrons.....	Volume 3 - 647
166	07	0207136F	Manned Destructive Suppression.....	Volume 3 - 661
167	07	0207138F	F-22A Squadrons.....	Volume 3 - 669
168	07	0207142F	F-35 Squadrons.....	Volume 3 - 689

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
169	07	0207146F	F-15EX.....	Volume 3 - 715
170	07	0207161F	Tactical AIM Missiles.....	Volume 3 - 723
171	07	0207163F	Advanced Medium Range Air-to-Air Missile (AMRAAM).....	Volume 3 - 731
172	07	0207227F	Combat Rescue - Pararescue.....	Volume 3 - 741
173	07	0207238F	E-11A.....	Volume 3 - 747
174	07	0207247F	AF TENCAP.....	Volume 3 - 765
175	07	0207249F	Precision Attack Systems Procurement.....	Volume 3 - 775
176	07	0207253F	Compass Call.....	Volume 3 - 781
177	07	0207268F	Aircraft Engine Component Improvement Program.....	Volume 3 - 791
178	07	0207325F	Joint Air-to-Surface Standoff Missile (JASSM).....	Volume 3 - 807
179	07	0207327F	Small Diameter Bomb (SDB).....	Volume 3 - 817
180	07	0207410F	Air & Space Operations Center (AOC).....	Volume 3 - 829
181	07	0207412F	Control and Reporting Center (CRC).....	Volume 3 - 837
182	07	0207417F	Airborne Warning and Control System (AWACS).....	Volume 3 - 845
183	07	0207418F	AFSPECWAR - TACP.....	Volume 3 - 857
185	07	0207431F	Combat Air Intelligence System Activities.....	Volume 4 - 1
186	07	0207438F	Theater Battle Management (TBM) C4I.....	Volume 4 - 17
187	07	0207439F	Electronic Warfare Integrated Reprogramming (EWIR).....	Volume 4 - 23

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
188	07	0207444F	Tactical Air Control Party-Mod.....	Volume 4 - 31
189	07	0207452F	DCAPES.....	Volume 4 - 43
190	07	0207521F	Air Force Calibration Programs.....	Volume 4 - 53
191	07	0207522F	Airbase Air Defense Systems (ABADS).....	Volume 4 - 59
192	07	0207573F	National Technical Nuclear Forensics.....	Volume 4 - 65
193	07	0207590F	Seek Eagle.....	Volume 4 - 71
194	07	0207601F	USAF Modeling and Simulation.....	Volume 4 - 81
195	07	0207605F	Wargaming and Simulation Centers.....	Volume 4 - 95
196	07	0207610F	Battlefield Abn Comm Node (BACN).....	Volume 4 - 105
197	07	0207697F	Distributed Training and Exercises.....	Volume 4 - 113
198	07	0208006F	Mission Planning Systems.....	Volume 4 - 121
199	07	0208007F	Tactical Deception.....	Volume 4 - 141
200	07	0208064F	OPERATIONAL HQ - CYBER.....	Volume 4 - 147
201	07	0208087F	Distributed Cyber Warfare Operations.....	Volume 4 - 155
202	07	0208088F	AF Defensive Cyberspace Operations.....	Volume 4 - 165
203	07	0208097F	Joint Cyber Command and Control (JCC2).....	Volume 4 - 193
204	07	0208099F	Unified Platform (UP).....	Volume 4 - 201
208	07	0208288F	Intel Data Applications.....	Volume 4 - 209

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
209	07	0301025F	GeoBase.....	Volume 4 - 215
210	07	0301112F	Nuclear Planning and Execution System (NPES).....	Volume 4 - 221
211	07	0301113F	Cyber Security Intelligence Support.....	Volume 4 - 235
218	07	0301401F	AF Multi-Domain Non-Traditional ISR Battlespace Awareness.....	Volume 4 - 241
219	07	0302015F	E-4B National Airborne Operations Center (NAOC).....	Volume 4 - 247
220	07	0303004F	EIT CONNECT.....	Volume 4 - 255
221	07	0303089F	Cyberspace Operations Systems.....	Volume 4 - 261
222	07	0303131F	Minimum Essential Emergency Communications Network (MEECN).....	Volume 4 - 267
223	07	0303133F	High Frequency Radio Systems.....	Volume 4 - 287
224	07	0303140F	Information Systems Security Program.....	Volume 4 - 295
225	07	0303142F	Global Force Management - Data Initiative.....	Volume 4 - 311
226	07	0303248F	All Domain Common Platform.....	Volume 4 - 317
227	07	0303260F	Joint Military Deception Initiative.....	Volume 4 - 333
228	07	0304100F	Strategic Mission Planning & Execution System (SMPES).....	Volume 4 - 339
230	07	0304260F	Airborne SIGINT Enterprise.....	Volume 4 - 355
231	07	0304310F	Commercial Economic Analysis.....	Volume 4 - 379
234	07	0305015F	C2 Air Operations Suite - C2 Info Services.....	Volume 4 - 385
235	07	0305020F	CCMD Intelligence Information Technology.....	Volume 4 - 393

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
236	07	0305022F	ISR Modernization & Automation Dvmt (IMAD).....	Volume 4 - 401
237	07	0305099F	Global Air Traffic Management (GATM).....	Volume 4 - 413
238	07	0305103F	Cyber Security Initiative.....	Volume 4 - 421
239	07	0305111F	Weather Service.....	Volume 4 - 427
240	07	0305114F	Air Traffic Control, Approach, and Landing System (ATCAL).....	Volume 4 - 441
241	07	0305116F	Aerial Targets.....	Volume 4 - 453
244	07	0305128F	Security and Investigative Activities.....	Volume 4 - 463
245	07	0305146F	Defense Joint Counterintelligence Activities.....	Volume 4 - 469
246	07	0305179F	Integrated Broadcast Service (IBS).....	Volume 4 - 475
247	07	0305202F	Dragon U-2.....	Volume 4 - 485
248	07	0305206F	Airborne Reconnaissance Systems.....	Volume 4 - 493
249	07	0305207F	Manned Reconnaissance Systems.....	Volume 4 - 539
250	07	0305208F	Distributed Common Ground/Surface Systems.....	Volume 4 - 549
251	07	0305220F	RQ-4 UAV.....	Volume 4 - 559
252	07	0305221F	Network-Centric Collaborative Targeting.....	Volume 4 - 569
253	07	0305238F	NATO AGS.....	Volume 4 - 577
254	07	0305240F	Support to DCGS Enterprise.....	Volume 4 - 585
255	07	0305600F	International Intelligence Technology and Architectures.....	Volume 4 - 597

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
256	07	0305881F	Rapid Cyber Acquisition.....	Volume 4 - 605
257	07	0305984F	Personnel Recovery Command & Ctrl (PRC2).....	Volume 4 - 611
258	07	0307577F	Intelligence Mission Data (IMD).....	Volume 4 - 619
259	07	0401115F	C-130 Airlift Squadron.....	Volume 4 - 625
260	07	0401119F	C-5 Airlift Squadrons (IF).....	Volume 4 - 635
261	07	0401130F	C-17 Aircraft (IF).....	Volume 4 - 649
262	07	0401132F	C-130J Program.....	Volume 4 - 657
263	07	0401134F	Large Aircraft IR Countermeasures (LAIRCM).....	Volume 4 - 673
264	07	0401218F	KC-135s.....	Volume 4 - 681
265	07	0401318F	CV-22.....	Volume 4 - 693
266	07	0408011F	Special Tactics / Combat Control.....	Volume 4 - 703
267	07	0708055F	Maintenance, Repair & Overhaul System.....	Volume 4 - 713
268	07	0708610F	Logistics Information Technology (LOGIT).....	Volume 4 - 723
269	07	0801380F	AF LVC Operational Training (LVC-OT).....	Volume 4 - 739
270	07	0804743F	Other Flight Training.....	Volume 4 - 755
271	07	0808716F	Other Personnel Activities.....	Volume 4 - 763
272	07	0901202F	Joint Personnel Recovery Agency.....	Volume 4 - 769
273	07	0901218F	Civilian Compensation Program.....	Volume 4 - 777

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Appropriation 3600: Research, Development, Test & Evaluation, Air Force

Line #	Budget Activity	Program Element Number	Program Element Title	Page
274	07	0901220F	Personnel Administration.....	Volume 4 - 783
275	07	0901226F	Air Force Studies and Analysis Agency.....	Volume 4 - 793
276	07	0901538F	Financial Management Information Systems Development.....	Volume 4 - 799
277	07	0901554F	Defense Enterprise Acntng and Mgt Sys (DEAMS).....	Volume 4 - 815
278	07	1202140F	Service Support to SPACECOM Activities.....	Volume 4 - 825

UNCLASSIFIED

UNCLASSIFIED

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UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Master Program Element Table of Contents (Alphabetically by Program Element Title)

Program Element Title	Program Element Number	Line #	BA	Page
A-10 Squadrons	0207131F	163	07.....	Volume 3 - 621
AF Defensive Cyberspace Operations	0208088F	202	07.....	Volume 4 - 165
AF Integrated Personnel and Pay System (AF-IPPS)	0605018F	140	07.....	Volume 3 - 289
AF LVC Operational Training (LVC-OT)	0801380F	269	07.....	Volume 4 - 739
AF Multi-Domain Non-Traditional ISR Battlespace Awareness	0301401F	218	07.....	Volume 4 - 241
AF TENCAP	0207247F	174	07.....	Volume 3 - 765
AFSPECWAR - TACP	0207418F	183	07.....	Volume 3 - 857
AFWERX Prime	0604009F	42	04.....	Volume 2 - 141
Acq Workforce- Advanced Prgm Technology	0605832F	118	06.....	Volume 3 - 67
Acq Workforce- Capability Integration	0605831F	117	06.....	Volume 3 - 61
Acq Workforce- Cyber, Network, & Bus Sys	0605829F	115	06.....	Volume 3 - 49
Acq Workforce- Global Battle Mgmt	0605830F	116	06.....	Volume 3 - 57
Acq Workforce- Global Reach	0605828F	114	06.....	Volume 3 - 43
Acq Workforce- Global Vig & Combat Sys	0605827F	113	06.....	Volume 3 - 39
Acq Workforce- Nuclear Systems	0605833F	119	06.....	Volume 3 - 71
Acquisition and Management Support	0702806F	128	06.....	Volume 3 - 117
Adaptive Engine Transition Program (AETP)	0604534F	54	04.....	Volume 2 - 283

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Advanced Aerospace Sensors	0603203F	18	03.....	Volume 1 - 213
Advanced Battle Management System (ABMS)	0604003F	37	04.....	Volume 2 - 89
Advanced Engine Development	0604004F	38	04.....	Volume 2 - 109
Advanced Materials for Weapon Systems	0603112F	16	03.....	Volume 1 - 197
Advanced Medium Range Air-to-Air Missile (AMRAAM)	0207163F	171	07.....	Volume 3 - 731
Advanced Pilot Training	0605223F	93	05.....	Volume 2 - 761
Advanced Technology and Sensors	0604257F	49	04.....	Volume 2 - 209
Advanced Weapons Technology	0603605F	26	03.....	Volume 1 - 305
Aerial Targets	0305116F	241	07.....	Volume 4 - 453
Aerospace Propulsion	0602203F	8	02.....	Volume 1 - 89
Aerospace Propulsion and Power Technology	0603216F	20	03.....	Volume 1 - 237
Aerospace Sensors	0602204F	9	02.....	Volume 1 - 115
Aerospace Technology Dev/Demo	0603211F	19	03.....	Volume 1 - 225
Aerospace Vehicle Technologies	0602201F	6	02.....	Volume 1 - 53
Agile Combat Support	0604617F	84	05.....	Volume 2 - 667
Agile Combat Support	0604617F	137	07.....	Volume 3 - 179
Air & Space Operations Center (AOC)	0207410F	180	07.....	Volume 3 - 829
Air Force Calibration Programs	0207521F	190	07.....	Volume 4 - 53
Air Force Studies and Analysis Agency	0901226F	275	07.....	Volume 4 - 793

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Air Force Weather Services Research	0604002F	36	04.....	Volume 2 - 81
Air Refueling Capability Modernization	0605164F	59	04.....	Volume 2 - 397
Air Traffic Control, Approach, and Landing System (ATCALs)	0305114F	240	07.....	Volume 4 - 441
Air-Launched Cruise Missile (ALCM)	0101122F	146	07.....	Volume 3 - 421
Airbase Air Defense Systems (ABADS)	0207522F	65	04.....	Volume 2 - 459
Airbase Air Defense Systems (ABADS)	0207522F	191	07.....	Volume 4 - 59
Airborne Reconnaissance Systems	0305206F	248	07.....	Volume 4 - 493
Airborne SIGINT Enterprise	0304260F	230	07.....	Volume 4 - 355
Airborne Warning and Control System (AWACS)	0207417F	182	07.....	Volume 3 - 845
Aircraft Engine Component Improvement Program	0207268F	177	07.....	Volume 3 - 791
All Domain Common Platform	0303248F	226	07.....	Volume 4 - 317
Anti-Tamper Technology Executive Agency	0605024F	141	07.....	Volume 3 - 301
Armament/Ordnance Development	0604602F	82	05.....	Volume 2 - 635
Automated Test Systems	0701212F	105	05.....	Volume 2 - 881
Autonomous Collaborative Platforms	0207179F	62	04.....	Volume 2 - 427
B-1B Squadrons	0101126F	147	07.....	Volume 3 - 427
B-2 Squadrons	0101127F	148	07.....	Volume 3 - 439
B-52 Squadrons	0101113F	145	07.....	Volume 3 - 351
Battle Management Command and Control (BMC2) Sensor Development ARSR-4 Replacement - Hawaii	0604283F	135	07.....	Volume 3 - 163

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Battlefield Abn Comm Node (BACN)	0207610F	196	07.....	Volume 4 - 105
Battlespace Knowledge Development and Demonstration	0603788F	28	03.....	Volume 1 - 323
C-130 Airlift Squadron	0401115F	259	07.....	Volume 4 - 625
C-130J Program	0401132F	262	07.....	Volume 4 - 657
C-17 Aircraft (IF)	0401130F	261	07.....	Volume 4 - 649
C-5 Airlift Squadrons (IF)	0401119F	260	07.....	Volume 4 - 635
C2 Air Operations Suite - C2 Info Services	0305015F	234	07.....	Volume 4 - 385
CCMD Intelligence Information Technology	0305020F	235	07.....	Volume 4 - 393
CV-22	0401318F	265	07.....	Volume 4 - 693
Civilian Compensation Program	0901218F	273	07.....	Volume 4 - 777
Combat Air Intelligence System Activities	0207431F	185	07.....	Volume 4 - 1
Combat Identification	0207420F	63	04.....	Volume 2 - 445
Combat Identification Technology	0603742F	32	04.....	Volume 2 - 21
Combat Rescue - Pararescue	0207227F	172	07.....	Volume 3 - 741
Combat Training Ranges	0604735F	86	05.....	Volume 2 - 695
Command, Control, Communication, and Computers (C4) - STRATCOM	0303255F	126	06.....	Volume 3 - 103
Commercial Economic Analysis	0304310F	231	07.....	Volume 4 - 379
Common Data Link Executive Agent (CDL EA)	0305236F	68	04.....	Volume 2 - 485
Compass Call	0207253F	176	07.....	Volume 3 - 781

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Contracting Information Technology System	0901410F	74	04.....	Volume 2 - 537
Control and Reporting Center (CRC)	0207412F	29	03.....	Volume 1 - 335
Control and Reporting Center (CRC)	0207412F	181	07.....	Volume 3 - 837
Conventional Munitions	0602602F	12	02.....	Volume 1 - 145
Conventional Weapons Technology	0603601F	25	03.....	Volume 1 - 295
Cyber Capabilities Support Office (CCSO)	0304369F	67	04.....	Volume 2 - 477
Cyber Operations Technology Support	0306250F	70	04.....	Volume 2 - 505
Cyber Resiliency of Weapon Systems-ACS	0604414F	53	04.....	Volume 2 - 263
Cyber Security Initiative	0305103F	238	07.....	Volume 4 - 421
Cyber Security Intelligence Support	0301113F	211	07.....	Volume 4 - 235
Cyberspace Operations Systems	0303089F	221	07.....	Volume 4 - 261
DCAPES	0207452F	189	07.....	Volume 4 - 43
Defense Enterprise Acntng and Mgt Sys (DEAMS)	0901554F	277	07.....	Volume 4 - 815
Defense Joint Counterintelligence Activities	0305146F	245	07.....	Volume 4 - 469
Defense Laboratories R&D Projects (10 U.S.C, Sec 2358)	0602212F	10	02.....	Volume 1 - 141
Defense Research Sciences	0601102F	1	01.....	Volume 1 - 1
Deployment & Distribution Enterprise R&D	0604776F	56	04.....	Volume 2 - 295
Deployment & Distribution Enterprise R&D	0604776F	138	07.....	Volume 3 - 187
Dept of the Air Force Tech Architecture	0604006F	40	04.....	Volume 2 - 123

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Directed Energy Prototyping	0604032F	45	04.....	Volume 2 - 177
Directed Energy Technology	0602605F	13	02.....	Volume 1 - 157
Distributed Common Ground/Surface Systems	0305208F	250	07.....	Volume 4 - 549
Distributed Cyber Warfare Operations	0208087F	201	07.....	Volume 4 - 155
Distributed Training and Exercises	0207697F	197	07.....	Volume 4 - 113
Dominant Information Sciences and Methods	0602788F	14	02.....	Volume 1 - 167
Dragon U-2	0305202F	247	07.....	Volume 4 - 485
E-11A	0207238F	173	07.....	Volume 3 - 747
E-4B National Airborne Operations Center (NAOC)	0302015F	219	07.....	Volume 4 - 247
E-7	0604007F	41	04.....	Volume 2 - 133
EIT CONNECT	0303004F	220	07.....	Volume 4 - 255
ENTEPRISE INFORMATION SERVICES (EIS)	0308602F	127	06.....	Volume 3 - 109
Electronic Combat Technology	0603270F	21	03.....	Volume 1 - 257
Electronic Warfare Development	0604270F	79	05.....	Volume 2 - 597
Electronic Warfare Integrated Reprogramming (EWIR)	0207439F	187	07.....	Volume 4 - 23
Enabled Cyber Activities	0306415F	71	04.....	Volume 2 - 513
Endurance Unmanned Aerial Vehicles	0305205F	102	05.....	Volume 2 - 847
F-15 EPAWSS	0207171F	96	05.....	Volume 2 - 799
F-15E Squadrons	0207134F	165	07.....	Volume 3 - 647

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
F-15EX	0207146F	169	07.....	Volume 3 - 715
F-16 Squadrons	0207133F	164	07.....	Volume 3 - 631
F-22A Squadrons	0207138F	167	07.....	Volume 3 - 669
F-35 C2D2	0604840F	139	07.....	Volume 3 - 193
F-35 Squadrons	0207142F	168	07.....	Volume 3 - 689
Facilities Restoration and Modernization - Test and Evaluation Support	0605976F	121	06.....	Volume 3 - 79
Facilities Sustainment - Test and Evaluation Support	0605978F	122	06.....	Volume 3 - 83
Financial Management Information Systems Development	0901538F	276	07.....	Volume 4 - 799
Financing for Cancelled Account Adjustments	0909999F	131	06.....	Volume 3 - 129
Foreign Materiel Acquisition and Exploitation	0605117F	142	07.....	Volume 3 - 309
Full Combat Mission Training	0207701F	99	05.....	Volume 2 - 827
Future AF Capabilities Applied Research	0602020F	3	02.....	Volume 1 - 23
Future AF Integrated Technology Demos	0603032F	15	03.....	Volume 1 - 183
Future Advanced Weapon Analysis & Programs	0604200F	76	05.....	Volume 2 - 553
General Skill Training	0804731F	129	06.....	Volume 3 - 125
GeoBase	0301025F	209	07.....	Volume 4 - 215
Global Air Traffic Management (GATM)	0305099F	237	07.....	Volume 4 - 413
Global Force Management - Data Initiative	0303142F	225	07.....	Volume 4 - 311
Ground Based Strategic Deterrent	0605230F	60	04.....	Volume 2 - 403

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Ground Based Strategic Deterrent EMD	0605238F	95	05.....	Volume 2 - 779
HC/MC-130 Recap RDT&E	0605278F	143	07.....	Volume 3 - 317
HH-60W	0605229F	94	05.....	Volume 2 - 769
Hard and Deeply Buried Target Defeat System (HDBTDS) Program	0604327F	52	04.....	Volume 2 - 255
High Frequency Radio Systems	0303133F	223	07.....	Volume 4 - 287
Human Effectiveness Advanced Technology Development	0603456F	24	03.....	Volume 1 - 279
Human Effectiveness Applied Research	0602202F	7	02.....	Volume 1 - 69
Hypersonics Prototyping	0604033F	46	04.....	Volume 2 - 185
Hypersonics Prototyping - Hypersonic Attack Cruise Missile (HACM)	0604183F	47	04.....	Volume 2 - 193
ICBM Fuze Modernization	0604933F	88	05.....	Volume 2 - 717
ICBM Reentry Vehicles	0101328F	153	07.....	Volume 3 - 511
ISR Modernization & Automation Dvmt (IMAD)	0305022F	236	07.....	Volume 4 - 401
Information Systems Security Program	0303140F	224	07.....	Volume 4 - 295
Initial Operational Test & Evaluation	0605712F	111	06.....	Volume 3 - 25
Integrated Broadcast Service (IBS)	0305179F	246	07.....	Volume 4 - 475
Integrated Primary Prevention	0808737F	73	04.....	Volume 2 - 527
Integrated Strategic Planning & Analysis Network	0101324F	152	07.....	Volume 3 - 503
Intel Data Applications	0208288F	208	07.....	Volume 4 - 209
Intelligence Advanced Development	0603260F	31	04.....	Volume 2 - 7

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Intelligence Mission Data (IMD)	0307577F	258	07.....	Volume 4 - 619
Intercontinental Ballistic Missile - Dem/Val	0603851F	34	04.....	Volume 2 - 53
International Activities	1001004F	132	06.....	Volume 3 - 131
International Intelligence Technology and Architectures	0305600F	255	07.....	Volume 4 - 597
Isolated Personnel Survivability and Recovery	0207279F	97	05.....	Volume 2 - 807
Joint Air-to-Surface Standoff Missile (JASSM)	0207325F	178	07.....	Volume 3 - 807
Joint Counter RCIED Electronic Warfare	0205671F	161	07.....	Volume 3 - 607
Joint Cyber Command and Control (JCC2)	0208097F	203	07.....	Volume 4 - 193
Joint Military Deception Initiative	0303260F	227	07.....	Volume 4 - 333
Joint Personnel Recovery Agency	0901202F	272	07.....	Volume 4 - 769
Joint Tactical Network (JTN)	0605031F	90	05.....	Volume 2 - 735
Joint Tactical Network Center (JTNC)	0605030F	89	05.....	Volume 2 - 727
Joint Transportation Management System (JTMS)	0604668F	55	04.....	Volume 2 - 289
KC-135s	0401218F	264	07.....	Volume 4 - 681
KC-46A Tanker Squadrons	0401221F	103	05.....	Volume 2 - 853
Large Aircraft IR Countermeasures (LAIRCM)	0401134F	263	07.....	Volume 4 - 673
Life Support Systems	0604706F	85	05.....	Volume 2 - 685
Logistics Information Technology (LOGIT)	0708610F	268	07.....	Volume 4 - 723
Long Range Standoff Weapon	0604932F	87	05.....	Volume 2 - 705

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Long Range Strike - Bomber	0604015F	43	04.....	Volume 2 - 157
MH-139A	0102110F	155	07.....	Volume 3 - 529
MQ-9 UAV	0205219F	160	07.....	Volume 3 - 585
Maintenance, Repair & Overhaul System	0708055F	267	07.....	Volume 4 - 713
Major T&E Investment	0604759F	108	06.....	Volume 3 - 9
Management HQ - R&D	0605898F	120	06.....	Volume 3 - 75
Management HQ - T&E	0606398F	124	06.....	Volume 3 - 97
Manned Destructive Suppression	0207136F	166	07.....	Volume 3 - 661
Manned Reconnaissance Systems	0305207F	249	07.....	Volume 4 - 539
Manufacturing Technology Program	0603680F	27	03.....	Volume 1 - 311
Materials	0602102F	5	02.....	Volume 1 - 33
Maui Space Surveillance System (MSSS)	0603444F	23	03.....	Volume 1 - 277
Medical C-CBRNE Programs	0208036F	100	05.....	Volume 2 - 841
Minimum Essential Emergency Communications Network (MEECN)	0303131F	222	07.....	Volume 4 - 267
Minuteman Squadrons	0101213F	149	07.....	Volume 3 - 457
Mission Partner Environments	0305601F	69	04.....	Volume 2 - 499
Mission Planning Systems	0208006F	198	07.....	Volume 4 - 121
Modular Advanced Missile	0603036F	30	04.....	Volume 2 - 1
Multi-Platform Electronic Warfare Equipment	0207040F	162	07.....	Volume 3 - 613

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
NATO AGS	0305238F	253	07.....	Volume 4 - 577
NATO Research and Development	0603790F	33	04.....	Volume 2 - 47
NC3 Advanced Concepts	0604001F	35	04.....	Volume 2 - 75
NC3 Commercial Development & Prototyping	0604005F	39	04.....	Volume 2 - 117
NC3 Integration	0606018F	144	07.....	Volume 3 - 343
National Technical Nuclear Forensics	0207573F	192	07.....	Volume 4 - 65
Network-Centric Collaborative Targeting	0305221F	252	07.....	Volume 4 - 569
Next Generation Air Dominance	0207110F	61	04.....	Volume 2 - 415
Next Generation Air-refueling System	0605057F	92	05.....	Volume 2 - 753
North Warning System (NWS)	0102412F	157	07.....	Volume 3 - 553
Nuclear Planning and Execution System (NPES)	0301112F	210	07.....	Volume 4 - 221
Nuclear Weapons Support	0604222F	78	05.....	Volume 2 - 573
OPERATIONAL HQ - CYBER	0208064F	200	07.....	Volume 4 - 147
Open Architecture Management	0605056F	91	05.....	Volume 2 - 743
Operational Energy and Installation Resilience	0604860F	58	04.....	Volume 2 - 389
Other Flight Training	0804743F	270	07.....	Volume 4 - 755
Other Personnel Activities	0808716F	271	07.....	Volume 4 - 763
Over-the-Horizon Backscatter Radar	0102417F	158	07.....	Volume 3 - 559
PNT Resiliency, Mods, and Improvements	0604201F	48	04.....	Volume 2 - 201

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
PNT Resiliency, Mods, and Improvements	0604201F	77	05.....	Volume 2 - 563
Personnel Administration	0901220F	274	07.....	Volume 4 - 783
Personnel Recovery Command & Ctrl (PRC2)	0305984F	257	07.....	Volume 4 - 611
Physical Security Equipment	0604287F	81	05.....	Volume 2 - 627
Precision Attack Systems Procurement	0207249F	175	07.....	Volume 3 - 775
RAND Project Air Force	0605101F	109	06.....	Volume 3 - 17
RQ-4 UAV	0305220F	251	07.....	Volume 4 - 559
Rapid Cyber Acquisition	0305881F	256	07.....	Volume 4 - 605
Rapid Defense Experimentation Reserve (RDER)	0604025F	44	04.....	Volume 2 - 169
Rapid Sustainment Modernization (RSM)	0708051F	72	04.....	Volume 2 - 519
Region/Sector Operation Control Center Modernization Program	0102326F	156	07.....	Volume 3 - 545
Requirements Analysis and Maturation	0606017F	123	06.....	Volume 3 - 87
Science & Technology for Nuclear Re-entry Systems	0603273F	22	03.....	Volume 1 - 271
Science and Technology Management - Major Headquarters Activities	0602298F	11	02.....	Volume 1 - 143
Security and Investigative Activities	0305128F	244	07.....	Volume 4 - 463
Seek Eagle	0207590F	193	07.....	Volume 4 - 71
Service Support to SPACECOM Activities	1202140F	278	07.....	Volume 4 - 825
Service Support to STRATCOM - Global Strike	0101318F	151	07.....	Volume 3 - 495
Small Business Innovation Research	0605502F	110	06.....	Volume 3 - 21

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Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Small Diameter Bomb (SDB)	0207327F	179	07.....	Volume 3 - 817
Space Test Program (STP)	1206864F	133	06.....	Volume 3 - 137
Special Tactics / Combat Control	0408011F	266	07.....	Volume 4 - 703
Specialized Undergraduate Flight Training	0604233F	134	07.....	Volume 3 - 141
Stand In Attack Weapon	0207328F	98	05.....	Volume 2 - 817
Strategic Mission Planning & Execution System (SMPES)	0304100F	228	07.....	Volume 4 - 339
Submunitions	0604604F	83	05.....	Volume 2 - 659
Support to DCGS Enterprise	0305240F	254	07.....	Volume 4 - 585
Support to Information Operations (IO) Capabilities	0303166F	125	06.....	Volume 3 - 99
Survivable Airborne Operations Center (SAOC)	0604288F	50	04.....	Volume 2 - 229
Sustainment Science and Technology (S&T)	0603199F	17	03.....	Volume 1 - 209
Tactical AIM Missiles	0207161F	170	07.....	Volume 3 - 723
Tactical Air Control Party-Mod	0207444F	188	07.....	Volume 4 - 31
Tactical Data Networks Enterprise	0604281F	80	05.....	Volume 2 - 609
Tactical Deception	0208007F	199	07.....	Volume 4 - 141
Tech Transition Program	0604858F	57	04.....	Volume 2 - 341
Technology Transfer	0604317F	51	04.....	Volume 2 - 237
Test and Evaluation Support	0605807F	112	06.....	Volume 3 - 31
Theater Battle Management (TBM) C4I	0207438F	186	07.....	Volume 4 - 17

UNCLASSIFIED

UNCLASSIFIED

Air Force • Budget Estimates FY 2024 • RDT&E Program

Program Element Title	Program Element Number	Line #	BA	Page
Threat Simulator Development	0604256F	107	06.....	Volume 3 - 1
Three Dimensional Long-Range Radar (3DELRR)	0207455F	64	04.....	Volume 2 - 451
Training Developments	0804772F	106	05.....	Volume 2 - 893
Training Developments	0804772F	130	06.....	Volume 3 - 127
U.S. Space Command Research and Development Support	1206415F	75	04.....	Volume 2 - 547
USAF Modeling and Simulation	0207601F	194	07.....	Volume 4 - 81
Unified Platform (UP)	0208099F	204	07.....	Volume 4 - 201
University Affiliated Research Center (UARC) - Tactical Autonomy	0602022F	4	02.....	Volume 1 - 29
University Research Initiatives	0601103F	2	01.....	Volume 1 - 17
VC-25B	0401319F	104	05.....	Volume 2 - 873
Vehicles and Support Equipment - General	0202834F	159	07.....	Volume 3 - 577
War Reserve Materiel - Ammunition	0208030F	66	04.....	Volume 2 - 469
Wargaming and Simulation Centers	0207605F	195	07.....	Volume 4 - 95
Weather Service	0305111F	239	07.....	Volume 4 - 427
Wide Area Surveillance	0604445F	136	07.....	Volume 3 - 171
Worldwide Joint Strategic Communications	0101316F	150	07.....	Volume 3 - 485

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Department of the Air Force
 FY 2024 President's Budget
 Exhibit R-1 FY 2024 President's Budget
 Total Obligational Authority
 (Dollars in Thousands)

Mar 2023

	FY 2022 Actuals	FY 2023 Less Supplementals Enactment	FY 2023 Supplementals Enactment*	FY 2023 Total Enactment	FY 2024 Request
<u>Summary Recap of Budget Activities</u>					
Basic Research	505,166	612,317		612,317	583,858
Applied Research	1,590,543	1,744,375		1,744,375	1,433,320
Advanced Technology Development	918,318	1,096,066		1,096,066	891,376
Advanced Component Development & Prototypes	9,427,253	8,360,072	1,300	8,361,372	9,859,030
System Development & Demonstration	2,176,294	6,074,824		6,074,824	6,481,731
Management Support	3,828,179	3,304,709		3,304,709	3,486,758
Operational Systems Development	23,061,515	23,805,224	283,546	24,088,770	23,829,283
Total Research, Development, Test, & Evaluation	41,507,268	44,997,587	284,846	45,282,433	46,565,356
<u>Summary Recap of FYDP Programs</u>					
Strategic Forces	1,117,861	1,358,245		1,358,245	2,047,638
General Purpose Forces	4,400,861	4,731,867	10,000	4,741,867	5,160,229
Intelligence and Communications	1,209,806	1,173,980		1,173,980	1,061,042
Mobility Forces	557,864	396,697		396,697	756,557
Research and Development	16,948,692	19,386,302	38,800	19,425,102	20,470,070
Central Supply and Maintenance	174,960	171,979		171,979	94,340
Training Medical and Other	17,540	23,238		23,238	39,491
Administration and Associated Activities	103,958	77,443		77,443	93,157
Support of Other Nations	2,420	2,593		2,593	3,917
Space	6,551	21,768		21,768	24,670
Classified Programs	16,966,755	17,653,475	236,046	17,889,521	16,814,245

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328).

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Department of the Air Force
FY 2024 President's Budget
Exhibit R-1 FY 2024 President's Budget
Total Obligational Authority
(Dollars in Thousands)

Mar 2023

	FY 2022 Actuals	FY 2023 Less Supplementals Enactment	FY 2023 Supplementals Enactment*	FY 2023 Total Enactment	FY 2024 Request
Total Research, Development, Test, & Evaluation	41,507,268	44,997,587	284,846	45,282,433	46,565,356

*Includes enacted funding in the Ukraine Supplemental Appropriation Act, 2023 (Division B of Public Law 117-180) and Additional Ukraine Supplemental Appropriation Act, 2023 (Division M of Public Law 117-328)

Department of the Air Force
TOTAL CIVILIAN PERSONNEL COSTS
 OP-8B: OP-8 (PB)
 FY 2024 President's Budget
 (FY 2022)

	(\$ in Thousands)											d/c l Basic Comp	i/c m Total Comp	Rates k/c n Comp &	h/d o % BC Variables	j/d p % BC Benefits
	a Begin Strength	b End Strength	c FTEs	d Basic Comp	e Overtime Pay	f Holiday Pay	g Other O.C.11	e + f + g h Total Variables	d + h i Comp O.C.11	i Benefits -	i + j k Comp & Benefits					
Direct Funded Personnel (includes OC 13)	17,831	18,640	18,697	3,047,839	0	0	0	0	3,047,839	0	3,047,839	\$163,012	\$163,012	\$163,012	0.0%	0.0%
D1. US Direct Hire (USDH)	17,829	18,638	18,695	3,047,527	-	-	-	-	3,047,527	-	3,047,527	\$163,013	\$163,013	\$163,013	0.0%	0.0%
D1a. Senior Executive Schedule	13	13	13	2,005	-	-	-	-	2,005	-	2,005	\$154,231	\$154,231	\$154,231	0.0%	0.0%
D1b. General Schedule	14,787	15,532	15,544	2,819,640	-	-	-	-	2,819,640	-	2,819,640	\$181,397	\$181,397	\$181,397	0.0%	0.0%
D1c. Special Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1d. Wage System	3,029	3,093	3,138	225,882	-	-	-	-	225,882	-	225,882	\$71,983	\$71,983	\$71,983	0.0%	0.0%
D1e. Highly Qualified Experts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1f. Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D2. Direct Hire Program Foreign Nationals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D3. Total Direct Hire	17,829	18,638	18,695	3,047,527	-	-	-	-	3,047,527	-	3,047,527	\$163,013	\$163,013	\$163,013	0.0%	0.0%
D4. Indirect Hire Foreign Nationals (IHFN)	2	2	2	312	-	-	-	-	312	-	312	\$156,000	\$156,000	\$156,000	0.0%	0.0%
<i>Subtotal - Direct Funded (excludes OC 13)</i>	17,831	18,640	18,697	3,047,839	-	-	-	-	3,047,839	-	3,047,839	\$163,012	\$163,012	\$163,012	0.0%	0.0%
D5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reimbursable Funded Personnel (includes OC 13)	4,141	4,153	4,096	463,791	0	0	0	0	463,791	0	463,791	\$113,230	\$113,230	\$113,230	0.0%	0.0%
R1. US Direct Hire (USDH)	4,141	4,153	4,096	463,791	-	-	-	-	463,791	-	463,791	\$113,230	\$113,230	\$113,230	0.0%	0.0%
R1a. Senior Executive Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1b. General Schedule	4,141	4,153	4,096	463,791	-	-	-	-	463,791	-	463,791	\$113,230	\$113,230	\$113,230	0.0%	0.0%
R1c. Special Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1d. Wage System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1e. Highly Qualified Experts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1f. Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2. Direct Hire Program Foreign Nationals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3. Total Direct Hire	4,141	4,153	4,096	463,791	-	-	-	-	463,791	-	463,791	\$113,230	\$113,230	\$113,230	0.0%	0.0%
R4. Indirect Hire Foreign Nationals (IHFN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Subtotal - Reimbursable Funded (excludes OC 13)</i>	4,141	4,153	4,096	463,791	-	-	-	-	463,791	-	463,791	\$113,230	\$113,230	\$113,230	0.0%	0.0%
R5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Personnel (includes OC 13)	21,972	22,793	22,793	3,511,630	0	0	0	0	3,511,630	0	3,511,630	\$154,066	\$154,066	\$154,066	0.0%	0.0%
T1. US Direct Hire (USDH)	21,970	22,791	22,791	3,511,318	-	-	-	-	3,511,318	-	3,511,318	\$154,066	\$154,066	\$154,066	0.0%	0.0%
T1a. Senior Executive Schedule	13	13	13	2,005	0	0	0	0	2,005	0	2,005	\$154,231	\$154,231	\$154,231	0.0%	0.0%
T1b. General Schedule	18,928	19,685	19,640	3,283,431	0	0	0	0	3,283,431	0	3,283,431	\$167,181	\$167,181	\$167,181	0.0%	0.0%
T1c. Special Schedule	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T1d. Wage System	3,029	3,093	3,138	225,882	0	0	0	0	225,882	0	225,882	\$71,983	\$71,983	\$71,983	0.0%	0.0%
T1e. Highly Qualified Experts	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T1f. Other	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T2. Direct Hire Program Foreign Nationals	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T3. Total Direct Hire	21,970	22,791	22,791	3,511,318	-	-	-	-	3,511,318	-	3,511,318	\$154,066	\$154,066	\$154,066	0.0%	0.0%
T4. Indirect Hire Foreign Nationals (IHFN)	2	2	2	312	0	0	0	0	312	0	312	\$156,000	\$156,000	\$156,000	0.0%	0.0%
<i>Subtotal - Total Funded (excludes OC 13)</i>	21,972	22,793	22,793	3,511,630	-	-	-	-	3,511,630	-	3,511,630	\$154,066	\$154,066	\$154,066	0.0%	0.0%
T5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Department of the Air Force
TOTAL CIVILIAN PERSONNEL COSTS
 OP-8: OP-8 (PB)
 FY 2024 President's Budget
 (FY 2023)

	(\$ in Thousands)											Rates				
	<u>a</u> Begin Strength	<u>b</u> End Strength	<u>c</u> FTEs	<u>d</u> Basic Comp	<u>e</u> Overtime Pay	<u>f</u> Holiday Pay	<u>g</u> Other O.C.11	<u>e + f + g</u> <u>h</u> Total Variables	<u>d + h</u> <u>i</u> Comp O.C.11	<u>i</u> Benefits -	<u>i + j</u> <u>k</u> Comp & Benefits	<u>d/c</u> <u>l</u> Basic Comp	<u>i/c</u> <u>m</u> Total Comp	<u>k/c</u> <u>n</u> Comp &	<u>h/d</u> <u>o</u> % BC Variables	<u>j/d</u> <u>p</u> % BC Benefits
Direct Funded Personnel (includes OC 13)	18,640	19,087	18,944	2,677,292	0	0	0	0	2,677,292	0	2,677,292	\$141,327	\$141,327	\$141,327	0.0%	0.0%
D1. US Direct Hire (USDH)	18,638	19,085	18,942	2,676,982	-	-	-	-	2,676,982	-	2,676,982	\$141,325	\$141,325	\$141,325	0.0%	0.0%
D1a. Senior Executive Schedule	13	13	13	2,005	-	-	-	-	2,005	-	2,005	\$154,231	\$154,231	\$154,231	0.0%	0.0%
D1b. General Schedule	15,532	15,816	15,673	2,448,886	-	-	-	-	2,448,886	-	2,448,886	\$156,249	\$156,249	\$156,249	0.0%	0.0%
D1c. Special Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1d. Wage System	3,093	3,256	3,256	226,091	-	-	-	-	226,091	-	226,091	\$69,438	\$69,438	\$69,438	0.0%	0.0%
D1e. Highly Qualified Experts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1f. Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D2. Direct Hire Program Foreign Nationals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D3. Total Direct Hire	18,638	19,085	18,942	2,676,982	-	-	-	-	2,676,982	-	2,676,982	\$141,325	\$141,325	\$141,325	0.0%	0.0%
D4. Indirect Hire Foreign Nationals (IHFN)	2	2	2	310	-	-	-	-	310	-	310	\$155,000	\$155,000	\$155,000	0.0%	0.0%
<i>Subtotal - Direct Funded (excludes OC 13)</i>	18,640	19,087	18,944	2,677,292	-	-	-	-	2,677,292	-	2,677,292	\$141,327	\$141,327	\$141,327	0.0%	0.0%
D5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reimbursable Funded Personnel (includes OC 13)	4,153	4,091	4,091	542,297	0	0	0	0	542,297	0	542,297	\$132,559	\$132,559	\$132,559	0.0%	0.0%
R1. US Direct Hire (USDH)	4,153	4,091	4,091	542,297	-	-	-	-	542,297	-	542,297	\$132,559	\$132,559	\$132,559	0.0%	0.0%
R1a. Senior Executive Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1b. General Schedule	4,153	4,091	4,091	542,297	-	-	-	-	542,297	-	542,297	\$132,559	\$132,559	\$132,559	0.0%	0.0%
R1c. Special Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1d. Wage System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1e. Highly Qualified Experts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1f. Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2. Direct Hire Program Foreign Nationals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3. Total Direct Hire	4,153	4,091	4,091	542,297	-	-	-	-	542,297	-	542,297	\$132,559	\$132,559	\$132,559	0.0%	0.0%
R4. Indirect Hire Foreign Nationals (IHFN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Subtotal - Reimbursable Funded (excludes OC 13)</i>	4,153	4,091	4,091	542,297	-	-	-	-	542,297	-	542,297	\$132,559	\$132,559	\$132,559	0.0%	0.0%
R5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Personnel (includes OC 13)	22,793	23,178	23,035	3,219,589	0	0	0	0	3,219,589	0	3,219,589	\$139,769	\$139,769	\$139,769	0.0%	0.0%
T1. US Direct Hire (USDH)	22,791	23,176	23,033	3,219,279	-	-	-	-	3,219,279	-	3,219,279	\$139,768	\$139,768	\$139,768	0.0%	0.0%
T1a. Senior Executive Schedule	13	13	13	2,005	0	0	0	0	2,005	0	2,005	\$154,231	\$154,231	\$154,231	0.0%	0.0%
T1b. General Schedule	19,685	19,907	19,764	2,991,183	0	0	0	0	2,991,183	0	2,991,183	\$151,345	\$151,345	\$151,345	0.0%	0.0%
T1c. Special Schedule	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T1d. Wage System	3,093	3,256	3,256	226,091	0	0	0	0	226,091	0	226,091	\$69,438	\$69,438	\$69,438	0.0%	0.0%
T1e. Highly Qualified Experts	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T1f. Other	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T2. Direct Hire Program Foreign Nationals	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T3. Total Direct Hire	22,791	23,176	23,033	3,219,279	-	-	-	-	3,219,279	-	3,219,279	\$139,768	\$139,768	\$139,768	0.0%	0.0%
T4. Indirect Hire Foreign Nationals (IHFN)	2	2	2	310	0	0	0	0	310	0	310	\$155,000	\$155,000	\$155,000	0.0%	0.0%
<i>Subtotal - Total Funded (excludes OC 13)</i>	22,793	23,178	23,035	3,219,589	-	-	-	-	3,219,589	-	3,219,589	\$139,769	\$139,769	\$139,769	0.0%	0.0%
T5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Department of the Air Force
TOTAL CIVILIAN PERSONNEL COSTS
 OP-8: OP-8 (PB)
 FY 2024 President's Budget
 (FY 2024)

	(\$ in Thousands)											d/c l Basic Comp	i/c m Total Comp	Rates k/c n Comp &	h/d o % BC Variables	j/d p % BC Benefits
	a Begin Strength	b End Strength	c FTEs	d Basic Comp	e Overtime Pay	f Holiday Pay	g Other O.C.11	e + f + g h Total Variables	d + h i Comp O.C.11	i Benefits -	i + j k Comp & Benefits					
Direct Funded Personnel (includes OC 13)	19,087	19,199	19,160	3,191,398	0	0	0	0	3,191,398	0	3,191,398	\$166,566	\$166,566	\$166,566	0.0%	0.0%
D1. US Direct Hire (USDH)	19,085	19,197	19,158	3,191,089	-	-	-	-	3,191,089	-	3,191,089	\$166,567	\$166,567	\$166,567	0.0%	0.0%
D1a. Senior Executive Schedule	13	75	75	11,567	-	-	-	-	11,567	-	11,567	\$154,227	\$154,227	\$154,227	0.0%	0.0%
D1b. General Schedule	15,816	15,866	15,827	2,953,431	-	-	-	-	2,953,431	-	2,953,431	\$186,607	\$186,607	\$186,607	0.0%	0.0%
D1c. Special Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1d. Wage System	3,256	3,256	3,256	226,091	-	-	-	-	226,091	-	226,091	\$69,438	\$69,438	\$69,438	0.0%	0.0%
D1e. Highly Qualified Experts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D1f. Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D2. Direct Hire Program Foreign Nationals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D3. Total Direct Hire	19,085	19,197	19,158	3,191,089	-	-	-	-	3,191,089	-	3,191,089	\$166,567	\$166,567	\$166,567	0.0%	0.0%
D4. Indirect Hire Foreign Nationals (IHFN)	2	2	2	309	-	-	-	-	309	-	309	\$154,500	\$154,500	\$154,500	0.0%	0.0%
<i>Subtotal - Direct Funded (excludes OC 13)</i>	<i>19,087</i>	<i>19,199</i>	<i>19,160</i>	<i>3,191,398</i>	-	-	-	-	<i>3,191,398</i>	-	<i>3,191,398</i>	<i>\$166,566</i>	<i>\$166,566</i>	<i>\$166,566</i>	<i>0.0%</i>	<i>0.0%</i>
D5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reimbursable Funded Personnel (includes OC 13)	4,091	4,723	4,410	608,639	0	0	0	0	608,639	0	608,639	\$138,013	\$138,013	\$138,013	0.0%	0.0%
R1. US Direct Hire (USDH)	4,091	4,723	4,410	608,639	-	-	-	-	608,639	-	608,639	\$138,013	\$138,013	\$138,013	0.0%	0.0%
R1a. Senior Executive Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1b. General Schedule	4,091	4,723	4,410	608,639	-	-	-	-	608,639	-	608,639	\$138,013	\$138,013	\$138,013	0.0%	0.0%
R1c. Special Schedule	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1d. Wage System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1e. Highly Qualified Experts	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R1f. Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R2. Direct Hire Program Foreign Nationals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R3. Total Direct Hire	4,091	4,723	4,410	608,639	-	-	-	-	608,639	-	608,639	\$138,013	\$138,013	\$138,013	0.0%	0.0%
R4. Indirect Hire Foreign Nationals (IHFN)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Subtotal - Reimbursable Funded (excludes OC 13)</i>	<i>4,091</i>	<i>4,723</i>	<i>4,410</i>	<i>608,639</i>	-	-	-	-	<i>608,639</i>	-	<i>608,639</i>	<i>\$138,013</i>	<i>\$138,013</i>	<i>\$138,013</i>	<i>0.0%</i>	<i>0.0%</i>
R5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Personnel (includes OC 13)	23,178	23,922	23,570	3,800,037	0	0	0	0	3,800,037	0	3,800,037	\$161,223	\$161,223	\$161,223	0.0%	0.0%
T1. US Direct Hire (USDH)	23,176	23,920	23,568	3,799,728	-	-	-	-	3,799,728	-	3,799,728	\$161,224	\$161,224	\$161,224	0.0%	0.0%
T1a. Senior Executive Schedule	13	75	75	11,567	0	0	0	0	11,567	0	11,567	\$154,227	\$154,227	\$154,227	0.0%	0.0%
T1b. General Schedule	19,907	20,589	20,237	3,562,070	0	0	0	0	3,562,070	0	3,562,070	\$176,018	\$176,018	\$176,018	0.0%	0.0%
T1c. Special Schedule	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T1d. Wage System	3,256	3,256	3,256	226,091	0	0	0	0	226,091	0	226,091	\$69,438	\$69,438	\$69,438	0.0%	0.0%
T1e. Highly Qualified Experts	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T1f. Other	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T2. Direct Hire Program Foreign Nationals	0	0	0	0	0	0	0	0	0	0	0	-	-	-	-	-
T3. Total Direct Hire	23,176	23,920	23,568	3,799,728	-	-	-	-	3,799,728	-	3,799,728	\$161,224	\$161,224	\$161,224	0.0%	0.0%
T4. Indirect Hire Foreign Nationals (IHFN)	2	2	2	309	0	0	0	0	309	0	309	\$154,500	\$154,500	\$154,500	0.0%	0.0%
<i>Subtotal - Total Funded (excludes OC 13)</i>	<i>23,178</i>	<i>23,922</i>	<i>23,570</i>	<i>3,800,037</i>	-	-	-	-	<i>3,800,037</i>	-	<i>3,800,037</i>	<i>\$161,223</i>	<i>\$161,223</i>	<i>\$161,223</i>	<i>0.0%</i>	<i>0.0%</i>
T5. Other Object Class 13 Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T5a. USDH - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
T5b. DHFN - Benefits for Former Employees	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
T5c. Voluntary Separation Incentive Pay	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
T5d. Foreign National Separation Liability	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0

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ACRONYMS

GENERAL ACRONYMS

A&AS	- Advisory & Assistance Services
ABIDES	- Automated Budget Interactive Data Environment System
ACAT	- Acquisition Category
ACTD	- Advanced Concept Technology Demonstration
AGM	- Air-to-Ground Missile
AIM	- Air Intercept Missile
AIS	- Avionics Intermediate Shop
ACMI	- Aircraft Combat Maneuvering Instrumentation
AMRAAM	- Advanced Medium-Range Air-to-Air Missile
APPN	- Appropriation
ATD	- Advanced Technology Development
BA	- Budget Activity
BES	- Budget Estimate Submission
BY	- Budget Year
C3	- Command, Control, and Communication System
CFE	- Contractor Furnished Equipment
CONOPS	- Concept of Operation
CONUS	- Continental United States
CPMS	- Comprehensive Power Management System
CPT	- Cockpit Procedures Trainer
CRA	- Continuing Resolution Authority
CTS	- Countermeasures Test Set
CY	- Current Year
ECCM	- Electronic Counter Counter-Measures
ECM	- Electronic Counter Measures
ECO	- Engineering Change Orders
EOQ	- Economic Order Quantity
ECP	- Engineering Change Proposal
EPA	- Economic Price Adjustment
EW	- Electronic Warfare
EWAISP	- Electronic Warfare Avionics Integration Support Facility
FLIR	- Forward Looking Infra Red

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FOT&E	- Follow-on Test and Evaluation
FOC	- Fully Operational Capability
FLTS	- Flight Line Test Set
FPIF	- Fixed Price Incentive Firm
FPIS	- Fixed Price Incentive Fee, Successive Targets
FY	- Fiscal Year
GANS	- Global Access Navigation & Safety
GATM	- Global Air Traffic Management
GFE	- Government Furnished Equipment
GFP	- Government Furnished Property
GPS	- Global Positioning System
GSE	- Ground Support Equipment
ICS	- Interim Contractor Support
IOC	- Initial Operating Capability
IT	- Information Technology
JUON	- Joint Urgent Operational Need
MAIS	- Major Automated Information System Program
MDAP	- Major Defense Acquisition Program
METS	- Mobile Electronic Test Stations
MYP	- Multiyear Procurement
NAVWAR	- Navigation Warfare
NMC Rate	- Not Mission Capable Rate
OCO	- Overseas Contingency Operations
OOC	- Overseas Operations Costs
OT&E	- Operational Test and Evaluation
OWRM	- Other War Reserve Material
PAGEL	- Priced Aerospace Ground Equipment List
PB	- President's Budget
PBR	- Program Budget Review
PMA	- Program Management Administration
PMC	- Procurement Method Code
PNO	- Acquisition Program Number (MDAP Codes)
PR	- Purchase Request
PRCP	- Program Resource Collection Process
PTT	- Part Task Trainer
PY	- Prior Year

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R&M	- Reliability and Maintainability
RAA	- Rapid Acquisition Authority
RDT&E	- Research, Development, Test and Evaluation
RWR	- Radar Warning Receiver
ROM	- Rough Order of Magnitude
SS	- Sole Source
SOF	- Special Operation Force
TAF	- Tactical Air Force
TCAS	- Traffic Collision Alert and Avoidance System
TEWS	- Tactical Electronic Warfare System
TISS	- TEWS Intermediate Support System
TOA	- Total Obligation Authority
WCF	- Working Capital Fund
WRM	- War Reserve Material
WST	- Weapon System Trainer
UAV	- Unmanned Aerial Vehicle
XML	- Extensible Markup Language

BASE / ORGANIZATIONAL ACRONYMS

ACC	- Air Combat Command
AETC	- Air Education & Training Command
AFCAO	- Air Force Computer Acquisition Office
AFCEA	- Air Force Civil Engineering Support Agency
AFCIC	- AF Communications & Information Center
AFCSC	- Air Force Cryptologic Service Center
AFESC	- Air Force Engineering Services Center
AFGWC	- Air Force Global Weather Central
AFIT	- Air Force Institute of Technology
AFLCMC	- Air Force Life Cycle Management Center
AFMC	- Air Force Materiel Command
AFMETCAL	- Air Force Metrology and Calibration Office
AFMLO	- Air Force Medical Logistics Office
AFOSI	- Air Force Office of Special Investigation
AFOTEC	- Air Force Operational Test & Evaluation Center
AFPC	- Air Force Personnel Center

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AFPSL	- AF Primary Standards Lab
AFR	- Air Force Reserve
AFSOC	- AF Special Operations Command
AFSPC	- Air Force Space Command
AIA	- Air Intelligence Agency
ALC	- Air Logistics Center
AMC	- Air Mobility Command
ANG	- Air National Guard
ASC	- Aeronautical Systems Center
AETC	- Air Education Training Command
AU	- Air University
AWS	- Air Weather Service
CIA	- Central Intelligence Agency
DGSC	- Defense General Support Center
DLA	- Defense Logistics Center
DOE	- Department of Energy
DPSC	- Defense Personnel Support Center
DSCC	- Defense Supply Center, Columbus
DTIC	- Defense Technical Information Center
ER	- Eastern Range
ESC	- Electronic Systems Center
FAA	- Federal Aviation Agency
FBI	- Federal Bureau of Investigation
GSA	- General Services Administration
JCS	- Joint Chiefs of Staff
NATO	- North Atlantic Treaty Organization
OSD	- Office of the Secretary of Defense
PACAF	- Pacific Air Forces
USAF	- United States Air Force
USAFA	- United States Air Force Academy
USAFE	- United States Air Force Europe
USCENTCOM	- United States Central Command
USEUCOM	- United States European Command
USMC	- United States Marine Corps
USSTRATCOM	- United States Strategic Command
WP AFB	- Wright-Patterson AFB, OH

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CONTRACT METHOD / TYPE ACRONYMS

C	- Competitive
BA	- Basic Agreement
BOA	- Basic Ordering Agreement
BPA	- Blanket Purchasing Agreement
CS	- Cost Sharing
IDDQ	- Indefinite Delivery, Definite Quantity
IDIQ	- Indefinite Delivery, Indefinite Quantity
IDRT	- Indefinite Delivery, Requirements
Letter	- Letter
LH	- Labor-hour
MIPR	- Military Interdepartmental Purchase Request
MIPR-C	- Military Interdepartmental Purchase Request - Competitive
MIPR-OPT	- Military Interdepartmental Purchase Request - Option
MIPR-OTH	- Military Interdepartmental Purchase Request – Other
MIPR-SS	- Military Interdepartmental Purchase Request - Sole Source
OPT	- Option
OTH	- Other
PO	- Project Order
REQN	- Requisition
SS	- Sole Source
T&M	- Time and Materials
UCA	- Undefinitized Contract Action
WP	- Work Project

CONTRACTED BY ACRONYMS

11 WING	- 11th Support Wing, Washington, DC
ACC	- Air Combat Command, Langley AFB, VA
AEDC	- Arnold Engineering Development Center, Arnold AFB, TN
AAC	- Air Armament Center, Eglin AFB, FL
AEDC	- Arnold Engineering Development Center, Arnold AFB, TN
AETC	- Air Education and Training Command, Randolph AFB, TX
AFCIC	- Air Force Communications and Information Center, Washington, DC
AFCESA	- Air Force Civil Engineering Support Agency, Tyndall AFB, FL

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AFFTC	- Air Force Flight Test Center, Edwards AFB, CA
AFLCMC	- Air Force Life Cycle Management Center, Wright-Patterson AFB, OH
AFMC	- Air Force Materiel Command, Wright-Patterson AFB, OH
AFMETCAL	- Air Force Metrology and Calibration Office, Heath, Ohio
AFMLO	- Air Force Medical Logistics Office, Ft Detrick, MD
AIA	- Air Intelligence Agency, Kelly AFB, TX
AMC	- Air Mobility Command, Scott AFB, IL
ASC	- Aeronautical Systems Center, Wright-Patterson AFB, OH & Eglin AFB, FL
AFWA	- Air Force Weather Agency, Offutt AFB, NE
DGSC	- Defense General Support Center, Richmond, VA
DPSC	- Defense Personnel Support Center, Philadelphia, PA
ER	- Eastern Range, Patrick SFB, FL
ESC	- Electronic Systems Center, Hanscom AFB, MA
HSC	- Human Services Center, Brook AFB, TX
OC-ALC	- Oklahoma City Air Logistics Center, Tinker AFB, OK
OO-ALC	- Ogden Air Logistics Center, Hill AFB, UT
SMC	- Space & Missile Systems Center, Los Angeles AFB, CA
US STRATCOM	- US Strategic Command, Offutt AFB, NE
WACC	- Washington Area Contracting Center, Washington DC
WR	- Western Range, Vandenberg SFB, CA
WR-ALC	- Warner-Robins Air Logistics Center, Robins AFB, GA
AFSPC	- Air Force Space Command, Peterson AFB, CO
HQ ANG	- Headquarters, Air National Guard, Washington, DC
USAFE	- United States Air Force Europe, Ramstein AB, GE
USAFA	- United States Air Force Academy, Colorado Springs, CO

IDENTIFICATION CODES

Code "A"	- Line items of material which have been approved for Air Force service use.
Code "B"	- Line items of material that have not been approved for Service use
OBAN	- Operating Budget Account Number, 2-digit code for unit allocated funds

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force</i> / BA 1: <i>Basic Research</i>	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	331.118	406.125	401.486	0.000	401.486	382.183	399.768	407.209	433.283	Continuing	Continuing
613001: <i>Physics and Electronics</i>	0.000	70.930	118.359	117.740	0.000	117.740	111.853	114.611	116.067	122.242	Continuing	Continuing
613002: <i>Aerospace, Chemical and Material Sciences</i>	0.000	76.461	123.618	117.926	0.000	117.926	106.418	109.926	115.385	120.411	Continuing	Continuing
613003: <i>Mathematics, Information and Life Sciences</i>	0.000	69.387	124.835	118.511	0.000	118.511	113.258	116.009	117.709	123.734	Continuing	Continuing
613004: <i>Education and Outreach</i>	0.000	114.340	39.313	38.911	0.000	38.911	39.734	47.088	46.525	54.129	Continuing	Continuing
613005: <i>STEM Pipeline Development</i>	0.000	0.000	0.000	8.398	0.000	8.398	10.920	12.134	11.523	12.767	Continuing	Continuing

A. Mission Description and Budget Item Justification

Defense Research Sciences consists of extramural research activities in academia and industry along with in-house research performed in the Air Force Research Laboratory. This program supports basic broad-based scientific and engineering research in areas critical to Department of the Air Force weapon, sensor, and support systems. All research areas are subject to long-range planning and technical review by both Department of the Air Force and tri-Service scientific planning groups. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 0602298F, and 1206601SF.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

Funds in this program element may be used to investigate specified science advancements in air, space and/or cyber domains.

