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**Department of Defense
Fiscal Year (FY) 2012 Budget Estimates**

February 2011



Air Force

Justification Book Volume 1

Research, Development, Test & Evaluation, Air Force

Volume I

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Air Force • President's Budget FY 2012 • RDT&E Program

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Exhibit R-1

(Listing by Budget Activity, then Program Element Number)

BA# 01: Basic Research

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
01	01	0601102F	Defense Research Sciences	323.753	350.978	364.328	-	364.328
02	01	0601103F	University Research Initiatives	137.447	136.297	140.273	-	140.273
03	01	0601108F	High Energy Laser Research Initiatives	12.388	13.198	14.258	-	14.258
Total: Basic Research				473.588	500.473	518.859	-	518.859

BA# 02: Applied Research

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
04	02	0602102F	Materials	177.238	137.273	136.230	-	136.230
05	02	0602201F	Aerospace Vehicle Technologies	136.379	144.699	147.628	-	147.628
06	02	0602202F	Human Effectiveness Applied Research	93.461	87.452	86.663	-	86.663
07	02	0602203F	Aerospace Propulsion	218.323	207.049	207.508	-	207.508
08	02	0602204F	Aerospace Sensors	136.335	157.497	134.787	-	134.787
09	02	0602601F	Space Technology	117.324	111.857	115.285	-	115.285
10	02	0602602F	Conventional Munitions	57.598	61.330	60.692	-	60.692
11	02	0602605F	DIRECTED ENERGY TECHNOLOGY	102.906	103.596	111.156	-	111.156

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Exhibit R-1

(Listing by Budget Activity, then Program Element Number)

BA# 02: Applied Research

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
12	02	0602788F	Dominant Information Technology	115.369	117.283	127.866	-	127.866
13	02	0602890F	High Energy Laser Research	51.647	53.384	54.059	-	54.059
Total: Applied Research				1,206.580	1,181.420	1,181.874	-	1,181.874

BA# 03: Advanced Technology Development (ATD)

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
14	03	0603112F	Advanced Materials for Weapon Systems	66.972	33.414	39.738	-	39.738
15	03	0603199F	Sustainment Science and Technology (S&T)	2.852	2.935	5.780	-	5.780
16	03	0603203F	Advanced Aerospace Sensors	71.700	44.677	53.075	-	53.075
17	03	0603211F	Aerospace Technology Dev/Demo	73.589	53.588	67.474	-	67.474
18	03	0603216F	Aerospace Propulsion and Power Technology	187.212	136.135	120.953	-	120.953
19	03	0603270F	Electronic Combat Technology	31.456	16.992	22.268	-	22.268
20	03	0603401F	Advanced Spacecraft Technology	106.852	83.705	74.636	-	74.636
21	03	0603444F	MAUI SPACE SURVEILLANCE SYSTEM	36.582	5.899	13.555	-	13.555
22	03	0603456F	Human Effectiveness Adv Tech Dev	26.915	24.814	25.319	-	25.319

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(Listing by Budget Activity, then Program Element Number)

BA# 03: Advanced Technology Development (ATD)

Cost (\$ in Millions)

Line#	BA#	PE#	PE Title	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
23	03	0603601F	Conventional Weapons Technology	13.991	15.755	54.042	-	54.042
24	03	0603605F	Advanced Weapons Technology	44.045	17.461	28.683	-	28.683
25	03	0603680F	Manufacturing Technologies	49.507	39.701	40.103	-	40.103
26	03	0603788F	Global Information Dev/Demo	45.228	32.382	38.656	-	38.656
27	03	0603924F	High Energy Laser Advanced Technology Program	3.685	1.847	1.122	-	1.122
Total: Advanced Technology Development (ATD)				760.586	509.305	585.404	-	585.404

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PROGRAM ELEMENT COMPARISON SUMMARY

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

BUDGET ACTIVITY #1: BASIC RESEARCH (Volume 1)

0601102F

Defense Research Sciences

Remarks

In FY 2012, nine legacy Projects 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308 and 2311 were consolidated into three new Projects 3001, 3002, 3003 to more appropriately describe and align the changing focus of the scientific disciplines within the overall Basic Research Program. Also in FY 2012, External Research Programs - Project 4113 was renamed Education and Outreach- Project 3004 to more appropriately describe its mission.

BUDGET ACTIVITY #2: APPLIED RESEARCH (Volume 1)

0602204F

Aerospace Sensors

In FY 2012 the efforts in Project 624916 move from Hanscom AFB, MA to Wright Patterson AFB, OH due to the decisions of the Base Realignment and Closure Commission. The individual efforts from Project 624916 are merged into other existing Projects in this PE.

BUDGET ACTIVITY #3: ADVANCED TECHNOLOGY DEVELOPMENT (Volume 1)

0603216F

Aerospace Propulsion and Power Technology

In FY 2012, funding in this project is increased to complete scramjet engine flight demonstrations.

BUDGET ACTIVITY #4: ADVANCED COMPONENT DEVELOPMENT AND PROTOTYPE (Volume 2)

0305178F

National Polar-Orbiting Op Env Satellite

In FY2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$179.701M . Starting in the FY12 year of execution, DWSS funds will be transferred to a new PE (0305187F, Defense Weather Satellite System). Totals include funding for PRCP Program Number 239, NPOESS.

0603423F

Global Positioning System III - Operational Control Segment

In FY2012, totals include funding for PRCP Program Number, 292, GPS IIIA. The program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$6.464M. FY12-16 funding has been transferred to this PE from PE 0305265F. However, funds were incorrectly loaded into BPAC 67A021 instead of 64A021.

0603430F

Advanced (EHF MILSATCOM (Space)

In FY 2012,totals include funding for PRCP Program Number 261, AEHF. The program funding includes Overhead reduction and Reports/Studies/ Boards/Reviews efficiencies that are not intended to impact program content. The efficiencies reductions total \$4.3M. The Capability and Affordability Insertion Program (CAIP) is funded in BPAC 64A030, Evolved AEHF MILSATCOM. Prior to FY12PB, BPAC 64A030 funds were included in BPAC 644050.

PROGRAM ELEMENT COMPARISON SUMMARY

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

0603432F	Polar MILSATCOM (Space)	In FY2012, totals include funding for PRCP Program Number 121, EPS. The program funding includes Overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$1.8M.
0603438F	Space Control Technology	FY 2012, the program funding includes Overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.063M. CY funding totals include \$16.000M requested for Overseas Contingency Operations.
0603850F	Integrated Broadcast Service (DEM/VAL)	In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.085M.
0603860F	Joint Precision Approach and Landing Systems - Dem/Val	In FY2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.161M. While the Joint Precision Approach and Landing System (JPALS) is an ACAT ID program, the Air Force Exhibit R-3 does not include "to complete" costs as the JPALS Land-Based Increment 2 (Air Force lead) is pre-Milestone B (FY15) and not Section 2366a certified. The Sea-Based Increment 1a (Navy lead) is post-Milestone B and Section 2366a certified. Reference Navy JPALS R-Doc for data (PNO 238). Totals include funding for Program Resources Collection Process Program Number (PNO) 238, JPALS (Land-Based Increment 2).
0604283F	BMC2 Sensor Development	In FY 2012, Project 6002, Three Dimensional Expeditionary Long Range Radar (3DELRR), efforts were transferred from PE 0207412F, Control and Reporting Center, BPAC 675294, Theater Air Control System Improvement - Radar, in order to provide this pre-Major Defense Acquisition Program its own Program Element.
0604317F	Technology Transfer	In FY 2012, the Office of the Secretary of Defense (OSD) transferred this program to the Air Force.
0604857F	Operational Responsive Space	In FY 2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$1.187.

**BUDGET ACTIVITY #5: SYSTEM DEVELOPMENT AND DEMONSTRATION (SDD)
(Volume 2)**

0101125F	NUCLEAR WEAPON MODERNIZATION	In FY2012 B61 LEP efforts were transferred from PE 0604222F, Nuclear Weapons Support, to PE 0101125F, Nuclear Weapon Modernization in order to support B61 LEP development. In FY2012 LRSO efforts were transferred from PE 0101122F, Air Launched Cruise Missile, to PE 0101125F, Nuclear Weapon Modernization in order to support LRSO development.
0207100F	LAAR Squadrons	In FY 2012, Project 657005, Light Attack, includes New Start efforts.
0603840F	Global Broadcast Service (GBS)	In FY2012,the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.070M.

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

PROGRAM ELEMENT COMPARISON SUMMARY

0604222F	Nuclear Weapons Support	In FY12 B61 LEP efforts were transferred from PE 0604222F, Nuclear Weapons Support, to PE 0101125F, Nuclear Weapon Modernization in order to support B61 LEP development. In FY12 Joint Fuze efforts were transferred from PE 0604222F, Nuclear Weapons Support, to PE 0604851F, ICBM EMD in order to support Joint Fuze development.
0604270F	EW Development	In FY 2012, Project 653891, Advanced IR Counter Measures (AIRCМ), includes new start efforts.
0604281F	TACTICAL DATA NETWORKS ENTERPRISE	In FY 2012, the program funding includes reductions for reports/studies/boards efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.509M.
0604421F	Counterspace Systems	In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$2.099M in FY12. The program funding includes reductions for Knowledge Based Services, Acquisition Program Management Administrative efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.306M.
0604425F	Space Situational Awareness Systems	In FY 2012, the program funding in this Program Element includes overhead reductions that are not intended to impact program content. The efficiencies reductions total \$6.663M. Totals include funding for PRCP Program Number 328, SBSS Block 10.
0604429F	AIRBORNE ELECTRONIC ATTACK	In FY 2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.433M.
0604441F	Spaced Based Infrared System (SBIRS) High	In FY 2012, the program funding includes overhead reductions for efficiencies that are not intended to impact program content. The efficiencies reductions total \$12.499. Totals include funding for PRCP Program (PNO) 210 SBIRS High.
0604617F	Agile Combat Support	In FY2012, Project 652895, Civil Engineering Readiness, includes two new start efforts, one for Basic Expeditionary Airfield Resources and the other for Explosives Ordnance Disposal.
0604706F	Life Support Systems	In FY2012, Project 65412A, Life Support Systems, includes new starts for Aircrew Laser Eye Protection (ALEP) Block 3 and Voice in Beacon (ViB) programs. The program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.879M in FY12.
0604735F	Combat Training Ranges	In FY 2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.134.
0604851F	ICBM - EMD	In FY2012, Project Number 655037, Support Equipment, includes the Single Integrated Operation Plan Targeting Application Computer System new start effort. In FY2012, the fuze efforts in Project Number 657006, ICBM EMD: Fuze Support, were transferred from PE 0604222F Nuclear Weapons Support in order to consolidate service activities as they progress towards deployable products. The program funding includes reductions for overhead efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.432M in FY12 from the Support Equipment Programs.

PROGRAM ELEMENT COMPARISON SUMMARY

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

0604853F	Evolved Expendable Launch Vehicle - EMD	In FY 2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.059M.
0605221F	KC-X, Next Generation Aerial Refueling Aircraft	In FY2012, the program funding includes reductions for overhead efficiencies that are not intended to impact program content. The efficiencies reductions are \$13.806M.
0605229F	CSAR HH-60 Recapitalization	In FY2012, Project Number 657001, Avionics Development and Integration efforts were transferred to PE 0207224F, Project Number 676016, and PE 0101235F, Modification Number 3149T, in order to effectively execute this effort for both HH-60G and UH-1N aircraft.

BUDGET ACTIVITY #6: RDT&E MANAGEMENT SUPPORT (Volume 2)

0605807F	Test and Evaluation Support	In FY 2012, the program funding includes reductions for manpower efficiencies that are not intended to impact program content. The efficiencies total \$109.336.
0605860F	Rocket Systems Launch Program (RSLP)	In FY 2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$406k. In FY2012, Deep Space Climate Observatory (DSCOVR) launch service is a "New Start" effort.
0605864F	Space Test Program	In FY 2012, the program funding includes reductions for (Knowledge Based Services)efficiencies that are not intended to impact program content. The efficiencies reductions total \$291k.
0702806F	ACQUISITION AND COMMAND SUPPORT	In FY 2012, the program funding includes an increases for overhead reductions of \$4.822M efficiencies that are intended to reduce out year costs through improvement in program infrastructure or reduction in unit costs. The program funding also includes reductions for service support contractor efficiencies that are not intended to impact program content. The efficiencies reductions total \$2.187M.

BUDGET ACTIVITY #7: OPERATIONAL SYSTEM DEVELOPMENT (Volume 3)

0101113F	B-52 SQUADRONS	In FY 012, the program funding includes reductions for Overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$1.378M.
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PROGRAM ELEMENT (BY BUDGET ACTIVITY)

PROGRAM ELEMENT COMPARISON SUMMARY

0101127F	B-2 SQUADRONS	<p>In FY 2012, three new project numbers were established: 676021 Baseline Support 676022 EHF SATCOM and Computer 676023 Defensive Management System</p> <p>Funding for the three new project numbers was transferred from the existing 675345 project number. Project number 675345 will continue to be used for B-2 Modernization efforts that are not allocated to the three new project numbers.</p> <p>The program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$3.515M in FY12.</p> <p>The program funding includes reductions for acquisition excellence efficiencies for project 676023 in FY15 and FY16 that are not intended to impact program content. Reductions for efficiencies may be spread to other Air Force programs at a later date. Amounts of the reductions are: \$3.7M/FY15 and \$54.2M/FY16.</p>
0205219F	MQ-9 Development and Fielding	<p>In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.742M</p>
0207131F	A-10 SQUADRONS	<p>In FY 2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.777M</p>
0207133F	F-16 SQUADRONS	<p>In FY2012, the program funding includes reductions for acquisition excellence efficiencies and program management administration reductions that are not intended to impact program content. The efficiencies reductions total \$2.189M</p>
0207134F	F-15 PROGRAMS	<p>In FY 2012, the F-15 program has two FY 2012 new starts: F-15C/D BLOS will provide Beyond Line of Sight (BLOS)communications for Air Superiority and Air Sovereignty Alert missions. F-15 Radar Enhancements will improve F-15E capabilities with emphasis on Electronic Protection and other radar improvements.</p>
0207136F	Manned Destructive Suppression	<p>In FY 2012, the program funding includes reductions for Overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.077M.</p>
0207142F	Joint Strike Fighter Squadrons	<p>In FY 2012, Project 676011 Dual Capable Aircraft includes new start efforts. PE 0207142F was a new PE for Joint Strike Fighter (JSF) starting in FY11 for post SDD enhancements. PE 0604800F is the USAF RDT&E funding for JSF SDD. Program funding reflects reductions to overhead. These efficiencies total \$.643M in FY12, and do not impact program content.</p>
0207163F	Advanced Medium Range Air-to-Air Missile	<p>In FY 2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.345M.</p>
0207224F	0207224F	<p>In FY2012, Project Number 676016, Avionics Development and Integration, efforts were transferred from PE 0605229F, Project Number 657001, Avionics Development and Integration in order to effectively execute the HH-60G portion of the effort.</p>
0207253F	Compass Call	<p>In FY 2012, the program funding includes reductions for economic efficiencies that are not intended to impact program content. The efficiencies reduction total \$0.062M.</p>

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

PROGRAM ELEMENT COMPARISON SUMMARY

0207325F	Joint Air-to-Surface Standoff Missile (JASSM)	In FY 2012, the program funding includes reduction for overhead cost efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.721M.
0207410F	AEROSPACE OPERATION CENTER (AOC)	In FY 2012, The program funding includes reductions for efficiencies that are not intended to impact program content. The efficiencies reductions total \$8.703M.
0207412F	Modular Control System	In FY 2012, BPAC 675294, Theater Control System Improvement-Radar (TACSI-R) efforts transfer to PE 0604283F, Battle Management Command & Control (BMC2) Sensor Development, BPAC 646002, Three Dimensional Expeditionary Long Range Radar in order to provide this pre-Major Defense Acquisition Program its own Program Element.
0207417F	Airborne Warning and Control System (AWACS)	In FY 2012, totals include funding for Program Resources Collection Process (PRCP) Program Number, 277, AWACS Upgrade (for Block 40/45 Upgrade). The program funding includes reduction for Overhead Reduction, Service Support Contractors, and Reports/Studies/Boards efficiencies that are not intended to impact program content. The efficiencies reductions total \$17.565M
0207423F	Advanced Communications Systems	In FY2012, Project 674934, Tactical Air Control Party,efforts transferred to PE 0207444F, Tactical Air Control Party, Project 676013, Equipment Modernization, in order to better identify and delineate efforts for Tactical Air Control Party Modernization.
0207438F	Theater Battle Management (TBM) C4I	In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.127M
0207444F	Tactical Air Control Party Modernization	In FY2012, Project 676013, Equipment Modernization, efforts were transferred from PE 0207423F, Advanced Communications Systems, Project 674934, TACP-M, in order to better identify and deliniate efforts for Tactical Air Control Party Modernization.
0207449F	C2 Constellation	In FY 2012, the program funding includes reductions for efficiencies that are not intended to impact program content. The efficiencies reductions total \$2.262M
0207581F	JOINT STARS	In FY 2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$2.490M
0207605F	Wargaming and Simulation Centers	In FY 2012, the program funding includes reductions for Air Force efficiencies that are not intended to impact program content. The efficiencies reductions total \$.118M.
0208006F	Mission Planning Systems	In FY 2012, the program funding includes reductions for overhead efficiencies that are not intended to impact program content. The efficiencies reductions total \$2.664M.
0303131F	Minimum Essential Emergency Communications Network (MEECN)	In FY 2012, Project 675378 Long Term Solution (LTS) includes new start efforts. The program funding for Project 672832 MEECN System Improvements (MSI) includes reductions for Reports/Studies/Board efficiencies that are not intended to impact program content. The efficiencies reductions total \$292K in FY12.

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

PROGRAM ELEMENT COMPARISON SUMMARY

0303140F	Information Systems Security Program	<p>In FY 2012, the program funding includes reductions for CENTCOM Fourth Estate Baseline Review efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.455M.</p> <p>The program funding includes reductions for Reports, Studies, Boards and Commissions Review efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.572M in FY12.</p> <p>The program funding includes reductions for Reducing Reliance of DoD Services Support Contractors efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.012M in FY12.</p>
0303601F	MILSATCOM Terminals	<p>In FY 2012, the program funding includes Overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.948M.</p>
0304260F	Airborne SIGINT Enterprise (JMIP)	<p>In FY 2012, the program funding includes reductions for Overhead efficiencies that are not intended to impact program content. The efficiencies reductions total \$2.455M.</p> <p>Totals include funding for PRCP program number 375 "ASIP"</p>
0305110F	Satellite Control Network	<p>In FY2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.681M.</p>
0305111F	WEATHER SERVICE	<p>In FY 2012, The program funding includes reductions for Overhead and Reports/Studies Board efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.260M.</p>
0305164F	NAVSTAR Global Positioning System User Equipment Space	<p>In FY2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$3.902M.</p>
0305173F	SPACE TEST CTR/RANGE CONSOLIDATION	<p>In FY 2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$12.4M in FY12.</p> <p>FY2012-FY2016: +\$1.0B for Acquisition workforce civilian pay.</p>
0305182F	Spacelift Range System	<p>In FY 2012, the program funding includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.063M.</p>
0305205F	Endurance Unmanned Aerial Vehicles	<p>In FY2012, funding was added to this AF-DARPA joint project to develop a prototype for flight test and a potential operational demo in FY14.</p>
0305206F	Airborne Reconnaissance Systems	<p>In FY 2012, the program funding includes reductions for Overhead Reduction and 4th Estate Baseline Review efficiencies that are not intended to impact program content. The efficiencies reductions total \$1.488M and \$.017M, respectively, in FY12.</p> <p>In FY2012, project 675292, is renamed from Airborne Cueing & Exploitation System-Hyperspectral (ACES HY) to Hyperspectral Sensors to better reflect the depth of development efforts and operational need for hyperspectral airborne sensors.</p> <p>In FY2012, project 675382 is renamed from Wide Area Airborne Surveillance Program of Record (WAAS PoR) to Broad Area Surveillance Sensors to better reflect the WAAS PoR termination and continued technical development of Broad Area Surveillance Sensors.</p>
0305208F	Distributed Common Ground Systems	<p>In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.513M.</p> <p>In FY 2012, Project Number 676025, Data Compression, includes new start efforts.</p>
0305219F	PREDATOR DEVELOPMENT/FIELDING	<p>In FY 2012, Totals include funding for PRCP Program Number 271, "MQ-1 Predator".</p> <p>The program funding includes reductions for overhead efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.086M.</p>

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

PROGRAM ELEMENT COMPARISON SUMMARY

0305220F	GLOBAL HAWK DEVELOPMENT/FIELDING	<p>In FY 2012, This program element funds three related Air Force efforts sharing the Global Hawk platform in common: Global Hawk program, the Multi-Platform Radar Technology Insertion Program (MP-RTIP), and U.S participation and support of the North Atlantic Treaty Organization (NATO) Alliance Ground Surveillance (AGS) program.</p> <p>The program has been funded to latest cost estimate, less efficiencies. The reduction for efficiencies are not intended to impact program content. In FY 2012, P018, NATO AGS efforts transfer from PE 1001018D8Z, NATO AGS, to PE 0305220F, Project 676001, NATO AGS, in order to transfer control of this effort from OSD to the USAF.</p>
0305265F	GPS III Space Segment	<p>In FY 2012,totals include funding for PRCP Program Number 292, GPS IIIA.</p> <p>The program funding includes overhead reduction and Review, Study, Board reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$3.965M in FY12.</p> <p>FY12-16 total OCX funding transferred to PE 0603423F.</p> <p>In FY2012, BPAC 67007, DASS Integration, includes new start efforts.</p>
0305614F	JSpOC Mission System	<p>In FY 2012, the program funding includes Overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$1.417M.</p>
0305887F	Electronic Combat Intelligence Support	<p>In FY 2012, the program funding includes reductions for Service Support Contractors efficiencies that are not intended to impact program content. The efficiencies reductions total \$00.028M.</p>
0305913F	NUDET Detection System (Space)	<p>In FY 2012, the program funding includes reductions for overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$0.556M.</p>
0305940F	Space Situational Awareness Operations	<p>In FY 2012, the program funding in this Program Element includes overhead reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$.440M.</p>
0308699F	Shared Early Warning System	<p>In FY 2012, the program funding includes reductions for Fourth Estate Baseline Review efficiencies that are not intended to impact program content. The efficiencies reductions total \$10k.</p>
0401139F	LIGHT MOBILITY AIRCRAFT (LIMA)	<p>In FY2012, Project 5379, Light Mobility Aircraft, efforts were transferred from PE 0401315F, Cargo-Short Takeoff and Landing (C-STOL) Aircraft, Project 5379, Light Mobility Aircraft, in order to more readily differentiate Light Mobility Aircraft (LiMA) efforts from C-STOL activities.</p>
0401315F	C-STOL AIRCRAFT	<p>In FY2012, Project number 5379, Light Mobility Aircraft, efforts transferred to PE 0401139F, Light Mobility Aircraft, Project 5379, in order to more readily differentiate Light Mobility Aircraft (LiMA) efforts from Cargo-Short Takeoff and Landing (C-STOL) Aircraft efforts.</p>
0603423F	Global Positioning System III - Operational Control Segment	<p>In FY 2012, FY12-16 funding is in an incorrect BPAC - should be in 64A021, GPS III OCX.</p>
0708610F	Logistics Information Technology (LOGIT)	<p>In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$7.003M.</p>

PROGRAM ELEMENT (BY BUDGET ACTIVITY)

0901202F

PROGRAM ELEMENT COMPARISON SUMMARY

JOINT PERSONNEL RECOVERY AGENCY
(JPRA)

In FY 2012, the program funding includes reductions for Overhead Reduction efficiencies that are not intended to impact program content. The efficiencies reductions total \$3.598M.

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The following are Program Elements not providing RDT&E exhibits due to classification:

<u>Program Element</u>	<u>Title</u>
0101314F	NIGHT FIST- USSTRATCOM
0101815F	Advanced Strategic Program
0207424F	Evaluation and Analysis Program
0208161F	Special Evaluation System
0301310F	National Air Intelligence Center
0301314F	COBRA BALL
0301315F	Missile and Space Technical Collection
0301324F	FOREST GREEN
0301386F	GDIP Collection Management
0301555F	Classified Programs
0301556F	Special Program
0304111F	Special Activities
0304311F	Selected Activities
0304348F	Advanced Geospatial Intelligence (AGI)
0305124F	Special Applications Program
0305142F	Applied Technology and Integration
0305159F	Defense Reconnaissance Support Activities
0305172F	Combined Advanced Applications
0605798F	Analysis Support Group
0305127F	Foreign Counterintelligence Activities

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	323.753	350.978	364.328	-	364.328	379.046	396.590	414.923	433.592	Continuing	Continuing
612301: <i>Physics</i>	49.340	50.470	-	-	-	-	-	-	-	Continuing	Continuing
612302: <i>Solid Mechanics and Structures</i>	19.069	20.683	-	-	-	-	-	-	-	Continuing	Continuing
612303: <i>Chemistry</i>	40.370	41.587	-	-	-	-	-	-	-	Continuing	Continuing
612304: <i>Mathematical and Computer Sciences</i>	32.201	37.697	-	-	-	-	-	-	-	Continuing	Continuing
612305: <i>Electronics</i>	39.175	45.066	-	-	-	-	-	-	-	Continuing	Continuing
612306: <i>Materials</i>	28.431	32.040	-	-	-	-	-	-	-	Continuing	Continuing
612307: <i>Fluid Mechanics</i>	24.974	26.800	-	-	-	-	-	-	-	Continuing	Continuing
612308: <i>Propulsion</i>	31.164	34.022	-	-	-	-	-	-	-	Continuing	Continuing
612311: <i>Information Sciences</i>	49.622	53.143	-	-	-	-	-	-	-	Continuing	Continuing
613001: <i>Physics and Electronics</i>	-	-	110.120	-	110.120	114.306	119.340	124.640	130.225	Continuing	Continuing
613002: <i>Aerospace, Chemical and Material Sciences</i>	-	-	139.475	-	139.475	141.880	148.245	154.880	161.037	Continuing	Continuing
613003: <i>Mathematics, Information and Life Sciences</i>	-	-	104.313	-	104.313	111.400	116.400	121.538	127.080	Continuing	Continuing
613004: <i>Education and Outreach</i>	-	-	10.420	-	10.420	11.460	12.605	13.865	15.250	Continuing	Continuing
614113: <i>External Research Programs Interface</i>	9.407	9.470	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, nine legacy Projects 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308 and 2311 were consolidated into three new Projects 3001, 3002, 3003 to more appropriately describe and align the changing focus of the scientific disciplines within the overall Basic Research Program. Also in FY 2012, External Research Programs - Project 4113 was renamed Education and Outreach- Project 3004 to more appropriately describe its mission.

A. Mission Description and Budget Item Justification

This program consists of extramural research activities in academia and industry along with in-house investigations performed in the Air Force Research Laboratory. This program funds fundamental broad-based scientific and engineering research in areas critical to Air Force weapon systems. All research areas are subject to long-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>
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range planning and technical review by both Air Force and tri-Service scientific planning groups. This program is in Budget Activity 1, Basic Research, because it funds scientific study and experimentation.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	328.471	350.978	339.007	-	339.007
Current President's Budget	323.753	350.978	364.328	-	364.328
Total Adjustments	-4.718	-	25.321	-	25.321
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.019	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	2.390	-			
• SBIR/STTR Transfer	-7.010	-			
• Other Adjustments	-0.079	-	25.321	-	25.321

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

Project: 612301: *Physics*

Congressional Add: *Development of Deployable Biosensors.*

Congressional Add: *CO2 Sequestration and Utilization*

Congressional Add Subtotals for Project: 612301

Project: 612307: *Fluid Mechanics*

Congressional Add: *Development and Validation of Advanced Design Technologies for Hypersonic Research*

Congressional Add Subtotals for Project: 612307

Project: 612308: *Propulsion*

Congressional Add: *Coal Transformation Laboratory*

Congressional Add Subtotals for Project: 612308

Project: 612311: *Information Sciences*

Congressional Add: *Process Integrated Mechanism for Human-Computer Collaboration and Coordination.*

Congressional Add: *Safeguarding End-User Military Software.*

	FY 2010	FY 2011
	1.593	-
	2.390	-
Congressional Add Subtotals for Project: 612301	3.983	-
	1.593	-
Congressional Add Subtotals for Project: 612307	1.593	-
	0.797	-
Congressional Add Subtotals for Project: 612308	0.797	-
	0.797	-
Congressional Add Subtotals for Project: 612311	3.983	-

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

	FY 2010	FY 2011
Congressional Add Subtotals for Project: 612311	4.780	-
Congressional Add Totals for all Projects	11.153	-

Change Summary Explanation

Increase in funding in FY 2012 is due to greater Air Force emphasis on basic research.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612301: <i>Physics</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612301: <i>Physics</i>	49.340	50.470	-	-	-	-	-	-	-	Continuing	Continuing

Note
Note: In FY 2012, all efforts were moved from this Project to Project 3001 in this Program to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Physics basic research seeks to enable revolutionary advances in, and expand the fundamental knowledge supporting laser technologies, sensing and imaging capabilities, communications and navigational systems, fuels and explosives, and directed energy weapons that are critical to the Air Force. The primary areas of research investigated by this Project are laser and optical physics; electro-energetics (includes plasma) physics; atomic, molecular, and particle physics; space sensors and imaging physics; space environment physics; electronics; and physical mathematics and applied analysis.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate regulated, broad-spectrum, variable-energy lasers, laser arrays, and novel bright incoherent light sources.</p> <p>FY 2010 Accomplishments: Extended high energy solid-state laser research into new materials and materials processing procedures to increase the average power and tunability range of ceramic lasers. Studied novel optical fiber geometries to achieve single mode operation in large core area, thereby allowing high power operation. Studied novel techniques for alleviating deleterious nonlinear optical effects in high power, single mode fiber lasers, and novel means to couple such lasers for very high average powers.</p> <p>FY 2011 Plans: Extend studies on infrared semiconductor diode lasers to increase available power, efficiency, and wavelength range, at various temperatures. Study efficient nonlinear optical techniques capable of efficiently converting the wavelength of existing lasers to mid- and long-wave infrared, while capable of handling very high average power.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	10.455	11.530	-	-	-
<p>Title: Major Thrust 2.</p>	13.253	14.743	-	-	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612301: <i>Physics</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Description: Explore high-energy, electro-energetic device concepts and manipulation of atomic and molecular properties, atomic collision processes.</p> <p>FY 2010 Accomplishments: Explored properties of ultracold molecules for precision measurement applications. Moved from microfabrication to nanofabrication methodologies to achieve higher frequencies in compact, high-power electromagnetic radiation sources. Exploited new knowledge of quantum-level electron emission physics to create new generation of low work function field-emission (cold) high current density cathodes. Enhanced new simulation code algorithms to full 3-D hybrid modeling of high power microwave (HPM) sources.</p> <p>FY 2011 Plans: Continue to explore frequency comb techniques and ultracold atoms and molecules for precision measurement applications. Explore techniques in micro- and nano-fabrication that better lend themselves to affordable, high-volume fabrication of ultra-high-frequency, compact high-power electromagnetic radiation sources. Continue examination of materials science innovations that promise to advance the state-of-the-art in low work-function field-emission (cold) high current density cathodes. Continue innovations in 3-D modeling of HPM sources with emphasis on speeding execution times.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 3.</p> <p>Description: Advance technologies for space sensors, imaging, identification and tracking methods, and effective space situational awareness.</p> <p>FY 2010 Accomplishments: Investigated new sensing modalities to improve resolution and precision limits of ground-based and space-based surveillance of space objects. Continued study of spectral, polarimetric, and temporal signatures of space objects to identify unresolved space objects. Investigated physics involved in active imaging techniques. Investigated inclusion of fundamental processes of the solar-terrestrial system into physics-based models to predict atmospheric density and increase precision of satellite orbit prediction and precision tracking.</p> <p>FY 2011 Plans:</p>	5.770	6.513	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612301: <i>Physics</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Description: Research physical mathematics and applied analysis to develop accurate models of physical phenomena to enhance the fidelity of simulation. Conduct research in electromagnetics.</p> <p>FY 2010 Accomplishments: Increased research into the susceptibility to upset of various electronic circuits when exposed to suitable electromagnetic waveforms. Continued to pursue a deeper understanding of the propagation of ultra-short laser pulses through the atmosphere with emphases on managing their attributes as well as exploiting such potentials as sources of terahertz radiation, components of a long-distance spectroscope, and components of laser-guided bombs or ladar when cloud cover is present. Increased support for research into the possibility of identifying electromagnetic waveforms which are optimal from the perspective of instances of various dispersive media (foliage, clouds, buildings, airplane boundary layers), where optimality is defined as securing improved spatial resolution of objects obscured by such media.</p> <p>FY 2011 Plans: Increase basic research support for designing small, highly directive sources which can provide both secure communication and sophisticated waveforms which optimally propagate through various dispersive media. Such sources will depend crucially on progress in the area of electromagnetic metamaterials and composites which could display attributes not currently available. These sources will also include semiconductor lasers which are optically pumped and, in addition, might be combined to form partially coherent beams which are predicted to be less disturbed by atmospheric turbulence than are standard fully coherent laser beams. Continue support of circuit upset research with emphasis on digital circuits.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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Accomplishments/Planned Programs Subtotals	45.357	50.470	-	-	-
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Congressional Add: Development of Deployable Biosensors.	1.593	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612301: <i>Physics</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Research to investigate the fundamental effects of chemistry, geology and environment on carbon sequestration and the impact of these effects on the economic viability of utilization and sequestration of carbon dioxide produced by alternative energy sources.		
FY 2011 Plans:		
Congressional Add: CO2 Sequestration and Utilization	2.390	-
FY 2010 Accomplishments: Research to investigate the fundamental effects of chemistry, geology and environment on carbon sequestration and the impact of these effects on the economic viability of utilization and sequestration of carbon dioxide produced by alternative energy sources.		
FY 2011 Plans:		
Congressional Adds Subtotals	3.983	-

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

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612302: <i>Solid Mechanics and Structures</i>	19.069	20.683	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, all efforts were moved from this Project to Project 3002 in this Program to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Solid mechanics and structures basic research aims to improve load-bearing performance of air and space structures through the prediction and control of multi-scale phenomena ranging from micro-level deformation and fracture of materials to the structural dynamics of large platforms. The goals are cost-effective development and safe, reliable operation of superior Air Force weapon and defensive systems. Fundamental knowledge of "multi-functional" structures with smart materials, sensors, actuators, and control systems integrated to accomplish damage control, thermal management, vibration reduction, and reconfigurable shapes. Research topics include: the modeling of non-linear static/dynamic behavior of structures; mechanical reliability of micro-devices; design of multi-functional materials; mechanical behavior of nanomaterials; and composite materials for structures.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Explore the integration of advanced materials, nano-materials, and devices into turbine engines, air vehicles, space systems, and other weapon systems.</p> <p>FY 2010 Accomplishments: Expanded research in the area of multifunctional materials and microsystems for reconfigurable structures allowing shape change and property tuning. Continued research in the area of multifunctional hybrid composite systems for sensing and neutralization of exogenous threats to load-bearing capability. Continued research in the areas of diagnostics, prognostics, autonomics, self-healing, thermal management, energy harvesting/storage, electromagnetic energy radiation/transmission, and micro-/nano-mechanics to enable safer and more durable aerospace structures with improved performance characteristics. Further developed the fundamental knowledge required to design and manufacture multi-functional aerospace material systems and devices and to predict their performance and structural integrity.</p> <p>FY 2011 Plans:</p>	9.140	9.930	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Expand research in the area of multifunctional materials and microsystems for autonomic sensing and self-diagnosis of exogenous threats. Continue research in the area of multifunctional materials and microsystems for reconfigurable structures allowing shape change and property tuning. Continue research in the areas of prognostics, autonomics, self-healing, thermal management, energy harvesting/storage, electromagnetic energy radiation/transmission, and micro-/nano-mechanics to enable safer and more durable aerospace structures with improved performance characteristics. Further develop the fundamental knowledge required to design and manufacture multi-functional aerospace material systems and devices and to predict their performance and structural integrity.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 2.</p> <p>Description: Analyze structural fatigue and mechanics, adaptive structures, and material properties to improve the design, robustness, and performance of air and space systems.</p> <p>FY 2010 Accomplishments: Searched for unprecedented new and revolutionary flight structure concepts that will permit broader operational capabilities, a faster reconfigurable ability, and more affordable accelerated fabrication; this search included morphing aircraft structures. Investigated novel actuation devices and materials for Air Force aircraft and space structural applications. Expanded scientific knowledge related to new structures of the novel materials developed under the advanced materials programs. Expanded development of structural health monitoring sensors and techniques towards an integrated vehicle health monitoring and operational capability prognosis. Studied a risk-based approach to structural systems lifetime prognosis and reliability. Broadened understanding of mechanical and dynamical behavior of flight structures under extreme environments such as intense vibration, nonlinear structural dynamics, unsteady aero-thermo-elastic effects on flight structure, and directed energy with objective of enhancing operational survivability and mission success.</p> <p>FY 2011 Plans: Continue to seek new and revolutionary flight structure concepts that will permit broader operational capabilities, a faster reconfigurable ability, and more affordable accelerated fabrication. Investigate new structures of novel materials developed under the advanced materials programs. Expand the understanding of structural health monitoring sensors and techniques and test the developed new science under laboratory conditions. Enhance</p>	9.929	10.753	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612302: <i>Solid Mechanics and Structures</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
the understanding of dynamic and mechanical behavior of flight structures under extreme environments such as intense vibration, nonlinear structural dynamics, unsteady aero-thermo-elastic effects, directed energy effects to increase operational survivability and mission success. <i>FY 2012 Base Plans:</i> <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	19.069	20.683	-	-	-

C. Other Program Funding Summary (\$ in Millions)												
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612303: <i>Chemistry</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612303: <i>Chemistry</i>	40.370	41.587	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, all efforts were moved from this Project to Project 3002 in this Program to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Chemistry basic research seeks bold innovations in understanding, modeling, and controlling chemical reactions for developing new materials, improving synthesis of existing materials, controlling energy flow and storage, and regulating interactions between materials and their environments. Studies expand fundamental understanding of properties regulating the chemical dynamics and energy transfer processes that foster advances in laser weaponry and allow predictions of the infrared, optical, and radar signatures of reaction products and intermediates that advance reliable target assessment and tracking. Critical research topics include: novel synthesis and characterization of lower cost, higher performance functional and structural materials, electronics, and photonic materials; nanostructures; electromagnetics; and conventional weaponry. Focused investigations include bio-derived mechanisms for lifetime extension of materials and catalysis and the exploration of atomic and molecular surface interactions that limit performance of electronic devices, compact power sources, and lubricant materials. Primary areas of research include molecular reaction dynamics; theoretical chemistry; polymer chemistry; biophysical mechanisms; and surface and interfacial science.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Research and characterize molecular dynamics, reaction mechanics/interactions, and theoretical chemistry to model, predict, control, and exploit atomic and molecular energetics.</p> <p>FY 2010 Accomplishments: Advanced the development of experimental and theoretical methods to understand and control chemical reactivity and energy in molecular systems. Developed the understanding of catalytic mechanisms in systems that can improve energy utilization in propulsion applications. Explored synthetic methods and computational screening procedures to streamline the production of novel propellants. Investigated methods for producing energetic metastable species and analyzing their lifetimes. Explored the mechanisms of processes induced by plasmonic structures and its impact on chemical processes. Performed experiments and theoretical analysis to provide benchmarks for models of chemistry in the space environment. Investigated novel approaches for high-power hybrid electric-chemical lasers.</p> <p>FY 2011 Plans:</p>	16.972	17.485	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612303: <i>Chemistry</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continued to develop theoretical and predictive methods for the fundamental understanding of the structure and reactivity of surfaces and interfaces, particularly under non-equilibrium conditions. Continued to investigate phenomena at surfaces and interfaces, including the fundamental mechanisms of friction and wear, lubrication, corrosion, material degradation in extreme environments, and thermal transport. Developed methods for understanding and controlling interfacial chemistry in the creation of complex materials, including nano-composite lubricants that provide function over a wide variety of extreme environments. Developed instrumentation and methodologies capable of examining surface chemistry and kinetics with high spatial resolution.</p> <p><i>FY 2011 Plans:</i> Apply knowledge of chemical and morphological effects on degradation of simple surfaces towards development of theoretical and predictive models for degradation of complex and hybrid surfaces and materials across multiple length scales. Investigate fundamental chemistry and physics of surface wear driving towards a comprehensive understanding of the role of the chemical environment. Develop real-time nano-tribological instrumentation capable of in-situ friction, adhesion, and wear experimentation.</p> <p><i>FY 2012 Base Plans:</i></p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	40.370	41.587	-	-	-

C. Other Program Funding Summary (\$ in Millions)										
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy
Not Applicable.

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612304: <i>Mathematical and Computer Sciences</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612304: <i>Mathematical and Computer Sciences</i>	32.201	37.697	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, all efforts were moved from this Project to Project 3003 in this Program to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Mathematics and computing sciences basic research develops novel techniques for mathematical modeling and simulation, algorithm development, complex systems control, and innovative analytical and high performance computing methods for air and space systems. Basic research provides fundamental knowledge enabling improved performance and control of systems and subsystems through accurate models and computational tools, artificial intelligence, and improved programming techniques and theories. The primary areas of research investigated by this Project are dynamics and control, optimization and discreet mathematics, and computational mathematics.

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

Title: Major Thrust 1.

Description: Perform dynamics and control research to develop innovative techniques for design and analysis of complex control systems.

FY 2010 Accomplishments:

Developed the design and analysis techniques for cooperative control systems in dynamic, uncertain, adversarial environments with applications to swarms of smart munitions, remotely piloted aircraft (RPAs), and constellations of small satellites with an emphasis on heterogeneous agents and mixed human-robot interactions. Expanded additional research for teams of micro air vehicles operating at various altitudes in complex environments to execute assigned missions with variable operator intervention to include adaptive control and machine learning. Developed control methodologies to improve non-equilibrium behavior of complex, nonlinear systems. Advanced image processing and sensor technologies for use in RPA controllers and smart munitions to include target tracking and ownship state estimation. Developed mathematical control theoretic models that capture the robust, nonlinear, hybrid dynamics of microbiological systems. Developed methods for design and analysis of bio-inspired sensing systems, controls, and computational systems. Continued

FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
16.410	19.161	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612304: <i>Mathematical and Computer Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>development of algorithms for control of and over dynamic, large-scale networks. Developed theory and algorithms for specification, design, verification, and validation of distributed embedded control systems.</p> <p>FY 2011 Plans: Further develop heterogeneous and mixed human-robot interaction concepts for the design and analysis of cooperative control systems in dynamic, uncertain, adversarial environments with applications to swarms of smart munitions, RPAs, and constellations of small satellites. Develop increased levels of high-confidence adaptive control and machine learning techniques for teams of micro air vehicles operating at various altitudes in complex environments to execute assigned missions with variable operator intervention. Continue development of control methodologies to improve non-equilibrium behavior of complex, nonlinear systems. Advance image processing and sensor technologies for use in cooperative teams of RPAs and smart munitions to include multiple target tracking, ownship and world state estimation. Continue development of mathematical control theoretic models that capture the robust, nonlinear, hybrid dynamics of microbiological systems. Further develop methods for design and analysis of bio-inspired sensing systems, controls, and computational systems. Continue development of algorithms for control of and over dynamic, large-scale networks. Continue development of theory and algorithms for specification, design, verification, and validation of distributed embedded control systems.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Conduct research in optimization, as well as computational and discrete mathematics, to validate and further advance mathematical methods, algorithms, and modeling and simulation.</p> <p>FY 2010 Accomplishments: Placed emphasis on development of innovative mathematical and numerical algorithms that enhance modeling and simulation capabilities in understanding and forecasting of complex physical phenomena and design and control of systems of interest to the Air Force. The application areas of interest included non-equilibrium plasma, non-steady aerodynamics for various flight regimes, material design, and structural mechanics. Emphasized development of algorithms for efficient and robust multidisciplinary design and optimization as well as understanding and quantifying the effects of uncertainties in computational models.</p> <p>FY 2011 Plans:</p>	15.791	18.536	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612304: <i>Mathematical and Computer Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue developing mathematically rigorous numerical algorithms for enhancing the modeling and simulations of large, complex, multi-scale, and nonlinear systems and phenomena of interest to the Air Force. The application areas in plasma, aerodynamics, structural mechanics, and materials will emphasize the increasing challenges in capturing the unsteady, dynamic, multi-physics, and multi-scale nature of the problems. Support development and integration of novel optimization strategies with high-order, time-accurate solutions for superior design of Air Force systems. <i>FY 2012 Base Plans:</i> <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	32.201	37.697	-	-	-