This program is in Budget Activity 1, Basic Research because this budget activity includes scientific study and experimentation directed toward increasing fundamental knowledge and understanding in those fields of the physical, engineering, environmental, and life sciences related to long-term national security needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force</i> / BA 1: <i>Basic Research</i>	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	353.303	375.325	376.916	0.000	376.916
Current President's Budget	331.118	406.125	401.486	0.000	401.486
Total Adjustments	-22.185	30.800	24.570	0.000	24.570
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	30.800			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-9.053	0.000			
• Other Adjustments	-13.132	0.000	24.570	0.000	24.570

Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2022	FY 2023
Project: 613001: <i>Physics and Electronics</i>		
Congressional Add: <i>Program Increase - basic research</i>	0.000	8.000
Congressional Add Subtotals for Project: 613001	0.000	8.000
Project: 613002: <i>Aerospace, Chemical and Material Sciences</i>		
Congressional Add: <i>Program Increase - basic research</i>	0.000	8.000
Congressional Add Subtotals for Project: 613002	0.000	8.000
Project: 613003: <i>Mathematics, Information and Life Sciences</i>		
Congressional Add: <i>Program Increase - basic research</i>	0.000	8.000
Congressional Add: <i>Program increase - Space Force human performance optimization research</i>	-	5.800
Congressional Add Subtotals for Project: 613003	0.000	13.800
Project: 613004: <i>Education and Outreach</i>		
Congressional Add: <i>Program increase: basic research</i>	24.359	1.000
Congressional Add Subtotals for Project: 613004	24.359	1.000
Congressional Add Totals for all Projects	24.359	30.800

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>				Project (Number/Name) 613001 / <i>Physics and Electronics</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
613001: <i>Physics and Electronics</i>	0.000	70.930	118.359	117.740	0.000	117.740	111.853	114.611	116.067	122.242	Continuing	Continuing

A. Mission Description and Budget Item Justification

Basic research in the Physics and Electronics Project seeks to enable revolutionary advances and expand the fundamental knowledge supporting technologies critical to the future of the Department of the Air Force. Research prioritizes high-risk, high-reward, game-changing capability breakthroughs essential for future leaps in warfighter system performance, functionality, reliability, and survivability while simultaneously reducing component and system power, size, mass, and life cycle costs. Major areas being investigated in this project are complex electronics and fundamental quantum processes; plasma physics and high energy density non-equilibrium processes; and lasers and optics, electromagnetics, communication, and signal processing. While the following specific efforts are the focus of the project, there is interest in exploring novel ideas that may bridge these major efforts as well as those in the other projects within this program.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Complex Electronics and Fundamental Quantum Processes</p> <p>Description: Scientific focus areas are atomic and molecular physics, photonics, quantum electronic solids, gigahertz-terahertz electronics and material, semiconductor and electromagnetic materials, and optoelectronics.</p> <p>FY 2023 Plans: Explore a wide range of complex materials and devices, including non-linear optical materials, photonics, optoelectronics, metamaterials, cathodes, dielectric and magnetic materials, memristive systems, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. Includes generating and controlling quantum states, such as superposition and entanglement, in photonic systems, quantum dots and defects in solids, and ultracold atoms and molecules.</p> <p>FY 2024 Plans: Continue exploring a wide range of complex materials and devices, including non-linear optical materials, photonics, optoelectronics, metamaterials, cathodes, dielectric and magnetic materials, memristive systems, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. Includes generating and controlling quantum states, such as superposition and entanglement, in photonic systems, quantum dots and defects in solids, and ultracold atoms and molecules.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.952 million. Funding increased due to added emphasis in quantum information sciences and GHz-THz Electronics.</p>	28.372	44.144	47.096
<p>Title: Plasma Physics and High Energy Density Non-Equilibrium Processes</p> <p>Description: Scientific focus areas are plasma, electro-energetic physics and space sciences.</p> <p>FY 2023 Plans:</p>	14.186	23.175	24.725

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613001 / <i>Physics and Electronics</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Explore a wide range of activities characterized by processes sufficiently energetic to require understanding and managing plasma phenomenology and the non-linear response of materials to high electric and magnetic fields. Includes space weather, plasma discharges, radio frequency propagation, radio frequency-plasma interaction, and high-power, beam-driven microwave devices.</p> <p>FY 2024 Plans: Continue exploring a wide range of activities characterized by processes sufficiently energetic to require understanding and managing plasma phenomenology and the non-linear response of materials to high electric and magnetic fields. Includes space weather, plasma discharges, radio frequency propagation, radio frequency-plasma interaction, and high-power, beam-driven microwave devices.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.550 million. Funding increased due to added emphasis in high energy radiation-matter interactions research.</p>			
<p>Title: Lasers and Optics, Electromagnetics, Communication and Signal Processing</p> <p>Description: Scientific focus areas are physical mathematics and applied analysis, novel computational methods, electromagnetics and wave propagation in complex media, ultra-fast dynamics, for revolutionary approaches to remote sensing and imaging physics, and surveillance and navigation, including both air and the space environment from near Earth to cis-lunar trajectories.</p> <p>FY 2023 Plans: Explore all aspects of producing and receiving electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. Continue to investigate aspects of the phenomenology of lasers including high energy lasers, non-linear optics, and ultra-short pulse laser science. Includes the development of sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals as well as calculating astrodynamical spacecraft orbits.</p> <p>FY 2024 Plans: Continue exploring all aspects of producing and receiving electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging. Continue to investigate aspects of the phenomenology of lasers including high energy lasers, non-linear optics, and ultra-short pulse laser science. Includes the development of sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals as well as calculating astrodynamical spacecraft orbits.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	28.372	43.040	45.919

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613001 / <i>Physics and Electronics</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$2.879 million. Funding increased due to added emphasis in astrodynamics.			
Accomplishments/Planned Programs Subtotals	70.930	110.359	117.740

	FY 2022	FY 2023
Congressional Add: Program Increase - basic research	0.000	8.000
FY 2022 Accomplishments: Not Applicable		
FY 2023 Plans: Conducted Congressionally directed effort.		
Congressional Adds Subtotals	0.000	8.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>				Project (Number/Name) 613002 / <i>Aerospace, Chemical and Material Sciences</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
613002: <i>Aerospace, Chemical and Material Sciences</i>	0.000	76.461	123.618	117.926	0.000	117.926	106.418	109.926	115.385	120.411	Continuing	Continuing

A. Mission Description and Budget Item Justification

Mission Description and Budget Item Justification Basic research in the Aerospace, Chemical, and Materials Sciences Project seeks to enable revolutionary advances and expand the fundamental knowledge supporting technologies critical to the future of the Department of the Air Force. Research stresses high-risk, high-reward, game-changing capability breakthroughs essential for future leaps in warfighter system performance, functionality, reliability, and survivability while simultaneously reducing component and system power, size, mass, and life cycle costs. Research topics include: aero-structure interactions and control; energy, power, and propulsion; complex materials and structures; and cross-disciplinary research reflecting the highly integrated nature of future weapon systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Aero-Structure Interactions and Control</p> <p>Description: Scientific focus areas are high temperature aerospace materials, non-equilibrium aerothermodynamics and chemistry, unsteady, compressible flow turbulence, multiscale fluid-material interactions, and flow control.</p> <p>FY 2023 Plans: Investigate the characterization, modeling, and exploitation of interactions between the unsteady aerodynamic flow field and the dynamic air vehicle structure to enable enhanced performance in next generation Department of the Air Force systems. Explore the synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, high-performance structures, and thermodynamics.</p> <p>FY 2024 Plans: Continue investigating the characterization, modeling, and exploitation of interactions between the unsteady aerodynamic flow field and the dynamic air vehicle structure to enable enhanced performance in next generation Department of the Air Force systems. Continue to explore the synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, high-performance structures, and thermodynamics.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.693 million. Funds increased as described in above plans.</p>	22.938	34.685	35.378
<p>Title: Energy, Power, and Propulsion</p> <p>Description: Scientific focus areas are thermal control, theoretical chemistry, molecular dynamics, power and propulsion, and combustion and diagnostics.</p>	22.939	35.842	36.557

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613002 / <i>Aerospace, Chemical and Material Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Exploit technological innovations and develop potentially revolutionary technologies by integrating core disciplines of combustion, plasma dynamics, chemistry, hydrodynamics, structural dynamics, and multi-fidelity simulations. Investigate processes associated with the generation, storage, and utilization of energy, specifically for Department of the Air Force systems including developing novel energetic materials as well as understanding optimizing and controlling combustion processes.</p> <p><i>FY 2024 Plans:</i> Continue developing potentially revolutionary scientific advances by integrating core disciplines of combustion, plasma dynamics, chemistry, hydrodynamics, structural dynamics, and multi-fidelity simulations. Continue to investigate processes associated with the generation, storage, and utilization of energy, specifically for Department of the Air Force systems including developing novel energetic materials as well as understanding optimizing and controlling combustion processes.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$0.715 million. Funds increased as described in above plans.</p>			
<p><i>Title:</i> Complex Materials and Structures</p> <p><i>Description:</i> Scientific focus areas are design, manufacturing, and dynamics and control of multifunctional materials and microsystems, multi-scale mechanics, diagnostics and prognosis, and physio-chemistry of novel organic materials.</p> <p><i>FY 2023 Plans:</i> Investigate multifunctional materials and structures composed of different classes of materials, both organic and inorganic, that can adapt to environmental constraints or mission requirements. Explore complex materials, microsystems, and structures that incorporate hierarchical design and functionality from the nano-scale through the mesoscale, ultimately leading to controlled, well understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.</p> <p><i>FY 2024 Plans:</i> Continue investigating multifunctional materials and structures composed of different classes of materials, both organic and inorganic, that can adapt to environmental constraints or mission requirements. Continue to explore complex materials, microsystems, and structures that incorporate hierarchical design and functionality from the nano-scale through the mesoscale, ultimately leading to controlled, well-understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i></p>	30.584	45.091	45.991

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613002 / <i>Aerospace, Chemical and Material Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$0.900 million. Funds increased as described in above plans.			
Accomplishments/Planned Programs Subtotals	76.461	115.618	117.926

	FY 2022	FY 2023
Congressional Add: Program Increase - basic research	0.000	8.000
FY 2022 Accomplishments: Not Applicable		
FY 2023 Plans: Conduct Congressionally directed effort.		
Congressional Adds Subtotals	0.000	8.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613003 / <i>Mathematics, Information and Life Sciences</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
613003: <i>Mathematics, Information and Life Sciences</i>	0.000	69.387	124.835	118.511	0.000	118.511	113.258	116.009	117.709	123.734	Continuing	Continuing

A. Mission Description and Budget Item Justification

Mission Description and Budget Item Justification Basic research in the Mathematics, Information Sciences, and Life Sciences Project seeks to expand fundamental knowledge and enable revolutionary advances and supporting technologies critical to the future of the Department of the Air Force. Major areas being investigated in this project are data fusion, machine learning and artificial intelligence, information and complex networks, cyber-security, autonomous decision making, dynamical systems, optimization and control, and natural materials and systems. While the following are specific sub-areas within this project, there is a continuing interest to explore novel ideas to bridge disciplines within this program.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Information and Complex Networks</p> <p>Description: Scientific focus areas are information operations and security, data and information fusion, advanced computing, artificial intelligence and complex networks.</p> <p>FY 2023 Plans: Design and analyze techniques to enable reliable and secure exchange of information and predictable operation of networks and systems, including hardware and software interactions. Investigate traditional aspects of information assurance with an emphasis on the underlying mathematics of secure-by-design architectures of networked communications and neural information processing. Analyze, optimize and design multi-scale networks with resilient features against noise and corruption from difficult environments and adversarial operations, using rigorous mathematical models of information exchange, physical operations, and human-machine interactions. Develop new computing approaches and algorithms for network-of-network information processing at the speed of warfare and new mathematical approaches for predictive, multi-scale and multi-physics simulations of Department of the Air Force systems and systems-of-systems in realistic environments.</p> <p>FY 2024 Plans: Continue designing and analyzing techniques to enable reliable and secure exchange of information and predictable operation of networks and systems, including hardware and software interactions. Investigate traditional aspects of information assurance with an emphasis on the underlying mathematics of secure-by-design architectures of networked communications and neural information processing. Analyze, optimize and design multi-scale networks with resilient features against noise and corruption from difficult environments and adversarial operations, using rigorous mathematical models of information exchange, physical operations, and human-machine interactions. Develop new computing approaches and algorithms for network-of-network</p>	17.347	27.759	29.628

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613003 / <i>Mathematics, Information and Life Sciences</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>information processing at the speed of warfare and new mathematical approaches for predictive, multi-scale and multi-physics simulations of Department of the Air Force systems and systems-of-systems in realistic environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.869 million. Funding increased due to added emphasis in information assurance and cybersecurity research.</p>				
<p>Title: Decision Making</p> <p>Description: Scientific focus areas are mathematical modeling of cognition and decision making, development and testing of advanced representations and processes for higher-level artificial intelligence, trust between humans and autonomous agents, mixed human-machine decision making, and computational social science for asymmetric threat detection and predictive largescale influence.</p> <p>FY 2023 Plans: Investigate new mathematical laws, scientific principles, and robust algorithms that underlie intelligent, mixed human-machine decision-making to achieve accurate real-time integration of human expertise and knowledge into a machine-based battlespace network. Develop new mathematical models for information capture; object, scene and relation identification; and multi-level reasoning and meta-learning. Advance the critical knowledge base in modeling of individual and group cognitive processing and decision making, and construct advanced methodologies for predictive, verifiable simulations of large-scale socio-cultural and human-machine hybrid networks.</p> <p>FY 2024 Plans: Continue investigating new mathematical laws, scientific principles, and robust algorithms that underlie intelligent, mixed human-machine decision-making to achieve accurate real-time integration of human expertise and knowledge into a machine based battlespace network. Continue to develop new mathematical models for information capture; object, scene and relation identification; and multi-level reasoning and meta-learning. Continue to advance the critical knowledge base in modeling of individual and group cognitive processing and decision making, and construct advanced methodologies for predictive, verifiable simulations of large-scale socio-cultural and human-machine hybrid networks.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.495 million. Funding increased due to added emphasis in artificial intelligence and human-machine teaming research.</p>		13.877	22.207	23.702
<p>Title: Dynamical Systems, Optimization, and Control</p> <p>Description: Scientific focus areas are computer models of dynamical data and communication networks, data-fusion, dynamics and control theory for multi-scale and complex networks, and mathematics of distributed optimization in uncertain, variable,</p>		17.347	28.869	30.813

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613003 / <i>Mathematics, Information and Life Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>continuous and discrete networked systems. Includes the development of advanced computing architectures for solving optimization and data-fusion problems in real time and by embedded processors in autonomous or semi-autonomous platforms.</p> <p>FY 2023 Plans: Develop new scientific concepts supported by rigorous analysis for advancing the science of autonomy and promoting the understanding necessary to analyze and design complex multi-scale systems as well as provide guaranteed levels of performance. Develop novel adaptive control strategies for coordinating heterogeneous, autonomous, or semi-autonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial, and networked environments.</p> <p>FY 2024 Plans: Continue developing new scientific concepts supported by rigorous analysis for advancing the science of autonomy and promoting the understanding necessary to analyze and design complex multi-scale systems as well as provide guaranteed levels of performance. Continue to develop novel adaptive control strategies for coordinating heterogeneous, autonomous, or semiautonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial, and networked environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.944 million. Funding increased due to added emphasis in machine learning and computational mathematics.</p>			
<p>Title: Natural Materials and Systems</p> <p>Description: Scientific focus areas are natural materials and nature inspired systems, human performance and biosystems, cognitive neuroscience and biophysics.</p> <p>FY 2023 Plans: Investigate multi-disciplinary approaches for studying, using, mimicking, synthesizing and adapting to the ways natural systems are built, assembled and organized, and functioning to accomplish their objectives. Develop a fundamental understanding of biochemical mechanisms and control procedures for the production and manufacture of natural materials, and develop reverse engineering approaches to optimize the bio-chemical functionality. Develop approaches to adapt, blend and mimic existing natural sensory systems and neural systems of varying complexity, to add existing capabilities to these organisms and design in-silico replicas with similar or advanced capabilities.</p> <p>FY 2024 Plans: Continue investigating multi-disciplinary approaches for studying, using, mimicking, synthesizing and adapting to the ways natural systems are built, assembled and organized, and functioning to accomplish their objectives. Continue to develop a fundamental understanding of bio-chemical mechanisms and control procedures for the production and manufacture of natural materials and</p>	20.816	32.200	34.368

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613003 / <i>Mathematics, Information and Life Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
develop reverse-engineering approaches to optimize the bio-chemical functionality. Continue to develop approaches to adapt, blend and mimic existing natural sensory systems and neural systems of varying complexity, to add existing capabilities to these organisms and design in-silico replicas with similar or advanced capabilities.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$2.168 million. Funding increased due to added emphasis in human performance and bio-systems research.			
Accomplishments/Planned Programs Subtotals	69.387	111.035	118.511

	FY 2022	FY 2023
<i>Congressional Add:</i> Program Increase - basic research	0.000	8.000
<i>FY 2022 Accomplishments:</i> Not Applicable		
<i>FY 2023 Plans:</i> Conduct Congressionally directed effort.		
<i>Congressional Add:</i> Program increase - Space Force human performance optimization research	-	5.800
<i>FY 2023 Plans:</i> Conduct Congressionally directed effort.		
Congressional Adds Subtotals	0.000	13.800

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>				Project (Number/Name) 613004 / <i>Education and Outreach</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
613004: <i>Education and Outreach</i>	0.000	114.340	39.313	38.911	0.000	38.911	39.734	47.088	46.525	54.129	Continuing	Continuing

A. Mission Description and Budget Item Justification

The major efforts in the Science and Technology (S&T) Education and Outreach Project are to facilitate interactions between the international and domestic research communities and Department of the Air Force researchers, and to develop scientists and engineers with an awareness of Department of the Air Force basic research priorities. These professional interactions and collaborations benefit the Department of the Air Force by increasing awareness of basic research priorities in the research community as a whole and attracting talented scientists and engineers to address Department of the Air Force needs. International interactions foster relationships with scientific partners and leverage international expertise in nascent scientific developments. This project also seeks to enhance interactions with Historically Black Colleges and Universities, Hispanic serving institutions, and other minority institutions.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Outreach to International S&T Community</p> <p>Description: Foster international basic research cooperation by supporting direct interchanges with a broad range of key international researchers and communities. Identify and leverage international scientific advances when appropriate.</p> <p>FY 2023 Plans: Leverage international expertise and support international technology liaison missions to identify and maintain awareness of foreign science and technology developments. Explore current foreign investments and influence world-class scientific research on specific topics of interest to the Department of the Air Force. Pursue access to technical information on foreign research capabilities within our interests. Support international visits by scientists and high-level DoD science and technology delegations and provide a primary interface to coordinate international science and technology participation among DoD organizations.</p> <p>FY 2024 Plans: Continue leveraging international expertise to identify and maintain awareness of foreign scientific developments. Continue to explore foreign investments and influence world-class scientific research on specific topics of interest to the Department of the Air Force. Continue to pursue access to fundamental scientific discoveries outside the U.S. relevant to the Department of the Air Force. Continue to support international visits by scientists and high-level DoD fundamental science delegations, providing primary interface to coordinate international science and technology participation among DoD organizations.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.598 million. Funds increased as described in above plans.</p>	32.393	13.410	14.008
<p>Title: Outreach to U.S. S&T Workforce</p> <p>Description: Strengthen science, mathematics, and engineering research and infrastructure in the U.S., thereby strengthening current and future Department of the Air Force S&T capabilities.</p>	57.588	24.903	24.903

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613004 / <i>Education and Outreach</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Identify, recruit, and increase opportunities for new investigators to participate in critical Department of the Air Force research. Support basic science, mathematics, and engineering research including Historically Black Colleges and Universities, Hispanic-Serving Institutions, and other minority institutions. Foster Science, Technology, Engineering, and Mathematics (STEM) education and outreach activities for kindergarten through 12th grade (K-12) students. Complete activities that encourage elementary, middle, and high-school youths to develop an interest in and pursue higher education and employment in the science, mathematics, and engineering fields.</p> <p><i>FY 2024 Plans:</i> Continue identifying, recruiting, and increasing opportunities for new investigators to participate in critical Department of the Air Force and Space Force research. Support basic science, mathematics, and engineering research efforts with Historically Black Colleges and Universities, Hispanic-Serving Institutions, and other minority institutions. Focus investment and outreach to HBCU's to include funding in microelectronics, materials, energy, aerospace, and chemistry and other fields of importance to the Department. In FY 2024, activities that encourage K-12, elementary, middle, and high-school youths to develop an interest in science, mathematics, and engineering fields is redesignated to Project 613005, STEM Pipeline Development, to consolidate STEM outreach and increase funding visibility.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> N/A</p>			
Accomplishments/Planned Programs Subtotals	89.981	38.313	38.911

	FY 2022	FY 2023
<i>Congressional Add:</i> Program increase: basic research	24.359	1.000
<i>FY 2022 Accomplishments:</i> Conducted Congressionally directed effort		
<i>FY 2023 Plans:</i> Not Applicable		
Congressional Adds Subtotals	24.359	1.000

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 1					R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>				Project (Number/Name) 613005 / <i>STEM Pipeline Development</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
613005: <i>STEM Pipeline Development</i>	0.000	0.000	0.000	8.398	0.000	8.398	10.920	12.134	11.523	12.767	Continuing	Continuing

A. Mission Description and Budget Item Justification

The major efforts in the Science, Technology, Engineering, and Math (STEM) Pipeline Development Project are initiatives to support STEM education and outreach activities for kindergarten through 12th grade (K-12) students, and to support activities that encourage elementary, middle, and high-school youths to develop an interest in, and pursue, higher education and employment in the science, mathematics, and engineering career fields. These initiatives benefit the Department of the Air Force by cultivating a progressive pipeline of highly-trained and knowledgeable scientists and engineers aimed at filling Department of the Air Force science and engineering (S&E) workforce needs. This project seeks to cultivate STEM opportunities across the Department of the Air Force by supporting education and outreach activities that promote foundational knowledge building and experiential learning to inspire young students to pursue STEM-related career fields of critical importance to the Department of the Air Force.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: K-12 STEM Outreach</p> <p>Description: Foster Science, Technology, Engineering, and Mathematics (STEM) education and outreach activities for kindergarten through 12th grade (K-12) students and their educators to encourage an interest in STEM, provide exposure to STEM careers and opportunities, and to inspire the pursuit of higher education and employment in the Department of the Air Force science, mathematics, and engineering fields.</p> <p>FY 2023 Plans: Described in Project 613004.</p> <p>FY 2024 Plans: Continue developing, institutionalizing and coordinating K-12 STEM outreach activities throughout the Department of the Air Force. Leverage ongoing partnerships with industry, schools, and other government agencies, in order to enhance the effectiveness of investments in outreach that promotes foundational knowledge building, experiential learning and STEM workforce development.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$6.373 million. Funding increased because STEM education and outreach activities for K-12 students were reassigned to Project 613005 from Project 613004.</p>	-	0.000	6.373
<p>Title: Leadership Experience Growing Apprenticeships Committed to Youth (LEGACY)</p> <p>Description: Attract, inspire and develop the next generation of our nation's scientific and technical workforce, thereby strengthening future Department of the Air Force S&T capabilities.</p>	-	0.000	2.025

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 1	R-1 Program Element (Number/Name) PE 0601102F / <i>Defense Research Sciences</i>	Project (Number/Name) 613005 / <i>STEM Pipeline Development</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Described in Project 613004.</p> <p><i>FY 2024 Plans:</i> Continue identifying, cultivating, and increasing Science, Technology, Engineering, and Mathematics (STEM) opportunities across the Department of the Air Force through a progressive pipeline aimed at filling future science and engineering (S&E) workforce needs. Continue Supporting STEM activities that identify and retain talented elementary, middle school, high-school and undergraduate students to develop a young, diverse talent pool that will form the future S&E workforce.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$2.025 million. Funding increased because activities that encourage elementary, middle, and high-school students to develop an interest in science, mathematics, and engineering fields were reassigned to Project 613005 from Project 613004, for increased visibility.</p>			
Accomplishments/Planned Programs Subtotals	-	0.000	8.398

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity					R-1 Program Element (Number/Name)							
3600: <i>Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research</i>					PE 0601103F / <i>University Research Initiatives</i>							
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	174.048	206.192	182.372	0.000	182.372	158.784	137.782	149.011	157.144	Continuing	Continuing
615094: <i>University Research Initiatives</i>	-	174.048	206.192	182.372	0.000	182.372	158.784	137.782	149.011	157.144	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program supports defense-related basic research in a wide range of scientific and engineering disciplines relevant to maintaining U.S. military technology superiority. Research topics include, but are not limited to, transformational and high priority technologies such as nanotechnology, sensor networks, artificial intelligence and information fusion, smart materials and structures, quantum materials and processes for sensing, communication and computing, efficient energy and power conversion, and high-energy materials for propulsion and control. The program also enhances and promotes the education of U.S. scientists and engineers in disciplines critical to maintaining, advancing, and enabling future U.S. defense technologies. For example, the National Defense Science and Engineering Graduate program awards fellowships to train U.S. citizens in science and engineering disciplines of military importance under a joint tri-Service and Office of the Assistant Secretary of Defense for Research and Engineering competitive scholarship program. Finally, this program assists universities in establishing superior instrumentation capabilities needed to improve the quality of defense-related research and education. A fundamental component of this program is the recognition that future technologies and technology exploitations require highly coordinated and concerted multi- and inter-disciplinary efforts. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F. Funds in this program element may be used to investigate specified science advancements in air, space and/or cyber domains.

This program is in Budget Activity 1, Basic Research because this budget activity includes scientific study and experimentation directed toward increasing fundamental knowledge and understanding in those fields of the physical, engineering, environmental, and life sciences related to long-term national security needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research	R-1 Program Element (Number/Name) PE 0601103F I University Research Initiatives
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	187.403	171.192	173.509	0.000	173.509
Current President's Budget	174.048	206.192	182.372	0.000	182.372
Total Adjustments	-13.355	35.000	8.863	0.000	8.863
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	35.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-6.859	0.000			
• Other Adjustments	-6.496	0.000	8.863	0.000	8.863

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 615094: *University Research Initiatives*

Congressional Add: *Program increase: Defense university research instrumentation program*

Congressional Add: *CPF-GHz-THz Antenna Systems*

Congressional Add Subtotals for Project: 615094

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	24.085	30.000
	-	5.000
	24.085	35.000
	24.085	35.000

C. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Multidisciplinary University Research Initiative	82.480	92.444	96.372
Description: Promote fundamental, multi- and interdisciplinary science and engineering research projects involving multiple principal investigators.			
FY 2023 Plans: Enhance the program and continue funding competitive research grants at U.S. universities that focus on significantly expanding the basic knowledge of Department of the Air Force-relevant science and technology areas, not normally achievable in smaller funded, single investigator awards. Support and recognize superior academic researchers in the early stages of their careers through the Presidential Early Career Award for Scientists and Engineers program. Continue funding of existing multi-year awards of multi-disciplinary programs.			
FY 2024 Plans:			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force</i> / BA 1: <i>Basic Research</i>		R-1 Program Element (Number/Name) PE 0601103F / <i>University Research Initiatives</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Continue enhancing the program and continue funding competitive research grants at U.S. universities that focus on significantly expanding the basic knowledge of Department of the Air Force-relevant science and technology areas. Focus on complex research efforts not normally achievable in smaller funded, single investigator awards. Continuing support and recognition for superior academic researchers in the early stages of their careers through the Presidential Early Career Award for Scientists and Engineers program. Continue funding the existing multi-year, multidisciplinary awards and receive proposals from universities to fund next round of multidisciplinary research grants. The FY 2024 Multidisciplinary University Research topics are: Plasmon-Controlled Single-Atom Catalysis; A New Mathematical Paradigm for Integrating Data, Models, Decisions; AlN Semiconductors for High-Power Electronics; Compositionally Complex Ceramics (CCCs) via Knowledge-Guided Pyrolysis for Hypersonics; Piezoelectric Materials Interfaced with Semiconductors for Integrated Quantum Systems; Space-Based Characterization of Arctic Permafrost Dynamics; Modeling and Measuring Multilevel Resonance; Fundamental Limits of Passive Heterodyne Photodetection of Incoherent, Broadband Sources; and Tensor Networks and Low-Rank Methods for High-Dimensional Computing.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$3.928 million. Funding increased to bolster investment in complex research efforts that require large, multidisciplinary, research teams, in the topic areas described in the plans above.</p>				
<p>Title: Science and Engineering Education</p> <p>Description: Support post-graduate, graduate, and undergraduate education in science and engineering disciplines at U.S. universities.</p> <p>FY 2023 Plans: Enhance the program and continue to award highly competitive National Defense Science and Engineering Graduate fellowships. Support competitive awards for graduate and undergraduate research experiences, including those established under the Awards to Stimulate and Support Undergraduate Research Experiences program. Continue funding for awards initiated under prior year DoD programs.</p> <p>FY 2024 Plans: Continue enhancing the program and continue to award highly competitive National Defense Science and Engineering Graduate fellowships. Continue to support competitive awards for graduate and undergraduate research experiences, including those established under the Awards to Stimulate and Support Undergraduate Research Experiences program. Continue funding for awards initiated under prior year DoD programs.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.371 million. Funds increased as described in above plans.</p>		52.487	61.629	62.000
<p>Title: Research Instrumentation</p>		14.996	17.119	24.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research	R-1 Program Element (Number/Name) PE 0601103F I University Research Initiatives
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Enhance scientific and engineering research through advanced education infrastructure and instrumentation at U.S. universities.</p> <p>FY 2023 Plans: Enhance the program and award grants on a competitive basis under the Defense University Research Instrumentation Program to U.S. universities to acquire state-of-the-art, high technology instrumentation and infrastructure to enhance research and educational capabilities.</p> <p>FY 2024 Plans: Continue enhancing the program and award grants on a competitive basis under the Defense University Research Instrumentation Program to U.S. universities to acquire state-of-the-art, high technology instrumentation and infrastructure to enhance research and educational capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$6.881 million. Funding increased to further enhance basic research through investments in laboratory instrumentation at U.S. universities, to support research in quantum science, biotechnology, trusted autonomy, advanced materials, directed energy, and other research enablers to future Department of the Air Force technologies.</p>			
Accomplishments/Planned Programs Subtotals	149.963	171.192	182.372

	FY 2022	FY 2023
Congressional Add: Program increase: Defense university research instrumentation program	24.085	30.000
FY 2022 Accomplishments: Conducted Congressionally directed effort		
FY 2023 Plans: Not Applicable		
Congressional Add: CPF-GHz-THz Antenna Systems	-	5.000
FY 2023 Plans: Conduct Congressionally directed effort.		
Congressional Adds Subtotals	24.085	35.000

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity
3600: *Research, Development, Test & Evaluation, Air Force I BA 1: Basic Research*

R-1 Program Element (Number/Name)
PE 0601103F / *University Research Initiatives*

E. Acquisition Strategy
Not Applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602020F / <i>Future AF Capabilities Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	74.393	99.901	90.713	0.000	90.713	91.293	94.302	96.899	101.090	Continuing	Continuing
620200: <i>Enterprise Transformational Appld Research</i>	-	74.393	99.901	90.713	0.000	90.713	91.293	94.302	96.899	101.090	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element develops multidisciplinary applied research efforts to accelerate the technology pipeline of transformational capabilities by reducing risk and maturing the technology, so it can transition in support of larger advanced technology development capability investments. These activities are selected to enable solutions to the Department of the Air Force (DAF)s highest priorities to include Operational Imperatives and Critical Technology Areas. The Explore effort engages traditional & nontraditional industry, government laboratories, and academia through 12-24 month feasibility studies and demonstrations. The Seedlings for Disruptive Capabilities Program (SDCP) facilitates Air Force Research Laboratory (AFRL) cross-disciplinary applied research to provide leap-ahead, high risk technology development. Modeling, simulation, and analyses activities will continue to explore transformational research analytic technologies to enable validated positions and provide a solid foundation with emphasis to predict future outcomes and technology needs, as well as looking for more seedlings to feed the transformational capability pipeline. Efforts will advance future workforce development projects and will broaden partnerships to deepen and expand the scientific and technology enterprise. Applied research efforts span a broad spectrum of activities, and established processes allow agility and flexibility to meet higher demand signals.

AFRL will plan and manage these funds at the enterprise level to achieve a high level of collaboration executed across all of the applicable Technology Directorates, and apply the research toward disruptive capabilities. Building off the technology competencies and ecosystems of the Technology Directorates brings together the needed expertise and components to develop the transformational capabilities.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be executed in the Technology Directorates in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602020F / <i>Future AF Capabilities Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	79.901	88.672	88.852	0.000	88.852
Current President's Budget	74.393	99.901	90.713	0.000	90.713
Total Adjustments	-5.508	11.229	1.861	0.000	1.861
• Congressional General Reductions	0.000	-8.771			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	20.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-5.508	0.000			
• Other Adjustments	0.000	0.000	1.861	0.000	1.861

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 620200: *Enterprise Transformational Appld Research*

Congressional Add: *Program increase - alternative energy research*

Congressional Add Subtotals for Project: 620200

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	0.000	20.000
	0.000	20.000
	0.000	20.000

C. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Transformational Capability Incubator	74.393	79.901	0.000
Description: This effort was previously titled "AF Explore" but was updated to include USSF support. Integrates cross-enterprise multi-directorate transformational applied research efforts to accelerate the "pipeline" of technology-enabled capability candidates pursuing the five strategic capabilities outlined in the Air Force Science and Technology Strategy. The Air Force Research Laboratory will plan and manage these research activities at the enterprise level with decentralized execution to achieve the intent of the Strategy.			
FY 2023 Plans: Continue to develop future candidate technology programs which result from the scanning and ideation activities from the previous year, while maturing the programs already in progress from the previous year. The current technology programs include: Explore, Seedlings for Disruptive Capabilities, WARfighter-TECHnologist (WARTECH) capability demonstrations, and novel business processes. Capability demonstrations and close out will occur for FY22 Explore projects with potential new technology studies and demonstrations in areas of fog and edge computing, cement replacement material, and potential WARTECH topics that require			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>		R-1 Program Element (Number/Name) PE 0602020F / <i>Future AF Capabilities Applied Research</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>technology maturation and studies, as well as, seedling technologies such as next generation targeted electromagnetics, In-Band lethality against seeker threats, Magnetic and star tracking for extended range navigation, and photonic integrated circuits for improved space-based position and timing. Continue to explore transformational research analytic technologies to enable validated positions and provide a solid foundation to predict future outcomes, as well as looking for more seedlings to feed the transformational capability pipeline. Continue to advance future workforce development programs and broadening partnerships to deepen and expand the scientific and technology enterprise.</p> <p>FY 2024 Plans: To clarify intent, the activities from this effort have been realigned into three discrete thrusts: Explore, Seedlings for Disruptive Capabilities, and Data to Decisions and Collaborative Learning.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$79.901 million. Decrease is a result of realignment of funding from this thrust Transformational Capability Incubator into three discrete efforts: Explore, Seedlings for Disruptive Capabilities, & Data to Decisions and Collaborative Learning.</p>				
<p>Title: Explore</p> <p>Description: Explore engages traditional & non-traditional industry, gov't labs and academia through competitive opportunity calls to incubate Transformational S&T. Its strategy-informed construct works to uncover game-changing and leap ahead technologies that address DAF future force priorities. Explore's three-step process identifies, invests in, and matures these technologies through 12-24-month feasibility studies and proof of concept activities. The technology areas are identified through concept decomposition, horizon-scanning, and broad competitive calls to the nation's best and brightest innovators in industry, academia, government, non-profits and other non-traditional partners. Promising technologies are accelerated through aggressive, short duration applied research and development efforts. These efforts assess operational viability and demonstrate feasibility of transformational warfighter capabilities, including their associated business and use cases. To do this, a variety of approaches are used including modeling and simulation, military utility experimentation, exercise participation, technical analysis, technology/concept maturation, risk reduction activities, and subject matter expertise input. Explore informs future areas of research and aids in identifying emerging technologies which could enable larger advanced technology development capability investments.</p> <p>FY 2023 Plans: Funding aligned within this Program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubators", \$36.000 million.</p> <p>FY 2024 Plans: Funding identified previously as part of the overall "Transformational Capability Incubators" effort. Initiate efforts which support immediate priorities of the Department of the Air Force which may include, but are not limited to, transformational needs</p>		0.000	0.000	38.075

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602020F / <i>Future AF Capabilities Applied Research</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>within the intelligence, surveillance, and reconnaissance envelope to include data support, software tools, automation, and machine learning; impacting adversaries kill chain and technology in kill chain analysis; affordable weapons to include weapon transfer/loading, high speed affordable weapons, and delivery mechanisms to include the use of decoys; alternative positioning, navigation, and timing technologies; and novel computing and communication approaches. Continue investments in multiple energy solutions such as those to explore loader technologies, rechargeable energy solutions, flexible power generation, renewable power generation, energy storage, energy transfer, and wireless power distribution for agile combat employment, new engine technology, and transformative ways to provide power to an aircraft or forward operating location. Continue investments in universal support equipment to include new capabilities and technology to support flightline support equipment and generate new capabilities that will support agile combat employment operations. Continue investments in electronic warfare to include autonomous modeling and simulation at the edge, resilient communications, and algorithm development. Continue investments in distributed command and control including technology within distributed human-human teaming leveraging complex machine tools, AI enabled planning for contested environments, and workflow-based system-of-systems deployment. Continue investments in fog and edge computing to include computing solutions to process sensor data in real time, generate insights, and interact with the data in a distributed manner with the ability to send data to the cloud for additional processing. This further includes human computer interface technologies, energy efficient computing and architecture for data collection and processing, and collaborative computing, fusion, and networking. Complete initial investments in resilient distributed command and control including technology within distributed human-human teaming leveraging complex machine tools, AI enabled planning for contested environments, and workflow-based system-of-systems deployment. Complete investments in runway independence to include vertical takeoff and landing.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$38.075 million. Increase is a result of realignment of effort from this program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator".</p>			
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<p>Title: Seedlings for Disruptive Capabilities (SDCP)</p> <p>Description: Integrates cross-enterprise multi-directorate transformational applied research efforts to accelerate the "pipeline" of technology-enabled capability candidates pursuing the Department of the Air Force Operational Imperatives. Seedlings for Disruptive Capabilities solicits applied research to provide leap-ahead, high risk technology development. To significantly advance scientific progress of innovative concepts underpinning transformational operational capabilities to future forces, enhance organic AFRL research capabilities in an enterprise-level, cross-Directorate environment & fortify external research partnerships to leverage key emerging technology developments in academia, industry, and/or government laboratories. The Air Force Research Laboratory will plan and manage these research activities at the enterprise level with decentralized execution to achieve the intent of the Strategy.</p> <p>FY 2023 Plans:</p>	-	0.000	31.700
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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>		R-1 Program Element (Number/Name) PE 0602020F / <i>Future AF Capabilities Applied Research</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Funding aligned within this Program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator", \$31.600 million.</p> <p>FY 2024 Plans: Effort previously incorporated as part of the FY23 effort called "Transformational Capability Incubator". Initiate efforts which support immediate priorities of the Department of the Air Force by implementing cross-disciplinary applied research to provide leap-ahead, high risk technology development in areas such as extended range weapons, coherent radars for increase detection of UAVs, wideband agile RF communications, networking quantum, or scalable affordable phased arrays for Space. Complete research in defending aircraft with next-generation targeted electromagnetics - electronic attack and counter electronic capabilities. Complete research in in-band lethality against seeker threats - modes of lethality for directed energy. Complete research in magnetic and star tracking for extended range navigation - accurate navigation over water. Complete research in photonic integrated circuits for space communications, position, navigation, and timing - architectures resilient to GPS denial. Continue research in infrastructure for trusted satellite autonomy for tactical rapid adversarial protection - safe, high assurance autonomy methodologies and human-autonomy interactions to react, plan and decide on appropriate actions in space. Continue research in spectral/polarization-sensitive event-based camera for intelligence, reconnaissance, and surveillance air moving target indicator - only reports changes in scene dynamics with enhanced target identification and real-world predictive power. Continue research in "Rainfly" - novel artificial intelligence-enabled methodologies to discover and characterize adversaries' defense systems to gain insight into organizational functionality.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$31.700 million. Increase is a result of realignment of funding from this program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator".</p>				
<p>Title: Data to Decisions and Collaborative Learning</p> <p>Description: Perform modeling, simulation, and analyses assessing the military utility of candidate transformational component applied research investments. Enhance the use of advanced systems for decision-making and a variety of innovations required to connect experts with operators in pursuit of achieving future force capabilities through applied research. Leverage best-in-class data analytics that connect warfighters with scientists and engineers, and innovating laboratory processes to accelerate technology maturation. Conduct a variety of strategic enterprise-level activities, including but not limited to: regional campus hubs, scientists and engineers working with the leading national innovators; Edison Grant program, promoting technical proficiency in our military members, centers for excellence, and the Air Force Research Laboratory (AFRL) Front Door. AFRL collaborates with thousands of subject matter experts inside and outside government, academia, and industry enhancing and developing DoD relevant capabilities. Continuous lab process innovation via Air Force "TechConnect" tools connecting people with people and building a pipeline of ideas from external sources; leveraging AI-fueled tech connect platforms, and supporting future force capabilities with real-time feedback loops through these tools, data analytics, and new connections to non-traditional partners.</p>		-	0.000	20.938

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602020F / <i>Future AF Capabilities Applied Research</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Funding aligned within this Program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubators", \$14.800 million.</p> <p><i>FY 2024 Plans:</i> Effort previously incorporated as part of the FY23 effort called "Transformational Capability Incubator". Continue modeling, simulation, & analyses enabling validated positions and providing a solid foundation for predicting future outcomes. Continue Air Force Research Laboratory's tech connect platforms connecting entrepreneurs, small business, industry, academia, & military with Air Force and Space Force science and technology ecosystem. Continue internships and undergraduate research opportunities to build the science and technology workforce pipeline. Continue "Savage Future", connecting warfighters with the science and technology community, enabling understanding of both the problems and optimal solutions to accelerate results. Continue the Edison Grant program building the military science and engineering pipeline by promoting technical proficiency of our uniformed scientists and engineers.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$20.938 million. Increase is a result of realignment of funding from this program Future AF Capabilities Applied Research, 0602020F; effort named "Transformational Capability Incubator".</p>			
Accomplishments/Planned Programs Subtotals	74.393	79.901	90.713

	FY 2022	FY 2023
<i>Congressional Add:</i> Program increase - alternative energy research	0.000	20.000
<i>FY 2022 Accomplishments:</i> Not applicable.		
<i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	0.000	20.000

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602022F I <i>University Affiliated Research Center (UARC) - Tactical Autonomy</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	0.000	0.000	8.018	0.000	8.018	8.208	8.400	8.558	8.739	Continuing	Continuing
622408: <i>HBCU University Affiliated Research Center (UARC)</i>	-	0.000	0.000	8.018	0.000	8.018	8.208	8.400	8.558	8.739	Continuing	Continuing

Note

This program, BA 2, PE 0602022F, project 622408, University Affiliated Research Center (UARC) For Tactical Autonomy, is a new start.

A. Mission Description and Budget Item Justification

The Tactical Autonomy University Affiliated Research Center (UARC) supports a consortium performing innovative research to advance the state of the art as well as cultivate awareness of and expertise in the field of tactical autonomy. Research topics of interest include, but are not limited to, the following: Trust in Mission Autonomy, Collaboration between Platforms, and Human Machine Teaming.

Funds in this program element are planned to investigate, design, develop, digitize, and/or analyze specified technology advancements in air, space, ground, sea, and/or cyber domains. This research will address factors that have complicated the deployment and adoption of autonomous technologies such as trust in mission autonomy, collaboration between platforms, and human-machine teaming. Research will also seek to integrate autonomous technologies with advanced battle management systems. The UARC will also work to expand the defense industrial base by identifying and incorporating applicable technologies from small businesses.

This research initiative will support the Department of Defense Science, Technology, Engineering, and Mathematics (STEM) strategic plan by establishing long-term core research expertise in tactical autonomy that will leverage scientific and engineering capabilities among the consortium of contributing HBCUs. Tactical autonomy will be a critical technology in prolonged great power conflict because the development of autonomous systems is a realistic approach to counter an advisory approaching parity in conventional strength in theatre, and tactical autonomy will enable warfighting capability in an environment where command and control may be disrupted by cyber or electronic warfare effects. This research will contribute to operational warfighting capabilities by increasing the capabilities of uncrewed platforms that will have greater availability, easier mobility and logistical sustainability, and shorter production cycle times. Research will produce creative solutions to optimize the capabilities of reliable data-driven autonomous platforms capable of operating in environments well suited to uncrewed systems, such as persistent defensive or force protection-related missions, or in high-risk environments such as heavy anti-access or Nuclear, Chemical, Biological (NBC) affected settings. One of the foremost advantages of the United States in great power competition is its advanced university-based scientific research institutions. This research initiative will strengthen HBCU scientific and engineering capabilities, advance the early career development of STEM students, leverage the research contributions of university faculty, and expand the pipeline of STEM graduates with national security experience for the government and the private-sector defense industrial base.

This program is in Budget Activity 2, Applied Research, because it includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602022F I <i>University Affiliated Research Center (UARC) - Tactical Autonomy</i>
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This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	0.000	0.000	0.000	0.000
Current President's Budget	0.000	0.000	8.018	0.000	8.018
Total Adjustments	0.000	0.000	8.018	0.000	8.018
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	8.018	0.000	8.018

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: University Affiliated Research Center (UARC) For Tactical Autonomy	-	-	8.018	0.000	8.018
Description: Development of technologies and tools to enable autonomous systems to act with delegated and bounded authority of humans in support of tactical, short-term actions, associated with longer-term strategic visions. Examples of capability objectives are: Enhancing multi-domain situational awareness, faster data processing and analysis, enhancing force protection, supporting cyber defense, augmenting logistics operations, and automating maneuverability and mobility functions.					
FY 2024 Base Plans: Development of technologies and tools to enable autonomous systems to act with delegated and bounded authority of humans in support of tactical, short-term actions, associated with longer-term strategic visions.					
FY 2024 OCO Plans: Not applicable.					
FY 2023 to FY 2024 Increase/Decrease Statement: This funding is a new program element request in FY 2024. The base contract was awarded to Howard University in FY 2023 as the lead vendor for the HBCU tactical autonomy university consortium.					
Accomplishments/Planned Programs Subtotals	-	-	8.018	0.000	8.018

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force Date: March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602022F <i>I University Affiliated Research Center (UARC) - Tactical Autonomy</i>
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D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

The HBCU Tactical Autonomy UARC will be co-funded by the Office of the Under Secretary of Defense (Research and Engineering) and the Office of the Under Secretary of Defense (Acquisition and Sustainment).

E. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	214.878	275.945	142.325	0.000	142.325	141.219	139.242	142.809	154.490	Continuing	Continuing
624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	-	144.168	169.294	54.318	0.000	54.318	54.637	56.068	57.392	62.495	Continuing	Continuing
624348: <i>Materials for Electronics, Optics, and Survivability</i>	-	42.792	57.279	39.593	0.000	39.593	39.209	40.097	40.979	43.679	Continuing	Continuing
624349: <i>Materials Technology for Sustainment</i>	-	27.918	49.372	48.414	0.000	48.414	47.373	43.077	44.438	48.316	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops advanced materials, processing, and inspection technologies to reduce life cycle costs and improve performance, sustainability, availability, affordability, supportability, reliability, and survivability of current and future Department of the Air Force systems and operations. The program has three projects that develop: structural, propulsion, and sub-systems materials and processes technologies; electronic, optical, and survivability materials and processes technologies; and sustainment materials, processes technologies, and advanced non-destructive inspection methodologies. Efforts in the program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

Funds in this PE may be used to investigate specified technology advancements in air, space and/or cyber domains.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	220.960	134.795	135.031	0.000	135.031
Current President's Budget	214.878	275.945	142.325	0.000	142.325
Total Adjustments	-6.082	141.150	7.294	0.000	7.294
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	141.150			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-6.082	0.000			
• Other Adjustments	0.000	0.000	7.294	0.000	7.294

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 624347: *Materials for Structures, Propulsion, and Subsystems*

- Congressional Add: *Program increase - thermal protection for hypersonic vehicles*
- Congressional Add: *Program increase - born qualified additive manufacturing*
- Congressional Add: *Program increase - high and ultra-high temperature ceramic-matrix composites for hypersonics*
- Congressional Add: *Program increase - additive manufacturing of alloys*
- Congressional Add: *Program increase - high energy synchotron x-ray research*
- Congressional Add: *Program increase - maturation of carbon-carbon thermal protection systems*
- Congressional Add: *Program increase - additive manufactured ceramic matrix composites*
- Congressional Add: *Program increase - catalytic architectures for ASCENT satellite maneuverability*
- Congressional Add: *Program increase - computationally-driven next generation carbon composite material development*
- Congressional Add: *Program increase - materials for high-energy fuels*
- Congressional Add: *Program increase - modeling ultra high temperature materials for hypersonics*
- Congressional Add: *Program increase - scanning and additive manufacturing*
- Congressional Add: *Program increase - accelerated material development for high mach capabilities*
- Congressional Add: *Program increase - disruptive alloy metals development*
- Congressional Add: *Program Increase - Deployable passive cooling*

	FY 2022	FY 2023
	9.827	0.000
	19.655	10.000
	9.827	10.000
	9.827	10.000
	8.353	9.000
	4.913	5.000
	0.000	5.000
	0.000	6.000
	0.000	5.000
	0.000	10.000
	0.000	10.000
	0.000	1.500
	0.000	10.000
	0.000	10.000
	0.000	5.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>
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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>	FY 2022	FY 2023
Congressional Add Subtotals for Project: 624347	62.402	106.500
Project: 624348: <i>Materials for Electronics, Optics, and Survivability</i>		
Congressional Add: <i>Program Increase - Deployable passive cooling</i>	4.913	0.000
Congressional Add: <i>Program increase - nano-bio technologies for aeromedical and en route care</i>	9.827	0.000
Congressional Add: <i>Program increase - photonic radio frequency CM</i>	9.827	0.000
Congressional Add: <i>Program increase - small satellite technology</i>	0.000	20.000
Congressional Add Subtotals for Project: 624348	24.567	20.000
Project: 624349: <i>Materials Technology for Sustainment</i>		
Congressional Add: <i>Program increase - digital maintenance advisor demonstration for F-16</i>	4.913	0.000
Congressional Add: <i>Program increase - failure prediction in material models</i>	4.913	0.000
Congressional Add: <i>Program increase - stealth aircraft coatings research</i>	3.931	0.000
Congressional Add: <i>Program increase - coating technologies to reduce lifecycle costs</i>	4.913	0.000
Congressional Add: <i>Program increase - transparency repair program</i>	0.000	4.650
Congressional Add: <i>Program increase - flexible conductive materials</i>	0.000	5.000
Congressional Add: <i>Program increase - electromagnetic protected advanced lightweight multifunctional materials</i>	0.000	5.000
Congressional Add Subtotals for Project: 624349	18.670	14.650
Congressional Add Totals for all Projects	105.639	141.150

Change Summary Explanation

The increase in FY2024 is due to increased emphasis in materials and processes for materials for system survivability in extreme environments and in characterization of materials for assessment and repair of damage from these environments.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>				Project (Number/Name) 624347 / <i>Materials for Structures, Propulsion, and Subsystems</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	-	144.168	169.294	54.318	0.000	54.318	54.637	56.068	57.392	62.495	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the materials and processing technology base for aircraft, spacecraft, launch systems, and missiles to improve affordability, maintainability, and performance of current and future Department of the Air Force systems. A family of affordable lightweight materials is being developed, including metals, polymers, ceramics, metallic and nonmetallic composites, and hybrid materials to provide upgraded capabilities for existing aircraft, missile, and propulsion systems to meet the future system requirements. The project develops high-temperature turbine engine materials that will enable engine designs to improve turbine engine thrust-to-weight ratio, specific fuel consumption and affordability. Advanced high temperature protection materials are being developed that are affordable, lightweight, dimensionally stable, thermally conductive, and/or ablation and erosion resistant to meet aerospace and missile requirements. Alternative or replacement materials are being developed to maintain the performance of fielded operational systems. The project concurrently develops advanced processing methods to enable adaptive processing of aerospace materials.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Ceramics and Composites	46.606	35.512	27.263
Description: Develop ceramic, polymer, polymer and ceramic matrix composites, and hybrid materials technologies for performance and supportability improvement in propulsion systems and high temperature aerospace structures.			
FY 2023 Plans: Continue to validate, demonstrate and mature new advanced processing methods, coating technologies, and behavioral life prediction concepts for current and future higher capability polymer and ceramic matrix composites. Continue in-depth analyses and assessment of severe environment durability of advanced composite systems via mechanical testing. Continue validating, developing, and testing the new ceramic and polymer matrix composite materials and processes with higher temperature capability for next generation propulsion systems and aerospace structures. Continue to advance and integrate the computational material science infrastructure for composite materials in tools to model, characterize, and accelerate the development and certification of advanced composite materials. Continue to verify and validate damage progression models on increasingly complex polymer matrix composite structural applications. Continue developing and validating newer testing and assessment methods on composite damage progression models for application in an engineering environment. Continue to develop and validate advanced materials to meet evolving requirements for structural hardening. Continue development and refinement modeling tools to link processing to performance of organic/polymer matrix composites and expand damage mechanics models to increasingly complex composite materials.			
FY 2024 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624347 / <i>Materials for Structures, Propulsion, and Subsystems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue validating, demonstrating, and maturing new advanced processing methods, coating technologies, and behavioral life prediction concepts for current and future higher capability polymer and ceramic matrix composites. Continue in-depth analyses and assessment of severe environment durability of advanced composite systems via mechanical testing. Continue validating, developing, and testing the new ceramic and polymer matrix composite materials and processes with higher temperature capability for next generation propulsion systems and aerospace structures. Continue advancing and integrating the computational material science infrastructure for composite materials in tools to model, characterize, and accelerate the development and certification of advanced composite materials. Continue verifying and validating damage progression models on increasingly complex polymer matrix composite structural applications. Continue developing and validating newer testing and assessment methods on composite damage progression models for application in an engineering environment. Continue developing and validating advanced materials to meet evolving requirements for structural hardening. Continue development and refinement modeling tools to link processing to performance of organic/polymer matrix composites and expand damage mechanics models to increasingly complex composite materials.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$8.249 million. Funding decreased due decreased emphasis on affordable composites.</p>			
<p>Title: Metals</p> <p>Description: Develop lightweight and high temperature metallics, life prediction technologies, and metals processing technologies for increased affordability, durability, and reliability of Department of the Air Force systems.</p> <p>FY 2023 Plans: Continue to validate, demonstrate and implement advanced computation methods to support faster material development and characterization modeling. Continue to analyze relationships between microstructure, processing, properties, and performance of affordable metallic and high performance gradient metallic materials. Continue to validate integrated material/manufacturing and component analysis for life management and development of affordable structural metals and low cost processes. Continue to advance reliable affordable metallic structural components through computational methods. Continue to validate the value of integrated analytical tools in the optimization of design and certification of additively manufactured metallic components. Continue development of novel capabilities via metallic additive manufacturing to be used as an alternative process when applicable. Continue to develop and refine processing methods and affordable metals for low cost, attritable propulsion systems. Continue research on application of advanced data science, artificial intelligence and machine learning on materials science problems. Continue research on engine life prediction. Complete development of enhanced life management practices to incorporate effects of engineered residual stress.</p> <p>FY 2024 Plans:</p>	27.819	18.576	18.490

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624347 / <i>Materials for Structures, Propulsion, and Subsystems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue validating, demonstrating, and implementing advanced computation methods to support faster material development and characterization modeling. Continue analyzing relationships between microstructure, processing, properties, and performance of affordable metallic and high performance gradient metallic materials. Continue validating integrated material/manufacturing and component analysis for life management and development of affordable structural metals and low cost processes. Continue advancing reliable affordable metallic structural components through computational methods. Continue validating the value of integrated analytical tools in the optimization of design and certification of additively manufactured metallic components. Continue development of novel capabilities via metallic additive manufacturing to be used as an alternative process when applicable. Continue developing and refining processing methods and affordable metals for low cost, attritable propulsion systems. Continue research on application of advanced data science, artificial intelligence and machine learning on materials science problems. Complete research on engine life prediction.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.086 million. Funding decreased due to the above plans.</p>			
<p>Title: Thermal Protection Materials</p> <p>Description: Develop and evaluate lightweight, active, adaptive, multifunctional, high temperature, and durable material systems for extreme environments and hypersonic applications.</p> <p>FY 2023 Plans: Continue to validate and mature processing methods for fabricating materials required for expendable hypersonic applications. Continue to validate, develop and refine unique experimental techniques to assess mechanical properties and time-dependent behavior. Continue to validate and demonstrate material properties and performance to meet design needs for control surfaces, leading edges, aeroshells, and apertures. Continue development of computational models to assess environmental degradation of materials in a hypersonic environment.</p> <p>FY 2024 Plans: Continue validating and maturing processing methods for fabricating materials required for expendable hypersonic applications. Continue validating, developing, and refining unique experimental techniques to assess mechanical properties and time-dependent behavior. Continue validating and demonstrating material properties and performance to meet design needs for control surfaces, leading edges, aeroshells, and apertures. Continue development of computational models to assess environmental degradation of materials in a hypersonic environment.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.141 million. Funding decreased due to the above plans.</p>	7.341	5.594	5.453
<p>Title: Pervasive and Affordable Metals Technologies</p>	0.000	3.112	3.112

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624347 / <i>Materials for Structures, Propulsion, and Subsystems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Develop and demonstrate affordable, novel high temperature powder processing materials/structures and additive metals technology concepts to enable future defense capabilities, air vehicle propulsion, and computational prediction models.</p> <p>FY 2023 Plans: Initiate demonstration of affordable metallic turbine engine disks made via powder processing technologies through high temperature, aggressive environment testing. Initiate development of low cost, complex shape metallic components made through additive manufacturing for advanced weapon system component prototypes. Initiate development of computational methodologies that incorporate impact of surface residual stress on the ability to extend life and lower life cycle cost of air vehicle propulsion system components.</p> <p>FY 2024 Plans: Continue demonstration of affordable metallic turbine engine disks made via powder processing technologies through high temperature, aggressive environment testing. Continue development of low cost, complex shape metallic components made through additive manufacturing for advanced weapon system component prototypes. Continue development of computational methodologies that incorporate impact of surface residual stress on the ability to extend life and lower life cycle cost of air vehicle propulsion system components.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: N/A</p>			
Accomplishments/Planned Programs Subtotals	81.766	62.794	54.318

	FY 2022	FY 2023
<p>Congressional Add: Program increase - thermal protection for hypersonic vehicles</p> <p>FY 2022 Accomplishments: Conducted Congressionally directed efforts.</p> <p>FY 2023 Plans: Not applicable</p>	9.827	0.000
<p>Congressional Add: Program increase - born qualified additive manufacturing</p> <p>FY 2022 Accomplishments: Conducted Congressionally directed efforts.</p> <p>FY 2023 Plans: Conduct Congressionally directed efforts.</p>	19.655	10.000
<p>Congressional Add: Program increase - high and ultra-high temperature ceramic-matrix composites for hypersonics</p>	9.827	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)	
3600 / 2	PE 0602102F / <i>Materials</i>	624347 / <i>Materials for Structures, Propulsion, and Subsystems</i>	
		FY 2022	FY 2023
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - additive manufacturing of alloys		9.827	10.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - high energy synchrotron x-ray research		8.353	9.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - maturation of carbon-carbon thermal protection systems		4.913	5.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - additive manufactured ceramic matrix composites		0.000	5.000
FY 2022 Accomplishments: Not applicable			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - catalytic architectures for ASCENT satellite maneuverability		0.000	6.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - computationally-driven next generation carbon composite material development		0.000	5.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - materials for high-energy fuels		0.000	10.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - modeling ultra high temperature materials for hypersonics		0.000	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624347 / <i>Materials for Structures, Propulsion, and Subsystems</i>	
		FY 2022	FY 2023
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - scanning and additive manufacturing		0.000	1.500
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - accelerated material development for high mach capabilities		0.000	10.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - disruptive alloy metals development		0.000	10.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program Increase - Deployable passive cooling		0.000	5.000
FY 2022 Accomplishments: Not Applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Adds Subtotals		62.402	106.500
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624348 / <i>Materials for Electronics, Optics, and Survivability</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To	Total
											Complete	Cost
624348: <i>Materials for Electronics, Optics, and Survivability</i>	-	42.792	57.279	39.593	0.000	39.593	39.209	40.097	40.979	43.679	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops materials technologies for the Department of the Air Force's Intelligence, Surveillance, and Reconnaissance (ISR), situational awareness, and specialty coatings for aerospace platforms and munitions. This includes sensors for microwave, short, mid, and long-wave infrared (SWIR, MWIR, LWIR) detection and countermeasures devices used for targeting, electronic warfare, and active aircraft protection. Electronic and optical materials are being developed to enable surveillance and situational awareness with faster operating speeds, greater tunability, higher power output, improved thermal management (including higher operating temperatures), greater sensitivity, and extended dynamic range. This project develops materials for protection of aircrews, sensors, and aerospace structures from directed energy threats without impairing mission effectiveness. Nanostructured and biological materials are being developed for aerospace structures, munitions, aerospace vehicle subsystems, and personnel.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Infrared Detector and Electromagnetic Device Materials</p> <p>Description: Develop infrared (IR) detector and electro-magnetic device materials and processes technologies for performance, affordability, and operational capability of surveillance, tracking, targeting, and situational awareness systems for the Department of the Air Force.</p> <p>FY 2023 Plans: Continue advanced development, demonstration and validation of materials and processes for control and detection of electromagnetic radiation for Intelligence, Surveillance and Reconnaissance (ISR) technologies. Further the development, testing, and assessment of materials for use in high resolution imaging by electromagnetic radiation. Continue advanced demonstration of nanoscale materials, metamaterials, and models for use in producing detectors. Continue to utilize all aspects of computational materials science to improve performance prediction and reliability models, as well as analyzing quantum materials for aerospace applications. Continue specific development and demonstration of short wave infrared detector and hyper-spectral long wave infrared materials. Continue to verify and validate materials and processes for integration of radio frequency and optical signals as well as concepts for novel optical devices and components. Continue development of photonics for aerospace applications, and demonstrate nanostructured materials for components to enable agile radio frequency capability. Continue development of techniques using quantum materials and processes. Initiate development of software defined imaging receivers.</p> <p>FY 2024 Plans:</p>	5.649	11.557	12.274

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624348 / <i>Materials for Electronics, Optics, and Survivability</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue advanced development, demonstration and validation of materials and processes for control and detection of electromagnetic radiation for Intelligence, Surveillance and Reconnaissance (ISR) technologies. Further the development, testing, and assessment of materials for use in high resolution imaging by electromagnetic radiation. Continue advanced demonstration of nanoscale materials, metamaterials, and models for use in producing detectors. Continue utilizing all aspects of computational materials science to improve performance prediction and reliability models, as well as analyzing quantum materials for aerospace applications. Continue specific development and demonstration of short wave infrared detector and hyper-spectral long wave infrared materials. Continue verifying and validating materials and processes for integration of radio frequency and optical signals as well as concepts for novel optical devices and components. Continue development of photonics for aerospace applications, and demonstrate nanostructured materials for components to enable agile radio frequency capability. Continue development of techniques using quantum materials and processes. Continue development of software defined imaging receivers.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.717 million. Funding increased due to increased emphasis on sensor materials for Intelligence, Surveillance, and Reconnaissance (ISR).</p>			
<p>Title: Directed Energy Hardened Materials</p> <p>Description: Develop and demonstrate technologies to enhance the safety, survivability, and mission effectiveness of personnel, sensors, viewing systems, and related Department of the Air Force assets.</p> <p>FY 2023 Plans: Continue to analyze, validate and demonstrate the comprehensive generated data of materials and technologies to protect against directed energy threats. Continue to develop and demonstrate advanced optical limiter materials for damage protection, enhanced hybrid materials for advanced applications, and continue to assess the response of new materials for high-energy laser interactions. Continue developing novel approaches for integration of multimodal hardening into structures and devices. Continue to assess data, validate repeatability and utilize computational materials science to enhance multi-scale modeling for design of robust, reliable integrated protection. Continue development of proven selected advanced materials technologies to protect against nuclear flash blindness.</p> <p>FY 2024 Plans: Continue analyzing, validating, and demonstrating the comprehensive generated data of materials and technologies to protect against directed energy threats. Continue developing and demonstrating advanced optical limiter materials for damage protection, enhanced hybrid materials for advanced applications, and continue to assess the response of new materials for high-energy laser interactions. Continue developing novel approaches for integration of multimodal hardening into structures and devices. Continue assessing data, validating repeatability, and utilizing computational materials science to enhance multi-scale modeling for design</p>	5.468	11.184	11.878

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624348 / <i>Materials for Electronics, Optics, and Survivability</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
of robust, reliable integrated protection. Continue development of proven selected advanced materials technologies to protect against nuclear flash blindness. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.694 million. Funding increased due to increased emphasis on integrated directed energy protection systems.				
Title: Laser Source Materials Description: Develop materials to enable higher performance high power laser sources (quasi-Continuous Wave to Continuous Wave) with emphasis on laser output in the mid-InfraRed spectral region (2-5 microns). FY 2023 Plans: Continue to demonstrate and validate materials and process technologies to control and generate directed electromagnetic energy for survivability and other applications. Further demonstrate and model materials processes for controlling laser beam direction and focus with optical components and materials for frequency conversion, high power optical isolators, mid-wave infrared laser sources, and high power microwave sources for directed energy sources. FY 2024 Plans: Continue demonstrating and validating materials and process technologies to control and generate directed electromagnetic energy for survivability and other applications. Further demonstrate and model materials processes for controlling laser beam direction and focus with optical components and materials for frequency conversion, high power optical isolators, and mid-wave infrared laser sources for directed energy sources. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.093 million. Funding increased due increased emphasis on high power optical isolators.		0.729	1.491	1.584
Title: Nanostructured and Biological Materials Description: Develop enabling and foundational biotechnologies for guidance and control, resilient basing, bio-integrated electronics and sensing for the Department of the Air Force applications. FY 2023 Plans: Continue to validate and verify engineering, scientific, and processing methods for nano and biological materials to address unique requirements for the Department of the Air Force human-machine integration and electronic components. Continue to explore biotechnology to assess the impact of microbes and fungi on Department of the Air Force systems. Continue to study more robust and reliable materials and processes to optimize components for compact, flexible, stretchable multi-functional		6.379	13.047	13.857

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624348 / <i>Materials for Electronics, Optics, and Survivability</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>devices, and validate materials and processes for functional additive manufacturing of electronic components. Continue to demonstrate methods to assess reliability and field resiliency of nano and biological materials and processes. Continue to support the Flexible Hybrid Electronics Institutes for Manufacturing Innovation and the NanoBio Manufacturing Consortium for collaborative teaming. Continue development of agile materials for basing, infrastructure and expeditionary operations.</p> <p>FY 2024 Plans: Continue validating and verifying engineering, scientific, and processing methods for nano and biological materials to address unique requirements for the Department of the Air Force human-machine integration and electronic components. Continue exploring biotechnology to assess the impact of microbes and fungi on Department of the Air Force systems. Continue studying more robust and reliable materials and processes to optimize components for compact, flexible, stretchable multi-functional devices, and validate materials and processes for functional additive manufacturing of electronic components. Continue demonstrating methods to assess reliability and field resiliency of nano and biological materials and processes. Continue supporting the Flexible Hybrid Electronics Institutes for Manufacturing Innovation and the NanoBio Manufacturing Consortium for collaborative teaming. Continue development of agile materials for basing, infrastructure and expeditionary operations.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.810 million. Increased funding due to increased emphasis on biologically engineered materials.</p>			
Accomplishments/Planned Programs Subtotals	18.225	37.279	39.593

	FY 2022	FY 2023
<p>Congressional Add: Program Increase - Deployable passive cooling</p> <p>FY 2022 Accomplishments: Conducted Congressionally directed efforts.</p> <p>FY 2023 Plans: Not Applicable</p>	4.913	0.000
<p>Congressional Add: Program increase - nano-bio technologies for aeromedical and en route care</p> <p>FY 2022 Accomplishments: Conducted Congressionally directed efforts.</p> <p>FY 2023 Plans: Not Applicable</p>	9.827	0.000
<p>Congressional Add: Program increase - photonic radio frequency CM</p> <p>FY 2022 Accomplishments: Conducted Congressionally directed efforts.</p> <p>FY 2023 Plans: Not Applicable</p>	9.827	0.000
<p>Congressional Add: Program increase - small satellite technology</p>	0.000	20.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624348 / <i>Materials for Electronics, Optics, and Survivability</i>
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	FY 2022	FY 2023
FY 2022 Accomplishments: Not applicable.		
FY 2023 Plans: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	24.567	20.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>				Project (Number/Name) 624349 / <i>Materials Technology for Sustainment</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624349: <i>Materials Technology for Sustainment</i>	-	27.918	49.372	48.414	0.000	48.414	47.373	43.077	44.438	48.316	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops materials and processing technologies to support operational Department of the Air Force mission areas by providing the ability to inspect the quality of delivered systems, transition more reliable and maintainable materials, establish a capability to detect and characterize performance threatening defects, characterize materials processes and properties necessary for materials transition, and provide quick reaction support and failure analysis to the operational commands and repair centers. Repair techniques and nondestructive inspection/evaluation (NDI/E) methods are developed that are needed for metallic and non-metallic structures, coatings, corrosion control processes, and to support integration of composite structures for aerospace systems. Various NDI/E methods are essential to ensure optimum quality in the design and production of aircraft, propulsion, and missile systems. These NDI/E methods are also essential to monitor and detect the onset of any service-initiated damage and/or deterioration due to aging of operational systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Material State Awareness	3.236	12.153	16.945
Description: Develop Materials State Awareness technologies to identify and characterize materials and/or damage regardless of scale for managing the health of fielded structures, propulsion systems, and specialty materials, plus enabling advanced materials qualification for Department of the Air Force systems.			
FY 2023 Plans: Continue to validate and demonstrate non-destructive evaluation modeling capabilities and use these competencies to drive improvements in capability to detect, characterize and quantify damage in realistic aerospace structures and engine components. Continue to analyze approaches to address the variability inherent in aerospace systems and materials to quantify the impact of that variability on nondestructive inspection capability and reliability. Continue to validate advanced sensing technologies to detect and characterize changes in material properties, damage evolution, and other factors that detrimentally affect aerospace systems. Continue to improve methods to acquire and analyze data to facilitate improved characterization, registration, and tracking of degradation and damage of specialty materials that enables/ensures more affordable coatings assessment. Continue to validate tools to improve characterization and failure modes of specialty multilayer coatings. Continue to develop automation and robotic technologies for visual inspections that will realize human-assisted inspection capabilities and begin to provide capabilities for automated multi-spectral characterization. Initiate development of miniaturized nondestructive evaluation/inspection capabilities.			
FY 2024 Plans: Continue validating and demonstrating non-destructive evaluation modeling capabilities and use these competencies to drive improvements in capability to detect, characterize and quantify damage in realistic aerospace structures and engine components.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624349 / <i>Materials Technology for Sustainment</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Continue analyzing approaches to address the variability inherent in aerospace systems and materials to quantify the impact of that variability on nondestructive inspection capability and reliability. Continue validating advanced sensing technologies to detect and characterize changes in material properties, damage evolution, and other factors that detrimentally affect aerospace systems. Continue improving methods to acquire and analyze data to facilitate improved characterization, registration, and tracking of degradation and damage of specialty materials that enables/ensures more affordable coatings assessment. Continue validating tools to improve characterization and failure modes of specialty multilayer coatings. Continue developing automation and robotic technologies for visual inspections that will realize human-assisted inspection capabilities and begin to provide capabilities for automated multi-spectral characterization. Continued development of miniaturized nondestructive evaluation/inspection capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$4.792 million. Increased funding due to increased emphasis on automation capabilities.</p>			
<p>Title: Production and Repair Technologies</p> <p>Description: Develop support capabilities, information, and processes to resolve problems with materials in the production and repair of systems components and structures for the Department of the Air Force.</p> <p>FY 2023 Plans: Continue to develop and communicate to the field best practices to ensure repeatability of advanced materials and processes technology to repair and extend the life of Department of the Air Force systems. Further refine through demonstration the understanding of material durability and repair limits for emerging Department of the Air Force systems. Continue to advance the analysis and development of improved life cycle prediction test methods and techniques to understand effects of service environments, corrosion, residual stresses, and material processes on structural and functional materials. Continue to improve the service life of advanced materials, processes and designs for improved repair and maintainability and life cycle cost of outer mold line coatings, access panel treatments, and multifunctional systems. Continue to further advance specialty material affordability technologies and processes to reduce maintenance costs of specialty materials.</p> <p>FY 2024 Plans: Continue developing and communicating to the field best practices to ensure repeatability of advanced materials and processes technology to repair and extend the life of Department of the Air Force systems. Further refine through demonstration the understanding of material durability and repair limits for emerging Department of the Air Force systems. Complete the advancement of the analysis and development of improved life cycle prediction test methods and techniques to understand effects of service environments, residual stresses, and material processes on structural and functional materials. Continue improving the service life of advanced materials, processes and designs for improved repair and maintainability and life cycle cost of outer mold</p>	2.404	9.028	12.588

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624349 / <i>Materials Technology for Sustainment</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
line coatings, access panel treatments, and multifunctional systems. Continue to further advance specialty material affordability technologies and processes to reduce maintenance costs of specialty materials. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by 3.560 million. Increased funding is due to increased emphasis on materials and processes to extend service life and reduce life cycle cost of system.				
Title: Failure Analysis Technologies Description: Develop support capabilities, information, and processes to resolve materials problems and provide electronic and structural failure analysis for the Department of the Air Force. FY 2023 Plans: Continue to perform and increase efficiency of quick response failure analyses and materials investigations. Further the development and investigate improved analysis techniques to determine and prevent root cause materials failure/degradation. Continue to develop and provide advanced materials and processing solutions to ensure warfighter systems availability and safety of flight. Continue to refine development of functional materials failure analysis capabilities. Continue to analyze and validate advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Continue to transition advanced test and characterization methods for analyzing electrical and structural failures of emerging materials. Continue development of new, more durable materials and protection for high power wiring technologies, and advanced materials. FY 2024 Plans: Continue performing and increasing efficiency of quick response failure analyses and materials investigations. Further the development and investigate improved analysis techniques to determine and prevent root cause materials failure/degradation. Continue developing and providing advanced materials and processing solutions to ensure warfighter systems availability and safety of flight. Continue refining development of functional materials failure analysis capabilities. Continue analyzing and validating advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Continue transitioning advanced test and characterization methods for analyzing electrical and structural failures of emerging materials. Continue development of new, more durable materials and protection for high power wiring technologies, and advanced materials. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$5.340 million. Increased funding is a result of increased emphasis on functional materials failure analysis.		3.608	13.541	18.881
Accomplishments/Planned Programs Subtotals		9.248	34.722	48.414

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624349 / <i>Materials Technology for Sustainment</i>	
		FY 2022	FY 2023
Congressional Add: Program increase - digital maintenance advisor demonstration for F-16		4.913	0.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not Applicable			
Congressional Add: Program increase - failure prediction in material models		4.913	0.000
FY 2022 Accomplishments: Conduct Congressionally directed efforts.			
FY 2023 Plans: Not Applicable			
Congressional Add: Program increase - stealth aircraft coatings research		3.931	0.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not Applicable			
Congressional Add: Program increase - coating technologies to reduce lifecycle costs		4.913	0.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not Applicable			
Congressional Add: Program increase - transparency repair program		0.000	4.650
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - flexible conductive materials		0.000	5.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - electromagnetic protected advanced lightweight multifunctional materials		0.000	5.000
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Adds Subtotals		18.670	14.650
C. Other Program Funding Summary (\$ in Millions)			
N/A			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602102F / <i>Materials</i>	Project (Number/Name) 624349 / <i>Materials Technology for Sustainment</i>

C. Other Program Funding Summary (\$ in Millions)

Remarks

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	173.628	199.453	161.268	0.000	161.268	157.425	160.803	164.169	190.877	Continuing	Continuing
622401: <i>Structures</i>	-	97.151	80.320	67.567	0.000	67.567	66.654	68.320	69.721	74.439	Continuing	Continuing
622403: <i>Flight Controls and Pilot-Vehicle Interface</i>	-	15.207	39.422	39.916	0.000	39.916	38.649	39.529	40.397	57.840	Continuing	Continuing
622404: <i>Aeromechanics</i>	-	16.731	9.745	10.135	0.000	10.135	9.115	9.312	9.507	11.111	Continuing	Continuing
622405: <i>High Speed Systems Technology</i>	-	38.685	66.432	40.026	0.000	40.026	39.307	40.251	41.083	43.901	Continuing	Continuing
625172: <i>NUCLEAR SYSTEM TECHNOLOGY</i>	-	5.854	3.534	3.624	0.000	3.624	3.700	3.391	3.461	3.586	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and analyzes aerospace vehicle technologies in the primary areas of high speed systems, autonomy and flight control technologies, aeromechanics, structure systems and nuclear system technology. The effort has five current projects, each focusing on a technology area critical to the Department of the Air Force. The High Speed Systems Technology project develops component level vehicle technologies for expendable and reusable high speed/hypersonic aerospace systems. The Flight Controls and Pilot-Vehicle Interface project develops technologies that enable maximum affordable capability from manned, remotely-piloted and autonomous aerospace vehicles. The Aeromechanics and Integration project designs advanced aerodynamic vehicle configurations that are developed and analyzed through simulations, experiments, and multi-disciplinary analyses. It also develops design techniques, incorporating vehicle, inter-vehicle, and intra-vehicle control systems. The Structures project develops and exploits new materials, and fabrication processes. The Nuclear System Technology project provides science and technology to preserve nuclear deterrence for future generations.