C. Other Program Funding Summary (\$ in Millions)												
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612305: <i>Electronics</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612305: <i>Electronics</i>	39.175	45.066	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, all efforts were moved from this Project to Project 3001 in this Program to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Electronics basic research generates and exploits fundamental knowledge and understanding of novel solid-state electronic, sensor, and optoelectronic materials and device implementation schemes vital to advance Air Force operational capabilities in surveillance, information and signal processing, communications, command and control, electronic countermeasures, stealth technologies, and directed energy weapons. Solid-state electronics research discovers and develops new materials, advances processing and fabrication sciences, and develops and implements advanced physical modeling and simulation capabilities essential to evaluate novel electronic, sensor, and optoelectronic structures and device concept implementation schemes. Research stresses high-risk, far-term, 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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate novel detector and electronic materials, device concepts, and circuit architecture and implementation schemes important to future military space platforms.</p> <p>FY 2010 Accomplishments: Investigated novel methods for achieving integrated multi-mode electromagnetic spectra detection utilizing spatial, spectral, polarimetric, radiometric, phase, and temporal imaging and non-imaging detection and discrimination techniques, to include adaptive reconfigurable 'pixel' and/or detector element approaches spanning multiple-modes, and in one or more ultraviolet-infrared bands; biologically inspired detection processes and concepts were also considered. Possible novel detector structures included, but were not limited to, integrated monolithic and/or hybrid approaches utilizing homogeneous and/or heterogeneous semiconductor and oxide material structures, potentially enabled by 0D, 1D, and/or 2D quantum-based structures. Additionally, bulk and nanostructure based electronic defect engineering physics were studied to determine opportunities for modifying electronic band structure that critically affects photon absorption and carrier transport properties.</p> <p>FY 2011 Plans:</p>	9.526	10.987	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612305: <i>Electronics</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue investigating novel multi-modal electromagnetic spectra detection approaches and concepts utilizing increased understanding of phenomenological interactions between target/background radiation and novel nano-materials, -structures, and -devices. Specific emphasis shall be placed on achieving material structures yielding linearly-graded semiconductor bandgap behavior or capable of dynamic bandgap tuning over the range ~ 0.2 - 2.5eV. In addition, novel materials and/or device structures capable of dynamic absorption coefficient tuning will be studied, along with concepts for thin-film spectra-filter tuning. Continued emphasis shall be placed on physics controlling semiconductor hetero-interface band misalignments that critically control carrier transport properties.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Investigate quantum and optoelectronic materials/devices, memory, information processing, and nanoscience for wide-field spectral sensors and critical, high-speed communication.</p> <p>FY 2010 Accomplishments: Further supported research activities to better understand the fundamental nature of multi-ferroic alloys and composite materials for potential applicability to spin-gain devices, dynamic magnetic field detection for radio frequency (RF) and microwave applications, and very high efficiency and compact piezoelectric AC to AC and DC to DC transformers. Continued to investigate meta-materials, phase-change and state-change semiconducting and dielectric materials for exploitation in reconfigurable logic, memory, and dynamic analog devices and systems. Further investigated silicon photonics as a mechanism for all optical fiber device signal and power interconnect. Further supported research activities in the development of interconnectable photonic crystal modules so that integrated, all-optical photonic crystal logic and control systems can be subsequently developed as a transition from basic research.</p> <p>FY 2011 Plans: Continue advanced research efforts to better determine the optimal implementation of multi-ferroic materials for a wide variety of technologically advanced applications for the warfighter. Continue to explore the suitability of spintronic device elements that can be integrated into high performance, ultra-miniature logic and control systems. Further explore special semiconducting and electronic materials that enable all photonic signal processing and logic technology, and begin to explore integration of these advanced technologies with RF micro electro-mechanical systems concepts. Further explore wide band gap semiconductors for high performance,</p>	15.313	16.967	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612305: <i>Electronics</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>high power RF applications with an in-depth understanding of device reliability issues. Continue research on special materials and nanostructures that will permit an expansion of device functionality beyond the current limits on silicon technology.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 3.</p> <p>Description: Exploit advances in nanotechnology to support multi-spectral detection technology, chip-scale optical networks, and compact power.</p> <p>FY 2010 Accomplishments: Continued to develop revolutionary infrared sensors with new functionality that would greatly limit the complexity, cost, and size of conventional imaging systems. Created mid-infrared detectors with nanoscale-patterned metallic photonic crystal structures supporting frequency-specific optical resonances that achieve dramatic improvement in the conversion efficiency of detectors. Investigated the fundamental science, materials, processes, and novel device architectures for surface plasmon-based, complimentary metal-oxide semiconductor-compatible (CMOS), optical elements, with focus on ultracompact, robust, and highly efficient photonic networks that are optimally suited for insertion into mobile military platforms. Exploited nanoscience to further understand and improve solar cells, fuel cells, thermoelectrics, and supercapacitors, by examining approaches such as quantum dots, nanowires, nanocrystals, nanotubes, nanomembranes, and non-traditional materials.</p> <p>FY 2011 Plans: Pursue research in light localization below the wavelength scale, using concepts of plasmon optics, photonic crystal, and metamaterial nanophotonics for ultra-compact integrated photonic systems, ultra-compact optically functional devices, light-harvesting elements for molecular and nanocrystalline-based photovoltaic devices, lithographic patterning at deep sub-wavelength dimensions, and aberration-free lenses that enable optical imaging with unprecedented resolution. Continue to exploit silicon-compatible components for photonics and take advantage of the mature processing and manufacturing expertise that silicon technology affords. Pursue smaller and more highly integrated optical subsystems for telecommunications applications and high speed processing. Explore thermoelectric applications of silicon and germanium based nanomembranes made into nanowires and nanoribbons plus nanowire photovoltaic devices. Enhance solar-energy conversion through</p>	6.946	8.328	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612305: <i>Electronics</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>plasmon enhanced photovoltaic films, and investigate the feasibilities of nitride based and non-traditional material nanostructures for applications in photoelectrochemical cell technology, and thermoelectric device technology.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 4.</p> <p>Description: Investigate quantum electronic solids phenomena to explore superconducting, magnetic, negative index, and nanoscopic materials.</p> <p>FY 2010 Accomplishments: Discovered more useful, more economical superconductors for power and electronic applications, and progress toward identifying promising materials to set in motion new efforts in physics, chemistry and materials science. Further explored new concepts in superconducting electronics by using both magnesium diboride and yttrium-barium-copper-oxide superconducting films to determine if these unique structures have a potential to become the basis for improved radar systems. Continued research to find routes to make nanoscale ordered structures that will open the use of metamaterials to the optical and infrared part of the electromagnetic spectrum; at microwave frequencies, metamaterials were formed to produce sub-wavelength imaging. Demonstrated denser memory elements by using crossbar architecture in contact with standard complimentary metal-oxide semiconductor-compatible (CMOS) circuitry.</p> <p>FY 2011 Plans: Utilize implanted defect structures in diamond films to produce a system of addressable electron spin states that can be manipulated and entangled so that concepts in quantum information science may be tested at room temperature. Investigate nanoelectronic elements utilizing carbon nanotubes to form the basis for a new generation of sensors and circuit elements. Continue metamaterials research in coordination with Air Force laboratories to produce more efficient and smaller, omni-directional antennas. Continue search for new classes of superconductors to begin to produce several new superconducting materials that will be much more cost effective.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	7.390	8.784	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612305: <i>Electronics</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	39.175	45.066	-	-	-

C. Other Program Funding Summary (\$ in Millions)											
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612306: <i>Materials</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612306: <i>Materials</i>	28.431	32.040	-	-	-	-	-	-	-	Continuing	Continuing

Note
In FY 2012, all efforts were moved from this Project to Project 3002 in this Program (except the natural systems and extremophiles major thrust efforts moved to Project 3003) to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Materials basic research enhances the performance, cost, and reliability of structural materials to eliminate reliability issues related to high-temperature strength, toughness, fatigue, and environmental conditions. This research expands fundamental knowledge of material properties that leads to the development of novel materials for airframe, turbine engine, and spacecraft structures. The goals of this Project are to develop improved materials for air and space vehicles that provide increased structural efficiency and reliability, increase the operating temperature of aerospace materials, and further increase thrust-to-weight ratio of engines. A primary research focus is on refractory alloys, intermetallics, polymer composites, metal and ceramic matrix composites, advanced ceramics, and new material processing methods. Basic research is also conducted in natural materials and systems to exploit unique properties and products for use in the development of advanced weapon technologies. Research is conducted to mimic the natural detection systems of organisms at the molecular level for use in developing novel man-made sensors. Research in natural materials focuses on using existing organisms or bioengineered organisms to manufacture new materials, or using the organisms themselves as materials. The primary areas investigated by this Project are ceramics, non-metallic hybrid composites, metallic materials, and natural materials and systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	11.607	12.872	-	-	-
Description: Perform non-metallic, ceramic, and hybrid materials research to identify/design new materials and composites with very-high (above 1400F) and ultra-high (above 2500F) temperatures.					
FY 2010 Accomplishments: Explored the connectivity of molecular scale modeling and micromechanics modeling to link the influence of constituents' properties to properties of fiber reinforced composites, ceramic matrix composites, and metallic composites. Continued investigating interfacial properties of hybrid materials and their influence on component durability. Continued further study into damage initiation due to oxidation of high temperature polymer matrix composites.					
FY 2011 Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612306: <i>Materials</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Investigate the impact of incorporation of carbon nanotubes in carbon fibers. Study the incorporation of nano-particle incorporation in thermoplastic composites to improve its crystallization rate in filament winding conditions. Investigate the influence of nanoparticle networks within amorphous materials on high temperature mechanical properties. Continue modeling of interfacial properties between matrix and fiber in fiber reinforced composites.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 2.</p> <p>Description: Perform research in metallic, ceramic and hybrid materials to understand their properties at temperatures above 1000C.</p> <p>FY 2010 Accomplishments: Expanded the investigation of complex laminates for aerospace materials to include understanding of failure mechanisms within these novel systems. Expanded the development and verification of multi-scale equilibrium models to study the response of the material in a non-equilibrium environment. Refined the development of the informatics tools to accelerate the discovery of novel materials. Evolved the research on the fundamental science of friction and thermal effects during friction stir processing to focus on the role of the interface within metallic composites. Explored novel and alternative mechanisms to rapidly accelerate the processing and certification of advanced high temperature aerospace materials.</p> <p>FY 2011 Plans: Continue optimizing the thermal and mechanical stability of high temperature aerospace materials for air and space applications. Exploit new approaches to designing hybrid high temperature materials and to enhance performance in harsh thermal environments. Further examine innovative concepts for developing stronger and more damage-tolerant high temperature hybrid materials. Further explore opportunities to reduce system weight and/or size, increased operational lifetime, and high temperature performance of aerospace structures.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	12.475	13.779	-	-	-
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<p>Title: Major Thrust 3.</p>	4.349	5.389	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612306: <i>Materials</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Explore mimetics, natural materials, and natural/synthetic interfaces to enable development of novel sensors, engineering processes, and mechanisms.</p> <p>FY 2010 Accomplishments: Explored the manipulation of materials to mimic the desirable properties found in autonomous materials for maintenance, self-healing, and repair. Probed and manipulated chromophores and photoluminescent characteristics in natural systems for applications to military sensor systems. Conducted research of natural materials' extension into new electronic and photonic systems by utilizing the self-assembly of these materials into unique electronic and optical architectures for intelligence, surveillance, reconnaissance (ISR) applications.</p> <p>FY 2011 Plans: Continue to manipulate materials to mimic the desirable properties found in autonomous materials for maintenance, self-healing, and repair. Continue to probe and manipulate chromophores and photoluminescent characteristics in natural systems for applications to military sensor systems. Expand the research of natural materials' extension into new electronic and photonic systems by utilizing the self-assembly of these materials into unique electronic and optical architectures for ISR applications.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	28.431	32.040	-	-	-

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			PE 0601102F: <i>Defense Research Sciences</i>				612307: <i>Fluid Mechanics</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612307: <i>Fluid Mechanics</i>	24.974	26.800	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, all efforts were moved from this Project to Project 3002 in this Program (exception: the sensory information systems major thrust efforts moved to Project 3003) to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Fluid mechanics basic research advances fundamental knowledge, tools, data, concepts, and methods for improving the efficiency, effectiveness, and reliability of air and space vehicles. The goals are to improve theoretical models for aerodynamic prediction and design, as well as to originate flow control concepts and predictive methods used to expand current flight performance boundaries through enhanced understanding of key fluid flow (primarily high-speed air) phenomena. Vehicle control principles based upon natural flight sensory and sensorimotor systems applicable to small remotely piloted aircraft (RPAs) and ultraslow flight are also examined. Basic research emphasis is on turbulence prediction and control, unsteady and separated flows, subsonic/supersonic/hypersonic flows, and internal fluid dynamics. The primary approach is to perform fundamental experimental investigations and to formulate advanced computational methods for the simulation and study of complex flows, prediction of real gas effects in high-speed flight, and control and prediction of turbulence in flight vehicles and propulsion systems. Primary areas of research investigated by this Project are unsteady aerodynamics, supersonic and hypersonic aerodynamics, turbulence, and rotating and internal flows characteristic of turbomachinery flows.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate and characterize complex phenomena in supersonic, hypersonic, boundary layers, and turbulent flows to enable and optimize the design of air and space vehicles systems.</p> <p>FY 2010 Accomplishments: Characterized and modeled fundamental phenomena of high-speed boundary laminar-turbulent transition to include interactions between multiple instability modes and realistic surface conditions including roughness. Validated high-fidelity, unsteady numerical simulation methodologies for shock-dominated flows including non-equilibrium effects, laminar-turbulent transition and automated grid refinement. Explored strategies for control of excessive heat transfer, unsteadiness, and separation in hypersonic flows to reduce severe local loads on systems. Characterized and modeled interactions between severe phenomena in aerothermodynamic</p>	8.198	9.348	-	-	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612307: <i>Fluid Mechanics</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>environment and high-temperature vehicle materials with the goal of reducing thermal protection system complexity and increasing system performance.</p> <p>FY 2011 Plans: Characterize and model fundamental phenomena of high-speed boundary layers, including interactions between multiple instability modes in laminar-turbulent transition and the influence of realistic surface conditions including roughness, ablation and surface chemistry. Continue validation of high-fidelity, unsteady numerical simulation methodologies for shock-dominated flows, including non-equilibrium effects and laminar-turbulent transition and implementation of potential control methods via simulation of benchmark canonical problems. Refine strategies for control of excessive heat transfer, unsteadiness, and separation in hypersonic flows to reduce severe local loads on systems. Develop multidisciplinary simulation capability for prediction of interactions between severe phenomena in aerothermodynamic environment and high-temperature vehicle materials with the goal of reducing thermal protection system complexity and increasing system performance.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 2.</p> <p>Description: Expand fundamental knowledge of unsteady flows in integrated theoretical, experimental, and computational efforts. Study complex flow phenomena related to unsteady phenomena.</p> <p>FY 2010 Accomplishments: Explored reduced order, closed-loop flow control mechanisms on unsteady flows of complex geometries and flexible structures and identified canonical problems. Characterized and modeled promising applications of flow control techniques to optimize fluid-structure interactions and aerodynamic efficiency for a wider range of flight operating conditions. Validated tools for predicting and controlling unsteady, vortex-dominated flows on RPAs. Explored scientific issues related to multidisciplinary simulation of unsteady fluid-structure interactions.</p> <p>FY 2011 Plans: Develop physically accurate descriptions of unsteady flows over complex geometries and highly flexible structures. Derive and assess reduced order models of canonical flow problems that lead to robust, closed-loop flow control approaches. Refine modeling of promising flow control techniques to optimize fluid-structure interactions and aerodynamic efficiency for a wider range of flight operating conditions. Continue validation of</p>	9.103	10.288	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612307: <i>Fluid Mechanics</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	1.593	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612308: <i>Propulsion</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612308: <i>Propulsion</i>	31.164	34.022	-	-	-	-	-	-	-	Continuing	Continuing

Note
Note: In FY 2012, all efforts were moved from this Project to Project 3002 in this Program (exception: the bioenergy major thrust efforts moved to Project 3003) to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Propulsion basic research expounds fundamental knowledge to enable and enhance efficient utilization of energy in airbreathing engines, chemical and non-chemical rockets, and combined cycle propulsion systems for future rapid global reach and on-demand space access. Basic research thrusts include airbreathing propulsion, space power and propulsion, high altitude signature characterization and contamination, propulsion diagnostics, thermal management of space-based power and propulsion, and the synthesis of new chemical propellants. These thrusts can be grouped into reacting flows and non-chemical energetics. Study of reacting flows involves the complex coupling between energy release through chemical reaction and the flow processes that transport chemical reactants, products, and energy. Non-chemical energetics research includes both plasma and beamed-energy propulsion for orbit-raising space missions and ultra-high energy techniques for space-based energy utilization. Primary areas of research investigated by this Project are space power, propulsion, combustion, and diagnostics. As a newly emerging research direction within this Project, bioenergy and catalysis will investigate the economical production of renewable biofuels for airbreathing engines and will explore biocatalysis for compact power applications.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	11.229	12.477	-	-	-
Description: Research and model space propulsion and power in the areas of chemistry, electronics, miniaturization, and contamination/signature.					
FY 2010 Accomplishments: Continued to research high altitude plume signature and contamination, including ice formation and optical scattering in geosynchronous orbits. Continued investigating alternate launch systems using electromagnetic forces and beamed energy. Investigated electrothermal materials in plasma propulsion to achieve regenerative power, thereby resulting in higher efficiencies and lower waste heat in satellites. Investigated novel energetic propellants for space propulsion to achieve cryogenic propellant performance with non-cryogenic systems. Introduced nano-energetics in liquid or gel propellants to increase specific impulse in liquid propulsion systems,					

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612308: <i>Propulsion</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>and investigated various spray techniques for these novel propellant systems. Enhanced novel diagnostic techniques for characterization of combustion instabilities in high pressure, harsh, optically thick environments.</p> <p>FY 2011 Plans: Continue the study of novel energetic propellants for space propulsion, including nano-aluminum, ammonium borane, silicon, and hydrogen peroxide to achieve cryogenic propellant performance with non-cryogenic propellants in both launch and in-space systems. Continue investigation of nano-energetics in liquid and gel propellants to increase specific impulse in liquid propulsion systems, and study the dynamic behavior of such systems, including three-phase, high-pressure, and temperature combustion phenomena. Continue investigating alternate launch systems using electromagnetic forces and beamed energy. Investigate new electric propulsion concepts for nano, micro, and macro satellites, including electrodeless and propellantless systems, and power regeneration through thermoelectric materials. Conduct research on near-space propulsion alternatives, including air-breathing plasma propulsion systems.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Explore combustion, propulsion, and diagnostics in subsonics, supersonics, and hypersonics. Investigate multi-phase, turbulent reacting flows.</p> <p>FY 2010 Accomplishments: Continued improving laser diagnostic measurement capabilities, investigations of molecular transport effects causing and enhancing thermal destabilization of hydrocarbon fuels under supercritical thermodynamic conditions, and prediction methodologies, which are both quantitatively accurate and computationally tractable, for turbulent combustion models. Initiated research on the coupling between plasma chemistry and fuel combustion chemistry to understand ignition and combustion enhancement by plasmas. Continued exploitation of strategies for using alternate hydrocarbon fuels by inserting reduced fuel representations into comprehensive combustion models such as large eddy simulations. In support of the Energy Conservation-Assured Fuels Initiative, initiated studies of novel propulsion system design based on alternative fuel properties to achieve optimization with respect to performance, environmental impact, cost, and assured supply.</p> <p>FY 2011 Plans:</p>	13.126	14.449	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612308: <i>Propulsion</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue improving laser diagnostic measurement capabilities, investigations of molecular transport effects causing and enhancing thermal destabilization of hydrocarbon fuels under supercritical thermodynamic conditions, and prediction methodologies, which are both quantitatively accurate and computationally tractable, for turbulent combustion models. Continue research on the coupling between plasma chemistry and fuel combustion chemistry to understand ignition and combustion enhancement by plasmas. Continue exploitation of strategies for using alternate hydrocarbon fuels by inserting reduced fuel representations into comprehensive combustion models such as large eddy simulations. In support of the Energy Conservation-Assured Fuels Initiative, continue studies of novel propulsion system design based on alternative fuel properties to achieve optimization with respect to performance, environmental impact, cost, and assured supply.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Identify, characterize, and bioengineer photosynthetic and/or non-photosynthetic microorganisms and their metabolic pathways.</p> <p>FY 2010 Accomplishments: Continued researching the biosolar generation of hydrogen by seeking to understand and manipulate the metabolic, genetic, and biophysical mechanisms utilized by some photosynthetic microbes (algae and cyanobacteria) in generating renewable hydrogen energy. Began researching algal oil generation as a renewable jet fuel source by bio-prospecting for unique, oil-generating strains of algae whose genes may be used to enhance the production of algal oil. Continued research on biological fuel cells that explore the biophysical and catalytic mechanisms required for efficient electron transfer between electrodes and microbial materials, enabling the future utilization of complex, impure biofuels for compact power needs.</p> <p>FY 2011 Plans: Continue to study biosolar hydrogen research to redirect the photosynthetic flow of electrons to the hydrogen-generating enzyme by eliminating and/or adding genes that code for alternative pathways of electron flow and for the oxygen-sensitive inhibition of the hydrogen-generating enzyme. Expand bio-prospecting research to identify and clone unique algal oil-generating genes that metabolically engineer into one strain, optimizing the control and enhancement of algal oil for use as a future source of jet fuel. Continue research on microbial fuel</p>	6.012	7.096	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612308: <i>Propulsion</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
cells that may potentially enhance power generation by exploring and characterizing newly discovered bacterial nanowires to understand their role in transporting electrons from microbial biofilms to electrodes. <i>FY 2012 Base Plans:</i> <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	30.367	34.022	-	-	-

	FY 2010	FY 2011
Congressional Add: Coal Transformation Laboratory <i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort. <i>FY 2011 Plans:</i>	0.797	-
Congressional Adds Subtotals	0.797	-

C. Other Program Funding Summary (\$ in Millions)										Cost To	
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 612311: <i>Information Sciences</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
612311: <i>Information Sciences</i>	49.622	53.143	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: In FY 2012, all efforts were moved from this Project to Project 3003 in this Program (exception: the sensing, surveillance, and navigation major thrust efforts moved to Project 3001) to more appropriately describe and align the changing focus of the scientific disciplines within the overall Program.