Funds in this program element may be used to investigate, digitize, and analyze specified technology advancements in air, space and/or cyber domains.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602203F, 0602202F, 0602204F, 0602602F, 0602605F, 0602788F, 0602298F, and 1206601SF.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	183.032	159.453	163.842	0.000	163.842
Current President's Budget	173.628	199.453	161.268	0.000	161.268
Total Adjustments	-9.404	40.000	-2.574	0.000	-2.574
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	40.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-9.404	0.000			
• Other Adjustments	0.000	0.000	-2.574	0.000	-2.574

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 622401: Structures

Congressional Add: *Program increase - Educational partnership agreement for secure UAV technologies*

Congressional Add: *Program increase - Collaborative hypersonic demonstration*

Congressional Add: *Full scale determinant assembly for hypersonic airframe structures*

Congressional Add Subtotals for Project: 622401

Project: 622405: High Speed Systems Technology

Congressional Add: *Program increase - educational agreement partnership for aerospace engineering security integration*

Congressional Add: *Program increase: educational partnership agreement for secure UAV technologies*

Congressional Add: *Program increase: collaborative hypersonic demonstration*

Congressional Add Subtotals for Project: 622405

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	9.842	-
	9.842	-
	-	10.000
	19.684	10.000
	-	10.000
	-	10.000
	-	10.000
	-	30.000
	19.684	40.000

Change Summary Explanation

FY 2024 funding decreased in the FY 2024PB compared to the FY 2023PB by \$2.574 million. The decrease is due to the completion of Aircraft Service Life technology efforts as well as funding for the University Affiliated Research Center for Tactical Autonomy transferring to a new PE, 0602022F.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602201F / Aerospace Vehicle Technologies				Project (Number/Name) 622401 / Structures			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622401: Structures	-	97.151	80.320	67.567	0.000	67.567	66.654	68.320	69.721	74.439	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops advanced structures concepts to exploit new materials and fabrication processes and investigates new concepts and design techniques. New structural concepts include low cost design and fabrication techniques, incorporating subsystem hardware items and adaptive mechanisms into the aerospace structures and/or skin of the platform.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Aircraft Service Life Technologies</p> <p>Description: Develop an economic service life analysis capability comprised of analysis tools, methodologies, and structural health monitoring technologies.</p> <p>FY 2023 Plans: Complete lifing methods for durability and damage tolerance of aging structures on legacy fleet aircraft. Complete digital engineering systems analysis on a low cost attritable unmanned aircraft system.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$1.996 million. Funding decreased due to completion of technology development for Aircraft Service Life.</p>	27.976	1.996	0.000
<p>Title: Vehicle Design Technologies</p> <p>Description: Develop methodologies to reduce the cost and time involved from design to full-scale testing of structural concepts and aerospace systems.</p> <p>FY 2023 Plans: Continue the development of advanced high fidelity aircraft design analysis tools. Complete the development of integrating cost, mission effectiveness, and affordable manufacturing methods into aircraft design analysis tools. Complete new design techniques to quantify and trade risk impacts against performance in aircraft designs. Continue the development of new design methods that link vehicle system requirements to mission operation performance. Initiate the integration of model-based system engineering methodology with risk-aware aircraft design methods</p> <p>FY 2024 Plans:</p>	25.454	18.137	18.137

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622401 / <i>Structures</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Continue the development of advanced high fidelity aircraft design tools. Continue the development of new design methods that link vehicle system requirements to mission operation performance. Continue the integration of model-based system engineering methodology with risk-aware aircraft design methods. Initiate the integration of cost, mission effectiveness and affordable manufacturing methods with uncertainty quantification across all performance variables to include risk.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>				
<p>Title: Structural Concepts</p> <p>Description: Develop design methods, processes, and lightweight, adaptive, and multifunctional structural concepts to capitalize on new materials, multi-role considerations, and technology integration into aircraft systems.</p> <p>FY 2023 Plans: Continue development of innovative structural design methods to dramatically reduce weight and complexity of aircraft structures. Complete development of fail-safe technologies for bonded unitized composite structures applicable to next generation aircraft. Continue validation of impact damage analysis and methods for advanced fail-safe composite structures applicable to next generation aircraft. Continue new low cost design and manufacturing structural concepts for attritable vehicles. Initiate development of low-cost agile manufacturing concepts for structures in support of the development of a next variant of a low cost unmanned aerospace system.</p> <p>FY 2024 Plans: Complete development of innovative structural design methods to dramatically reduce weight and complexity of aircraft structures. Complete the validation of impact damage analysis and methods for advanced fail-safe composite structures applicable to next generation aircraft. Continue new low cost design and manufacturing structural concepts for attritable vehicles. Continue development of low-cost agile manufacturing concepts for structures in support of the development of a next variant of a low cost unmanned aerospace system. Initiate systems engineering assessments for the development of airworthiness certification criteria for advanced airframe structures. Initiate the validation of innovative structural design methods to dramatically reduce weight and complexity of aircraft structures. Initiate the demonstration of the fatigue life of bonded unitized composite structures for the next generation of aircraft</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>		24.037	24.938	24.938
<p>Title: Next Generation Aerodynamic Technologies</p> <p>Description: Develop and assess technologies for the next generation of multi-role large aircraft.</p>		0.000	8.075	7.318

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622401 / <i>Structures</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Complete the design of a small, pod-mounted tactical air refueling boom for future Mobility applications. Continue the development of advanced high fidelity aerodynamic analysis tools for aircraft conceptual design. Continue assessment of innovative next generation vehicle concepts.</p> <p><i>FY 2024 Plans:</i> Continue the development of advanced high fidelity aerodynamic analysis tools for aircraft conceptual design. Continue assessment of innovative next generation vehicle concepts. Initiate modeling and simulation development for the assessment of fuel and energy use.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 decreased compared to FY 2023 by \$0.757 million. Funding decreased due to the completion of tactical refueling boom design.</p>			
<p><i>Title:</i> Aircraft Integration Technologies</p> <p><i>Description:</i> Develop enabling technologies to allow efficient and effective integration of propulsion, weapons, and subsystems into current and future air vehicles.</p> <p><i>FY 2023 Plans:</i> Complete development of advanced kinetic and directed energy weapons integration technologies for Air Superiority 2030. Continue integrated full flow path demonstration of a medium bypass embedded engine for next generation mobility. Complete the design and analysis methods to allow rapid certification of stores separation for new small weapons on tactical aircraft. Continue development of hybrid electric distributed propulsion vehicle integration designs for next generation vehicle concepts. Initiate development of novel kinetic weapons integration technologies for enhanced weapon payload in attritable platforms.</p> <p><i>FY 2024 Plans:</i> Complete integrated full flow path demonstration of a medium bypass embedded engine for next generation mobility. Complete development of hybrid electric distributed propulsion vehicle integration designs for next generation vehicle concepts. Continue development of novel kinetic weapons integration technologies for enhanced weapon payload in attritable platforms. Initiate the development of a modeling and simulation approach to the design and integration of embedded propulsion systems.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Not Applicable</p>	0.000	17.174	17.174
Accomplishments/Planned Programs Subtotals	77.467	70.320	67.567

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622401 / <i>Structures</i>

	FY 2022	FY 2023
Congressional Add: Program increase - Educational partnership agreement for secure UAV technologies FY 2022 Accomplishments: Conduct Congressionally directed efforts.	9.842	-
Congressional Add: Program increase - Collaborative hypersonic demonstration FY 2022 Accomplishments: Conduct Congressionally directed efforts. This effort will be executed in Program 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology.	9.842	-
Congressional Add: Full scale determinant assembly for hypersonic airframe structures FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures.	-	10.000
Congressional Adds Subtotals	19.684	10.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>				Project (Number/Name) 622403 / <i>Flight Controls and Pilot-Vehicle Interface</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622403: <i>Flight Controls and Pilot-Vehicle Interface</i>	-	15.207	39.422	39.916	0.000	39.916	38.649	39.529	40.397	57.840	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies that enable maximum affordable capability from manned, remotely-piloted, and autonomous aerospace vehicles. Advanced control, automation, and autonomy technologies are developed for maximum vehicle performance throughout the flight envelope and simulated in full-scale, surrogate, and virtual environments. Resulting technologies contribute significantly towards the development of reliable autonomous or remotely piloted air vehicles, hypersonic aircraft, and extended-life legacy aircraft.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Advanced Flight Controls Technologies</p> <p>Description: Develop technologies for advanced control-enabled capabilities, including flight controls, components, integrated vehicle management systems, and software and system certification techniques for both manned/unmanned and remotely piloted aircraft.</p> <p>FY 2023 Plans: Continue the development of a trusted autonomy approach, integrating certification processes and autonomy development. Complete the development, demonstration, and assessment of autonomy capabilities under adverse and contested environments. Initiate the development, demonstration and assessment of autonomy capabilities for dynamic tasking in complex environments.</p> <p>FY 2024 Plans: Continue the development of a trusted autonomy approach, integrating certification processes and autonomy development. Continue the development, demonstration and assessment of autonomy capabilities for dynamic tasking in complex environments. Initiate the development of autonomy optimization and assurance in dynamic and uncertain environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.116 million. Funding increase described in plans above.</p>	3.504	9.362	9.478
<p>Title: Manned and Unmanned Teaming Technologies</p> <p>Description: Develop technology for flight control systems that will permit safe interoperability between manned and remotely piloted aircraft and effective teaming in adverse and contested environments.</p> <p>FY 2023 Plans:</p>	9.007	22.858	23.144

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622403 / <i>Flight Controls and Pilot-Vehicle Interface</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Complete development, demonstration, and assessment of advanced control automation techniques. Complete the development of autonomous behaviors for safe, effective manned-unmanned teams. Continue the development of tactical autonomy for manned-unmanned teams in contested, dynamic mission environments. Continue the development of mission management autonomy for manned-unmanned teams. Initiate development, demonstration and assessment of autonomous behaviors to address mission capability gaps.</p> <p>FY 2024 Plans: Continue the development of tactical autonomy for manned-unmanned teams in contested, dynamic mission environments. Continue the development of mission management autonomy for manned-unmanned teams. Continue the development, demonstration and assessment of autonomous behaviors to address mission capability gaps, such as operations of unmanned systems in terminal environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.286 million. Funding increase described in plans above.</p>			
<p>Title: Flight Controls Technologies Modeling and Simulation</p> <p>Description: Develop tools and methods for capitalizing on simulation-based research and development of future aerospace vehicles.</p> <p>FY 2023 Plans: Complete modeling and simulation efforts to evaluate emerging autonomous and robust flight control technologies and concepts, as well as assess mission level performance of integrated aerospace systems. Complete analyses of manned-unmanned teams in adversarial mission environments. Continue trade studies of vehicle concepts for strike, mobility and reconnaissance. Continue manned-unmanned teaming evaluations including rapid development of new capabilities. Continue analyses of capability concepts for future advanced development programs. Initiate modeling and simulation efforts to assess emerging aerospace technologies and concepts in complex and dynamic battlespace environments. Initiate digital engineering efforts to create a continuum from military utility and cost effectiveness analysis to investment planning to technology development to technology transition.</p> <p>FY 2024 Plans: Continue trade studies of vehicle concepts for strike, mobility and reconnaissance. Continue manned-unmanned teaming evaluations including rapid development of new integrated capabilities. Continue analyses of capability concepts for future advanced development programs. Continue modeling and simulation efforts to assess emerging aerospace technologies and</p>	2.696	7.202	7.294

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622403 / <i>Flight Controls and Pilot-Vehicle Interface</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
concepts in complex and dynamic battlespace environments. Continue digital engineering efforts to create a digital continuum of military utility and cost effectiveness analysis for investment planning to technology development to technology transition.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$0.092 million. Funding increase described in plans above.			
Accomplishments/Planned Programs Subtotals	15.207	39.422	39.916

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>				Project (Number/Name) 622404 / <i>Aeromechanics</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622404: <i>Aeromechanics</i>	-	16.731	9.745	10.135	0.000	10.135	9.115	9.312	9.507	11.111	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops aerodynamic configurations of a broad range of revolutionary, affordable aerospace vehicles. It matures and applies modeling and numerical simulation methods for fast and affordable aerodynamics prediction and integrates and demonstrates multi-disciplinary advances in airframe, propulsion, weapon, and air vehicle control integration.

In FY2023, Next Generation Aerodynamic Technologies and Aircraft Integration Technologies efforts will transfer to Program 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Aerodynamic Systems Technologies</p> <p>Description: Develop aerodynamic assessment prediction methods centered on expanding the design capabilities of future air vehicles.</p> <p>FY 2023 Plans: Continue design assessments of distributed propulsion concepts for next generation aircraft. Continue the assessment and development of incorporating active flow control techniques into advanced design to enable new aircraft configurations. Initiate design assessments of long-endurance unmanned platforms. Initiate the development of prediction methods which include air vehicle stability and control requirements.</p> <p>FY 2024 Plans: Complete design assessments of distributed propulsion concepts for next generation aircraft. Continue the assessment and development of incorporating active flow control techniques into advanced design to enable new aircraft configurations. Continue design assessments of long-endurance unmanned platforms. Continue the development of prediction methods which include air vehicle stability and control requirements.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.390 million. Increase described in plans above.</p>	3.766	9.745	10.135
<p>Title: Next Generation Aerodynamic Technologies</p> <p>Description: Develop and assess technologies for the next generation of multi-role large aircraft.</p> <p>FY 2023 Plans:</p>	4.160	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / Aerospace Vehicle Technologies	Project (Number/Name) 622404 / Aeromechanics

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>In FY 2023, this effort will transfer to Program 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not applicable</p>			
<p>Title: Aircraft Integration Technologies</p> <p>Description: Develop enabling technologies to allow efficient and effective integration of propulsion, weapons, and subsystems into current and future air vehicles.</p> <p>FY 2023 Plans: In FY 2023, this effort will transfer to Program 0602201F, Aerospace Vehicle Technologies, Project 622401, Structures, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not applicable</p>	8.805	0.000	0.000
Accomplishments/Planned Programs Subtotals	16.731	9.745	10.135

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622405 / <i>High Speed Systems Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622405: <i>High Speed Systems Technology</i>	-	38.685	66.432	40.026	0.000	40.026	39.307	40.251	41.083	43.901	Continuing	Continuing

A. Mission Description and Budget Item Justification

This effort investigates, analyzes, and develops high speed/hypersonic aerospace vehicle technologies. Advanced high temperature structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multi-disciplinary analyses. Advanced subsystem, integration and analysis technologies are developed and simulated for hypersonic vehicles. These technologies will enable future high speed weapons and platforms; intelligence, surveillance, and reconnaissance systems; and space access vehicles.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: High Speed Systems Technology</p> <p>Description: Develop design analysis methods and technologies for high speed systems at extreme flight conditions.</p> <p>FY 2023 Plans: Continue critical technology maturation for high speed/ hypersonic systems with primary emphasis on longer range flight and heavier payloads. Continue maturation of innovative aerospace structural concepts, analytical methods, service life predictions, airframe/engine integration, fluid/thermal/structural interactions and thermal management techniques. Continue development of high speed system concepts, including flight research concepts, to provide revolutionary capabilities for affordable expendable systems and robust reusable systems. Complete investigation of aeromechanic technologies to reduce drag and enable robust stability and control at all flight conditions. Continue efforts to characterize high-speed structural phenomena, develop and validate fundamental high-speed component technologies through computational analysis, ground, and flight testing.</p> <p>FY 2024 Plans: Continue critical technology maturation for high speed/ hypersonic systems with primary emphasis on longer range flight and heavier payloads. Continue maturation of innovative aerospace structural concepts, analytical methods, service life predictions, airframe/engine integration, fluid/thermal/structural interactions and thermal management techniques. Continue development of high speed system concepts, including flight research concepts, to provide revolutionary capabilities for affordable expendable systems and robust reusable systems. Continue efforts to characterize high-speed vehicle system phenomena, develop and validate fundamental high-speed component technologies through computational analysis, ground, and flight testing.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	22.461	21.153	23.240

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622405 / <i>High Speed Systems Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$2.087 million. Funding increased to accelerate development of innovative reusable structural concepts for hypersonic platforms.				
Title: High Speed Vehicle Aeromechanics and Integration		16.224	15.279	16.786
Description: Develop new and improved components, concepts, and designs for sustained flight of high-speed/hypersonic expendable and re-useable vehicles. Conduct analyses of high speed/hypersonic vehicles to enable revolutionary capabilities.				
FY 2023 Plans: Continue to mature critical technologies for high speed/hypersonic flight with primary emphasis on longer range and heavier payloads, with secondary emphasis on reusable systems. Continue development of multi-disciplinary design and analysis techniques and tools. Complete development of experimental approaches to enhance high-speed engine inlet performance over a wide range of flight conditions. Continue development of high speed system concepts that provide revolutionary capabilities through configuration research. Continue investigation of aeromechanic technologies to reduce drag, evaluate uncertainty, improve instrumentation accuracy, include safe multi-body physics, and achieve robust stability & control at all flight conditions. Continue efforts to characterize high-speed aeromechanics phenomena and develop and validate fundamental high-speed component technologies through computational analysis, ground, and flight testing. Complete assessment of engagement, mission, and campaign level effectiveness for promising high speed system concepts and refine concept designs to incorporate needed capabilities.				
FY 2024 Plans: Continue to mature critical technologies for high speed/hypersonic flight with primary emphasis on longer range and heavier payloads, with secondary emphasis on reusable systems. Continue development of multi disciplinary design and analysis techniques and tools. Continue development of high speed system concepts that provide revolutionary capabilities through configuration research. Continue investigation of aeromechanic technologies to evaluate uncertainty, improve instrumentation accuracy and safe multi-body physics; Complete initial investigation of aeromechanic technologies to reduce drag and achieve robust stability & control at all flight conditions. Continue efforts to characterize high-speed aeromechanics phenomena and develop and validate fundamental high-speed component technologies through computational analysis, ground, and flight testing. Initiate investigation of advanced aeromechanic technologies to extend system range through improvement of system lift/drag ratio and maintain robust stability and control at all flight conditions. Initiate investigation of computational and ground based experimental approaches to improved air induction systems over a wide range of flight conditions.				
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.507 million. Funding increased to accelerate development of Integrated vehicle designs with robust stability and control.				
Accomplishments/Planned Programs Subtotals		38.685	36.432	40.026

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 622405 / <i>High Speed Systems Technology</i>

	FY 2022	FY 2023
Congressional Add: Program increase - educational agreement partnership for aerospace engineering security integration FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0602201F, Aerospace Vehicle Technologies.	-	10.000
Congressional Add: Program increase: educational partnership agreement for secure UAV technologies FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology.	-	10.000
Congressional Add: Program increase: collaborative hypersonic demonstration FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0602201F, Aerospace Vehicle Technologies, Project 622405, High Speed Systems Technology.	-	10.000
Congressional Adds Subtotals	-	30.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 625172 / <i>NUCLEAR SYSTEM TECHNOLOGY</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625172: <i>NUCLEAR SYSTEM TECHNOLOGY</i>	-	5.854	3.534	3.624	0.000	3.624	3.700	3.391	3.461	3.586	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project provides sustaining S&T to preserve nuclear deterrence for future generations, develops complimentary projects to inform future systems, establishing inter-agency partnerships for Modeling & Simulation (M&S) and test platforms, and coordinates with existing programs for next generation strategic systems development and test platforms.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Nuclear Technologies	5.854	3.534	3.624
Description: Develop nuclear-related technologies to support National requirements for nuclear deterrence operations including environmental modeling and simulation on re-entry systems.			
FY 2023 Plans: Continue to develop and test new algorithms using high performance capabilities which focus on automation of seismic event discrimination and characterization. Continue to develop earth models and statistical approaches to advance the ground-based seismic nuclear monitoring mission through improving anomaly detection, attribution and protection. Continue to further develop new statistical approaches to the behavior of discriminants for local and regional seismic events. Initiate enhanced seismic monitoring with distributed acoustic sensing with machine learning data analysis approaches. Continue development of end-to-end modeling suite for re-entry systems by incorporating additional flight physics databases and solvers and adding more user/analysis tools. Continue aerothermal model validation and development through various testing mechanisms. Initiate analysis of strategic command, control, and communications to identify space-layer technologies of interest.			
FY 2024 Plans: Initiate development of nuclear re-entry systems modeling and simulation coordinated with PE 0603273F. Continue development and testing of advanced numerical methods for implementation of dynamic techniques for improved event discrimination and characterization for local and regional seismic events. Continue developing earth models and statistical approaches to the behavior of discriminants for local and regional seismic events. Continue model and algorithm development and testing of detection techniques to advance the ground-based seismic nuclear monitoring mission through improved anomaly detection, attribution and protection. Continue enhanced seismic monitoring with distributed acoustic sensing with machine learning data analysis approach to analyze geometries for noise reduction. Initiate new advanced waveform tomography with 3D source simulations, linear wave propagation simulations and earth structure models to enhance prediction capabilities.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602201F / <i>Aerospace Vehicle Technologies</i>	Project (Number/Name) 625172 / <i>NUCLEAR SYSTEM TECHNOLOGY</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Continue aerothermal model validation and development through various testing mechanisms to include the development of integrated end-to-end physics based modeling suite to predict aerodynamic flow fields, signatures and material characterizations. Continue to improve modeling fidelity of plasma chemistry through machine learning models for product state distributions. Continue analysis of strategic command, control, and communications to identify space-layer technologies of interest.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$0.090 Million. Justification for this increase is described in plans above.			
Accomplishments/Planned Programs Subtotals	5.854	3.534	3.624

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u> <u>Base</u>	<u>FY 2024</u> <u>OCO</u>	<u>FY 2024</u> <u>Total</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>FY 2028</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• RDTE 03 0603273F: <i>Science & Technology for Nuclear Re-entry Systems</i>	0.000	39.431	70.162	-	70.162	87.945	118.933	155.791	161.244	Continuing	Continuing

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	139.287	150.771	146.921	0.000	146.921	141.651	127.452	130.095	141.631	Continuing	Continuing
620200: <i>Enterprise Transformational Appld Research</i>	0.000	0.000	0.000	0.191	0.000	0.191	0.194	0.199	0.204	0.211	Continuing	Continuing
621123: <i>Learning and Operational Readiness</i>	0.000	9.279	21.164	22.394	0.000	22.394	21.849	21.991	23.080	25.758	Continuing	Continuing
625328: <i>Human Dynamics Evaluation</i>	0.000	94.080	43.668	32.218	0.000	32.218	31.798	32.997	33.322	33.998	Continuing	Continuing
625329: <i>Sensory Evaluation and Decision Science</i>	0.000	23.479	40.148	44.454	0.000	44.454	42.157	43.320	43.874	48.797	Continuing	Continuing
627757: <i>Bioeffects</i>	0.000	12.449	45.791	47.664	0.000	47.664	45.653	28.945	29.615	32.867	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program conducts applied research in the area of airmen training, airmen performance sustainment, bioeffects, and understanding and shaping adversarial behavior. The Learning and Operational Readiness project conducts research to increase the agility of training for readiness while advancing learning and performance assessment science and practice. The Biosciences Performance project conducts research to discover, demonstrate, and transition capabilities which optimize and safe-guard Airman and Guardian physical and cognitive performance allowing for the maximum potential of the multi-domain Airman. The Sensory Evaluation and Decision Science project conducts research to discover, develop, and transition advanced interface technology, decision aiding tools, and situationally-adaptive augmentation methods to seamlessly integrate Airmen and Guardian and intelligent machines into maximally collaborative warfighting teams. The Bioeffects project conducts novel and operational exposure bioeffects research, exposure effects analysis and national/international exposure standards for the Air Force to enable, sustain, and enhance Airman and Guardian performance and protection during deployment of directed energy systems.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities. This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	156.863	135.771	118.402	0.000	118.402
Current President's Budget	139.287	150.771	146.921	0.000	146.921
Total Adjustments	-17.576	15.000	28.519	0.000	28.519
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	15.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-17.576	0.000			
• Other Adjustments	0.000	0.000	28.519	0.000	28.519

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 625328: *Human Dynamics Evaluation*

Congressional Add: *Pilot Hypoxia Detection and Notification*

Congressional Add: *Critical Air Transport Technology Expansion*

Congressional Add: *Advanced Warfighter Physiology and Operational Readiness*

Congressional Add: *Special Tactics Support Assessment*

Congressional Add Subtotals for Project: 625328

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	7.000	0.000
	0.000	7.000
	0.000	4.000
	4.000	4.000
Congressional Add Subtotals for Project: 625328	11.000	15.000
Congressional Add Totals for all Projects	11.000	15.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / Human Effectiveness Applie d Research	Project (Number/Name) 620200 / Enterprise Transformational Appld Research
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
620200: Enterprise Transformational Appld Research	0.000	0.000	0.000	0.191	0.000	0.191	0.194	0.199	0.204	0.211	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program element develops multidisciplinary applied research efforts to accelerate the technology pipeline of transformational capabilities by reducing risk and maturing the technology so it can transition in support of larger advanced technology development capability investments. These activities are selected to enable solutions to the DAFs highest priorities to include Operational Imperatives and Critical Technology Areas. The Explore effort engages traditional & nontraditional industry, government laboratories and academia through 12-24 month feasibility studies and demonstrations. The Seedlings for Disruptive Capabilities Program (SDCP) facilitates AFRL cross-disciplinary applied research to provide leap-ahead, high risk technology development. Modeling, simulation, and analyses activities will continue to explore transformational research analytic technologies to enable validated positions and provide a solid foundation with emphasis to predict future outcomes and technology needs, as well as looking for more seedlings to feed the transformational capability pipeline. Continue to advance future workforce development programs and broadening partnerships to deepen and expand the scientific and technology enterprise. Applied research efforts span a broad spectrum of activities, and established processes allow agility and flexibility to meet higher demand signals.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Enterprise Transformational Applied Research	0.000	0.000	0.191
Description: Enterprise Transformational Applied Research			
FY 2023 Plans: Not applicable			
FY 2024 Plans: This work will be executed out of and described in the plans for Program PE 0602202F Enterprise Transformational Appld Research, Project 620200 Enterprise Transformational Appld Research effort.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.191 million. This increase is described in plans above.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	0.191

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 620200 / <i>Enterprise Transformational Applied Research</i>

D. Acquisition Strategy
Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 621123 / <i>Learning and Operational Readiness</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
621123: <i>Learning and Operational Readiness</i>	0.000	9.279	21.164	22.394	0.000	22.394	21.849	21.991	23.080	25.758	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project advances research to measure, accelerate, and expand the cognitive skills necessary to improve airmen training and mission performance. The emphasis is on developing technology to enable a more lethal force by delivering revolutionary training and readiness capabilities at the speed of operations. Research is conducted in two focus areas: personalized learning and cognitive modeling. Personalized learning focuses on exploratory application of adaptive proficiency technologies and interactive task learning capabilities to provide more effective, efficient learning that improves mission readiness. Cognitive modeling advances computational and mathematical methods to represent human information processing to facilitate the development of models capable of operating as intelligent teammates, adversaries, or coaches, and cognitive performance prediction systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Personalized Learning</p> <p>Description: Research lays the foundation for long-term Operational Training and Test Infrastructure by creating capabilities that enhance live-virtual-constructive environment and integration, exploring environments and mechanisms to enable collaborative learning in human-machine teams, researching individual and team measurement and assessment techniques, algorithms to enable a shift toward personalized and proficiency-based training and readiness management, and researching how advanced learning technologies like augmented and virtual reality can be used to increase the effectiveness and efficiency of training.</p> <p>FY 2023 Plans: Continue research evaluating integrated human and machine personalized learning capabilities in mission-relevant laboratory, testbed, and field environments. Evaluation includes adaptive, multi-objective optimization methods in constrained instructional settings. Incorporate uncertainty in proficiency measurement and prediction in laboratory assessments. Initiate research evaluating the impact of training fidelity related to augmented, virtual, mixed, and extended reality on readiness. Initiate exploring methods and standards for assessing transfer of skill for just in time, novel mission training requirements for a peer fight in deployed and austere environments.</p> <p>FY 2024 Plans: Continue research evaluating integrated human and machine personalized learning capabilities in mission-relevant laboratory. Initiate research integrating multi-objective optimization and team proficiency assessment into a common ecosystem for synthetic operational training and testing. Initiate transition of proficiency measurement and prediction capabilities, including uncertainty quantification, to targeted domains such as language learning and recurring training areas. Continue research evaluating the impact of training fidelity related to augmented, virtual, mixed, and extended reality on readiness. Continue exploring methods</p>	5.567	12.698	13.436

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 621123 / <i>Learning and Operational Readiness</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>and standards for assessing transfer of skill for just in time, novel mission training requirements for a peer fight in deployed and austere environments. Initiate mobile research platform for embedding in integrated training events for data collection in controlled, naturalistic environment. Initiate mechanisms for co-learning in teams of humans and machines to maximize collaboration and performance in a laboratory setting.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.738 million. Funding increase due to added emphasis training augmented, virtual, mixed, and extended reality on readiness and co-learning in teams of humans and machines.</p>				
<p>Title: Cognitive Modeling</p> <p>Description: Research explores application of mathematical and computational modeling to understand the human mind and factors that will enhance or degrade cognitive performance. Capabilities enable personalized learning by tracking individual learning and targeting training interventions where/when needed. Research also explores applications for computer-generated forces with greater cognitive fidelity improving realism while reducing manpower costs for large, simulated scenarios. Investigates algorithms that track and predict readiness and mission effectiveness based on influences of the mission context and individual stressors improving the fidelity of wargames, system development, and operational planning with better characterizations of human capital capacities and limitations.</p> <p>FY 2023 Plans: Continue laboratory capability to profile workload and cognitive performance in real time. Continue evaluating real-time, personalized tracking of fatigue in operationally relevant environments, including impacts of countermeasures. Initiate integrated physiology-cognitive models to oxygen deprivation and chemical air contaminants. Initiate demonstrating automated knowledge and skill learning through verbal instruction with knowledge gap resolution in a laboratory-based artificial learning system. Continue maturing mechanisms for adaptation in communication within human-machine teams.</p> <p>FY 2024 Plans: Initiate capability for real-time fatigue monitoring and prediction for mobility and maintainer community. Continue real-time, personalized tracking of fatigue in operationally relevant environments, including impacts of countermeasures. Complete integrated physiology cognitive models to oxygen deprivation and chemical air contaminants. Continue laboratory capability profile workload and cognitive performance in real-time, and assess and predict performance based on interacting effects of multiple cognitive modulators in a laboratory setting. Initiate research computational and mathematical frameworks for representing human performance across scales of analysis, components of cognition and performance, and levels of resolution for digital engineering applications. Initiate computational modeling capability for situational understanding through natural language interaction,</p>		3.712	8.466	8.958

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 621123 / <i>Learning and Operational Readiness</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
information extraction, and information seeking in a laboratory context. Initiate research to demonstrate autonomy-based dynamic task allocation based on operator workload with context sensitivity.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$0.492 million. Funding increase due to added emphasis in autonomy-based autonomy-based dynamic task allocation based on operator workload.			
Accomplishments/Planned Programs Subtotals	9.279	21.164	22.394

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks None
D. Acquisition Strategy Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602202F / Human Effectiveness Applied Research				Project (Number/Name) 625328 / Human Dynamics Evaluation			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625328: Human Dynamics Evaluation	0.000	94.080	43.668	32.218	0.000	32.218	31.798	32.997	33.322	33.998	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts bioengineering and biotechnology research to optimize, safe-guard, and restore the performance of the multi-domain Airman and Guardian in all environments. Research is focused in the areas of 1) Cognitive and physiological performance: technologies to sustain, augment, and recover operator performance; 2) Biotechnology for performance: research in systems biology, synthetic biology, and risk assessment; 3) Performance sensing and assessment: technologies to sense and forecast operator state based on physiological, molecular, and environmental signatures related to mission performance; and 4) Performance impact of space and flight: elucidate how air and space environments affect processes of life and the ability to maintain physiological equilibrium and develop countermeasures and solutions to sustain, enhance, and restore operator performance.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Performance Sensing and Assessment	20.770	7.167	6.444
<p>Description: Develop technologies to sense and forecast operator state based on physiological, molecular, and environmental signatures related to Airman and Guardian performance. Develop solutions optimized for real-time, minimally-invasive, and autonomous sensing and assessing capabilities to enhance and protect the Airman and Guardian across the spectrum of operational environments.</p> <p>In FY 2023, this effort changed names from Molecular Sensing and Physiology to Performance Sensing and Assessment.</p> <p>FY 2023 Plans: Initiate rapid Biological Recognition Element selection and optimization strategies. Initiate electrochemical and Field Effect Transistors-based biomarker sensing platforms, including synthetic biology developed components. Continue optimizing sensor form factor for deployment with focus on platform miniaturization. Continue wearable and implantable/biodegradable sensors for continuous biomarker monitoring. Initiate platforms to deliver augmentation strategies in an autonomous fashion. Continue evaluating commercial, off-the-shelf molecular-based sensing technologies for Air Force and Space Force applications. In FY 2023, the research performance of On-board Oxygen Generation System and implications on human physiology for current and next-generation aircraft is being performed under the Project 625328/Performance Impact of Air and Space effort.</p> <p>FY 2024 Plans: Continue rapid Biological Recognition Element selection and optimization strategies. Continue electrochemical and Field Effect Transistors-based biomarker sensing platforms, including synthetic biology developed components. Complete sensor form factor for deployment with focus on platform miniaturization. Complete wearable and implantable/biodegradable sensors for</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625328 / <i>Human Dynamics Evaluation</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>continuous biomarker monitoring. Complete platforms to deliver augmentation strategies in an autonomous fashion. Complete the evaluation of commercial, off-the-shelf molecular-based sensing technologies for Air Force and Space Force applications. Initiate the identification and optimize bio-molecular mechanisms to sense cognitive function, performance, fatigue, and stress in console operators (i.e. Intelligence, Surveillance, Reconnaissance; Cyber; Space). Initiate data analytics based on sensor output to assess operator cognitive status, and facilitate decision making. Initiate integrating sensing and intervention mechanisms to sustain and augment operator performance. Utilize these sensors and intervention inputs/outputs to optimize human-machine learning.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.723 million. Funding decrease due to reduced emphasis in wearable and implantable/biodegradable sensors for continuous biomarker monitoring.</p>			
<p>Title: Biotechnology for Performance</p> <p>Description: Conduct research in systems biology, synthetic biology, and physiologic risk assessment research to focus on the underlying mechanisms contributing to individual performance in various operational environments through the integration of multiple genetic and biomarker technologies. Conduct research to utilize biomarker technologies to determine the risk associated with exposure to toxic compounds and materials. Resulting research will generate biomarker candidates for sensing personalized predictions of response to stressors and novel interventions to optimize, safeguard, and restore Airman and Guardian performance.</p> <p>In FY 2023, this effort changed names from Systems Biology for Performance to Biotechnology for Performance.</p> <p>FY 2023 Plans: Initiate a microfluidic "brain-on-a-chip" platform simulating the dynamic environment and physiologic conditions of brain cells/tissue to include blood brain barrier oxygen dynamics. Continue utilizing advanced bio-data analytics and bioinformatics processing to analyze baseline multi-omics data collected on large scale research cohort--identify relevant biomarkers, mechanisms of action, and intervention strategies providing predictive performance assessment algorithms for physical and cognitive augmentation. Initiate identifying nasal microbiome strain suitable for peptide delivery to improve stress resilience.</p> <p>FY 2024 Plans: Complete a microfluidic "brain-on-a-chip" platform simulating the dynamic environment and physiologic conditions of brain cells/ tissue to include blood brain barrier oxygen dynamics. Continue utilizing advanced bio-data analytics and bioinformatics processing to analyze, and leverage these comprehensive baseline biomarker validation in a large-scale cohort developing Airman-specific predictive algorithms for physical/cognitive state, as well as personalized sustainment/augmentation strategies utilizing advanced bio-data analytics and bioinformatics processing. These relevant biomarkers will be used to generate optimal</p>	20.770	7.167	6.444

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625328 / <i>Human Dynamics Evaluation</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>targets for sensor development for personalized state assessment enabling real-time feedback and performance optimization. Complete the identification of a nasal microbiome strain suitable for improved stress resilience.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.723 million. Funding decrease due to reduced emphasis in microfluidic "brain-on-a-chip" platforms, and nasal microbiome strains for improved stress resilience.</p>				
<p>Title: Cognitive and Physiological Performance</p> <p>Description: Develop technologies in cognitive neuroscience and physical performance to sustain, augment, and recover operator performance and determine performance attributes/metrics for optimal career field alignment. Includes research focused on developing and validating physiological and behavioral assessments of current and predicted cognitive state combined with personalized cognitive performance enhancement techniques and technologies to augment operator performance.</p> <p>In FY 2023, this effort changed names from Cognitive Neuroscience to Cognitive and Physiological Performance.</p> <p>FY 2023 Plans: Continue evaluating Brain Machine Interface devices optimized for extended reality applications or alternate Air Force relevant application. Continue research determining feasibility of sending interpretable information directly to the brain. Initiate longitudinal study evaluating passive sensing technologies for cognitive state assessment. Transition artifact correction algorithms necessary for accurate cognitive state assessment to advanced development projects. Update real-time analytics testbed with additional capabilities and utilize for cognitive probing validation and replication experiments. Complete research detailing differences between effects of transcranial direct current stimulation and transcutaneous vagal nerve stimulation on brain physiology and structure. Initiate neuromodulation paradigms for cognitive enhancement across Air Force career fields (i.e., piloting; intelligence, surveillance, and reconnaissance; cyber operations; special operations).</p> <p>FY 2024 Plans: Continue evaluating brain machine interface technology applications that enhance human machine teaming performance. Continue maturing existing brain machine interfaces, neurotechnology, and advanced algorithms towards a candidate product capable of monitoring brain state, and applying non-invasive interventions that accelerate training and enhance skill retention. Initiate modeling for neural and physiological patterns associated with decision making, and evaluate neuromodulation approaches for inducing an optimal decision making state. Complete transition of neuromodulation technologies for mature devices and applications (e.g. accelerated training of image analysts) while simultaneously exploring and maturing neuromodulation technology (e.g. focused ultrasound and magnetic devices) paradigms for new cognitive enhancement/</p>		20.770	7.167	16.109

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625328 / <i>Human Dynamics Evaluation</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
sustainment applications. Continue real-time analytics testbed with additional capabilities and utilize for cognitive probing validation and replication experiments. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$8.942 million. Funding increase due to an added emphasis in brain machine interfaces, and models for neural and physiological patterns associated with decision making.				
Title: Performance Impact of Air and Space Description: Conduct research investigating Airman and Guardian performance degradation resulting from exposure to air and space environments, and seek understanding the fundamental mechanisms driving environmental and operational risks. Develop technologies to mitigate or eliminate the root physiologic causes of these degradations and to ultimately optimize Airman and Guardian performance resulting in the capability to fly faster, higher, and longer than our adversaries. In FY 2023, this effort changed names from Aircrew Biodynamics and Protection to Performance Impact of Air and Space. FY 2023 Plans: Continue research developing next generation onboard oxygen generation system technologies. Continue research to characterize aircrew body motion, and biomechanical sensitivity related to acute and chronic back/neck pain and musculoskeletal injuries. Continue mitigation strategies such as physical conditioning, system design improvements, and interventional strategies to repair post-sortie injury from high-G exposures. Initiate human digital engineering algorithms and models for fighter and bomber aircraft system design and human factors analysis applications. In FY 2023, Onboard Oxygen Generating System research moved from the Project 625328, effort Performance Sensing and Assessment. FY 2024 Plans: Continue applied research for Air Force customers in areas of aircrew injury assessment/mitigation and Onboard Oxygen Generation System operational performance assessment and enhancement. Continue research to characterize aircrew motion, biomechanical sensitivity to aircrew flight equipment and systems, the cause of acute and chronic back/neck pain, and musculoskeletal injuries towards the development of a Multi-Axial Neck Injury Criteria and Lumbar Injury Criteria. Complete mitigation strategies such as physical conditioning, system design improvements, and interventional strategies to repair post-sortie injury from high-G exposures. Continue human digital engineering algorithms and models for fighter and bomber aircraft system design, and human factors analysis applications. Initiate development of air supply pressure stabilization system to mitigate air supply pressure degradations. Initiate investigation into system integration approaches for fighter/trainer/bomber aircraft of onboard oxygen generation systems. FY 2023 to FY 2024 Increase/Decrease Statement:		20.770	7.167	3.221

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625328 / <i>Human Dynamics Evaluation</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 decreased compared to FY 2023 by \$3.946 million. Funding decrease due to reduced emphasis in mitigation strategies of post-sortie injury from high-G exposures, and efforts in onboard oxygen generation system performance impacts.			
Accomplishments/Planned Programs Subtotals	83.080	28.668	32.218

	FY 2022	FY 2023
Congressional Add: Pilot Hypoxia Detection and Notification <i>FY 2022 Accomplishments:</i> Conduct Congressionally directed efforts <i>FY 2023 Plans:</i> Not Applicable	7.000	0.000
Congressional Add: Critical Air Transport Technology Expansion <i>FY 2022 Accomplishments:</i> Not Applicable <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts	0.000	7.000
Congressional Add: Advanced Warfighter Physiology and Operational Readiness <i>FY 2022 Accomplishments:</i> Not Applicable <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts	0.000	4.000
Congressional Add: Special Tactics Support Assessment <i>FY 2022 Accomplishments:</i> Conduct Congressionally directed efforts <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts	4.000	4.000
Congressional Adds Subtotals	11.000	15.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>				Project (Number/Name) 625329 / <i>Sensory Evaluation and Decision Science</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625329: <i>Sensory Evaluation and Decision Science</i>	0.000	23.479	40.148	44.454	0.000	44.454	42.157	43.320	43.874	48.797	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts research to discover, develop, and transition advanced interface technology, decision aiding tools, and situationally-adaptive augmentation methods to seamlessly integrate Airmen and intelligent machines into maximally collaborative warfighting teams. Advanced technologies will enhance how Airmen and Guardian fight through improved team interactions and adaptive information throughput. Airman-Machine interaction design is critical for achieving mission success and maintaining meaningful human control in highly complex, uncertain, and rapidly evolving environments.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Collaborative Interfaces and Teaming	6.339	10.840	12.003
Description: Research new Human-Machine Teaming technologies and concepts (e.g., information portrayal, control devices, decision aiding algorithms and adaptive agents) for effective human-machine interaction and teamwork.			
FY 2023 Plans: Initiate the validate of effects of multiple interface designs for teaming solutions based on research on swift trust development and effective teaming methods between human operators in a Joint All Domain Command and Control (JADC2) context; expand a multi-domain playbook for JADC2 operators to include Air, Space and Cyber effects; continue research and experimentation focused on human-machine-teaming and collaborative interface design among mixed human-human and human-machine teams in applied and simulated domains; continue research on trust development within mixed human-synthetic agent teams; continue research on human implications of machine learning and run-time assurance technologies; continue research focused on development of software architectures and platforms to enable human-machine-teaming for pilot-vehicle interfaces in operationally relevant scenarios, Unmanned Aerial System teaming, base defense, and air battle management; apply research methodologies to conduct operator-centric field evaluations of fielded automation/autonomy systems; synthesize guidelines for engendering trust in human-human and human-machine teams.			
FY 2024 Plans: Initiate research effort on team resilience; build upon foundation of novel teaming metrics research to develop prototype team health scanner tool. Initiate research on transparency for distributed teams; build upon Joint All Domain Command and Control playbook research to develop prototype support tools for multi-domain teaming. Continue research on human autonomy collaboration tools to enhance resiliency. Complete research on human implications of machine learning and run-time assurance technologies. Complete research focused on development of software architectures and platforms to enable human-machine-teaming for pilot-vehicle interfaces in operationally relevant scenarios, Unmanned Aerial System teaming, base defense, and air			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625329 / <i>Sensory Evaluation and Decision Science</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>battle management. Initiate the exploration of test methods for achieving bi-directional transparency in human-machine teaming. Complete research on trust development within mixed human-synthetic agent teams. Continue transfer of authority research to facilitate rapid acquisition of situation awareness for unexpected custody of assets. Continue research methodologies to conduct operator-centric field evaluations of fielded automation/autonomy systems. Experiment with interface technologies for control of unmanned assets from aerial platforms. Continue to refine guidelines for engendering trust and/or suspicion in human-human and human-machine teams.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.163 million. Funding increase due to added emphasis Human-Machine Teaming technologies.</p>			
<p>Title: Multisensory Perceptions and Communication</p> <p>Description: Multisensory Perception and Communication focuses on identifying and exploiting the underlying sensory and cognitive mechanisms mediating human perception and communication in order to inform the development of multimodal interfaces and speech/language technologies. Research examines sensory processing, multisensory integration, and human communication processes in simple and complex environments to identify the barriers to effective information transmission and inform the development of technologies to overcome, or exploit, those barriers in order to enhance Airmen performance.</p> <p>FY 2023 Plans: Continue behavioral research on team communication; collect operationally-relevant speech databases; develop models of dialogue processes; build and integrate algorithms from these models into an existing communication interface for identifying intelligent interruption capability; identify characteristics of effective/ineffective communication informing miscommunication identification systems; evaluate these capabilities in operationally-relevant testbeds. Build and evaluate new communication management technologies and explore new domain-specific features and form factors. Continue evaluating Augmented and Virtual reality capabilities for providing information through additional perceptual channels (visual, haptic/tactile along with speech communications) for distributed, collaborative tasks, supporting multi-capable airmen. Initiate multimodal symbologies and evaluate, with subject matter experts from flight community and Special Forces, in simulation and real-world operating environments with appropriate environmental/task complexity. Continue collecting behavioral and neurophysiological data, use to refine real-time model of attention and processing capacity, integrate into testbeds to evaluate as driver for adaptive interfaces. Continue evaluating new technologies focused on perceptual and communication disruption in field tests.</p> <p>FY 2024 Plans: Continue behavioral research on issues associated with disrupted and degraded communication channels. Initiate natural ad hoc team coordination in emergency response and Joint-All Domain scenarios. Initiate the collection of communication data from live and simulated events in these domains, and use data to develop new models of natural human communication</p>	8.922	15.256	16.892

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625329 / <i>Sensory Evaluation and Decision Science</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>processes. Continue operationally-relevant speech databases and dialogue processes. Build and integrate algorithms from these new models into novel communication interface prototypes for effective and efficient human-autonomy teaming. Initiate the development of new tools for integrating situation awareness displays with language based communication systems, and evaluate these capabilities in laboratory studies and operationally-relevant testbeds. Complete the evaluation of Augmented and Virtual reality capabilities for providing information through additional perceptual channels (visual, haptic/tactile along with speech communications) for distributed, collaborative tasks, supporting multi-capable airmen. Complete multimodal symbiologies and evaluate, with subject matter experts from flight community and Special Forces, in simulation and real-world environments with appropriate environmental/task complexity. Complete the collection of behavioral and neurophysiological data, use to refine real-time model of attention and processing capacity, integrate into testbeds to evaluate as driver for adaptive interfaces. Complete the evaluation of new technologies focused on perceptual and communication disruption in field tests.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.636 million. Funding increase due to added emphasis in team coordination in Joint-All Domain scenarios.</p>			
<p>Title: System Analytics</p> <p>Description: System Analytics studies the macro-cognition of the Airman using computational tools to accomplish mission objectives, encompassing interactions between operators, analytics, and environment. The goal of this research area is to describe, assess, and design for effective integration of analytics into mission systems.</p> <p>FY 2023 Plans: Continue accelerating design and assessment of mission relevant, Airman-centric data analytics capabilities at speed and scale. Complete research of cognitive and physiological performance assessment, development of analytics for insider threat identification, and decision support for joint all domain mission planning and execution. Complete single-INT analytics studies, data visualization for wide area monitoring, and technologies for intelligence requirement management.</p> <p>FY 2024 Plans: Continue the assessing design systems and methods to effectively blend data analytics with human cognition, with the goal of enhancing Airman and Guardian decision-making and improving joint cognitive systems performance in the face of massive volumes of complex and fast-changing information. Initiate assessing and enhancing the impact of analytics on thinking and reasoning in order to tailor capabilities to the context-specific cognitive requirements of our Warfighters. Initiate sensemaking studies, improve situational awareness, and mitigate data overload in order to enable Warfighters to rapidly extract meaning from complex, uncertain, and multi-dimensional data sources. Specific work is being vectored to directly support Joint All-Domain</p>	8.218	14.052	15.559

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 625329 / <i>Sensory Evaluation and Decision Science</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Command and Control, with attention to experiments, studies, guidelines, and publications in high-priority and related strategic investment areas.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$1.507 million. Funding increase due to an added emphasis in the enhancement of sensemaking to improve situational awareness, and the support of Joint All-Domain Command and Control activities.			
Accomplishments/Planned Programs Subtotals	23.479	40.148	44.454

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602202F / Human Effectiveness Applied Research				Project (Number/Name) 627757 / Bioeffects			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
627757: Bioeffects	0.000	12.449	45.791	47.664	0.000	47.664	45.653	28.945	29.615	32.867	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research on the effects of human exposure to electromagnetic energy (direct current to radio frequency to optical, scalable directed energy weapons, and other novel weapons). This research addresses mechanisms of interactions through fundamental physical principles, biological responses, and physiological outcomes. Research is divided into two core focus areas: novel directed energy bioeffects and mechanisms and directed energy modeling, simulation, and analysis. The research enhances combat survivability and systems effectiveness through technologies that enable deployed forces to counter optical threats and exploit optical systems for offensive applications. In addition, basic biological investigations into the mechanisms associated with high peak power and high average power radio frequency exposure allow for the exploitation of directed energy systems for offensive capabilities while protecting the warfighter from adversarial use of radio frequency technologies. The novel directed energy bioeffects mechanisms research examines the physical, physiological, behavioral, and neural interactions of electromagnetic energy with tissues to understand dose-response effects as well as reveal the means to cause or prevent a specific effect. The directed energy modeling, simulation, and analysis research is focused on new software components that represent and optimize concepts of novel system employment from the Airman standpoint. These components are matured for future transition and application for engagement-to-mission level simulations in which directed energy weapons are employed.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Novel Directed Energy Bioeffects and Mechanisms	4.357	16.027	16.682
Description: Conduct laboratory experiments to provide fundamental knowledge of mechanisms of interaction of directed energy with molecules, cells, tissues, organs, and whole organisms in support of military directed energy systems. Conduct laboratory experiments to understand the mechanistic and behavioral effects of novel weapon incidents to the Airman and to understand the effects of protection strategies on Airman performance.			
FY 2023 Plans: Continue collection and transition of data from multiple parameterization, validation and verification experimental studies to candidate products that support high peak power microwave, high energy laser, and other emerging directed energy weapon concepts in order to assure valid modeling of real-world concerns. Continue studies to further the understanding of suprathreshold effects on critical tissues including dynamic tissue characteristics under suprathreshold insult. Initiate methodologies to represent human vulnerabilities and vision effects within the modeling and simulation environment. Continue research of mechanisms emerging from subcellular and cellular level response to radio frequency and optical radiation. Continue research that underpins enhanced assessment of operational exposures to battlefield directed energy environments. Continue			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 627757 / <i>Bioeffects</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>research data and expertise to activities that further the development of directed energy policy and exposure standards to maximize interoperability and safe use of technology.</p> <p>FY 2024 Plans: Continue collection and transition of data from multiple parameterization, validation and verification experimental studies to candidate products that support high peak power microwave, high energy laser, and other emerging novel weapon concepts in order to assure valid assessments of real-world concerns and manage the risks associated with technological surprise. Continue studies to further the understanding of high energy effects on critical tissues including dynamic tissue characteristics under high power insult. Extend prior-year studies to include additional near-to-mid infrared parameters to fill data gaps required for materiel selection of laser systems. Continue developing methodologies to understand vulnerabilities and vision effects, including impact of protective systems on color vision. Continue examining mechanisms emerging from subcellular and cellular level response to electromagnetic energy. Continue research that underpins enhanced assessment of operational exposures to battlefield directed energy environments to include counter directed energy weapon technology. Expand research data sets and expertise to activities that further the development of directed energy policy and exposure standards to maximize interoperability and safe use of technology.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.655 million. Funding increase due to a multi-year surge of funding supporting high priority, real-world events.</p>			
<p>Title: Directed Energy Bioeffects Modeling, Simulation and Analysis</p> <p>Description: Conduct physics-level modeling and simulations to represent and optimize directed energy bioeffects to include direct, scalable, and collateral effects.</p> <p>FY 2023 Plans: Continue advancing dose-response models to include probability of injury as a function of depth within the skin. Continue maturing approaches for utilizing high performance computing to quantify the uncertainty within multi-physics bioeffect simulations of directed energy engagement. Continue extending prototype approaches for surrogating physics-level simulations through machine learning applications. Initiate advanced three-dimensional digital anatomical models for use within physics-level software, and leverage these models against empirical datasets for advanced validation purposes.</p> <p>FY 2024 Plans: Continue advancing dose-response models to include severity of injury as part of employment risk as a function of directed energy weapon parameters. Continue advancing three-dimensional digital anatomical models for use within physics-level software, and leverage these models against empirical datasets for advanced validation purposes. Continue maturing approaches for utilizing high performance computing to quantify the uncertainty within multi-physics bioeffect simulations of directed energy in end-to-</p>	8.092	29.764	30.982

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602202F / <i>Human Effectiveness Applied Research</i>	Project (Number/Name) 627757 / <i>Bioeffects</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
end simulations at the engineering, engagement and mission levels, incorporating models from other collaborative organizations. Continue extending modeling approaches for surrogating physics-level simulations through machine learning approaches, and suitable for integration for digital representation of human throughout analyses.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$1.218 million. Funding increase due to a multi-year surge of funding supporting high priority, real-world events.			
Accomplishments/Planned Programs Subtotals	12.449	45.791	47.664

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research	R-1 Program Element (Number/Name) PE 0602203F I Aerospace Propulsion
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	173.665	212.361	184.867	0.000	184.867	178.396	182.572	186.365	202.449	Continuing	Continuing
623012: <i>Advanced Propulsion Technology</i>	-	9.633	17.358	18.638	0.000	18.638	18.212	18.640	19.026	20.552	Continuing	Continuing
623048: <i>Combustion and Mechanical Systems</i>	-	6.097	4.659	4.845	0.000	4.845	4.360	4.453	4.546	5.312	Continuing	Continuing
623066: <i>Turbine Engine Technology</i>	-	88.585	76.146	73.533	0.000	73.533	71.733	73.398	74.929	80.928	Continuing	Continuing
623145: <i>Aerospace Power Technology</i>	-	44.971	69.699	39.602	0.000	39.602	38.033	38.908	39.717	43.571	Continuing	Continuing
625171: <i>Missile Rocket Propulsion</i>	-	19.154	36.039	39.233	0.000	39.233	37.161	38.064	38.851	42.146	Continuing	Continuing
625330: <i>Aerospace Fuel Technology</i>	-	5.225	8.460	9.016	0.000	9.016	8.897	9.109	9.296	9.940	Continuing	Continuing

A. Mission Description and Budget Item Justification

This effort develops propulsion and power technologies to achieve enabling and revolutionary aerospace technology capabilities. The effort has six current projects, each focusing on a technology area critical to the Department of the Air Force. The Advanced Propulsion Technology project develops high-speed air breathing propulsion engines to include combined cycle, ramjet, and hypersonic scramjet technologies. The Combustion and Mechanical Systems project develops engine mechanical system technologies: bearings, seals, drives, and lubricants as well as combustion components, concepts, and technologies for legacy and advanced turbine engines. The Turbine Engine Technology project develops enabling capabilities to enhance performance and affordability of existing weapon systems and develops component technologies for ultra-high pressure ratio, substantially improved durability, and adaptive cycle engine architecture to provide optimized performance, fuel efficiency, and life for widely varying mission needs. The Aerospace Power Technology project develops electrical power and thermal control technologies for military applications that remove operational limitations and enable advanced vehicle designs and high-power mission systems. The Missile Rocket Propulsion project develops advances in rocket propulsion technologies for tactical missiles and the sustainment of strategic systems. The Aerospace Fuel Technology project evaluates fuels and related technologies for legacy and advanced turbine engines, scramjets, rotating detonation engines and combined-cycle engines. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602204F, 0602602F, 0602605F, 0602788F, 0602298F, and 1206601SF.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>
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This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

Funds in this program element may be used to investigate specified technology advancements in air, space and/or cyber domains.

All transfers detailed below are administrative realignments due to the stand up of the United States Space Force, and not new starts. This work will continue to be executed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, OH, Edwards Air Force Base, CA, or Arnold Air Force Base, TN.

In FY 2022, the work and funding associated with space technology research in Program 0602203F, Aerospace Propulsion, Project 624847, Rocket Propulsion Technology, are transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, Program 1206601SF, Project 624847, Rocket Propulsion Technology, due to the creation of a new Appropriation for Space Force.

In FY 2022, the work and funding associated with missile rocket propulsion technologies in Program 0602203F, Aerospace Propulsion are transferred from Project 624847, Rocket Propulsion Technology to Project 625171, Missile Rocket Propulsion Technology due to the creation of a new Appropriation for Space Force.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	190.683	172.861	174.787	0.000	174.787
Current President's Budget	173.665	212.361	184.867	0.000	184.867
Total Adjustments	-17.018	39.500	10.080	0.000	10.080
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	39.500			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-5.000	0.000			
• SBIR/STTR Transfer	-12.018	0.000			
• Other Adjustments	0.000	0.000	10.080	0.000	10.080

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 623066: *Turbine Engine Technology*

FY 2022	FY 2023

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>
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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>	FY 2022	FY 2023
Congressional Add: <i>Program Increase - Modular open system architecture for turbine engine technology</i>	5.837	8.000
Congressional Add Subtotals for Project: 623066	5.837	8.000
Project: 623145: Aerospace Power Technology		
Congressional Add: <i>Emergency power and cooling thermal management growth</i>	4.864	9.500
Congressional Add: <i>Modular cooling capacity for tactical aircraft</i>	-	5.000
Congressional Add: <i>Program Increase - high mach turbine engine</i>	-	10.000
Congressional Add: <i>High voltage aircraft power</i>	-	2.000
Congressional Add: <i>Improving reliability of electrical systems for future aircraft</i>	-	5.000
Congressional Add Subtotals for Project: 623145	4.864	31.500
Project: 625171: Missile Rocket Propulsion		
Congressional Add: <i>Program increase - Small business research for rocket technology</i>	4.860	0.000
Congressional Add Subtotals for Project: 625171	4.860	0.000
Congressional Add Totals for all Projects	15.561	39.500

Change Summary Explanation

FY 2022 funding shows a reprogramming decrease of \$5.000 million. The reprogram was performed to support the Research and Development project, MAYHEM.

FY 2024 funding increased in the FY 2024PB compared to the FY 2023PB by \$10.080 million. The increase is due to increased AF emphasis in aerospace propulsion technology.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>				Project (Number/Name) 623012 / <i>Advanced Propulsion Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623012: <i>Advanced Propulsion Technology</i>	-	9.633	17.358	18.638	0.000	18.638	18.212	18.640	19.026	20.552	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops combined/advanced cycle air breathing high-speed and hypersonic propulsion technologies to provide revolutionary propulsion options for the Air Force. These new engine technologies will enable future high-speed/hypersonic weapons and aircraft concepts. The primary focus is on hydrocarbon-fueled engines capable of operating over a broad range of flight Mach numbers. Efforts include modeling, simulations, and proof of concept demonstrations of critical components; advanced component development; and ground-based demonstrations.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Hypersonic Scramjet Technologies	9.633	17.358	18.638
Description: Develop robust hydrocarbon fueled scramjet engine components and technologies to improve performance, operability, durability, and scalability for future platforms.			
FY 2023 Plans: Continue development and demonstration of advanced, high speed engine components to improve operating margin, operating time and scaling laws for expendable and reusable applications. Continue development of low internal drag flame stabilization devices, instrumentation, endothermic fuels, and flight test engine components. Initiate development of design and analysis techniques and tools as well as experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. Continue propulsion studies and design efforts required for the development and demonstration of an engine flight test that expands the flight environment of current high speed propulsion systems.			
FY 2024 Plans: Continue development and demonstration of advanced, high speed engine components to improve operating margin and operating time for expendable and reusable applications; complete scaling laws element of research. Continue development of low internal drag flame stabilization devices, instrumentation, endothermic fuels, and flight test engine components. Continue development of design and analysis techniques and tools as well as experimental approaches to enable enhanced high-speed air induction system starting, operability, and performance for propulsion integration concepts over a wide range of flight conditions. Continue propulsion studies and design efforts required for the development and demonstration of an engine flight test that expands the flight environment of current high speed propulsion systems.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.280 million. Funding increased to accelerate the development			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623012 / <i>Advanced Propulsion Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
of innovative engine control technology.			
Accomplishments/Planned Programs Subtotals	9.633	17.358	18.638

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>				Project (Number/Name) 623048 / <i>Combustion and Mechanical Systems</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623048: <i>Combustion and Mechanical Systems</i>	-	6.097	4.659	4.845	0.000	4.845	4.360	4.453	4.546	5.312	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates lubricants, mechanical systems, and combustion concepts for advanced turbine engines, rotating detonation engines, and combined cycle engines. This project also develops technologies to increase turbine engine operational reliability, durability, mission flexibility, maintainability, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include: missiles, aircraft, and re-usable high-speed vehicles. Analytical and experimental areas of emphasis include: lubricants, bearings, mechanical systems diagnostics, mechanical systems prognostics, rotor dynamics, oil-less engine technology, optical diagnostics, fundamental combustion, detonations, combustors, and afterburners. Lubricants for these engines must be thermally stable, cost-effective, and operate over a broad range of conditions. Advanced combustion concepts must be cost-effective, durable, and reduce pollutant emissions. A portion of this project supports evaluation of technologies for future conceptual cycles. This project develops component technologies for future conceptual engine cycles and architectures that provide both optimized performance and fuel efficiency for widely varying mission needs.

In FY2023, Combustion Technologies, Diagnostic Technologies, and Bearing Technologies efforts in this Project will transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Combustion Technologies</p> <p>Description: Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulse detonation, and combined cycle engines for missiles, manned and unmanned systems.</p> <p>FY 2023 Plans: In FY 2023, this effort will transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>	2.519	0.000	0.000
<p>Title: Diagnostic Technologies</p> <p>Description: Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies.</p>	0.433	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623048 / <i>Combustion and Mechanical Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> In FY 2023, this effort will transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p><i>FY 2024 Plans:</i> Not Applicable</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Not Applicable</p>			
<p><i>Title:</i> Lubricant Technologies</p> <p><i>Description:</i> Develop, test, and model advanced turbine engine lubricants and applied lubrication technologies.</p> <p><i>FY 2023 Plans:</i> Continue developing innovative fluids by; defining target requirements for new polyolester oils, conduct Research & Development for new/enhanced turbine engine oils for legacy & emerging engines, qualify new & updated engine oil products for legacy & emerging engines. Continue the development of lubricant modeling through characterization of heat generation, lubrication system cooling effectiveness, failure progression of bearing materials under relevant engine conditions, and overall system performance of advanced bearing concepts for model validation. Continue supporting the warfighter on field-related mechanical system issues. Continue performance validation study of lubricant & lubrication system components via full-scale high-fidelity laboratory parametric testing at representative engine operating conditions. Complete the generation of the fatigue life database & assess fatigue growth characteristics of state of the art baseline, emerging, & advanced engine rolling element bearing materials thru sub-scale experimental investigations Initiate development of applied rotor dynamics models for design.</p> <p><i>FY 2024 Plans:</i> Complete developing innovative fluids by; defining target requirements for new polyolester oils, conduct Research & Development for new/enhanced turbine engine oils for legacy & emerging engines, qualify new & updated engine oil products for legacy & emerging engines. Continue the development of lubricant modeling through characterization of heat generation, lubrication system cooling effectiveness, failure progression of bearing materials under relevant engine conditions, and overall system performance of advanced bearing concepts for model validation. Complete supporting the warfighter on field-related mechanical system issues. Continue performance validation study of lubricant & lubrication system components via full-scale high-fidelity laboratory parametric testing at representative engine operating conditions. Continue development of applied rotor dynamics models for design. Initiate studies on bearings nonoil lubrication technologies for limited life systems.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i></p>	1.497	4.659	4.845

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623048 / <i>Combustion and Mechanical Systems</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$0.186 million. Funding increased due to increased costs to complete planned activities.				
<p>Title: Bearing Technologies</p> <p>Description: Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications.</p> <p>FY 2023 Plans: In FY 2023, this effort will transfer to Program 0602203F, Aerospace Propulsion, Project 623066, Turbine Engine Technology in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>		1.648	0.000	0.000
Accomplishments/Planned Programs Subtotals		6.097	4.659	4.845
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
Not applicable.				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / Aerospace Propulsion				Project (Number/Name) 623066 / Turbine Engine Technology			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623066: <i>Turbine Engine Technology</i>	-	88.585	76.146	73.533	0.000	73.533	71.733	73.398	74.929	80.928	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technology to increase turbine engine operational reliability, durability, mission flexibility, and performance, while reducing weight, fuel consumption, and cost of ownership. Analytical and experimental areas of emphasis are fans and compressors, high temperature combustors, turbines, internal flow systems, controls, augmentor and exhaust systems, integrated power and thermal management systems, engine inlet integration, mechanical systems, conceptual cycle technologies, and structural design. This project develops component technology for an adaptive cycle engine architecture that provides both optimized performance and fuel efficiency for widely varying mission needs. This project supports joint Department of Defense, agency, and industry efforts to focus turbine propulsion technology on national needs. The project plan is relevant across capability areas for global responsive strike, tactical and global mobility, responsive space lift, and persistent intelligence, surveillance, and reconnaissance (ISR).

In FY2023, Combustion Technologies, Diagnostic Technologies, and Bearing Technologies efforts will transfer from PE 0602203F, Aerospace Propulsion, Project 623048, Combustion and Mechanical Systems, to this Project 623066 Turbine Engine Technology, in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Turbofan/Turbojet Engine Core Technologies	36.445	23.761	26.339
Description: Develop core turbofan/turbojet engine components (i.e., compressors, and turbines) for strike and air superiority capabilities.			
FY 2023 Plans: Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency. Initiate transonic fan distortion tolerance and transfer study to enable design-for-integration and reliable assessment for embedded engines. Initiate high lift /high work turbine study to reduce turbine stage /blade count.			
FY 2024 Plans: Continue development of improved aerodynamic design tools and analysis methods to extend engine operability and efficiency. Continue transonic fan distortion tolerance and transfer study to enable design-for-integration and reliable assessment for embedded engines. Continue high lift /high work turbine study to reduce turbine stage /blade count. Initiate design of compressors and turbines for limited life and affordability.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623066 / <i>Turbine Engine Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$2.578 million. Funding increase due to increased emphasis in studies of compressors and turbines for limited life and affordability.				
<p>Title: Turboshaft/Turboprop and Small Turbofan Engine Technologies</p> <p>Description: Develop components for turboshaft/turboprop and small turbofan engines for trainers, special operations aircraft, and long range strike.</p> <p>FY 2023 Plans: Complete current demonstration phase of advanced component designs in rig testing. Complete validation of data to develop improved test protocol for small engine augmentor designs. Complete development and validation phase of modeling and simulation tools for the design and analysis of turbine components with mission-tailored aero-performance and highly efficient cooling geometries. Complete application evaluation in new innovative architectures, critical technologies, exploration of targeted life applications for small missile and remotely piloted aircraft applications; evaluate critical technologies that will increase range, performance, durability, electrical power and thermal capacity of these systems. Continue the exploration of new small engine technologies that can operate in high speed applications; evaluate risk reduction technologies to increase usage time of systems. Complete demonstrating advanced component designs and modeling tools in rig and engine testing. Continue to utilize validation data to develop improved test protocol for small engine designs. Complete development and validation of modeling and simulation tools for the design and analysis of engine components with new manufacturing processes. Complete the exploration of advanced integrated engine controls with potential for synergistic airframe system level benefits. Continue exploration of new small and medium size engine technologies for increased fuel efficiency, propulsive capability, power and thermal management, and reduced life cycle cost. Continue identification of new architectures and critical technologies for integrated power and thermal systems. Continue identification of requirements and develop models for simulation of highly integrated systems.</p> <p>FY 2024 Plans: Continue the exploration of new small engine technologies that can operate in high-speed applications; Complete evaluation of risk reduction technologies to increase usage time of systems. Complete utilizing validation data to develop improved test protocol for small engine designs. Continue exploration of new small and medium size engine technologies for increased fuel efficiency, propulsive capability, power and thermal management, and reduced life cycle cost. Continue identification of new architectures and critical technologies for integrated power and thermal systems. Continue identification of requirements and develop models for simulation of highly integrated systems.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>		6.361	4.896	4.896
Title: Revolutionary Propulsion Technology		22.377	17.225	18.587

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / Aerospace Propulsion	Project (Number/Name) 623066 / Turbine Engine Technology
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>Description: Develop, test, and evaluate revolutionary propulsion concepts for gas turbine, pressure gain propulsion, and combined cycle engines for missiles, manned and unmanned systems.</p> <p>FY 2023 Plans: Continue identification of control technology elements applicable to integrated propulsion/power/thermal solutions. Complete evaluation of power and thermal modeling of advanced architectures into aircraft system level multidisciplinary analysis and optimization tools. Continue evaluation of integration of advanced augmentors and ramburners. Continue exploration of new expendable and attritable architectures. Continue the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable, and reusable strike and Intelligence, Surveillance, and Reconnaissance (ISR) systems. Continue studies for exploration of advanced propulsion technologies. Complete exploration and evaluation of innovative architectures for affordable & efficient airlaunched propulsion capability from Mach 3 to Mach 5+, and turbine based combined cycle propulsion capability to Mach 5+.</p> <p>FY 2024 Plans: Complete identification of control technology elements applicable to integrated propulsion/power/thermal solutions. Continue evaluation of integration of advanced augmentors and ramburners. Continue exploration of new expendable and attritable architectures. Continue the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable, and reusable strike and Intelligence, Surveillance, and Reconnaissance (ISR) systems. Continue studies for exploration of advanced propulsion technologies. Initiate studies in hypersonic combined cycles.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.362 million. Funding increase due to increased initiating studies in hypersonic combined cycles.</p>			
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Title: Missile and Unmanned Aerial Systems (UAS) Engine Technologies	17.565	13.521	14.590
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<p>Description: Develop limited life engine components for missile and Unmanned Aerial System (UAS) applications, including long-range subsonic, and supersonic vehicles.</p> <p>FY 2023 Plans: Complete identification of control technology elements applicable to integrated propulsion/power/thermal solutions. Continue evaluation of power and thermal modeling of advanced architectures into aircraft system level multidisciplinary analysis and optimization tools: explore new control methods for integrated propulsion, power and thermal management; Complete evaluation of integration of advanced augmentors and ramburners; continue exploration of new expendable and attritable architectures. Complete the development and evaluation of advanced, integrated propulsion technologies for supersonic expendable, attritable,</p>			
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UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623066 / <i>Turbine Engine Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>and reusable strike and Intelligence, Surveillance, and Reconnaissance (ISR) systems. Continue exploration of new engine concepts for missile and unmanned systems. Initiate lifetime demonstration of limited life engine components.</p> <p>FY 2024 Plans: Continue evaluation of power and thermal modeling of advanced architectures into aircraft system level multidisciplinary analysis and optimization tools: explore new control methods for integrated propulsion, power and thermal management. Continue exploration of new expendable and attritable architectures. Continue exploration of new engine concepts for missile and unmanned systems. Continue lifetime demonstration of limited life engine components. Initiate Multi-disciplinary design & optimization, systems engineering & digital engineering frameworks. Initiate development of predictive analysis tools to enable reliable, sufficiently durable component designs for Autonomous Collaborative Platforms (ACP).</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.069 million. Funding increase due to increased emphasis to develop predictive analysis tools to enable reliable and durable component designs.</p>			
<p>Title: Combustion Technologies</p> <p>Description: Develop, test, and evaluate revolutionary combustion and propulsion concepts for gas turbine, pulse detonation, and combined cycle engines for missiles, limited life systems.</p> <p>FY 2023 Plans: Continue exploring interactions and effects of compressor and turbine components on the combustor and combustor materials to increase efficiency and improve altitude ignition & operability. Complete use of advanced diagnostics tools to develop high-quality datasets for use by academia and industry for model development and verification. Complete research in the determination of necessary reference performance and operability combustion systems and metrics to decrease the cost of certifying new and alternative fuels in weapon systems. Complete support of development of advanced computational fluid dynamics (CFD) models to reduce combustor and augmentor design costs. Continue development of computations, modeling and simulation, and research experimentation of advanced combustion concepts including pressure gain combustion components and system level architectures. Complete planned exploration of advanced combustion and flameholding concepts working towards improved understanding at relevant operating conditions such as sub-atmospheric (less than 1 atmosphere) and high pressure (greater than 10 atmospheres); this includes fundamental combustion modeling and fluid-dynamic phenomena on high speed systems and rocket propulsion and advanced turbine engine applications, identifying modeling and simulation concepts/approaches to address combustion chemistry and physics and light/matter interactions, for high speed systems exploring turbulent combustion modeling in advanced configurations, exploring advanced combustion including pressure gain propulsion as it relates to new applications and architectures. Continue the development and demonstration of new design, modeling and simulation and testing methods to improve efficiency and operability. Continue investigation to identify and assess disruptive propulsion/power concepts and evaluate concepts. Continue development of new technologies for unmanned aircraft system propulsion/power systems for</p>	0.000	4.788	5.166

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623066 / <i>Turbine Engine Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>improved understanding at relevant operating conditions. Initiate exploration of applied high speed combustion and combustor design. Initiate exploration of rotating detonation engines for next generation combustion systems. Initiate the development of improved numerical methods and combustion models to guide design and applied development of combustion components and systems.</p> <p>FY 2024 Plans: Complete exploring interactions and effects of compressor and turbine components on the combustor and combustor materials to increase efficiency and improve altitude ignition & operability. Complete development of computations, modeling and simulation, and research experimentation of advanced combustion concepts including pressure gain combustion components and system level architectures. Continue the development and demonstration of new design, modeling and simulation and testing methods to improve efficiency and operability. Continue investigation to identify and assess disruptive propulsion/power concepts and evaluate concepts. Continue development of new technologies for unmanned aircraft system propulsion/power systems for improved understanding at relevant operating conditions. Continue exploration of applied high speed combustion and combustor design. Continue exploration of rotating detonation engines for next generation combustion systems. Continue the development of improved numerical methods and combustion models to guide design and applied development of combustion components and systems.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.378 million. Funding increase described in plans above.</p>			
<p>Title: Diagnostic Technologies</p> <p>Description: Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies.</p> <p>FY 2023 Plans: Complete support to current phase in computational fluid dynamics combustion modeling by providing insights for interpreting experimental results using existing Modeling & Simulation methodologies and applying recently developed high-speed, spatially resolved laser diagnostics to our representative, single- element combustion experiments in order to demonstrate and deliver measurements of key combustion species and flow properties under high pressure conditions. Continue development of diagnostic tools/ methods for robust measurement capability in engine test cells and full annular ground test environments including reacting and nonreacting spray experiments for liquid fuel spray model development and employment of Nonintrusive optical diagnostics that will be used to obtain accurate, spatially/temporally resolved data. Initiate the application of optical diagnostic to challenging engine environments including detonations, high pressures, and multiphase. Complete the development of improved numerical methods and turbulent combustion models to guide design and development of experimental components and systems utilizing existing Modeling & Simulation methodologies.</p> <p>FY 2024 Plans:</p>	0.000	0.822	0.822

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623066 / <i>Turbine Engine Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Complete development of diagnostic tools/ methods for robust measurement capability in engine test cells and full annular ground test environments including reacting and nonreacting spray experiments for liquid fuel spray model development and employment of nonintrusive optical diagnostics that will be used to obtain accurate, spatially/temporally resolved data. Continue the application of optical diagnostic to challenging engine environments including detonations, high pressures, and multiphase.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not applicable</p>			
<p>Title: Bearing Technologies</p> <p>Description: Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-scale turbine engine applications.</p> <p>FY 2023 Plans: Continue developing physics-based bearing life model based on bearing alloy fatigue and microstructural investigations, including bearing life factors for advanced bearing materials. Continue incorporating fatigue life, fault evolution, and parametric heat generation of advanced material systems into the models. Continue development of oil-free bearing technology for Unmanned Air Systems. Continue the development and demonstration of propulsion technologies for subsonic expendable and attritable air platforms, small and medium scale propulsion technologies, and evaluate lubricants, mechanical systems, bearing technology and combustion concepts for advanced turbine engines. Continue the development of fundamental knowledge of bearing material rolling contact fatigue failure mechanisms and lubricant interactions through microstructural investigations and failure analysis.</p> <p>FY 2024 Plans: Complete developing physics-based bearing life model based on bearing alloy fatigue and microstructural investigations, including bearing life factors for advanced bearing materials. Complete incorporating fatigue life, fault evolution, and parametric heat generation of advanced material systems into the models. Continue development of oil-free bearing technology for Unmanned Air Systems. Continue the development and demonstration of propulsion technologies for subsonic expendable and attritable air platforms, small and medium scale propulsion technologies, and evaluate lubricants, mechanical systems, bearing technology and combustion concepts for advanced turbine engines. Continue the development of fundamental knowledge of bearing material rolling contact fatigue failure mechanisms and lubricant interactions through microstructural investigations and failure analysis. Initiate macro failure mode investigations as a function of underlying microstructure and material fatigue life.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not applicable</p>	0.000	3.133	3.133
Accomplishments/Planned Programs Subtotals	82.748	68.146	73.533

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623066 / <i>Turbine Engine Technology</i>
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	FY 2022	FY 2023
Congressional Add: Program Increase - Modular open system architecture for turbine engine technology	5.837	8.000
FY 2022 Accomplishments: Conduct Congressionally directed efforts.		
FY 2023 Plans: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	5.837	8.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>				Project (Number/Name) 623145 / <i>Aerospace Power Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
623145: <i>Aerospace Power Technology</i>	-	44.971	69.699	39.602	0.000	39.602	38.033	38.908	39.717	43.571	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops integrated electrical and thermal management components, controls and systems for military aerospace applications. Power component technologies are developed to increase reliability, maintainability, commonality, affordability, and supportability of aircraft and flight line equipment. Research is conducted in energy storage and hybrid power system technologies to enable special purpose applications. Electrical power and thermal management technologies enable future military power and thermal needs. Controls and system integration technologies ensure the interoperability of aircraft, power, thermal, engine and other systems and subsystems. This project supports development of electrical power and thermal management components, controls and systems suitable for applications to legacy and future aircraft platforms including strike and mobility concepts. Lightweight power systems suitable for other aerospace applications are also developed.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Power System Technologies	40.107	38.199	39.602
Description: Develop integrated system architecture, controls, and component technologies to provide for the large amounts of electrical power needed, and concurrent thermal mitigation required, by current and future manned and unmanned systems.			
FY 2023 Plans: Continue development of system and component electrical power, electro-mechanical, and thermal technologies for high-power applications. Continue testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation for energy optimization. Complete development of advanced, safe energy storage, power distribution, and management systems to include Silicon Carbide applications and batteries and fan tip generator development. Complete analysis and development of adaptive power and thermal control systems for high-power aircraft to include open system integration and test. Complete weapon system contractor support for platform integration of advanced power and thermal system architectures. Continue medium-scale propulsion, power and thermal system studies and development to include innovative, integrated hybrid architectures. Initiate development of advanced power and thermal capabilities for future hypersonic aircraft. Initiate development of adaptive, affordable power and thermal technologies for emerging medium-scale platforms and mission capabilities.			
FY 2024 Plans: Complete development of system and component electrical power, electro-mechanical, and thermal technologies for high-power applications. Continue testing of subsystems hardware in conjunction with continued platform level tip-to-tail modeling and simulation for energy optimization. Continue medium-scale propulsion, power and thermal system studies and development to include innovative, integrated hybrid architectures. Continue development of advanced power and thermal capabilities for future			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623145 / <i>Aerospace Power Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
hypersonic aircraft. Continue development of adaptive, affordable power and thermal technologies for emerging medium-scale platforms and mission capabilities. Initiate development of advanced vehicle energy management capabilities.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$1.403 million. Funding increase due to increased emphasis in higher power aircraft system technologies to enable hypersonics and autonomous collaborative capabilities.			
Accomplishments/Planned Programs Subtotals	40.107	38.199	39.602

	FY 2022	FY 2023
<i>Congressional Add:</i> Emergency power and cooling thermal management growth <i>FY 2022 Accomplishments:</i> Conduct Congressionally directed efforts. <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	4.864	9.500
<i>Congressional Add:</i> Modular cooling capacity for tactical aircraft <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	-	5.000
<i>Congressional Add:</i> Program Increase - high mach turbine engine <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	10.000
<i>Congressional Add:</i> High voltage aircraft power <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	-	2.000
<i>Congressional Add:</i> Improving reliability of electrical systems for future aircraft <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts. This effort will be executed in Program 0602203F, Aerospace Propulsion, Project 623145, Aerospace Power Technology.	-	5.000
Congressional Adds Subtotals	4.864	31.500

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 623145 / <i>Aerospace Power Technology</i>

D. Acquisition Strategy

Not applicable.

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / Aerospace Propulsion				Project (Number/Name) 625171 / Missile Rocket Propulsion			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625171: <i>Missile Rocket Propulsion</i>	-	19.154	36.039	39.233	0.000	39.233	37.161	38.064	38.851	42.146	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops rocket propulsion technologies for the sustainment of strategic systems (including solid boost/missile propulsion, post boost control, aging and surveillance efforts), and tactical missiles. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, and technology for sustainment of strategic systems. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of these systems. Develop technologies to reduce the weight and cost of components using new materials and improved designs and manufacturing techniques. All efforts in this project contribute to the sustainment of the rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense (DoD). Tasks include: modeling and simulation; proof of concept tests of critical components; advanced component development; and ground-based tests. Aging and surveillance tasks could reduce lifetime prediction uncertainties for individual motors by 50%, enabling motor replacement for cause. All efforts are reviewed by a DoD level steering committee yearly for relevance to DoD missions.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Fuel Technologies	4.678	10.565	11.501
Description: Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods. Development of propellant management devices in support of fabrication and fuel delivery.			
FY 2023 Plans: Continue to devise, synthesize, scale-up, and characterize novel energetic ingredients for monopropellants, fuels, and oxidizers, for use across the span of space and missile applications including tactical, strategic, and in-space thrust and attitude control. Continue to formulate, scale-up, and evaluate formulations of solid and liquid rocket propellants, including green monopropellants. Continue to identify, evaluate, and adapt 21st century automated formulation and production techniques to enable more rapid and agile munitions production arrangements. Continue research in high- temperature resins, insulators, and composite case fabrication techniques to enable high performance rocket motor cases.			
FY 2024 Plans: Continue to devise, synthesize, scale-up, and characterize novel energetic ingredients for monopropellants, fuels, and oxidizers, for use in DAF and missile applications including tactical, strategic, and in-space thrust and attitude control. Continue to formulate, scale-up, and evaluate formulations of solid and liquid rocket propellants, including green monopropellants. Continue to identify, evaluate, and adapt 21st century automated formulation and production techniques to enable more rapid and agile munitions			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 625171 / <i>Missile Rocket Propulsion</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
production arrangements. Continue research in high- temperature resins, insulators, and composite case fabrication techniques to enable high performance rocket motor cases. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.936 million. Funding increase due to one time increase upgrade to laboratory equipment.				
Title: Ballistic and Tactical Propulsion Technologies Description: Develop missile propulsion technologies and aging and surveillance technologies for ballistic and tactical missiles. FY 2023 Plans: Continue to apply next generation of chemical and mechanical aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, to user needs and unique challenges. Continue to develop advanced tactical propulsion hardware and concepts. Continue development, evaluation, verification, and validation of next generation of physics-based modeling, simulation, and analysis (MS&A) tools for rapid and agile missile propulsion design, analysis, and production to include designs for 21st century material processing techniques and hardware. Continue to support advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. Continue automated solid rocket motor production techniques and components to enable more rapid and agile munitions production and logistic support. FY 2024 Plans: Continue to apply next generation of chemical and mechanical aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, to user needs and unique challenges. Continue to develop advanced tactical propulsion hardware and concepts. Continue development, evaluation, verification, and validation of next generation of physics-based modeling, simulation, and analysis tools for rapid and agile missile propulsion design, analysis, and production to include designs for 21st century material processing techniques and hardware. Continue to support advanced component technologies for missile propulsion applications for strategic and strike systems helping to ensure their long-term sustainment. Continue automated solid rocket motor production techniques and components to enable more rapid and agile munitions production and logistic support. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.258 million. Funding increase due to major hardware purchases and integration for upcoming motor tests.		9.616	25.474	27.732
Accomplishments/Planned Programs Subtotals		14.294	36.039	39.233
		FY 2022	FY 2023	
Congressional Add: Program increase - Small business research for rocket technology		4.860	0.000	

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 625171 / <i>Missile Rocket Propulsion</i>
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	FY 2022	FY 2023
<i>FY 2022 Accomplishments:</i> Conduct Congressionally directed efforts.		
<i>FY 2023 Plans:</i> Not Applicable		
Congressional Adds Subtotals	4.860	0.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>				Project (Number/Name) 625330 / <i>Aerospace Fuel Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625330: <i>Aerospace Fuel Technology</i>	-	5.225	8.460	9.016	0.000	9.016	8.897	9.109	9.296	9.940	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates fuels for legacy and advanced turbine engines, scramjets, detonation, and combined cycle engines. This project also considers fuel related concepts that can increase turbine engine operational reliability, durability, mission flexibility, energy efficiency, and performance while reducing weight, fuel consumption, and cost of ownership. Applications include missiles, aircraft, sustained high-speed vehicles, hypersonic, and responsive space launch. Analytical and experimental areas of emphasis include evaluations of fuel properties and characteristics of traditional fuels and alternative fuels developed from unconventional sources, specialty fuels, and components development used in integrated thermal and energy management systems including high heat sink fuel capability, fuels logistics and associated vulnerabilities, and combustion diagnostics and engine emissions measurements.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Alternative Fuels</p> <p>Description: Investigate novel sustainable aviation fuels for engines, missiles, aircraft, sustained high-speed vehicles, hypersonic, and responsive space launch applications. Conduct evaluations and perform technical assessments of alternative fuels developed from unconventional sources for use in legacy and advanced aerospace systems. Support development of alternative fuel specification for commercial jet fuels with Federal Aviation Agency.</p> <p>FY 2023 Plans: Continue investigation and development of novel sustainable and alternative aviation fuels and technologies for potential propulsion performance and logistical enhancements.</p> <p>FY 2024 Plans: Complete development and continue investigation of novel sustainable and alternative aviation fuels and technologies for potential propulsion performance and logistical enhancements.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.042 million. Funding increase described in plans above.</p>	0.385	0.652	0.694
<p>Title: Integrated Thermal and Energy Management</p> <p>Description: Develop advanced and specialty fuels, components, associated technologies, and conduct performance assessments of advanced integrated thermal and energy management systems for engines, missiles, aircraft, sustained high-speed vehicles, and hypersonic. Evaluate stability and performance of advanced and specialty fuels.</p> <p>FY 2023 Plans:</p>	1.650	2.796	2.980

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 625330 / <i>Aerospace Fuel Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>Continue the development and evaluation of novel fuel additives, catalysts, compositions, and system approaches enabling new hypersonic applications and expanding into other advance concepts and system-level impacts of emerging aviation technologies. Continue development of fuel related integrated thermal and energy management technologies including models for designs and evaluation of vehicle fuel systems, methods to monitor the fuel coking and other chemistry, and characterization methods for system-level impacts from thermally-stressed fuel, as well as expanding use as a thermal management fluid. Continue prototype sensors to monitor the fuel chemistry that produces coke deposits and characterization of system-level impacts from thermally-stressed fuel. Continue evaluation of fuel reaction models that enable high temperature systems for evaluating advanced fuels including endothermic fuels. Continue investigation of fuel heat sink approaches for thermal management of advanced engines and other systems that evaluate integrated power and thermal management approaches to include heat exchangers. Continue development of fuel models for system design and evaluation of fuel system. Continue development of sensors and analysis techniques for monitoring fuel chemistry that causes deposits. Complete characterization system-level impacts of emerging aviation technologies. Complete studies using fuel as a thermal management fluid to meet Air Force requirements. Complete investigation of fuel heat exchangers as an independent investigation including additive manufactured units and their reaction to fuels. Continue developing integrated test rigs to tests these approaches and assess their efficiency.</p> <p>FY 2024 Plans: Continue the development and evaluation of novel fuel additives, catalysts, compositions, and system approaches enabling new hypersonic applications and expanding into other advance concepts and system-level impacts of emerging aviation technologies. Complete development of fuel related integrated thermal and energy management technologies including models for designs and evaluation of vehicle fuel systems, methods to monitor the fuel coking and other chemistry, and characterization methods for system-level impacts from thermally-stressed fuel, as well as expanding use as a thermal management fluid. Complete sensors to monitor the fuel chemistry that produces coke deposits and characterization of system-level impacts from thermally- stressed fuel. Complete evaluation of fuel reaction models that enable high temperature systems for evaluating advanced fuels including endothermic fuels. Continue investigation of fuel heat sink approaches for thermal management; Complete thermal management investigations of advanced engines and other systems that evaluate integrated power and thermal management approaches to include heat exchanger. Continue development of fuel models for system design and evaluation of fuel system. Continue development of sensors and analysis techniques for monitoring fuel chemistry that causes deposits. Continue developing integrated test rigs to tests these approaches and assess their efficiency.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.184 million. Funding increase described in plans above.</p>			
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Title: Fuel Logistics and Sustainment	1.650	2.796	2.980
Description: Study and evaluate low-cost approaches to reduce fuel logistics footprint to reduce cost. Study fuel logistics vulnerabilities and develop detection and mitigation technologies.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 625330 / <i>Aerospace Fuel Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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FY 2023 Plans:
Continue support of fuel sustainment issues as needed, to understand current needs and problems as well as work to find solutions. Continue development of fuel compositional analyses methods that are verifiable across services and leverages a database of specification and extended compositional information to advance data visualization and analytics. Continue method developments to capture fuel stability limiters to minimize logistics vulnerabilities; develop detection and mitigations for fuel biocontamination to support logistics readiness; and develop fuel-sensing technologies with coordination and collaboration across the government. Continue thermal stability studies (such as chemistry, fuel system, and hybrid developments), and technologies (such as additives, deoxygenation, and platform thermal stability sensors); and models and technologies developments for traditional, specialty, and sustainable aviation fuels under simulated current and future operational domain conditions to ensure Air Force's readiness. Continue to analyze and develop fuels, fuel blends, catalyst formulations, accessories, and models for operational requirement of hypersonic application and extending into other next generation applications and vehicles. Complete study of fuels and models for next generation vehicles.

FY 2024 Plans:
Continue support of fuel sustainment issues as needed, to understand current needs and problems as well as work to find solutions. Continue development of fuel compositional analyses methods that are verifiable across services and leverages a database of specification and extended compositional information to advance data visualization and analytics. Continue method developments to capture fuel stability limiters to minimize logistics vulnerabilities; develop detection and mitigations for fuel biocontamination to support logistics readiness; and develop fuel-sensing technologies with coordination and collaboration across the government. Complete thermal stability studies (such as chemistry, fuel system, and hybrid developments), and technologies (such as additives, deoxygenation, and platform thermal stability sensors); and models and technologies developments for traditional, specialty, and sustainable aviation fuels under simulated current and future operational domain conditions to ensure Air Force's readiness. Complete to analyze and develop fuels, fuel blends, catalyst formulations, accessories, and models for operational requirement of hypersonic application and extending into other next generation applications and vehicles.

FY 2023 to FY 2024 Increase/Decrease Statement:
FY 2024 increased compared to FY 2023 by \$0.184 million. Funding increase due to increased costs of raw materials.

Title: Combustion Emissions and Performance	1.540	2.216	2.362
Description: Develop and test applied emissions diagnostic techniques for air breathing propulsion systems. Evaluate aviation fuel for combustion and emissions characteristics and fuel composition performance impacts. Identify and develop approaches to improve system performance and emissions across different fuels and types.			
FY 2023 Plans: Complete development of augmentor combustor/simulator to determine fuel effects on augmentor operability under realistic conditions. Continue studies of impact on combustor performance and emissions based on fuel chemistry (traditional, specialty,			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602203F / <i>Aerospace Propulsion</i>	Project (Number/Name) 625330 / <i>Aerospace Fuel Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
and sustainable aviation fuels), and fuel entrance temperature well above historic use levels, and other operational impacts, such as high altitude. Continue development of low temperature catalyst augmented combustion technologies.			
<i>FY 2024 Plans:</i> Complete studies of impact on combustor performance and emissions based on fuel chemistry (traditional, specialty, and sustainable aviation fuels), and fuel entrance temperature well above historic use levels, and other operational impacts, such as high altitude. Complete development of low temperature catalyst augmented combustion technologies. Initiate studies of impact on combustor performance and emissions based on fuel chemistry of sustainable aviation fuels.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$0.146 million. Funding increase due to increased costs to complete planned activities.			
Accomplishments/Planned Programs Subtotals	5.225	8.460	9.016

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	244.612	260.833	216.269	0.000	216.269	209.316	203.739	198.776	217.708	Continuing	Continuing
622002: <i>Electronic Component Technology</i>	-	167.937	75.159	50.368	0.000	50.368	49.327	40.020	32.953	36.649	Continuing	Continuing
622003: <i>EO Sensors & Countermeasures Tech</i>	-	10.712	28.120	26.838	0.000	26.838	25.428	26.035	26.235	28.757	Continuing	Continuing
622005: <i>Cyber Technology</i>	-	3.607	12.566	15.075	0.000	15.075	15.000	15.328	15.527	16.587	Continuing	Continuing
624920: <i>Electronic Warfare Technology</i>	-	18.866	45.410	41.944	0.000	41.944	40.247	41.205	41.536	45.600	Continuing	Continuing
626095: <i>Sensor Fusion Technology</i>	-	24.742	63.577	37.642	0.000	37.642	36.846	37.717	38.536	41.956	Continuing	Continuing
627622: <i>RF Sensors and Countermeasures Tech</i>	-	18.748	36.001	44.402	0.000	44.402	42.468	43.434	43.989	48.159	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops the technology base for Air Force aerospace sensors and electronic combat. Advances in aerospace sensors are required to increase combat effectiveness by providing anytime, anywhere surveillance, reconnaissance, precision targeting, and electronic warfare (EW) capabilities. To achieve this progress, this program pursues simultaneous advances in: 1) generating, controlling, receiving, and processing electronic and photonic signals for radio frequency (RF) sensor aerospace applications; 2) electro-optical (EO) and infrared (IR) aerospace sensor technologies for a variety of offensive and defensive uses; 3) radio frequency antennas and associated electronics for airborne and space surveillance, together with active and passive electro-optical/infrared sensors; 4) technologies to manage and fuse on-board sensor information for timely, comprehensive situational awareness; 5) technology for affordable, trusted, and reliable, all-weather surveillance, reconnaissance, and precision strike radio frequency sensors and electronic combat systems; and 6) technologies that aid in the development of agile and resilient mission systems. This program has been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

Funds in this program element may be used to investigate specified technology advancements in air, space and/or cyber domains.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>
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This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	255.918	192.733	197.998	0.000	197.998
Current President's Budget	244.612	260.833	216.269	0.000	216.269
Total Adjustments	-11.306	68.100	18.271	0.000	18.271
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	68.100			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-11.306	0.000			
• Other Adjustments	0.000	0.000	18.271	0.000	18.271

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 622002: *Electronic Component Technology*

- Congressional Add: *Program increase - exploitation detection for flexible combat avionics*
- Congressional Add: *Program increase: enhanced security sensors to detect threats in near and far field emissions*
- Congressional Add: *Program increase: hardware-based oversight system for microelectronics endpoints*
- Congressional Add: *Program increase: low cost sensors for UAVs*
- Congressional Add: *Program increase: Zero-trust environment for semiconductor technology*
- Congressional Add: *Program increase: Extreme wideband RF sensor*
- Congressional Add: *Heterogeneous integration of microelectronics*
- Congressional Add: *Field programmable gate arrays*
- Congressional Add: *Reliability of combat cloud communications systems*

Congressional Add Subtotals for Project: 622002

	FY 2022	FY 2023
	4.930	-
	4.930	-
	5.916	-
	4.930	5.000
	9.860	10.000
	18.735	-
	-	5.000
	-	7.000
	-	7.000
Congressional Add Subtotals for Project: 622002	49.301	34.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2022	FY 2023
Project: 622005: <i>Cyber Technology</i>		
<i>Congressional Add: Automated legacy code modernization</i>	-	4.100
Congressional Add Subtotals for Project: 622005		
	-	4.100
Project: 626095: <i>Sensor Fusion Technology</i>		
<i>Congressional Add: Program increase: Reliability of combat cloud communications systems</i>	6.902	-
<i>Congressional Add: Cyber kinetic combat environment</i>	-	30.000
Congressional Add Subtotals for Project: 626095		
	6.902	30.000
Congressional Add Totals for all Projects		
	56.203	68.100

Change Summary Explanation

In 2024, funding for Aerospace Sensors (PE 0602204F) increased to emphasize science and technology investments necessary to maintain superiority over potential near-peer adversaries in key technology areas including communication, navigation, intelligence, surveillance, and reconnaissance, multi-domain/multi-dimensional sensor systems, and multi-source data collaboration.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>				Project (Number/Name) 622002 / <i>Electronic Component Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622002: <i>Electronic Component Technology</i>	-	167.937	75.159	50.368	0.000	50.368	49.327	40.020	32.953	36.649	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project focuses on electronics and optoelectronics technologies that generate, control, receive, and process electromagnetic spectrum for aerospace sensor and electronic warfare applications. The enabling technologies developed under this project will be used for intelligence, surveillance, reconnaissance, electronic warfare, battlespace access, and precision engagement capabilities. The technologies developed include exploratory electronic and optoelectronic devices, components, microsystems and subsystems.

This project also assesses designs, develops, fabricates, and demonstrates the associated technologies for integrating combinations of these component technologies. The project demonstrates significantly smaller size, lower weight, lower cost, lower power dissipation, higher reliability, trustworthiness and improved performance. The device and subsystem technology developments under this project are military unique; they are based on Air Force and other Department of Defense weapon systems requirements in the areas of radar, communications, electronic warfare, positioning, navigation, timing, and smart weapons.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Sensor Subsystems	22.796	7.475	8.631
Description: Develop, analyze, demonstrate, and perform engineering trade studies for technologies for compact, affordable, multi-function subsystems for aerospace sensors.			
FY 2023 Plans: Continue research into autonomous low size, weight and power sensor processing. Continue research into digital at every element technology for multifunction microwave and millimeter wave arrays. Continue development of low size weight and power wideband multifunction radio frequency sensor subsystem suitable for Group 4 unmanned aircraft system operation. Initiate millimeter wave digital array demonstrations. Initiate wideband phased array emulation utilizing digital beamforming demonstrator.			
FY 2024 Plans: Continue research into autonomous low size, weight and power sensor processing. Continue research into digital at every element technology for multifunction microwave and millimeter wave arrays. Continue development of low size weight and power wideband multifunction radio frequency sensor subsystem suitable for Group 4 unmanned aircraft system operation. Continue millimeter wave digital array demonstrations. Continue wideband phased array emulation utilizing digital beamforming demonstrator. Initiate system build phase for multifunction wideband digital active electronically scanned array.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 622002 / <i>Electronic Component Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$1.156 million. Funding increase is a result of increased emphasis in multi-function sensor systems.				
<p>Title: Electronic Devices</p> <p>Description: Assess, research, develop, demonstrate and transition revolutionary and evolutionary electronic devices and their associate technologies.</p> <p>FY 2023 Plans: Complete initial demonstration of wide bandgap device and power conversion integration. Continue development of integrated chip-level radio frequency device and power conversion modeling. Continue development of wide bandgap device and power conversion integration technologies. Continue demonstration of high efficiency microwave power modules with integrated high speed power conversion switching. Initiate next generation predictive analysis using higher order harmonics. Initiate wide bandgap W-band device and circuit optimization. Initiate evaluation of next generation wide bandgap radio frequency materials.</p> <p>FY 2024 Plans: Continue modeling efforts on integrated chip-level radio frequency device, power conversion modeling, and predictive analysis using higher order harmonics. Continue development of wide bandgap device and power conversion integration technologies. Continue demonstration of high efficiency microwave power modules with integrated high speed power conversion switching. Continue development of high frequency characterization capability and evaluation of next generation wide bandgap radio frequency materials.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.649 million. Funding increase is a result of increased emphasis in wide bandgap devices</p>		19.572	6.762	8.411
<p>Title: Electro-Optical/Infrared (EO/IR) Components</p> <p>Description: Research, develop, demonstrate and transition electro-optical/infrared components for next generation intelligence, surveillance, reconnaissance and countermeasures.</p> <p>FY 2023 Plans: Continue photonic and quantum substructure technology development. Continue research into non-linear devices for tunability and power scaling. Continue development of high power, narrow line width lasers sources for advanced sensing and countermeasure applications. Initiate laser component packaging for laser detection and ranging.</p> <p>FY 2024 Plans:</p>		20.079	7.288	9.550

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 622002 / <i>Electronic Component Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Continue photonic and quantum substructure technology development. Continue research into non-linear devices for tunability and power scaling. Continue development of high power, narrow line width lasers sources for advanced sensing and countermeasure applications. Continue laser component packaging for laser detection and ranging.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.262 million. Funding increase is a result of increased emphasis in multi-function laser system devices.</p>				
<p>Title: Trusted and Assured Electronics</p> <p>Description: Investigate and develop designs of trusted electronic and optoelectronic systems when integrating commercially available solutions with emerging government-off-the-shelf advanced technologies. Areas of development include: multi-function radio frequency and electro-optical subsystems, advanced electronic and optoelectronic materials, on-board sensor processing, high-frequency power modules, electro-optical/infrared sources, electro-optical/infrared detectors, beam control and waveguides, and trusted and reliable electronics.</p> <p>FY 2023 Plans: Complete initial investigation of trust in design and trust in fabrication methodologies. Complete studies of modeling and simulation capability to improve predictive capability of mission assurance for highly integrated microsystems, devices, and materials. Complete the initial development of processes and techniques for trust through design. Continue development of prototype trustworthiness assessment capability. Continue reliability assessments of advanced heterogeneously integrated microsystems. Continue verification and validation of security techniques and methodologies for integrated circuit designs. Initiate disaggregated multi chip System in Package demonstration using fine pitch for assurance.</p> <p>FY 2024 Plans: Continue development of prototype trustworthiness assessment capability. Continue reliability assessments of advanced heterogeneously integrated microsystems. Continue verification and validation of security techniques and methodologies for integrated circuit designs. Continue disaggregated multi chip System in Package demonstration using fine pitch for assurance. Initiate application of trust in design to digital engineering and virtual prototyping for assured design.</p> <p>In FY 2024 this effort was renamed from Trusted Electronics for Intelligence, Surveillance, Reconnaissance and Avionics Mission Systems to Trusted and Assured Electronics.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.895 million. Funding increase is a result of increased emphasis implementing trust in design methods.</p>		22.894	8.886	10.781
<p>Title: Advanced Highly Integrated Microsystems for Intelligence, Surveillance, Reconnaissance and Electronic Warfare</p>		18.705	6.218	7.773

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 622002 / <i>Electronic Component Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Perform research and development of electronic and photonic circuit and microsystem technologies focused on miniaturization, power reduction, reconfigurability and reduced cost.</p> <p>FY 2023 Plans: Continue development of next generation reconfigurable transceivers. Continue development of microsystem integration solutions that integrate advanced components and thermal management technologies for cost, size, weight and power constrained microwave and millimeter wave applications. Continue development of chip-scale photonic/electronic wideband transceiver components. Initiate development of high-Q passive components for heterogeneous integration. Initiate identification of application areas and development of heterogeneous integration concepts.</p> <p>FY 2024 Plans: Continue development of next generation reconfigurable transceiver. Continue development of microsystem integration solutions that integrate advanced components and thermal management technologies for cost, size, weight and power constrained microwave and millimeter wave applications. Continue development of chip-scale photonic/electronic wideband transceiver components. Continue development of high-Q passive components for heterogeneous integration. Continue identification of application areas and development of heterogeneous integration concepts.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.555 million. Funding increase is a result of increased emphasis in the heterogeneous integration of electronic and photonic devices.</p>			
<p>Title: Microelectronics & Embedded System Assurance</p> <p>Description: Investigate and develop microelectronics security technologies to impede unwanted technology transfer and enable timely adoption of commercial and government-off-the-shelf microelectronic technologies that enable revolutionary capabilities for the Air Force.</p> <p>FY 2023 Plans: Complete investigation of trust technologies and techniques in sensors and sensor systems. Continue development of techniques to deter reverse engineering and exploitation of critical program information. Initiate advanced exploitation tool development to assess modern threat capability.</p> <p>FY 2024 Plans: Continue development of techniques to deter reverse engineering and exploitation of critical program information. Continue advanced exploitation tool development to assess modern threat capability. Initiate protective technology development for</p>	14.590	4.530	5.222

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / Aerospace Sensors	Project (Number/Name) 622002 / Electronic Component Technology

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
sensors and sensor systems. This may involve commercial and government technologies to deter reverse engineering and unwanted technology transfer, alteration of system capability, and prevent development of countermeasures.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$0.692 million. Justification for this increase is described in plans above.			
Accomplishments/Planned Programs Subtotals	118.636	41.159	50.368

	FY 2022	FY 2023
<i>Congressional Add:</i> Program increase - exploitation detection for flexible combat avionics <i>FY 2022 Accomplishments:</i> Conduct Congressional directed efforts	4.930	-
<i>Congressional Add:</i> Program increase: enhanced security sensors to detect threats in near and far field emissions <i>FY 2022 Accomplishments:</i> Conduct Congressional directed efforts	4.930	-
<i>Congressional Add:</i> Program increase: hardware-based oversight system for microelectronics endpoints <i>FY 2022 Accomplishments:</i> Conduct Congressional directed efforts	5.916	-
<i>Congressional Add:</i> Program increase: low cost sensors for UAVs <i>FY 2022 Accomplishments:</i> Conduct Congressional directed efforts <i>FY 2023 Plans:</i> Conduct Congressional directed efforts	4.930	5.000
<i>Congressional Add:</i> Program increase: Zero-trust environment for semiconductor technology <i>FY 2022 Accomplishments:</i> Conduct Congressional directed efforts <i>FY 2023 Plans:</i> Conduct Congressional directed efforts	9.860	10.000
<i>Congressional Add:</i> Program increase: Extreme wideband RF sensor <i>FY 2022 Accomplishments:</i> Conduct Congressional directed efforts	18.735	-
<i>Congressional Add:</i> Heterogeneous integration of microelectronics <i>FY 2023 Plans:</i> Conduct Congressional directed efforts	-	5.000
<i>Congressional Add:</i> Field programmable gate arrays <i>FY 2023 Plans:</i> Conduct Congressional directed efforts	-	7.000
<i>Congressional Add:</i> Reliability of combat cloud communications systems	-	7.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 622002 / <i>Electronic Component Technology</i>
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	FY 2022	FY 2023
<i>FY 2023 Plans:</i> Conduct Congressional directed efforts		
Congressional Adds Subtotals	49.301	34.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>				Project (Number/Name) 622003 / <i>EO Sensors & Countermeasures Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622003: <i>EO Sensors & Countermeasures Tech</i>	-	10.712	28.120	26.838	0.000	26.838	25.428	26.035	26.235	28.757	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project determines the technical feasibility of advanced electro-optical aerospace sensor technologies for a variety of offensive and defensive uses. The sensor technologies under development range from the ultraviolet through the infrared portion of the spectrum. Related efforts include improvements in avionics integration, digital processing, analysis tools, and sensor architectures. One of the project's goals is to improve electro-optical and related technologies for the detection, tracking, and identification of non-cooperative and difficult targets, such as those obscured by camouflage or acquired at great range. This project also develops the passive and active imaging sensors and algorithms needed to enable precision targeting in severe weather. These technologies are critical to future aerospace surveillance and targeting. Other project goals include advanced electro-optical threat warning and countermeasures.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Passive Electro-Optical/Infrared Sensing in Contested Environments	5.377	13.765	12.960
Description: Develop innovative passive optical sensing technology to support surveillance and reconnaissance in contested environments. Develop high performance focal planes, aperture technologies, sensing architectures, and imaging techniques capable of long range target detection and characterization for intelligence, surveillance, reconnaissance and air-to-air sensing.			
FY 2023 Plans: Continue refinement of advanced processing algorithms for hyperspectral imaging. Complete demonstration of low-cost, compact hyperspectral imaging sensor with on-board, near real time processing software that utilizes advanced processing algorithms under development. Perform testing of new multi-spectral cameras and filters that allow more compact designs. Continue development of low-earth orbit sensing systems for critical Air Force needs, including event-based sensors and passive interferometry. Perform a field demonstration and evaluation of an event based/neuromorphic sensing system. Initiate development of large format, long wave infrared detector array for infrared search and track in preparation for future testing. Initiate development of low size, weight and power processor for infrared search and track.			
FY 2024 Plans: Continue development of advanced processing algorithms for hyperspectral imaging. Continue development of low-earth orbit sensing systems for critical Department of the Air Force needs, including event-based sensors and passive interferometry. Continue development of large format, long wave infrared detector array for infrared search and track in preparation for future testing. Continue development of low size, weight and power processor for infrared search and track.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 622003 / <i>EO Sensors & Countermeasures Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 decreased compared to FY 2023 by \$0.805 million. Justification for this decrease is described in plans above.				
<p>Title: Laser Radar Sensing in Contested Environments</p> <p>Description: Develop innovative laser sensing technology for non-cooperative identification of airborne and ground-based targets in contested environments. Develop optical spectrum transmitters, detectors and agile aperture technologies capable of sensing multiple target characteristics for robust non-cooperative target identification.</p> <p>FY 2023 Plans: Complete designing multi-mode laser radar system for attritable platforms. Continue evaluation of modeling and simulation software by using data collected from airborne laser radar programs. Complete initial development of processing software for multi-mode laser radar collecting vibration and synthetic aperture data. Initiate investigation to feasibility of multi-static laser radar concepts. Continue designing large aperture laser radar for high-resolution imaging needs, with a focus on improving performance post demonstration, while working with customers to investigate transition potential of existing designs.</p> <p>FY 2024 Plans: Initiate multi-mode laser radar system demonstration for attritable platforms and benchmark model with collected data, including validation of data processing algorithms. Initiate effort to reduce size, weight, and power of laser radar systems. Continue development of processing software for multi-mode laser radar with a focus on processing efficiency. Initiate work on non-mechanical beam steering methods for optical apertures. Continue designing large aperture laser radar for high-resolution imaging needs, with a focus on improving performance post demonstration, while working with customers to investigate transition potential of existing designs.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.477 million. Justification for this decrease is described in plans above.</p>		5.335	14.355	13.878
Accomplishments/Planned Programs Subtotals		10.712	28.120	26.838
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
Not applicable				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>				Project (Number/Name) 622005 / <i>Cyber Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622005: <i>Cyber Technology</i>	-	3.607	12.566	15.075	0.000	15.075	15.000	15.328	15.527	16.587	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project focuses on technologies for enabling agile and resilient Air Force mission systems. This project improves our understanding of cyber vulnerabilities of mission systems by investigating the fundamental nature of those vulnerabilities including: how they come about, how they can be discovered, how they can be quantified and categorized, how they can be exploited, and how they can be removed or mitigated to secure the system. This project develops adaptable and resilient hardware/software for real-time avionics cyber-attack pattern recognition and develop a protection system with the capability for autonomous learning, adaptation, and self-protection. This project investigates open architecture concepts and technologies to deliver capability flexibility to Air Force mission systems. These technologies are matured via integrated capability demonstrations.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Flexible and Secure Avionics	3.607	8.466	15.075
Description: Develop avionics protection tools and capabilities to enable manned and unmanned aircraft, avionics, and related support equipment to automatically adapt to and withstand cyber attacks. Research and develop tools, methodologies and architecture guidelines that enable the design of avionics systems with sense, learn and adapt capabilities. Support test, maintenance, and acquisition communities with cyber subject matter expertise and techniques through consultation and technical interchange. Support other Services with cyber resiliency capabilities for air, ground and sea platforms and develop Open Mission Systems architectures incorporating cyber protections and resilience technologies.			
FY 2023 Plans: Continue investigation and development of techniques to enable resilient cyber protections for avionics systems. Continue laboratory demonstrations on flight worthy hardware. Share expertise with other Services and Test, Maintenance, and Acquisition communities. Initiate investigating protection technologies applied to open system architectures to enable resilience in next-generation mission systems and facilitate agility in mission system capability. Initiate development of advanced modular architecture for agile avionics.			
FY 2024 Plans: Continue investigation and development of techniques to enable resilient cyber protections for mission systems. Continue laboratory demonstrations on flight worthy hardware. Share expertise with other services and test, maintenance, and acquisition communities. Continue investigating protection technologies applied to open system architectures to enable resilience in next-generation mission systems and facilitate agility in mission system capability. Continue development of advanced modular architecture for agile avionics mission systems. Initiate investigation of model-based systems engineering applications to improve			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 622005 / <i>Cyber Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
agility and resiliency of legacy and next-generation avionics mission systems architectures. Leverage models and open system architecture standards to quicken integration and transition of critical sensors technology.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$6.609 million. Funding increase is a result of the increased emphasis in cyber resiliency in next-generation mission systems architectures.			
Accomplishments/Planned Programs Subtotals	3.607	8.466	15.075

	FY 2022	FY 2023
<i>Congressional Add:</i> Automated legacy code modernization	-	4.100
<i>FY 2023 Plans:</i> Conduct Congressional directed efforts		
Congressional Adds Subtotals	-	4.100

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>				Project (Number/Name) 624920 / <i>Electronic Warfare Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624920: <i>Electronic Warfare Technology</i>	-	18.866	45.410	41.944	0.000	41.944	40.247	41.205	41.536	45.600	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and assesses affordable, reliable, all weather radio frequency countermeasure concepts for aerospace applications covering the range of radio frequency sensors including communications, navigation, intelligence, surveillance and reconnaissance (ISR), and radar, both active and passive, across the air, land, sea, space and cyber domains. It develops and evaluates technology for electronic warfare, integrated radar and electronic warfare systems, and electro-optical/infrared seeker defeat. This project develops the radio frequency warning and countermeasure technology for advanced electronic warfare and information operations applications. The project also explores technologies to maintain a military advantage in positioning, navigation and timing integrity, accuracy, and resiliency as well as on aircraft mission assurance - the protection of airborne platforms, manned and unmanned, in contested environments. The ultimate goal of the project is to ensure unrestricted access to the airspace and the electromagnetic spectrum in contested and congested environments.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Positioning, Navigation and Timing in Contested/Denied Environments	5.997	13.778	13.204
Description: Develop resilient position, navigation and timing sensors. Explore position, navigation and timing solutions to enable novel distributed radio frequency sensing and countermeasure techniques. Develop technology base to provide solutions addressing navigation and timing threats.			
FY 2023 Plans: Continue research and demonstrations of integrated position, navigation and timing alternatives to satellite navigation, such as radio frequency signals of opportunity, magnetic, and vision aiding of inertial navigation systems. Continue demonstrating technologies to support airborne precise time, frequency, velocity and position as well as transfer between platforms to enable coherent sensing (intelligence, surveillance, reconnaissance) and effects (electromagnetic warfare). Continue developing and demonstrate trust techniques to enable military use of foreign satellite navigation signals. Continue developing software defined antenna electronics to complement software defined navigation receiver efforts, and explore advanced algorithms for software defined navigation. Initiate and complete development of requirements for a communications receiver to provide a connected solution for time, frequency, velocity and position data transfer.			
FY 2024 Plans: Continue research and demonstrations of integrated positioning, navigation and timing alternatives to satellite navigation aiding of inertial measurement units. Such environmentally sensed alternatives include radio frequency signals of opportunity, magnetic gradient sensing, and sensor derived vision aiding. Continue developing technologies to support airborne precise time and frequency transfer in contested environments, to enable missions such as coherent sensing (intelligence, surveillance, reconnaissance), coherent effects (electromagnetic warfare), and operational concepts such as the Air Battle Management			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 624920 / <i>Electronic Warfare Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>System. Continue developing and demonstrating trust techniques and operational concepts such as distribution of trusted satellite trajectories/information to enable blue force use of foreign satellite navigation signals. Continue research of software defined antenna electronics to complement software defined navigation receiver efforts. Continue to explore advanced algorithms for software defined navigation.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.574 million. Justification for this decrease is described in plans above.</p>			
<p>Title: Radio Frequency Electronic Warfare Technologies</p> <p>Description: This project develops the radio frequency warning and countermeasure technology for advanced electronic warfare and information operations applications. This project develops techniques and technologies to detect and counter the communications links and sensors of threat integrated air defense systems and hostile command and control networks.</p> <p>FY 2023 Plans: Continue research to develop electromagnetic warfare technologies that operate in a contested electromagnetic environment to reason about complex threat capabilities/intentions. Technologies must understand the electromagnetic environment to synthesize an optimized response in a time frame to support aircraft survivability against adaptive and agile threats. Continue integration of electro-optical and radio frequency engagement model development and experimentation to develop strategies to counter multi-spectral threats to airborne platforms. Continue robust modeling, simulation, and assessment capability to include multi-spectral components to determine the efficiency versus effectiveness of emerging electronic support and electronic attack technologies. Continue to enhance hardware in the loop assessment capabilities to keep pace with complex electromagnetic spectrum background environments and emerging threats. Continue developing and demonstrating distributed electronic warfare techniques to defeat integrated air defense systems.</p> <p>FY 2024 Plans: Continue to develop, assess and mature radio frequency electromagnetic warfare technologies to identify, address, and reason about capabilities and intentions of complex emitters in contested environments. Expand specific threat identification to generalized techniques and logic, evolving traditional strategies towards adaptive capabilities that lead towards autonomous implementation for optimized response at tactically relevant timescale. Continue to develop and mature capabilities to defeat advanced radio frequency and multi-spectrum (integrated electro-optical and radio frequency) threats utilizing a common architecture that will feed into multiple advanced technology development programs. Initiate development of radio frequency environment signal based simulations that are moving towards a modular open systems approach. Continue to enhance and upgrade hardware in the loop assessment capabilities to keep pace with complex electromagnetic spectrum background environments and emerging threats. Continue robust modeling, simulation, and assessment capability, completing an effort looking at a particular advanced threat kill chain defeat concept.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	8.629	24.650	22.089

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 624920 / <i>Electronic Warfare Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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FY 2024 decreased compared to FY 2023 by \$2.561 million. Funding decrease is a result of the decreased emphasis of single-use modeling and simulation efforts.			
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Title: Electro-Optical/Infrared Threat Warning and Countermeasures Technologies	4.240	6.982	6.651
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Description: Develop electro-optical/infrared sensor countermeasure technologies. Explore novel concepts to enable electro-optical/infrared threat seeker exploitation and surrogate modeling. Conduct fundamental research in countermeasures to defeat electro-optical/infrared threat seekers. Conduct fundamental research on integrated electro-optical/infrared threat warning systems.

FY 2023 Plans:

Continue threat characterization and development of countermeasures techniques to defeat emerging advanced electro-optical/infrared guided threats to airborne platforms. Continue investigating long-range missile warning and develop laser warning technology concepts to improve aircraft and aircrew survivability. Continue development of advanced threat surrogates and conduct infrared countermeasure testing at test ranges. Continue development of an advanced framework for modeling and simulation and hardware in the loop assessment with scene generation of engagements and techniques to defeat electro-optical and infrared guided threats to airborne platforms. Continue validating results using data collected in live fire tests. Continue development of electro-optical/infrared models and scenes to transition to multi-spectral threat assessment.

FY 2024 Plans:

Continue protection of aircraft and aircrew against advanced electro-optical/infrared guided threats by developing new or improved threat detection and countermeasure techniques. Continue investigate long-range missile warning and develop laser warning technology concepts to improve aircraft and aircrew survivability. Continue to validate threat warning results and missile signature modeling using data collected in live fire tests. Continue developing the digital engineering ecosystem to create/improve countermeasure techniques and evaluate novel infrared countermeasures system concepts. Continue the perform verification and validation activities on digital twin models within this digital ecosystem by collecting data in static flight tests, laboratory measurement, and peer assessments. Continue development and usage of threat surrogates to gain technical knowledge of future and emerging threats. Continue development of digital engineering components for electro-optical/infrared/radio frequency multi-spectrum threat assessment.

FY 2023 to FY 2024 Increase/Decrease Statement:

FY 2024 decreased compared to FY 2023 by \$0.331 million. Justification for this decrease is described in plans above.

Accomplishments/Planned Programs Subtotals	18.866	45.410	41.944
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C. Other Program Funding Summary (\$ in Millions)

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force Date: March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 624920 / <i>Electronic Warfare Technology</i>
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C. Other Program Funding Summary (\$ in Millions)

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>				Project (Number/Name) 626095 / <i>Sensor Fusion Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
626095: <i>Sensor Fusion Technology</i>	-	24.742	63.577	37.642	0.000	37.642	36.846	37.717	38.536	41.956	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops foundational and applied technologies required for closed-loop autonomous sensing employing multiple information domains, diverse sensor phenomena, and multiple platform types to provide intelligence, surveillance, and reconnaissance; target recognition; situational awareness and battlespace visualization; fire control; and battle damage assessment capabilities against a wide variety of air and ground based targets engaged in multitudes of behaviors in a broad range of operational environments. This project conducts exploratory and applied investigations to determine technology feasibility and estimate operational capability constraints associated with missions in future contested and highly contested operating environments, using cooperative and non-cooperative sensing sources. This project develops techniques to automate multi-sensor exploitation and information processing which leverage data fusion, adaptive signal processing, sensor and platform orchestration, leveraging artificial intelligence / machine learning research communities. This project develops concepts and algorithms for efficient processing at the edge, parallel processing, distributed processing, and high-performance computing in sensor data processing and synthetic data generation.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Battlespace Awareness Sensing Fusion	7.225	15.883	18.912
<p>Description: Developing novel techniques for behavioral and physical knowledge generation from multiple sensors, intelligence sources, domains (Air, Space, Cyber) and sources to include algorithm development, assessment, and experiments across multiple distributed, homogeneous and heterogeneous sensors and platforms. This effort will focus on technology areas of data association, entity detect/track/identification, information fusion, training with limited data, and data/performance modeling. The application of machine learning techniques to address technical challenges in contested environments is a particular emphasis.</p> <p>FY 2023 Plans: Continue generating knowledge through fusion of multiple spatial and temporal sensors, improving the state of the art in fusion exploitation. Continue providing solutions for contested environments wherein data is extremely limited. Continue applying deep and machine learning techniques to the detection/ tracking/targeting, recognition of stationary and moving objects and ground-based systems, pattern of life understanding, applying advanced information understanding tools and emerging techniques, over a broad set of sensing operating conditions. Initiate research applying techniques learned in air/space to ground application, applying those techniques, where applicable to the air/space to air problem. Continue investigating fusion of hard and soft information sources for military relevant applications. Continue improving the time between development and demonstration of integration capabilities with a development, secure, operations and algorithm containerization.</p> <p>FY 2024 Plans: Initiate a system of systems construct, bringing opportunistic sensing capabilities to tactical edge information integration. Continue generating knowledge through fusion of multiple spatial and temporal sensors, improving the state of the art in fusion exploitation.</p>			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 626095 / <i>Sensor Fusion Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue to provide solutions for contested environments wherein data is extremely limited. Continue to apply novel state of the art deep and machine learning techniques to the recognition of stationary and moving objects in air/ground/surface based systems, pattern of life understanding, applying advanced information understanding tools and emerging techniques, over a broad set of sensing operating conditions. Continue advancing research techniques learned in air/space to ground application; where applicable expand sensing domain to include surface. Continue investigating fusion of hard and soft information sources for military relevant applications. Continue improving the time between development and demonstration of integration capabilities with a development, secure, operations and algorithm containerization. Initiate a research and development push to standardized integration environments and expand simulation capabilities to estimate performance across a wide spectrum of operating conditions.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$3.029 million. Increase is a result of new emphasis on surface-based systems recognition research.</p>			
<p>Title: Multi-Domain Sensing Effects and Analysis</p> <p>Description: This effort focuses on two primary areas: (1) Multi domain sensing and effects mission analysis and (2) performance understanding and assessments. It develops methodologies and modeling, simulation, and analysis tools to enable multi domain analysis and technology development, informing other efforts and projects across the directorate. Investments in modeling, simulation and analysis represent current and next generation sensing platforms to include air, space, and cyber to include fusion of information, battlespace understanding, and the ability to simulate sensor and platform performance at the mission level, engagement level, and physics level, to understand performance and trade space amongst these domains.</p> <p>FY 2023 Plans: Continue development of autonomy performance evaluation techniques adapted to specific artificial intelligence and machine learning challenges. Continue performing empirical performance estimation for intelligence, surveillance, and reconnaissance automated sensing exploitation of military-critical targets with limited training data. Continue data as-a-service research environment by extending from unclassified to classified networks, leveraging research cloud environments, further enabling sensing autonomy developers and warfighting analysts. Initiate defense applications for the ability to perform new data tagging and automated data availability architecture to a service-wide application along with our intelligence community partners. Continue the transition of test and evaluation harness software to department-wide performance analysis community, leveraging standardize test metrics and performance measurement understanding.</p> <p>FY 2024 Plans: Continue development of autonomy performance evaluation techniques adapted to specific artificial intelligence and machine learning challenges. Continue to perform empirical performance estimation for intelligence, surveillance, and reconnaissance automated sensing exploitation of military-critical targets with limited training data. Continue the employment of data as-a-service</p>	3.721	3.436	3.948

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 626095 / <i>Sensor Fusion Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>research environment across unclassified to classified networks, leveraging research cluster compute, cloud environments and high-performance compute facilities, further enabling sensing autonomy developers and warfighting analysts. Continue the transition to defense applications data tagging and automated data availability architecture to a service-wide application along with our intelligence community partners. Continue the transition of test and evaluation harness software to department-wide performance analysis community, leveraging standardize test metrics and performance measurement understanding.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.512 million. Justification for this increase is described in plans above.</p>			
<p>Title: Knowledge and Execution Management</p> <p>Description: Develop, evaluate, and demonstrate models for sensing and for adversary behavior that support anticipatory asset tasking, characterization of latencies and related uncertainties, and joint inference and control. Develop multisource sensing techniques to include sensor and platform optimization and control, providing environment characterization consistent with the needs of automated and autonomous systems. This research and development investment allows for the automation of closed-loop intelligence, surveillance and reconnaissance.</p> <p>FY 2023 Plans: Continue improving and integrate onboard mission resource management techniques for distributed sensing/effects capabilities via open autonomy architectures and continue evaluation. Continue to accomplish performance understanding through simulation, demonstration, and blended sim/live testing (multiple aircraft & sensors). Continue improving representational and computational efficiency of on-board reasoning about ground targets and target groupings, and target behaviors. Initiate new research in foundational knowledge of emerging management algorithms for battlespace awareness incorporating interacting air/ground targets, air/air targets, environments, and operationally representative contingencies. Continue the development of emerging algorithms to perform information reasoning and continue to evolve forms of representations and combined representations and reasoning approaches such as self-querying synergistic knowledge graph / machine learning world models, more diverse state representations in reinforcement learning, and spiking neural network reinforcement learning.</p> <p>FY 2024 Plans: Continue improving mission resource management techniques for distributed sensing/effects capabilities through open autonomy architectures and state of the art AI/ML techniques. Initiate applied research in direct support of systems of systems programs. Continue to accomplish performance understanding through simulation, demonstration, and blended simulation/live testing (multiple vehicles & sensors). Continue improving representational and computational efficiency of on-board reasoning about ground/surface targets and target groupings, and target behaviors. Continue research in foundational knowledge of emerging management algorithms for battlespace awareness incorporating interacting air/ground targets, air/air targets, and air/surface</p>	4.247	11.216	10.371

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 626095 / <i>Sensor Fusion Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
environments, and operationally representative contingencies. Continue the development of emerging algorithms to perform information reasoning and continue to evolve forms of representations and combined representations and reasoning approaches. <i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 decreased compared to FY 2023 by \$0.845 million. Justification for this decrease is described in the plans above.			
<i>Title:</i> Cyber Physical Sensing <i>Description:</i> Cyber Physical Sensing is the opportunity to exploit the internet of things and other non-traditional intelligence, surveillance and reconnaissance sensing systems in a way other than what they were designed to do. This additional source of information closes the gap between current intelligence, surveillance and reconnaissance collection capabilities and the vision of all intelligence, surveillance and reconnaissance, all the time. This technology investment looks at the sensing opportunities which exist at the point where physics meets the cyber domain. This effort focuses on the proliferated sensing devices, extracting information from multi-intelligence sensors and translating that information into detection, tracking and identification by use of multi-intelligence fusion. This effort leverages processing at-the-edge and distributed processing, exploited using new-generation machine learning, artificial intelligence and deep learning techniques. <i>FY 2023 Plans:</i> Initiate non-traditional intelligence, surveillance and reconnaissance collection opportunities, associate opportunities to intelligence, surveillance and reconnaissance collection capabilities, and invest appropriately in research and development of techniques to improve collection, processing, and dissemination of information, allowing for automation and autonomy in intelligence, surveillance and reconnaissance. Continue research and development in edge to core/cloud information processing and how these capabilities can best be utilized to get within the adversaries observe, orient, decide, act loop. Initiate research in novel techniques to exploit unforeseen information from these non-traditional ISR information sources. Continue research which advances tactics, techniques and procedures by way of new exploitation techniques of cyber physical modalities. <i>FY 2024 Plans:</i> Continue research of non-traditional intelligence, surveillance and reconnaissance collection opportunities, associate opportunities to intelligence, surveillance and reconnaissance collection capabilities, and invest appropriately in research and development of techniques to improve collection, processing, and dissemination of information, allowing for automation and autonomy. Continue research and development in edge to core/cloud. Initiate science and technology investment of cyber physical sensing capabilities into systems of systems information flows, bringing opportunistic/non-traditional/proliferated sensing products into Air Force integrated capability intelligence, surveillance and reconnaissance exploitation programs. Continue research in new novel techniques to exploit unforeseen information from these non-traditional ISR information sources. Continue research which advances tactics, techniques, and procedures by way of new exploitation techniques of cyber physical modalities. <i>FY 2023 to FY 2024 Increase/Decrease Statement:</i>	2.647	3.042	4.411

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 626095 / <i>Sensor Fusion Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$1.369 million. Increase is a result of new emphasis on systems of systems research.			
Accomplishments/Planned Programs Subtotals	17.840	33.577	37.642

	FY 2022	FY 2023
Congressional Add: Program increase: Reliability of combat cloud communications systems	6.902	-
FY 2022 Accomplishments: Conduct Congressional directed efforts		
Congressional Add: Cyber kinetic combat environment	-	30.000
FY 2023 Plans: Conduct Congressional directed efforts		
Congressional Adds Subtotals	6.902	30.000

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>				Project (Number/Name) 627622 / <i>RF Sensors and Countermeasures Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
627622: <i>RF Sensors and Countermeasures Tech</i>	-	18.748	36.001	44.402	0.000	44.402	42.468	43.434	43.989	48.159	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and assesses affordable, reliable all weather radio frequency sensing and countermeasure concepts for aerospace applications covering the range of radio frequency sensors including communications, navigation, intelligence, surveillance and reconnaissance (ISR), and radar, both active and passive, across the air, land, sea, space and cyber domains. This project also develops and evaluates technology for intelligence, surveillance and reconnaissance sensors, fire control radars, electronic warfare, integrated radar and electronic warfare systems, and offensive information operations systems. It emphasizes the detection and tracking of surface and airborne targets with radio frequency signatures that are difficult to detect due to reduced radar cross sections, concealment and camouflage measures, severe clutter, or heavy jamming. Techniques exploited include the use of multiple radio frequency phenomenologies, multi-dimensional adaptive processing, advanced waveforms and knowledge-aided processing techniques. This project also develops concepts to counter threats to our aerospace systems. It develops and evaluates technology for electronic warfare, integrated radar and electronic warfare systems, and electro-optical/infrared seeker defeat. This project develops the radio frequency warning and countermeasure technology for advanced electronic warfare and information operations applications. The project also explores technologies to maintain a military advantage in positioning, navigation and timing integrity, accuracy, and resiliency.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Multiband Multifunction Radio Frequency Sensing	7.344	14.295	14.976
Description: Develop multi-band and multi-beam forming technologies. Address technologies for antenna array operations in dynamic sensor networks.			
FY 2023 Plans: Continue demonstrating integrated electronic support measure/airborne moving target indicator/ground moving target indicator modes for passive multi-mode radar using ultra high frequency to S-band digital array system. Continue advanced mode development for multi-beam and multi-function digital arrays, implementing more complex modes and advanced waveforms with applications for Advanced Early Warning radar. Initiate transition of ground-based modes to airborne digital array demonstrator. Continue integration of additively manufactured antennas and radar backend components to demonstrate low-cost, wide bandwidth, scalable, and conformal phased array antennas for unmanned sensing platforms. Complete bi-static flight data collection using low cost digital beamforming receiver. Continue development of techniques for analysis of complex active electronically scanned arrays on large platforms.			
FY 2024 Plans: Complete demonstrations of integrated electronic support measure/airborne moving target indicator/ground moving target indicator modes for passive multi-mode radar using ultra high frequency to S-band digital array demonstrator. Continue advanced			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 627622 / <i>RF Sensors and Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>mode development for multi-beam and multi-function digital arrays, implementing more complex modes and advanced waveforms with applications for Advanced Early Warning radar. Complete transition of ground-based modes to laboratory experimental airborne digital array system. Initiate migration of mode implementation from custom interfaces to Department of Defense and Department of the Air Force standardized interfaces. Continue integration of additively manufactured antennas and radar backend components to demonstrate low-cost, wide bandwidth, scalable, and conformal phased array antennas for unmanned sensing platforms. Initiate analysis identifying performance bounds and requirements for low-cost radio frequency sensors in selected mission scenarios. Continue development of techniques for analysis of complex active electronically scanned arrays on large platforms.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.681 million. Justification for this increase is described in plans above.</p>			
<p>Title: Passive Radio Frequency Sensing</p> <p>Description: Develop a system that performs traditional radar sensing modes through passive means. The research plan is designed to continue the development of the subsystems which make up the passive radar and to follow a spiral development path that involves the integration and testing of various technology instantiations to produce alternate versions of a full passive multi-mode system. Includes the development of low size-weight-and-power radio frequency signal detection and geolocation payloads for small unmanned air systems and the integration of advanced receiver subsystems to meet a particular need of the Air Force. Explore combat identification technologies, modeling and simulation enhancements, and technologies supporting passive radar, electronic support, and signals intelligence.</p> <p>FY 2023 Plans: Continue development of small low cost direction finding payloads and advanced processing techniques for onboard signal characterization, geolocation/track, and signals pattern-of-life analysis. Initiate demonstration of distributed multi-ship geolocation aboard small unmanned aircraft systems. Continue development of enhanced radio frequency modeling and simulation tools for evaluation of passive radar performance in complex environments. Complete integration of bi- and multi-static radar clutter models into modeling and simulation tools. Continue integrating high fidelity modeling and simulation with mission level modeling to demonstrate operational utility of passive radar concepts. Continue analysis of bi-static target/ground scattering phenomenology and bi-static high resolution radar data in conjunction with advanced automated target recognition algorithms to demonstrate improved accuracy and timeliness for combat identification of complex targets. Initiate investigation of advanced processing techniques to enhance passive radar performance.</p> <p>FY 2024 Plans: Continue development of small low cost direction finding payloads and advanced processing techniques for onboard signal characterization, geolocation/track, and signals pattern-of-life analysis. Continue demonstrating distributed multi-ship geolocation</p>	4.186	9.081	15.071

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 627622 / <i>RF Sensors and Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>aboard an expanded set of small unmanned aircraft systems responsive to user requirements. Continue development of enhanced radio frequency modeling and simulation tools for evaluation of passive radar performance in complex environments. Expand clutter modelling capability by incorporating sea clutter models from the Navy into the Air Force analysis tools to support performance and mission modeling including maritime targets. Continue integrating high fidelity modeling and simulation with mission level modeling to demonstrate operational utility of passive radar concepts. Continue analysis of bi-static target/ground scattering phenomenology and bi-static high resolution radar data in conjunction with advanced automated target recognition algorithms to demonstrate improved accuracy and timeliness for combat identification of complex targets. Continue the investigation of advanced processing techniques to enhance passive radar performance and enhance target ID performance. Initiate investigation of emerging receiver technology such as quantum enabled receivers.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$5.990 million. Increase is a result of realignment of funding from Program Aerospace Sensors, 0602204F; Project RF Sensors and Countermeasures Tech, 627622; Multiband Multifunction Radio Frequency Sensing and Distributed Radio Frequency Sensing efforts.</p>			
<p>Title: Distributed Radio Frequency Sensing</p> <p>Description: Develop innovative, timely, and affordable target detection, tracking, and characterization (namely imaging/identification) capabilities that leverage two or more spatially-distributed receivers and transmitters that use cooperative radio frequency transmitters (illuminators), namely those radio frequency sources that have a common objective to the receiver systems being used.</p> <p>FY 2023 Plans: Continue development of robust non-traditional multi-static transmit waveforms and receive processing chains for operationally relevant multi-static ground moving target indicator systems. Initiate investigation of platform constraints and implementation of near real-time processing. Define requirements for capstone flight experiment demonstrating multi-static detection and tracking of ground targets. Continue enhancements of multi-static synthetic aperture radar algorithms to support combat identification and automatic target recognition requirements on tactical timelines. Continue implementation and evaluation of multi-static synthetic aperture radar algorithms on cost and size constrained platforms. Initiate development/maturation of distributed 3-dimensional imaging algorithms that are scalable to a multi-domain approach. Continue data collection and analysis to assess performance of distributed radar systems for ground moving target indicator and synthetic aperture radar. Continue to explore multi- and cross-domain applications.</p> <p>FY 2024 Plans: Continue development of robust non-traditional multi-static transmit waveforms and receive processing chains for operationally relevant multi-static ground moving target indicator systems. Continue investigation of platform constraints and implementations</p>	7.218	12.625	14.355

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602204F / <i>Aerospace Sensors</i>	Project (Number/Name) 627622 / <i>RF Sensors and Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>of near real-time processing. Provide required technology enhancements to capstone flight experiment demonstrating multi-static detection and tracking of ground targets. Continue enhancements of multi-static synthetic aperture radar algorithms to support combat identification and automatic target recognition requirements on tactical timelines. Continue implementation and demonstration of multi-static synthetic aperture radar algorithms on cost and size constrained platforms. Continue development/ maturation of distributed 3-dimensional imaging algorithms that are scalable to a multi-domain approach. Continue data collection and analysis to assess performance of distributed radar systems for ground moving target indicator and synthetic aperture radar. Continue to explore multi- and cross-domain applications.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$1.730 million. Funding increase is a result of an increased emphasis in the processing timelines of the algorithms supporting distributed sensing.</p>			
Accomplishments/Planned Programs Subtotals	18.748	36.001	44.402

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity					R-1 Program Element (Number/Name)							
3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>					PE 0602212F / <i>Defense Laboratories R&D Projects (10 U.S.C, Sec 2358)</i>							
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	98.862	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	98.862
622030: <i>Defense Lab R&D Projects</i>	-	98.862	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	98.862

A. Mission Description and Budget Item Justification

Implementation of 10 U.S.C. Section 2363, amendment to PL 110-417, 10 U.S.C. Section 2358 and 10 U.S.C. 2805(d)(1)(B), to fund: innovative basic and applied research conducted at the defense laboratory and supports military missions; development programs supporting the transition of technologies developed by the defense laboratory into operational use; workforce development activities improving the capacity of the defense laboratory to recruit and retain personnel with necessary scientific and engineering expertise that support military missions; and the repair or minor military construction of the laboratory infrastructure and equipment.