A. Mission Description and Budget Item Justification

Information sciences basic research generates fundamental knowledge and understanding to support critical Air Force capabilities in information superiority, precision targeting (or strike), and improved battle space awareness. Areas of research focus are (1) access to disparate data and information, (2) information fusion and distribution, and (3) conversion of information into knowledge to support decision making. The data, fusion engines, and command and control functions reside on interlocking systems connected by networks leading to a system of systems architecture. Areas of research underpinning these team-focused, network-enabled systems are those in networks and communications, software, information management, and human-system interactions. Complementing these overall focus areas, research is occurring in the following areas: information operations network, software, and system architectures; information fusion; information forensics; communications and signals and control of large systems. Information Sciences also derive mathematical models and computational algorithms designed to optimize information intelligently and problem-solving under adverse conditions, including sustained operations, non-cooperative environments, and multi-interactive command and control.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	9.584	12.180	-	-	-
Description: Conduct fundamental research in signals analysis for enhancement of sensing, surveillance, and targeting capabilities, increased awareness, and improved reaction/response.					
FY 2010 Accomplishments: Studied and refined results of selected solid state partially coherent laser designs together with the propagation of partially coherent laser beams through surrogate turbulent media. Moved toward an evaluative assessment of practicality of free-space optical communication based on reduced or variable beam coherence. Conducted research in compressive sensing and image reconstruction to effect fusion of diverse sensors under multi-modal regime and data from sensor networks and countermeasures. Continued assessment of technical alternatives for feasibility of super-resolution millimeter and search and rescue imagery.					
FY 2011 Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612311: <i>Information Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Conduct further research in innovative sensing and multi-modal data acquisition, and promote the ways and means for integration of electro-optical, radar, ladar, and inertial systems with global positioning satellite (GPS) in electromagnetically and physically challenged environments. Scientific issues connected with radar imaging (and target identification) include the determination of advantageous classes of transmit waveforms, for bi-static, multiple-output, or some other distributed set-up, together with the needed conceptual mathematics and computational techniques. Covertness and encryption requirements in “free-space” communication lead to problems of information theory/optics whose solutions provide new methods of sequence key encryption. In precision navigation and timing, new basic results in the integration of sensing GPS data over multiple platforms are needed. Progress in this domain will facilitate confident actions under many military scenarios, such as the mutual updating of geo-location and timing data for a group of remotely piloted aircraft, allowing their seamless cooperation for surveillance, pursuit, and attack.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Conduct research in complex systems and algorithms for highly flexible, reliable, secure, and rich information systems supporting battlefield commanders.</p> <p>FY 2010 Accomplishments: Focused studies on how to develop software-intensive systems that take into account the deep interaction between humans and computers. Initiated information operations research on attack attribution and hardware/software interface security, and continued research on covert channel discovery. Developed fundamental mathematical methods for the description of local, global, and dynamic phenomena in networks and the assurance of the associated protocols. Developed techniques that enable integration of information and processes on networked systems in order to achieve high levels of situation awareness and response.</p> <p>FY 2011 Plans: Increase emphasis on developing a science of cyber security. Develop new software systems modeling techniques that incorporate human behavioral models into software architectures to capture fundamental human-computer interaction. Initiate information operations research on artificial diversity. Expand research on how fundamental mathematical methods translate into improved reliability and security of existing and future</p>	24.542	27.617	-	-	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612311: <i>Information Sciences</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>networks. Continue developing fundamental science of information integration and fusion that provides for situation and impact assessment to achieve predictive response.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 3.</p> <p>Description: Evaluate fundamental mechanisms and build mathematical descriptions of cognitive decision-making, including adaptation to non-cooperative interactions.</p> <p>FY 2010 Accomplishments: Investigated high-order cognitive processes critical for decision-making and problem-solving, with emphasis on the challenges of sustained operations in environments that require efficient operations under risk, uncertainty, high workload, and fatigue. Elucidated brain mechanisms that may inform computational approaches to information analysis, including mathematical representations of coupled neural oscillation, modulation filtering, and compressive sampling. Sought deeper scientific insight into principles of adaptive intelligence. Developed new approaches to optimize problem-solving in dynamic environments, with emphasis on decision strategies for adversarial, multi-dimensional, and multi-cultural conflict. Developed the basic research foundation, using computational and modeling approaches, to understand and anticipate competitive and cooperative interactions among decision-makers in a cross-cultural context.</p> <p>FY 2011 Plans: Continue to investigate high-order cognitive processes, and explore new mathematical frameworks to enable, in a principled way, upward scaling of cognitive information processing approaches from simpler to more complex and realistic decision-making tasks. Develop and test algorithms for applications in reinforcement learning, sequential sampling, kernel-based classification and generalization, Bayesian forecasting, and optimization of attentional resources. Develop new techniques to understand, measure, and control informational masking to enhance speech communication and situational awareness. Investigate the fundamental constraints and limits of computationally-based socio-cultural prediction, including scalability from individual or small groups to larger coalitions.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	10.716	13.346	-	-	-
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 612311: <i>Information Sciences</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	44.842	53.143	-	-	-
	FY 2010	FY 2011			
Congressional Add: Process Integrated Mechanism for Human-Computer Collaboration and Coordination. <i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort. <i>FY 2011 Plans:</i>	0.797	-			
Congressional Add: Safeguarding End-User Military Software. <i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort. <i>FY 2011 Plans:</i>	3.983	-			
Congressional Adds Subtotals	4.780	-			

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613001: <i>Physics and Electronics</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
613001: <i>Physics and Electronics</i>	-	-	110.120	-	110.120	114.306	119.340	124.640	130.225	Continuing	Continuing

Note

Note: In FY 2012, all efforts from Projects 2301 and 2305 in this PE as well as the sensing, surveillance, and navigation major thrust effort in Project 2311 in this PE moved to this new Project to more appropriately describe and align the changing focus of the scientific disciplines within the overall program

A. Mission Description and Budget Item Justification

Basic research in the Physics and Electronics Project seeks to enable revolutionary advances in, and expand the fundamental knowledge supporting technologies critical to the future of the Air Force. Research stresses high-risk, far-term, 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 thrust areas being investigated in this Project are complex electronics and fundamental quantum processes; plasma physics and high energy density non-equilibrium processes; and optics, electromagnetics, communication, and signal processing.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Complex Electronics and Fundamental Quantum Processes: Scientific focus areas are atomic and molecular physics, laser and optical physics, quantum electronic solids, adaptive multi-mode sensing and ultra-high speed electronics, semiconductor and electromagnetic materials, and optoelectronics.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research includes exploration and understanding of a wide range of complex engineered materials and devices, including non-linear optical materials, optoelectronics, meta-materials, cathodes, di-electric and magnetic materials, high energy lasers, semiconductor lasers, new classes of high-temperature superconductors, quantum dots, quantum wells and graphene. Also includes generating and controlling quantum states, such as superposition and entanglement, in photons and ultra-cold atoms and molecules.</p> <p>FY 2012 OCO Plans:</p>	-	-	64.971	-	64.971
<p>Title: Major Thrust 2.</p>	-	-	14.316	-	14.316

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613001: <i>Physics and Electronics</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Plasma Physics and High Energy Density Non-Equilibrium Processes: Scientific focus areas are electro-energetic physics and space sciences.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research includes a wide range of activities characterized by processes sufficiently energetic to require the understanding and managing of plasma phenomenology and the non-linear response of materials to high-electric and magnetic fields. This includes such endeavors as space weather, plasma control of boundary layers in turbulent flow, plasma discharges, radio frequency (RF) propagation, RF-plasma interaction, and high-power, beam-driven microwave devices.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 3.</p>					
<p>Description: Optics, Electromagnetics, Communication and Signal Processing Research: Scientific focus areas are physical mathematics and applied analysis, electromagnetics, remote sensing and imaging physics, and surveillance and navigation.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research includes all aspects of producing and receiving complex electromagnetic and electro-optical signals, as well as their propagation through complex media, including adaptive optics and optical imaging; it also covers aspects of the phenomenology of lasers and non-linear optics. It focuses on the development of physical devices to enable such activities, and also includes sophisticated mathematics and algorithm development for extracting information from complex and/or sparse signals.</p> <p>FY 2012 OCO Plans:</p>	-	-	30.833	-	30.833
Accomplishments/Planned Programs Subtotals	-	-	110.120	-	110.120

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613001: <i>Physics and Electronics</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>			R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>					PROJECT 613002: <i>Aerospace, Chemical and Material Sciences</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost	
613002: <i>Aerospace, Chemical and Material Sciences</i>	-	-	139.475	-	139.475	141.880	148.245	154.880	161.037	Continuing	Continuing	

Note

Note: In FY 2012, all efforts from Projects 2302, 2303, 2306 (except the natural systems and extremophiles major thrust effort, which moved to Project 3003), 2307 (except the sensory information systems major thrust effort, which moved to Project 3003), and 2308 (except the bioenergy major thrust effort, which moved to Project 3003) in this Program moved to this new Project to more appropriately describe and align the changing focus of the scientific disciplines within the overall program.

A. Mission Description and Budget Item Justification

Basic research in the Aerospace, Chemical, and Materials Sciences Project seeks to enable revolutionary advances in, and expand the fundamental knowledge supporting technologies critical to the future of the Air Force. Research stresses high-risk, far-term, 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 thrust areas being investigated in this Project are aero-structure interactions and control; energy, power, and propulsion; and complex materials and structures.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Aero Structure Interactions and Control: Scientific focus areas are high temperature aerospace materials, hypersonics and turbulence, and flow control and aeroelasticity.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research focuses on 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 Air Force systems. Of particular interest is the synergy gained from an interdisciplinary look at multiple technologies and the integration of core disciplines of fluid mechanics, structures, and materials.</p> <p>FY 2012 OCO Plans:</p>	-	-	34.868	-	34.868
<p>Title: Major Thrust 2.</p>	-	-	46.027	-	46.027

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613002: <i>Aerospace, Chemical and Material Sciences</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Energy, Power, and Propulsion: Scientific focus areas are thermal control, theoretical chemistry, molecular dynamics, space power and propulsion, and combustion and diagnostics.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research in this cross-cutting, multi-disciplinary thrust area seeks to harvest technological innovations and develop potentially revolutionary technologies by integrating core disciplines of combustion, plasma dynamics, chemistry, hybrid simulation, structures, and materials. Focus is on underlying processes associated with the production, storage, and utilization of energy, specifically for Air Force systems. Examples include developing novel energetic materials as well as understanding and optimizing combustion processes.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 3.</p>					
<p>Description: Complex Materials and Structures: Scientific focus areas are mechanics of multifunctional materials and microsystems, multi-scale mechanics and prognosis, surface and interfacial sciences, low density materials, and polymer chemistry.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research is on future materials and structures composed of different classes of materials that may be able to change functionality or performance characteristics to enhance the mission versatility of future air and space systems, with a key goal of increasing functionality while decreasing weight and volume. The concentration is on complex materials, microsystems, and structures that incorporate hierarchical design and functionality from the nano-scale through the meso-scale, ultimately leading to controlled, well-understood material or structural behavior capable of dynamic functionality and/or performance characteristics to enhance mission versatility.</p> <p>FY 2012 OCO Plans:</p>	-	-	58.580	-	58.580
Accomplishments/Planned Programs Subtotals	-	-	139.475	-	139.475

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613002: <i>Aerospace, Chemical and Material Sciences</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 613003: <i>Mathematics, Information and Life Sciences</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
613003: <i>Mathematics, Information and Life Sciences</i>	-	-	104.313	-	104.313	111.400	116.400	121.538	127.080	Continuing	Continuing

Note

Note: In FY 2012, all efforts from Projects 2304 and 2311 with the exception of sensing, surveillance, and navigation major thrust effort, which moved to Project 3001. In addition the natural systems and extremophiles major thrust effort in Project 2306, the sensory information systems major thrust effort in Project 2307, and the bioenergy major thrust effort in Project 2308 of this Program moved to this new Project to more appropriately describe and align the changing focus of the scientific disciplines within the overall program.

A. Mission Description and Budget Item Justification

Basic research in the Mathematics, Information, and Life Sciences Project seeks to enable revolutionary advances in, and expand the fundamental knowledge supporting technologies critical to the future of the Air Force. Research stresses high-risk, far-term, 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 thrust areas being investigated in this Project are information and complex networks; decision making; dynamical systems, optimization, and control; and natural materials and systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Information and Complex Networks: Scientific focus areas are systems and software, information operations and security, information fusion, and complex networks.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Focuses on research required to enable reliable and secure exchange of information and predicable operation of networks and systems. Though it includes traditional aspects of information assurance and research into reliable systems, the emphasis is on the mathematics that underlies fundamental new secure-by-design architectures of networked communications and decision-making platforms. Sub-areas supporting this scientific focus include system and network performance prediction, design and analysis, and modeling of human-machine systems.</p> <p>FY 2012 OCO Plans:</p>	-	-	29.208	-	29.208

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>		R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>		PROJECT 613003: <i>Mathematics, Information and Life Sciences</i>		
B. Accomplishments/Planned Programs (\$ in Millions)						
		FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 2.		-	-	14.604	-	14.604
Description: Decision Making: Scientific focus areas are mathematical modeling of cognition and decision making, chronobiology, and collective behavior and socio-cultural modeling.						
FY 2010 Accomplishments:						
FY 2011 Plans:						
FY 2012 Base Plans: Research focuses on the discovery of mathematical laws, foundational scientific principles, and new robust algorithms. They all underlie intelligent, mixed human-machine decision making to achieve accurate real-time projection of expertise and knowledge into and out of the battlespace. It includes efforts to advance the critical knowledge base in information sciences and information fusion, and to model individual and group cognitive processing and decision making.						
FY 2012 OCO Plans:						
Title: Major Thrust 3.		-	-	39.638	-	39.638
Description: Dynamical Systems, Optimization, and Control: Scientific focus areas are computational mathematics, dynamics and control, and optimization and discrete mathematics.						
FY 2010 Accomplishments:						
FY 2011 Plans:						
FY 2012 Base Plans: Emphasizes mathematical research for discovering 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. It includes novel adaptive control strategies for coordinating heterogeneous, autonomous, or semi-autonomous aerospace vehicles in uncertain, information rich, dynamically changing, adversarial, and networked environments.						
FY 2012 OCO Plans:						
Title: Major Thrust 4.		-	-	20.863	-	20.863

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613003: <i>Mathematics, Information and Life Sciences</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Natural Materials and Systems: Scientific focus areas are bioenergy; natural materials, systems, and extremophiles; and sensory information systems.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Research focuses on multi-disciplinary approaches for studying, using, mimicking or altering the novel ways natural systems accomplish their required tasks. Many of these natural systems include exquisite materials and sensors that often outperform man-made versions. This scientific thrust discovers how to mimic existing natural sensory systems and adds existing capabilities to these organisms for more precise control over their material production.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	-	-	104.313	-	104.313

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>				PROJECT 613004: <i>Education and Outreach</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
613004: <i>Education and Outreach</i>	-	-	10.420	-	10.420	11.460	12.605	13.865	15.250	Continuing	Continuing

Note

Note: In FY 2012, all efforts from Project 4113 of this PE moved to this new Project to more appropriately describe and align the changing focus of outreach development within the overall program.

A. Mission Description and Budget Item Justification

The major thrust areas in this Science & Technology (S&T) Outreach Development Project are to facilitate interactions between the international and domestic research communities and Air Force researchers, and to support and develop scientists and engineers with an awareness of Air Force basic research priorities. These professional interactions and collaborations stimulate scientific and engineering education beneficial to the Air Force, increase the awareness of Air Force basic research priorities to the research community as a whole, and attract talented scientists and engineers to address Air Force needs. International interactions facilitate future interoperability of coalition systems and foster relationships with future coalition partners. This Project also seeks to enhance educational interactions with historically black colleges and universities, Hispanic serving institutions, and other minority institutions.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Outreach to International S&T Community: Foster international S&T 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 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Provide centralized cooperation expertise and support international technology liaison missions in order to identify and maintain awareness of foreign science and technology developments. Capitalize on foreign investments by influencing and acquiring world-class scientific research on specific topics of Air Force interest. Seek and maintain access to technical briefs and publications on unique foreign research capabilities. Support international visits by high-level DoD S&T delegations, and provide primary interface to coordinate international S&T participation among Department of Defense (DoD) organizations.</p> <p>FY 2012 OCO Plans:</p>	-	-	5.238	-	5.238

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 613004: <i>Education and Outreach</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2.</p> <p>Description: Outreach to U.S. S&T Workforce: Strengthen science, mathematics, and engineering research and educational infrastructure in the U.S., thereby strengthening current and future Air Force S&T capabilities.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans: Increase awareness of Air Force research needs and opportunities throughout the civilian scientific community, while simultaneously identifying, recruiting, and increasing opportunities for new young investigators to participate in critical Air Force research. Support science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including historically black colleges and universities, Hispanic serving institutions, and other minority institutions.</p> <p>FY 2012 OCO Plans:</p>	-	-	5.182	-	5.182
Accomplishments/Planned Programs Subtotals	-	-	10.420	-	10.420

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 614113: <i>External Research Programs Interface</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
614113: <i>External Research Programs Interface</i>	9.407	9.470	-	-	-	-	-	-	-	Continuing	Continuing

Note

In FY 2012, as part of the realignment of the overall Program to reflect the changing focus of the scientific disciplines, this Project was renamed Education and Outreach - Project 3004 to more appropriately describe its mission.

A. Mission Description and Budget Item Justification

The primary elements in this Project are to facilitate interactions between the international and domestic research communities and Air Force researchers, and to support and develop scientists and engineers with an awareness of Air Force basic research priorities. These professional interactions and collaborations stimulate scientific and engineering education beneficial to the Air Force, increase the awareness of Air Force basic research priorities to the research community as a whole, and attract talented scientists and engineers to address Air Force needs. International interactions facilitate future interoperability of coalition systems and foster relationships with future coalition partners. This Project also seeks to enhance educational interactions with historically black colleges and universities, Hispanic serving institutions, and other minority institutions.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Foster international science and technology cooperation by supporting the Air Force's international strategy mission. Identify and leverage unique foreign research capabilities.</p> <p>FY 2010 Accomplishments: Continued to provide centralized cooperation expertise and support international technology liaison missions in order to identify and maintain awareness of foreign science and technology developments. Continued to capitalize on foreign investments by influencing and acquiring world-class scientific research. Continued to seek and maintain access to technical briefs and publications on unique foreign research capabilities. Continued to support international visits of high-level DoD delegations and provide primary interface to coordinate international participation among DoD organizations.</p> <p>FY 2011 Plans: Continue to provide centralized cooperation expertise and support international technology liaison missions in order to identify and maintain awareness of foreign science and technology developments. Continue to capitalize on foreign investments by influencing and acquiring world-class scientific research. Continue to seek and</p>	5.193	5.238	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 614113: <i>External Research Programs Interface</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
maintain access to technical briefs and publications on unique foreign research capabilities. Continue to support international visits of high-level DoD delegations and provide primary interface to coordinate international participation among DoD organizations. FY 2012 Base Plans: FY 2012 OCO Plans:					
Title: Major Thrust 2. Description: Strengthen science, mathematics, and engineering research as well as educational infrastructure in the U.S., thereby strengthening Air Force technical capabilities. FY 2010 Accomplishments: Supported science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including historically black colleges and universities, Hispanic serving institutions, and other minority institutions. Increased awareness of Air Force research needs throughout civilian scientific community, while simultaneously identifying/recruiting the best scientific talent to participate in critical Air Force research. FY 2011 Plans: Continue to support science, mathematics, and engineering research, and educational outreach programs at U.S. colleges and universities, including historically black colleges and universities, Hispanic serving institutions, and other minority institutions. Increase awareness of Air Force research needs throughout civilian scientific community, while simultaneously identifying/recruiting the best scientific talent to participate in critical Air Force research. FY 2012 Base Plans: FY 2012 OCO Plans:	4.214	4.232	-	-	-
Accomplishments/Planned Programs Subtotals	9.407	9.470	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601102F: <i>Defense Research Sciences</i>	PROJECT 614113: <i>External Research Programs Interface</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				PE 0601103F: <i>University Research Initiatives</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	137.447	136.297	140.273	-	140.273	145.093	147.415	149.702	152.397	Continuing	Continuing
615094: <i>University Research Initiatives</i>	137.447	136.297	140.273	-	140.273	145.093	147.415	149.702	152.397	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, intelligence information fusion, smart materials and structures, 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 (NDSEG) 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 Director of Defense Research and Engineering competition. 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 Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 1, Basic Science, because it funds basic scientific study and experimentation.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	141.524	136.297	140.273	-	140.273
Current President's Budget	137.447	136.297	140.273	-	140.273
Total Adjustments	-4.077	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.008	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-4.069	-			
• Other Adjustments	-	-			

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

Project: 615094: *University Research Initiatives*

Congressional Add: *High Temperature Hydrogen Energy Production.*

FY 2010	FY 2011
0.797	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Congressional Add: <i>Cyber Security for Control Networks Research.</i>	1.693	-
Congressional Add: <i>Cyber Security Research Program/Cyber Security Laboratory.</i>	1.195	-
Congressional Add: <i>Unmanned Aerial Systems Mission Planning and Operation Center.</i>	2.788	-
Congressional Add: <i>Cyber Innovation Center (CIC) Research and Development Seed Fund.</i>	0.797	-
Congressional Add: <i>Energy and Sensor Informatics Research and Transition.</i>	0.797	-
Congressional Add: <i>Frank R. Seaver Science and Engineering Initiative.</i>	1.753	-
Congressional Add Subtotals for Project: 615094	9.820	-
Congressional Add Totals for all Projects	9.820	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>				PROJECT 615094: <i>University Research Initiatives</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
615094: <i>University Research Initiatives</i>	137.447	136.297	140.273	-	140.273	145.093	147.415	149.702	152.397	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, intelligence information fusion, smart materials and structures, 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 (NDSEG) 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 Director of Defense Research and Engineering competition. 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 Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 1, Basic Science, because it funds basic scientific study and experimentation.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	70.483	75.646	77.852	-	77.852
Description: Promote fundamental, multi- and interdisciplinary science and engineering research projects.					
FY 2010 Accomplishments: Continued funding competitive research grants at U.S. universities that focus on significantly expanding the basic knowledge of Air Force-relevant science and technology areas, not normally achievable in smaller funded, single investigator awards. Supported and recognized superior academic researchers in the early stages of their career through the Presidential Early Career Award for Scientists and Engineers (PECASE) program. Continued funding of multi-disciplinary programs initially awarded in prior years.					
FY 2011 Plans: Continue funding competitive research grants at U.S. universities that focus on significantly expanding the basic knowledge of 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 career through the PECASE program. Continue funding of multi-disciplinary programs initially awarded in prior years.					
FY 2012 Base Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue funding competitive research grants at U.S. universities that focus on significantly expanding the basic knowledge of 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 career through the PECASE program. Continue funding of multi-disciplinary programs initially awarded in prior years. FY 2012 OCO Plans:					
Title: Major Thrust 2. Description: Support post-graduate, graduate, and undergraduate education in science and engineering disciplines at U.S. universities. FY 2010 Accomplishments: Awarding of fellowships within the highly competitive NDSEG program continued, as did competitive awards for graduate and undergraduate research experiences including those established under the Awards to Stimulate and Support Undergraduate Research Education (ASSURE) program. Continued funding for awards initiated under prior year Department of Defense programs. FY 2011 Plans: Continue to award highly competitive NDSEG fellowships. Continue to support competitive awards for graduate and undergraduate research experiences, including those established under the ASSURE program. Continue funding for awards initiated under prior year Department of Defense programs. FY 2012 Base Plans: Continue to award highly competitive NDSEG fellowships. Continue to support competitive awards for graduate and undergraduate research experiences, including those established under the ASSURE program. Continue funding for awards initiated under prior year Department of Defense programs. FY 2012 OCO Plans:	42.614	45.250	46.571	-	46.571
Title: Major Thrust 3. Description: Enhance the scientific and engineering research through advanced education infrastructure and instrumentation at U.S. universities. FY 2010 Accomplishments:	14.530	15.401	15.850	-	15.850

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Awarded grants on a competitive basis under the Defense University Research Instrumentation Program (DURIP) to U.S. universities to acquire state-of-the-art, high technology instrumentation and infrastructure that will enhance research and educational capabilities.</p> <p>FY 2011 Plans: Continue to award grants on a competitive basis under the DURIP to U.S. universities to acquire state-of-the-art, high technology instrumentation and infrastructure to enhance research and educational capabilities.</p> <p>FY 2012 Base Plans: Continue to award grants on a competitive basis under the DURIP to U.S. universities to acquire state-of-the-art, high technology instrumentation and infrastructure to enhance research and educational capabilities.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	127.627	136.297	140.273	-	140.273