The Air Force is dependent on technological advances in response to emerging threats and to maintain a competitive advantage. Air Force has a comprehensive and deliberative planning process to identify and fund research that is expected to have the greatest benefit to the Air Force and the warfighter. 10 U.S.C. Section 2363 provides the Commander of the Air Force Research Laboratory (AFRL), in consultation with the Air Force Science and Technology (S&T) Executive, a degree of flexibility to rapidly exploit scientific breakthroughs or respond to emerging threats, to include developing a skilled workforce and necessary infrastructure. This flexibility increases the rate of innovation and accelerates the development and fielding of needed military capabilities to address current and future problems.

The Air Force has established PE 0602212F, where the 10 U.S.C. Section 2363 funds are internally reprogrammed to this program element in the year of execution after receipt of the appropriation. This allows increased transparency to Congress on 10 U.S.C. Section 2363 funding and additional execution flexibility for 10 U.S.C. Section 2363 activities to cross all technology areas.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602212F / <i>Defense Laboratories R&D Projects (10 U.S.C, Sec 2358)</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	0.000	0.000	0.000	0.000
Current President's Budget	98.862	0.000	0.000	0.000	0.000
Total Adjustments	98.862	0.000	0.000	0.000	0.000
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	98.862	0.000	0.000	0.000	0.000

Change Summary Explanation

Increase in FY 2021 in Other Adjustments is due to realignment of funds to PE 0602212F to support Research and Development Projects, 10 U.S.C. Section 2358, as amended by 10 U.S.C. 2805(d)(1)(B) and 10 U.S.C. Section 2363.

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Title: Defense Laboratories R&D Projects - Air Force Research Laboratory	98.862	-	-
Description: Implementation of 10 U.S.C. Section 2363, amendment to PL 110-417, 10 U.S.C. Section 2358 and 10 U.S.C. 2805(d)(1)(B), to fund: innovative basic and applied research conducted at the Air Force Research Laboratory (AFRL) and supports military missions; development programs supporting the transition of technologies developed by AFRL into operational use; workforce development activities improving the capacity of AFRL to recruit and retain personnel with necessary scientific and engineering expertise that support military missions; and the repair or minor military construction of the laboratory infrastructure and equipment.			
Accomplishments/Planned Programs Subtotals	98.862	-	-

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

Not Applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research	R-1 Program Element (Number/Name) PE 0602298F I Science and Technology Management - Major Headquarters Activities
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	8.891	8.856	10.303	0.000	10.303	9.402	9.604	9.805	11.289	Continuing	Continuing
622520: Science and Technology Management - Major HQ	-	8.891	8.856	10.303	0.000	10.303	9.402	9.604	9.805	11.289	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force Research Laboratory (AFRL) is a global technical enterprise, boasting some of the best and brightest leaders in the world. It provides revolutionary, relevant, and responsive science and technology (S&T) to the Warfighter. AFRL's mission is to lead the discovery, development, and integration of affordable warfighting technologies for the global air, space, and cyberspace force.

This program element includes necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 1206601SF.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	8.891	8.856	9.040	0.000	9.040
Current President's Budget	8.891	8.856	10.303	0.000	10.303
Total Adjustments	0.000	0.000	1.263	0.000	1.263
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	1.263	0.000	1.263

Change Summary Explanation

FY24 increase to reflect inflation.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602298F / <i>Science and Technology Management - Major Headquarters Activities</i>	Project (Number/Name) 622520 / <i>Science and Technology Management - Major HQ</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622520: <i>Science and Technology Management - Major HQ</i>	-	8.891	8.856	10.303	0.000	10.303	9.402	9.604	9.805	11.289	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force Research Laboratory (AFRL) is a global technical enterprise, boasting some of the best and brightest leaders in the world. It provides revolutionary, relevant, and responsive science and technology (S&T) to the Warfighter. AFRL's mission is to lead the discovery, development, and integration of affordable warfighting technologies for the global air, space, and cyberspace force.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: AFRL - Major Headquarters Activities	8.891	8.856	10.303
Description: Provide professional government civilian workforce in support of all AFRL programs and activities.			
FY 2023 Plans: Continue to provide professional government civilian workforce in support of all AFRL programs and activities.			
FY 2024 Plans: Continue to provide professional government civilian workforce in support of all AFRL programs and activities.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by 1.256 million. Funding increase due to civilian pay reprice adjustments.			
Accomplishments/Planned Programs Subtotals			10.303

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	142.906	144.303	160.599	0.000	160.599	155.407	155.289	158.405	167.513	Continuing	Continuing
622068: <i>Advanced Guidance Technology</i>	-	61.381	75.017	88.179	0.000	88.179	90.401	97.777	93.771	99.179	Continuing	Continuing
622502: <i>Ordnance Technology</i>	-	81.525	69.286	72.420	0.000	72.420	65.006	57.512	64.634	68.334	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and establishes the technical feasibility and military utility of guidance and ordnance technologies for conventional munitions. The effort supports core technical competencies of munitions aerodynamics, guidance, navigation, and control; terminal seeker sciences; fuze technology; energetic materials; damage mechanisms; and munition systems effects. Technologies and associated models and simulation assets to be developed include seekers that provide high-confidence target discrimination and classification with precise target location and robust terminal tracking; navigation technologies that do not rely upon the Global Positioning System (GPS); blast, fragmentation, penetrating, low-collateral-damage, and multi-mission warheads; collaborative, synchronized fuzing; and high-performance and insensitive explosives.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of such program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602605F, 0602788F, 0602298F, and 0602020F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	151.757	137.303	140.602	0.000	140.602
Current President's Budget	142.906	144.303	160.599	0.000	160.599
Total Adjustments	-8.851	7.000	19.997	0.000	19.997
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	10.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-0.003	0.000			
• SBIR/STTR Transfer	-2.778	0.000			
• Other Adjustments	-6.070	-3.000	19.997	0.000	19.997

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 622502: *Ordnance Technology*

Congressional Add: *Convergence technology research*

	FY 2022	FY 2023
	0.000	10.000
Congressional Add Subtotals for Project: 622502	0.000	10.000
Congressional Add Totals for all Projects	0.000	10.000

Change Summary Explanation

FY 2024 adjustment of \$19.997 million reflects increased emphasis on networked collaborative autonomous weapon technology and alternative navigation concepts for high speed/hypersonic weapons.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>				Project (Number/Name) 622068 / <i>Advanced Guidance Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622068: <i>Advanced Guidance Technology</i>	-	61.381	75.017	88.179	0.000	88.179	90.401	97.777	93.771	99.179	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional munitions guidance technologies to establish technical feasibility and military utility of innovative munition seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation. Project payoffs include adverse-weather, Global Positioning System (GPS)-degraded and Global Positioning System-denied, networked, and autonomous precision munition guidance capability; increased number of kills per sortie; increased aerospace vehicle survivability; improved weapon reliability and affordability; and improved weapon survivability and effectiveness.

B. Accomplishments/Planned Programs (\$ in Millions)

<p>Title: Seeker Technologies</p> <p>Description: Develops seeker technologies for munitions to provide high-confidence target discrimination and classification, precise target location, and robust terminal tracking.</p> <p>FY 2023 Plans: Continue emphasizing technology development of multi-function sensors, rapid data compression for targeting, bio-inspired information processing and data fusion, and low-power computation. Continue developing technologies that simplify, increase flexibility, and reduce the cost of advanced seeker concepts. Continue to develop algorithmic approaches integrating weapons into the kill chain to enable distributive, flexible seeker targeting with or without an operator in the loop. Continue development and testing of innovative engagements for fifth generation aircraft and beyond. Continue development of weapon radomes and apertures to improve transmission and optical performance while increasing protection from operational environments including directed energy and rain. Continue exploring incorporation of open architecture principles to reduce cost and enable technology refresh within seeker sub-systems. Continue exploring specific techniques for seeker cost reduction with performance improvement such as sparse sensing and compressive sensing. Continue research on integrated processing techniques to enable networked systems. Continue multi-function radio frequency technique development to enable coherent multi-weapon operation. Continue developing weapon open system architecture with extended view and integration into weapon mission computer to enable cooperative weapon operation. Continue open seeker architecture integration into the weapon open system architecture and evaluate the impact with respect to cyber vulnerability. Continue developing and demonstrate coherent collaborative radio frequency seeker operation.</p> <p>FY 2024 Plans: Continue emphasizing technology development of multi-function sensors, rapid data compression for targeting, bio-inspired information processing and data fusion, and low-power computation. Continue developing technologies that simplify, increase flexibility, and reduce the cost of advanced seeker concepts. Continue to develop algorithmic approaches integrating weapons</p>	FY 2022	FY 2023	FY 2024
	14.528	14.421	17.675

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622068 / <i>Advanced Guidance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>into the kill chain to enable distributive, flexible seeker targeting with or without an operator in the loop. Continue seeker algorithm development, modeling, simulation, and testing of innovative engagements against fifth-generation threat aircraft. Continue development of weapon radomes and apertures to improve transmission and optical performance while increasing protection from operational environments including directed energy and rain. Complete incorporation of open architecture principles to reduce cost and enable technology refresh within seeker sub-systems. Continue exploring specific techniques for seeker cost reduction with performance improvement such as sparse sensing and compressive sensing. Continue research on integrated processing techniques to enable networked systems. Continue multi-function radio frequency technique development to enable coherent multi-weapon operation. Complete development of weapon open system architecture with extended view and integration into weapon mission computer to enable cooperative weapon operation. Continue open seeker architecture integration into the weapon open system architecture and evaluate the impact with respect to cyber vulnerability. Continue development and demonstration of coherent collaborative radio frequency seeker operation.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$3.254 million. Funding increased due to increased emphasis on addressing weapon cyber vulnerabilities and accelerating munition targeting across multiple platforms.</p>			
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Title: Aerodynamics, Navigation, and Control Technologies	25.367	34.217	39.535
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<p>Description: Develops weapon aerodynamic control, navigation, and networking technologies for munitions to provide precise, agile flight, networked effects, and immunity to countermeasures.</p> <p>FY 2023 Plans: Continue novel position, navigation and timing technology development for global positioning system denied environments with intent to insert into demonstration programs. Continue investigation of cooperative, autonomous, and collaborative weapon behaviors to develop robust algorithms and swarming playbooks. Continue experiments demonstrating precision navigation, emphasizing cruise missile, form-factored optics and tracker for celestial aided navigation at supersonic cruise missile speeds and trajectory. Continue flight testing of articulating head missile at supersonic speeds at full scale to include analysis of range extension through airframe morphing and articulation. Continue kinetic and electronic attack swarm plays incorporating cyber domain, electric warfare, and kinetic effects. Continue flight demonstration of network aided navigation autonomy playbook. Continue flight demonstration of high-speed, high-performance weaponized quadrotor in a complex environment in support of autonomy tactics development and maturation. Continue machine learning to develop tactics for multi-weapon engagements. Initiate synthetic aperture radar based alternative-navigation technology investigation. Initiate post-weapon deployment data analytics to improve guidance, navigation, and controls models and autonomy tactics.</p> <p>FY 2024 Plans: Continue novel position, navigation and timing technology development for global positioning system denied environments with intent to insert into demonstration programs. Continue investigation of cooperative, autonomous, and collaborative weapon</p>			
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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622068 / <i>Advanced Guidance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023		FY 2024
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<p>behaviors to develop robust algorithms and swarming play-books. Continue experiments demonstrating precision navigation, emphasizing cruise missile, form-factored optics and tracker for celestial-aided navigation at supersonic cruise missile speeds and trajectory. Continue flight testing of articulating head missile at supersonic speeds at full scale to include analysis of range extension through airframe morphing and articulation. Continue kinetic and electronic attack swarm plays incorporating cyber domain, electronic warfare, and kinetic effects. Continue flight demonstration of network-aided navigation autonomy play-book. Complete flight demonstration of high-speed, high-performance weaponized quad-rotor in a complex environment in support of autonomy tactics development and maturation. Continue machine learning to develop tactics for multi-weapon engagements. Continue synthetic aperture radar-based alternative-navigation technology investigation. Continue post-weapon deployment data analytics to improve guidance, navigation, and controls models and autonomy tactics.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$5.318 million. Funding increased due to acceleration of networked collaborative autonomous (NCA) weapons technology to include incorporation of artificial intelligence and machine learning as well as enhanced focus on alternative navigation solutions for high speed/hypersonic weapons.</p>				
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Title: Guidance Technologies	21.486	26.379		30.969
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Description: Develops guidance subsystem integration and evaluation technologies to provide open and closed-loop ground testing, flight test risk reduction, and digital simulation of novel concepts.

FY 2023 Plans:
Continue development of cruise missile behaviors for distributed, cooperative, collaborative strategies and other advanced guidance capabilities. Continue improvement of constructive and virtual analysis tools for design, development, and analysis of advanced missile concepts in representative environments. Continue engagement level analysis on high-speed and air-to-air weapon concepts providing design, performance, and trade space analysis to the program offices. Continue improvement of simulation technologies evaluating innovative air-to-air and air-to-surface engagements to include guidance and control evaluation. Continue inclusion of additional targets and improved terrain resolution to radar, millimeter wave, infrared, and ultraviolet signature generation capability for testing algorithms in real-time software and hardware in-the-loop environments. Continue development of high-speed hardware-in-the-loop simulation technology, including thermal environment, aerodynamic control uncertainty, seeker modeling, and navigation sensor effectiveness. Continue development of infrared light emitting diode target simulator technology to create higher frame rate and higher resolution target simulator technology. Continue providing weapon oriented multi-security level, cross-domain distributed modeling and simulation support using distributed connectivity between Eglin Air Force Base facilities and other geographic locations. Continue development of 6-degrees of freedom and scene generation modules for the extended modeling and simulation community using Air Force Simulator. Continue hardware-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622068 / <i>Advanced Guidance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>in-the-loop activities in support of international cooperative research efforts. Initiate exploration of guidance technologies for potential United States Space Force applications.</p> <p><i>FY 2024 Plans:</i> Continue development of cruise missile behaviors for distributed, cooperative, collaborative strategies and other advanced guidance capabilities. Continue improvement of constructive and virtual analysis tools for design, development, and analysis of advanced missile concepts in representative environments. Continue engagement-level analysis on high-speed and air-to-air weapon concepts providing design, performance, and trade-space analysis to the program offices. Continue improvement of simulation technologies evaluating innovative air-to-air and air-to-surface engagements to include guidance and control evaluation. Continue inclusion of additional targets and improved terrain resolution to radar, millimeter wave, infrared, and ultraviolet signature generation capability for testing algorithms in real-time software and hardware in-the-loop environments. Continue development of high-speed hardware-in-the-loop simulation technology, including thermal environment, aerodynamic control uncertainty, seeker modeling, and navigation sensor effectiveness. Continue development of infrared light-emitting diode target simulator technology to create higher frame rate and higher resolution target simulator technology. Continue providing weapon-oriented multi-security level, cross-domain distributed modeling and simulation support using distributed connectivity between Eglin Air Force Base facilities and other geographic locations. Continue development of 6-degrees of freedom and scene generation modules for the extended modeling and simulation community using Air Force Simulator. Continue hardware-in-the-loop activities in support of international cooperative research efforts. Complete exploration of guidance technologies for potential United States Space Force applications.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$4.590 million. Funding increased due to acceleration of networked collaborative autonomous (NCA) weapons technology to include incorporation of artificial intelligence and machine learning as well as high speed/hypersonic guidance components and algorithms.</p>			
Accomplishments/Planned Programs Subtotals	61.381	75.017	88.179

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>				Project (Number/Name) 622502 / <i>Ordnance Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
622502: <i>Ordnance Technology</i>	-	81.525	69.286	72.420	0.000	72.420	65.006	57.512	64.634	68.334	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional ordnance technologies to establish technical feasibility and military utility for advanced explosives, fuzes, warheads, sub-munitions, and weapon airframes, carriage, and dispensing. The project also assesses the lethality and effectiveness of current and planned conventional weapons technology programs and assesses target vulnerability. The payoffs include improved storage capability and transportation safety of fully assembled weapons, improved warhead and fuze effectiveness, improved sub-munitions dispensing, low-cost airframe/subsystem components and structures, and reduced aerospace vehicle and weapon drag.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Energetic Materials Technology	7.593	6.620	9.613
Description: Investigates and develops energetic materials and technology that safely and securely optimize survivability, cost, and weapon lethality for munitions.			
FY 2023 Plans: Continue advancement and development of selected energetic materials to increase energy density over traditional explosives while enhancing damage mechanisms and lethality for mass and volume-constrained applications. Continue building and implementing experimental techniques/capabilities to quantify dynamic and mechanical properties as well as survivability of energetic materials in extreme temperature and vibrational environments. Continue developing tools and analysis techniques to further the understanding of energy partitioning in order to optimize lethality against a broad spectrum of targets. Continue maturation of additive manufacturing techniques to increase the design space for kinetic weapon lethality. Continue formulation of novel explosive fill to satisfy severe environmental constraints. Continue development of large scale nano-energetic material fabrication.			
FY 2024 Plans: Continue advancement and development of selected energetic materials, specifically nano-intermetallic compounds, to increase energy density over traditional explosives while enhancing damage mechanisms and lethality for mass and volume-constrained applications. Continue building and implementing experimental techniques/capabilities to quantify dynamic and mechanical properties as well as survivability of energetic materials in extreme temperature and vibrational environments. Continue development of tools and analysis techniques to further the understanding of energy partitioning between blast/fragmentation and combined effects in order to optimize lethality against a broad spectrum of targets. Continue maturation of additive manufacturing techniques to increase the design space for kinetic weapon lethality and to facilitate distributed manufacturing processes.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622502 / <i>Ordnance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023		FY 2024
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Continue formulation of novel explosive fill to satisfy severe environmental constraints. Continue development of large-scale nano-energetic material fabrication.				
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<p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.993 million. Funding increased due to increased emphasis upon agile manufacturing of ordnance components at point of demand and activation of technical facilities at the Advanced Munitions Technology Complex.</p>				
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<p>Title: Fuze Technologies</p>	9.295	6.479		9.803
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<p>Description: Investigate and develop fuzing technology for weapons to ensure reliable and optimal function to maximize weapon lethality for all engagement scenarios.</p>				
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<p>FY 2023 Plans: Completed development of testing capabilities for munitions penetration scenarios and modeling and simulation capabilities to reduce research and development costs and timelines. Continue development and demonstration of alternative packaging technology for survivable fuze electronic components. Continue investigating the reliability and survivability of electronic components for prediction and measurement of fuze performance during munition penetration at high-impact speeds. Continue research facilitating tailored lethal effects and enable optimum fuzing solutions across the spectrum of weapon and target interactions. Continue research for distributed and multi-point fuzing concepts. Continue implementing additive manufacturing techniques to increase fuze reliability. Continue fuze explosive interfaces analysis for robust definition of explosive train reliability and performance. Continue fuze endgame, active imaging for target detection and aim point selection.</p>				
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<p>FY 2024 Plans: Initiate implementation of digital engineering tools to enable digital design of munition fuzes. Continue development and demonstration of alternative packaging technology for survivable fuze electronic components. Continue investigating the reliability and survivability of electronic components for prediction and measurement of fuze performance during munition penetration at high-impact speeds. Continue research facilitating tailored lethal effects that enable optimum fuzing solutions across the spectrum of weapon and target interactions as enabling technologies for agile weapon effect concepts. Continue research for distributed and multi-point fuzing concepts as enabling technologies for agile weapon effect concepts. Continue implementing additive manufacturing techniques to increase fuze reliability and to facilitate distributed manufacturing. Continue fuze explosive interfaces analysis for robust definition of explosive train reliability and performance. Continue fuze endgame, active imaging for target detection and aim point selection.</p>				
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<p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>				
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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622502 / <i>Ordnance Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$3.324 million. Funding increased due to enhanced focus on ordnance technologies for agile weapons providing dynamic effects on the tactical edge and high speed weapons versus maritime targets.				
<p>Title: Warhead Technologies</p> <p>Description: Investigate and develop innovative warhead kill mechanisms for weapons that maximize weapon lethality for all engagement scenarios.</p> <p>FY 2023 Plans: Continue maturation of small, multi-output warhead technologies for soft-surface targets, to include limited penetration capability of hardened structures. Continue evolving test capabilities to enhance quantification of the mechanical response under high-rate, high-pressure loading conditions for use in high-fidelity modeling and simulation tools, to include materials used in additive manufacturing processes. Continue development of additive manufacturing techniques and produce optimized sub-scale articles for test. Complete demonstration of technologies for effective and survivable high-speed penetration. Continue development of warhead concepts for the air targets in peer engagement scenarios. Continue research and develop cumulative damage mechanisms taking advantage of distributed blast, as well as shock wave and reactive particle interactions. Continue subsystem warhead technology integration. Continue the development of topological optimization in support of additive manufacturing. Complete studies of composite-based warheads for penetrator/perforator applications.</p> <p>FY 2024 Plans: Continue maturation of small, multi-output warhead technologies for soft-surface targets, to include limited penetration capability of surface-hardened structures. Continue evolving test capabilities to enhance quantification of the mechanical response under high-rate, high-pressure loading conditions for use in high-fidelity modeling and simulation tools, to include materials used in additive manufacturing processes, enabling digital engineering of warhead concepts. Continue developing additive manufacturing techniques and produce optimized sub-scale articles for test. Initiate demonstration of technologies for effective and survivable high-speed penetration, specifically focusing on maritime and surface targets relevant to Joint Warfighting Concept. Continue development of warhead concepts for the air targets in peer engagement scenarios. Continue research and develop cumulative damage mechanisms taking advantage of coordinated and distributed impact. Continue subsystem warhead technology integration. Complete the development of topological optimization in support of additive manufacturing.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.423 million. Funding increased due to increased emphasis on high speed ordnance technology versus maritime targets and activation of technical facilities at the Advanced Munitions Technology Complex.</p>		13.229	11.225	13.648
<p>Title: Ordnance Technologies</p> <p>Description: Investigate and develop ordnance sub-system (energetics, fuzes and war-heads) and integrated system concepts using both high-fidelity and fast-running engineering level Modeling and Simulation tools.</p>		51.408	34.962	39.356

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622502 / <i>Ordnance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Continue developing validated mesoscale modeling and simulation tools for computational physics sciences. Continue developing engineering-level simulation architecture capability to enable weapon sub-system and system-level technology assessments. Continue implementing cost-effective and rapid transition warhead technologies for inventory weapons. Continue modeling and simulation efforts exploring the ordnance technology trade space for low-cost, long-range munition concepts. Continue developing predictive techniques for munition effectiveness tools used in concept development and assessment as well as studies involving analysis of alternatives. Continue developing test capability and data collection for modeling and simulation tools to characterize lethality, survivability, and performance of sub-systems and integrated ordnance systems. Continue the development of ordnance test and evaluation capabilities that include thermal and vibration management for hypersonic and high-speed flight. Initiate investigation of machine learning technologies for ordnance. Initiate and explore connection of ordnance modeling and simulation and lethality tools to the broader digital engineering ecosystem.</p> <p><i>FY 2024 Plans:</i> Continue developing validated mesoscale modeling and simulation tools for computational physics sciences. Continue to develop engineering-level simulation architecture capability to enable weapon sub-system and system-level technology assessments. Continue implementing cost-effective and rapid- transition warhead technologies for inventory weapons. Continue modeling and simulation efforts exploring the ordnance technology trade-space for low-cost, long-range munition concepts. Continue developing predictive techniques for munition effectiveness tools used in concept development and assessment as well as studies involving analysis of alternatives. Continue developing test capability and data collection for modeling and simulation tools to characterize lethality, survivability, and performance of sub-systems and integrated ordnance systems. Complete the development of ordnance test and evaluation capabilities that include thermal and vibration management for hypersonic and high-speed flight. Continue investigation of machine learning technologies for ordnance. Continue exploring the connection of ordnance modeling and simulation and lethality tools to the broader digital engineering ecosystem.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$4.394 million. Funding increased due to enhanced focus in lethality tools for automated Advanced Battle Management System/Joint All-Domain Command and Control and improved modeling and simulation tools for weapons design and weaponeering.</p>			
Accomplishments/Planned Programs Subtotals	81.525	59.286	72.420

<i>Congressional Add:</i> Convergence technology research	FY 2022	FY 2023
	0.000	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602602F / <i>Conventional Munitions</i>	Project (Number/Name) 622502 / <i>Ordnance Technology</i>
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	FY 2022	FY 2023
FY 2022 Accomplishments: Not applicable.		
FY 2023 Plans: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	0.000	10.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	109.529	120.947	129.961	0.000	129.961	125.474	117.680	120.193	131.935	Continuing	Continuing
624866: <i>Lasers & Imaging Technology</i>	-	0.000	25.305	26.254	0.000	26.254	23.471	23.991	24.493	28.703	Continuing	Continuing
624867: <i>Advanced Weapons & Survivability Technology</i>	-	32.371	60.896	80.652	0.000	80.652	79.350	70.182	71.839	78.507	Continuing	Continuing
625173: <i>Laser Technology</i>	-	77.158	34.746	23.055	0.000	23.055	22.653	23.507	23.861	24.725	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program covers research in Directed Energy (DE) technologies, primarily High Energy Lasers (HEL) and High Power Electromagnetics (HPEM). High Energy Lasers (HEL) research includes moderate to high continuous power laser devices that are applicable to a wide range of applications, optical technologies to propagate laser beams through the atmosphere, and integration of these technologies into demonstration packages. High power microwaves research examines technologies for applications such as counter-electronics and nonlethal weapons. This program conducts research into other novel Directed Energy applications; conducts Directed Energy vulnerability/lethality assessments; develops protection technologies versus Directed Energy; conducts research into other advanced non-conventional/innovative weapons; develops and uses tools to compare solutions to determine the most effective and efficient Directed Energy technologies to meet Air Force needs; coordinates efforts through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602788F, 1206601SF, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

Funds in this PE may be used to investigate specified technology advancements in air, space and/or cyber domains.

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	116.456	109.302	112.221	0.000	112.221
Current President's Budget	109.529	120.947	129.961	0.000	129.961
Total Adjustments	-6.927	11.645	17.740	0.000	17.740
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	20.000			
• Congressional Directed Transfers	0.000	-8.355			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-6.920	0.000			
• Other Adjustments	-0.007	0.000	17.740	0.000	17.740

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 625173: *Laser Technology*

Congressional Add: *Program Increase - directed energy research*

Congressional Add: *Program increase - counter-UAS directed energy effectiveness*

Congressional Add: *Program increase - early detection of threats*

Congressional Add Subtotals for Project: 625173

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	-	5.000
	-	5.000
	-	10.000
	-	20.000
	-	20.000

Change Summary Explanation

Funding increase due to multi-year surge of funding developing and building sources supporting high priority, real-world events and higher Air Force priorities.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>				Project (Number/Name) 624866 / <i>Lasers & Imaging Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624866: <i>Lasers & Imaging Technology</i>	-	0.000	25.305	26.254	0.000	26.254	23.471	23.991	24.493	28.703	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores the technical feasibility of moderate to high power lasers, including beam control, for applications such as aircraft protection, force protection, and precision engagement from the Department of the Air Force platforms. This project investigates the effects of laser weapons on a wide range of systems and components as well as producing, modifying, validating and applying Directed Energy and non-Directed Energy concept development and assessment tools to determine which technology solutions to pursue.

In FY 2022, a portion of PE 0602605F, the optical space domain awareness and satellite vulnerability efforts of PE 0602605F, Directed Energy Technology, Project 624866, Lasers & Imaging Technology, was transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, PE 1206601SF, Space Technology, Project 624866, Lasers & Imaging Technology from Appropriation 3600, Budget Activity 2 due to the creation of a new Appropriation for Space Force.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Energy Laser Technologies and Directed Energy Assessments	0.000	25.305	26.254
Description: This effort explores the technical feasibility of moderate to high power lasers, including beam control, for applications such as aircraft protection, force protection, and precision engagement from the Department of the Air Force platforms. This project investigates the effects of laser weapons on a wide range of systems and components as well as producing, modifying, validating and applying Directed Energy and non-Directed Energy concept development and assessment tools to determine which technology solutions to pursue.			
FY 2023 Plans: Complete testing of the effects of a 2 micron (um) wavelength laser on targets of interest and make decision on path for improving compactness and power. Continue planning to demonstrate 100 Watt average power for Beacon Illuminating Laser used for target acquisition. Continue development of fiber optic amplifiers that are more resistant to nonlinear effects. Complete fiber optic gyro to enable next generation optical Inertial Reference Unit (IRU).			
FY 2024 Plans: Continue assessment and development of sources for beacon/tracking illuminator lasers and associated tracking and pointing improvements. Continue planning to demonstrate 100 Watt average power for beacon illuminating laser used for target acquisition. Continue development of fiber optic amplifiers that are more resistant to nonlinear effects.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>	Project (Number/Name) 624866 / <i>Lasers & Imaging Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$0.949 million. Funding increase as described in the plans above.			
Accomplishments/Planned Programs Subtotals	0.000	25.305	26.254

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>				Project (Number/Name) 624867 / <i>Advanced Weapons & Survivability Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624867: <i>Advanced Weapons & Survivability Technology</i>	-	32.371	60.896	80.652	0.000	80.652	79.350	70.182	71.839	78.507	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores the use of High Power Microwave and other unconventional/innovative weapon concepts to support applications on the Department of the Air Force platforms such as base defense and electronic warfare including disruption, degradation, and damage of electronic infrastructure. This research includes weapon technology that can provide covert effects and/or no collateral or human damage. The project also investigates the effects of potential adversary High Power Microwave weapons and how to mitigate those effects on US assets, as well as producing and applying Directed Energy and non-Directed Energy concept development and assessment tools to determine which technology solutions to pursue. This project includes but is not limited to high power microwaves, plasmas, particle beams, and millimeter waves

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Power Microwave and Unconventional Weapon Technologies	12.504	23.522	38.417
Description: Investigate technologies for High Power Microwave and unconventional weapon components. Investigate High Power Microwave and other unconventional weapon concepts using innovative technologies. Investigate advanced technologies that support force protection tactical applications, including non-kinetic/non-lethal counter-electronics applications.			
FY 2023 Plans: Continue effects testing and propagation experiments to define the performance requirements to develop an ultra-short pulsed laser system. Continue designing and developing high power microwave technology that will be integrated into an airborne platform for the next generation Department of the Air Force airborne high power microwave technology demonstration. Continue developing smaller, higher power source technology with all support components to enable the next generation Department of the Air Force high power microwave demonstration. Continue testing high power microwave components for ground and aerial high power microwave demonstrators. Continue supporting the modeling, simulation, and analysis tools that have been transitioned to the broader modeling, simulation, and analysis community.			
FY 2024 Plans: Complete effects testing and propagation experiments to define the performance requirements to develop an ultra-short pulsed laser system. Complete design and develop high power microwave technology that could be integrated into an airborne platform for the next generation Department of the Air Force airborne high power microwave technology demonstration. Continue developing smaller, higher power source technology with all support components to enable the next generation Department of the Air Force high power microwave demonstration. Continue testing high power microwave components for ground and aerial high power microwave demonstrators. Continue supporting the modeling, simulation, and analysis tools that have been transitioned			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>	Project (Number/Name) 624867 / <i>Advanced Weapons & Survivability Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>to the broader modeling, simulation, and analysis community. Initiate research to build sources to address high priority, real-world events. Initiate increased effort to research microwave propagation through arctic environments and effects to support future airborne applications.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$14.895 million. Funding increase due to multi-year surge of funding developing and building sources supporting high priority, real-world events and reflects increased emphasis on microwave propagation and effects in support of future airborne microwave applications.</p>				
<p>Title: High Power Microwave Effects</p> <p>Description: Assess the effects/lethality of High Power Microwave technologies. Develop and apply sophisticated models to enhance the development of High Power Microwave and related technology. Develop tools and perform assessments which allow comparisons among Directed Energy concepts and tradeoffs between Directed Energy and non-Directed Energy solutions.</p> <p>FY 2023 Plans: Continue supporting software applications that are hosted in the directed energy High Performance Computing Software Applications Institute for broad spectrum directed energy sources. Continue populating database of high power sources. Continue conducting military utility assessment of high power microwave weapon technology that is integrated into various platforms for multiple target engagements using end-to-end modeling. Continue assessing synergistic weapon concepts that merge kinetic energy and non-kinetic high power microwave weapon capabilities into one weapon system. Continue supporting the modeling, simulation, and analysis tools that have been transitioned to the broader modeling, simulation, and analysis community. Continue validation of the modeling, simulation, and analysis tools that have been transitioned to the broader modeling, simulation, and analysis community.</p> <p>FY 2024 Plans: Complete the transition of software applications hosted in the directed energy High Performance Computing Software Applications Institute for a broad spectrum directed energy sources. Continue populating the database of high power sources to include solid-state sources. Initiate increased effort conducting military utility assessments of high power microwave weapon technology integrated into the kill-chain for multiple target engagements using end-to-end mission level modeling. Continue assessing synergistic weapon concepts that merge kinetic energy and non-kinetic high power microwave weapon capabilities into one weapon system. Continue supporting the modeling, simulation, and analysis tools that have been transitioned to the broader modeling, simulation, and analysis community. Complete validation of the modeling, simulation, and analysis tools that have been transitioned to the broader modeling, simulation, and analysis community. Complete transitioning of the validated modeling, simulation, and analysis tools to the broader modeling, simulation, and analysis community.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>		19.867	37.374	42.235

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>	Project (Number/Name) 624867 / <i>Advanced Weapons & Survivability Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$4.861 million. Funding increase due to emphasis on the development of full kill chain integration of high-power microwave weapons.			
Accomplishments/Planned Programs Subtotals	32.371	60.896	80.652

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>				Project (Number/Name) 625173 / <i>Laser Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625173: <i>Laser Technology</i>	-	77.158	34.746	23.055	0.000	23.055	22.653	23.507	23.861	24.725	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores the technical feasibility of moderate to high continuous power lasers, including beam control, for applications such as aircraft protection, base protection, and precision engagement from the Department of the Air Force platforms. This project investigates the effects of laser weapons on a wide range of systems and components as well as producing, modifying, validating and applying Directed Energy and non-Directed Energy concept development and assessment tools to determine which technology solutions to pursue.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Laser Technology</p> <p>Description: Develop and demonstrate High Energy Laser device technologies for the Department of the Air Force applications. Develop and demonstrate laser beam control technologies including atmospheric propagation and pointing and tracking. Perform laser system level modeling and simulation validated by laser effects and vulnerability testing. Develop tools and perform assessments which allow comparisons among concepts and tradeoffs between Directed Energy and non-Directed Energy solutions. Integrate optical beam control technologies with laser device technologies and demonstrate the combined technologies. Develop and use modeling, testing and diagnostic technologies to better understand the vulnerability of adversary weapon systems to High Energy Lasers.</p> <p>FY 2023 Plans: Continue development and validation of the predictive physics-based End-to-End model that covers all elements of laser weapon systems (LWS)-photon "birth to death". Continue to develop laser vulnerability models for high-priority emerging threat systems. Continue to transition the models to the Department of Defense and Industry Modeling, Simulation and Analysis community. Conduct table top exercises and focused wargames to develop concepts of employment for directed energy weapons in representative scenarios and vignettes.</p> <p>FY 2024 Plans: Continue development and validation of the predictive physics-based end-to-end model that covers all elements of laser weapon systems (LWS)-photon "birth to death". Initiate increase emphasis assessment of electric laser sources for all Air Force Directed Energy applications. Continue and increase effort on developing laser vulnerability models for high-priority emerging threat systems. Continue transitioning models to the Department of Defense and industry modeling, simulation, and analysis community. Continue tabletop exercises and focused wargames to develop concepts of employment for directed energy weapons in representative scenarios and vignettes.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	77.158	14.746	23.055

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602605F / <i>Directed Energy Technology</i>	Project (Number/Name) 625173 / <i>Laser Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increase compared to FY 2023 by \$8.309 million. Funding increase due to additional emphasis of electric laser sources and development laser vulnerability models.			
Accomplishments/Planned Programs Subtotals	77.158	14.746	23.055

	FY 2022	FY 2023
Congressional Add: Program Increase - directed energy research <i>FY 2023 Plans:</i> Conduct Congressional directed efforts.	-	5.000
Congressional Add: Program increase - counter-UAS directed energy effectiveness <i>FY 2023 Plans:</i> Conduct Congressional directed efforts.	-	5.000
Congressional Add: Program increase - early detection of threats <i>FY 2023 Plans:</i> Conduct Congressional directed efforts.	-	10.000
Congressional Adds Subtotals	-	20.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Non Applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	209.892	271.005	182.076	0.000	182.076	175.548	179.617	182.347	199.453	Continuing	Continuing
625315: <i>C4I Dominance Technology</i>	-	154.343	187.246	89.429	0.000	89.429	88.040	90.106	91.983	99.726	Continuing	Continuing
625319: <i>Cyberspace Dominance Technology</i>	-	31.177	59.282	65.335	0.000	65.335	61.615	63.033	64.342	70.691	Continuing	Continuing
62OMMS: <i>Research Site Support</i>	-	24.372	24.477	27.312	0.000	27.312	25.893	26.478	26.022	29.036	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops enterprise-centric information technology for the Department of the Air Force. Advances in enterprise-centric information technologies are required to increase warfighter readiness and effectiveness by providing the right information, at the right time, in the right format, anytime, anywhere in the world. The C4I Dominance Technology project provides the technologies for (a) secure, self-configuring, self-healing, seamless networks; (b) timely delivery of information to tactical assets; (c) scaling, robustness, and collaboration features required of the Department of the Air Force net-centric information management environment; and (d) real-time effective portrayal of complex data sets. This project also provides a network-centric, collaborative intelligence analysis capability that enables the fusion of multi-intelligence and sensor sources to provide timely situational awareness, understanding, and anticipation of the threats in the battlespace; and the advanced, novel exploitation technologies needed to intercept, collect, locate, and process both covert and overt raw data from intelligence and sensor sources. The Cyberspace Dominance Technology project provides technologies to deliver a full range of options in cyberspace on par with air and space dominance in each of the areas of cyber-attack, cyber defense, and cyber support to achieve the strategic capability of cyber dominance. This project also provides technology that ensures Department of Air Force ability to (a) access, maintain presence on, and deliver effects to adversary systems; (b) detect, defend, and respond to attacks on friendly computer systems and provide forensic analysis concerning those attack attempts; (c) bring game-changing computing power to the warfighter and disruptive computing power at the tactical edge and for federated grid services; and (d) provide cyber situational awareness to Department of the Air Force Commanders. The Research Site Support project provides the Rome Research Site infrastructure at Rome, New York and provides for the continued operations of all Rome Research Site properties, buildings, and services necessary for the research mission. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0603788F, and 0602298F.

Funds in this program element may be used to investigate specified technology advancements in air, space and/or cyber domains.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>
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This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	221.110	166.041	170.096	0.000	170.096
Current President's Budget	209.892	271.005	182.076	0.000	182.076
Total Adjustments	-11.218	104.964	11.980	0.000	11.980
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	105.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-11.218	-0.036			
• Other Adjustments	0.000	0.000	11.980	0.000	11.980

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 625315: C4I Dominance Technology

	FY 2022	FY 2023
Congressional Add: <i>Program Increase - Quantum Network Testbed</i>	9.798	10.000
Congressional Add: <i>Program Increase - Photonic Quantum Computing</i>	24.496	-
Congressional Add: <i>Program Increase - Quantum Internet Battlefield</i>	6.859	-
Congressional Add: <i>Program Increase - Ion Trap Quantum Computing</i>	9.798	-
Congressional Add: <i>Internet of Things Innovation Ecosystem</i>	-	5.000
Congressional Add: <i>University-based Quantum Materials Applied Research</i>	-	30.000
Congressional Add: <i>Program Increase - Secure Quantum Computing Facility</i>	-	20.000
Congressional Add: <i>Program Increase - Trapped Ion Quantum Computer</i>	-	30.000
Congressional Add: <i>Traffic management operational readiness</i>	-	10.000
Congressional Add Subtotals for Project: 625315	50.951	105.000
Congressional Add Totals for all Projects	50.951	105.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force Date: March 2023

Appropriation/Budget Activity
3600: *Research, Development, Test & Evaluation, Air Force I BA 2: Applied Research*

R-1 Program Element (Number/Name)
PE 0602788F / *Dominant Information Sciences and Methods*

Change Summary Explanation

In 2024, funding for Dominant Information Sciences & Methods (PE 0602788F) increased to emphasize science and technology investments necessary to maintain superiority over potential near-peer adversaries in key technology areas including multi-source data fusion, collaborative intelligence analysis, cyber offense and defense, and game-changing computing power.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625315: <i>C4I Dominance Technology</i>	-	154.343	187.246	89.429	0.000	89.429	88.040	90.106	91.983	99.726	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Department of the Air Force requires advanced technologies which support the Department of the Air Force core missions and enable the Department of the Air Force to achieve Global Vigilance, Global Reach, and Global Power in support of national security objectives. The technologies developed under this project enable the National Defense Strategy and Department of the Air Force future operating concepts which require operational agility (the ability to rapidly generate—and shift among—multiple solutions for a given challenge), creating combinations of air, space, and cyberspace capabilities to achieve desired effects in the battlespace.

This project provides the technologies for secure, self-configuring, self-healing, seamless networks; advanced communications processors; anti-jam and low probability of intercept communications techniques; agile and dynamic policy-based network management capabilities; and modular, programmable, low-cost software radios. In addition, it develops both the technology base for ultra-wide bandwidth and multi-channeled communications networks (both air and space based) on and between platforms.

This project provides the technologies which enable the ability to globally share, discover, and access information across organizational, functional, and coalition boundaries and between and among domains, the timely delivery of information to tactical assets, the tailoring and prioritization of information based on mission needs and importance, and the scaling, robustness, and collaboration features required of the Department of the Air Force net-centric information management environment.

This project advances technologies enabling the effective execution of military objectives that will vastly improve the ability to support the commander and staff's ability to command all viable options to achieve desired effects across the full spectrum of operations (air, space, and cyberspace) at all levels of war (strategic, operational, and tactical) and during all phases of conflict. This project provides technologies for anticipatory decision support; course of action development, planning, scheduling, and assessment; and the real-time effective portrayal of complex data sets.

This project improves and automates the capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project provides not only a network-centric, collaborative intelligence analysis capability that enables the fusion of multi-intelligence and sensor sources to provide timely situational awareness, understanding, and anticipation of the threats in the battlespace, but also the advanced, novel exploitation technologies needed to intercept, collect, locate, and process both covert and overt raw data from intelligence and sensor sources.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Assured Communications & Networks	28.298	18.917	17.355
Description: Develop communications, networking, and signal processing technologies with improved survivability and capacity to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity tailored to anti-access and area-denial			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
environments and contested operations. Includes the research and development to advance existing nuclear capable forces to ensure command, control, and connectivity for the President without constraints.				
<p>FY 2023 Plans: Continue the research and development of technologies for robust, adaptive, and mission aware airborne networks. Continue the research and development of large-scale hardware-in-the-loop verification of developed directional networking protocols. Continue the research and development of propagation models. Decrease the development of a network stack suitable for high-bandwidth terahertz links. Continue the development, verification, and validation of advanced, airborne high-frequency antenna/ionospheric structure. Continue the development of an airborne mesh networking capability that utilizes adaptive and responsive antennas for a dynamic and reliable high capacity mesh network suitable for communications in contested environments. Continue the development, verification, and test of advanced waveforms. Continue the development, verification, and test of software-defined radio prototypes. Continue development of enhanced assurance and filtration offloading. Continue to develop, verify, and validate software-defined radio prototypes. Initiate development of capabilities that incorporate communications network connectivity into information extraction tools.</p> <p>FY 2024 Plans: Continue the research and development of technologies for robust, adaptive, and mission aware airborne networks. Continue the research and development of large-scale hardware-in-the-loop verification of developed directional networking protocols. Continue the research and development of propagation models. Decrease the development of a network stack suitable for high-bandwidth terahertz links. Continue the development, verification, and validation of advanced, airborne high-frequency antenna/ionospheric structure. Continue the development of an airborne mesh networking capability that utilizes adaptive and responsive antennas for a dynamic and reliable high capacity mesh network suitable for communications in contested environments. Continue the development, verification, and test of advanced waveforms. Continue the development, verification, and test of software-defined radio prototypes. Continue development of enhanced assurance and filtration offloading. Continue to develop, verify, and validate software-defined radio prototypes. Continue to develop capabilities that incorporate communications network connectivity into information extraction tools. Initiate implementation and simulation against several adversarial interference conditions, and initiate developing and testing the operationally-relevant scenario.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by 1.562 million due to decreased emphasis in high-bandwidth terahertz technology and advanced directional propagation models.</p>				
Title: Data to Decisions		16.892	14.180	16.512
Description: Investigate and develop technologies for decision quality information dissemination services via publish, subscribe, and query across the Global Information Grid to enterprise and tactical assets and coalition partners.				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Continue the research and development of data analytics and strategic indications and warnings technologies (including large data alignment, indexing and search on textual data, large-scale and disparate data sources, both structured and unstructured data, and employment of various ontologies and machine learning techniques). Continue the development of Conversational Artificial Intelligence capabilities to deliver conversational agents capable of answering complex analytical questions. Continue the development of a user customizable entity, event, and relation text extraction capability with automatic performance estimates of the user-customized extractors on new documents and mission areas. Continue research and development of a Request for Information dialog system that can help answer Requests for Information for single service applications across 10 essential Intelligence enterprise identified Requests for Information. Continue the development of a Multi-Source Intelligence, Surveillance, and Reconnaissance ontology connecting Air Force analytics, Application Programming Interfaces, and services. Continue research and development of an integrated threat detection system based on vetted events from Publicly Available Information fused and corroborated with Intelligence, Surveillance, and Reconnaissance sources. Continue the research and development of autonomous, heterogeneous, distributed multi-sensor management and upstream data fusion for improved target detection, tracking and classification. Continue the development of Counter Small Unmanned Air Systems detection and identification, via acoustics, and algorithm work. Initiate the development of new methods that exploit traditional and non-traditional data to categorize and predict engagement scenarios of coordinated, non-cooperative targets, and that assess the threats based on situation-driven adversary capabilities. Continue to develop capabilities to automate emitter corridor extraction and mode tagging to deploy capabilities onboard the collection platform. Initiate research to add new data sources to identify signatures corresponding to different categories of multi-satellite actions. Initiate research methods to allow for change detection and pattern recognition. Initiate research to seek correlations between non-traditional data source signatures and multi-satellite actions.</p> <p><i>FY 2024 Plans:</i> Continue the research and development of data analytics and strategic indications and warnings technologies (including large data alignment, indexing and search on textual data, large-scale and disparate data sources, both structured and unstructured data, and employment of various ontologies and machine learning techniques). Continue the development of Conversational Artificial Intelligence (CAI) capabilities to deliver conversational agents capable of answering complex analytical questions. Continue the development of a user customizable entity, event, and relation text extraction capability with automatic performance estimates of the user-customized extractors on new documents and mission areas. Continue research and development of a Request for Information dialog system that can help answer RFIs for single service applications across 10 essential Intelligence enterprise identified RFIs. Continue the development of a Multi-Source Intelligence, Surveillance, and Reconnaissance ontology connecting Air Force analytics, Application Programming Interfaces, and services. Continue research and development of an integrated threat detection system based on vetted events from Publicly Available Information fused and corroborated with ISR sources. Continue the research and development of autonomous, heterogeneous, distributed multi-sensor management and upstream data fusion for improved target detection, tracking, and classification. Continue the development of new methods that</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>exploit traditional and non-traditional data to categorize and predict engagement scenarios of coordinated, non-cooperative targets, and that assess the threats based on situation-driven adversary capabilities. Continue to develop capabilities to automate emitter corridor extraction and mode tagging to deploy capabilities onboard the collection platform. Continue research to add new data sources to identify signatures corresponding to different categories of multi-satellite actions. Continue researching methods that allow for change detection and pattern recognition. Continue research to seek correlations between non-traditional data source signatures and multi-satellite actions. Initiate development of a machine-learning environment to autonomously govern the execution of composite tasks. Initiate development of an analyst recognition engine for application programming interfaces, data, and services. Complete development of Counter Small Unmanned Air Systems detection and identification technology. Complete a proof-of-concept assistant to perform composite tasks over multiple turns. Initiate development of an advanced multimodal threat forecasting system with advanced veracity and fusion components. Initiate and complete analyst dialog interface and threat detection system.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.332 million due to an increased emphasis in research creating a machine-learning environment to autonomously govern the execution of composite tasks and the development of an analyst recognition engine for application programming interfaces, data, and services.</p>			
<p>Title: Processing Technologies</p> <p>Description: Develop automatic and dynamically reconfigurable, scalable, affordable distributed peta-flop processing technologies for real-time global information systems.</p> <p>Starting in FY 2021, the remaining non-cyber work that was performed under Project 625319, Cyberspace Dominance Technology, in the Processing Technologies effort within this PE will now be performed within this effort.</p> <p>FY 2023 Plans: Continue advancing the application of novel neuromorphic systems for robust machine learning. Continue advancing research and development of the neuromorphic processor and validate capabilities for dynamic learning on mobile and power-constrained platforms. Continue the development of integrating embedded high performance computing systems. Continue the development and delivery of a Neuromorphic High-Performance-Computing (Brain-in-the-Box).</p> <p>FY 2024 Plans: Continue advancing the application of novel neuromorphic systems for robust machine learning. Continue advancing research and development of the neuromorphic processor and validate capabilities for dynamic learning on mobile and power-constrained platforms. Complete the development of a model integrated with existing embedded high performance computing systems.</p>	8.294	7.258	6.616

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Complete the development and delivery of a Neuromorphic High-Performance-Computing (Brain-in-the-Box). Initiate research to advance the Strategic Sensing Grid orchestration and data exploitation. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.642 million. Justification for the decrease is described in the plans above.				
Title: Multi-Domain Command & Control (MDC2) Description: Develop advanced monitoring, planning, and assessment technologies enabling aerospace commanders to develop effects-based campaigns. Investigate, analyze, and develop technologies for planning, execution, and automatic rapid reconfiguration of distributed intelligent and integrated command and control information systems to achieve the commander's intent throughout varying crisis levels. FY 2023 Plans: Continue research applying machine learning techniques to enhance and optimize multi domain operations (including space). Continue research and development to refine the mathematical framework and provide a method for evaluating and presenting multi-domain courses of action to maximize operational effects for decisive advantage. Continue the development of tools, technology, and a framework for execution management of operational center process workflows and applications. Continue the research and development of a novel composable planning paradigm to overcome the serial and time-intensive nature of existing planning techniques. FY 2024 Plans: Continue research for applying machine learning techniques to enhance and optimize multi domain operations (including space). Complete research into a mathematical framework and provide a method for evaluating and presenting multi-domain courses of action to maximize operational effects for decisive advantage. Continue the development of tools, technology, and a framework for execution management of operational center process workflows and applications. Continue the research and development of a novel composable planning paradigm to overcome the serial and time-intensive nature of existing planning techniques. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.551 million due to increased emphasis in mathematical frameworks for providing a method of evaluation to maximize operational effects for decisive advantage.		21.929	17.884	19.435
Title: Artificial Intelligence/Autonomy/Machine Learning Description: Perform research and development (R&D) to harness the speed and scale of computers and machines to address problems of complexity. FY 2023 Plans:		18.559	15.573	15.596

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Continue the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments. Continue the research to understand operational needs of machine learning algorithms and systems with the multi-domain command and control connect. Continue research into the application of Interactive Learning techniques to the auto-planning problem and development of an IL based planning capability to augment existing auto-planning tools. Continue the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments.</p> <p>FY 2024 Plans: Continue advancing the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments. Continue the research to understand operational needs of machine learning algorithms and systems with the multi-domain command and control connect. Continue research into the application of Interactive Learning techniques to the auto-planning problem and development of an IL based planning capability to augment existing auto-planning tools. Continue the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.023 million. Justification for the decrease is described in the plans above.</p>				
<p>Title: Quantum Information Science</p> <p>Description: Perform research and development (R&D) that will utilize quantum physics for the storage, transmission, manipulation, computing, or measurement of information in ways that offer advantages to classical capabilities.</p> <p>FY 2023 Plans: Continue research and development in the area of supreme and quantum computing information sciences through algorithm development and characterization of commercial device capability. Continue development of further reducing SWaP of network node demonstrations. Continue demonstration of quantum information processing on a single chip by using developed quantum photonics processor with photon sources.</p> <p>FY 2024 Plans: Continue research and development in the area of supreme and quantum computing information sciences. Continue to advance development of further reducing SWaP of network node demonstrations. Continue demonstration of quantum information processing on a single chip by using developed quantum photonics processor with photon sources. Initiate research and development of quantum photonic integrated circuits for transmission/node operations. Initiate research into designs for network architecture and connectivity.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>		9.420	8.434	13.915

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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$5.481 million due to increase in research and development in the area of supreme and quantum computing information sciences, research and development of quantum photonic integrated circuits for transmission/node operations, and research of designs for network architecture and connectivity.			
Accomplishments/Planned Programs Subtotals	103.392	82.246	89.429

	FY 2022	FY 2023
Congressional Add: Program Increase - Quantum Network Testbed <i>FY 2022 Accomplishments:</i> Conduct congressionally directed efforts. <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	9.798	10.000
Congressional Add: Program Increase - Photonic Quantum Computing <i>FY 2022 Accomplishments:</i> Conduct congressionally directed efforts.	24.496	-
Congressional Add: Program Increase - Quantum Internet Battlefield <i>FY 2022 Accomplishments:</i> Conduct congressionally directed efforts.	6.859	-
Congressional Add: Program Increase - Ion Trap Quantum Computing <i>FY 2022 Accomplishments:</i> Conduct congressionally directed efforts.	9.798	-
Congressional Add: Internet of Things Innovation Ecosystem <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	5.000
Congressional Add: University-based Quantum Materials Applied Research <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	30.000
Congressional Add: Program Increase - Secure Quantum Computing Facility <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	20.000
Congressional Add: Program Increase - Trapped Ion Quantum Computer <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	30.000
Congressional Add: Traffic management operational readiness <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	10.000
Congressional Adds Subtotals	50.951	105.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625315 / <i>C4I Dominance Technology</i>

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625319 / <i>Cyberspace Dominance Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
625319: <i>Cyberspace Dominance Technology</i>	-	31.177	59.282	65.335	0.000	65.335	61.615	63.033	64.342	70.691	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Department of the Air Force requires technologies to deliver a full range of options in cyberspace on par with air and space dominance in each of the areas of cyber-attack, cyber defense, and cyber support to achieve the strategic capability of cyber dominance. The Department of the Air Force requires the development of superior, intelligent, on-demand computing to enable information superiority to include advances in secure information sharing across domains and boundaries as well as technologies that successfully deter any adversary from attacking computer systems anytime, anywhere by ensuring the Department of the Air Force's ability to: access, maintain presence on, and deliver effects to adversary systems; detect, defend, and respond to attacks on friendly computer systems and provide forensic analysis concerning those attack attempts; and provide cyber situational awareness to Department of the Air Force Commanders. In addition, the Department of the Air Force requires technology development that produces computing architectures with greater capacity and sophistication for addressing constrained, dynamic mission objectives; game-changing computing power to the warfighter, disruptive computing power at the tactical edge and for federated grid services; and interactive and real-time computing improving the usability of high-performance computing to the Department of the Air Force. It includes technologies in computational sciences and engineering, computer architectures and software intensive systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Cyber Defense Technologies	19.234	29.279	32.035
Description: Develop cyber defense and supporting technologies to detect, defend, and respond to attacks on computer systems as well as provide forensic concerning attacks.			
FY 2023 Plans: Continue research in the area of autonomous integrated cyber operations. Continue applied research in the area of biologically resilient cyber technologies. Continue research into mission-specific block-chain capabilities, and the alignment of cyber resilient services and dynamic management tailored towards unmanned aerial systems. Continue the development of radical architectural and infrastructural changes from computational diversity, to deliver a quantifiable improvement to cybersecurity. Continue research and validation of a cyber-hardened (robust, secure) processor for embedded weapon systems. Continue applied research to create trusted and resilient embedded systems that are capable of identifying, localizing, and automatically repairing previously unknown and/or unintended vulnerabilities. Continue development of software using evolutionary approaches to make embedded systems tolerant to unexpected and unforeseen situations. Continue research effort to discover concepts and capabilities for cyber survivability techniques and algorithms for counter-unmanned aerial systems. Continue development of a counter-unmanned aerial systems open architecture to enable interoperability. Continue evolution of autonomous machine learning functions. Decrease the validation and demonstration of automated workflows into defensive cyber operations systems. Continue development of a model-assisted concolic firmware exploration and threat models based on device behavior. Continue			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625319 / <i>Cyberspace Dominance Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>large scale device analysis and demonstration on AF-relevant system. Initiate a capability to model, intercept, and synchronize the state of all embedded devices connected on a single bus. Initiate development of a physics-based and topologically-based model of an intra-connected and inter-connected electric power grid and communications network. Initiate research and development of the design, implementation, and evaluation of a proof-of-concept system to enable secure and efficient outsourcing of relational queries and Machine Learning training. Initiate research into the inference to untrusted clouds with cost-based optimization options, under Multiparty Computation protocols with different threat models, guarantees, and physical deployments (i.e., Local Area Network, Wide Area Networks, Blockchain, or mixed) settings.</p> <p>FY 2024 Plans: Continue research in the area of autonomous integrated cyber operations. Continue research into mission-specific block-chain capabilities and the alignment of cyber resilient services. Continue research and validation of a cyber-hardened (robust, secure) processor for embedded weapon systems. Continue applied research to create trusted and resilient embedded systems that are capable of identifying, localizing, and automatically repairing previously unknown and/or unintended vulnerabilities. Continue development of software using evolutionary approaches to make embedded systems tolerant to unexpected and unforeseen situations. Continue research effort to discover concepts and capabilities for cyber survivability techniques and algorithms for counter-unmanned aerial systems. Continue development of a counter-unmanned aerial systems open architecture to enable interoperability. Continue evolution of autonomous machine learning functions, including the validation and demonstration of automated workflows into defensive cyber operations systems. Continue development of a model-assisted concolic firmware exploration and threat models based on device behavior. Continue conducting large scale device analysis and demonstration on AF-relevant system. Continue to create a capability to model, intercept, and synchronize the state of all embedded devices connected on a single bus. Continue development of a physics-based and topologically-based model of an intra-connected and inter-connected electric power grid and communications network. Continue research and develop the design, implementation, and evaluation of a proof-of-concept model to enable secure and efficient outsourcing of relational queries and Machine Learning training. Initiate research on the inference to untrusted clouds with cost-based optimization options, under Multiparty Computation (MPC) protocols with different threat models, guarantees, and physical deployments (i.e., Local Area Network, Wide Area Networks, Blockchain, or mixed) settings. Initiate research to implement a binary injection suite on software binaries. Initiate research on expansion of software introspection techniques to exploit introspection accelerator capabilities. Complete the implementation of multiparty computation and zero knowledge proof schemes over multiple content service providers.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.756 million. Justification for the increase is added emphasis in defensive technologies, including adversary behavior predictions, operational use of commercial cloud-computing platforms, and cyber situational awareness of friendly and adversarial systems.</p>				
Title: Cyber Offense Technologies		11.943	30.003	33.300

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 625319 / <i>Cyberspace Dominance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Develop offensive cyber operations technologies to access, maintain presence on, and deliver effects to adversary systems.</p> <p>FY 2023 Plans: Continue research and development of game changing technologies which employ dominant power for cyber offensive operations and information warfare to change the future fight. Continue research and development in capabilities for multi-function, non-kinetic cyber effects against adversarial systems. Continue demonstrating ground-based and airborne delivery of disrupt, deny, degrade, destroy, or deceive effects that are both cyber and physical/kinetic. Continue the advancement of research in systems performing blind data discovery associated with the Internet of Things. Continue research and development for the identification of items of interest associated with the Internet of Things. Continue research for specific items of interest within the Internet of Things.</p> <p>FY 2024 Plans: Continue research and development of game changing technologies which employ dominant power for cyber offensive operations and information warfare to change the future fight. Continue research and development in capabilities for multi-function, non-kinetic cyber effects against adversarial systems. Continue to demonstrate ground-based and airborne delivery of disrupt, deny, degrade, destroy, or deceive effects that are both cyber and physical/kinetic. Continue the advancement of research in systems to perform blind data discovery associated with the Internet of Things. Continue research and development for the identification of items of interest associated with the Internet of Things. Continue research for specific items of interest within the Internet of Things. Initiate development of a model of an Electrical Power and interconnected communication network. Initiate and complete the design, implementation, and test of user equipment positioning and geofencing methods.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$3.297 million. Justification for the increase is added emphasis in multi-function cyber effects, complexity capabilities against adversarial systems, and technology advancements to ensure cyberspace dominance.</p>			
Accomplishments/Planned Programs Subtotals	31.177	59.282	65.335

C. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

D. Acquisition Strategy
Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 2					R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>				Project (Number/Name) 62OMMS / <i>Research Site Support</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
62OMMS: <i>Research Site Support</i>	-	24.372	24.477	27.312	0.000	27.312	25.893	26.478	26.022	29.036	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force Research Laboratory Information Directorate leads the discovery, development and implementation of information science and technology to drive transformation within the Department of the Air Force and across the Department of Defense. The focus of the work is to provide the warfighter with the required technology-based capabilities to defend the Nation by unleashing the power of innovative information science and technology to anticipate, find, fix, track, target, engage, and assess anything, anytime, anywhere. Since the site is a single-purpose location which is not located on a military installation, the Information Directorate has unique requirements for supporting its science and technology mission. As the host unit, the directorate is responsible to provide the Rome Research Site infrastructure at Rome, New York and provide for the continued operations of all Rome Research Site properties, buildings, and services necessary for the research mission. Operations include: logistics and communication services, utilities, maintenance of facilities and structures, safety and security of the workforce and visiting researchers, and ensures compliance with the laws, regulations, and directives that pertain to site operations. These services are host unit responsibilities and are necessary to provide a safe and effective environment for the Research Site's workforce and mission.

B. Accomplishments/Planned Programs (\$ in Millions)

Title: Rome Research Infrastructure	FY 2022	FY 2023	FY 2024
Description: Provide the necessary services and support including, but not limited to: fire inspections, refuse collection, water, electricity, steam, heat, custodial, and grounds maintenance services to the Research Site. Provide the necessary support for the maintenance and repair of Research Site facilities (buildings and other structures), vehicle and equipment lease and security/safety inspections and services as necessary for compliance and safety/security of personnel and research assets. Provide the Research Site with long haul communications (using the Government Services Administration set of Networx contracts for Continental United States), trunk connectivity and wireless communications.	24.372	24.477	27.312
FY 2023 Plans: Continue providing civilian payroll and non-pay costs for installation operations in support of the Rome Research Site property and all onsite personnel. Continue providing facilities, facility operations, facility sustainment, support equipment, contracts, and associated costs to plan, manage and execute the following functions: fire prevention, disaster preparedness, plant operation and purchase of commodity, refuse collection, pavement clearance of snow and ice, grounds maintenance including landscaping, real property special inspections, pest control, and custodial services. Continue providing Real Property Management and Engineering Services, including: (1) Facility Management and Administration and (2) Installation Engineering Services. Facility Management includes public works management costs, contract management, material procurement, facility data management, furnishings management costs, and real estate management. Installation Engineering Services includes annual inspection of facilities, master planning, overhead of planning and design, overhead of construction management, and non Site Recovery Management service			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / <i>Dominant Information Sciences and Methods</i>	Project (Number/Name) 62OMMS / <i>Research Site Support</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>calls. Continue providing basic installation communication services, including long haul trunk and telecommunications services. Continue providing site vehicle lease for logistics, security, and mission support under the Government Services Administration.</p> <p>FY 2024 Plans: Continue providing civilian payroll and non-pay costs for installation operations in support of the Rome Research Site property and all onsite personnel. Continue providing facilities, facility operations, facility sustainment, support equipment, contracts, and associated costs to plan, manage and execute the following functions: fire prevention, disaster preparedness, plant operation and purchase of commodity, refuse collection, pavement clearance of snow and ice, grounds maintenance including landscaping, real property special inspections, pest control, and custodial services. Continue providing Real Property Management and Engineering Services, including: (1) Facility Management and Administration and (2) Installation Engineering Services. Facility Management includes public works management costs, contract management, material procurement, facility data management, furnishings management costs, and real estate management. Installation Engineering Services includes annual inspection of facilities, master planning, overhead of planning and design, overhead of construction management, and non Site Recovery Management service calls. Continue providing basic installation communication services, including long haul trunk and telecommunications services. Continue providing site vehicle lease for logistics, security, and mission support under the Government Services Administration.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.835 million due to increased costs of materials and labor in virtually every sector such as construction, building repair, pavement, pest control, fire and police equipment maintenance, vehicle maintenance, network services, and security.</p>			
Accomplishments/Planned Programs Subtotals	24.372	24.477	27.312

<p>C. Other Program Funding Summary (\$ in Millions) N/A</p> <p>Remarks</p>
<p>D. Acquisition Strategy Not applicable</p>

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	103.886	163.887	255.855	0.000	255.855	270.984	300.704	299.982	310.993	Continuing	Continuing
630320: <i>Air Force Vanguard</i> s	-	103.886	163.887	255.855	0.000	255.855	270.984	300.704	299.982	310.993	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Program uses a deliberate, data-driven strategy-to-investment approach to develop and deliver transformational operational capabilities through advanced technology solutions. These capabilities focus on the DAF Operational Imperatives and five strategic capabilities: Global Persistent Awareness; Resilient Information Sharing; Rapid, Effective Decision-Making; Complexity, Unpredictability, and Mass; and Speed and Reach of Disruption and Lethality.

A multi-disciplinary WARfighter - TECHnologist (WARTECH) process and analytics are used to understand and validate Department of the Air Force (DAF) Future Force priorities. Teams examine emerging technologies and recommend those which could produce new transformational capabilities. This approach allows the DAF to rapidly respond to emerging S&T opportunities within the budget cycle.

Technologies needing concept refinement become Vanguard Pathfinders to better define capability concepts. Current Vanguard Pathfinders are Integrated Electronic Warfare, Integrated Networks, Advanced Emulation for Test and Training, and Enabling Technology for Agile Basing.

Promising technologies with defined concepts are accelerated and matured as Vanguard Prospects. The DAF Technology Executive Officer partners with Air Force Futures (A5/7), USSF (CTIO, USSF/S5B), and the Deputy Assistant Secretary (Science, Technology and Engineering) to identify these technologies. Current Vanguard Prospects are Resolute Sentry, Fight Tonight, Long Range Kill Chains, and Area Effects Demonstration.