	FY 2010	FY 2011
<p>Congressional Add: High Temperature Hydrogen Energy Production. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:</p>	0.797	-
<p>Congressional Add: Cyber Security for Control Networks Research. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:</p>	1.693	-
<p>Congressional Add: Cyber Security Research Program/Cyber Security Laboratory. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:</p>	1.195	-
<p>Congressional Add: Unmanned Aerial Systems Mission Planning and Operation Center. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:</p>	2.788	-
<p>Congressional Add: Cyber Innovation Center (CIC) Research and Development Seed Fund.</p>	0.797	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601103F: <i>University Research Initiatives</i>	PROJECT 615094: <i>University Research Initiatives</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		
Congressional Add: Energy and Sensor Informatics Research and Transition. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	0.797	-
Congressional Add: Frank R. Seaver Science and Engineering Initiative. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.753	-
Congressional Adds Subtotals	9.820	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2012</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Continuing</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				PE 0601108F: <i>High Energy Laser Research Initiatives</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	12.388	13.198	14.258	-	14.258	14.094	14.326	14.554	14.816	Continuing	Continuing
615097: <i>High Energy Laser Research Initiatives</i>	12.388	13.198	14.258	-	14.258	14.094	14.326	14.554	14.816	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds basic research aimed at developing fundamental scientific knowledge to support future Department of Defense (DoD) high energy laser (HEL) systems. The HEL Joint Technology Office (JTO) sends these funds to multi-disciplinary research institutes (MRIs) for projects on laser and beam control technologies. In addition, funding supports educational grants to stimulate interest in HELs. These educational grants are used for educational tools, scholarships, and summer intern employees in military laboratories. Through this program, the DoD invests in research directed toward increasing knowledge and understanding in those fields of science and engineering related to long-term national security needs. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 1, Basic Research, because it funds scientific study and experimentation.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	12.781	13.198	14.258	-	14.258
Current President's Budget	12.388	13.198	14.258	-	14.258
Total Adjustments	-0.393	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.001	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings		-			
• SBIR/STTR Transfer	-0.390	-			
• Other Adjustments	-0.002	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>				R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>				PROJECT 615097: <i>High Energy Laser Research Initiatives</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
615097: <i>High Energy Laser Research Initiatives</i>	12.388	13.198	14.258	-	14.258	14.094	14.326	14.554	14.816	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds basic research aimed at developing fundamental scientific knowledge to support future Department of Defense (DoD) high energy laser (HEL) systems. The HEL Joint Technology Office (JTO) sends these funds to multi-disciplinary research institutes (MRIs) for projects on laser and beam control technologies. In addition, funding supports educational grants to stimulate interest in HELs. These educational grants are used for educational tools, scholarships, and summer intern employees in military laboratories. Through this program, the DoD invests in research directed toward increasing knowledge and understanding in those fields of science and engineering related to long-term national security needs. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 1, Basic Research, because it funds scientific study and experimentation.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Improve the fundamental understanding of high-power laser sources, to include solid-state, free electron, and gas laser technologies.</p> <p>FY 2010 Accomplishments: Continued research on awarded topics in diode-pumped alkali, free electron, and solid state laser technologies. Established overseas efforts to leverage international technology advancements. Initiated a new call for innovative laser technologies.</p> <p>FY 2011 Plans: Complete research efforts on awarded topics in diode-pumped alkali, free electron, fiber laser and solid state laser technologies. Continue overseas efforts to leverage international technology advancements.</p> <p>FY 2012 Base Plans: Initiate a new call for innovative laser technologies in diode-pumped alkali, free electron, fiber laser and solid state technologies. Continue overseas efforts to leverage international technology advancements.</p> <p>FY 2012 OCO Plans:</p>	8.375	8.838	9.349	-	9.349
<p>Title: Major Thrust 2.</p>	3.299	3.610	4.159	-	4.159

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Improve the fundamental understanding of beam control technologies, as they relate to high power laser applications. Conduct research in atmospheric characterization, metrology, control systems, algorithms and beam control component technology.</p> <p>FY 2010 Accomplishments: Continued mitigation of aero-optics effects to optimize HEL architectures; and optimize size, weight and complexity of the beam control system. Established overseas efforts to leverage international technology advancements.</p> <p>FY 2011 Plans: Complete mitigation of aero-optics effects to optimize HEL architectures; and optimize size, weight and complexity of the beam control system. Continue overseas efforts to leverage international technology advancements.</p> <p>FY 2012 Base Plans: Initiate a new call for innovative beam control architectures. Continue overseas efforts to leverage international technology advancements.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Fund educational grants intended to stimulate interest in High Energy Lasers among students.</p> <p>FY 2010 Accomplishments: Provided scholarships and internships to support to college students studying HEL degrees. Provided grants to Service Academies to stimulate HEL studies among military cadets. Funded publication of journals and continuing education for professionals in the HEL field.</p> <p>FY 2011 Plans: Provide scholarships and internships to support to college students studying HEL degrees. Provide grants to Service Academies to stimulate HEL studies among military cadets. Fund publication of journals and continuing education for professionals in the HEL field.</p> <p>FY 2012 Base Plans:</p>	0.714	0.750	0.750	-	0.750

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 1: <i>Basic Research</i>	R-1 ITEM NOMENCLATURE PE 0601108F: <i>High Energy Laser Research Initiatives</i>	PROJECT 615097: <i>High Energy Laser Research Initiatives</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Provide scholarships and internships to support to college students studying HEL degrees. Provide grants to Service Academies to stimulate HEL studies among military cadets. Fund publication of journals and continuing education for professionals in the HEL field. <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	12.388	13.198	14.258	-	14.258

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	177.238	137.273	136.230	-	136.230	136.277	135.681	138.778	141.429	Continuing	Continuing
624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	109.378	84.865	81.915	-	81.915	81.785	81.117	81.449	83.042	Continuing	Continuing
624348: <i>Materials for Electronics, Optics, and Survivability</i>	33.109	31.687	30.421	-	30.421	30.442	30.566	30.846	31.415	Continuing	Continuing
624349: <i>Materials Technology for Sustainment</i>	22.361	16.893	20.052	-	20.052	20.158	19.998	22.341	22.744	Continuing	Continuing
624915: <i>Deployed Air Base Technology</i>	12.390	3.828	3.842	-	3.842	3.892	4.000	4.142	4.228	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 Air Force systems and operations. The program has five projects that develop: (1) the materials and processing technology base for spacecraft and launch systems; (2) structural, propulsion, and sub-systems materials and processes technologies; (3) electronic, optical, and survivability materials and processes technologies; (4) sustainment materials, processes technologies, and advanced non-destructive inspection methodologies; and (5) air base operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities. Efforts in the program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary materials technologies.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	179.202	137.273	135.649	-	135.649
Current President's Budget	177.238	137.273	136.230	-	136.230
Total Adjustments	-1.964	-	0.581	-	0.581
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.968	-			
• Other Adjustments	0.004	-	0.581	-	0.581

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

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

Congressional Add: <i>Air Force Minority Program</i>		4.780	-
Congressional Add: <i>Carbon Nanomaterials for Advanced Aerospace Applications</i>		0.797	-
Congressional Add: <i>ONAMI Safer Nanomaterials and Nanomanufacturing</i>		3.505	-
Congressional Add: <i>Consortium for Nanomaterials for Aerospace Commerce and Technology (CONTACT)</i>		3.187	-
Congressional Add: <i>Advanced Aerospace Carbon Foam Heat Exchanges</i>		3.187	-
Congressional Add: <i>Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation</i>		3.585	-
Congressional Add: <i>Development of Mobile Wind Turbine Systems to Power Forward Bases</i>		1.195	-
Congressional Add: <i>Aerospace Laser Micro Engineering Station</i>		0.797	-
Congressional Add: <i>Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing</i>		0.797	-
Congressional Add: <i>Lightning Protection Composites</i>		2.987	-
Congressional Add: <i>Ultra-high Temperature Materials for Hypersonic Aerospace Vehicles</i>		2.390	-
Congressional Add: <i>Pennsylvania Nanomaterials Commercialization Center</i>		0.797	-
Congressional Add Subtotals for Project: 624347		28.004	-

Project: 624348: *Materials for Electronics, Optics, and Survivability*

Congressional Add: <i>Large Area, APTV Materials Development for High Power Devices</i>		1.593	-
Congressional Add: <i>Mid-IR Laser Materials</i>		0.797	-
Congressional Add: <i>Low-Defect Density Gallium Nitride Materials for High-Performance Electronics Devices</i>		2.788	-
Congressional Add: <i>Gallium Nitride (GaN) Microelectronics and Materials</i>		1.593	-
Congressional Add Subtotals for Project: 624348		6.771	-

Project: 624349: *Materials Technology for Sustainment*

Congressional Add: <i>Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Materials Substitution and Repair</i>		1.992	-
Congressional Add: <i>Conducting Polymer Stress and Polymer Damage Sensors for Composites</i>		2.868	-
Congressional Add: <i>LGX High Temperature Acoustic Wave Sensors</i>		1.593	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Congressional Add: <i>Hybrid Materials Integration (HMI)</i>	1.992	-
Congressional Add Subtotals for Project: 624349		
	8.445	-
Project: 624915: <i>Deployed Air Base Technology</i>		
Congressional Add: <i>Fire and Blast Resistant Materials for Force Protection</i>	3.187	-
Congressional Add: <i>Energy Efficiency, Recovery, and Generation (ENERGy)</i>	0.996	-
Congressional Add: <i>Fine Water Mist Fire Suppression Technology to Replace Halon</i>	1.992	-
Congressional Add: <i>Partnership for Energy and Automation Technologies</i>	1.593	-
Congressional Add: <i>Temperature Resistant Landing Pad Jet Blast Protection</i>	0.797	-
Congressional Add Subtotals for Project: 624915		
	8.565	-
Congressional Add Totals for all Projects		
	51.785	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	109.378	84.865	81.915	-	81.915	81.785	81.117	81.449	83.042	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 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. Develops high-temperature turbine engine materials that will enable engine designs to double the turbine engine thrust-to-weight ratio. 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 aging operational systems. Materials for thermal management including coolants, adaptive thermally conductive materials, coatings, friction and wear-resistant materials, and other pervasive nonstructural materials technologies are being developed for directed energy, propulsion, and subsystems on aircraft, spacecraft, and missiles. Develops nanostructured and biological materials for aircraft structures, munitions, air vehicle subsystems, and personnel. Develops novel materials for electromagnetic interactions with matter for electromagnetic pulse (EMP), high power microwave, and lightning strike protection. Concurrently develops advanced processing methods to enable adaptive processing of aerospace materials.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	11.216	13.073	12.630	-	12.630
Description: Develop ceramic, ceramic matrix composite, and hybrid materials technologies for performance and supportability improvement in propulsion systems and high temperature aerospace structures.					
FY 2010 Accomplishments: Completed validation of advanced ceramic composite performance through testing under real and simulated engine service life conditions. Validate the life prediction model to address time dependent degradation associated with environmental exposure. Validate the severe environment durability of advanced ceramic composite systems with advanced interfaces via mechanical testing. Completed development of new spacecraft catalyst bed systems. Assessed performance of ultra high temperature ceramics leading edges in a relevant hypersonic environment (arc jet test rig) and validated oxidation models. Validated materials and materials process technologies for application in combined optical and radio frequency communication system apertures.					
FY 2011 Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
<p>components for air vehicles. Explored metamaterials options for electro-optic/infrared (EO/IR) applications. Explored metamaterials for high frequency RF passive microwave applications.</p> <p>FY 2011 Plans: Complete development of material concepts for adaptive and multifunctional aircraft structures. Validated and demonstrated materials and process low-cost processing methodologies for photovoltaics for RPA applications. Investigate new materials systems and nano geometries to improve electrochemical energy storage including development of long-life electrodes. Advance concepts for RF passive metamaterials-based components. Explore RF/IR photonics for compact air vehicle applications. Develop fabrication and characterization for EO/IR metamaterials. Develop fabrication and characterization for emerging metamaterial applications.</p> <p>FY 2012 Base Plans: Continue to investigate new materials systems and nano geometries to improve electrochemical energy storage including development of long-life electrodes. Accelerate applications development for optical metamaterials. Continue to investigate concepts for RF passive metamaterials-based components. Continue to develop RF/IR photonics for compact air vehicle applications. Continue to develop fabrication and characterization for EO/IR metamaterials. Develop fabrication and characterization for emerging metamaterial applications.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3</p> <p>Description: Develop lightweight metallic/inter-metallic high temperature materials, life prediction, and metals processing technologies for sustainment issues such as lower costs, increased durability, and improved reliability</p> <p>FY 2010 Accomplishments: Initiated development of an advanced disk system concept, advanced materials/processes, materials modeling, and propulsion. Demonstrated processing for thin gage metallics and fabrication of honeycomb and sandwich parts. Validated panel analysis methodology. Developed quantitative models linking microstructure with thermal and physical properties for metallic in high temperature environments.</p> <p>FY 2011 Plans: Continue development of an advanced disk system concept for insertion into advanced propulsion concepts for air platforms. Continue development of advanced computation methods to support modeling of materials</p>					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	15.441	13.903	13.442	-	13.442

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
Description: Develop the basic nanomaterial building blocks for munitions and propulsion energetic systems. Develop fundamental Science and Technology for pervasive device processing mechanisms via bio-inspired concepts and at the nanoscale level.					
FY 2010 Accomplishments: Demonstrated large-scale synthesis and characterization techniques for energetic nanomaterials to provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Validated the transport and compartmentalization of nanoparticles being investigated as nanoenergetics to evaluate potential environmental impact. Analyzed microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems. Developed multi-component, structured nanoparticle catalyses as controlled release agents for enhancing stability and storage, as well as providing enhanced ignition. Downselected most promising biological/nanomaterial hybrids for the detection and identification of threat agents.					
FY 2011 Plans: Demonstrate nanomaterials that provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Develop understanding of rapid propulsion methods for nano bio-material devices for aircraft and space structures, actuators, sensors, and electronics. Demonstrate the transport and compartmentalization of nanoparticles being investigated as nanoenergetics to evaluate potential environmental impact. Validate microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems.					
FY 2012 Base Plans: Demonstrate and validate nanomaterials. for structural nano-energetic (SNE) materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Develop biological engineering methods to facilitate the generation of sensors, materials, and electro-optic devices for production of complex hybrid materials. Investigate the confluence on nano-materials and bio-materials focusing on transitioning mechanical optical or electronic devices based upon nano-materials and bio-materials.					
FY 2012 OCO Plans:					
Title: Major Thrust 7					
Description: Develop high temperature materials, structures, and thermal management concepts to enable future defense capabilities for prompt global strike concepts.					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	1.977	2.726	2.652	-	2.652

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><i>FY 2010 Accomplishments:</i> Investigated advanced ceramics, ceramic matrix composites, hybrids, and metallic concepts for hot structure and thermal protection systems.</p> <p><i>FY 2011 Plans:</i> Continue to investigate advanced ceramics, ceramic matrix composites, hybrids, and metallic concepts for hot structure and thermal protection systems.</p> <p><i>FY 2012 Base Plans:</i> Develop advanced ceramics, ceramic matrix composites, hybrids, and metallic concepts for reuseable hot structure and thermal protection systems.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	81.374	84.865	81.915	-	81.915
	FY 2010	FY 2011			
<i>Congressional Add:</i> Air Force Minority Program	4.780	-			
<i>FY 2010 Accomplishments:</i> Conduct Congressionally-directed effort.					
<i>FY 2011 Plans:</i>					
<i>Congressional Add:</i> Carbon Nanomaterials for Advanced Aerospace Applications	0.797	-			
<i>FY 2010 Accomplishments:</i> Conduct Congressionally-directed effort.					
<i>FY 2011 Plans:</i>					
<i>Congressional Add:</i> ONAMI Safer Nanomaterials and Nanomanufacturing	3.505	-			
<i>FY 2010 Accomplishments:</i> Conduct Congressionally-directed effort.					
<i>FY 2011 Plans:</i>					
<i>Congressional Add:</i> Consortium for Nanomaterials for Aerospace Commerce and Technology (CONTACT)	3.187	-			
<i>FY 2010 Accomplishments:</i> Conduct Congressionally-directed effort.					
<i>FY 2011 Plans:</i>					
<i>Congressional Add:</i> Advanced Aerospace Carbon Foam Heat Exchanges	3.187	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>	
		FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Institute for Science and Engineering Simulation/Aircraft Fatigue Modeling and Simulation		3.585	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Development of Mobile Wind Turbine Systems to Power Forward Bases		1.195	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Aerospace Laser Micro Engineering Station		0.797	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Hybrid Nanoparticle-based Coolant Technology Development and Manufacturing		0.797	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Lightning Protection Composites		2.987	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Ultra-high Temperature Materials for Hypersonic Aerospace Vehicles		2.390	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.			
FY 2011 Plans:			
Congressional Add: Pennsylvania Nanomaterials Commercialization Center		0.797	-
FY 2010 Accomplishments: Conduct Congressionally directed effort.			
FY 2011 Plans:			
Congressional Adds Subtotals		28.004	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624347: <i>Materials for Structures, Propulsion, and Subsystems</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624348: <i>Materials for Electronics, Optics, and Survivability</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624348: <i>Materials for Electronics, Optics, and Survivability</i>	33.109	31.687	30.421	-	30.421	30.442	30.566	30.846	31.415	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops materials technologies for surveillance and situational awareness systems and subsystems for aircraft and missile applications, including sensor, microwave, and infrared detection and countermeasures devices used for targeting, electronic warfare, and active aircraft protection. Materials for protection of aircrews, sensors, and aircraft from laser and high-power microwave directed energy threats are also developed. 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. New materials are being developed to counter the most prominent laser threats and to respond to emerging and agile threat wavelengths without impairing mission effectiveness.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop IR detector and hybrid materials, Materials and Processes (M&P) technologies for performance, affordability, and operational capability of surveillance, tracking, targeting, and situational awareness systems.</p> <p>FY 2010 Accomplishments: Increased yield of full wafer focal plane arrays of 2k x 2k and developed multifunction readout integrated circuit. Investigated alternative Infra-Red (IR) materials for long wavelength detection. Pursued emerging IR materials in the short wave regime for day-night operation. Modeled and evaluated optical behavior of materials for low observable (LO), intelligence, surveillance, and reconnaissance (ISR), and other applications. Investigated materials constructs for multi-wavelength detection. Explored single material, multi-wavelength materials schemes. Extended capability of three-dimensional detection to multiple bands and explore tailoring options for diverse mission requirements. Advanced and refined growth technology for nano-scale IR detection. Explored options for novel nano-scale detection. Scaled up growth technology for nano-scale IR. Advance novel nano- scale materials options.</p> <p>FY 2011 Plans: Optimize 2k x 2k detector and readout integrated circuit design, processing, and packaging for enhanced focal plane array yields.</p>	8.040	8.665	8.295	-	8.295

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Further IR materials development for long wavelength. Advance mid wavelength materials development for high temperature, low-noise operation for use on low-power systems. Model and evaluate optical behavior of materials for LO, ISR, and other applications. Explore enhancing detection capability of three-dimensional detection. Investigate next generation alternative three-dimension schemes. Scale up growth technology for nano-scale IR. Advance novel nano-scale materials options. Continue to model and evaluate materials optical/IR behavior for LO, ISR, and other applications.</p> <p>FY 2012 Base Plans: Demonstrate reproducibility of optimized 2k x 2k detector and readout integrated circuit design, processing, and packaging for enhanced focal plane array yields. Develop a superlattice based material system for use in the detector elements of very long wavelength IR detector focal plane arrays. Continue to advance mid wavelength materials development for high temperature, low-noise operation for use on low-power systems. Validate models of materials optical/IR behavior for LO, ISR, and other applications. Initiate development of materials for nano-scale detection.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2</p> <p>Description: Develop and demonstrate technologies to enhance the safety, survivability, and mission effectiveness of aircrews, sensors, viewing systems, and related assets.</p> <p>FY 2010 Accomplishments: Developed nonlinear optical limiter solid state materials into device concepts for damage protection of space-based sensor systems. Investigated photorefractive materials growth repeatability for increased probability of technology transition to Air Force passive protection applications. Demonstrated electrically tunable liquid crystal filters for sensor system protection concepts. Developed thin film concepts for enhanced fixed filter performance. Developed and analyzed electromagnetic interference and high power microwave shielding for electronics hardening.</p> <p>FY 2011 Plans: Demonstrate optimized nonlinear optical limiter materials for damage protection. Demonstrate enhanced photorefractive hybrid materials concepts for Air Force passive protection applications. Mature improved liquid crystal materials for photo-tunable devices for sensor system protection concepts. Demonstrate thin film</p>	5.828	9.115	8.730	-	8.730

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624348: <i>Materials for Electronics, Optics, and Survivability</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>growth capabilities for enhanced fixed filter performance. Demonstrate semiconductor optical limiter materials performance for damage protection in the short wave infrared.</p> <p>FY 2012 Base Plans: Continue demonstration of optimized nonlinear optical limiter materials for damage protection. Continue to develop new optical limiter materials and material technologies for robust in-band protection. Continue demonstration of enhanced photorefractive hybrid materials concepts for Air Force passive protection applications. Develop tunable/switchable materials and concepts to provide jamming protection to a variety of systems. Develop and demonstrate passive optical coating technology for advanced applications in airborne, space, and personnel systems.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3</p> <p>Description: Develop M&P technologies for power generation and control, and microwave components for surveillance, tracking, targeting, situational awareness, and lethal and non-lethal systems.</p> <p>FY 2010 Accomplishments: Explored and identified materials-to-materials interactions responsible for reduced reliability. Refined thin film growth process for improved wide bandgap semiconductor material. Investigated performance issues in materials components of high power microwave directed energy weapons. Developed nanostructured materials using multiple approaches for high energy density capacitors for pulsed power applications.</p> <p>FY 2011 Plans: Develop materials growth adjustment/mitigation methodologies for improved reliability. Improve materials and materials applications for increased reliability and power for high power microwave directed energy applications.</p> <p>FY 2012 Base Plans: Develop and validate characterization and modeling tools to analyze material changes that occur at the nanoscale within an operating device.</p>	5.229	5.830	5.610	-	5.610

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop and demonstrate reliable materials and processes to optimize components for compact, lightweight, high power microwave directed energy applications. Continue to develop nanostructured materials using multiple approaches for high energy density capacitors for pulsed power applications. FY 2012 OCO Plans:					
Title: Major Thrust 4 Description: Develop enabling and foundational biotechnologies for guidance and control, rapid tagging, tracking, and identification of targets, and bio-integrated electronics and sensing. FY 2010 Accomplishments: Validated efficacy of using taggants for preemptive destruction of threat agents. Incorporated taggants into a variety of media (polymer, paints) for optimal and mission-specific dispersal. Modeled dispersion properties of polymer-encapsulated taggants for optimal release and coverage. FY 2011 Plans: Develop new bio-materials and nano-materials that enable broad spectrum mitigation of environmental threats. Integrate delivery methods and bio-materials and nano-materials appropriate for specific Air Force requirements. Demonstrate materials with specific performance characteristic. FY 2012 Base Plans: Develop bio-materials and nano-based and functionalized materials for tagging, tracking, and locating applications. Develop biological engineering methods for sensors and electro-optic devices for complex hybrid materials. Develop bio-materials and nano-materials that enable broad spectrum mitigation of environmental threats. FY 2012 OCO Plans:	4.843	4.970	4.730	-	4.730
Title: Major Thrust 5 Description: Develop materials enabling higher performance lasing media, new laser architectures, optical isolators, beam steering, and other high energy laser components for directed energy. FY 2010 Accomplishments: Investigated host/dopant materials for fiber lasers in the eye-safe regime.	2.398	3.107	3.056	-	3.056