Matured technologies evolve into integrated system-of-systems concepts with transition partners and fielding strategies, known as Vanguard Programs. Vanguard Programs - high risk by design - are focused, priority initiatives with enterprise commitment aiming to answer specific questions to inform future acquisition programs, identify gaps, and areas for additional research. They are commissioned by the Under Secretary of the Air Force, Vice Chief of Staff of the Air Force, and Vice Chief of Space Operations as a Department of the Air Force (DAF).

The current Vanguard Programs are Navigation Technology Satellite 3 (NTS-3) and Rocket Cargo. NTS-3 will demonstrate technologies and tactics involving space, control, and user equipment for advanced satellite navigation, in order to provide robust and resilient, agile augmentation to the GPS system. Rocket Cargo will demonstrate new trajectories and ways to fly large rockets, the ability to land rockets at austere locations, and design & test an ejectable pod for air drop.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>
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This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	112.643	152.559	56.819	0.000	56.819
Current President's Budget	103.886	163.887	255.855	0.000	255.855
Total Adjustments	-8.757	11.328	199.036	0.000	199.036
• Congressional General Reductions	0.000	-90.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	5.000			
• Congressional Directed Transfers	0.000	96.990			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-8.757	0.000			
• Other Adjustments	0.000	-0.662	199.036	0.000	199.036

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 630320: *Air Force Vanguard*s

Congressional Add: *Program increase - automated geospatial intelligence detection algorithms*

Congressional Add Subtotals for Project: 630320

Congressional Add Totals for all Projects

	FY 2022	FY 2023
Congressional Add Subtotals for Project: 630320	0.000	5.000
Congressional Add Totals for all Projects	0.000	5.000

Change Summary Explanation

In FY 2023 and beyond, Program Element (PE) 0603032 Future AF Integrated Technology Demos, Project 630320 Air Force Vanguard, increases due to the realignment of Transformational Technology Development Efforts from 11 Budget Activity 03 Programs into this Program. This activity is not a new start as it is realigning from previously justified PEs. The following PE/ Projects are impacted: PE 0603112 Advanced Materials for Weapons Systems, Projects 633153 Non-Destructive Inspection Development and 633946 Materials Transition; PE 0603199 Sustainment Science and Technology, Project 635351 Technology Sustainment; PE 0603203 Advanced Aerospace Sensors, Projects 63665A Advanced Aerospace Sensors and Technology and 6369DF Target Attack and Recognition Technology; PE 0603211 Aerospace Technology Dev/Demo, Projects 634920 Flight Vehicle Tech Integration and 634927 Flight Systems Control; PE 0603216 Aerospace Propulsion & Power Technology, Projects 633035 Aerospace Power Technology, 634093 Missile Rocket Propulsion Integration and Demo, 634921 Aircraft Propulsion Subsystems Int; PE 0603270 Electronic Combat Technology, Projects 633720 EW Quick Reaction Capabilities, 63431G RF Warning & Countermeasures Technology, 634335 Cyber Concepts, 63691X EO/IR Warning & Countermeasures Technology; PE 0603456 Human Effectiveness Advanced Technology Development, Projects 635323 Directed Energy Bioeffects Parameters, 635324 Human Dynamics and Terrain Demonstration, 635325 Mission Effective Performance, 635327 Warfighter Interfaces; PE 0603601 Conventional Weapons Technology, Project 63670B Weapon Concept Development;

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>
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PE 0603605 Advanced Weapons Technology, Projects 633151 High Power Solid State Laser Technology, 633152 High Power Microwave Development and Integration; PE 0603788 Battlespace Knowledge Development & Demonstration, Projects 635321 C4I Battlespace Dev & Demo 635329 Cyber Battlespace Dev & Demo. Increase also represents increased emphasis on incubating the next generation of Vanguard Programs through the newly-described Vanguard Pathfinder efforts in this program. Pathfinder efforts represent technology maturation and risk reduction efforts in support of strategically-aligned topics intended to develop into future Vanguard candidates.

C. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: WARTECH</p> <p>Description: The Department of the Air Force needs to provide game-changing leap-ahead capabilities to meet future force designs. This effort identifies transformational science and technology investment opportunities through the WARfighter-TECHnologist (WARTECH) process. The WARTECH process enables the DAF enterprise to collaboratively translate future force design priorities and requirements into targeted multi-disciplinary science and technology investments.</p> <p>WARTECH accelerates capability development and responds to emerging technology opportunities by supporting integrated concept exploration. These investments support activities such as mission thread analyses to demonstrate military utility and software and hardware feasibility assessments. Select efforts will evolve into either a Vanguard Pathfinder to allow for further assessment and maturation or be designated a Vanguard Prospect indicating enterprise-level priority.</p> <p>FY 2023 Plans: Continue investments that address DAF priorities such as achieving operationally optimized command and control, achieving target engagement at scale, and defining optimized resilient basing, sustainment, and communications. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process.</p> <p>FY 2024 Plans: Initiate activities to mature and demonstrate advanced technology solutions, components and sub-system prototypes and models to accomplish successful large-scale widely distributed all-domain warfighter operations. Initiate activities to explore technologies that support achieving all-domain moving target engagement at scale in challenging operational environments. Continue activities exploring sensing technologies, investigating algorithm development to support battle management and command and control solutions, exploring alternative position navigation and timing techniques, supporting next generation air refueling, and exploring technology development and production of low-cost and high-speed weapons. Continue activities exploring technologies supporting offensive and defensive capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	8.358	1.880	21.108

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 funding increased compared to FY 2023 by \$19.228 million. This increase represents an increased emphasis on activities supporting sensing technologies, algorithm development to support battle management, command and control solutions, alternative position, navigation, and timing techniques, and low-cost, high-speed weapons.				
<p>Title: Navigation Technology Satellite 3 (NTS-3)</p> <p>Description: Develop and demonstrate advanced space-based navigation system technologies to provide resilient navigation support in contested environments. The demonstration includes a space-based test vehicle, ground based enterprise command and control, and agile software defined receivers for the user.</p> <p>FY 2023 Plans: Complete experimental operations training and rehearsals. Complete all experiment plans and finalize experimental procedures and 1-year on-orbit experiment schedule. Complete final user equipment software release and deploy all receivers to CONUS sites to support experimental data collection. Initiate support of pre-launch activities such as delivering certifications of flight readiness, shipping fully integrated and tested spacecraft to launch site, and supporting launch activities. Prepare for transition to follow-on residual operations.</p> <p>FY 2024 Plans: Continue supporting pre-launch activities. Initiate launch of satellite and perform early orbit operations. Initiate on-orbit experimentation. Initiate simulated operational test events through both receivers in the field and on-orbit transmitted signals. Initiate completion of mission objectives. Continue supporting transition of the overall system for conduct of residual use activities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$5.562 million. Funding decreased due to completing test & spacecraft integration and ground control system deployment to mission operations control site, completing final integrated system tests, completing experimental operations training and rehearsals, and launch integration.</p>		14.858	10.735	5.173
<p>Title: Skyborg</p> <p>Description: Skyborg is an autonomous, attritable vehicle architecture suite which will enable the Air Force to posture, produce and sustain multi-mission sorties at sufficient tempo to thwart adversary attempts at quick, decisive action in contested and highly contested environments. Skyborg is organized into three main lines of effort (LOEs). LOE 1 develops, demonstrates, and prototypes the Autonomy Core System (ACS) consisting of Skyborg autonomy architecture and software, enabling machine and manned-unmanned teaming, while also ensuring openness, modularity, and expandability of the Skyborg autonomy mission systems suite. The ACS LOE also develops, demonstrates, and prototypes the hardware components and Open Architecture standards needed to allow modular sensor, communication, and other payload integration into the Skyborg autonomy and vehicle architectures in systems integration laboratories and platforms. LOE 2 (Low-cost vehicles) develops, demonstrates,</p>		54.017	46.680	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>and prototypes new low cost attritable vehicle concepts and technologies for expeditionary mass generation including sortie generation employment concepts. LOE 3 (Operational Experimentation) conducts analysis and experimentation on concepts of operations and concepts of employment for attritable, autonomous, unmanned systems and assesses the openness, and modular capabilities / sensors integration for autonomous, attritable, aircraft and mission systems.</p> <p>FY 2023 Plans: Complete development, demonstration, and transition of Skyborg Autonomy Core System hardware and software open architecture and components. Complete maturation and transition of human systems interfaces for autonomous systems. Complete demonstration and transition of government open architectures for autonomous unmanned systems. Complete demonstration and transition of a DevSecOps pipeline for the Skyborg Autonomy Core system software architecture. Complete creation and start-up of a digital integration facility including a system integration laboratory, digital engineering modeling, simulation and analysis laboratory and hardware/software-in-the-loop test facility for transition of Skyborg technology to program customers.</p> <p>FY 2024 Plans: Skyborg technology transitioned to USAF Program of Record.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$46.680 million. Funding decreased due to S&T program transitioning to an acquisition program.</p>				
<p>Title: Golden Horde</p> <p>Description: Integrate networked collaborative technologies into selected inventory weapon systems. Technologies can include new payloads, weapon datalinks/radios, and autonomous behaviors that are bounded by operator-defined mission rules of engagement. Supports the integration of Air Force weapons into the Joint All-Domain Command/Control network. Develop new standard software and hardware architecture environment to accelerate change for new weapon systems. This environment will integrate new concept designs via simulations, virtual and live testing, and operational analysis, experiments and war games to show the value of collaborative weapons in increasing combat power across the spectrum of conflict. Work with Weapons Program Executive Officer to define requirements for future weapons and Concept of Operations.</p> <p>FY 2023 Plans: Complete development of the multi-tier digital weapon ecosystem, consisting of a high fidelity, government owned, open architected, live, virtual, and constructive development pipeline for Networked Collaborative and Autonomous (NCA) technology and tactics. Complete the Software Integration and Simulation Laboratory. Complete the hardware-in-the-loop environment. Complete conducting yearly challenges where both traditional and non-traditional suppliers can compete new NCA weapon</p>		0.000	18.812	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>technology using Government reference architectures to accelerate delivery and verification of new weapon technology. Complete building the repository of industry NCA weapon technology and containerized NCA algorithms/software to have off-the-shelf solutions for new weapon development programs. Initiate and complete demonstration of UAS surrogate capability to conduct high fidelity live constructive testing of NCA technology with a mix of live and simulated vehicles. Complete transition of the ecosystem to potential users/partners.</p> <p>FY 2024 Plans: Golden Horde multi-tier digital weapon ecosystem transition to Weapons Program Executive Officer.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$18.812 million. Funding decreased due to S&T program transitioning to Weapons Program Executive Officer.</p>			
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<p>Title: Rocket Cargo</p> <p>Description: Rocket Cargo is an S&T effort to leverage the multi-billion dollars of commercial investments in large reusable launch vehicles to extend the commercial rocket capabilities and create a novel DOD solution for global reach. DAF S&T efforts and resources are focused on the specific areas that are unique to military transport applications. The S&T objective is to determine the viability, performance, military utility, and business case of the commercial rocket capability. Potential investigation activities will include detailed mission & cost analyses, investigation of the harsh rocket plume interactions with landing surfaces, evaluation of rocket landing capabilities at austere sites, and human factors at landing sites. Investments will also determine the ability to airdrop cargo after reentry, will assess in-flight communications to the rocket, will test cargo environments and novel cargo "loadmaster" designs for rapid load/unload, and will evaluate rocket detectability and vulnerability.</p> <p>FY 2023 Plans: Continue multi-disciplinary S&T to expand commercial rocket capabilities for DOD global cargo delivery on tactical timelines. Continue investigations of rocket landing viability over a broader range of unprepared sites and non-standard landing surfaces relevant to rocket delivery directly to the point of need, including landing pad material surface degradation and human factors at the landing site. Complete initial rocket plume degradation assessments for high-temperature concrete at landing sites. Complete landing acoustic experiments and update DAF computational fluid dynamic (CFD) models. Initiate leveraging commercial full-scale rocket engine tests on concrete and other terrains to update computational simulations and predict landing surface degradation for DOD operations. Continue airdrop S&T on container freefall aerodynamics and stability through wind tunnel experiments to anchor CFD models. Complete wind tunnel experiments for rocket landing aerodynamics to support heavy landing maneuvers. Continue to leverage commercial rocket ground testing and commercial rocket flights to determine rocket cargo environments and performance, specifically to including 2nd stage rocket reentry and landing maneuvers that are unique to rocket delivery of 30 to 100 tons cargo. Complete assessment of rocket landing G-loads and compared to DOD standards for</p>	26.653	28.900	42.200
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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>air transport to guide container development S&T. Complete review of cargo payloads and cargo interfaces for heavy landing demonstration. Complete FFRDC analysis of mission applications and CONOPS for a specific use case. Continue quantitative S&T assessment of the rocket detectability and vulnerability, anchored with rocket flight data, to determine implications for military missions; incorporate these details into detailed mission analysis and the capability return on investment. Complete analysis of rocket vulnerability based on predicted flight trajectories. Complete assessment of detectability based on predicted flight trajectories and field-test campaigns. Continue development of mission planning tools for tactical cargo delivery timelines.</p> <p>FY 2024 Plans: Continue multi-disciplinary S&T to expand commercial rocket capabilities for DOD global cargo delivery on tactical timelines. Continue investigations of rocket landing viability over a broader range of unprepared sites and non-standard landing surfaces relevant to rocket delivery directly to the point of need, including landing pad material surface degradation and human factors at the landing site. Continue to leverage commercial full-scale rocket engine tests on concrete and other terrains to update computational simulations and predict landing surface degradation for DOD operations. Complete airdrop S&T on container freefall aerodynamics and stability through wind tunnel experiments to anchor computational fluid dynamics (CFD) models. Initiate new airdrop S&T on the high-speed separation physics for airdrop payload ejection from the rocket, including new wind tunnel capabilities. Continue to leverage commercial rocket ground testing and commercial rocket flights to determine rocket cargo environments and performance, specifically to including 2nd stage rocket reentry and landing maneuvers that are unique to rocket delivery of 30 to 100 tons cargo. Initiate new design tasks for a scheduled FY25 demonstration launch to transport 30 to 100 tons of cargo to an austere site. Initiate experiments of in-flight communications to the rocket during all phases of flight, including hypersonic reentry. Continue quantitative S&T assessment of the rocket detectability and vulnerability, anchored with rocket flight data, to determine implications for military missions; incorporate these details into detailed mission analysis and the capability return on investment. Continue development of mission planning tools for tactical cargo delivery timelines. Initiate testing of rapid cargo load/unload capabilities with DOD partners and optimize these for tactical timelines and the DOD logistics mission set.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$13.3 million. This funding increase is due to the scheduled ramp-up of several critical tasks on rocket CONOPS to begin preparations for a scheduled FY25 demonstration launch, initiation of new airdrop S&T on the high-speed separation physics for airdrop payload ejection from the rocket in wind tunnels, assessments of in-flight communications to the rocket during all phases of flight, and testing of rapid load/unload capabilities.</p>				
Title: Vanguard Prospect - Resolute Sentry		0.000	14.958	30.325
Description: Provides real-time multi-domain battlespace awareness in highly contested environments. Develops and demonstrates autonomous cross-domain, cross-platform integrated software and hardware capabilities that enable Intelligence, Surveillance, and Reconnaissance in unmanned airborne systems at the tactical edge in communications degraded and denied				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>
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C. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>environments. Resolute Sentry fuses information from multiple sources with on-board and local sensors to provide higher fidelity battlespace awareness information to the joint force as part of the Sensing Grid feed to the Joint All Domain Command and Control capability. Resolute Sentry leverages Open Mission Systems and Sensor Open Systems Architectures to maximize platform compatibility.</p> <p>FY 2023 Plans: Continue open systems assessments, development, maturation, integration, and testing of advanced sensor fusion, robust communications, and platform orchestration technologies integrated with advanced computing hardware for autonomous unmanned systems at the tactical edge. Continue modeling, simulation, and analysis of system design trades and Model Based System Engineering activities for the air domain. Continue air domain analyses and technology maturation for sensing systems integration, platform data fusion integration and system orchestration, and advanced analytics for on-board autonomous systems, systems trades analyses, and software integration. Continue software development and maturation of current advanced multi-platform autonomous system orchestration efforts for integration into the Systems Integration Laboratory/Hardware Integration Laboratory. Continue software interfaces analyses with off-board systems connected to Joint All-Domain Command and Control enterprise. Continue integration of robust communications applications with industry for highly contested environments. Continue integrated systems testing and demonstration planning for test and evaluation on surrogates and experimentation platforms. Continue Systems Integration Laboratory/Hardware Integration Laboratory, ground, and flight test planning supporting system verification and validation activities. Initiate program transition planning and documentation development of the overall system to a non-Air Force Research Laboratory organization.</p> <p>FY 2024 Plans: Continue assessments, development and maturation, integration, and testing of advanced sensor fusion, robust communications, and platform orchestration technologies integrated with advanced computing hardware for autonomous unmanned systems at the tactical edge. Continue modeling, simulation, and analysis of system design trades and Model Based System Engineering activities for the air domain. Continue existing technology maturation plans for sensing systems integration for the air domain, platform data fusion integration and orchestration, and advanced analytics for on-board autonomous systems, systems trades analyses, and software integration. Initiate software development and maturation of software/hardware mission management and multi-platform autonomous system orchestration efforts with industry for integration into the Systems Integration Laboratory/Hardware Integration Laboratory. Initiate software development interfaces with off-board systems connected to Joint All-Domain Command and Control enterprise. Continue integration of robust communications applications with industry for highly contested environments. Continue integrated systems testing and demonstration planning on experimentation platforms. Initiate hardware purchases for multi-platform flight testing and operational demonstration. Continue Systems Integration Laboratory/Hardware</p>			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Integration Laboratory, ground, and flight test planning and events supporting system verification and validation activities. Continue transition analysis, planning and documentation of the overall system.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$15.370 million. Increase represents realignment of FY 2023 efforts from the WARTECH line within this project to provide a more complete picture of the Vanguard program and supports new software, hardware, and interface development efforts.</p>				
<p>Title: Vanguard Prospect - Long Range Kill Chain</p> <p>Description: The Department of the Air Force (DAF) is prototyping and testing advanced techniques that utilize data sources from all domains to form and maintain the best possible targeting information against challenging adversary threats. This effort matures key special communications techniques and hardware required to utilize the assembled targeting information in tactically relevant timelines. The hardware and techniques matured under this effort will be inserted into the end-to-end kill chain.</p> <p>FY 2023 Plans: Initiate development of special communications equipment and techniques suitable for transmitting and receiving fused target data to and from tactically relevant platforms within the required timelines for mission success.</p> <p>FY 2024 Plans: Complete development of special communications equipment and techniques suitable for transmitting and receiving fused target data to and from tactically relevant platforms, including over-the-air demonstrations. Initiate demonstration of over-the-air performance of special communications techniques with a specific radio intended for use in selected tactical platforms, including assessment against known and anticipated adversary threats.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$20.320 million. Increase represents realignment of FY 2023 efforts from the WARTECH line within this project to provide a more complete picture of the Vanguard program and accelerates development of specialized equipment and multiple high-level demonstrations, integration, and security incorporation.</p>		0.000	5.566	25.882
<p>Title: Vanguard Prospect - Area Effects Demonstration</p> <p>Description: The Vanguard Prospect Area Effects Demo advances the development of high-speed area effects concepts. The effort consists of modeling and simulation conducted in conjunction with aerodynamic ground testing to validate the simulation methodology. The physics-based computations and ground testing provide risk reduction for flight demonstrations. The demonstration and data collected from the ground and flight experiments facilitate advanced tool development and enable tailored high speed area effects concepts.</p>		0.000	10.950	18.247

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Continue aerodynamic ground test campaign to generate data validation set. Continue pretest modeling of the aero-thermo ground test campaign. Continue the design, fabrication, and integration of the aero-thermo ground test activity. Initiate and complete the aero-thermo ground test activity. Continue modeling and analysis of flight test representative components. Initiate and complete the flight systems critical design review for flight hardware manufacture. Initiate the design and fabrication of the experimental test vehicle as well as the design, fabrication, and integration of the area effects concept.</p> <p><i>FY 2024 Plans:</i> Continue validating modeling and simulation tools using data obtained through ground testing of various flight-representative components. Complete the design and fabrication of the experimental test vehicle as well as the design, fabrication, and integration of the area effects concept. Initiate and complete flight test integration activities to include software in the loop testing; hardware in the loop testing; environmental testing; and other form, fit, function, and acceptance testing. Initiate and complete a flight test demonstrating the area effects concept. Using the flight test results, evaluate the accuracy of the pre-test simulations and inform future tool development efforts.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 funding increased compared to FY 2023 by \$7.300 million. Increase represents realignment of FY 2023 efforts from the WARTECH line within this project to provide a more complete picture of the Vanguard program and supports multiple flight, environmental, and hardware in the loop test activities.</p>				
<p><i>Title:</i> Vanguard Prospect - Fight Tonight</p> <p><i>Description:</i> Develop and demonstrate a transformational gaming engine and Artificial Intelligence based military planning capability enabling the Department of the Air Force to develop, assess, and continuously adapt the employment of combat power at the pace and scale needed for peer conflict, achieving decision advantage across highly dynamic and contested environments.</p> <p><i>FY 2023 Plans:</i> Continue development of software capability for theater scale plans rehearsal and analysis of plan options. Initiate development of plan adaptation from real-time data feeds. Initiate development of scalability and performance improvements to match pace and scale of target environment. Continue human-AI teaming assessment and apply findings to optimize system. Initiate demonstration of operational level planning capability on representative classified network and data, scaling software for digital plan rehearsal and plan adaptation and integrate with existing data used for operational mission. Initiate Systems Integration Laboratory deployment and user-driven assessment of software system effectiveness with Department of the Air</p>		0.000	20.406	39.118

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Force operational planners. Initiate transition planning of the software systems to non-Air Force Research Laboratory partners to address critical process and technology gaps.</p> <p>FY 2024 Plans: Complete development of software capability for theater scale plans rehearsal and analysis of plan options. Complete development of plan adaptation from real-time data feeds. Complete development of scalability and performance improvements to match pace and scale of target environment. Continue human-AI teaming assessment and apply findings to optimize system. Continue demonstration of operational level planning capability on representative classified network and data, scaling software for digital plan rehearsal and plan adaptation and integrate with existing data used for operational mission. Initiate Systems Integration Laboratory deployment and user-driven assessment of software system effectiveness with Department of the Air Force operational planners. Continue and accelerate transition planning of the software systems addressing critical process and technology gaps.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$18.712 million. Increase represents realignment of FY 2023 efforts from the WARTECH line to provide a more complete picture of the Vanguard program and enables deployment of developed software components to network-accessible Systems Integration Laboratory, integration into DAF experiments and exercises, and acceleration of system transition.</p>				
<p>Title: Analysis for Emerging Vanguard Pipeline</p> <p>Description: Conduct operational analysis and mission thread engineering activities assessing military utility and cost-effective implementations of emerging technology opportunities under consideration in the WARTECH process.</p> <p>FY 2023 Plans: N/A</p> <p>FY 2024 Plans: Initiate activities performing modeling, simulation, and analyses assessing the military utility of candidate Transformational Component investments. Continue assessments informing decisions to promote candidate technologies in the WARTECH process.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$10.350 million. This increase represents a realignment of work from the WARTECH effort within this project to provide a more complete picture of the Vanguard program.</p>		0.000	0.000	10.350
<p>Title: Vanguard Pathfinder - Integrated Electronic Warfare</p>		0.000	0.000	23.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Description: The Department of the Air Force has a need to identify, protect against and counter evolving adversarial electromagnetic threats to enhance aircraft survivability and mission success. This effort identifies and assesses advanced electromagnetic, directed energy and cyber technologies to rapidly recognize threats from electromagnetic sources and protect against emerging threats with offensive and defensive electronic attack techniques. This effort includes algorithm and tool development with modeling, simulation and analysis and hardware-in-the loop testing.</p> <p>FY 2023 Plans: N/A</p> <p>FY 2024 Plans: Initiate activities assessing, integrating, and demonstrating advanced electronic warfare technology solutions, components and sub-systems, to accomplish warfighter relevant engagements at scale. Initiate implementation of open, flexible, and reprogrammable hardware and software architectures, applications and algorithms that enable threat environment data collection and analysis/synthesis to assess operationally optimized situational awareness and demonstrate countermeasures, waveforms/techniques against modern and emerging threats in challenging electromagnetic (EM) spectrum operating environments. Initiate activities integrating, demonstrating, and advancing the technical maturity of software algorithms, adaptive techniques and autonomy-based approaches and assess awareness of and responses to threats across the EM spectrum. These activities include the integration and demonstration of hardware and software applications and algorithms in simulated environments and field experiments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$23.000 million. This increase establishes the activities necessary to begin the transformational portion of this capability maturation effort.</p>				
<p>Title: Vanguard Pathfinder - Integrated Networks</p> <p>Description: The Department of the Air Force has a need to communicate with Joint partners and to provide battle management during complex military operations. This effort identifies and assesses accessible, resilient, and secure bi-directional information exchange technology solutions, components and sub-systems, to enable seamless movement of data to the right place at the right time informing effective decision making on military relevant timescales. Efforts support the integration of applications and algorithms into flexible hardware and software architectures to achieve movement of appropriate data across multiple security levels, and modeling and simulation to assess information exchanges for large-scale all-domain warfighter operations.</p> <p>FY 2023 Plans:</p>		0.000	0.000	12.502

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
N/A				
<p>FY 2024 Plans: Initiate efforts identifying technology in the areas of next-generation cross domain solutions incorporated into flexible networking architectures demonstrating the technical feasibility of improved communication methods. Initiate supporting emulation efforts establishing the scalability of emerging technologies. These activities may include the integration and demonstration of hardware and software applications and algorithms in simulated environments and field experiments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$12.502 million. This increase establishes the activities necessary to begin the transformational portion of this capability maturation effort.</p>				
<p>Title: Vanguard Pathfinder - Enabling Technology for Agile Basing</p> <p>Description: The Department of the Air Force is evaluating agile basing concepts to prepare against threats to its forward operating bases from evolving adversary capabilities. This effort encompasses assessment and maturation of technologies that will enhance survivability in agile basing scenarios.</p> <p>FY 2023 Plans: N/A</p> <p>FY 2024 Plans: Initiate activities developing technologies and metrics evaluating effectiveness of technologies for improving resilience of agile operating bases. Initiate efforts maturing capabilities that invoke a combination of techniques and technologies in support of agile basing defense, enable modeling and simulation to assess their effectiveness and vulnerabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$13.000 million. This increase establishes the activities necessary to begin this transformational capability maturation effort.</p>		0.000	0.000	13.000
<p>Title: Vanguard Pathfinder - Advanced Emulation for Test and Training</p> <p>Description: The Department of Air Force has a need to prepare our forces for joint military operations through simulation of major conflicts and training activities. This effort integrates, assesses and demonstrates mature science and technology solutions supporting test and training in the synthetic environment to enable future force operations.</p> <p>FY 2023 Plans:</p>		0.000	0.000	14.950

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603032F / <i>Future AF Integrated Technology Demos</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
N/A			
FY 2024 Plans: Initiate development and demonstration of a Synthetic Operational Test and Training Infrastructure capability to support test, training, and experimentation for multi-domain operations by integrating high-fidelity command and control functions with existing test and training infrastructure. Initiate cross disciplinary research for autonomous collaborative platform development to further enhance system integration laboratory supporting next-generation autonomy.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$14.950 million. This increase establishes the activities necessary to begin the transformational portion of this capability maturation effort.			
Accomplishments/Planned Programs Subtotals	103.886	158.887	255.855

	FY 2022	FY 2023
Congressional Add: Program increase - automated geospatial intelligence detection algorithms	0.000	5.000
FY 2022 Accomplishments: Not applicable.		
FY 2023 Plans: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	0.000	5.000

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	60.566	49.765	30.372	0.000	30.372	32.704	34.331	35.907	37.968	Continuing	Continuing
632100: <i>Laser Hardened Materials</i>	-	21.050	18.295	15.957	0.000	15.957	16.655	16.764	17.107	17.726	Continuing	Continuing
633153: <i>Non-Destructive Inspection Development</i>	-	2.555	4.806	5.178	0.000	5.178	4.564	4.716	4.812	4.986	Continuing	Continuing
633946: <i>Materials Transition</i>	-	36.961	26.664	9.237	0.000	9.237	11.485	12.851	13.988	15.256	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates advanced materials and process technologies to satisfy Department of the Air Force requirements in areas such as survivability, readiness, affordability, and new processes and materials. These projects ensure the Department of the Air Force weapon systems are ready and able when needed.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	63.378	29.116	34.883	0.000	34.883
Current President's Budget	60.566	49.765	30.372	0.000	30.372
Total Adjustments	-2.812	20.649	-4.511	0.000	-4.511
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	25.000			
• Congressional Directed Transfers	0.000	-4.351			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-2.809	0.000			
• Other Adjustments	-0.003	0.000	-4.511	0.000	-4.511

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 632100: *Laser Hardened Materials*

Congressional Add: *Program increase - laser protective eyewear*

Congressional Add: *Program increase - advanced aerospace materials technology development and testing*

Congressional Add Subtotals for Project: 632100

Project: 633946: *Materials Transition*

Congressional Add: *Program increase - Metals Affordability Research*

Congressional Add: *Program increase - polymer printing technology for additive manufacturing*

Congressional Add: *Program increase - certification for advanced materials*

Congressional Add Subtotals for Project: 633946

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	1.756	0.000
	0.000	10.000
	1.756	10.000
	9.758	10.000
	4.879	5.000
	14.637	0.000
	29.274	15.000
	31.030	25.000

Change Summary Explanation

Decrease in FY 2023 and FY 2024 is due to Congressionally directed transfer into Program 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>				Project (Number/Name) 632100 / <i>Laser Hardened Materials</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
632100: <i>Laser Hardened Materials</i>	-	21.050	18.295	15.957	0.000	15.957	16.655	16.764	17.107	17.726	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials technologies that enhance protection for Department of the Air Force personnel to ensure safety and to enable them to perform required missions in threat environments. Advanced materials technologies also enhance protection for Department of the Air Force sensors and systems to ensure safety, survivability, and operability in threat environments.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Aerospace Systems Protection	11.109	4.816	10.372
Description: Develop and demonstrate materials technologies that enhance hardening for sensors, avionics, and components to increase survivability and mission effectiveness of Department of the Air Force systems.			
FY 2023 Plans: Continue to validate and assess the demonstrated results and transition the use of protection technologies for future sensor designs and strategies to mitigate directed energy damage for visual/near, short-wave, and mid-wave infrared detectors. Continue transitioning new technologies and integrate the developments into light, operator friendly survivable electro-optic sensors that provide full spectrum protection for missile warning. Continue analyzing the high-performance properties of damage limiting semiconductor materials designed to harden electro-optic imaging sensors. Continue to transition developed laser countermeasures for survivability of dynamic electro-optic/infrared imagers. Continue to advance the employment and integration of evolved computational materials science to model materials characteristics to increase accuracy and shorten design cycle time of coatings development for use in sensor hardening. Continue development of materials for survivable next generation aircraft sensor systems. Complete technology development and maturation of anti-access munitions hardening.			
FY 2024 Plans: Continue validating and assessing the demonstrated results and transition the use of protection technologies for future sensor designs and strategies to mitigate directed energy damage for visual/near, short-wave, and mid-wave infrared detectors. Continue transitioning technologies and integrate the developments into light, operator friendly survivable electro-optic sensors that provide full spectrum protection for missile warning. Continue analyzing the high-performance properties of damage limiting semiconductor materials designed to harden electro-optic imaging sensors. Continue transitioning developed laser countermeasures for survivability of dynamic electro-optic/infrared imagers. Continue advancing the employment and integration of evolved computational materials science to model materials characteristics to increase accuracy and shorten design cycle time			

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 632100 / <i>Laser Hardened Materials</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
of coatings development for use in sensor hardening. Continue development of materials for survivable next generation aircraft sensor systems. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increased compared to FY 2023 by \$5.556 million. Funding increase is due to increased emphasis on survivable aircraft sensor systems				
Title: Aircrew Protection Description: Develop and demonstrate materials technologies that enhance protection for Department of the Air Force personnel to ensure safety and to enable crews to perform required missions in a threat environment. FY 2023 Plans: Continue to develop, validate, demonstrate, and transition laser protection materials and technologies for personnel protection. Continue to validate and develop light-weight helmet-mounted sensor hardening materials focusing on next-generation nighttime specialized sensors. Continue to advance transition efforts and development of visor based aircrew protection materials with agile protection. Continue to evaluate and assess new materials and advances in characterization and demonstration of eye protection technologies using computational materials science tools. Continue to transition, validate, mature, and test improvements to functionality and performance of personnel protection technologies in expected operational conditions. Continue development and testing of materials technologies to protect against nuclear flash blindness. FY 2024 Plans: Continue developing, validating, demonstrating, and transitioning laser protection materials and technologies for personnel protection. Complete validation and development of light-weight helmet-mounted sensor hardening materials focusing on next-generation nighttime specialized sensors. Continue advancing transition efforts and development of visor based aircrew protection materials with agile protection. Continue evaluating and assessing materials and advances in characterization and demonstration of eye protection technologies using computational materials science tools. Continue transitioning, validate, mature, and test improvements to functionality and performance of personnel protection technologies in expected operational conditions. Continue development and testing of materials technologies to protect against nuclear flash blindness. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.106 million. Funding increased due to increased emphasis on visor based aircrew protection.		8.185	3.479	5.585
Title: Transformational Technology Development Description: This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas		0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 632100 / <i>Laser Hardened Materials</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through advanced materials technologies for hardening avionics, sensors, and components and increasing personnel protection. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard, effort Vanguard Prospect - Fight Tonight.</p> <p>FY 2024 Plans: Not applicable.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not applicable,</p>			
Accomplishments/Planned Programs Subtotals	19.294	8.295	15.957

	FY 2022	FY 2023
Congressional Add: Program increase - laser protective eyewear	1.756	0.000
FY 2022 Accomplishments: Conducted Congressionally directed efforts.		
FY 2023 Plans: Not Applicable		
Congressional Add: Program increase - advanced aerospace materials technology development and testing	0.000	10.000
FY 2022 Accomplishments: Not applicable.		
FY 2023 Plans: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	1.756	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 632100 / <i>Laser Hardened Materials</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u> <u>Base</u>	<u>FY 2024</u> <u>OCO</u>	<u>FY 2024</u> <u>Total</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>FY 2028</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• RDTE 03 0603112F: <i>Advanced Materials for Weapon Systems</i>	0.000	0.000	0.000	-	0.000	-	-	-	-	0.000	0.000

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>				Project (Number/Name) 633153 / <i>Non-Destructive Inspection Development</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
633153: <i>Non-Destructive Inspection Development</i>	-	2.555	4.806	5.178	0.000	5.178	4.564	4.716	4.812	4.986	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced nondestructive inspection and evaluation technologies to monitor performance integrity and to detect failure causing conditions in weapon systems components and materials. Nondestructive inspection and evaluation capabilities greatly influence and/or limit many design, manufacturing, and maintenance practices. This project provides technology to satisfy Department of the Air Force requirements to extend the lifetime of current systems through increased reliability and cost-effectiveness at field and depot maintenance levels. Equally important is assuring manufacturing quality, integrity, and safety requirements are built in.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Special Material Inspection Technologies	0.235	1.202	1.295
Description: Develop and demonstrate advanced inspection technologies supporting special material systems to enhance affordability and ensure full performance and survivability.			
FY 2023 Plans: Continue the transition process to depots and flight lines for improved methods to acquire and analyze data to facilitate improved characterization, registration, and tracking of degradation and damage to special materials that enables/ensures more affordable coatings assessment. Continue to validate tools to improve characterization and failure modes of specialty multilayer coatings. Continue to develop automation for robotic technologies for visual inspections that will realize human-assisted inspection capabilities and begin to provide capabilities for automated multi-spectral characterization.			
FY 2024 Plans: Continue the transition process to depots and flight lines for improved methods to acquire and analyze data to facilitate improved characterization, registration, and tracking of degradation and damage to special materials that enables/ensures more affordable coatings assessment. Continue validating tools to improve characterization and failure modes of specialty multilayer coatings. Continue developing automation for robotic technologies for visual inspections that will realize human-assisted inspection capabilities and provide capabilities for automated multi-spectral characterization.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by 0.093 million. Funding increase due to above described plans.			
Title: Advanced System Monitoring Technologies	0.706	3.604	3.883

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 633153 / <i>Non-Destructive Inspection Development</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Description: Develop and demonstrate advanced systems status monitoring technologies to provide on-board and embedded sensing to gain continuous awareness of the state of key subsystems.</p> <p>FY 2023 Plans: Continue to demonstrate advanced analytical methods to more accurately assess the location, and register spatial location, of damage detected using nondestructive inspection data and results. Develop augmented reality technologies to improve the process of performing non-destructive evaluation tasks, acquiring and archiving data and reporting results, and enabling improved inspector guidance and visualization. Continue development and transition of novel approaches to collect, analyze, transport, archive, and use digital nondestructive inspection data and information. Continue enhanced methods for compiling, reporting, collecting and rapidly analyzing digital nondestructive testing and evaluation data necessary for improved damage detection and characterization. Demonstrate and transition technologies to locate damage to composite structures without coating removal and to inspect composite structures with complex geometry. Continue the transition and integration of computational materials science tools to provide data necessary for life prediction methods to enable risk-based life management.</p> <p>FY 2024 Plans: Continue demonstrating advanced analytical methods to more accurately assess the location, and register spatial location, of damage detected using nondestructive inspection data and results. Develop augmented reality technologies to improve the process of performing non-destructive evaluation tasks, acquiring and archiving data and reporting results, and enabling improved inspector guidance and visualization. Continue development and transition of novel approaches to collect, analyze, transport, archive, and use digital nondestructive inspection data and information. Continue enhanced methods for compiling, reporting, collecting and rapidly analyzing digital nondestructive testing and evaluation data necessary for improved damage detection and characterization. Demonstrate and transition technologies to locate damage to composite structures without coating removal and to inspect composite structures with complex geometry. Continue the transition and integration of computational materials science tools to provide data necessary for life prediction methods to enable risk-based life management.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by 0.279 million. Funding increase due to the above described plans.</p>				
<p>Title: Transformational Technology Development</p> <p>Description: This effort initiates new and continues existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through developments in nondestructive inspection and evaluation technologies to monitor performance integrity and detect</p>		1.614	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 633153 / <i>Non-Destructive Inspection Development</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>failures before they affect they system. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard, effort Vanguard Prospect - Area Effects Demo.</p> <p>FY 2024 Plans: Not applicable.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not applicable.</p>			
Accomplishments/Planned Programs Subtotals	2.555	4.806	5.178

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 633946 / <i>Materials Transition</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
633946: <i>Materials Transition</i>	-	36.961	26.664	9.237	0.000	9.237	11.485	12.851	13.988	15.256	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials and processing technologies for fielded and planned Department of the Air Force weapon, airframe, aerospace structure, protection, and propulsion applications. Advanced materials and processes that have matured beyond applied research are characterized, critical data are collected, and critical evaluations in the proposed operating environment are performed. This design and scale-up data improves the overall affordability of promising materials and processing technologies, providing needed initial incentives for their industrial development.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Air Vehicle Materials Technologies</p> <p>Description: Develop and demonstrate materials and processes technologies for air vehicle and subsystems to enhance lift, propulsion, power generation management, survivability, and affordability of air vehicles.</p> <p>FY 2023 Plans: Continue development of technologies for organic engine lifing analysis for enhanced engine component risk management capability. Continue development and characterization for transitioning materials to protect infrared apertures on next generation hardened assets. Continue to validate and verify results of microstructure sensitive lifing methodologies that lower life cycle cost and advance performance characteristics of airframe and engine components in order to start development of next generation modeling tools that incorporate residual stress effects on component life. Continue development and characterization of materials for application in nuclear systems and protection for next-generation hardened assets.</p> <p>FY 2024 Plans: Complete development of technologies for organic engine lifing analysis for enhanced engine component risk management capability. Continue development and characterization for transitioning materials to protect next generation hardened assets. Complete microstructure sensitive lifing methodologies that lower life cycle cost and advance performance characteristics of airframe and engine components in order to start development of next generation modeling tools that incorporate residual stress effects on component life. Continue development and characterization of materials for next-generation hardened assets.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$6.427 million. Funding decrease due to completion of lifing methodologies and analysis development.</p>	5.854	11.664	5.237
<p>Title: Counter Intelligence, Surveillance, and Reconnaissance Technologies</p>	0.000	0.000	4.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 633946 / <i>Materials Transition</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Develop and demonstrate multiple intelligence technologies to degrade adversarial Intelligence, Surveillance, and Reconnaissance (ISR) collection and analysis to cause enemy decisions and actions which favor Department of the Air Force mission goals. This work directly supports both passive airbase defense and overall theatre operations.</p> <p>FY 2023 Plans: Not applicable as effort is starting in FY2024.</p> <p>FY 2024 Plans: Initiate developmental efforts in counter ISR technologies across multiple collection domains in a tactically coordinated way that considers all relevant operational environments. Initiate development of a closed-loop simulation in a digital test environment with a human in the loop and quantify the utility of techniques incorporating cost, size, weight and power requirements.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY2024 increased by \$4.000 million due to increased focus on counter ISR technologies.</p>			
<p>Title: Transformational Technology Development</p> <p>Description: This effort initiates new and continues existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through characterization and data evaluation of advanced materials in potential operational environment in order to improve affordability. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard, effort Vanguard Prospect - Area Effects Demo.</p> <p>FY 2024 Plans: Not applicable.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	1.833	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603112F / <i>Advanced Materials for Weapon Systems</i>	Project (Number/Name) 633946 / <i>Materials Transition</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Not applicable.				
Accomplishments/Planned Programs Subtotals		7.687	11.664	9.237
		FY 2022	FY 2023	
Congressional Add: Program increase - Metals Affordability Research		9.758	10.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.				
FY 2023 Plans: Conduct Congressionally directed efforts.				
Congressional Add: Program increase - polymer printing technology for additive manufacturing		4.879	5.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.				
FY 2023 Plans: Conduct Congressionally directed efforts.				
Congressional Add: Program increase - certification for advanced materials		14.637	0.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.				
FY 2023 Plans: Not applicable				
Congressional Adds Subtotals		29.274	15.000	
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
N/A				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603199F / <i>Sustainment Science and Technology (S&T)</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	17.598	10.662	10.478	0.000	10.478	12.533	12.939	13.206	13.684	Continuing	Continuing
635351: <i>Technology Sustainment</i>	-	17.598	10.662	10.478	0.000	10.478	12.533	12.939	13.206	13.684	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This program develops and demonstrates mature Air Force Research Laboratory (AFRL) sustainment technologies such as: materials, corrosion, maintenance/repair techniques, state awareness/non-destructive inspection, health management, life prediction, composite materials and logistics for transition into fielded Department of the Air Force systems to reduce life cycle sustainment costs and increase readiness. Technologies matured and demonstrated impact affordability and availability of fielded aerospace weapon systems by reducing sustainment costs, extending service life, and maintaining mission readiness and capability. This program develops and demonstrates maintenance, life cycle management, and system/fleet decision making technologies that can be implemented to address operational sustainment issues and could influence future system sustainability decisions via risk reduction to support inclusion into new systems. Studies are conducted to analyze processes and methodologies for application of technologies to address sustainment issues across the force, identifying cross cutting applications for fielded systems, and opportunities for building in sustainability into future applications. This program also develops and demonstrates affordable advanced composites for aircraft structures of fielded and emerging systems. This includes studies, analyses, and tests for application of composites to address sustainment and affordability issues across the force.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603199F I Sustainment Science and Technology (S&T)
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	19.112	10.695	11.368	0.000	11.368
Current President's Budget	17.598	10.662	10.478	0.000	10.478
Total Adjustments	-1.514	-0.033	-0.890	0.000	-0.890
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	-0.033			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-1.514	0.000			
• Other Adjustments	0.000	0.000	-0.890	0.000	-0.890

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Title: Prevention/Enhanced Maintainability Technologies	4.849	5.544	5.449
Description: Develop, demonstrate, and transition maintenance and sustainment technologies to improve component design, maintenance, replacement, and concepts for performance improvement and reduced maintenance burden for the Department of the Air Force.			
FY 2023 Plans: Continue rapid repair and materials development for aircraft battle damage repair of advanced fighter aircraft. Continue advanced canopy technology development. Continue total body nondestructive evaluation system for outer mold line inspection of advanced fighter aircraft. Continue development of materials and processes to reduce maintenance burden on aerospace systems. Continue efforts to demonstrate high reliability of repair and maintenance technologies to increase service time between maintenance actions. Continue to develop, demonstrate, and transition maintenance and sustainment technologies to improve component design, maintenance, repair, replacement, and concepts for maintainer training, extending part life, and reduced maintenance burden spanning Department of the Air Force mission areas of Air, Space, and Cyber. Complete development of abrasion resistance coating to protect composite material substrates. Complete development of a flexible crack-blunting primer.			
FY 2024 Plans: Continue rapid repair and materials development for aircraft battle damage repair of advanced fighter aircraft. Continue advanced canopy technology development. Continue total body nondestructive evaluation system for outer mold line inspection of advanced fighter aircraft. Continue development of materials and processes to reduce maintenance burden on aerospace systems. Continue efforts to demonstrate high reliability of repair and maintenance technologies to increase service time between maintenance actions. Continue to develop, demonstrate, and transition maintenance and sustainment technologies to improve component			

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603199F / <i>Sustainment Science and Technology (S&T)</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
design, maintenance, repair, replacement, and concepts for maintainer training, extending part life, and reduced maintenance burden spanning Department of the Air Force mission areas of Air, Space, and Cyber. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.095 million. Funding decreased due to completion of the development of the flexible crack-blunting primer.				
Title: Management/Improved Reliability Technologies Description: Develop, demonstrate, and transition technologies to improve existing and new components, fleet management/decision-making tools, and supply chain/sustainment infrastructure to decrease downtime and costs, and increase reliability. FY 2023 Plans: Continue system development to provide prognostic capabilities for avionics components and analysis techniques to extend engine component service life. Continue efforts to develop system fleet management decision-making tools, maintenance/repair database technologies and techniques, and supply chain/infrastructure approaches to reduce sustainment costs. These efforts span Department of the Air Force mission areas of Air, Space, and Cyber. Continue efforts based on competitive selection processes in FY 2021. FY 2024 Plans: Continue system development to provide prognostic capabilities for avionics components and analysis techniques to extend engine component service life. Continue efforts to develop system fleet management decision-making tools, maintenance/repair database technologies and techniques, and supply chain/infrastructure approaches to reduce sustainment costs. These efforts span Department of the Air Force mission areas of Air, Space, and Cyber. Continue efforts based on competitive selection processes in FY 2021. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.089 million. Funding decreased due to the plans described above.		4.537	5.118	5.029
Title: Transformational Technology Development Description: This effort initiates and continues Transformational Technology Developments. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to: materials, corrosion, maintenance/repair techniques, state awareness/non-destructive inspection, health management, life prediction, low observable materials and processes, composite materials and logistics technologies that affect mission availability. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of		8.212	0.000	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603199F / <i>Sustainment Science and Technology (S&T)</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.			
<i>FY 2023 Plans:</i> In FY 2023 this effort will be realigned under Program 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard, effort WARTECH.			
<i>FY 2024 Plans:</i> Not applicable.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Not applicable.			
Accomplishments/Planned Programs Subtotals	17.598	10.662	10.478

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	50.326	37.917	48.046	0.000	48.046	49.880	44.969	45.057	46.372	Continuing	Continuing
63665A: <i>Advanced Aerospace Sensors Technology</i>	-	20.421	16.204	29.373	0.000	29.373	30.297	24.919	25.222	25.806	Continuing	Continuing
6369DF: <i>Target Attack and Recognition Technology</i>	-	29.905	21.713	18.673	0.000	18.673	19.583	20.050	19.835	20.566	Continuing	Continuing

A. Mission Description and Budget Item Justification

The program develops and demonstrates advanced technologies for electro-optical sensors, radar sensors and electronic counter-countermeasures, and components and algorithms. It also develops and demonstrates radio frequency (RF) and electro-optical (EO) sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets obscured by natural or man-made means. This program develops the means to find, fix, target, track, and engage air and ground targets anytime, anywhere, and in any weather. This program creates and applies artificial intelligence toolsets to ensure an asymmetric advantage for the Department of the Air Force. The program demonstrates artificial intelligence enabled autonomy to augment cognitive capabilities of our Airmen and Guardians so they can keep up with the faster pace and increased complexity of warfare. This program has been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

The Department of the Air Force technologies in this program are both enabling and enduring as we invest in maturing emerging technologies that address established mission gaps, and transformational technologies that address integrated enterprise capabilities intended to reshape the future force across air, space, and cyber warfighting domains. Development of transformational operational capabilities through advanced technology solutions focuses on five strategic capabilities: Global Persistent Awareness; Resilient Information Sharing; Rapid, Effective Decision-Making; Complexity, Unpredictability, and Mass; and Speed and Reach of Disruption and Lethality.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	53.750	36.997	42.398	0.000	42.398
Current President's Budget	50.326	37.917	48.046	0.000	48.046
Total Adjustments	-3.424	0.920	5.648	0.000	5.648
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	5.600			
• Congressional Directed Transfers	0.000	-4.680			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-3.424	0.000			
• Other Adjustments	0.000	0.000	5.648	0.000	5.648

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 6369DF: *Target Attack and Recognition Technology*

Congressional Add: *Program increase: software verification and validation for autonomous sensors*

Congressional Add: *Modular open autonomous software testing*

Congressional Add Subtotals for Project: 6369DF

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	9.017	-
	-	5.600
	9.017	5.600
	9.017	5.600

Change Summary Explanation

In FY 2023, Congressional Directed Reductions were due to realignment into Program 0603032F, Future AF Integrated Technology Demos, Project 0603030, Air Force Vanguard, in order to more appropriately categorize the funding according to purpose.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>				Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
63665A: <i>Advanced Aerospace Sensors Technology</i>	-	20.421	16.204	29.373	0.000	29.373	30.297	24.919	25.222	25.806	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project area develops and demonstrates aerospace sensor and processing technologies for intelligence, surveillance, reconnaissance, target, and attack radar applications in both manned and unmanned platforms, including electro-optical sensors and electronic counter-countermeasures for radars. It provides aerospace platforms with the capability to precisely detect, track, and target both airborne (conventional and low radar cross-section) and ground-based, high-value, time-critical targets in adverse clutter and jamming environments. Project activities include developing multi-function radio-frequency systems including radar and electronic warfare technology and the position and timing information to enable distributed sensing. Desired warfighting capabilities include the ability to detect concealed targets in difficult background conditions.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Passive/Multi-Mode Sensing	7.171	10.123	0.000
Description: Develop advanced techniques and prototype passive radio frequency sensors to intercept, collect, locate and track enemy radio frequency sensor systems for intelligence, surveillance and reconnaissance of air and ground targets.			
FY 2023 Plans: Complete development of core illumination selection manager algorithms that operate in complex signal environments. Continue mission level modeling to evaluate system effectiveness for relevant operational scenarios. Complete implementation of electronic support, passive radar and ISM subsystems in advanced wideband digital active electronically scanned arrays. Perform a ground-based integrated demonstration incorporating a state-of-the-art digital active electronically scanned arrays. Complete implementation of illumination selection manager into sensor resource manager, demonstrating that illumination selection manager subsystem interfaces are compliant with open architectures. Continue integration of illumination selection manager and/or passive multi-mode radar on existing airborne platforms. Continue planning for follow-on airborne demonstration.			
FY 2024 Plans: In FY 2024 technical work from this effort has been realigned to Program Advanced Aerospace Sensors, 0603203F; Project Advanced Aerospace Sensors Technology, 63665A; Multi-Spectrum Sensing Demonstration effort.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 decreased compared to FY 2023 by \$10.123 million. Decrease is a result of realignment of funding to Program Advanced Aerospace Sensors, 0603203F; Project Advanced Aerospace Sensors Technology, 63665A; Multi-Spectrum Sensing Demonstration effort.				
<p>Title: Triple Raven Advanced Technology Demonstration</p> <p>Description: Advance, demonstrate, and transition innovative imaging and non-imaging optical sensing technologies for surveillance and reconnaissance of airborne and ground-based objects of interest in an anti-access/area denial environment. This effort includes the development of systems, subsystems, and components necessary to yield new capabilities.</p> <p>FY 2023 Plans: Complete development of turbulence mitigation algorithms. Complete assembly of the entire passive and active electro-optical sensor system. Complete long range mountain-to-ground demonstration of the system at a Government test range. Demonstrate performance of system during airborne data collections and ability of the system to meet program office data collection needs.</p> <p>FY 2024 Plans: In FY 2024 technical work from this effort has been realigned to Program Advanced Aerospace Sensors, 0603203F; Project Advanced Aerospace Sensors Technology, 63665A; Multi-Spectrum Sensing Demonstration effort.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$6.081 million. Decrease is a result of realignment of funding to Program Advanced Aerospace Sensors, 0603203F; Project Advanced Aerospace Sensors Technology, 63665A; Multi-Spectrum Sensing Demonstration effort.</p>		8.179	6.081	0.000
<p>Title: Multi-Spectrum Sensing Demonstration</p> <p>Description: Develop and demonstrate new techniques for finding and identifying critical mobile targets (both land and maritime) in a highly contested environment. Bring together electro-optical/infrared and radio frequency technologies suitable for the contested environment (both airborne and space-based), in conjunction with advanced processing and algorithms to provide for decision-making at the edge. Multiple sensing modalities may be deployed on the same platform or on separate platforms to improve survivability and flexibility. A focus is on providing actionable information to a user making a decision for future actions, such as strike. The program will conduct a robust demonstration showing how the techniques enable combat operations, emphasizing resilience and tactically-relevant persistence.</p> <p>FY 2023 Plans:</p>		-	0.000	14.373

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>In FY 2023 technical work in this effort was described in Program Advanced Aerospace Sensors, 0603203F; Project Advanced Aerospace Sensors Technology, 63665A; Passive/Multi-Mode Sensing and Triple Raven Advanced Technology Demonstration efforts.</p> <p>FY 2024 Plans: Initiate investigation of employment concepts for penetrating intelligence, surveillance and reconnaissance, and strike to bound platforms along with their costs and available payloads. Initiate definition of options for electro-optical/infrared sensors drawing on prior work on low cost, size, weight, and power sensors and algorithms. Initiate work on an attritable laser radar sensor based on prior multi-mode laser radar work. Initiate definition of options for radio frequency sensors and techniques drawing on prior work on low-cost multi-function radio frequency sensors and distributed radio frequency techniques. Initiate planning for experiments to refine distributed radio frequency techniques. Initiate investigation into paths to bring legacy sensors into compliance with Department of Defense and Department of the Air Force open interface standards. Initiate stand up a hardware/software integration lab to verify open standard compliance. Continue to leverage prior work on sensor fusion to initiate a focused effort on fusion in support of command and control to engage surface (ground and maritime) targets.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$14.373 million. Increase is a result of realignment of funding from Program Advanced Aerospace Sensors, 0603203F; Project Advanced Aerospace Sensors Technology, 63665A; Passive/Multi-Mode Sensing and Triple Raven Advanced Technology Demonstration efforts.</p>				
<p>Title: Surface Targets Sense-Making</p> <p>Description: Provides real-time multi-domain battlespace awareness in highly contested environments. Develops and demonstrates autonomous cross-domain, cross-platform integrated software and hardware capabilities that enables Intelligence, Surveillance, and Reconnaissance, against high value maritime targets, in unmanned airborne systems at the tactical edge in communications degraded and denied environments. Fusion of information from multiple sources with on-board and local sensors to provide higher fidelity battlespace awareness information to the joint force as part of the Sensing Grid feed to the Joint All Domain Command and Control capability. Leverages Open Mission Systems and Sensor Open Systems Architectures to maximize platform compatibility.</p> <p>FY 2023 Plans: Not Applicable</p> <p>FY 2024 Plans: Initiate assessment and selection of surface sensing and sense-making capabilities to provide multi-modal surface target classification. Initiate assessment and selection of sensing autonomy capabilities that will enable multi-modal and distributed sensor resource management that will optimize the tracking and identification of high value surface targets. Initiate the expansion</p>		0.000	0.000	15.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>of existing Modeling, Simulation, and Analysis products to represent the maritime scenario of interest and enable the necessary assessment of system design trades and associated Model Based System Engineering activities. Initiate algorithm development of mission autonomy solutions that would enable the orchestration of unmanned airborne systems for ISR support to maintain custody of high value maritime targets. Initiate the algorithm development of advanced analytics to forecast the behavior of priority surface targets. Initiate software and hardware integration of contributing algorithms into the Systems Integration Laboratory/Hardware Integration Laboratory. Initiate investigation into the optimization of existing interfaces with off-board systems connected to Joint All Domain Command and Control enterprise to enable the sharing of relevant Multi-Intelligence/Multi-Domain data sources. Initiate advanced hardware purchases for multi-platform Live, Virtual, and Constructive testing and operational experimentation. Initiate transition analysis, planning and documentation of the overall system to a transition partner.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$15 million. Increase is a result of changes of Air Force priorities in response to the Operational Imperatives effort.</p>			
<p>Title: Transformational Technology Development</p> <p>Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through electro-optical and radio frequency sensing capabilities and algorithms. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort was realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>	5.071	0.000	0.000
Accomplishments/Planned Programs Subtotals	20.421	16.204	29.373

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 63665A / <i>Advanced Aerospace Sensors Technology</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>				Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
6369DF: <i>Target Attack and Recognition Technology</i>	-	29.905	21.713	18.673	0.000	18.673	19.583	20.050	19.835	20.566	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project area develops and demonstrates advanced technologies for closed-loop, multi-domain, multi-intelligence sources, multi-platform, multi-sensor automation and autonomy, providing capabilities in battle management, fire control, battlespace awareness and visualization, predictive analytics, target recognition, sensor and information fusion, and sensor / platform asset tasking. This project also conducts advanced investigations to determine solution credibility, in terms of underlying technology and in terms of consistency with future Air Force missions within highly contested environments. This project includes robust techniques to support intelligence, surveillance, and reconnaissance and targeting missions within adverse weather conditions and against adversaries employing deceptive techniques. This project includes development of software-intensive solutions suitable for cloud-based integration and for development/operations-like operational environments. This project develops technology for effective management of online and offline information sources incorporating both constrained and cooperative sensing. This project has been realigned to better reflect technical areas being emphasized such as autonomy, multi-domain and multi-sensor information processing, leverage of machine learning developments and enterprise-level modeling, simulation and analysis.

This project includes the initiation and development of programs addressing DAF capability gaps and provides technologies for transformational future force capabilities. Transformational efforts will be identified through a competitive process and be responsive to DAF design priorities. Selected efforts will be designated as transformational, indicating enterprise-level priority.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Multidomain Analytic Development - Evolution	13.871	14.228	0.000
Description: Develop enabling capabilities and technical know-how required for Department of the Air Force multi-domain command and control within highly contested environments through closed-loop central and decentralized sensing for battle management, automated onboard systems that use complex reasoning for situational awareness (SA) leading "intelligent" response, executive reasoning for selectable re-planners that provide task allocation. Use of shared models with both onboard reasoners and mission simulation and evaluation. Built with government-owned scalable closed-loop algorithms.			
FY 2023 Plans: Continue the integration and demonstration of onboard and off-board intelligence, surveillance and reconnaissance algorithms to build a dominating intelligence, surveillance and reconnaissance capability against our adversaries. Continue the model, simulate and test new algorithm advancements for detection, identification, tracking, fusion, battle space awareness, predictive and prescriptive analytics, reasoning over an adversaries actions, collection, and execution of sensing and platform resources.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue integration of new component capabilities aimed at augmenting existing Department of the Air Force capability by developing processes used to generate adversary activity models and using those models to automatically generate indications and warnings alerts. Continue to integrate all components in an open-architecture testbed running on a cloud-based environment.</p> <p>FY 2024 Plans: FY 2024 funding the technical work from this effort has been realigned to Program Advanced Aerospace Sensors, 0603203F; Project Target Attack and Recognition Technology, 6369DF; Integrated Sensing Demonstration and Autonomous Capability for Air Defense efforts.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$14.228 million. Decrease is a result of realignment of funding to Program Advanced Aerospace Sensors, 0603203F; Project Target Attack and Recognition Technology, 6369DF; Integrated Sensing Demonstration and Autonomous Capability for Air Defense efforts.</p>			
<p>Title: Resilient & Agile Mission Systems Architecture</p> <p>Description: This project performs advanced development and demonstration of methods, technologies, and tools to enable resilience and protect mission systems against threats. This involves open and adaptable architectures for rapid integration and agile systems, cyber protections and resilience technologies to protect against threats. It integrates research efforts in electronic and cyber warfare to demonstrate novel operational capabilities through laboratory, field, and flight tests and experimentation. The goal is to reduce risk for rapid transition of novel operational capabilities into Air Force mission systems.</p> <p>FY 2023 Plans: Continue investigations to evolve and mature open architecture standards. Continue development of advanced networking, processing, advanced computing paradigms, and cybersecurity technologies for next-generation avionics mission system capabilities. Apply agile software technologies and digital engineering techniques for rapid and affordable development, integration, and prototype capability demonstrations. Initiate development of Reference Architecture Implementation for resilient mission systems.</p> <p>FY 2024 Plans: FY 2024 funding and the technical work from this effort has been realigned to Program Advanced Aerospace Sensors, 0603203F; Project Target Attack and Recognition Technology, 6369DF; Integrated Sensing Demonstration and Autonomous Capability for Air Defense efforts.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	3.388	1.885	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 decreased compared to FY 2023 by \$1.885 million. Decrease is a result of realignment of funding to Program Advanced Aerospace Sensors, 0603203F; Project Target Attack and Recognition Technology, 6369DF; Integrated Sensing Demonstration and Autonomous Capability for Air Defense efforts.				
<p>Title: Integrated Sensing Demonstration</p> <p>Description: Integrate emerging technologies to demonstrate enhanced forward air-layer air base defense capabilities. Goal is to improve surveillance, shorten reaction time, and to apply a range of effects at precise points to provide early warning and enable defensive measures.</p> <p>FY 2023 Plans: Not applicable</p> <p>FY 2024 Plans: Initiate development and integration of demonstrated Air Force Research Laboratory technologies, emerging commercial capabilities and program of record systems into a forward air-layer air base defense mission-focused capability. Employ mission level modeling and model-based systems engineering to provide quantifiable data to drive towards solution sets that provide leading capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$12.249 million. Increase is a result of realignment of funding from Program Advanced Aerospace Sensors, 0603203F; Project Target Attack and Recognition Technology, 6369DF; Multidomain Analytic Development - Evolution and Resilient & Agile Mission Systems Architecture efforts.</p>		0.000	0.000	12.249
<p>Title: Autonomous Capability for Air Defense</p> <p>Description: Design, develop and demonstrate an artificial intelligence tactical autopilot engaging in multi-ship/multi-role beyond visual range and intelligence, surveillance and reconnaissance combat operations with proficiency at or greater than Weapons School graduates. Design, develop and demonstrate an artificial intelligence-driven multi-platform/multi-domain sense-making, predictive analytics, and orchestration at the tactical edge to track/identify air and ground targets; Autonomous Air Combat Operations.</p> <p>FY 2023 Plans: Not applicable</p> <p>FY 2024 Plans: Initiate integration and demonstration of edge sensing assets cued via centralized intelligence data on air threats. Initiate evaluation of on board fusion and predictive analytics to inform orchestration of attributable platforms into areas of interest. Initiate</p>		0.000	0.000	6.424

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
testing and evaluation of multi-platform resource managers to position assets for optimal sensing geometries. Initiate development of advanced autonomy algorithms using modern machine learning tools that control the aircraft, sensors, and weapons onboard manned and/or unmanned aircraft and perform operationally relevant combat tactics.				
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$6.424 million. Increase is a result of realignment of funding from Program Advanced Aerospace Sensors, 0603203F; Project Target Attack and Recognition Technology, 6369DF; Multidomain Analytic Development - Evolution and Resilient & Agile Mission Systems Architecture efforts.				
Title: Transformational Technology Development		3.629	0.000	0.000
Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through multi-sensor automation and autonomy, battlespace awareness and visualization, predictive analytics, target recognition, sensor and information fusion, and sensor/platform asset tasking. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.				
FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry.				
FY 2024 Plans: Not Applicable				
FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable				
Accomplishments/Planned Programs Subtotals		20.888	16.113	18.673
		FY 2022	FY 2023	
Congressional Add: Program increase: software verification and validation for autonomous sensors		9.017	-	

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603203F / <i>Advanced Aerospace Sensors</i>	Project (Number/Name) 6369DF / <i>Target Attack and Recognition Technology</i>
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	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct Congressional directed efforts		
Congressional Add: Modular open autonomous software testing	-	5.600
FY 2023 Plans: Conduct Congressional directed efforts		
Congressional Adds Subtotals	9.017	5.600

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force / BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603211F / <i>Aerospace Technology Dev/Demo</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	98.806	95.267	51.896	0.000	51.896	77.684	74.981	76.246	100.203	Continuing	Continuing
634094: <i>Next Gen Platform Dev/Demo</i>	-	15.964	14.740	6.591	0.000	6.591	6.736	6.900	7.042	7.298	Continuing	Continuing
634920: <i>Flight Vehicle Tech Integration</i>	-	71.941	26.399	13.008	0.000	13.008	26.119	12.291	12.543	34.616	Continuing	Continuing
634926: <i>High Speed Systems Integ & Demo</i>	-	5.281	37.080	13.611	0.000	13.611	32.038	36.959	37.714	39.080	Continuing	Continuing
634927: <i>Flight Systems Control</i>	-	5.620	17.048	18.686	0.000	18.686	12.791	18.831	18.947	19.209	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program supports Department of Defense (DoD) priorities for demonstrations in hypersonics and manned/unmanned systems, respectively. This effort integrates and demonstrates advanced flight vehicle technologies that improve the performance and supportability of existing and future aerospace vehicles. System level integration brings together aerospace vehicle technologies along with avionics, propulsion, and weapon systems for demonstration in a near-realistic operational environment. Integration and technology demonstrations reduce the risk and time required to transition technologies into operational aircraft. Additionally, this effort supports the nuclear enterprise and nuclear deterrence through advanced component and technology demonstrations. Projects in this program have been coordinated through the DoD Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 0602298F, and 1206601SF.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603211F I Aerospace Technology Dev/Demo
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	105.486	54.727	63.167	0.000	63.167
Current President's Budget	98.806	95.267	51.896	0.000	51.896
Total Adjustments	-6.680	40.540	-11.271	0.000	-11.271
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	40.540			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-6.680	0.000			
• Other Adjustments	0.000	0.000	-11.271	0.000	-11.271

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 634920: Flight Vehicle Tech Integration

Congressional Add: Program increase - Heavy fuel engine hybrid electric ducted fan advanced propulsion

Congressional Add: Program increase - Small unit autonomous UAS resupply

Congressional Add: Unmanned adversary air platform

Congressional Add: Bonded unitized composites large scale structural demonstration

Congressional Add: Program increase - digital design studio

Congressional Add: Airborne missile defense beam Director development and Flight Environment Qualification

Congressional Add Subtotals for Project: 634920

Project: 634926: High Speed Systems Integ & Demo

Congressional Add: Hypersonic aircraft rapid prototyping

Congressional Add Subtotals for Project: 634926

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	14.451	-
	19.268	-
	-	10.000
	-	10.000
	-	2.000
	-	1.000
	33.719	23.000
	-	30.000
	-	30.000
	33.719	53.000

Change Summary Explanation

FY 2024 funding decreased in the FY 2024PB compared to the FY 2023PB by \$11.271 million. The decrease is due to Transformational Technology work relocating PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603211F / Aerospace Technology Dev /Demo				Project (Number/Name) 634094 / Next Gen Platform Dev/Demo			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634094: Next Gen Platform Dev/Demo	-	15.964	14.740	6.591	0.000	6.591	6.736	6.900	7.042	7.298	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project demonstrates advanced nuclear-related components and technologies in support of the nuclear enterprise and nuclear deterrence operations missions. Next Gen Platform Development/Demonstration efforts are accomplished through development, integration, testing, and evaluation of various technologies to include fuzes, aeroshells, inertial guidance, and nuclear-specific communications for demonstration in near-realistic operational environments.