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624348: <i>Materials for Electronics, Optics, and Survivability</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Demonstrate preliminary fiber development. Demonstrated solid state, very high-speed beam steering materials options. Investigated very high-speed beam steering configurations. Explored options and developed alternate materials and processes for high energy lasers.</p> <p>FY 2011 Plans: Pursue materials for enabling improved laser source components operating in the mid-infrared range. Improve very high-speed beam steering materials and pursue most promising beam steering configurations. Improve materials to increase high energy laser efficiency and gain.</p> <p>FY 2012 Base Plans: Develop materials for enabling improved laser source components operating in the mid-infrared range. Continue to develop materials processes for fabricating new laser beam scanning architectures that utilize the latest generation of EO polymers to enable the high-speed beam steering. Develop and demonstrate materials that increase high energy laser efficiency and gain.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	26.338	31.687	30.421	-	30.421

	FY 2010	FY 2011
<p>Congressional Add: Large Area, APTV Materials Development for High Power Devices</p> <p>FY 2010 Accomplishments: Conduct Congressionally directed effort.</p> <p>FY 2011 Plans:</p>	1.593	-
<p>Congressional Add: Mid-IR Laser Materials</p> <p>FY 2010 Accomplishments: Conduct Congressionally directed effort.</p> <p>FY 2011 Plans:</p>	0.797	-
<p>Congressional Add: Low-Defect Density Gallium Nitride Materials for High-Performance Electronics Devices</p> <p>FY 2010 Accomplishments: Conduct Congressionally directed effort.</p> <p>FY 2011 Plans:</p>	2.788	-
<p>Congressional Add: Gallium Nitride (GaN) Microelectronics and Materials</p>	1.593	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	6.771	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624349: <i>Materials Technology for Sustainment</i>	22.361	16.893	20.052	-	20.052	20.158	19.998	22.341	22.744	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops materials and materials processing technologies to support operational Air Force mission areas by providing the ability to inspect the quality of delivered systems, transitioning more reliable and maintainable materials, establishing a capability to detect and characterize performance threatening defects, characterizing materials processes and properties necessary for materials transition, and providing 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	2.941	5.079	7.153	-	7.153
Description: Develop sensing and life prediction technologies to identify damage and characterize the health of aging structures, propulsion systems, and low-observable (LO) materials and structures.					
FY 2010 Accomplishments: Developed advanced novel sensing techniques to detect and track corrosion and other damage to materials in aerospace systems. Demonstrated multi-layer sensing capabilities to demonstrate applications and damage models for a wide variety of aerospace structures. Developed advanced sensing technologies that detect changes in material properties from corrosion and in-field use, damage evolution, and other factors that detrimentally affect aerospace systems. Develop and validate affordable prognosis approaches for life cycle sustainment and management and for life extension capability. Demonstrate novel LO point inspection probes to enable rapid assessment of LO material performance. Investigate next generation LO point inspection needs.					
FY 2011 Plans: Demonstrate advanced novel sensing techniques to detect and track corrosion and other damage to materials in aerospace systems. Demonstrate augmented multi-layer sensing capabilities to demonstrate applications and damage models for a wide variety of aerospace structures. Demonstrate sensing technologies that detect changes in material properties from corrosion and in-field use, damage evolution, and other factors that detrimentally affect aerospace systems. Develop and validate affordable prognosis approaches for life cycle					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>sustainment and management and for life extension capability. Demonstrate novel LO point inspection probes to enable rapid assessment of LO material performance. Investigate next generation LO point inspection needs.</p> <p>FY 2012 Base Plans: Advance novel sensing modeling, methods, and techniques to detect and track damage to other materials and components for aerospace systems. Conduct applied research to enhance sensing through multiple layers of skin and structures to improve the probabilities of finding deeply imbedded or hidden damage in aerospace systems. Advance sensing technologies that detect changes in material properties, damage evolution, and other factors that detrimentally affect aerospace systems. Develop and improve affordable prognosis approaches for life cycle management and life extension capability for aerospace structure and turbine engines. Investigate and augment innovative LO point inspection probes to enable rapid assessment of LO material performance.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2</p> <p>Description: Develop support capabilities, information, and processes to resolve problems with materials in the production and repair of systems components and structures.</p> <p>FY 2010 Accomplishments: Evaluated advanced materials and processes technologies to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Developed and demonstrated test methods and techniques to understand the effects of in-service environments and materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrated and transitioned technologies for improved maintainability and life cycle cost of advanced LO materials and designs, such as conductive outer-mold-line, applique, door edges and seals, and multifunctional systems. Developed and demonstrated laboratory test methods to evaluate and characterize candidate space materials for properties and material behavior suitable for use in space applications.</p> <p>FY 2011 Plans: Evaluate advanced materials and processes technology to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Develop and demonstrate test methods and techniques to understand the effects of in-service environments and materials processes, such as the application of residual stress on the surface of steel and other structural</p>	4.827	5.140	6.053	-	6.053

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems.</p> <p>Demonstrate and transition technologies for improved maintainability and life cycle cost of advanced materials and designs, such as conductive outer-mold-line, films, coatings, access panel treatments and multifunctional systems. Develop and demonstrate laboratory test methods to evaluate and characterize candidate space materials for properties and material behavior suitable for use in space applications.</p> <p>FY 2012 Base Plans: Evaluate advanced materials and processes technology to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Develop and demonstrate test methods and techniques to understand the effects of in-service environments, residual stress and materials processes on structural materials, and to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrate and transition technologies for improved maintainability and life cycle cost of advanced materials and designs, such as conductive outer-mold-line, aircraft films, coatings, access panel treatments and multifunctional systems. Develop and demonstrate laboratory test methods to evaluate and characterize candidate space materials for properties and material behavior suitable for use in space applications.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3</p> <p>Description: Develop support capabilities, information, and processes to resolve materials problems and provide electronic and structural failure analysis of components.</p> <p>FY 2010 Accomplishments: Performed quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provided advanced materials solutions to ensure system availability and safety of flight. Developed advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrated advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Developed advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapon systems.</p> <p>FY 2011 Plans:</p>	6.148	6.674	6.846	-	6.846

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Perform quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provide advanced materials solutions to ensure system availability and safety of flight. Develop advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrate advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Develop advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapon systems.</p> <p>FY 2012 Base Plans: Perform quick response failure analysis and materials investigations. Provide advanced materials solutions to ensure system availability and safety of flight. Initiate development of Microelectromechanical System (MEMS) failure analysis capabilities. Develop advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrate advanced test methodologies for analyzing electrical and structural failures of emerging materials. Develop and demonstrate advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapon systems.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	13.916	16.893	20.052	-	20.052

	FY 2010	FY 2011
<p>Congressional Add: Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Materials Substitution and Repair</p> <p>FY 2010 Accomplishments: Conduct Congressionally-directed effort.</p> <p>FY 2011 Plans:</p>	1.992	-
<p>Congressional Add: Conducting Polymer Stress and Polymer Damage Sensors for Composites</p> <p>FY 2010 Accomplishments: Conduct Congressionally-directed effort.</p> <p>FY 2011 Plans:</p>	2.868	-
<p>Congressional Add: LGX High Temperature Acoustic Wave Sensors</p>	1.593	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624349: <i>Materials Technology for Sustainment</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Add: Hybrid Materials Integration (HMI)	1.992	-
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	8.445	-

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

Line Item	FY 2010	FY 2011	FY 2012	FY 2012	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Cost To	
			Base	OCO	Total					Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>				PROJECT 624915: <i>Deployed Air Base Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624915: <i>Deployed Air Base Technology</i>	12.390	3.828	3.842	-	3.842	3.892	4.000	4.142	4.228	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops new deployable airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs, and to improve protection and survivability of deployed Air Expeditionary Force (AEF) warfighters. Affordable, efficient technologies are developed for base infrastructure, fire fighting, and force protection to improve Expeditionary Combat Support operations.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop deployable infrastructure airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations.</p> <p>FY 2010 Accomplishments: Developed deployable applications of higher efficiency collection and conversion of solar power for deployed applications. Analyzed performance of candidate high temperature aircraft operating surface materials. Developed remote non-destructive inspection of airfield surface evaluation technologies.</p> <p>FY 2011 Plans: Develop and demonstrate deployable applications of higher efficiency collection and conversion of solar power for deployed applications. Develop and optimize performance of candidate high temperature operating surface materials. Develop and improve remote and autonomous non-destructive inspection of airfield surface evaluation technologies</p> <p>FY 2012 Base Plans: Investigate and develop innovative airbase alternative energy generation capability, power grid conditioning, and distribution methods. Explore and continue development of innovative high operating temperature materials and technologies for aircraft operating surfaces.</p> <p>FY 2012 OCO Plans:</p>	2.110	1.911	1.974	-	1.974
<p>Title: Major Thrust 2</p>	1.715	1.917	1.868	-	1.868

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>		PROJECT 624915: <i>Deployed Air Base Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
Description: Develop affordable technologies to provide force protection and survivability to AEF deployed warfighters and infrastructure.					
FY 2010 Accomplishments: Analyzed fire suppression agents using methodologies supporting deployed warfighters and infrastructure. Investigated novel, cost-effective technologies for fire fighter effectiveness and optimized developed technologies. Investigated novel structural materials and technologies to support deployed warfighters and infrastructure, using methodologies developed for protection. Analyzed and conducted experiments to verify effectiveness for defeat of Improvised Explosive Device (IED) and high energy threat technologies. Transitioned mature defeat technologies and investigated emerging threats. Explored functions of microbes and developed effective methodologies to capture biological processes for use in Air Force applications.					
FY 2011 Plans: Develop and optimize fire suppression agents using methodologies supporting deployed warfighters and infrastructure. Develop novel cost- effective technologies for fire fighter effectiveness in deployed environments. Develop novel structural materials and technologies to support deployed warfighters and infrastructure using methodologies developed for protection from emerging threats. Develop and optimize techniques and materials for defeat of new and evolving IED and high energy threats. Analyze functions of microbes and develop effective methodologies to capture biological processes for use in Air Force applications, such as sensing and development of solid state materials. Evaluate design and performance of microbial-based technologies.					
FY 2012 Base Plans: Develop technologies for airbase structural protection against blast and fragmentation. Explore technology to enhance structural integrity. Investigate composite material combustion processes and develop modeling for aircraft fires. Develop innovative technologies for airbase firefighting.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	3.825	3.828	3.842	-	3.842
Congressional Add: Fire and Blast Resistant Materials for Force Protection					
	3.187	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602102F: <i>Materials</i>	PROJECT 624915: <i>Deployed Air Base Technology</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally directed effort. FY 2011 Plans:		
Congressional Add: Energy Efficiency, Recovery, and Generation (ENERGY) FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	0.996	-
Congressional Add: Fine Water Mist Fire Suppression Technology to Replace Halon FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.992	-
Congressional Add: Partnership for Energy and Automation Technologies FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Temperature Resistant Landing Pad Jet Blast Protection FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	0.797	-
Congressional Adds Subtotals	8.565	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	136.379	144.699	147.628	-	147.628	143.845	148.002	150.601	153.388	Continuing	Continuing
622401: <i>Structures</i>	43.684	44.224	47.116	-	47.116	55.322	56.898	57.885	58.938	Continuing	Continuing
622403: <i>Flight Controls and Pilot-Vehicle Interface</i>	19.568	39.283	39.295	-	39.295	37.280	38.345	39.006	39.727	Continuing	Continuing
622404: <i>Aeromechanics and Integration</i>	73.127	61.192	61.217	-	61.217	51.243	52.759	53.710	54.723	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and analyzes aerospace vehicle technologies in the three primary areas of structures, controls, and aeromechanics. Advanced structures concepts are explored and developed to exploit new materials, fabrication processes, and design techniques. Flight control technologies are developed and simulated for aerospace vehicles. Advanced aerodynamic vehicle configurations are developed and analyzed through simulations, experiments, and multi-disciplinary analyses. Resulting technologies improve performance of existing and future manned and remotely piloted air and space access vehicles. Improvements include but are not limited to reduced energy use by efficient air platform designs; use of lightweight composite structures; improved sustainment methods based upon the condition of the platform and sub-systems. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary aerospace vehicle technologies.

B. Program Change Summary (\$ in Millions)

	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>
Previous President's Budget	138.563	144.699	149.062	-	149.062
Current President's Budget	136.379	144.699	147.628	-	147.628
Total Adjustments	-2.184	-	-1.434	-	-1.434
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.189	-			
• Other Adjustments	0.005	-	-1.434	-	-1.434

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

Project: 622404: *Aeromechanics and Integration*

FY 2010	FY 2011

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>
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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>	FY 2010	FY 2011
Congressional Add: <i>Materials Integrity Management Research for the Air Force.</i>	2.987	-
Congressional Add: <i>Unmanned Air Vehicle Sensor and Maintenance Development center.</i>	3.904	-
Congressional Add: <i>Unmanned Aerial System Exploitation.</i>	3.485	-
Congressional Add: <i>Unmanned Air Vehicle Sense, Track, and Avoid Radar.</i>	1.593	-
Congressional Add Subtotals for Project: 622404	11.969	-
Congressional Add Totals for all Projects	11.969	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>			PE 0602201F: <i>Aerospace Vehicle Technologies</i>				622401: <i>Structures</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622401: <i>Structures</i>	43.684	44.224	47.116	-	47.116	55.322	56.898	57.885	58.938	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 incorporating subsystem hardware items and adaptive mechanisms into the aerospace structures and/or skin of the platform.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop an economic service life analysis capability comprised of analysis tools, methodologies, and structural health monitoring schemes.</p> <p>FY 2010 Accomplishments: Initiated the development of health reasoners for determination of system health. Continued to incorporate newly developed analysis tools into life prediction and failure analysis. Continued to develop failure criteria tools. Developed residual stress processes to enhance service life.</p> <p>FY 2011 Plans: Continue the development of health reasoners for determination of system health. Incorporate newly developed analysis tools. Complete the development of failure criteria tools for advanced high temperature aircraft components and concepts. Continue the development of residual stress processes to enhance service life.</p> <p>FY 2012 Base Plans: Continue the development of integrated sensors for determination of system health. Incorporate newly developed analysis tools. Complete the development of failure criteria tools for advanced high temperature aircraft components and concepts. Initiate efforts for condition based maintenance of structural integrity.</p> <p>FY 2012 OCO Plans:</p>	25.353	18.820	19.763	-	19.763
<p>Title: Major Thrust 2.</p> <p>Description: Develop methodologies to reduce the cost and time involved in actual full-scale testing of components and aircraft prior to obtaining airworthiness certification.</p> <p>FY 2010 Accomplishments:</p>	4.043	6.432	6.897	-	6.897

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622401: <i>Structures</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continued development of analytical certification methodologies. Initiated the development of response prediction methodologies.</p> <p>FY 2011 Plans: Continue development of analytical certification methodologies that incorporate advanced methods. Initiate increased fidelity of analytical methodologies. Continue the development of reliability-based certification.</p> <p>FY 2012 Base Plans: Continue development of methodologies that will allow for lower cost analytical certification of advanced designed structure. Initiate the development of advanced aircraft flutter analysis tools.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Develop design methods to capitalize on new materials, multirole considerations, and integration of various subsystem hardware items and adaptive mechanisms into the actual aircraft.</p> <p>FY 2010 Accomplishments: Continued the development of multirole aircraft structural concepts. Continued evaluation of innovative technologies for long-range and long endurance air vehicle and micro air vehicle concepts. Continued development of multi-functional structures.</p> <p>FY 2011 Plans: Continue the development of technologies to increase the survivability and performance of future systems. Develop and demonstrate system level thermal management concepts to meet the need of multifunction, multirole, and adaptive aircraft.</p> <p>FY 2012 Base Plans: Continue the development of technologies to increase the survivability and performance of future systems. Develop and demonstrate system level thermal management concepts to meet the need of multifunction, multirole, and adaptive aircraft.</p> <p>FY 2012 OCO Plans:</p>	5.806	7.923	8.562	-	8.562
<p>Title: Major Thrust 4.</p>	8.482	11.049	11.894	-	11.894

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622401: <i>Structures</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop technologies that will permit the structural development of platforms that can operate at an extreme altitude, while at sustained speeds greater than Mach 2.</p> <p>FY 2010 Accomplishments: Developed technologies for an integrated air vehicle structure that can withstand extreme flight environments. Continued to refine operationally responsive space access concepts.</p> <p>FY 2011 Plans: Further develop technologies for integrated air vehicle structures that can withstand extreme flight environments. Refine operationally responsive space access concepts and apply these technologies for lower cost, reduced weight expendable vehicle airframes.</p> <p>FY 2012 Base Plans: Further develop technologies that incorporate advanced materials and design concepts for the creation of an integrated air vehicle structure that can withstand extreme flight environments. Continue to develop structural concepts and analysis methods for design and evaluation of hot primary structure. Continue to refine operationally responsive space access concepts and apply these technologies for lower cost, reduced weight expendable vehicle airframes.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	43.684	44.224	47.116	-	47.116

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
Not Applicable.

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>				PROJECT 622403: <i>Flight Controls and Pilot-Vehicle Interface</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622403: <i>Flight Controls and Pilot-Vehicle Interface</i>	19.568	39.283	39.295	-	39.295	37.280	38.345	39.006	39.727	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops technologies that enable maximum affordable capability from manned and unmanned aerospace vehicles. Advanced flight control technologies are developed for maximum vehicle performance throughout the flight envelope and simulated in virtual environments. Resulting technologies contribute significantly towards the development of reliable autonomous remotely piloted air vehicles, space access systems with aircraft-like operations, and extended-life legacy aircraft.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop advanced flight control systems, components, and integrated vehicle monitoring systems for both manned and remotely piloted aircraft.</p> <p>FY 2010 Accomplishments: Furthered the development, assessment, and certification of advanced control mechanization technologies. Developed control configurations for small and micro-sized unmanned air systems.</p> <p>FY 2011 Plans: Further the development of advanced control mechanization technologies to provide highly reliable operations for aerospace systems under adverse environments. Initiate development of control architecture enhancements for complex and adaptive remotely piloted systems.</p> <p>FY 2012 Base Plans: Further the assessment of advanced control technologies. Refine development of control architecture enhancements for remotely piloted systems.</p> <p>FY 2012 OCO Plans:</p>	5.409	9.562	9.642	-	9.642
<p>Title: Major Thrust 2.</p> <p>Description: Develop flight control systems that will permit safe interoperability between manned and remotely piloted aircraft.</p> <p>FY 2010 Accomplishments:</p>	11.069	13.664	13.808	-	13.808

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622403: <i>Flight Controls and Pilot-Vehicle Interface</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				PE 0602201F: <i>Aerospace Vehicle Technologies</i>				622404: <i>Aeromechanics and Integration</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622404: <i>Aeromechanics and Integration</i>	73.127	61.192	61.217	-	61.217	51.243	52.759	53.710	54.723	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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop aerodynamic prediction efforts centered on expanding the design capabilities of manned and remotely piloted air vehicles.</p> <p>FY 2010 Accomplishments: Performed mission assessments and develop low-cost remotely piloted air vehicle concepts to perform current and future missions including tactical surveillance and weapon delivery. Continued work to develop and demonstrate flow control to enable fluidic thrust vectoring, area control, and thermal management for a remotely piloted air vehicle exhaust nozzle.</p> <p>FY 2011 Plans: Continue to perform mission assessments of aerospace platforms for current and future missions including tactical surveillance and weapon delivery. Continue development of technologies for improved weapon delivery and propulsion system performance. Continue development of innovative aerodynamic control methods for small remotely piloted air vehicles.</p> <p>FY 2012 Base Plans: Continue to develop and assess aeronautical technologies that enable broad use of unmanned air vehicles. Continue work to develop and demonstrate flow control to enable fluidic thrust vectoring, area control, and thermal management for a remotely piloted air vehicle exhaust nozzle. Continue development of innovative aerodynamic control methods for small remotely piloted air vehicles.</p> <p>FY 2012 OCO Plans:</p>	2.700	3.487	3.517	-	3.517
<p>Title: Major Thrust 2.</p>	22.663	27.518	27.630	-	27.630

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622404: <i>Aeromechanics and Integration</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop new and improved concepts, designs, and analysis of technologies to enable revolutionary capabilities for sustained high-speed re-useable high altitude vehicle efforts.</p> <p>FY 2010 Accomplishments: Developed technologies for high-speed flight. Continued development of techniques for propulsion integration technologies. Continued to characterize high-speed phenomena and develop and validate high-speed component technologies.</p> <p>FY 2011 Plans: Continue development of analysis/design techniques and tools to enable shock/boundary layer interaction flow control and enhanced stability for high speed propulsion concepts. Continue efforts for high performance high speed mixed compression inlet concepts utilizing advanced flow control technologies for Mach 3+ expendable systems. Develop and test inlet variable geometry concepts.</p> <p>FY 2012 Base Plans: Continue development of analysis/design techniques and tools to enable shock/boundary layer interaction flow control and enhanced stability for high speed propulsion concepts. Continue efforts to characterize high-speed phenomena and develop and validate fundamental high-speed component technologies through experimental flight techniques in a relevant environment.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 3.</p>					
<p>Description: Develop enabling technologies to allow integration of directed energy weapons into current and future air vehicle platforms.</p> <p>FY 2010 Accomplishments: Continued development of combined flow control and adaptive optics systems to optimize directed energy system performance. Initiated work to apply advanced analysis tools to predict the performance of flow control and adaptive optics systems.</p> <p>FY 2011 Plans:</p>	2.210	2.533	2.534	-	2.534

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622404: <i>Aeromechanics and Integration</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue development of combined flow control and adaptive optics systems to optimize directed energy system performance on large low-speed aircraft. Initiate development of combined flow control and adaptive optics systems for transonic/supersonic aircraft.</p> <p>FY 2012 Base Plans: Continue work to apply advanced analysis tools to predict the performance of flow control and adaptive optics systems for problems of interest to the Air Force. Extend development of analysis tools for prediction of advanced flow control and adaptive optics to higher speed transonic/supersonic flows.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Develop and assess technologies for the next generation of multi-role large aircraft.</p> <p>FY 2010 Accomplishments: Continued development and assessment of aeronautical technologies that enable revolutionary tanker and transport aircraft designs for rapid global mobility. Continued development of inlet and integration technologies for an advanced mobility platform designed to operate efficiently at transonic speeds and provide short take-off capabilities.</p> <p>FY 2011 Plans: Continue to develop technologies that enable multiple roles and missions for delivery and support aircraft. Conduct wind tunnel experiments to show the feasibility of mobility aircraft using 40% less energy through the use of natural and artificial laminar boundary layers, alternative fuels and very high bypass propulsion integration.</p> <p>FY 2012 Base Plans: Continue to develop technologies that enable multiple roles and missions for delivery and support aircraft. Conduct wind tunnel experiments to show the feasibility of mobility aircraft using 40% less energy through the use of natural and artificial laminar boundary layers, alternative fuels and very high bypass propulsion integration.</p> <p>FY 2012 OCO Plans:</p>	33.585	27.654	27.536	-	27.536
Accomplishments/Planned Programs Subtotals	61.158	61.192	61.217	-	61.217

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602201F: <i>Aerospace Vehicle Technologies</i>	PROJECT 622404: <i>Aeromechanics and Integration</i>

	FY 2010	FY 2011
Congressional Add: Materials Integrity Management Research for the Air Force. FY 2010 Accomplishments: Conducted Congressionally direct effort. FY 2011 Plans:	2.987	-
Congressional Add: Unmanned Air Vehicle Sensor and Maintenance Development center. FY 2010 Accomplishments: Conducted Congressionally direct effort. FY 2011 Plans:	3.904	-
Congressional Add: Unmanned Aerial System Exploitation. FY 2010 Accomplishments: Conducted Congressionally direct effort. FY 2011 Plans:	3.485	-
Congressional Add: Unmanned Air Vehicle Sense, Track, and Avoid Radar. FY 2010 Accomplishments: Conducted Congressionally direct effort. FY 2011 Plans:	1.593	-
Congressional Adds Subtotals	11.969	-

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

Line Item	FY 2010	FY 2011	FY 2012	FY 2012	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Cost To		
			Base	OCO	Total					Complete	Total Cost	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	93.461	87.452	86.663	-	86.663	86.109	88.892	90.557	92.363	Continuing	Continuing
621123: <i>Learning and Organizational Collaboration</i>	22.635	13.214	13.745	-	13.745	13.852	13.729	13.596	13.878	Continuing	Continuing
625328: <i>Human Dynamics Evaluation</i>	14.144	16.587	15.229	-	15.229	14.819	18.342	18.694	19.046	Continuing	Continuing
625329: <i>Sensory Evaluation and Decision Science</i>	22.734	22.492	23.471	-	23.471	23.544	23.738	24.477	24.964	Continuing	Continuing
627184: <i>Performance Evaluation in Extreme Environments</i>	19.634	18.436	17.016	-	17.016	16.837	15.424	15.703	16.038	Continuing	Continuing
627757: <i>Directed Energy Bioeffects</i>	14.314	16.723	17.202	-	17.202	17.057	17.659	18.087	18.437	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program conducts applied research in the area of airmen training, airmen system interfaces, directed energy bioeffects, deployment and sustainment of airmen in extreme environments, and understanding and shaping adversarial behavior. The Learning and Organizational Collaboration project conducts research to measure, accelerate, and expand the cognitive skills necessary to improve airmen training and mission performance. The Human Dynamics Evaluation project conducts research to advance information operations and intelligence operator-aiding technologies by developing and applying human-focused research to create and influence behavior signatures of existing and emerging adversaries. The Sensory Evaluation and Decision Science project conducts research to revolutionize the manner in which the human optimizes the capabilities of Air Force systems, including remotely piloted aircraft (RPA) and adaptive teams of humans and machines. The Performance Evaluation in Extreme Environments project conducts research to enhance human sensory, cognitive, and physical capabilities to increase airmen survivability and performance. The Directed Energy Bioeffects project conducts research on the effects of human exposure to electromagnetic energy (radio frequency to optical), scalable directed energy weapons, and non-lethal weapons. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	93.527	87.452	89.331	-	89.331
Current President's Budget	93.461	87.452	86.663	-	86.663
Total Adjustments	-0.066	-	-2.668	-	-2.668
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	1.000	-			
• SBIR/STTR Transfer	-1.047	-			
• Other Adjustments	-0.019	-	-2.668	-	-2.668

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

Project: 621123: *Learning and Organizational Collaboration*

Congressional Add: *Center for UAS Research, Education and Training*

Congressional Add Subtotals for Project: 621123

Project: 625329: *Sensory Evaluation and Decision Science*

Congressional Add: *Advanced Night Vision System - Cockpit Integration*

Congressional Add Subtotals for Project: 625329

Project: 627184: *Performance Evaluation in Extreme Environments*

Congressional Add: *Imaging Tools for Human Performance Enhancement and Diagnostics*

Congressional Add Subtotals for Project: 627184

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	6.373	-
	6.373	-
	0.797	-
	0.797	-
	1.593	-
	1.593	-
	8.763	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 621123: <i>Learning and Organizational Collaboration</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
621123: <i>Learning and Organizational Collaboration</i>	22.635	13.214	13.745	-	13.745	13.852	13.729	13.596	13.878	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research to measure, accelerate, and expand the cognitive skills necessary to improve airmen training and mission performance. Research is conducted in three focus areas: immersive environments; continuous learning and aiding; and cognitive and behavioral modeling. The immersive environments effort creates live, virtual, and constructive (LVC) decision-making environments for use in developing revolutionary simulation technologies to increase training capabilities. Continuous learning and aiding enhances training effectiveness and efficiency by using learning theory to improve military training and mission performance. Cognitive and behavioral modeling creates realistic models and simulations of human behavior to advance the understanding of how people perform complex tasks.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Research enhances Distributed Mission Operations (DMO) and decision dominance environments; identifies requirements for aircrew training in live, immersive environments.</p> <p>FY 2010 Accomplishments: Researched training and rehearsal issues for helmet cueing and targeting pod simulation systems that will allow for greater realistic composite force training. Expanded sensory-driven modeling efforts to predict targeting pod performance and investigate how neural-sensory measurements correlate with model predictions. Defined sensory requirements for a fully immersive collaborative training environment for DMO. Assessed modeling and simulation requirements for intelligent threat models to support immersive training. Conducted research for the capabilities needed for a full-threat reaction trainer system. Enhanced training capabilities by populating DMO databases with robust 3-D cultural content and correlated sensor attribution.</p> <p>FY 2011 Plans: Complete analysis of simulation requirements for air-to-ground and air-to-air force training. Utilize results to address specific training requirements for current and future Air Force fighter platforms. Apply sensory-driven decision-making models to broader range of Air Force mission areas. Evaluate analysis of modeling and simulation efforts for enhanced training. Complete evaluation of real-time data insertion capabilities into DMO.</p> <p>FY 2012 Base Plans:</p>	5.144	4.094	4.094	-	4.094

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 621123: <i>Learning and Organizational Collaboration</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
national best practices for RPA personnel selection, placement, and training. Demonstrate persistent training and operations event tracking for individual and small team proficiency and squadron readiness assessment. FY 2012 OCO Plans:					
Title: Major Thrust 3 Description: Cognitive/behavioral modeling explores application of cognitive science for performance improvement by enhancing training in mission-relevant environments (e.g., flight simulators). FY 2010 Accomplishments: Created adaptive language comprehension and generation capability for computer-generated communication models. Continued to integrate knowledge and skill tracking prediction system with mission essential competencies to predict individualized, optimized training requirements for airmen. Broadened ability to model and predict individual differences in trainee susceptibility to cognitive fatigue across multiple tasks. FY 2011 Plans: Integrate mission-relevant task model with language comprehension and generation capability to improve situational awareness of computer-generated teammates. Conduct empirical studies with skill acquisition/retention models and demonstrate ability to produce optimized training and rehearsal programs. Develop graphical user interface for performance prediction systems. FY 2012 Base Plans: Improve human behavior representation in synthetic teammates by incorporating prediction intervals, enhanced knowledge base, and decision heuristics. FY 2012 OCO Plans:	4.248	3.335	3.396	-	3.396
Accomplishments/Planned Programs Subtotals	16.262	13.214	13.745	-	13.745
	FY 2010	FY 2011			
Congressional Add: Center for UAS Research, Education and Training FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	6.373	-			
Congressional Adds Subtotals	6.373	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 621123: <i>Learning and Organizational Collaboration</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 625328: <i>Human Dynamics Evaluation</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625328: <i>Human Dynamics Evaluation</i>	14.144	16.587	15.229	-	15.229	14.819	18.342	18.694	19.046	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research to advance information operations and intelligence operator-aiding technologies by developing and applying human-focused research to create and influence behavior signatures of existing and emerging adversaries. Research will be in six focus areas: mission-essential human capabilities for air, space, and cyber operations; enhancing human components of intelligence, surveillance, and reconnaissance (ISR); anticipatory command, control, and intelligence (C2I); adversarial modeling and cross-cultural communication; predicting and evaluating organizational effectiveness alignment and collaboration readiness; and electromagnetic theory. These focus areas will enhance capabilities in layered sensing, decision aids for computer network attack/defense/survive, and human-centric exploitation of measurement and signatures intelligence.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Identify methods to enhance mission-essential human capabilities for cyber operations. Develop measures of effectiveness for cyber capabilities.</p> <p>FY 2010 Accomplishments: Conducted research to enhance performance and increase situational awareness within cyber operations, including operations support center environments. Developed the operator's ability to anticipate and influence the behavior of adversaries. Conducted foundational studies toward enhancing cognitive cyber performance.</p> <p>FY 2011 Plans: Continue conducting research to enhance performance and increase situational awareness within cyber operations, including operations support center environments. Develop quantifiable measures of effectiveness to demonstrate ability to effectively anticipate and influence the behavior of adversaries. Continue foundational studies toward enhancing cognitive cyber performance.</p> <p>FY 2012 Base Plans: Continue conducting research into enhancing cognitive cyber performance. Develop technologies that increase situational awareness within cyber operations and research metrics to accurately assess attacks from adversaries.</p> <p>FY 2012 OCO Plans:</p>	4.743	3.971	1.436	-	1.436

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625328: <i>Human Dynamics Evaluation</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2</p> <p>Description: Conduct research to enhance human components of ISR. Develop ability to anticipate, influence, and dominate adversary's air, space, and cyber ISR systems, processes, and organizations.</p> <p>FY 2010 Accomplishments: Conducted cognitive task analysis and cognitive systems engineering to develop new intelligence analyst tools, training, and methods to establish and demonstrate dynamic command and control of air, space, and cyber ISR collection capabilities. Specific ISR capability objectives include universal situational awareness, dynamic control of ISR planning, workload reduction, and multi-source/multi-intelligence collaboration.</p> <p>FY 2011 Plans: Conduct research to enable human operators to maximize utility of multi-sensor ISR systems in planning for dynamic situations. Conduct research to develop distributed, collaborative ISR dynamic planning capabilities for intelligence analysts.</p> <p>FY 2012 Base Plans: Develop framework and knowledge-based foundation for intelligence analysis. Conduct studies and incorporate feedback from the intelligence community to enhance methodologies for exploiting unstructured and cognitively complex data and information.</p> <p>FY 2012 OCO Plans:</p>	1.238	2.518	4.061	-	4.061
<p>Title: Major Thrust 3</p> <p>Description: Conduct research to develop technology base for anticipatory C2I decision support environment using past and present battlefield mission states to predict adversarial intent and actions.</p> <p>FY 2010 Accomplishments: Refined knowledge of representation techniques to model potential adversarial behavior and complex systems of systems and begin integrating information within visual displays. Researched integrated set of work aids to achieve persistent operational planning, persistent prediction, and focused execution. Developed aids to enhance understanding of underlying C2I models and algorithms.</p> <p>FY 2011 Plans:</p>	1.741	1.368	1.977	-	1.977

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625328: <i>Human Dynamics Evaluation</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop models/metrics to predict/evaluate organizational effectiveness alignment and collaboration readiness.</p> <p>FY 2010 Accomplishments: Identified organizational vulnerabilities at the structure, organizational culture, process, or human operator levels. Focused on exploitation of theories involving human trust in automation and interpersonal relationships to provide an understanding of how to influence systems with little to no degree of detection/ suspicion among operators. Developed relevant organizational metrics, work design solutions, and simulation models to facilitate organizational effectiveness.</p> <p>FY 2011 Plans: Develop foundational decision aid concepts to exploit operator human-human trust and trust in automation for influence operators. Mature research on organizational effectiveness to support organizational change in government domains. Develop advanced models/simulations to show the impact of improved work design, engaged organizational culture, and enhanced collaboration readiness.</p> <p>FY 2012 Base Plans: Continue research and development on decision aid concepts to exploit operator human-human trust and trust in automation. Conduct trust-based experimentation, discourse analysis and building vulnerability modeling tools. Complete organizational vulnerabilities research; illustrate and document modes/simulations that show the impact of improved work design, engaged organizational culture and enhanced collaboration readiness.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 6</p> <p>Description: Conduct applied research in the areas of mathematics and electromagnetic theory to exploit/ counter adversarial capabilities.</p> <p>FY 2010 Accomplishments: Conducted research on datasets from past/current influence operations. Continued anticipatory research designed to enhance blue force situational awareness of adversarial location and intent.</p> <p>FY 2011 Plans:</p>	0.813	0.968	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625328: <i>Human Dynamics Evaluation</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Refine advanced, automated algorithms for measures of effectiveness analyses supporting improved influence operations capabilities. Develop methods to enhance warfighter situational awareness of adversarial location and intent. FY 2012 Base Plans: Research will be consolidated and combined in FY12 with Influence Operations major thrust above due to Defense Base Closure and Realignment Commission realignment. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	14.144	16.587	15.229	-	15.229

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>				PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625329: <i>Sensory Evaluation and Decision Science</i>	22.734	22.492	23.471	-	23.471	23.544	23.738	24.477	24.964	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research to revolutionize the manner in which the human optimizes the capabilities of Air Force systems, including remotely piloted aircraft (RPA) and adaptive teams of humans and machines. Research optimizes situational awareness, improves the human-machine interface, and seamlessly integrates warfighters with their weapon systems across air, space, and cyber domains. Research is conducted in four focus areas: network-centric collaboration; supervisory control; battlespace visualization; and battlespace acoustics. The network-centric collaboration area develops warfighter interface technologies to enhance human-human and human-machine collaborations and system interactions in distributed decision-making environments. The supervisory control area develops new control/display concepts and technologies to optimize Air Force platform capabilities. The battlespace visualization area advances the science and technology associated with collecting, optimizing, displaying, and assimilating sensory information to enhance warfighter decision-making. The battlespace acoustics area researches human-human and human-machine communications to exploit the use of voice and acoustic data in collaborative, net-centric environments while accounting for the effects of acoustic propagation.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develops warfighter interface technologies to enhance human-human and human-machine collaboration and system interaction in distributed decision-making environments.</p> <p>FY 2010 Accomplishments: Investigated individual and teams-of-teams performance metrics for team collaboration in a cross-domain distributed environment to include air, space, and cyber. Explored alternate human sensory technologies for operator functional state model development. Began initial understanding of adaptive interface algorithms for individual operator decision aiding.</p> <p>FY 2011 Plans: Investigate teams-of-teams performance metrics and begin to explore the nature of teams-of-teams cognitive workload so that future development of adaptive aiding algorithms shape team situational awareness in a network-centric environment. Investigate algorithms that assess team cognitive workload independent of the workload of individual operators. Begin to develop adaptive interface algorithms for operator decision aiding.</p> <p>FY 2012 Base Plans:</p>	5.191	4.881	5.582	-	5.582

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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Develop team functional state assessment criteria and characterize context dependent methodologies for assessing the cognitive functional state of teams. Explore algorithm utility for assessing real-time team functional state in distributed operations. Evaluate ability to capture team functional state assessments to enhance collaboration and team decision-making. Develop adaptive interface algorithms for operator decision aiding.

FY 2012 OCO Plans:

<i>Title:</i> Major Thrust 2	5.943	6.075	5.524	-	5.524
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Description: Researches new control/display concepts and technologies (e.g., information portrayal, control devices, and decision aiding algorithms). Identify best design to direct operator attention.

FY 2010 Accomplishments:

Designed and evaluated advanced visualization concepts to support rapid situation assessment associated with switching tasks, interruptions, and unexpected state changes within multi-RPA control scenarios. Evaluated novel video exploitation aids to enable a single operator to monitor multiple video feeds. Compressed critical net-centric and system information onto man-portable RPA interfaces in a manner that permits flexible, high-level tasking without undue workload. Identified techniques that improve operator awareness of RPA automation mode and rationale for autonomous decisions.

FY 2011 Plans:

Evaluate the utility of 3-D information displays, multi-sensory interfaces, and other virtual reality technologies for multi-RPA supervisory control. Generate intuitive ways to monitor, interact, and coordinate with complex, intelligent RPA automation algorithms. Identify predictive information displays, including temporal displays that furnish proactive decision support to the human operator in multi-RPA scenarios. Investigate unique facets of automation, such as social attributes, that may improve the overall RPA human-system bandwidth.

FY 2012 Base Plans:

Explore flexible automation techniques and transitions to enable a human operator to intervene at various levels with autonomous systems. Develop methods to quickly and easily ascertain the status/intent of complex automation. Design and evaluate methods and interfaces to support distributed, ubiquitous unmanned system control of many heterogeneous systems. Investigate combined spatial and temporal displays for proactive management of multiple semi-autonomous assets.

FY 2012 OCO Plans:

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 3</p> <p>Description: Battlespace visualization advances science and technology associated with collecting, optimizing, displaying, and assimilating sensory information to enhance warfighter decision-making.</p> <p>FY 2010 Accomplishments: Explored vision enhancement techniques to increase rapid classification and identification for objects of interest in air, space, and cyber. Developed visualization technologies and interaction techniques for presenting complex information to enhance air, space, and cyber operations. Investigated presentation and interface technologies for enhancing space situational awareness.</p> <p>FY 2011 Plans: Explore vision enhancement techniques that can support the air, space, and cyber analyst's ability to quickly categorize objects of interest. Perform laboratory evaluations of visualizations that support human knowledge when presented with complex information in the air, space, and cyber domains. Develop visualizations and interaction techniques to exploit dynamic information. Develop situational awareness presentation and interface technologies that increase warfighter knowledge.</p> <p>FY 2012 Base Plans: Explore vision enhancement techniques for fusing multi-source data to facilitate decision making. Develop interactive visualizations for displaying and analyzing multi-source information to improve situational awareness. Investigate visual analytics to optimally represent relevant information from large and disparate data sets. Develop initial visualizations to represent and analyze large amounts of data to increase human performance.</p> <p>FY 2012 OCO Plans:</p>	6.106	6.162	6.755	-	6.755
<p>Title: Major Thrust 4</p> <p>Description: Conducts battlespace acoustics research on advanced auditory and communication technologies that mitigate effects of noise and enhance performance in operational environments.</p> <p>FY 2010 Accomplishments: Examined applications of how advanced multi-modal interfaces can optimize distributed team performance in large-scale communication networks. Conducted research on network-based audio technologies for achieving shared situational awareness and exploiting information from multi-layered arrays of sensors in complex operational environments. Explored the use of persistent audio displays and other advanced auditory cueing</p>	4.697	5.374	5.610	-	5.610

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>techniques for continuously monitoring the status of complex RPA technologies. Conducted research on sensor systems and immersive display technologies for facilitating remote telepresence and optimizing the presentation of complex information in human-machine interfaces.</p> <p>FY 2011 Plans: Evaluate the use of multi-modal speech displays to optimize distributed team performance in large-scale communication networks. Conduct research on immersive audio and multi-modal interfaces for exploiting large-scale networks of distributed information and enhancing real-time situational awareness and time-critical decision effectiveness. Explore integrated multi-sensory display concepts to optimize the flow of information across distributed teams, emphasizing how intuitive displays can promote shared situational awareness between command, control, intelligence, surveillance, and reconnaissance assets and operators.</p> <p>FY 2012 Base Plans: Explore the application of multi-modal digital communication technologies to enhance speech intelligibility, communication effectiveness, and situational awareness in communication-intense military environments. Explore the use of accelerated speech to enhance situational awareness and communication effectiveness. Assess integration of graphical images with speech and text communication to enhance operator situational awareness and understanding. Evaluate and monitor operator stress and workload using verbal communication signals.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	21.937	22.492	23.471	-	23.471

	FY 2010	FY 2011
<p>Congressional Add: Advanced Night Vision System - Cockpit Integration</p> <p>FY 2010 Accomplishments: Conducted Congressionally-directed effort.</p> <p>FY 2011 Plans:</p>	0.797	-
Congressional Adds Subtotals	0.797	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 625329: <i>Sensory Evaluation and Decision Science</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
627184: <i>Performance Evaluation in Extreme Environments</i>	19.634	18.436	17.016	-	17.016	16.837	15.424	15.703	16.038	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research to enhance human sensory, cognitive, and physical capabilities to increase airmen survivability and performance. The research is focused in four areas: biobehavioral performance; biomechanics; applied biotechnology; and counterproliferation. Both biobehavioral and biomechanics focus areas enhance airmen performance and survivability through dynamic human modeling techniques that define the capabilities and limits of system operators under military-unique stressors, as well as assessing and identifying adversarial threats. Applied biotechnology advances bioscience, nanotoxicology, and neuroscience research to protect airmen from the effects of toxic chemicals and materials, and to monitor and enhance cognitive and physiological performance. Counterproliferation research focuses on biotechnology for the detection, identification, monitoring, and neutralization of biological threat agents.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop databases of human motion and features collected from air/space platforms. Identify human threat signatures across diverse populations for ISR and force protection applications.</p> <p>FY 2010 Accomplishments: Used principles of biomechanics to analyze behavioral data. Collected motion data and develop initial analysis techniques to identify behaviors that seem out-of-context. Included cultural information to develop physical behavior signatures. Integrated information from multiple sensors to help identify a human threat.</p> <p>FY 2011 Plans: Develop anthropometry and motion database ontology to exploit human threat signatures. Complete development and validate techniques to identify human motion that seem out-of-context as viewed from Air Force sensors. Develop models that include cultural information to detect anomalies in both behavior and expressions.</p> <p>FY 2012 Base Plans: Initiate 3-D human activity replication using 3-D human models. Develop a human motion repository to identify human threat and performance signatures. Develop tools for image analyst training that identify and visualize critical threat indicating signatures.</p> <p>FY 2012 OCO Plans:</p>	4.789	4.873	2.274	-	2.274

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Title: Major Thrust 2</p> <p>Description: Define and model operator cognitive performance in stressful environments and develop technologies to mitigate effects of stressors on cognitive function, safety, and mission effectiveness.</p> <p>FY 2010 Accomplishments: Used performance databases to refine warfighter physical training programs with the goal of improving retention and operational performance. Conducted research integrating behavioral psychology and metabolomic research to enhance human performance in multiple stressor environments.</p> <p>FY 2011 Plans: Develop biological, behavioral, and physical metrics and markers of cognitive performance. Delineate mechanisms that affect warfighter (e.g., battlefield airmen and RPA operators) cognitive and physical performance.</p> <p>FY 2012 Base Plans: Define stressor-influenced mechanisms for developing strategies to optimize cognitive readiness and to influence performance in theater. Target specific biological, behavioral, and physical metrics and markers for defining mechanisms that improve cognitive performance.</p> <p>FY 2012 OCO Plans:</p>	2.907	3.055	6.193	-	6.193
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<p>Title: Major Thrust 3</p> <p>Description: Conduct bio/nanotechnology research to advance warfighter performance. Leverage toxicological/ biological data to improve human performance and decision-making abilities.</p> <p>FY 2010 Accomplishments: Conducted research to identify and validate biomarkers relevant to cognitive and physiological changes that enhance human performance. Conducted analysis of novel Air Force nanomaterial toxicity. Defined cell-based pathway engineering for biosensors of human performance.</p> <p>FY 2011 Plans:</p>	5.119	5.201	3.592	-	3.592
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Advance toxicity research associated with Air Force relevant nanomaterials and conduct toxicity assessments of biofuels of Air Force interest. Continue to identify molecular markers that enhance human performance. Continue to investigate cell-based pathways. FY 2012 Base Plans: Pursue advanced analysis of new and emerging nanomaterials and biofuels of Air Force interest. Validate molecular markers in specific cognitive and physiological pathways that impact human performance. FY 2012 OCO Plans:					
Title: Major Thrust 4 Description: Conduct surveillance and counterproliferation research to support detection, identification, and assessment of threat agents in support of Air Force operational missions. FY 2010 Accomplishments: Conducted research to develop nanoparticle taggants for line-of-sight, stand-off assessment of preemptive airstrike destruction of biological warfare agents. Defined preliminary techniques to effectively neutralize genetically-modified biological threat agents. Performed initial research to anticipate impacts of high threat environments on air operations and to provide post-attack situational awareness. FY 2011 Plans: Complete techniques to effectively neutralize threat agents. Use bioinspired approaches to expand and refine nanoparticle taggants research. FY 2012 Base Plans: Develop and incorporate bioinspired nanoparticle taggants for enhanced warfighter counterproliferation capability during operational missions. Identify biological markers that indicate that individuals have handled, transported, or manipulated weapons of mass destruction. FY 2012 OCO Plans:	5.226	5.307	4.957	-	4.957
Accomplishments/Planned Programs Subtotals	18.041	18.436	17.016	-	17.016
	FY 2010	FY 2011			
Congressional Add: Imaging Tools for Human Performance Enhancement and Diagnostics	1.593	-			