This Project and associated efforts will continue to be executed by the Air Force Research Laboratory Space Vehicles Technology Directorate located in Kirtland Air Force Base, New Mexico.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Advanced Nuclear Components	15.964	14.740	6.591
Description: Develop next-generation solid state, radiation-hardened strategic advance inertial system components for hostile environment.			
FY 2023 Plans: Continue iterative development of inertial measurement unit (IMU) prototypes, including nested sensor configuration of gyroscope and accelerometer technologies, and environmental testing. Continue development of radiation hardened electronics supporting nested sensor design. Continue to mature covariance analysis through test data inputs from sensor/system testing.			
FY 2024 Plans: Continue iterative development of inertial sensor systems, including gyroscope and accelerometer technologies for a nested sensor configuration insertion into an IMU, in coordination with PE 0603273 guidance technology development. Continue development of radiation hardened electronics/components supporting the nested sensor design. Continue laboratory and environmental testing of IMU components. Complicate concept design and testing of radiation hardened solid-state gyroscope technology. Continue covariance analysis improvement through sensor/system test data inputs to predict IMU performance.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$8.149 million due to maturation of accelerometer and gyroscope and inertial sensors, integration and testing funded and described in PE 0603273.			
Accomplishments/Planned Programs Subtotals	15.964	14.740	6.591

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force			Date: March 2023		
Appropriation/Budget Activity 3600 / 3		R-1 Program Element (Number/Name) PE 0603211F / <i>Aerospace Technology Dev /Demo</i>		Project (Number/Name) 634094 / <i>Next Gen Platform Dev/Demo</i>	

C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u> <u>Base</u>	<u>FY 2024</u> <u>OCO</u>	<u>FY 2024</u> <u>Total</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>FY 2028</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• RDTE 03 0603273F: <i>Science & Technology for Nuclear Re-entry Systems</i>	0.000	39.431	70.162	-	70.162	87.945	118.933	155.791	161.244	Continuing	Continuing

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603211F / Aerospace Technology Dev /Demo				Project (Number/Name) 634920 / Flight Vehicle Tech Integration			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634920: <i>Flight Vehicle Tech Integration</i>	-	71.941	26.399	13.008	0.000	13.008	26.119	12.291	12.543	34.616	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project demonstrates advanced aerospace vehicle technologies. Aerospace Vehicle Technology Integration efforts are accomplished through integration of various technologies to include avionics, advanced propulsion, and weapon systems for demonstration in near-realistic operational environments. Advanced Aerospace Structures Technologies are demonstrated to enhance the capability of current and future aerospace vehicles.

This project includes the initiation and development of programs addressing DAF capability gaps and provides technologies for transformational future force capabilities. Transformational efforts will be identified through a competitive process and be responsive to DAF design priorities. Selected efforts will be designated as transformational, indicating enterprise-level priority.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Aerospace Vehicle Technology Integration	38.222	3.399	13.008
Description: Develop, simulate, and demonstrate integrated technologies to improve the performance of aerospace platform capabilities.			
FY 2023 Plans: Continue development and initiate flight test of a next variant of a low cost unmanned aerospace system. Initiate the development of a forward weapons employment derivative of a low cost unmanned aerospace system.			
FY 2024 Plans: Complete the fabrication and continue flight test of a sensor variant of a low cost unmanned aerospace system. Continue the development of technology demonstrations for a forward weapons employment derivative of a low cost unmanned aerospace system. Initiate build of the affordable weapons platform for future flight experimentation.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$9.609 million. Funding increased due to increased emphasis in Aerospace Vehicle Technology Integration and continued technology development and demonstrations for low-cost unmanned aerospace systems. Including weapons separation certification for the new class of air vehicles.			
Title: Transformational Technology Development	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603211F / Aerospace Technology Dev /Demo	Project (Number/Name) 634920 / Flight Vehicle Tech Integration

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: This effort initiates and continues existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through integration techniques for technologies including avionics, advanced propulsion, and weapon systems. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: Continue to develop and demonstrate a capability for high speed delivery of area effects. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process.</p> <p>FY 2024 Plans: In FY 2023 and beyond, this work is performed under PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: N/A</p>			
Accomplishments/Planned Programs Subtotals	38.222	3.399	13.008

	FY 2022	FY 2023
Congressional Add: Program increase - Heavy fuel engine hybrid electric ducted fan advanced propulsion FY 2022 Accomplishments: Conduct Congressionally directed efforts.	14.451	-
Congressional Add: Program increase - Small unit autonomous UAS resupply FY 2022 Accomplishments: Conduct Congressionally directed efforts.	19.268	-
Congressional Add: Unmanned adversary air platform	-	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603211F / <i>Aerospace Technology Dev /Demo</i>	Project (Number/Name) 634920 / <i>Flight Vehicle Tech Integration</i>
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	FY 2022	FY 2023
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration.		
Congressional Add: Bonded unitized composites large scale structural demonstration	-	10.000
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration.		
Congressional Add: Program increase - digital design studio	-	2.000
FY 2023 Plans: Conduct Congressionally directed efforts.		
Congressional Add: Airborne missile defense beam Director development and Flight Environment Qualification	-	1.000
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration.		
Congressional Adds Subtotals	33.719	23.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603211F / <i>Aerospace Technology Dev /Demo</i>				Project (Number/Name) 634926 / <i>High Speed Systems Integ & Demo</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634926: <i>High Speed Systems Integ & Demo</i>	-	5.281	37.080	13.611	0.000	13.611	32.038	36.959	37.714	39.080	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops, integrates and demonstrates, via simulations, ground, and flight tests, advanced flight vehicle technologies that improve the performance and supportability of future high speed/hypersonic vehicles. System level integration brings together air vehicle technologies with avionics, propulsion, warheads and other aerospace subsystems for demonstration in a near-realistic operational environment. Integration and technology demonstrations reduce the risk and time required to transition technologies into operational systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Speed/Hypersonic Vehicle Technologies	5.281	7.080	13.611
Description: Develop, simulate, and demonstrate integrated vehicle technologies to enable and improve the performance of future high-speed and hypersonic systems.			
FY 2023 Plans: Continue Multi-Mission Cruiser technology maturation activities to expand performance capabilities of high speed systems. Initiate robust digital engineering framework, model-based systems engineering, and multi-level modeling, simulation & analysis (MS&A) for accelerated, focused technology development.			
FY 2024 Plans: Continue Multi-Mission Cruiser technology maturation activities to expand performance capabilities of high speed systems. Continue robust digital engineering framework, model-based systems engineering, and multi-level modeling, simulation & analysis (MS&A) for accelerated, focused technology development and demonstration. Initiating design work for expendable hypersonic multi-mission ISR and Strike demo.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$6.531 million. Funding increase due to increased emphasis in engineering framework and technology maturation work in thermal structures; initiate design work for expendable hypersonic multi-mission ISR and Strike demo.			
Accomplishments/Planned Programs Subtotals	5.281	7.080	13.611

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603211F / <i>Aerospace Technology Dev /Demo</i>	Project (Number/Name) 634926 / <i>High Speed Systems Integ & Demo</i>
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	FY 2022	FY 2023
Congressional Add: Hypersonic aircraft rapid prototyping	-	30.000
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603211F, Aerospace Technology Dev/Demo, Project 634926, High Speed Systems Integ & Demo.		
Congressional Adds Subtotals	-	30.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603211F / Aerospace Technology Dev /Demo	Project (Number/Name) 634927 / Flight Systems Control
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634927: <i>Flight Systems Control</i>	-	5.620	17.048	18.686	0.000	18.686	12.791	18.831	18.947	19.209	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This program integrates and demonstrates advanced control technologies that improve the performance, reliability, safety, and survivability of existing and future, manned and unmanned, aerospace systems. Enhanced capabilities are enabled by control, automation, and system level integration of subsystems and systems such as propulsion, airframes, avionics, power & thermal management, weapons, communications, and operator interfaces. Modeling and simulation, integration, and technology demonstrations in a near-operational environment reduce the risk and time required to transition technologies into existing and future aerospace systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Autonomous Systems Control</p> <p>Description: Develop, simulate, and demonstrate advanced automation and control-enabled capabilities for manned or unmanned aerospace platforms. Develop, simulate, and demonstrate autonomous flight controls for safe flight and cooperative operations between manned and remotely piloted air platforms.</p> <p>FY 2023 Plans: Complete development and demonstration of technologies for situational awareness, autonomous control, and survivability for unmanned systems and manned platforms. Continue research to incorporate autonomous and safe airspace interoperability for manned and remotely piloted aircraft systems, airborne control of teams of unmanned aircraft, and unmanned sense and avoid technologies for ground and air operations to the autonomy spiral demonstrations.</p> <p>FY 2024 Plans: Continue research to incorporate autonomous and safe airspace interoperability for manned and remotely piloted aircraft systems, airborne control of teams of unmanned aircraft, and unmanned sense and avoid technologies for ground and air operations. Initiate development and autonomy spiral demonstrations of advanced autonomy to manage a heterogeneous team of attritable and expendable aircraft without human interaction in complex missions and challenging threat environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY2024 increased compared to FY2023 by \$1.638 million. Funding increase due to increase emphasis on autonomy development and demonstration for rapid transition to enable autonomous collaboration capability.</p>	5.620	17.048	18.686
<p>Title: Transformational Technology Development</p> <p>Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which</p>	0.000	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603211F / <i>Aerospace Technology Dev /Demo</i>	Project (Number/Name) 634927 / <i>Flight Systems Control</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through advanced control technologies to improve manned and unmanned aerospace systems, modeling and simulation, and integration. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: Continue investments leveraging Artificial Intelligence and gaming technologies to accelerate Department of the Air Force capability to create theatre-scale operational plans within hours. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process.</p> <p>FY 2024 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320, Air Force Vanguards, effort Vanguard Prospect - Fight Tonight and effort Future Transformational Capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: N/A</p>			
Accomplishments/Planned Programs Subtotals	5.620	17.048	18.686

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603216F I Aerospace Propulsion and Power Technology
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	103.219	94.540	56.789	0.000	56.789	72.309	73.463	68.940	71.454	Continuing	Continuing
633035: Aerospace Power Technology	-	32.499	22.049	10.067	0.000	10.067	10.105	10.145	10.345	10.648	Continuing	Continuing
634093: Missile Rocket Propulsion Integ & Demo	-	18.657	13.192	6.045	0.000	6.045	6.067	5.681	5.797	6.006	Continuing	Continuing
634921: Aircraft Propulsion Subsystems Int	-	17.019	41.862	17.411	0.000	17.411	23.597	20.020	14.411	15.023	Continuing	Continuing
635098: Advanced Aerospace Propulsion	-	16.227	17.437	23.266	0.000	23.266	32.540	37.617	38.387	39.777	Continuing	Continuing
63681B: Advanced Turbine Engine Gas Generator	-	18.817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to achieve enabling and revolutionary advances in turbine, advanced-cycle, rocket, and space propulsion as well as electrical power, thermal management, and fuels. The program has five current projects, each focusing on technologies with a high potential to enhance the performance of existing and future Air Force weapon systems. The Aerospace Power Technology project develops and demonstrates adaptive power and thermal management components, controls, and systems for high-power payloads and aircraft as part of energy-optimized aircraft development. The Aircraft Propulsion Subsystems Integration project develops demonstrator engines by integrating the engine cores demonstrated in the Advanced Turbine Engine Gas Generator project with low-pressure components. The Advanced Aerospace Propulsion project develops the scramjet propulsion cycle to a technology readiness level appropriate for in-flight demonstration and for full integration with other engine cycles (including turbine and rocket based). The Advanced Turbine Engine Gas Generator project develops and demonstrates core turbine engine technologies for current and future aircraft propulsion systems. The Missile Rocket Propulsion project develops and demonstrates innovative rocket propulsion technologies, propellants, and manufacturing techniques.

All transfers detailed below are administrative realignments due to the stand up of the United States Space Force, and not new starts. This work will continue to be executed by the Air Force Research Laboratory Aerospace Systems Technology Directorate located in Wright Patterson Air Force Base, OH, Edwards Air Force Base, CA, or Arnold Air Force Base, TN.

In FY2022, the work and funding associated with advanced space technology demonstrations in Program 0603216F, Aerospace Propulsion, Project 634922, Space & Missile Rocket Propulsion, are transferred to Appropriation 3620F, Research, Development, Test & Evaluation, Space Force, Program 1206616SF, Space Advanced Technology Development/Demo, Project 634922, Space & Missile Rocket Propulsion, due to the creation of a new Appropriation for Space Force.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>
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In FY 2022, the work and funding associated with missile rocket propulsion technologies in Program 0603216F, Aerospace Propulsion, are transferred from Project 634922, Space & Missile Rocket Propulsion, to Project 634093, Missile Rocket Propulsion Integ & Demo due to the creation of a new Appropriation for Space Force.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 0602298F, and 1206601SF.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

Projects in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	110.273	64.254	85.665	0.000	85.665
Current President's Budget	103.219	94.540	56.789	0.000	56.789
Total Adjustments	-7.054	30.286	-28.876	0.000	-28.876
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	30.286			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-7.047	0.000			
• Other Adjustments	-0.007	0.000	-28.876	0.000	-28.876

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 633035: *Aerospace Power Technology*

Congressional Add: *Program increase - Silicon carbide research*

Congressional Add: *Program increase - Domestic manufacturing of solid state power controllers*

	FY 2022	FY 2023
	9.634	10.000
	9.634	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add Subtotals for Project: 633035	19.268	10.000
Project: 634093: <i>Missile Rocket Propulsion Integ & Demo</i>		
Congressional Add: <i>Program increase - Hypersonic liquid rocket propulsion</i>	9.634	-
Congressional Add: <i>Program increase - Altitude chamber infrastructure upgrades</i>	4.817	5.000
Congressional Add: <i>Advanced hybrid engine rocket development</i>	-	5.000
Congressional Add Subtotals for Project: 634093	14.451	10.000
Project: 634921: <i>Aircraft Propulsion Subsystems Int</i>		
Congressional Add: <i>Low spool generator capabilities</i>	-	5.000
Congressional Add: <i>Program increase - turbo air cool HTPEM hydrogen fuel cell development</i>	-	12.330
Congressional Add Subtotals for Project: 634921	-	17.330
Congressional Add Totals for all Projects	33.719	37.330

Change Summary Explanation

FY 2024 funding decreased in the FY 2024PB compared to the FY 2023PB by \$28.876 million. The decrease is due to Transformational Technology work relocating PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>				Project (Number/Name) 633035 / <i>Aerospace Power Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
633035: <i>Aerospace Power Technology</i>	-	32.499	22.049	10.067	0.000	10.067	10.105	10.145	10.345	10.648	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates system and subsystem integration to include adaptive architectures, controls, actuation, electrical power, thermal management, and distribution for aerospace applications. This project develops and demonstrates the components, controls and systems required to satisfy the operational needs of current and future aircraft and enables the use of future high-power payloads. This technology enhances reliability and survivability, and reduces vulnerability, weight, and life cycle costs of air platforms. The electrical power system components developed are projected to provide a two-fold to five-fold improvement in aircraft reliability and maintainability, and a reduction in power system weight. This project is integrated into energy optimized aircraft efforts and power and thermal programs.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Power Aircraft Subsystem Technologies	13.231	12.049	10.067
Description: Develop and demonstrate integrated architecture, controls and components for power generation, conditioning, and distribution; energy storage components; and thermal management and subsystem technologies for integration into high power aircraft.			
FY 2023 Plans: Complete development and demonstration of system and component electrical power, electro-mechanical, and thermal technologies for high-power aircraft. Complete the development of hybrid-cycle power and thermal management system. Complete development of advanced power generation and distribution system. Continue development and demonstration of integrated, adaptive megawatt- class tactical aircraft power and thermal capability. Continue development and demonstration of megawatt class architecture, controls and integration. Complete development and demonstration of robust electrical power systems for megawatt applications. Complete development and demonstration of thermal management systems for megawatt applications.			
FY 2024 Plans: Complete development and demonstration of integrated, adaptive megawatt- class tactical aircraft power and thermal capability. Complete development and demonstration of megawatt class architecture, controls and integration. Initiate development and demonstration of integrated power, thermal, and propulsion technologies for medium-scale systems. Initiate architecture and technology assessment and digital integration.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 633035 / <i>Aerospace Power Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY2024 decreased compared to FY2023 by \$1.982 million. Funding decreased due to completion of development and demonstration of megawatt class architecture, controls, and integration.			
<p>Title: Transformational Technology Development</p> <p>Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through engine core and low spool component technologies. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: Continue to develop and demonstrate a capability for high speed delivery of area effects. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process.</p> <p>FY 2024 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Area Effects Demonstration and effort Future Transformational Capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: N/A</p>	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	13.231	12.049	10.067

	FY 2022	FY 2023
Congressional Add: Program increase - Silicon carbide research	9.634	10.000
FY 2022 Accomplishments: Conduct Congressionally directed efforts.		
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603216F, Aerospace Propulsion and Power Technology, Project 633035, Aerospace Power Technology.		
Congressional Add: Program increase - Domestic manufacturing of solid state power controllers	9.634	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 633035 / <i>Aerospace Power Technology</i>

	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct Congressionally directed efforts.		
Congressional Adds Subtotals	19.268	10.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>				Project (Number/Name) 634093 / <i>Missile Rocket Propulsion Integ & Demo</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634093: <i>Missile Rocket Propulsion Integ & Demo</i>	-	18.657	13.192	6.045	0.000	6.045	6.067	5.681	5.797	6.006	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops technologies for the sustainment of strategic systems (including solid rocket motor boosters and missile propulsion, post boost control, and aging and surveillance efforts) and tactical rockets. Characteristics such as environmental acceptability, affordability, reliability, responsiveness, reduced weight, and reduced operation and launch costs are emphasized. Increased life and performance of propulsion systems are key goals. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion technologies and high-energy propellants. Aging and surveillance thrusts for solid rocket motors could reduce lifetime prediction uncertainties for individual motors by fifty percent, enabling motor replacement for cause. The efforts in this project contribute to the sustainment of the rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense (DoD). The efforts in this project are reviewed by a DoD level steering committee annually for relevance to DoD missions.

This project includes the initiation and development of programs addressing DAF capability gaps and provides technologies for transformational future force capabilities. Transformational efforts will be identified through a competitive process and be responsive to DAF design priorities. Selected efforts will be designated as transformational, indicating enterprise-level priority.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Ballistic Missile Technologies	4.206	3.192	6.045
Description: Develop and demonstrate missile propulsion and post-boost control systems technologies for ballistic missiles.			
FY 2023 Plans: Continue development and test of solid rocket motors relevant to defense needs such as large air-launched boosters for high speed weapon application. Continue to design and develop modeling and simulation tools that more fully describe the physical processes that occur during manufacture and/or operation, and that reduce predictive uncertainty in design and analysis. Continue development of advanced manufacturing processes for solid rocket motors including inert components, energetic components, fabrication systems and automated assembly operations.			
FY 2024 Plans: Continue development and test of solid rocket motors relevant to defense needs such as large air-launched boosters for high speed weapon application. Continue to design and develop modeling and simulation tools that more fully describe the physical processes that occur during manufacture and/or operation, and that reduce predictive uncertainty in design and analysis. Continue			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 634093 / <i>Missile Rocket Propulsion Integ & Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
development of advanced manufacturing processes for solid rocket motors including inert components, energetic components, fabrication systems and automated assembly operations. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.853 million. Funding increased due to increased emphasis on hardware fabrication and testing operations after the design work in FY23.				
Title: Transformational Technology Development Description: This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through sustainment technologies for solid rocket motor boosters and post boost control. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made. FY 2023 Plans: Continue to develop and demonstrate a capability for high speed delivery of area effects. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process FY 2024 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Area Effects Demonstration. FY 2023 to FY 2024 Increase/Decrease Statement: N/A		0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals		4.206	3.192	6.045
		FY 2022	FY 2023	
Congressional Add: Program increase - Hypersonic liquid rocket propulsion		9.634	-	

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 634093 / <i>Missile Rocket Propulsion Integ & Demo</i>

	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct Congressionally directed efforts.		
Congressional Add: Program increase - Altitude chamber infrastructure upgrades	4.817	5.000
FY 2022 Accomplishments: Conduct Congressionally directed efforts.		
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603216F, Aerospace Propulsion and Power Technology, Project 64093, Missile Rocket Propulsion Integ & Demo.		
Congressional Add: Advanced hybrid engine rocket development	-	5.000
FY 2023 Plans: Conduct Congressionally directed efforts. This effort will be executed in Program 0603216F, Aerospace Propulsion and Power Technology, Project 64093, Missile Rocket Propulsion Integ & Demo.		
Congressional Adds Subtotals	14.451	10.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>				Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634921: <i>Aircraft Propulsion Subsystems Int</i>	-	17.019	41.862	17.411	0.000	17.411	23.597	20.020	14.411	15.023	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The Aircraft Propulsion Subsystems Integration (APSI) project includes demonstrator engines for manned systems and efficient small-scale propulsion for remotely piloted aircraft and cruise missile applications. The demonstrator engines integrate the core (high- pressure spool) technology developed under a joint multi-agency and aerospace industry project with the engine (low-pressure spool) technology such as fans, turbines, engine controls, mechanical systems, exhaust nozzles, and augmentors. Additionally, this project includes activities to improve propulsion safety and readiness. This project also focuses on integration of inlets, nozzles, engine-to-airframe compatibility, and power and thermal management subsystems technologies. The APSI project provides aircraft with potential for longer range and higher cruise speeds with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost, and improved survivability, resulting in increased mission effectiveness. Technologies developed are applicable to sustained high-speed vehicles and responsive space launch. The Aircraft Propulsion Subsystems Integration project is focused on improving propulsion capabilities while at the same time reducing the cost of ownership. Anticipated technology advances include turbine engine improvements providing approximately twice the range for a sustained supersonic combat aircraft, doubling the time on station with ten times the power output for surveillance aircraft and propulsion for a high speed supersonic missile with double the range for time sensitive targets.

This project includes the initiation and development of programs addressing DAF capability gaps and provides technologies for transformational future force capabilities. Transformational efforts will be identified through a competitive process and be responsive to DAF design priorities. Selected efforts will be designated as transformational, indicating enterprise-level priority.

In FY2023, Core Engine Technologies, High Pressure Ratio Core Engine Technologies, and Adaptive Turbine Engine Core Technology efforts transferred from Program 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator to Program 0603216F, Aerospace Propulsion and Power Technology, Project 634921, Aircraft Propulsion Subsystems Integration in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Missile/Remotely Piloted Aircraft Engine Performance	10.082	11.010	13.961
Description: Design, fabricate, and test component technologies for limited-life engines to improve the performance, durability, and affordability of missile and remotely piloted aircraft engines.			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Continue next innovative architecture, critical technologies and component designs for efficient small engines. Continue operational benefits analysis for missile and unmanned aerial vehicle (UAV) systems. Continue development of pervasive, hydrocarbon pressure gained propulsion fueled technologies. Initiate advanced development in rotating detonation engine technologies to advance powered munitions.</p> <p><i>FY 2024 Plans:</i> Complete next innovative architecture, critical technologies and component designs for efficient small engines. Continue operational benefits analysis for missile and unmanned aerial vehicle (UAV) systems. Continue development of pervasive, hydrocarbon pressure gained propulsion fueled technologies. Continue advanced development in rotating detonation engine technologies to advance powered munitions. Initiate new engine technologies to deliver reduced takeoff length, increased range, loiter, combat maneuverability, and lower cost for attritable UAS in contested environments.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$2.951 million. Funding increase due to increased emphasis in advancing rotating detonation engine technologies to advance powered munitions.</p>			
<p><i>Title:</i> Adaptive Turbine Engine Technologies</p> <p><i>Description:</i> Design, fabricate, and demonstrate performance, durability, and operability technologies to mature adaptive turbine engine technologies.</p> <p><i>FY 2023 Plans:</i> Complete analysis and evaluation conceptual design of adaptive engine technology and complete technology rig tests to decrease risk in core technology testing. Complete maturation and integration of key technology through component and rig testing. Emphasis moving to Missile/Remotely Piloted Aircraft Engine Performance effort.</p> <p><i>FY 2024 Plans:</i> Not Applicable</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 decreased compared to FY 2023 by \$4.148 million. Funding decreased due to Adaptive Turbine Engine Technologies completion in FY2023.</p>	6.937	4.148	0.000
<p><i>Title:</i> Core Engine Technologies</p> <p><i>Description:</i> Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan and for turbojet engines.</p>	0.000	7.765	1.972

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p><i>FY 2023 Plans:</i> Continue core tests for medium scale engines maturing key technologies. Continue risk reduction component tests for medium-scale engine advanced fan and core. Initiate advanced propulsion air frame integration experiments to enable embedded propulsion systems.</p> <p><i>FY 2024 Plans:</i> Continue core tests for medium scale engines maturing key technologies. Continue risk reduction component tests for medium-scale engine advanced fan and core. Continue advanced propulsion air frame integration experiments to enable embedded propulsion systems.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 decreased compared to FY 2023 by \$5.793 million. Funding decrease due to decreased emphasis to core tests for medium scale engines.</p>			
<p><i>Title:</i> High Pressure Ratio Core Engine Technologies</p> <p><i>Description:</i> Design, fabricate, and demonstrate high overall pressure ratio engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines.</p> <p><i>FY 2023 Plans:</i> Continue assessing innovative architecture, critical technologies and component designs for efficient, small engines. Continue assembly of advanced concept additive manufacturing heat exchanger for small core engines. Continue fabrication of recuperator for demonstration of increased core efficiency in small core engines. Continue to work and mature medium scale core technologies.</p> <p><i>FY 2024 Plans:</i> Complete assembly of advanced concept additive manufacturing heat exchanger for small core engines. Complete fabrication of recuperator for demonstration of increased core efficiency in small core engines. Continue to work and mature medium scale core technologies.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Not Applicable</p>	0.000	1.478	1.478
<p><i>Title:</i> Adaptive Turbine Engine Core Technologies</p> <p><i>Description:</i> Design, fabricate, and demonstrate adaptive turbine engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines.</p>	0.000	0.131	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>FY 2023 Plans: Complete component tests of advanced variable turbine and innovative compression rear block designed to accept flow variations caused by variable turbine operation. Emphasis moving to in Core Engine Technologies effort.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.131 million. Funding decreased due to Adaptive Turbine Engine Core Technologies completion in FY2023 and emphasis move to Core Engine Technology.</p>			
<p>Title: Transformational Technology Development</p> <p>Description: This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through engine core and low spool component technologies. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: Continue to develop and demonstrate a capability for high speed delivery of area effects. Initiate projects selected from the annual WARTECH process that investigate Department of the Air Force prioritized topics. Continue to perform modeling, simulation, and analyses to establish the future force effect of candidate Transformational Component investments and continue the next cycle of WARTECH process.</p> <p>FY 2024 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Area Effects Demonstration and effort Future Transformational Capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: N/A</p>	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	17.019	24.532	17.411

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 634921 / <i>Aircraft Propulsion Subsystems Int</i>
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	FY 2022	FY 2023
Congressional Add: Low spool generator capabilities <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts. This effort will be executed in Program 0603216F, Aerospace Propulsion and Power Technology.	-	5.000
Congressional Add: Program increase - turbo air cool HTPEM hydrogen fuel cell development <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts. This effort will be executed in Program 0603216F, Aerospace Propulsion and Power Technology.	-	12.330
Congressional Adds Subtotals	-	17.330

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>				Project (Number/Name) 635098 / <i>Advanced Aerospace Propulsion</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635098: <i>Advanced Aerospace Propulsion</i>	-	16.227	17.437	23.266	0.000	23.266	32.540	37.617	38.387	39.777	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates, via ground and flight tests, the scramjet propulsion cycle to a technology readiness level appropriate for full integration with other engine cycles (including turbine and rocket-based) to provide the Air Force with transformational military capabilities. The primary focus is on the hydrocarbon-fueled, scramjet engine. Multi-cycle engines will provide the propulsion systems for possible application to support aircraft and weapon platforms. Efforts include: scramjet flow-path optimization to enable operation over the widest possible range of Mach numbers; active combustion control to assure continuous positive thrust (even during mode transition); robust flame-holding to maintain stability through flow distortions; and maximized volume-to-surface area to minimize the thermal load imposed by the high-speed engine. Thermal management plays a vital role in scramjet and combined cycle engines, including considerations for protecting low speed propulsion systems (e.g., turbine engines) during hypersonic flight.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Scramjet Technologies	16.227	17.437	23.266
Description: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation.			
FY 2023 Plans: Continue development and integration of larger scale scramjet component technologies to enhance operability including robust operation during maneuvers and extended operating time. Continue development and demonstration of tactically-relevant, high speed strike scramjet engine designs, technologies, and components including ground and flight demonstrations needed for potential follow-on acquisition program. Continue propulsion technology maturation activities for multi-mission cruiser concept to expand performance capabilities of high speed systems.			
FY 2024 Plans: Continue development and integration of larger scale scramjet component technologies to enhance operability including robust operation during maneuvers and extended operating time. Continue development and demonstration of tactically-relevant, scramjet engine designs, technologies, and components including ground and flight demonstrations needed for potential follow-on acquisition program. Continue propulsion technology maturation activities for multi-mission cruiser concept to expand performance capabilities of high speed systems. Initiate integration of scramjet components into expendable hypersonic multi-mission ISR and Strike demo design.			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 635098 / <i>Advanced Aerospace Propulsion</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$5.829 million. Funding increase due to increased emphasis on expanding high speed engine operability; initiate integration of scramjet components into expendable hypersonic multi-mission ISR and Strike demo design.			
Accomplishments/Planned Programs Subtotals	16.227	17.437	23.266

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>				Project (Number/Name) 63681B / <i>Advanced Turbine Engine Gas Generator</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
63681B: <i>Advanced Turbine Engine Gas Generator</i>	-	18.817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates technology to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The objective is to provide continuous evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and maintainability can be assessed in a realistic engine environment. The gas generator, or core, is the basic building block of the engine and nominally consists of a compressor, a combustor, a high-pressure turbine, mechanical systems, and core subsystems. Experimental core engine demonstration validates engineering design tools and enhances rapid, low-risk transition of key engine technologies into engineering development, where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, ships, and responsive space launch. Component technologies are demonstrated in a core (sub-engine). This project also assesses the impact of low spool components such as; inlet systems, fans, low pressure turbines, exhaust systems, and system level technologies such as; integrated power generators and thermal management systems on core engine performance, and durability in ground demonstrations of engine cores. The core performances of this project are validated on demonstrator engines in the Aircraft Propulsion Subsystem Integration Project of this program. A portion of this project supports the demonstration of adaptive cycle technologies, which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

In FY2023, Core Engine Technologies, High Pressure Ratio Core Engine Technologies, and Adaptive Turbine Engine Core Technologies efforts will transfer to Program 0603216F, Aerospace Propulsion and Power Technology, Project 634921, Aircraft Propulsion Subsystems Integration from Program 0603216F, Aerospace Propulsion & Power Technology, Project 63681B, Advanced Turbine Engine Gas Generator in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Core Engine Technologies	7.920	0.000	0.000
Description: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan and for turbojet engines.			
FY 2023 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 63681B / <i>Advanced Turbine Engine Gas Generator</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>In FY2023, this effort will transfer to Program 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Integration in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>				
<p>Title: High Pressure Ratio Core Engine Technologies</p> <p>Description: Design, fabricate, and demonstrate high overall pressure ratio engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines.</p> <p>FY 2023 Plans: In FY2023, this effort will transfer to Program 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Integration in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>		2.979	0.000	0.000
<p>Title: Adaptive Turbine Engine Core Technologies</p> <p>Description: Design, fabricate, and demonstrate adaptive turbine engine cores to provide increased durability and affordability with lower fuel consumption for turbofan and for turboshaft engines.</p> <p>FY 2023 Plans: In FY2023, this effort will transfer to Program 0603216F, Aerospace Propulsion & Power Technology, Project 634921, Aircraft Propulsion Subsystems Integration in order to effectively and efficiently align resources to Aerospace Systems Core Technical Competencies.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>		7.918	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603216F / <i>Aerospace Propulsion and Power Technology</i>	Project (Number/Name) 63681B / <i>Advanced Turbine Engine Gas Generator</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Not Applicable			
Accomplishments/Planned Programs Subtotals	18.817	0.000	0.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	41.869	31.037	32.510	0.000	32.510	36.372	37.300	37.352	38.715	Continuing	Continuing
633720: <i>EW Quick Reaction Capabilities</i>	-	28.491	17.877	19.552	0.000	19.552	22.081	22.651	22.694	23.522	Continuing	Continuing
63431G: <i>RF Warning & Countermeasures Tech</i>	-	8.109	7.896	12.876	0.000	12.876	14.178	14.488	14.527	15.057	Continuing	Continuing
634335: <i>Cyber Concepts</i>	-	3.068	3.021	0.043	0.000	0.043	0.045	0.090	0.053	0.055	Continuing	Continuing
63691X: <i>EO/IR Warning & Countermeasures Tech</i>	-	2.201	2.243	0.039	0.000	0.039	0.068	0.071	0.078	0.081	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to support Air Force electronic combat warfighting capabilities. The program focuses on developing components, subsystems, and technologies with potential aerospace, special operations, and airlift electronic combat applications. It develops and demonstrates technologies for integrating electronic combat sensors and systems into a fused and seamless whole. It integrates and focuses research efforts in electronic warfare and cyber warfare to rapidly demonstrate a capability for rapid fielding. It develops and demonstrates technologies for navigation and timing in radio frequency (RF) contested and denied environments. It develops and demonstrates advanced technologies for radio frequency electronic combat suites and advanced warning and countermeasure technologies to defeat electro-optical, infrared, and laser threats to aerospace platforms. It also develops and demonstrates technologies that will enable mission systems to be more resilient, agile, autonomous, and be able to operate in multiple domains. This program has been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	44.938	33.380	39.964	0.000	39.964
Current President's Budget	41.869	31.037	32.510	0.000	32.510
Total Adjustments	-3.069	-2.343	-7.454	0.000	-7.454
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	-2.343			
• Reprogrammings	-0.004	0.000			
• SBIR/STTR Transfer	-3.065	0.000			
• Other Adjustments	0.000	0.000	-7.454	0.000	-7.454

Change Summary Explanation

In FY 2023, Congressional Directed Reductions were due to realignment into Program 0603032F, Future AF Integrated Technology Demos, Project 0603030, Air Force Vanguard, in order to more appropriately categorize the funding according to purpose

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>				Project (Number/Name) 633720 / <i>EW Quick Reaction Capabilities</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
633720: <i>EW Quick Reaction Capabilities</i>	-	28.491	17.877	19.552	0.000	19.552	22.081	22.651	22.694	23.522	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project establishes a capability to rapidly assess, develop and demonstrate new electronic warfare concepts, techniques, and capabilities as well as the required position navigation and timing technologies and capabilities in the context of systemic electronic warfare effects (electronic warfare threat interactions) in a congested/contested electromagnetic spectrum, system-of-systems environment of the future. It develops disruptive electronic warfare and countermeasures concepts specifically selected for high-impact, game-changing effects; evaluates them in high fidelity virtual and hardware evaluation settings; and demonstrates them in an operationally relevant environment. It establishes and maintains an all-source, physics-based, threat-to-countermeasures electronic warfare systems engineering methodology. It develops a core analytic function, supported by simulation-based wargaming and interactive engineering modeling capabilities to evaluate advanced countermeasures concepts.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Radio Frequency Electronic Warfare	3.559	3.432	0.000
Description: Develop electronic warfare focused knowledge databases, engineering models, mission simulations, analysis tools and assessment environments which enable the development of multi-domain electronic warfare technologies. The primary focus is on emulating complex battlespace radio frequency environments, electronic attack effects against emerging, networked weapon systems, and assessing flexible, software-defined electronic warfare systems with non-deterministic performance (for example, utilizing cognitive algorithms).			
FY 2023 Plans: Continue the implementation of emerging electromagnetic attack and support capabilities into open architectures to support electromagnetic spectrum operations. Continue conducting technology demonstrations to support transition into Air Force platforms and electromagnetic spectrum operations units. Continue using agile software defined process to demonstrate the capability to rapidly respond to new and unexpected complex emitters in realistic radio frequency environments. Continue expansion and maturation of modeling, simulation and laboratory assessment environments commensurate with technologies being researched, developed and tested including cognitive and autonomous electronic warfare technologies for multi-spectral treats in a complex electromagnetic environment.			
FY 2024 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 633720 / <i>EW Quick Reaction Capabilities</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>FY 2024 funding and technical work from this effort has been realigned to Program Electronic Combat Technology, 0603270F; Project EW Quick Reaction Capabilities, 633720; Integrated EW Demonstration effort.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding decreased compared to FY 2023 by \$3.432 million. Decrease is a result of realignment of funding and technical work to Program Electronic Combat Technology, 0603270F; Project EW Quick Reaction Capabilities, 633720; Integrated EW Demonstration effort.</p>				
<p>Title: Resilient Positioning, Navigation and Timing</p> <p>Description: Develop and transition robust Global Navigation Satellite System capabilities; resilient complementary position, navigation and timing techniques; precise position, navigation and timing technologies for distributed sensing/effects; position, navigation and timing technology to provide position, navigation and timing electronic warfare situational awareness and training; and position, navigation and timing architectures to enable resiliency against the rapidly evolving threat. Efforts will include prototypes and relevant Open Architecture standards where applicable to enable timely technology transition.</p> <p>FY 2023 Plans: Continue developing systems and transition technologies for geolocation of sources interfering with navigational satellite signals. Continue developing and demonstrate a transcoder that converts modernized Global Positioning System military signals into military signals useable by legacy Department of Defense GPS receivers. Continue software defined radio technology efforts to authenticate signals from foreign satellite navigation systems. Continue developing, demonstrating, and promulgating navigational open architecture standards to permit integration of alternative/complementary position, navigation and timing approaches into future Department of Defense systems, such as the resilient embedded Global Positioning System-inertial program of record.</p> <p>FY 2024 Plans: Continue maturation and transition of technologies for characterization of geolocation of sources interfering with navigational satellite signals. Continue developing and flight demonstrate a transcoder that converts trusted navigation sources such as modernized military Global Positioning System signals into synthesized radio frequency directly injected and useable by legacy Department of Defense Global Positioning System receivers. Continue algorithm efforts to authenticate signals as emanating directly from foreign navigation satellites. Continue developing, demonstrate, and promulgate navigational open architecture standards to permit integration of alternative/complementary position, navigation and timing approaches into future Department of Defense systems, such as the resilient embedded Global Positioning System-inertial program of record.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>		15.305	10.098	11.108

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 633720 / <i>EW Quick Reaction Capabilities</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 funding increased compared to FY 2023 by \$1.010 million, due to increased emphasis in Resilient Position, Navigation, and Timing technologies.				
<p>Title: Electro-Optical/Infrared Warfare Demonstrator</p> <p>Description: Develop next generation countermeasure techniques to address the complete range of multispectral (for example, dual band infrared) threats including advanced techniques versus advanced man portable air defense system and air-to-air threats with multimode capabilities. Develop capabilities for situational awareness and countermeasure to integrated air defense systems and associated multispectral threats.</p> <p>FY 2023 Plans: Complete assessment of developed low cost, integrated missile and laser warning capability to identify, geo-locate, and counter, using both laser and expendable countermeasure response techniques, advanced laser and electro-optical/infrared guided missile threats to aircrews. Continue iterating and refreshing techniques for in-house at range data collection capabilities. Continue analysis from field test to develop requirements for proactive detection and situation awareness for multiple Department of the Air Force platforms. Continue efforts to develop multi-spectral electro-optical/radio frequency countermeasures and insert capabilities into existing and developing engagement modeling and simulation tools.</p> <p>FY 2024 Plans: FY 2024 funding and technical work from this effort has been realigned to Program Electronic Combat Technology, 0603270F; Project EW Quick Reaction Capabilities, 633720; Integrated EW Demonstration effort.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding decreased compared to FY 2023 by \$4.347 million. Decrease is a result of realignment of funding and technical work to Program Electronic Combat Technology, 0603270F; Project EW Quick Reaction Capabilities, 633720; Integrated EW Demonstration effort.</p>		3.559	4.347	0.000
<p>Title: Integrated EW Demonstration</p> <p>Description: Integrate emerging technologies to develop and demonstrate electromagnetic warfare spectrum dominance concepts, technologies and techniques. Goal is to counter advanced complex electromagnetic threats in contested environments across radio frequency and electro-optic/infrared spectrums.</p> <p>FY 2023 Plans: Not Applicable</p> <p>FY 2024 Plans:</p>		0.000	0.000	8.444

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 633720 / <i>EW Quick Reaction Capabilities</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue the implementation of emerging electromagnetic attack and support capabilities into open architectures to support electromagnetic spectrum operations. Continue using agile development processes to demonstrate the capability to rapidly respond to new and unexpected complex emitters in realistic radio frequency environments. Continue expansion and maturation of modeling, simulation and laboratory assessment environments commensurate with technologies being researched, developed and tested including cognitive and autonomous electronic warfare technologies for multi-spectral treats in a complex electromagnetic environment. Continue iterating and refreshing techniques for data collection capabilities to enhance research and development efforts. Continue analysis from field test to develop requirements for proactive detection and situation awareness for multiple Department of the Air Force platforms.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding increase compared to FY 2023 by \$8.444 million. Increase is described in the plans above. This is a result of realignment of funding and technical work from "Program Electronic Combat Technology, 0603270F; Project EW Quick Reaction Capabilities, 633720; Radio Frequency Electronic Warfare" effort and "Program Electronic Combat Technology, 0603270F; Project EW Quick Reaction Capabilities, 633720; Electro-Optical/Infrared Warfare Demonstrator" effort, in order to more effectively support converging efforts in the Multi-Spectral Warfare domain.</p>			
<p>Title: Transformational Technology Development</p> <p>Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through new electronic warfare concepts, techniques and capabilities as well as new positioning, navigation and timing technologies and capabilities. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 work in this effort will be accomplished under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	6.068	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 633720 / <i>EW Quick Reaction Capabilities</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Not Applicable			
Accomplishments/Planned Programs Subtotals	28.491	17.877	19.552

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>				Project (Number/Name) 63431G / <i>RF Warning & Countermeasures Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
63431G: <i>RF Warning & Countermeasures Tech</i>	-	8.109	7.896	12.876	0.000	12.876	14.178	14.488	14.527	15.057	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for radio frequency electronic combat suites, including the required navigation technologies and capabilities, to enhance the survivability of aerospace vehicles and to provide crew situational awareness. The research addresses technologies for missile/threat warning, radio frequency receivers, electronic combat pre-processors, advanced sorting/pre-processing algorithms, and expert software for applications on existing and future electronic combat systems. The research also focuses on the development and demonstration of subsystems and components for generating on-board/off-board radio frequency countermeasure techniques. This includes the development of electronic countermeasures techniques, as well as advanced electronic countermeasures technologies such as antennas, power amplifiers, and preamplifiers.

In FY 2024 in order to better execute these converging efforts in the Multi-Spectral domain, funding and technical work was transferred into this BPAC from "Program 0603270F Electronic Combat Technology, Project 634335: Cyber Concepts, effort Resilient and Agile Mission Systems Architecture" and "Program 0603270F Electronic Combat Technology, Project 63691X: EO/IR Warning & Countermeasures Tech, effort Advanced Electro-Optical/Infrared Warning and Countermeasure Technologies"

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Spectrum Dominance Technology Demonstrations	7.625	7.896	12.876
Description: Develop aerospace platform jamming concepts, technologies and techniques to counter advanced radio frequency threats associated with current and future aerospace weapon systems. Provide position, navigation and system resilience via open architecture solutions.			
Note: In FY 2023 and prior this Thrust was titled "Radio Frequency Electronic Warfare Demonstrator" This change was made to accommodate the transfer of funding and technical work to this Effort from "Program 0603270F Electronic Combat Technology, Project 634335: Cyber Concepts, effort Resilient and Agile Mission Systems Architecture" and "Program 0603270F Electronic Combat Technology, Project 63691X: EO/IR Warning & Countermeasures Tech, effort Advanced Electro-Optical/Infrared Warning and Countermeasure Technologies" in order to better execute these converging efforts in the Multi-Spectral domain.			
FY 2023 Plans: Continue the implementation of emerging electromagnetic attack and support capabilities into open architectures to support electromagnetic spectrum operations. Continue conducting technology demonstrations to support transition into Air Force			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 63431G / <i>RF Warning & Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>platforms and electromagnetic spectrum operations units. Use agile software defined process to demonstrate the capability to rapidly respond to new and unexpected complex emitters in realistic radio frequency environments. Continue expansion and maturation of modeling, simulation and laboratory assessment environments commensurate with technologies being researched, developed and tested including cognitive and autonomous electronic warfare technologies for multi-spectral treats in a complex electromagnetic environment.</p> <p>FY 2024 Plans: Complete the Radio Frequency Electronic Warfare Demonstrator effort and deliver a software-centric cognitive electromagnetic warfare-based rapid reprogramming system to the 350th Spectrum Warfare Wing to improve next sortie reprogramming capability against complex emitters. These deliverables include cognitive electromagnetic warfare applications integrated into an on-station system to support electromagnetic spectrum maneuverability and data analytics and visualization tools to assess system performance for reprogramming.</p> <p>Continue expansion and maturation of modeling, simulation and laboratory assessment environments commensurate with technologies being researched, developed and tested including cognitive and autonomous electronic warfare technologies for multi-spectral treats in a complex electromagnetic environment. Continue the implementation and development of spectrum warfare's integration into Reference Architecture Implementations and open architectures standards to support modeling and simulation analysis. Continue conducting technology demonstrations to support transition into Air Force platforms and electromagnetic spectrum operations units. Continue maturing the process for threat characterization and countermeasures development and field testing of new advanced threats to include laser jam codes and techniques. Continue effectiveness assessment of laser and missile warning technologies and techniques for a variety of Air Force platforms. Continue development of advanced networking, processing, advanced computing paradigms, and cybersecurity technologies for next-generation avionics mission system capabilities. Continue utilizing agile development processes and digital engineering techniques for rapid and affordable development, integration, and demonstrations to rapidly respond to new and unexpected complex emitters in realistic radio frequency environments.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$4.980 million, due to increased emphasis of close collaboration with the 350th Spectrum Warfare Wing for Electronic Warfare efforts .</p>			
<p>Title: Transformational Technology Development</p> <p>Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat</p>	0.484	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 63431G / <i>RF Warning & Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>environment through development and demonstration of advanced technologies for radio frequency electronic combat suites. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>			
Accomplishments/Planned Programs Subtotals	8.109	7.896	12.876

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 634335 / <i>Cyber Concepts</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
634335: <i>Cyber Concepts</i>	-	3.068	3.021	0.043	0.000	0.043	0.045	0.090	0.053	0.055	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates methods to discover cyber susceptibilities, assess avionics systems, formulate mitigation strategies, and investigate use of tools and technologies to automate this process. It is designed to apply developed vulnerability discovery, vulnerability mitigation, and cyber protection technology to avionics systems and components and embedded systems. This involves technologies for trusted sensors and trusted systems that deter exploitation of our critical hardware and software. This project aims to develop cyber resilience and protect systems through adaptation of the system to the threat. It demonstrates these technologies in open and adaptable architectures for system integration in field demonstrations and proves out the technologies through rapid integration of sensors and architectures for technology transition. It integrates research efforts in electronic and cyber warfare to rapidly demonstrate a capability for rapid fielding.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Resilient and Agile Mission Systems Architecture	2.412	3.021	0.043
<p>Description: This effort performs advanced development and demonstration of methods, technologies, and tools to enable resilience and protect mission systems against threats. This involves open and adaptable architectures for rapid integration and agile systems, cyber protections and resilience technologies to protect against threats. It integrates research efforts in electronic and cyber warfare to demonstrate novel operational capabilities through laboratory, field, and flight tests and experimentation. The goal is to reduce risk for rapid transition of novel operational capabilities into Department of the Air Force mission systems.</p> <p>FY 2023 Plans: Continue investigations to evolve and mature open architecture standards. Continue development of advanced networking, processing, advanced computing paradigms, and cybersecurity technologies for next-generation avionics mission system capabilities. Initiate using agile software technologies and digital engineering techniques for rapid and affordable development, integration, and prototype capability demonstrations. Initiate development of Reference Architecture Implementation for resilient mission systems.</p> <p>FY 2024 Plans: Continue transfer of technical work while it realigns under Program 0603270F Electronic Combat Technology, Project 63431G: RF Warning & Countermeasures Tech, effort Spectrum Dominance Technology Demonstrations.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 634335 / <i>Cyber Concepts</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 decreased compared to FY 2023 by \$2.978 million. Justification for this decrease is described in plans above. In FY 2024 technical effort will be realigned under Program 0603270F Electronic Combat Technology, Project 633720: EW Quick Reaction Capabilities, effort Spectrum Dominance Technology Demonstrations.				
<p>Title: Transformational Technology Development</p> <p>Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through vulnerability discovery, vulnerability mitigation, and cyber protection technology to avionics systems and components and embedded systems. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>		0.656	0.000	0.000
Accomplishments/Planned Programs Subtotals		3.068	3.021	0.043
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
D. Acquisition Strategy				
Not applicable				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>				Project (Number/Name) 63691X / <i>EO/IR Warning & Countermeasures Tech</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
63691X: <i>EO/IR Warning & Countermeasures Tech</i>	-	2.201	2.243	0.039	0.000	0.039	0.068	0.071	0.078	0.081	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates the advanced warning and countermeasure technologies required to negate electro-optical/infrared and laser threats to aerospace platforms. Develops off-board (decoys and expendables) and on-board countermeasure technologies for aircraft self-protection to provide robust, affordable solutions for protection against infrared missiles with autonomous seekers, multi-spectral threats, laser-guided weapons, and electro-optical/infrared tracking systems used to direct electro-optical/infrared and radar-guided missiles.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Advanced Electro-Optical/Infrared Warning and Countermeasure Technologies	1.658	2.243	0.039
Description: Analyze the vulnerabilities of current infrared missile systems and future imaging infrared sensors. Develop advanced countermeasure system techniques to exploit vulnerabilities for use against infrared and electro-optical guided missile threats. Develop advanced optical and infrared sensor systems for airborne and space situational awareness and threat warning.			
FY 2023 Plans: Continue maturing the process for threat characterization and countermeasures development and field testing of new advanced threats to include laser jam codes and techniques. Continue effectiveness assessment of laser and missile warning technologies and techniques for a variety of Air Force platforms. Continue providing electro-optical/infrared models to be combine with radio frequency models to further enhance the overarching Advanced Framework for Simulation, Integration and Modeling software environment to address multi-spectral threats.			
FY 2024 Plans: Continue transfer of technical work while it realigns under Program 0603270F Electronic Combat Technology, Project 63431G: RF Warning & Countermeasures Tech, effort Spectrum Dominance Technology Demonstrations.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$2.204 million. Justification for this decrease is described in plans above. In FY 2024 technical effort will be realigned under Program 0603270F Electronic Combat Technology, Project 633720: EW Quick Reaction Capabilities, effort Spectrum Dominance Technology Demonstrations.			
Title: Transformational Technology Development	0.543	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603270F / <i>Electronic Combat Technology</i>	Project (Number/Name) 63691X / <i>EO/IR Warning & Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Continually funded effort. This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through development and demonstration of advanced warning and countermeasure technologies required to negate electro-optical/infrared and laser threats to aerospace platforms. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 and beyond, this work is performed under PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.</p> <p>FY 2024 Plans: Not Applicable</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Not Applicable</p>			
Accomplishments/Planned Programs Subtotals	2.201	2.243	0.039

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force</i> / BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603273F / <i>Science & Technology for Nuclear Re-entry Systems</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	0.000	27.031	70.321	0.000	70.321	88.464	120.090	157.035	162.718	Continuing	Continuing
634094: <i>Next Gen Platform Dev/Demo</i>	-	0.000	27.031	70.321	0.000	70.321	88.464	120.090	157.035	162.718	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

NOTE: Funding in this Project was spread into four separate thrusts in FY 2024 to provide for additional detail and traceability to efforts being executed. The total funding change for this project increased by \$43.290 million in FY 2024 as compared to FY 2023, that increase is due to investment in next-generation hardware, software and material technologies for flight representative environments for re-entry systems, as well as component integration into initial flight experimentation.

Future FYs will include a detailed increase/decrease by thrust area described in a more relevant manner.

A. Mission Description and Budget Item Justification

This program supports Department of Defense (DOD) priorities for enduring nuclear science and technology (S&T) for re-entry systems. This effort will provide advanced technology development that will effectively address evolving threats and maintain operational effectiveness while also aligning with the highest-level guidance for nuclear forces identified in the 2022 Nuclear Posture Review, and National Defense Strategy. This effort will contribute to preserving the viability of the nuclear deterrent in a cost-effective manner by reducing technical and programmatic risk associated with execution of the overall nuclear modernization program. This effort will advance materials and manufacturing methods to develop new, manufacturable options to increase capability and reduce cost for re-entry systems. These ends will be reached by developing technologies to inform future system requirements, establishing interagency partnerships for re-entry system platform development and infrastructure modernization, revitalizing nuclear workforce talent, and coordinating with existing programs for next generation strategic system development. This program enhances and enables technology developed under the Next Gen Platform Dev/Demo Effort currently being executed under program element 0603211F, Aerospace Technology Dev/Demo, Project 634094.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603273F I Science & Technology for Nuclear Re-entry Systems
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	39.431	70.162	0.000	70.162
Current President's Budget	0.000	27.031	70.321	0.000	70.321
Total Adjustments	0.000	-12.400	0.159	0.000	0.159
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-12.400			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	0.159	0.000	0.159

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Title: Re-entry System Technologies</p> <p>Description: Develop next generation hardware, software and material technologies for flight representative testing and environments for re-entry systems.</p> <p>FY 2023 Plans: Initiate development of advanced aeroshell technologies to maintain a viable deterrent for the foreseeable future through enhanced resiliency and survivability. Initiate development of advanced fuzing solutions that are able to maintain operational effectiveness against emerging targeting challenges and develop alternative safety and surety features required for nuclear systems. Initiate development of strategic-grade, radiation-hardened guidance, navigation and control solutions for advanced systems. Initiate establishment of requisite testing infrastructure to enable nuclear re-entry S&T development activities and to evaluate component technologies in relevant environments.</p> <p>FY 2024 Plans: Plans are spread between new thrusts in FY 2024</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$27.031 million. FY 2024 funds were reallocated across the four thrust areas supporting S&T for nuclear re-entry systems: Aeroshell Technologies, Advanced Fuzing Technologies, Advanced Guidance, Navigation and Control Technologies, and Integration, Experimentation and Evaluation Solutions. In FY 2023 the funds breakout was as follows: \$5.747 million, \$6.784 million, \$7.883 million, and \$6.617 million.</p>	0.000	27.031	0.000
Title: Aeroshell Technologies	-	0.000	24.487

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603273F <i>I Science & Technology for Nuclear Re-entry Systems</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Description: Develop next-generation material technologies and joint Government Reference Designs (GRD) for flight representative environments and experimentation for re-entry systems.</p> <p>FY 2023 Plans: New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described.</p> <p>FY 2024 Plans: Continue development of advanced aeroshell technologies to maintain a viable deterrent through modeling and simulation (M&S) of re-entry environments (being supported by PE 0602201F). Initiate advanced M&S development to characterizing re-entry environment. Initiate update to M&S integrated solvers for enhanced analysis workflow with inclusion of an advanced physics-based re-entry characterization protocol for decreased computational time. Initiate benchtop experimentation supporting M&S code validation.</p> <p>Continue aeroshell materials trade studies and procurement of material coupons. Initiate iterative material characterization and benchtop experimentation to build materials database. Initiate additional material development for future benchtop experimentation. Initiate trade studies and requirements of material sample experimentation for integration onto platform generating a combined effects environment.</p> <p>Initiate development of a GRD platform through requirements development and with continued design trade studies and optimization. Initiate manufacturing process trade studies and analysis. Initiate model-based systems engineering approach for future GRD development build and risk reduction. Initiate investigations into sourcing options for outer aeroshell materials and high-temperature GRD components.</p> <p>Initiate requirements development supporting component integration onto a future launch platform. Initiate required test-bed design trades and/or modifications, including instrumentation options for future flight characterization and analysis capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$24.487 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. \$5.747 million was executed against Aeroshell Technologies in FY 2023 thus the actual increase was \$18.740 million for increased emphasis in advanced M&S analysis, aeroshell materials characterization and experimentation, GRD platform development, and requirements development for component integration.</p>				
Title: Advanced Fuzing Technologies		-	0.000	9.341

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603273F / <i>Science & Technology for Nuclear Re-entry Systems</i>		
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Description: Develop next-generation fuzing solutions which maintain operational effectiveness against emerging targeting challenges and develop alternative safety and surety features required for nuclear systems.</p> <p>FY 2023 Plans: New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described.</p> <p>FY 2024 Plans: Continue the development of advanced fuzing solutions which maintain operational effectiveness against emerging targeting challenges and threat environments. Initiate research into integrated guidance/fuzing solutions which are capable of synthesizing positional information with altitude measurement. Initiate advanced fuzing design requirements. Initiate the development of hardware concepts for advanced fuzing architectures. Initiate experimentation on advanced impact fuze technologies.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$9.341 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. \$6.784 million was executed against Advanced Fuzing Technologies in FY 2023 thus the actual increase was \$2.557 million for increased emphasis in integrated guidance/fuzing solutions, and design requirements for fuzing architectures.</p>				
<p>Title: Advanced Guidance, Navigation and Control (GNC) Technologies</p> <p>Description: Develop next generation, strategic level radiation hardened GNC technologies and solutions, including sensors, systems, aides and control elements to support GNC requirements in relevant environments.</p> <p>FY 2023 Plans: New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described.</p> <p>FY 2024 Plans: Continue strategic-grade, solid-state radiation-hardened guidance solution development and radiation component testing reinforcing nuclear efforts in PE 0603211F.</p> <p>Initiate design of high-gravity (high-g) accelerometer Application Specific Integrated Circuits (ASICs). Initial delivery of solid-state, high-g accelerometer advanced technological development characterization and insertion into inertial measurement unit (IMU) future architecture. Initiate and complete solid-state, low-g accelerometer development unit design/build and initiate integration into IMU.</p>		-	0.000	20.218

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603273F / <i>Science & Technology for Nuclear Re-entry Systems</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
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<p>Initiate benchtop experimentation of resonant fiber optic gyroscope (RFOG), including multiple component level design, testing and experimentation, to inform the iterative development of ensuing RFOG design. Initiate final RFOG design trades and develop mechanical flight architectures. Initiate risk reduction activities for resonant fiber optic gyroscope (RFOG) components, including fiber improvement, radiation hardened parts development, and light source performance.</p> <p>Initiate inertial measurement unit (IMU) concept development and maturation through the design, build and environmental testing of inertial sensor components. Initiate purchase of long-lead IMU components. Initiate bench-level characterization for IMU system with early sensor designs. Initiate IMU radiation-hardened electronics design, build and analysis. Initiate risk reduction to meet future follow-on evaluation opportunities. Initiate requirements development in support of inertial sensor component integration for future re-entry testbed flight.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$20.218 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. \$7.883 million was executed against Advanced guidance, navigation and control (GNC) Technologies in FY 2023 thus the actual increase was \$12.335 million for high-g accelerometer design and delivery of the low-g accelerometer, RFOG experimentation and final design, and IMU maturation.</p>			
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<p>Title: Integration, Experimentation and Evaluation Solutions</p> <p>Description: Development of inherent government expertise through integration and experimentation laboratories. This capability enables S&T for current and future nuclear re-entry systems and component Technology Readiness Level (TRL) maturation through Government reference designs (GRDs) in strategic environments.</p> <p>FY 2023 Plans: New thrust created in FY 2024. Prior plans captured in Re-entry System Technologies thrust, previously described.</p> <p>FY 2024 Plans: Continue establishing requisite testing infrastructure to enable nuclear re-entry science and technology (S&T) development activities and to evaluate component technologies in relevant environments. Initiate procurement of long-lead time special equipment for installation into government integration facilities. Initiate and complete design of radiographic facility to support imaging for high-fidelity demonstrators and begin procurement of radiographic equipment.</p> <p>Initiate the development of enhanced ground and complementary experimentation capabilities. Initiate and complete high-gravity, high-precision centrifuge designs. Initiate build supporting strategic-grade inertial sensor characterization and validation to meet GNC analytic activities for future flight to achieve IMU TRL 6. Initiate the development of a recoverable re-entry testbed</p>	-	0.000	16.275
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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603273F / <i>Science & Technology for Nuclear Re-entry Systems</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>supporting modeling and simulation (M&S) validation and component technology readiness level (TRL) maturation through interim design review. Initiate integration planning activities for recoverable flight unit.</p> <p>Initiate functional requirements development to establish an integration strategy and proposed test plan in relation to guidance, navigation and control (GNC) technologies and telemetry for future flight. Initiate planning and requirements development activities for enduring government reference design (GRD) flights. Initiate and complete planning and development of integration and radiographic facility operations, roadmaps and procedures.</p> <p>Initiate in-house employee training program, supporting enduring expertise for integration, experimentation and evaluation activities for future flight demonstrators.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$16.275 million due to funding being realigned from Re-entry System Technologies to provide additional detail aligned with established thrust areas as described above. \$6.617 million was executed against Integration, Experimentation and Evaluation Solutions in FY 2023 thus the actual increase was \$9.658 million for development of experimentation capabilities for component TRL maturation, purchase of laboratory equipment and in-house training supporting enduring expertise.</p>			
Accomplishments/Planned Programs Subtotals	0.000	27.031	70.321

D. Other Program Funding Summary (\$ in Millions)
N/A

Remarks

E. Acquisition Strategy
Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603444F / <i>Maui Space Surveillance System (MSSS)</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	Continuing	Continuing
634868: <i>Maui Space Surveillance System</i>	-	0.000	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note
not applicable

A. Mission Description and Budget Item Justification

This program funded ground-based optical space situational awareness (SSA) technology development and demonstration at the Maui Space Surveillance System (MSSS) in Hawaii, as well as the operation and upgrade of the facility. Efforts in this program were coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

B. Program Change Summary (\$ in Millions)	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024 Base</u>	<u>FY 2024 OCO</u>	<u>FY 2024 Total</u>
Previous President's Budget	0.000	0.000	0.002	0.000	0.002
Current President's Budget	0.000	0.000	0.002	0.000	0.002
Total Adjustments	0.000	0.000	0.000	0.000	0.000
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	0.000	0.000	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603444F / <i>Maui Space Surveillance System (MSSS)</i>		
<u>Change Summary Explanation</u> Not applicable				
<u>C. Accomplishments/Planned Programs (\$ in Millions)</u>		FY 2022	FY 2023	FY 2024
<i>Title:</i> Operate and Upgrade Maui Space Surveillance System		0.000	0.000	0.002
<i>Description:</i> Operate and upgrade the Maui Space Surveillance System to support development, demonstration, and integration of ground-based optical space situational awareness technologies.				
<i>FY 2023 Plans:</i> Not applicable				
<i>FY 2024 Plans:</i> Not applicable				
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> Not applicable				
Accomplishments/Planned Programs Subtotals		0.000	0.000	0.002
<u>D. Other Program Funding Summary (\$ in Millions)</u> N/A				
<u>Remarks</u> Not Applicable				
<u>E. Acquisition Strategy</u> Not applicable				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	31.135	15.440	15.593	0.000	15.593	19.528	19.810	20.211	20.861	Continuing	Continuing
635323: <i>Directed Energy Bioeffects Parameters</i>	-	6.484	4.262	7.290	0.000	7.290	6.303	4.965	4.905	5.060	Continuing	Continuing
635324: <i>Human Dynamics and Terrain Demonstration</i>	-	11.541	2.313	0.346	0.000	0.346	2.973	4.223	3.927	5.036	Continuing	Continuing
635325: <i>Mission Effective Performance</i>	-	3.407	4.023	4.134	0.000	4.134	3.914	6.165	7.455	7.667	0.000	36.765
635327: <i>Warfighter Interfaces</i>	-	9.703	4.842	3.823	0.000	3.823	6.338	4.457	3.924	3.098	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to enhance Airman performance and effectiveness in the aerospace force. State-of-the-science advances are made in warfighter training, warfighter system interfaces, directed energy bioeffects, deployment and sustainment of warfighters in extreme environments, and understanding and shaping adversarial behavior. The Directed Energy Bioeffects Parameters project develops, demonstrates, and transitions technologies to predict, evaluate, and mitigate the effects of directed energy on personnel and mission performance, and exploits the offensive capabilities of directed energy systems. The Human Dynamics and Terrain Demonstration develops, demonstrates, and transitions technologies to sustain airman performance in adverse operational and/or training environments, monitor and mitigate in-flight unexplained physiological events, and prevent human performance related mishaps through real-time monitoring and mitigation—particularly through highly automated or autonomous systems. The Mission Effective Performance project develops, demonstrates, and transitions advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. The Warfighter Interfaces project develops, demonstrates, and transitions technologies to revolutionize the way airmen synergistically use Air Force systems, including autonomous machines and adaptive teams of airmen and machines. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities. This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, and 0602298F.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603456F I Human Effectiveness Advanced Technology Development
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	23.459	20.652	26.461	0.000	26.461
Current President's Budget	31.135	15.440	15.593	0.000	15.593
Total Adjustments	7.676	-5.212	-10.868	0.000	-10.868
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-5.212			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	9.425	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-1.749	0.000			
• Other Adjustments	0.000	0.000	-10.868	0.000	-10.868

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 635324: *Human Dynamics and Terrain Demonstration*

Congressional Add: *F-35 Helmet Mounted Display System Tech Refresh and Weight Reduction*

Congressional Add Subtotals for Project: 635324

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	9.590	0.000
	9.590	0.000
	9.590	0.000

Change Summary Explanation

In FY 2023, Congressional Directed Reductions were due to realignment into Program 0603032F, Future AF Integrated Technology Demos, Project 0603030, Air Force Vanguard, in order to more appropriately categorize the funding according to purpose.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>				Project (Number/Name) 635323 / <i>Directed Energy Bioeffects Parameters</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635323: <i>Directed Energy Bioeffects Parameters</i>	-	6.484	4.262	7.290	0.000	7.290	6.303	4.965	4.905	5.060	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to predict, evaluate, and mitigate the effects of novel weapon systems on personnel and mission performance, and exploits the offensive capabilities of directed energy systems. This project develops the human components of the guidelines for testing, deployment, and protection from high-power microwave and high-energy laser systems and uses this information to inform design and enhance the effectiveness of these weapon systems in air, space, and cyber operations. This project develops tools and plug-ins that enhance mission and engagement models, provide predictive risk analysis for deployment of Directed Energy systems, and analyzes systems for use. This project develops tools and analysis techniques for counter directed energy weapon technologies. The effort also develops modeling and simulation tools to unite bioeffects and human performance models from across the Department of the Air Force in support of Digital Transformation initiatives.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: WARTECH	0.958	0.000	0.000
Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through the development of new tools and plug-ins that enhance mission and engagement models, and provide predictive risk analysis for deployment of directed energy systems. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.			
FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Fight Tonight.			
FY 2024 Plans: Not Applicable			
Title: Directed Energy Bioeffects	5.526	4.262	7.290

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635323 / <i>Directed Energy Bioeffects Parameters</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: This project combined two efforts into a single effort to better align the directed energy modeling simulation and analysis supporting both radio-frequency and laser bioeffects advanced demonstration. Developed and demonstrated modeling capabilities to assess collateral hazards from high power directed energy systems, including the use of probabilistic risk assessment techniques and analysis of system-level effects on the Airman. Develop and demonstrate counter directed energy weapons technologies for aircrew and ground personnel to provide protection against directed energy threats. United bioeffects and human performance models from across the Department of the Air Force in support of Digital Transformation initiatives.</p> <p>FY 2023 Plans: Continue providing hazard analysis for directed energy systems under development for the Department of Defense. Continue maturation of high peak power radio frequency and laser assessment models and tools to address real world concerns. Continue analyzing operational and mission performance impacts of ocular personnel protection equipment. Continue integration of radio frequency and optical radiation hazards and vision analysis into engagement-level modeling, simulation, and analysis tools for future transitions in mission-level tool suites to support formal studies and analyses. Continue development of integrated vision modeling libraries to inform display design and advanced protection technologies.</p> <p>FY 2024 Plans: Continue to provide hazard analysis for directed energy and novel weapon systems under development. Continue maturation of high peak power radio frequency and laser human effects assessment models and tools to address real world concerns. Provide human based design requirements optimizing operational and mission performance for counter directed energy weapon technologies. Continue integration of radio frequency and optical radiation hazards and behavioral analysis into engagement-level modeling, simulation, and analysis tools for future transitions in mission-level tool suites to support formal studies and analyses. Continue development of integrated vision modeling libraries to optimize agile laser eye protection technologies. Integrate modeling and simulation capabilities into existing architectures for weaponeering and mission level analyses to enable holistic human performance modeling.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$3.028 million. Funding increase due to added emphasis on Directed Energy Bioeffects efforts such as radio frequency and laser human effects assessment models and tools to address real world concerns.</p>			
Accomplishments/Planned Programs Subtotals	6.484	4.262	7.290

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635323 / <i>Directed Energy Bioeffects Parameters</i>

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>				Project (Number/Name) 635324 / <i>Human Dynamics and Terrain Demonstration</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635324: <i>Human Dynamics and Terrain Demonstration</i>	-	11.541	2.313	0.346	0.000	0.346	2.973	4.223	3.927	5.036	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Project objective is to develop, demonstrate, and transition products that provide Airman-integrated capabilities to sustain, enhance, and augment airmen physical and cognitive performance under challenging and adverse operational and training mission environments. Integrate technical advances in molecular and synthetic biology, multi-omics, cognitive performance optimization, brain-machine interface, and application of non-invasive physiological and cognitive performance monitoring devices. Develop solutions to sense, assess, and mitigate impacts to airmen performance degradation including, but not limited to, unexplained physiological events, fatigue, injury, stressors (i.e. environmental, occupational, personal), and cognitive overload. Develop technologies to enhance and accelerate individual physical and cognitive ability to rapidly learn and acquire new mission skills and maintain proficiency of acquired skills. Develop technologies providing commanders real time status monitoring and assessment of individual's mission ready status and intervention protocols to accelerate restoral to combat readiness.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: WARTECH	1.232	0.000	0.000
Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through unexplained physiological events, fatigue, injury, stressors (environmental, occupational, personal), and cognitive overload. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.			
FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguards, effort Vanguard Prospect - Fight Tonight.			
FY 2024 Plans: Not Applicable			
Title: Sensing and Assessment	0.719	1.291	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635324 / <i>Human Dynamics and Terrain Demonstration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>Description: Develop advanced systems integrating biological, physiological, neural, environmental, and behavioral sensing capabilities with validated analytics and assessments to sustain and enhance Airman performance. Resulting products fall within three operational mission environments: (1) maintenance, (2) special operations/dismount forces, and (3) aircrew (cockpit). Emphasis is on maturing and transitioning platform integrated technologies that provide operator mission-specific performance sustainment and enhancement.</p> <p>FY 2023 Plans: Complete development of the Integrated Cockpit Sensing prototype, conduct operational flight demonstration of the Integrated Cockpit Sensing prototype, and transition Integrated Cockpit Sensing system and corresponding data package to transition partner. Complete system development of the baseline Hypothermia Prevention System and conduct operational demonstration of the Hypothermia Prevention System prototype. Foster and maintain a rapid prototype capability to support activities relating to early learning prototyping, product development, and quick turn customer needs.</p> <p>FY 2024 Plans: There are no planned FY 2024 activities for the Sensing and Assessment Project. The project will complete all planned activities by end of FY 2023 and close out.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$1.291 million. Funding decrease due to a reduced emphasis in sensing and assessment efforts, and the close out and completion of all planned activities by end of FY 2023.</p>				
<p>Title: Human Performance Augmentation and Development</p> <p>Description: Develop and demonstrate advanced prototype products that provide Air and Space-integrated capabilities to provide decision advantage and enable Airman and Guardian performance under cognitive and physiological stressors associated with prolonged, high tempo, and demanding mission scenarios as well as stressors associated with operations in adverse environments (i.e. high altitude, Arctic, Space). Provide capabilities to assess in real-time the physical and cognitive state of operators and provide feedback and intervention capabilities to restore and enhance operator performance.</p> <p>FY 2023 Plans: Initiate advanced product development effort to develop a fatigue management system prototype incorporating integrated sensing capabilities with validated models of cognitive performance under fatigue to guide targeted intervention. Initiate planning for start of advanced product effort to develop a biochemical sensor platform utilizing interstitial fluid sensing technologies to analyze operator biomarkers indicative of operational and mission stressors.</p> <p>FY 2024 Plans:</p>		0.000	1.022	0.346

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635324 / <i>Human Dynamics and Terrain Demonstration</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
Continue system development of a fatigue management system, Fatigue Optimized Cognition Under Stress (FOCUS). Integrate the FOCUS mobile device app with sensors monitoring both physical/cognitive biometrics and molecular biomarkers indicative of fatigue. Develop and fine tune models/algorithms utilizing the sensor data and self-assessment inputs to provide real-time feedback and intervention protocols to sustain and optimize cognitive performance per mission needs. Initiate testing, evaluation, and validation of a recommended caffeine dosing algorithm. Initiate initial field testing of the Gen 1 FOCUS app, integrated sensors, and data analytics. Complete interstitial fluid sensing analysis of operational and mission stressors.			
<i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 decreased compared to FY 2023 by \$0.676 million. Funding decrease due to reduced emphasis in fatigue and cognitive monitoring, and the improvement to models and algorithms utilizing sensor data to optimize cognitive performance for mission needs.			
Accomplishments/Planned Programs Subtotals	1.951	2.313	0.346

	FY 2022	FY 2023
<i>Congressional Add:</i> F-35 Helmet Mounted Display System Tech Refresh and Weight Reduction	9.590	0.000
<i>FY 2022 Accomplishments:</i> Conduct Congressionally directed efforts		
<i>FY 2023 Plans:</i> Not Applicable		
Congressional Adds Subtotals	9.590	0.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>				Project (Number/Name) 635325 / <i>Mission Effective Performance</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635325: <i>Mission Effective Performance</i>	-	3.407	4.023	4.134	0.000	4.134	3.914	6.165	7.455	7.667	0.000	36.765
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. This project also develops advanced methods and technologies to enable interactive Live-Virtual-Constructive blended environments for performance-aiding methods and technologies. Focus areas include integrated high-fidelity weapon systems training technologies for air, space, and cyber; tailored immersive simulation environments for airmen at the tactical and operational levels; and incorporation of performance assessment and feedback tools. These methods and technologies facilitate the development of mission-essential competencies.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: WARTECH	1.643	0.000	0.000
Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through advanced training, simulation, mission rehearsal, and other performance-aiding methods and technologies to enhance warfighter readiness. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.			
FY 2023 Plans: In FY 2023 and beyond, this work is performed under PE 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.			
FY 2024 Plans: Not Applicable			
Title: Readiness	1.764	4.023	4.134

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635325 / <i>Mission Effective Performance</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Develop and demonstrate a secure, persistent, and standardized blended live-virtual-constructive operational test and training enterprise. Utilize modeling capabilities for technology demonstration efforts focused on developing software-based tools for managing training, tracking proficiency and readiness, and for training that would replace the human as adversaries and instructors.</p> <p>FY 2023 Plans: Complete proficiency tracking and reporting in Program of Record Mission Training Centers for the F-16, F-15E and Airborne Warning and Control System Block 40/45. Using encrypted data specifications begin migration and integration of those data into an operational readiness data lake with user-specified data extraction and reporting formats. Continue integration of readiness measurement tools in all current training and readiness environments, to include augmented and virtual reality, part-task and full fidelity simulators, and operational range infrastructure. Continue conducting evaluations of higher fidelity software agent models integrated with live and virtual systems and their impact on the quality of training and exercise for a peer fight. Initiate work integrating technologies to support multi-capable airmen with just-in-time-training and readiness support in deployed and austere mission contexts and locations. Initiate work connecting developed data lake and proficiency infrastructure with operational event-based tracking and reporting systems. Initiate systematic evaluations of proficiency-based live-virtual-constructive on operational readiness and more optimal mixes of live and virtual training and exercise.</p> <p>FY 2024 Plans: Continue using encrypted data specifications as part of the migration and integration of those data into an operational readiness data lake with user-specified data extraction and reporting formats. Continue integration of readiness measurement tools in all current training and readiness environments, to include augmented and virtual reality, part-task, full fidelity simulators, the Joint Simulation Environment, and operational range infrastructure. Continue conducting evaluations of higher fidelity software agent models integrated with live and virtual systems and their impact on the quality of training and exercise for a peer fight. Continue work to integrate, evaluate and demonstrate technologies to support multi-capable airmen with just-in-time-training and readiness support in deployed and austere mission contexts and locations. Initiate work integrating training management and data tracking tools and interfaces into the Synthetic Operational Test and Training Infrastructure. Continue field evaluations connecting big data and proficiency-based training infrastructure with operational event-based tracking and reporting systems. Continue systematic evaluations of proficiency-based live-virtual-constructive on operational readiness and more optimal mixes of live and virtual training and exercise. Initiate demonstrations of secure fighter integration blended training events in both research and operational locations, including The Five Eyes coalition partner venues. Initiate work to integrate Distributed Mission operations-and Joint Simulation Environment-based architectures to support interoperable, peer-level training and rehearsal across 4th, 5th, and beyond generation mission sets.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635325 / <i>Mission Effective Performance</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$0.111 million. Funding increase due to added emphasis in training management and data tracking tools and interfaces for Synthetic Operational Test and Training infrastructure.			
Accomplishments/Planned Programs Subtotals	3.407	4.023	4.134

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635327 / <i>Warfighter Interfaces</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635327: <i>Warfighter Interfaces</i>	-	9.703	4.842	3.823	0.000	3.823	6.338	4.457	3.924	3.098	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and readies the transition of technologies to revolutionize the way airmen optimize the capabilities of Air Force systems, including autonomous machines and adaptive teams of Airmen and machines. Improvements in the presentation of operational information to the community of users, from the system operator to the commander, must be developed in step with advancements in the acquisition, storage, and retrieval of information. This project provides the advances in understanding of human cognitive abilities, as well as the utilization of human interfaces, multisensory fusion, high-resolution image displays, and three-dimensional audio to customize communications and enhance shared understanding across a diverse user community in air, space, and cyber for maximum situational awareness.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: WARTECH</p> <p>Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through autonomous machines and adaptive teams of Airmen and machines. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Fight Tonight.</p> <p>FY 2024 Plans: Not Applicable</p>	0.685	0.000	0.000
<p>Title: Airman Machine Interfaces</p> <p>Description: Develops advanced, situationally-adaptive and scalable interface technology and decision aiding tools for more rapid and accurate battlefield awareness, decision making and maximized collaborative, distributed human-machine team</p>	3.156	1.694	1.338

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635327 / <i>Warfighter Interfaces</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
<p>performance. This is accomplished through integrated solutions that manage Airman and Guardian cognitive workload in complex, distributed, and degraded environments.</p> <p>FY 2023 Plans: Continue transitioning advanced command and control (C2) technologies for operators in multiple domains, as well as enabling Air Battle Management System capabilities for distributed C2. Continue building library of user interfaces for manned-unmanned teaming in order to meet demands of strategic, operational and tactical environments. Continue development of collaborative interfaces, leveraging intelligent agents, for cognitive workload reduction. Initiate open and interoperable software to Air Battle Management System-supported platforms. Initiate interface technologies for base defense and protection of the tactical airspace from small unmanned aerial systems. Initiate development wearable communication management platform prototype for mission recording and intelligibility enhancement. Initiate automating mission planning and debrief for assets with unique capabilities and enhance with intelligent agent aided decision making.</p> <p>FY 2024 Plans: Continue advanced command and control (C2) technologies for operators in multiple domains (to include cyber and space domains), as well as enabling Air Battle Management System capabilities for distributed C2. Continue expanding the library of user interfaces for Autonomous Collaborative Enabling Technologies, and initiate multiple autonomous behaviors developed by Defense Advanced Research Projects Agency and the Air Force Strategic Development Planning and Experimentation in order to meet demands of strategic, operational and tactical environments for manned-unmanned teaming. Continue development of collaborative interfaces, leveraging intelligent agents and autonomy for cognitive workload reduction, and optimization of distributed human-human and human-machine teaming. Continue the transition of open and interoperable software to Air Battle Management System-supported platforms. Continue the transition of interface technologies and battle management C2 systems for base defense and protection of the tactical airspace from small unmanned aerial systems. Complete wearable communication management system prototypes for mission recording and intelligibility enhancement. Continue automation of mission planning and debrief for assets with unique capabilities and include intelligent agent aided decision making. Initiate the development of mission planning for Intelligence, Surveillance, Reconnaissance optimization and battle damage assessment. Initiate the enhancement of map drawing capabilities for mission planning and debrief.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.356 million. Funding decrease due to reduced emphasis in command and control technologies.</p>				
Title: Analytic Tools		5.862	3.148	2.485
Description: Develop, demonstrate, and transition software and hardware tools that help conventional Department of Defense, Special Operations, and Intelligence customers to rapidly identify, analyze, shape, and operationalize all types of information				

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / <i>Human Effectiveness Advanced Technology Development</i>	Project (Number/Name) 635327 / <i>Warfighter Interfaces</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>without succumbing to "analysis paralysis." In addition to delivering stand-alone tools, supports other Air Force Research Laboratory Technical Directorates. Build human-centric training solutions to: triage data-at-scale, automate mundane processes, optimize workflow, identify obscured patterns, mitigate cognitive overload, expedite logical decision-making, quantify performance metrics, accelerate human interpretation of information, and autonomously cue humans in live-virtual-constructive environments. These tools mitigate the scale and complexity in Joint All Domain Operations environments.</p> <p>FY 2023 Plans: Continue in-house Live-Virtual-Constructive simulation architecture to address training deficiencies across the United States Air Force. Automate the following: post-training grading in single simulator environment, real-time feedback in single simulator environment, proactive cueing in single simulator environment, real-time feedback and proactive cueing in multi-simulator, team environment. Continue in-house Live-Virtual-Constructive simulation architecture to include the Space, Cyber, and/or Maritime domains to support the emerging focus on the Great Power Competition, and Joint All Domain Operations environment. Initiate productizing a suite of customized software developed to operationalize existing, in-house Live-Virtual-Constructive architecture. Continue developing existing Artificial Intelligence/Machine Learning analytic tools from "canned" frameworks to explainable architectures and interfaces that leverage the psychology of human trust.</p> <p>FY 2024 Plans: Continue in-house Live-Virtual-Constructive simulation architecture to address training deficiencies across the Department of the Air Force. Initiate the integration of augmented reality, virtual reality, and mixed reality tools into Live-Virtual-Constructive environments, improving upon the current simulation ecosystems. Complete automation and real-time feedback of single simulator environments, and proactive cueing in multisimulator, team environments. Continue expansion of in-house Live-Virtual-Constructive simulation architecture to include the Space, Cyber, and/or Maritime domains. Continue the production and maturation of software to operationalize existing, in-house Live-Virtual-Constructive architecture, to include autonomy-enabled intelligence, Surveillance, and Reconnaissance applications. Initiate integration of data analysis tools into the emerging Synthetic Operational Test and Training Infrastructure, with emphasis on software that detect patterns in: friend/enemy verbal communications, multi-sensor data extraction/correlation, and automated cueing for complex, high-stress, and/or time-sensitive tasks. Continue Artificial Intelligence/Machine Learning analytic tools from "canned" frameworks to explainable architectures and interfaces that leverage the psychology of human trust. Initiate object-based Graphical User Interfaces that are highly customizable by military users with limited software skills.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$0.663 million. Funding decrease due to reduced emphasis automation and real-time feedback of single simulator environments, and proactive cueing in multisimulator, team environments.</p>			
Accomplishments/Planned Programs Subtotals	9.703	4.842	3.823

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603456F / Human Effectiveness Advanced Technology Development	Project (Number/Name) 635327 / Warfighter Interfaces

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	144.116	154.618	132.311	0.000	132.311	136.709	125.329	124.906	132.650	Continuing	Continuing
63670A: <i>Weapon Technology Development</i>	-	54.786	56.569	68.027	0.000	68.027	85.022	81.427	82.747	92.209	Continuing	Continuing
63670B: <i>Weapon Concept Development</i>	-	89.330	98.049	64.284	0.000	64.284	51.687	43.902	42.159	40.441	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops, integrates, and demonstrates advanced ordnance and guidance technologies for conventional weapons. The effort focuses on conventional ordnance component technologies such as warheads, fuzes, and explosives, as well as munition guidance component technologies such as navigation and control systems and seekers. Technologies to be developed, demonstrated, and integrated into system concepts will address blast, fragmentation, penetration, low collateral damage, variable depth/location fuzing, precise guidance, and high-performance and insensitive explosives. Efforts in this project have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of such program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602605F, 0602788F, 0602298F, and 0602020F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	155.306	187.374	226.278	0.000	226.278
Current President's Budget	144.116	154.618	132.311	0.000	132.311
Total Adjustments	-11.190	-32.756	-93.967	0.000	-93.967
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	10.000			
• Congressional Directed Transfers	0.000	-32.756			
• Reprogrammings	-0.005	0.000			
• SBIR/STTR Transfer	-4.889	0.000			
• Other Adjustments	-6.296	-10.000	-93.967	0.000	-93.967

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 63670B: *Weapon Concept Development*

Congressional Add: *Next generation affordable direct attack munition*

	FY 2022	FY 2023
	0.000	10.000
Congressional Add Subtotals for Project: 63670B	0.000	10.000
Congressional Add Totals for all Projects	0.000	10.000

Change Summary Explanation

In FY 2023 the Transformational component effort was realigned under Program 0603032F WARTECH, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry, effort Vanguard Prospect - Fight Tonight, effort Future Transformational Capabilities, and effort Vanguard Prospect - Long Range Kill Chain.

FY 2023 adjustment of \$32.756 million reflects realignment of the Transformational component funding as described above.

FY 2024 adjustment of \$93.967 million reflects realignment of the Transformational component funding and a decrease in scope of efforts associated with system-level integration and concept demonstration of technical components/subsystems in deference to higher Air Force priorities.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>				Project (Number/Name) 63670A / <i>Weapon Technology Development</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
63670A: <i>Weapon Technology Development</i>	-	54.786	56.569	68.027	0.000	68.027	85.022	81.427	82.747	92.209	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops, matures, assesses, and demonstrates advanced/innovative ordnance and guidance component and subsystem technologies for conventional weapons. The project focuses on maturation of advanced explosives, fuzes, warheads, sub-munitions, and weapon airframes, carriage and dispensing; as well as innovative munition seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Ordnance Technologies	26.841	27.728	32.626
Description: Develop and demonstrate integrated ordnance technologies to improve conventional munitions. Specific technical areas of focus include energetic materials, fuze technology, warhead sciences, and modeling and simulation tools.			
FY 2023 Plans: Continue demonstrating and assessing advanced distributed, embedded fuzing concepts for long-term safety, survivability, and functionality. Continue advanced development of ordnance technologies to allow tailored lethality by controlling weapon fragmentation. Continue maturation of advanced ordnance technologies for rapid transition into high-speed strike weapon concepts, collecting complex arena test data for implementation into lethality modeling and simulation tools. Continue developing test capabilities and high-fidelity analysis tools to quickly generate more accurate weaponing data. Continue developing advanced ordnance technologies for high-speed impact. Continue developing advanced ordnance technologies/methodologies for functional defeat. Continue research into armament systems for Special Operations applications. Continue conducting lethality analyses for weapons and lethality/survivability tools at the meso/micro-scale. Complete research on distributed, collaborative and cooperative effects munition technologies. Continue the development of high-fidelity test capabilities and analysis tools to evaluate ordnance technologies in relevant environments. Continue incorporation of previously developed material models and improve/advance additional joint kinetic/directed energy common target models. Continue synthesis and incorporation of warhead models for progressive collapse, multiple point initiation, secondary debris and other models.			
FY 2024 Plans: Continue demonstrating and assessing advanced distributed, embedded fuzing concepts for long-term safety, survivability, and functionality. Continue advanced development of ordnance technologies to allow tailored lethality by controlling weapon fragmentation. Continue maturation of advanced ordnance technologies for rapid transition into high-speed strike weapon concepts, collecting complex arena test data for implementation into lethality modeling and simulation tools. Continue developing			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>	Project (Number/Name) 63670A / <i>Weapon Technology Development</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>test capabilities and high-fidelity analysis tools to quickly generate more accurate weaponing data. Continue developing advanced ordnance technologies for high-speed impact. Continue developing advanced ordnance technologies/methodologies for functional defeat. Continue research into armament systems for Special Operations applications. Continue conducting lethality analyses for weapons and lethality/survivability tools at the meso/micro-scale. Continue the development of high-fidelity test capabilities and analysis tools to evaluate ordnance technologies in relevant environments. Continue incorporation of previously developed material models and improve/advance additional joint kinetic/directed energy common target models. Continue synthesis and incorporation of warhead models for progressive collapse, multiple point initiation, secondary debris and other models to include those supportive of coordinated and distributed impact.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$4.898 million. Funding increased due to increased emphasis in high speed ordnance technology and ordnance technologies versus maritime targets.</p>			
<p>Title: Guidance Technologies</p> <p>Description: Develop guidance technologies to improve the precision, controlled lethality, and flexibility of conventional munitions. Specific technical areas include precision navigation and terminal seekers.</p> <p>FY 2023 Plans: Continue integration of hardware-in-the-loop, software-in-the-loop, and other modeling and simulation technologies for the demonstration of open architecture, high-speed, networked, collaborative and autonomous, and modular munition concepts. Continue the design, development, and evaluation of seeker sub-system prototypes for platform self-defense. Continue development of advanced, high-resolution infrared scene projectors, distributed simulation concepts, software-defined radio frequency test chamber, scene generation, mission, engagement, campaign level simulations, and panoramic infrared dome technologies. Continue developing technologies for precision navigation of weapons in Global Positioning System-denied scenarios. Continue maturation and integration of advanced carriage and release concepts and sub-systems. Continue improving multi-security level, cross-domain distributed modeling and simulation for munition research using distributed connectivity between Eglin Air Force Base facilities and other geographic locations. Continue integrating higher-fidelity lethality models into guidance and control simulations to enhance weapon integrated performance. Complete development of sensor test technologies to enable verification of autonomous munition concepts. Continue integrating higher fidelity constructive analysis tools with engagement and mission level modeling and simulation. Continue miniature munition technology integration for ground launch demonstration. Initiate design and development of a weapons digital ecosystem that enables digital engineering and the use of high-fidelity digital twinning across the weapons lifecycle.</p> <p>FY 2024 Plans:</p>	27.945	28.841	35.401

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>	Project (Number/Name) 63670A / <i>Weapon Technology Development</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue integration of hardware-in-the-loop, software-in-the-loop, and other modeling and simulation technologies for the demonstration of open architecture, high-speed, networked, collaborative and autonomous, and modular munition concepts. Complete the design, development, and evaluation of seeker sub-system prototypes for platform self-defense and initiate investigation of alternative applications. Continue development of advanced, high-resolution infrared scene projectors, distributed simulation concepts, software-defined radio frequency test chamber, scene generation, mission, engagement, campaign level simulations, and panoramic infrared dome technologies. Continue to develop technologies for precision navigation of weapons in Global Positioning System-denied scenarios. Continue to mature and integrate advanced carriage and release concepts and sub-systems. Continue improving multi-security level, cross-domain distributed modeling and simulation for munition research using distributed connectivity between Eglin Air Force Base facilities and other geographic locations. Continue integrating higher-fidelity lethality models into guidance and control simulations to enhance weapon integrated performance. Continue integrating higher fidelity constructive analysis tools with engagement and mission level modeling and simulation. Complete miniature munition technology integration for ground launch demonstration. Continue design and development of a weapons digital ecosystem that enables digital engineering and the use of high-fidelity digital twinning across the weapons lifecycle.</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> FY 2024 increased compared to FY 2023 by \$6.560 million. Funding increased due to the acceleration of digital demonstrations of open architecture, high-speed, networked, collaborative and autonomous (NCA), and modular munition concepts within a weapons digital ecosystem.</p>			
Accomplishments/Planned Programs Subtotals	54.786	56.569	68.027

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>				Project (Number/Name) 63670B / <i>Weapon Concept Development</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
63670B: <i>Weapon Concept Development</i>	-	89.330	98.049	64.284	0.000	64.284	51.687	43.902	42.159	40.441	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops, refines, integrates, demonstrates, and assesses ordnance and guidance technologies to reduce risk for potential conventional weapons acquisitions. The project concentrates in two effort areas, Air-to-Air Concept Development and Air-to-Ground Concept Development. The project focuses on risk reduction of advanced explosives, fuzes, warheads, sub-munitions, and weapon airframes, carriage and dispensing; as well as innovative munition seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Air-to-Air Concept Development	38.813	42.284	30.585
Description: Mature, integrate, and demonstrate air-to-air weapon components and systems to include ordnance, guidance, and carriage and release technologies to demonstrate war-fighter capability.			
FY 2023 Plans: Continue developing the technology trade space to enable air-to-air weapons with robust capability in the future threat environment, including technologies for efficient propulsion, high lethality, efficient flight, high agility, miniaturization, as well as cost and risk reduction for both offensive and defensive purposes. Continue developing and testing prototype propulsion systems with flexibility to enable more adaptable next generation air-to-air weapons. Continue conducting lethality analysis to enable design of small form factor warheads lethal against the 2030 plus target set. Continue transitioning advanced target models to other AF and DoD offices. Continue developing preliminary design of air-to-air weapon concepts for sixth generation platforms. Continue documenting missile flight dynamics trade space. Continue conducting wind-tunnel experiments to characterize airframes and validate aerodynamic codes leading to development of highly maneuverable and efficient missiles to counter advanced targets, and improve persistence and survivability of future platforms. Continue conducting ground and arena tests of advanced weapons experimental carriages for sixth generation weapon concept and prepare for flight worthiness testing. Complete simulation architectures to assess the trade and synergies between kinetic and directed energy weapons. Continue performing experiments with small warheads to obtain data for lethality analysis to validate and improve designs. Continue planning and executing integrated sub-system experiments. Continue miniature munition ground launch demonstration. Continue modeling, simulation, analysis, and digital engineering in support of air-to-air advanced weapon technologies.			
FY 2024 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>	Project (Number/Name) 63670B / <i>Weapon Concept Development</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue developing the technology trade space to enable air-to-air weapons with robust capability in the future threat environment, including technologies for efficient propulsion, high lethality, efficient flight, high agility, miniaturization, as well as cost and risk reduction for both offensive and defensive purposes. Continue developing and testing propulsion systems with flexibility to enable more adaptable next generation air-to-air weapons. Continue conducting lethality analysis to enable design of small form factor warheads for lethality against the 2030-plus target set. Continue transitioning advanced target models to other AF and DoD offices. Continue developing preliminary design of air-to-air weapon concepts for sixth- generation platforms. Continue exploring and documenting missile flight dynamics trade space. Continue conducting wind-tunnel experiments to characterize airframes and validate aerodynamic codes leading to development of highly maneuverable and efficient missiles to counter advanced targets, and improve persistence and survivability of future platforms. Continue conducting ground and arena tests of advanced weapons experimental carriages for sixth-generation weapon concept and prepare for flight worthiness testing. Continue performing experiments with small warheads to obtain data for lethality analysis to validate and improve designs. Continue planning and executing integrated sub-system experiments. Continue modeling, simulation, analysis, and digital engineering in support of air-to-air advanced weapon technologies.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$11.699 million. Funding decreased due to reduced scope of efforts associated with system-level integration and concept demonstration of technical components/subsystems in deference to higher Air Force priorities.</p>			
<p>Title: Air-to-Ground Concept Development</p> <p>Description: Mature, integrate, and demonstrate air-to-ground weapon components and systems (ordnance, guidance, and carriage and release technologies) to demonstrate war-fighter capability.</p> <p>FY 2023 Plans: Complete integration of collaborative weapon technology onto additional weapon systems. Continue technology risk reduction including demonstration and flight testing for weapons concepts responsive to the future threat environment (including hypersonic and high-speed concepts). Complete developing simulation architectures assessing the trades and synergies between kinetic and directed energy weapons. Continue developing kinetic/non-kinetic payloads, seeker, and fuze technology for hypersonic applications. Continue modeling, simulation, analysis, and digital engineering in support of air-to-ground advanced weapon technologies.</p> <p>FY 2024 Plans: Continue technology risk reduction including demonstration and flight testing for weapons concepts responsive to the future threat environment (including hypersonic and high-speed concepts). Initiate technology risk reduction for hypersonic and high-speed weapon concepts development within a scalable, cloud-enabled modeling and simulation ecosystem. Continue developing kinetic/</p>	42.047	45.765	33.699

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>	Project (Number/Name) 63670B / <i>Weapon Concept Development</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>non-kinetic payloads, seeker, and fuze technology for hypersonic applications. Continue modeling, simulation, analysis, and digital engineering in support of air-to-ground advanced weapon technologies.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$12.066 million. Funding decreased due to reduced scope of efforts associated with system-level integration and concept demonstration of technical components/subsystems in deference to higher Air Force priorities.</p>			
<p>Title: Transformational Component</p> <p>Description: This funding allocation will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through ordnance and guidance technologies. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: In FY 2023 this effort will be realigned under Program 0603032F WARTECH, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry, effort Vanguard Prospect - Fight Tonight, effort Future Transformational Capabilities, and effort Vanguard Prospect - Long Range Kill Chain.</p> <p>FY 2024 Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: N/A</p>	8.470	0.000	0.000
Accomplishments/Planned Programs Subtotals	89.330	88.049	64.284

Congressional Add: Next generation affordable direct attack munition	FY 2022	FY 2023
	0.000	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603601F / <i>Conventional Weapons Technology</i>	Project (Number/Name) 63670B / <i>Weapon Concept Development</i>	
		FY 2022	FY 2023
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally-directed efforts.			
Congressional Adds Subtotals		0.000	10.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603605F / <i>Advanced Weapons Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	29.585	89.024	102.997	0.000	102.997	52.172	31.961	31.115	32.180	Continuing	Continuing
633151: <i>High Power Solid State Laser Technology</i>	-	20.738	31.401	15.849	0.000	15.849	13.675	13.202	13.492	14.075	Continuing	Continuing
633152: <i>High Power Microwave Development and Integration</i>	-	8.847	57.623	87.148	0.000	87.148	38.497	18.759	17.623	18.105	0.000	246.602

A. Mission Description and Budget Item Justification

This program provides for the development, integration, demonstration, and detailed assessment of directed energy (DE) weapon technologies for potential application on Air Force platforms. These include high energy laser (HEL), high power microwaves (HPM), and other unconventional weapon generation and transmission technologies, which can support a wide range of Air Force applications. The program develops a corresponding susceptibility, vulnerability, and lethality database for directed energy weapons. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this program element would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity	R-1 Program Element (Number/Name)
3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	PE 0603605F / <i>Advanced Weapons Technology</i>

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	31.855	98.503	114.373	0.000	114.373
Current President's Budget	29.585	89.024	102.997	0.000	102.997
Total Adjustments	-2.270	-9.479	-11.376	0.000	-11.376
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	5.000			
• Congressional Directed Transfers	0.000	-14.414			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-2.262	0.000			
• Other Adjustments	-0.008	-0.065	-11.376	0.000	-11.376

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 633151: *High Power Solid State Laser Technology*

Congressional Add: *Program increase - LIDAR CUAS automated target recognition*

Congressional Add Subtotals for Project: 633151

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	-	5.000
	-	5.000
	-	5.000

Change Summary Explanation

Funding decrease is due to realignment into Program 0603032F, Future AF Integrated Technology Demonstrations, Project 630320, Air Force and higher Air Force priorities.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603605F / <i>Advanced Weapons Technology</i>				Project (Number/Name) 633151 / <i>High Power Solid State Laser Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
633151: <i>High Power Solid State Laser Technology</i>	-	20.738	31.401	15.849	0.000	15.849	13.675	13.202	13.492	14.075	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project provides for the development, integration, demonstration, and detailed technical assessment of high energy laser devices, advanced imaging, and beam control technologies needed for applications such as force protection, force application, precision engagement, and aircraft protection. Laser system concept assessments to include vulnerability assessments and target effect testing are performed.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Energy Laser/Beam Control	19.797	26.401	15.849
Description: Develop and demonstrate advanced beam control technologies, integrated laser systems, and aircraft protection laser technologies. Demonstrate beam control components integrated with high energy lasers for the Department of the Air Force utility.			
FY 2023 Plans: Complete the laser system, the beam control system, and the pod delivery of the Self Defense High Energy Laser Demonstrator (SHIELD) which is intended to be a flight demonstrator of a laser weapon laser system in pod form factor. Continue additional testing and demonstration activities with packaged high energy laser (HEL) and/or beam control subsystem. Initiate laser subsystems integration for a ground demonstration. Initiate assistance in the development of a high power microwave system with the military services for Directed Energy Frontline Electromagnetic Neutralization and Defeat (DEFEND) being executed in 0603605F:6633152.			
FY 2024 Plans: Continue additional testing and demonstration activities with packaged high energy laser (HEL) and/or beam control subsystem. Continue laser subsystems integration for a ground demonstration. Initiate next phase of advanced integrated technologies for compact, low-size, weight and power (SWaP) airborne laser weapon system.			
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$10.552 million. Funding decrease due to transfer of funds to accurately reflect previous allocation.			
Title: Transformational Technology Development	0.941	0.000	0.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603605F / <i>Advanced Weapons Technology</i>	Project (Number/Name) 633151 / <i>High Power Solid State Laser Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Continually funded effort. This funding allocation will start new and continue Transformational Technology Developments. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to development and demonstration of new high energy laser devices, advanced imaging and beam control technologies, as well as assessments to enable new laser system concept development. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans: Not applicable.</p> <p>FY 2024 Plans: Not applicable.</p>			
Accomplishments/Planned Programs Subtotals	20.738	26.401	15.849

	FY 2022	FY 2023
Congressional Add: Program increase - LIDAR CUAS automated target recognition	-	5.000
FY 2023 Plans: Conduct Congressional directed efforts.		
Congressional Adds Subtotals	-	5.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

Not Applicable

D. Acquisition Strategy

Not Applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603605F / <i>Advanced Weapons Technology</i>				Project (Number/Name) 633152 / <i>High Power Microwave Development and Integration</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
633152: <i>High Power Microwave Development and Integration</i>	-	8.847	57.623	87.148	0.000	87.148	38.497	18.759	17.623	18.105	0.000	246.602
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project develops and demonstrates high power microwave and other unconventional electromagnetic field generation and transmission technologies that can be integrated into future weapon systems to support a wide range of the Department of the Air Force missions such as air base defense or the damage/destruction of an adversary's electronic infrastructure. It also provides inputs to the susceptibility, vulnerability, and lethality databases used across the Department of Defense to understand thresholds for scalable effects of directed energy weapons.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: High Power Microwave Technologies	3.989	57.623	87.148
Description: Develop and evaluate high power microwave and other unconventional weapon technologies for various platforms, including aerial, for applications such as counter-electronics. Develop and evaluate high power microwave technologies for non-kinetic and counter-electronic weapon applications.			
FY 2023 Plans: Continue development of high power microwave components to enable the integration into aerial platforms, ground-based systems and mobile systems. Complete high power microwave payload development for a later integration support missile defense mission under development with the Navy. Continue characterization, model, test, and evaluate current and projected blue Directed Energy weapons against relevant red assets. Initiate development of a high power microwave system with the military services for Directed Energy Frontline Electromagnetic Neutralization and Defeat (DEFEND).			
FY 2024 Plans: Continue development of high power microwave components to enable the integration into aerial platforms, ground-based systems and mobile systems. Initiate development of a high power microwave system for an integrated air and missile defense mission. Continue development of modeling tools and test capabilities to evaluate current and projected blue Directed Energy weapons against relevant red assets. Continue development of next generation high power microwave high frequency sources. Continue a high-priority base defense mission with joint high power microwave system with the Military Services for Directed Energy Frontline Electromagnetic Neutralization and Defeat (DEFEND).			
FY 2023 to FY 2024 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603605F / <i>Advanced Weapons Technology</i>	Project (Number/Name) 633152 / <i>High Power Microwave Development and Integration</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$29.525 million. Funding increase reflects the development and delivery of a high-priority base defense mission with joint high power microwave defense system with the military services.				
Title: Transformational Technology Development		4.858	0.000	0.000
Description: Continually funded effort. This funding allocation will start new and continue Transformational Technology Developments. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming; Battlespace Awareness; Integrated Base Defense; and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to: development and demonstration of new high power microwave sources, transmission technologies, and applications, to include non-kinetic and counter-electronic. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.				
FY 2023 Plans: Effort realigned PE 0603032F Future AF Integrated Technology Demonstration, Project 630320, Air Force Vanguard, in order to provide a more complete picture of the Vanguard program.				
FY 2024 Plans: Not Applicable.				
Accomplishments/Planned Programs Subtotals		8.847	57.623	87.148
C. Other Program Funding Summary (\$ in Millions)				
N/A				
Remarks				
Not Applicable				
D. Acquisition Strategy				
Not Applicable				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	169.459	270.959	44.422	0.000	44.422	44.256	44.999	45.411	48.042	Continuing	Continuing
635280: <i>Manufacturing Technologies</i>	-	169.459	270.959	44.422	0.000	44.422	44.256	44.999	45.411	48.042	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This program executes technical efforts to develop and maintain an affordable and reliable industrial base and manufacturing capability responsive to Department of the Air Force warfighter needs. The program develops and improves manufacturing technologies and processes to reduce transition risk, enable cost reduction, improve component and system quality, increase readiness and affordable mission availability, enhance industrial capability, and promote transformation through the industrial base. Value stream modifications and manufacturing throughput improvements are implemented to shorten weapon system cycle times during design, development, production, and sustainment. Cost savings are realized through early engagement with stakeholders to promote producible designs, ensuring the industrial base will be ready to manufacture at the needed quantities. Manufacturing technologies objectives are conducted through industrial partnerships that enable targeted investment of manufacturing technologies and reduce risk in the industrial supply chain for existing weapon system upgrades and new warfighter systems. Efforts in the program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602020F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	176.200	47.759	43.332	0.000	43.332
Current President's Budget	169.459	270.959	44.422	0.000	44.422
Total Adjustments	-6.741	223.200	1.090	0.000	1.090
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	223.200			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-6.270	0.000			
• Other Adjustments	-0.471	0.000	1.090	0.000	1.090

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 635280: *Manufacturing Technologies*

- Congressional Add: *Program increase - Technologies to repair fastener holes*
- Congressional Add: *Program increase - Manufacturing technology for reverse engineering*
- Congressional Add: *Program increase - Hybrid manufacturing for rapid tooling and repair*
- Congressional Add: *Program increase - flexible thermal protection systems for hypersonics*
- Congressional Add: *Program increase - thermoplastic material systems*
- Congressional Add: *Program increase - automated fiber placement for composite structures*
- Congressional Add: *Program increase - massive area additive manufacturing*
- Congressional Add: *Program increase - academic-industry partnerships for advanced materials and manufacturing processes*
- Congressional Add: *Program increase - adaptive modeling for low-cost titanium*
- Congressional Add: *Program increase - beryllium additive manufacturing*
- Congressional Add: *Program increase - component 3D online demonstration*
- Congressional Add: *Program increase - MRO advanced process technology development*
- Congressional Add: *Program increase - sustainment and modernization research and development*
- Congressional Add: *Program increase - virtual augmented mixed reality readiness*
- Congressional Add: *Program increase - affordable manufacture of resistive films*

	FY 2022	FY 2023
	4.873	5.000
	4.873	5.000
	9.747	0.000
	9.747	10.000
	4.631	0.000
	4.873	0.000
	9.747	0.000
	5.848	6.000
	4.873	5.000
	2.924	3.000
	9.747	0.000
	9.747	10.000
	9.747	0.000
	7.797	8.000
	9.747	10.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603680F I Manufacturing Technology Program
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2022	FY 2023
Congressional Add: <i>Program increase - rapid large format metal additive manufacturing to optimize scramjet production</i>	4.873	7.500
Congressional Add: <i>Program increase - universal robotic controller</i>	5.848	0.000
Congressional Add: <i>Program increase - hypersonics supply chain research</i>	9.747	0.000
Congressional Add: <i>Program increase - additive manufacturing qualification</i>	0.000	5.000
Congressional Add: <i>Program increase - composites for advanced air mobility</i>	0.000	10.000
Congressional Add: <i>Program increase - digital engineering work cell</i>	0.000	5.000
Congressional Add: <i>Program increase - gallium oxide for high power electronics</i>	0.000	5.000
Congressional Add: <i>Program increase - vertical integration of scramjet supply chain</i>	0.000	10.000
Congressional Add: <i>Program increase - low-cost rapid aerospace fabrication technology</i>	0.000	6.500
Congressional Add: <i>Program increase - smart manufacturing digital thread initiative</i>	0.000	10.000
Congressional Add: <i>Program increase - trusted metal additive manufacturing</i>	0.000	10.000
Congressional Add: <i>Program increase - additive manufacturing industrial base and capability expansion</i>	0.000	10.000
Congressional Add: <i>Program increase - agile Factory Floor for Depot Sustainment</i>	0.000	5.300
Congressional Add: <i>Program increase - F-35 agnostic battery development</i>	0.000	9.800
Congressional Add: <i>Program increase - high temperature hypersonic aeroshell</i>	0.000	6.000
Congressional Add: <i>Program increase - large -scale metal 3D printing</i>	0.000	10.000
Congressional Add: <i>Program increase - low cost manufacturing methods for hypersonic vehicle components</i>	0.000	5.000
Congressional Add: <i>Program increase - tools and processes for affordable high temperature composites</i>	0.000	9.000
Congressional Add: <i>Program increase - nanocomposite coatings advanced research</i>	0.000	10.000
Congressional Add: <i>Program increase - digital engineering enabled workforce development</i>	0.000	7.000
Congressional Add: <i>Program increase - alternative domestic rubber production</i>	0.000	5.100
Congressional Add: <i>Program increase - hypersonic manufacturing capability and supply</i>	0.000	5.000
Congressional Add: <i>Program increase - advanced air mobility in NEO environment</i>	0.000	10.000
Congressional Add Subtotals for Project: 635280	129.389	223.200
Congressional Add Totals for all Projects	129.389	223.200

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>		R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>		
Change Summary Explanation Increase in FY2024 is due to increased emphasis on affordable manufacturing at scale for future force systems.				
C. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Title: Affordable Mission Availability		12.021	14.328	13.327
Description: Develop and transition pervasive manufacturing technologies for affordable mission availability of Department of the Air Force components and systems.				
FY 2023 Plans: Continue to advance high demand specialized manufacturing technologies to develop cost effective conventional production, overhaul, and specialty material repair technologies to enable affordable sustainment of aircraft systems. Continue to develop cost-effective manufacturing and repair processes to meet specific needs of Programs of Record and depots. Continue to develop manufacturing methods to meet the needs of next generation hypersonic platforms. Continue to develop and demonstrate the manufacturability of materials, processes and devices for command and control communication technologies, intelligence, surveillance and reconnaissance systems, and RF, digital and power management components. Continue manufacturing repair technologies for turbine engine components. Initiate manufacturing technologies for high temperature sensors and windows.				
FY 2024 Plans: Continue advancing high demand specialized manufacturing technologies to develop cost effective conventional production, overhaul, and specialty material repair technologies to enable affordable sustainment of aircraft systems. Continue developing cost-effective manufacturing and repair processes to meet specific needs of Programs of Record and depots. Continue developing manufacturing methods to meet the needs of next generation hypersonic platforms. Continue developing and demonstrating the manufacturability of materials, processes and devices for command and control communication technologies, intelligence, surveillance and reconnaissance systems, and RF, digital and power management components. Continue manufacturing repair technologies for turbine engine components. Continue manufacturing technologies for high temperature sensors and windows.				
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding decreased compared to FY 2023 by \$1.001 million. Funding decreased due to decreased emphasis on manufacturing technologies for optical components.				
Title: Advanced Manufacturing Technologies		20.035	23.880	22.211
Description: Develop and transition affordable advanced manufacturing for Department of the Air Force fielded and future platforms.				
FY 2023 Plans:				

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Continue to enable and promote advanced manufacturing processes, techniques, and equipment availability for reducing materiel acquisition, maintenance and repair costs. Continue to develop and demonstrate intelligent robotics and digital engineering concepts into manufacturing processes. Continue to develop, demonstrate and evaluate additively manufactured aerospace components and subcomponents. Continue to develop and demonstrate technologies enabling factory of the future, digital supply chain management, and industrial internet of things to provide improvements in production, delivery and support of warfighter capabilities.</p> <p>FY 2024 Plans: Continue enabling and promoting advanced manufacturing processes, techniques, and equipment availability for reducing materiel acquisition, maintenance and repair costs. Continue developing and demonstrate intelligent robotics and digital engineering concepts into manufacturing processes. Continue developing, demonstrating and evaluating additively manufactured aerospace components and subcomponents. Continue developing and demonstrating technologies enabling factory of the future, digital supply chain management, and industrial internet of things to provide improvements in production, delivery and support of warfighter capabilities.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding decreased compared to FY 2023 by \$1.669 million. Funding decreased due to decreased emphasis on manufacturing automation.</p>			
<p>Title: Manufacturing for the Future Force</p> <p>Description: Develop and transition manufacturing technologies that enable advanced technology solutions that will shape the future force across the air, space and cyberspace domains. Prior to FY2024 this effort was titled, "Manufacturing for Transformational Technologies."</p> <p>FY 2023 Plans: Continue development of high demand manufacturing technologies including low cost and attritable systems, thermal protection materials for high temperature applications and other manufacturing technologies geared toward realizing the future force and to provide a cost-imposing strategy against adversarial forces.</p> <p>FY 2024 Plans: Continue development of high demand manufacturing technologies including low cost and attritable systems, thermal protection materials for high temperature applications and other manufacturing technologies geared toward realizing the future force and to provide a cost-imposing strategy against adversarial forces.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	8.014	9.551	8.884

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
FY 2024 funding decreased compared to FY 2023 by 0.667 million. Funding decreased is due to the above plans.			
Accomplishments/Planned Programs Subtotals	40.070	47.759	44.422

	FY 2022	FY 2023
Congressional Add: Program increase - Technologies to repair fastener holes <i>FY 2022 Accomplishments:</i> Conducted Congressionally directed efforts. <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	4.873	5.000
Congressional Add: Program increase - Manufacturing technology for reverse engineering <i>FY 2022 Accomplishments:</i> Conducted Congressionally directed efforts. <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	4.873	5.000
Congressional Add: Program increase - Hybrid manufacturing for rapid tooling and repair <i>FY 2022 Accomplishments:</i> Conducted Congressionally directed efforts. <i>FY 2023 Plans:</i> Not applicable	9.747	0.000
Congressional Add: Program increase - flexible thermal protection systems for hypersonics <i>FY 2022 Accomplishments:</i> Conducted Congressionally directed efforts. <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	9.747	10.000
Congressional Add: Program increase - thermoplastic material systems <i>FY 2022 Accomplishments:</i> Conducted Congressionally directed efforts. <i>FY 2023 Plans:</i> Not applicable	4.631	0.000
Congressional Add: Program increase - automated fiber placement for composite structures <i>FY 2022 Accomplishments:</i> Conducted Congressionally directed efforts. <i>FY 2023 Plans:</i> Not applicable	4.873	0.000
Congressional Add: Program increase - massive area additive manufacturing	9.747	0.000

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)		
3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	PE 0603680F I Manufacturing Technology Program		
	FY 2022	FY 2023	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not applicable			
Congressional Add: Program increase - academic-industry partnerships for advanced materials and manufacturing processes	5.848	6.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - adaptive modeling for low-cost titanium	4.873	5.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - beryllium additive manufacturing	2.924	3.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - component 3D online demonstration	9.747	0.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not applicable			
Congressional Add: Program increase - MRO advanced process technology development	9.747	10.000	
FY 2022 Accomplishments: Conduct Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - sustainment and modernization research and development	9.747	0.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - virtual augmented mixed reality readiness	7.797	8.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - affordable manufacture of resistive films	9.747	10.000	

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)		
3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	PE 0603680F I Manufacturing Technology Program		
	FY 2022	FY 2023	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not applicable			
Congressional Add: Program increase - rapid large format metal additive manufacturing to optimize scramjet production	4.873	7.500	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - universal robotic controller	5.848	0.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not applicable			
Congressional Add: Program increase - hypersonics supply chain research	9.747	0.000	
FY 2022 Accomplishments: Conducted Congressionally directed efforts.			
FY 2023 Plans: Not applicable			
Congressional Add: Program increase - additive manufacturing qualification	0.000	5.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - composites for advanced air mobility	0.000	10.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - digital engineering work cell	0.000	5.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - gallium oxide for high power electronics	0.000	5.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - vertical integration of scramjet supply chain	0.000	10.000	

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)		
3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	PE 0603680F I Manufacturing Technology Program		
	FY 2022	FY 2023	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - low-cost rapid aerospace fabrication technology	0.000	6.500	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - smart manufacturing digital thread initiative	0.000	10.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - trusted metal additive manufacturing	0.000	10.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - additive manufacturing industrial base and capability expansion	0.000	10.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - agile Factory Floor for Depot Sustainment	0.000	5.300	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - F-35 agnostic battery development	0.000	9.800	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - high temperature hypersonic aeroshell	0.000	6.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - large -scale metal 3D printing	0.000	10.000	

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)		
3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	PE 0603680F I Manufacturing Technology Program		
	FY 2022	FY 2023	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - low cost manufacturing methods for hypersonic vehicle components	0.000	5.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - tools and processes for affordable high temperature composites	0.000	9.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - nanocomposite coatings advanced research	0.000	10.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - digital engineering enabled workforce development	0.000	7.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - alternative domestic rubber production	0.000	5.100	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Add: Program increase - hypersonic manufacturing capability and supply	0.000	5.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Program increase - hypersonic manufacturing capability and supply			
Congressional Add: Program increase - advanced air mobility in NEO environment	0.000	10.000	
FY 2022 Accomplishments: Not applicable.			
FY 2023 Plans: Conduct Congressionally directed efforts.			
Congressional Adds Subtotals	129.389	223.200	

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603680F / <i>Manufacturing Technology Program</i>
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D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	67.753	55.919	37.779	0.000	37.779	39.528	36.693	36.335	37.667	Continuing	Continuing
635321: <i>C4I Battlespace Dev and Demo</i>	-	45.542	36.396	24.682	0.000	24.682	26.026	21.145	20.972	21.741	Continuing	Continuing
635329: <i>Cyber Battlespace Dev & Demo</i>	-	22.211	19.523	13.097	0.000	13.097	13.502	15.548	15.363	15.926	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates Air Force enterprise-centric information technologies for the warfighter. The C4I Battlespace Dev and Demo project provides technology enabling the Air Force (a) to monitor, assess, plan, and execute missions rapidly across the full spectrum of operations at all levels of war and during all phases of conflict; (b) to field advanced, secure, net-enabled architectures and communications/network technologies in support of persistent, global, and survivable kinetic and non-kinetic military operations; (c) to process and exploit data and information from a variety of sources and domains to create a common operating picture of the battlespace; and (d) to provide the decision maker and staff with seamless access to tailored information within a mobile, dynamic, and scalable, globally distributed Air Operations Center, as well as among other producers, consumers, and managers of information relevant to other particular Communities of Interest (COI). The Cyber Battlespace Dev & Demo project develops the ability to deliver cyber-attack capabilities (access, stealth, persistence, intelligence, and weapons delivery), cyber defense capabilities (attack detection, attack attribution, and response automation) and cyber support capabilities (situation awareness and war gaming). This project will also develop (a) a science and engineering capability demonstrating new models of computation; (b) novel approaches for high performance, interactive, net-centric, distributed and embedded computing systems; and (c) the technological tools enabling affordable, large-scale, and complex software-intensive systems.

The National Defense Strategy and Air Force Future Operating Concept established science and technology challenges to enable operational agility (the ability to rapidly generate and shift among multiple solutions for a given challenge) as a way to adapt swiftly to any situation or enemy action. Operational agility will require flexibility (manifested as multi-domain operations), speed (manifested as superior decision speed), coordination (manifested as dynamic command and control), balance (manifested as presenting a balanced capability mix), and strength (manifested as performance-optimized teams). In order to enable operational agility, this program will begin to shape future research and development (R&D) to focus on technologies in support of operational agility through multi-domain command and control (MDC2) capabilities.

This program has been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0603788F I Battlespace Knowledge Development and Demonstration
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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	72.138	51.824	59.213	0.000	59.213
Current President's Budget	67.753	55.919	37.779	0.000	37.779
Total Adjustments	-4.385	4.095	-21.434	0.000	-21.434
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	17.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	-12.905			
• SBIR/STTR Transfer	-4.385	0.000			
• Other Adjustments	0.000	0.000	-21.434	0.000	-21.434

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 635321: C4I Battlespace Dev and Demo

Congressional Add: Program Increase - Assured Communication and Networks

Congressional Add: Project Increase - Command and Control Capability Development and Deployment

Congressional Add: Program Increase - Non-PKI Based Advanced Encryption Modalities

Congressional Add Subtotals for Project: 635321

Project: 635329: Cyber Battlespace Dev & Demo

Congressional Add: Project Increase - Development of Cybersecurity Methodologies

Congressional Add: Project Increase - Skydome Trusted Smart-X Experimentation Environment

Congressional Add Subtotals for Project: 635329

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	9.707	10.000
	4.853	-
	-	7.000
	14.560	17.000
	2.902	-
	0.194	-
	3.096	-
	17.656	17.000

Change Summary Explanation

In FY 2023, Congress directed transformational capability activity realignment into Program 0603032F, Future AF Integrated Technology Demos, Project 0603030, Air Force Vanguard, in order to provide a more complete picture of the Vanguard program. As a result, FY 2024 funding is reduced in the FY 2024 President Budget from the levels in the FY 2023 President's Budget.

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>				Project (Number/Name) 635321 / <i>C4I Battlespace Dev and Demo</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635321: <i>C4I Battlespace Dev and Demo</i>	-	45.542	36.396	24.682	0.000	24.682	26.026	21.145	20.972	21.741	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The National Defense Strategy and Air Force Future Operating Concept established science and technology challenges to enable operational agility (the ability to rapidly generate and shift among multiple solutions for a given challenge) as a way to adapt swiftly to any situation or enemy action. In order to enable multi-domain operations, this project will begin to shape future research and development to focus on technologies in support of multi-domain command and control.

In order to achieve operational agility, the Air Force must be able (a) to monitor, assess, plan, and execute missions rapidly across the full spectrum of operations at all levels of war and during all phases of conflict; (b) to field advanced, secure, net-enabled architectures and communications/network technologies in support of persistent, global, and survivable kinetic and non-kinetic military operations; (c) to process and exploit data and information from a variety of sources and domains to create a common operating picture of the battlespace; and (d) to provide the decision maker and staff with seamless access to tailored information within a mobile, dynamic, and scalable, globally distributed Air Operations Center, as well as among other producers, consumers, and managers of information relevant to other particular Communities of Interest (COI).

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Transformational Technology Development	5.811	0.000	0.000
<p>Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through advances in enterprise-centric information technologies, offensive and defensive cyber operations capabilities, advanced command and control capabilities, and collection, management, analysis, and exploitation of complex data. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.</p> <p>FY 2023 Plans:</p>			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635321 / <i>C4I Battlespace Dev and Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
Funding transferred to Line 16 for future transformational capabilities under Program 0603032F Future AF Integrated Technology Demos, Project 630320: Air Force Vanguard, effort Vanguard Prospect - Resolute Sentry.				
FY 2024 Plans: N/A				
FY 2023 to FY 2024 Increase/Decrease Statement: N/A				
Title: Multi-Domain Command and Control		6.721	7.951	10.118
Description: Perform research and development that will advance existing, or discover new, command and control capabilities to support multi-domain operations for air, space, cyberspace, land, sea, and undersea.				
FY 2023 Plans: Continue demonstration of communication, information management, and replication capabilities for intra base distribution of one Command and Control operational echelon function. Continue executing experiments, based on operational scenarios, which incorporate process management execution into the extensible Space command and control framework, and which integrate disparate data and applications, providing a pedigree for proposed tasking options to decision makers. Continue development of tools, technology, and framework for execution management of operational center process workflows and applications.				
FY 2024 Plans: Continue demonstration of communication, information management, and replication capabilities for intra base distribution of one Command and Control operational echelon function. Continue executing experiments, based on operational scenarios, which incorporate process management execution into the extensible Space command and control framework, and which integrate disparate data and applications, providing a pedigree for proposed tasking options to decision makers. Continue development of tools, technology, and framework for execution management of operational center process workflows and applications. Initiate demonstration of a fused installation security architecture- air, ground, and cyber, multi-mission Unmanned Air System "wingmen" for installation security capabilities. Initiate development and demonstration of distributed operational-echelon Command and Control deployable kits for rapid distribution and dispersion of Air Operations Center functions theater-wide.				
FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$2.167 million due to increased emphasis in deployable Command and Control kits to enable theater-wide distributed Air Operations Center capabilities.				
Title: Artificial Intelligence/Autonomy/Machine Learning		3.155	2.180	2.774

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635321 / <i>C4I Battlespace Dev and Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Description: Develop and demonstrate the ability to harness the speed and scale of computers and machines to address problems of complexity.</p> <p>FY 2023 Plans: Continue development of robust artificial intelligence/machine learning for targeted transition capabilities. Continue development to operationalize and implement state of the art learning models. Continue to integrate within the StreamlinedML framework. Continue development of secure diode for cross-domain embedded solution. Initiate implementation and testing of neuromorphic-based algorithms for processing and exploitation of multiple data feeds.</p> <p>FY 2024 Plans: Continue development of robust artificial intelligence/machine learning for targeted transition capabilities. Continue development operationalizing and implement state of the art learning models. Continue to integrate within the StreamlinedML framework. Complete development of secure diode for cross-domain embedded solution. Continue implementing and testing neuromorphic-based algorithms for processing and exploitation of multiple data feeds.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.594 million. Justification for this increase is described in the plans above.</p>			
<p>Title: Data to Decisions</p> <p>Description: Develop and demonstrate the collection, management, analysis, and exploitation of complex data for availability to Air Force and other stakeholders.</p> <p>FY 2023 Plans: Continue development and demonstration of intelligence analysis capabilities from multiple intelligence sources for both near-real time and post mission. Continue research and development in data analytics and strategic indications and warnings for the air and space domains. Continue performing service-based capability development. Continue investments to advance systems to deliver multi-INT exploitation on-board and in real-time.</p> <p>FY 2024 Plans: Continue development and demonstration of intelligence analysis capabilities from multiple intelligence sources for both near-real time and post mission. Continue research and development in data analytics and strategic indications and warnings for the air and space domains. Continue performing service-based capability development. Complete efforts advancing systems to deliver multi-INT exploitation on-board and in real-time. Continue software development for automatic detection, characterization, and classification of relative maneuver behaviors between multiple resident space objects.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>	3.669	1.920	2.444

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635321 / <i>C4I Battlespace Dev and Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
FY 2024 increased compared to FY 2023 by \$0.523 million. Justification for this increase is described in the plans above.				
<p>Title: Game Changing Computing Power</p> <p>Description: Develop and demonstrate computer architectures with greater capacity and sophistication to enable game-changing computing power to the warfighter anywhere, anytime.</p> <p>FY 2023 Plans: Continue demonstrating secure, on-board, simultaneous processing of multi-INT data to correlate and identify surface targets. Initiate integration and testing to utilize pod for additional data sources.</p> <p>FY 2024 Plans: Continue demonstrating secure, on-board, simultaneous processing of multi-INT data to correlate and identify surface targets. Complete integration and testing to utilize pod for additional data sources. Continue development of artificial intelligence/machine learning for data sources with correlation and automated alert to enable human-machine tip and cue on surrogate platform.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$0.601 million. Justification for the increase is described in the plans above.</p>		2.986	2.204	2.805
<p>Title: Assured Communications & Networks</p> <p>Description: Develop and demonstrate secure and reliable communications to ensure the delivery of timely, reliable, and actionable information to warfighters and systems.</p> <p>FY 2023 Plans: Continue development and demonstration for rapid waveform development of multi-mission software defined radio frequency capability. Continue development of wideband high frequency waveform development and testing. Continue to enhance communication link availability prediction for better Command, Control, and Communications planning and simulation. Continue demonstrating a protected, single security domain commercial off-the-shelf device hosting user and asset tracking, machine learning architecture provisioning and innovative aerial port solutions for mobile situational awareness and decision making.</p> <p>FY 2024 Plans: Continue development and demonstration for rapid waveform development of multi-mission software defined radio frequency capability. Continue development of wideband high frequency waveform development and testing. Continue development of enhancing communication link availability prediction for better Command, Control, and Communications planning and simulation. Continue demonstrating a protected, single security domain commercial off-the-shelf device hosting user and asset tracking,</p>		8.640	5.141	6.541

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635321 / <i>C4I Battlespace Dev and Demo</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
machine learning architecture provisioning and innovative aerial port solutions for mobile situational awareness and decision making. FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 increased compared to FY 2023 by \$1.400 million due to increased emphasis in high-frequency wideband waveform development.			
Accomplishments/Planned Programs Subtotals	30.982	19.396	24.682

	FY 2022	FY 2023
Congressional Add: Program Increase - Assured Communication and Networks <i>FY 2022 Accomplishments:</i> Conduct congressionally directed effort. <i>FY 2023 Plans:</i> Conduct Congressionally directed effort.	9.707	10.000
Congressional Add: Project Increase - Command and Control Capability Development and Deployment <i>FY 2022 Accomplishments:</i> Conduct congressionally directed effort.	4.853	-
Congressional Add: Program Increase - Non-PKI Based Advanced Encryption Modalities <i>FY 2023 Plans:</i> Conduct Congressionally directed efforts.	-	7.000
Congressional Adds Subtotals	14.560	17.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force										Date: March 2023		
Appropriation/Budget Activity 3600 / 3					R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>				Project (Number/Name) 635329 / <i>Cyber Battlespace Dev & Demo</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
635329: <i>Cyber Battlespace Dev & Demo</i>	-	22.211	19.523	13.097	0.000	13.097	13.502	15.548	15.363	15.926	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Air Force requires the ability to deliver sovereign options in cyberspace through the development and integration of cyber-attack, cyber defense, and cyber support technologies for a strategic capability of cyber dominance. This project develops the ability to deliver cyber-attack capabilities (access, stealth, persistence, intelligence, and weapons delivery), cyber defense capabilities (attack detection, attack attribution, and response automation) and cyber support capabilities (situation awareness and war gaming). This project will also develop 1) a science and engineering capability demonstrating new models of computation, 2) novel approaches for high performance, interactive, net-centric, distributed and embedded computing systems, and 3) the technological tools enabling affordable, large-scale, and complex software-intensive systems.

The National Defense Strategy and Air Force Future Operating Concept established science and technology challenges to enable operational agility (the ability to rapidly generate and shift among multiple solutions for a given challenge) as a way to adapt swiftly to any situation or enemy action. In order to enable multi-domain operations, this project will begin to shape future research and development to focus on cyber technologies in support of multi-domain command and control.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
Title: Transformational Technology Development	2.457	0.000	0.000
Description: This effort will initiate new and continue existing Transformational Technology Development efforts. The Transformational Technology Development program will select new projects, in alignment with mission focused areas which include, but are not limited to: Intelligent Planning and Wargaming, Battlespace Awareness, Integrated Base Defense, and Hypersonic Multi-Mission Aircraft. Investments focus on technology development efforts including, but are not limited to technologies to enhance survivability, operability and performance of personnel, sensors, and structures in a threat environment through advances in enterprise-centric information technologies, offensive and defensive cyber operations capabilities, advanced command and control capabilities, and collection, management, analysis, and exploitation of complex data. This investment is overseen by senior representatives from Air and Space Forces who participate in the submission, initial review, and down-selection of Transformational Technology Development proposed efforts. Final selections will be reviewed by the Air Force Deputy Assistant Secretary for Science, Technology, and Engineering before a final recommendation for Congressional approval is made.			
FY 2023 Plans: Activity realigned into Program 0603032F, Future AF Integrated Technology Demos, Project 630320, Air Force Vanguard.			
FY 2024 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023		
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635329 / <i>Cyber Battlespace Dev & Demo</i>		
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023	FY 2024
N/A				
FY 2023 to FY 2024 Increase/Decrease Statement: N/A				
<p>Title: Cyber Defense Technologies</p> <p>Description: Develop and demonstrate defensive cyber operations capabilities in a series of experimental technology demonstrations.</p> <p>FY 2023 Plans: Continue development of software capabilities and concept of operations for active guidance and automated processes addressing cyber defense. Continue demonstration of automated cyber survivability using integrated cyber technologies within the operational system laboratory in the context of risk management framework requirements. Continue development of an advanced secure processor hardware capability. Continue development, demonstration, and integration of Project IKE Cyber system (an end-to-end military system and cyber mission execution framework).</p> <p>FY 2024 Plans: Continue development of software capabilities and concept of operations for active guidance and automated processes addressing cyber defense. Continue demonstration of automated cyber survivability using integrated cyber technologies within the operational system laboratory in the context of risk management framework requirements. Continue development of an advanced secure processor hardware capability. Continue development, demonstration, and integration of the Project IKE Cyber system (an end-to-end military system and cyber mission execution framework). Initiate research into dynamic management tailored towards unmanned aerial systems.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 funding decreased compared to FY 2023 by \$1.579 million due to decreased emphasis in demonstrating automated cyber survivability using integrated cyber technologies.</p>		7.473	4.798	3.219
<p>Title: Cyber Offense Technologies</p> <p>Description: Develop and demonstrate offensive cyber operations capabilities in a series of experimental technology demonstrations.</p> <p>FY 2023 Plans: Continue research towards development of non-kinetic cyber effects against high-impact, critical targets within Areas of Responsibility or Areas of Interest to enable stand-off power projection options that enable cyber-only and coordinated cyber-kinetic target prosecution. Continue development in signal identification capabilities in adverse environments addressing</p>		9.185	14.725	9.878

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635329 / <i>Cyber Battlespace Dev & Demo</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>advanced communications signals and networks. Continue investments for the development of a counter small unmanned aerial system open architecture specification to enable interoperability between disparate protection systems. Continue developing a base-threat awareness toolkit. Continue development of processor-agnostic sub-system for golden-image storage, verification, and re-flashing. Continue integration and transition multiple Air Force Research Laboratory and Air Force Lifecycle Management Center counter small unmanned aerial system capabilities. Continue investments for the development of a capability to enable the warfighter access into congested environments as directed by warfighter requirements. Continue investments for the development of cellular testbed with 5G and Internet of Things representative technologies. Initiate demonstration of an initial SIGINT hardware prototype.</p> <p>FY 2024 Plans: Continue the advancement of research towards development of non-kinetic cyber effects against high-impact, critical targets within Areas of Responsibility or Areas of Interest to enable stand-off power projection options that enable cyber-only and coordinated cyber-kinetic target prosecution. Continue development in signal identification capabilities in adverse environments addressing advanced communications signals and networks. Continue investments for the development of a counter small unmanned aerial system open architecture specification to enable interoperability between disparate protection systems. Continue development of a base-threat awareness toolkit. Continue development of processor-agnostic sub-system for golden-image storage, verification, and re-flashing. Continue investments to integrate and transition multiple Air Force Research Laboratory and Air Force Lifecycle Management Center counter small unmanned aerial system capabilities. Decrease investments for the development of a capability to enable the warfighter access into congested environments as directed by warfighter requirements. Continue investments for the development of cellular testbed with 5G and Internet of Things representative technologies. Complete demonstration of an initial SIGINT hardware prototype.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: FY 2024 decreased compared to FY 2023 by \$4.847 million due to decreased emphasis in processor-agnostic systems and decreased emphasis in counter small unmanned aerial system tools.</p>			
Accomplishments/Planned Programs Subtotals	19.115	19.523	13.097

	FY 2022	FY 2023
Congressional Add: Project Increase - Development of Cybersecurity Methodologies	2.902	-
FY 2022 Accomplishments: Conduct congressionally directed effort.		
Congressional Add: Project Increase - Skydome Trusted Smart-X Experimentation Environment	0.194	-
FY 2022 Accomplishments: Conduct congressionally directed effort.		
Congressional Adds Subtotals	3.096	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3600 / 3	R-1 Program Element (Number/Name) PE 0603788F / <i>Battlespace Knowledge Development and Demonstration</i>	Project (Number/Name) 635329 / <i>Cyber Battlespace Dev & Demo</i>

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0207412F I Control and Reporting Center (CRC)
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	0.000	0.000	2.005	0.000	2.005	2.012	0.000	0.000	0.000	0.000	4.017
635321: C4I Battlespace Dev & Demo	-	0.000	0.000	2.005	0.000	2.005	2.012	0.000	0.000	0.000	0.000	4.017
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note
This program, BA 3, PE 0207412F, project 635321, C2/Battlespace Awareness Tools, is a new start.

A. Mission Description and Budget Item Justification

Incorporating emerging technology into major operational exercises informs and refines Warfighter requirements and provides opportunities for early adoption and Tactics, Techniques, and Procedures (TTPs) development. Utilizing operationally relevant conditions also provides early opportunities for learning and materiel deficiency discovery. Efforts explore technology advancement to provide a common operating picture in support of Agile Combat Employment (ACE).

FY2024 funds will identify and integrate emerging capabilities to develop and enable evaluation of tools within major exercise campaigns that will provide a common operating picture to advance C2/Battlespace Awareness.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	0.000	0.000	0.000	0.000
Current President's Budget	0.000	0.000	2.005	0.000	2.005
Total Adjustments	0.000	0.000	2.005	0.000	2.005
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	2.005	0.000	2.005

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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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Appropriation/Budget Activity 3600: Research, Development, Test & Evaluation, Air Force I BA 3: Advanced Technology Development (ATD)	R-1 Program Element (Number/Name) PE 0207412F I Control and Reporting Center (CRC)
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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>Title: C2/Battlespace Awareness Tools</p> <p>Description: Integrating emerging technologies into major exercises</p> <p>FY 2023 Plans: N/A</p> <p>FY 2024 Plans: Identify, develop, integrate and field emerging technologies Testing of tools to provide a common operating picture</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: Funding increased to incorporate emerging technologies into major exercises</p>	-	0.000	2.005
Accomplishments/Planned Programs Subtotals	-	0.000	2.005

D. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

E. Acquisition Strategy

Participating in major exercises will aid in the advancement of providing a common operating picture to advance C2/Battlespace Awareness capabilities. Contracting strategies will vary for each exercise.