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627184: <i>Performance Evaluation in Extreme Environments</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	1.593	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602202F: <i>Human Effectiveness Applied Research</i>	PROJECT 627757: <i>Directed Energy Bioeffects</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
627757: <i>Directed Energy Bioeffects</i>	14.314	16.723	17.202	-	17.202	17.057	17.659	18.087	18.437	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project conducts applied research on the effects of human exposure to electromagnetic (EM) energy (radio frequency to optical), scalable directed energy weapons, and non-lethal weapons. This research addresses fundamental physical principles as well as the psychophysical interaction between directed energy and the individual or groups of individuals. Research is divided into three core focus areas: optical radiation bioeffects; radio frequency radiation (RFR) bioeffects; and biobehavioral systems. Optical radiation bioeffects research enhances combat survivability and systems effectiveness through technologies that enable deployed forces to counter optical threats and exploit optical systems for offensive applications. The RFR bioeffects research focuses on theoretical and empirical dosimetry, bioeffects of short- and long-term exposure, methods to counter RFR threats, and exploitation of directed energy systems for offensive capabilities. Biobehavioral systems research concentrates on the design and characterization of scalable directed energy and novel-effects weapons, and their ability to modify human behavior.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Conducts laboratory experiments and field research on laser bioeffects, enabling military exploitation of laser technology, while providing countermeasures for optical hazards/threats.</p> <p>FY 2010 Accomplishments: Evaluated collateral hazard assessment software model on high energy laser platforms and develop next generation of hazard assessment tools. Expanded laser damage threshold database for multiple wavelengths to validate Department of Defense, national, and international safety standards. Evaluated superthreshold tissue impacts and further define weapon effectiveness parameters. Conducted experiments for future high energy laser weapon systems to predict, evaluate, and explore target bioeffects.</p> <p>FY 2011 Plans: Conduct research to refine Department of Defense, national, and international safe exposure standards to include multiple wavelength laser exposures. Initiate research to provide personal protection while operating in a high energy directed energy weapon hazard zones. Validate collateral hazard assessment software for high energy laser systems and weapon platforms.</p> <p>FY 2012 Base Plans: Begin developing tools to assess collateral high energy laser hazards using probabilistic techniques. Develop new models and techniques for assessing vision effects from laser eye protection. Assess human factors</p>	7.119	8.186	8.406	-	8.406

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
integration of laser eye protection with visor, helmet, and advanced cockpit designs. Continue research on advanced designs of personal protection in high energy directed energy weapons hazard zones. FY 2012 OCO Plans:					
Title: Major Thrust 2 Description: Conducts laboratory experiments and field research to enable safe exploitation of directed energy technologies for communication, target identification, and weapons development. FY 2010 Accomplishments: Evaluated biological responses to high power and high peak power electromagnetic systems from cellular to whole organism perspectives. Validated models of RFR bioeffects through laboratory and field experimentation, as well as applied mathematics. Conducted research to support fielding and effectiveness of scalable directed energy weapon systems. Conducted research into the bioeffects and safety of terahertz sources. FY 2011 Plans: Conduct terahertz research in order to refine national and international safe exposure levels and evaluate potential military utility. Conduct bioeffects research to support scalable directed energy weapon capabilities. Initiate development of a model of scalable RFR effects based on experimentation and theoretical physics. Assess combinations of directed energy parameters on behavior and physiology. FY 2012 Base Plans: Conduct electromagnetic radiation (0 Hz – 10 THz) bioeffects research in support of national and international safety standards. Conduct biological studies of advanced directed energy weapon concepts. Conduct physiological and behavioral research to support scalable directed energy weapon capabilities. Continue scalable RFR effects modeling development based on theoretical and experimental physics. Assess bioeffects of combined directed energy sources. FY 2012 OCO Plans:	6.822	8.136	8.388	-	8.388
Title: Major Thrust 3 Description: Concentrates on human responses to non-lethal weapons and conducts research to assess the effects and risk of these weapons. FY 2010 Accomplishments:	0.373	0.401	0.408	-	0.408

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Developed initial quantitative models of behavioral responses to RFR non-lethal weapons. Developed Human Effect-Modeling Applications Program (HE-MAP) by incorporating a software interface that links graphical user interfaces with predictive models of RFR non-lethal weapon-induced effectiveness and risk. Incorporated within HE-MAP the development of a design optimization and effects-based module that will allow analysis of design parameters and their influence on effectiveness.</p> <p><i>FY 2011 Plans:</i> Develop initial quantitative models of behavioral responses using effects data from directed energy non-lethal weapons. Enhance HE-MAP through addition of a software interface linking HE-MAP graphical user interfaces with predictive models of acoustic non-lethal weapon-induced effectiveness and risk. Incorporate within HE-MAP the development of an effects-based design module that will allow analysis of design parameters of directed energy non-lethal weapons and their influence on effectiveness.</p> <p><i>FY 2012 Base Plans:</i> Develop a quantitative framework for relating directed energy and scalable novel-effects technologies (including non-lethal and escalation of force weapons) to operationally relevant outcomes via research on physiological and psychological human effects (HE). Establish a database containing behavioral effectiveness and risk of injury information under operational conditions to facilitate coordination among operators, researchers, and weapon acquisition professionals. Develop methodology to quantify behavioral effectiveness (e.g., sensory, cognitive, motor) across the range of directed energy and scalable novel-effects technologies. Develop methodology to quantify the risk of injury (e.g., reversible, irreversible) across the range of non-lethal and escalation of force weapons.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	14.314	16.723	17.202	-	17.202

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	218.323	207.049	207.508	-	207.508	204.967	190.705	188.546	192.073	Continuing	Continuing
623012: <i>Advanced Propulsion Technology</i>	17.061	22.859	20.377	-	20.377	23.095	20.688	21.160	21.553	Continuing	Continuing
623048: <i>Combustion and Mechanical Systems</i>	19.171	18.679	20.079	-	20.079	18.925	16.579	15.712	15.999	Continuing	Continuing
623066: <i>Turbine Engine Technology</i>	60.738	67.274	67.735	-	67.735	63.495	53.969	50.376	51.301	Continuing	Continuing
623145: <i>Aerospace Power Technology</i>	40.488	32.604	32.655	-	32.655	32.768	31.623	32.361	32.963	Continuing	Continuing
624847: <i>Rocket Propulsion Technology</i>	74.121	58.954	60.420	-	60.420	60.144	61.312	62.432	63.633	Continuing	Continuing
625330: <i>Aerospace Fuel Technology</i>	6.744	6.679	6.242	-	6.242	6.540	6.534	6.505	6.624	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops propulsion and power technologies to achieve enabling and revolutionary aerospace technology capabilities. The program has six projects, each focusing on a technology area critical to the Air Force. The Advanced Propulsion Technology project develops high-speed air breathing propulsion engines to include combined cycle, ramjet, and hypersonic scramjet technologies to enable revolutionary propulsion capability for the Air Force. The Combustion and Mechanical Systems project evaluates lubricants and combustion concepts and technologies for new and existing 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 management technologies for military applications that are part of energy optimized aircraft development. The Rocket Propulsion Technology project develops advances in rocket propulsion technologies for space access, space maneuver, missiles, the sustainment of strategic systems, and tactical rockets. The Aerospace Fuel Technology project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse detonation, and combined-cycle engines. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	221.503	207.049	209.957	-	209.957
Current President's Budget	218.323	207.049	207.508	-	207.508
Total Adjustments	-3.180	-	-2.449	-	-2.449
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.181	-			
• Other Adjustments	0.001	-	-2.449	-	-2.449

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

Project: 623048: *Combustion and Mechanical Systems*

Congressional Add: *Hybrid Bearings.*

Congressional Add Subtotals for Project: 623048

Project: 623066: *Turbine Engine Technology*

Congressional Add: *Split Discharge Variable Delivery Pump for Military Aircraft.*

Congressional Add Subtotals for Project: 623066

Project: 623145: *Aerospace Power Technology*

Congressional Add: *Advanced Lithium Battery Scale-Up and Manufacturing.*

Congressional Add: *Energy Superior Lithium Battery Technology for Defense Applications.*

Congressional Add: *High-Energy Li-Ion Technology for Aviation Batteries.*

Congressional Add: *Integrated Engine Starter/Generator.*

Congressional Add: *Thermal and Energy Management for Aerospace.*

Congressional Add: *Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller.*

Congressional Add Subtotals for Project: 623145

	FY 2010	FY 2011
	0.797	-
Congressional Add Subtotals for Project: 623048	0.797	-
	1.593	-
Congressional Add Subtotals for Project: 623066	1.593	-
	1.593	-
	1.593	-
	1.195	-
	1.593	-
	3.187	-
	1.195	-
Congressional Add Subtotals for Project: 623145	10.356	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Project: 624847: Rocket Propulsion Technology		
Congressional Add: <i>Advanced Vehicle Propulsion Center.</i>	2.390	-
Congressional Add: <i>Aerospace Lab Equipment Upgrade.</i>	1.195	-
Congressional Add: <i>AFRL Edwards Rocket Test Stand 2-A Technical Improvements.</i>	3.187	-
Congressional Add: <i>Development and Testing of Advanced Hybrid Rockets for Space Applications.</i>	2.788	-
Congressional Add: <i>Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET).</i>	4.780	-
Congressional Add: <i>Multi-Mode Propulsion Phase II-A: High Performance Green Propellant.</i>	1.593	-
Congressional Add: <i>Next Generation Solar Electric In-Space Propulsion.</i>	0.797	-
Congressional Add Subtotals for Project: 624847		16.730
Project: 625330: Aerospace Fuel Technology		
Congressional Add: <i>National Test Facility for Aerospace Fuels Propulsion.</i>	1.306	-
Congressional Add Subtotals for Project: 625330		1.306
Congressional Add Totals for all Projects		30.782

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
623012: <i>Advanced Propulsion Technology</i>	17.061	22.859	20.377	-	20.377	23.095	20.688	21.160	21.553	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops combined/advanced cycle air breathing high-speed (up to Mach 4) and hypersonic (Mach 4 to 8+) 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop advanced fuel-cooled scramjet engine technologies to support flight demonstration and enable the broad application of hypersonics to meet future warfighter needs.</p> <p>FY 2010 Accomplishments: Developed and demonstrated flight weight engine components and advanced engine control logic. Performed trajectory optimization for flight test. Fabricated hardware for ground test of advanced scramjet start technique. Initiated fabrication of flight test hardware to demonstrate ramjet to scramjet transition. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.</p> <p>FY 2011 Plans: Develop and demonstrate flight weight engine components and advanced engine control logic. Assess advanced instrumentation with control logic to improve scramjet operability. Perform trajectory optimization for flight test. Conduct ground test of advanced scramjet start technique. Complete fabrication of flight test hardware to demonstrate ramjet to scramjet transition. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.</p> <p>FY 2012 Base Plans: Develop and demonstrate advanced engine control systems and flight weight scramjet engine components. Develop and demonstrate closed loop engine control system with advanced instrumentation to increase</p>	1.650	2.565	1.650	-	1.650

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
scramjet engine operability at low scramjet Mach numbers. Conduct flight test using sounding rocket launch to demonstrate transition from ramjet to scramjet.					
FY 2012 OCO Plans:					
Title: Major Thrust 2. Description: Conduct assessments, technology design trades, and simulations to integrate combined cycle engines (CCEs) and air breathing hypersonic propulsion technologies into future systems. FY 2010 Accomplishments: Conducted trade studies to determine military payoff and establish component technology goals. Defined component and engine performance objectives to enable development of affordable hypersonic flight demonstrators jointly with the National Aeronautics and Space Administration (NASA) and the Defense Advanced Research Projects Agency (DARPA). Developed technology maturation plan for advanced components for turbine-based and rocket-based CCEs. FY 2011 Plans: Conduct further trade studies to determine military payoff and establish component technology goals. Define component and engine performance objectives to enable development of affordable hypersonic flight demonstrators jointly with NASA and DARPA. Develop technology maturation plan, including test facility requirements, for advanced components for turbine-based and rocket-based CCEs. FY 2012 Base Plans: Continue to conduct trade studies to determine military payoff and establish component technology goals. Improve definition of component and engine performance objectives to enable development of affordable hypersonic flight demonstrators jointly with NASA and DARPA. Update technology maturation plan, including test facility requirements, for advanced components for turbine-based and rocket-based CCEs. FY 2012 OCO Plans:	0.165	0.165	0.165	-	0.165
Title: Major Thrust 3. Description: Develop robust hydrocarbon fueled scramjet engine components and technologies to improve performance, operability, durability, and scalability for future platforms. FY 2010 Accomplishments:	15.246	20.129	18.562	-	18.562

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Developed advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Developed techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Developed low internal drag flame stabilization devices and flight test engine components. Completed fabrication of subscale components/combustors to represent medium scale (5 to 20 times) scramjet engines.</p> <p><i>FY 2011 Plans:</i> Develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Develop low internal drag flame stabilization devices and flight test engine components. Ground test subscale components/combustors to represent medium scale (5 to 20 times) scramjet engines. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.</p> <p><i>FY 2012 Base Plans:</i> Develop advanced engine components to improve scramjet operating margin and to refine scramjet scaling laws for reusable applications. Develop techniques to decrease scramjet take-over from Mach 4.5 to Mach 3.5 to provide robust options for CCEs. Develop low internal drag flame stabilization devices and flight test engine components. Design and initiate fabrication of heavy weight scramjet combustor in medium scale (5 to 20 times) scramjet engines.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	17.061	22.859	20.377	-	20.377

C. Other Program Funding Summary (\$ in Millions)										
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000 Continuing Continuing

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623012: <i>Advanced Propulsion Technology</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 623048: <i>Combustion and Mechanical Systems</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
623048: <i>Combustion and Mechanical Systems</i>	19.171	18.679	20.079	-	20.079	18.925	16.579	15.712	15.999	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates lubricants, mechanical systems, and combustion concepts for advanced turbine engines, pulse 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 sustained high-speed vehicles. Analytical and experimental areas of emphasis include lubricants, bearings, mechanical systems diagnostics, mechanical systems prognostics, rotordynamics, 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 adaptive cycle technologies. This effort develops component technology for an adaptive cycle engine architecture that provides optimized performance/fuel efficiency for widely varying mission needs.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</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 2010 Accomplishments: Tested concept designs for larger-scale inter-turbine burners at relevant gas turbine engine conditions. Evaluated performance characteristics in small internal combustion engines burning military fuels. Identified potential performance improvements for small engines. Investigated novel combustor, augmentor, continuous detonation, and pulse-detonation concepts that reduce fuel burn and improve system performance. Studied combustion processes using alternative fuels. Developed new chemistry models for combustion processes. Employed modeling and simulation tools to evaluate advanced combustion systems. Investigated high-efficiency direct injection methods for pulse detonation engines.</p> <p>FY 2011 Plans: Test full-scale inter-turbine burner concepts at relevant engine conditions. Investigate novel valving concepts for pulse detonation engines. Study pulse detonation engine-turbine interactions. Explore the use of regenerative fuel cooling with pulse detonation engines and other combustion systems. Demonstrate novel small internal combustion engine concepts that improve system performance. Use advanced modeling and simulation tools</p>	6.924	8.128	8.669	-	8.669

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623048: <i>Combustion and Mechanical Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>to understand combustion processes and to guide combustion system design. Employ new chemistry models for alternative fuels. Test concept designs for adaptive combustors for ultra efficient turbine engine components which reduce harmful emissions.</p> <p>FY 2012 Base Plans: Evaluate alternative fuels in combustion systems at relevant engine conditions. Test full-scale compact combustor concept relevant to highly efficient, embedded turbine engine goals. Demonstrate small-scale propulsion system operation using reduced-octane fuels. Employ new physical models in simulation tools. Investigate pressure gain combustion concepts for application to propulsion systems. Continue studies of pulse detonation engine-turbine interactions. Investigate feasibility of rotary detonation engines and continuous detonation engines.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop and demonstrate optical, electromechanical, and laser diagnostic tools and sensors for application to revolutionary propulsion technologies.</p> <p>FY 2010 Accomplishments: Developed megahertz-rate high-speed measurement techniques for combustion species. Used two-color planar laser-induced fluorescence techniques to measure temperature in experimental combustion systems. Developed robust line-of-sight measurement techniques for temperature and species and apply to relevant combustion devices. Applied ultrafast spectroscopy techniques developed in FY 2009 to practical combustion devices and engine systems. Applied advanced optical diagnostics suites to characterize and improve engine combustors and afterburners.</p> <p>FY 2011 Plans: Use two-color planar laser induced fluorescence techniques to measure temperature in relevant-environment combustion systems. Develop robust line-of-sight measurement techniques for temperature and species and apply to engine systems. Develop simultaneous high-speed planar laser-induced fluorescence and particle-image velocimetry for measurements of species and velocity fields in practical combustion devices. Expand line-of-sight measurement techniques for temperature and species to include many simultaneous lines of sight and</p>	0.975	1.212	1.311	-	1.311

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623048: <i>Combustion and Mechanical Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>tomographic reconstruction of complex reacting flowfields characteristic of real-world hardware. Apply advanced optical diagnostics suites for characterization and improvement of engine combustors and afterburners.</p> <p>FY 2012 Base Plans: Apply line-of-sight measurement techniques for temperature and species to combustion systems in a relevant engine environment. Demonstrate simultaneous high-speed planar laser-induced fluorescence and particle-image velocimetry for measurements of species and velocity fields in practical combustion devices. Demonstrate tomographic reconstruction of reacting flowfields in relevant combustion systems.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Develop, test, and qualify advanced turbine engine lubricants. Generate and maintain military specifications for aviation engine lubricants.</p> <p>FY 2010 Accomplishments: Completed testing of enhanced ester oil candidate in Technology Readiness Level (TRL) 5 full-scale bearing endurance rigs and in a technology demonstrator engine. Finalized elastomer and load capacity limits jointly with US Navy, initiated draft of joint USAF-Navy enhanced ester oil specification and supported initial transition activities to aircraft. Conducted TRL 2-3 component level testing of high-Mach ester lubricant for future high-mach turbine engine aircraft. Investigated anti-coke lube system surface modifiers using vapor phase coke (VPC) test rig for sustained supersonic engine oil system. Developed intelligent prognostics for lubrication system health monitoring.</p> <p>FY 2011 Plans: Complete TRL 5 full-scale bearing endurance test on second enhanced ester candidate oil in preparation for an engine demonstration. Support full transition of enhanced ester oil to the operational fleet by coordinating with engine manufacturers and users. Conduct adaptive components for high efficiency risk mitigation bearing and gear rig tests with enhanced ester oil in preparation for 2013 demonstration engine test. Demonstrate anti-coke surface modifiers on sub-scale supersonic lube system components. Expand development of intelligent prognostics for lubrication system health monitoring. Investigate advanced lube system thermal and health management technologies for highly embedded efficient turbine engines.</p> <p>FY 2012 Base Plans:</p>	5.111	4.620	4.996	-	4.996

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623048: <i>Combustion and Mechanical Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Demonstrate anti-coke surface modifiers on full-scale lubrication system components. Develop engine mechanical system health management control algorithms for active rotor thrust balancing. Develop suite of technologies for intelligent lube system prognostics and health monitoring, such as integrated debris capture devices, real-time oil debris monitoring, and vibration sensing. Develop lubrication system thermal management technologies for reduced heat generation and improved heat dissipation for efficient turbine engines. FY 2012 OCO Plans:					
Title: Major Thrust 4. Description: Develop and test advanced bearing material technology and bearing concepts for small, intermediate, and large-sized turbine engine applications. FY 2010 Accomplishments: Investigated spall propagation of nitrided bearings. Continued experimental validation of bearing heat generation models. Initiated fabrication of adaptive components for high efficiency and ultra efficient turbine engine mechanical systems components and initiated risk mitigation tests. Tested bearing concepts, such as foil bearings for high Mach missile and other future applications. Continued developing in-house rotor dynamic modeling expertise in support of adaptive components for high efficiency, ultra efficient turbine engine components, and future advanced turbine engine efforts. FY 2011 Plans: Investigate fatigue life and spall propagation of Vacuum Induction Melted-Vacuum Arc Remelted (VIM-VAR) bearings. Complete mechanical systems risk mitigation test activities for adaptive components for high efficiency. Develop coupled bearing and rotor dynamic models for virtual simulation of mechanical systems for advanced engines. Continue developing reliable bearing technologies for sustained hi-mach reusable and limited-life engines. Complete fabrication of active rotor thrust balance bearing test rig. FY 2012 Base Plans: Conduct shakedown tests of active thrust balance rig. Develop and demonstrate robust thrust load sensing devices for highly loaded engine thrust bearings. Develop bearing spall debris monitoring model and limits and incorporate into thrust load control algorithm. Demonstrate oil debris monitoring technology fused with vibration sensing on seeded fault bearing rig tests. Develop new bearing heat generation models for engines and validate with full-scale bearing experimental performance data. FY 2012 OCO Plans:	5.364	4.719	5.103	-	5.103

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623048: <i>Combustion and Mechanical Systems</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	18.374	18.679	20.079	-	20.079
	FY 2010	FY 2011			
Congressional Add: Hybrid Bearings.	0.797	-			
FY 2010 Accomplishments: Conducted Congressionally-directed effort.					
FY 2011 Plans:					
Congressional Adds Subtotals	0.797	-			

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623066: <i>Turbine Engine Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
623066: <i>Turbine Engine Technology</i>	60.738	67.274	67.735	-	67.735	63.495	53.969	50.376	51.301	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, adaptive cycle technologies, and structural design. This project develops component technology for an adaptive cycle engine architecture that provides optimized performance/fuel efficiency for widely varying mission needs. This project supports joint DoD, agency, and industry efforts to focus turbine propulsion technology on national needs. The program plan is relevant across capability areas for global responsive strike, capable unmanned war-fighting, tactical and global mobility, responsive space lift, and persistent intelligence, surveillance, and reconnaissance (ISR).

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop core turbofan/turbojet engine components (i.e., compressors, combustors, and turbines) for fighters, bombers, sustained supersonic/hypersonic cruise vehicles, and transports.</p> <p>FY 2010 Accomplishments: Developed and applied advanced modeling and simulation rules and tools for advanced components. Developed computational fluid dynamics methodology for analyzing turbine flows. Developed ceramic matrix composite lifing models. Conducted bench and rig tests for validation of components with significantly improved efficiency. Rig tested lightweight, simple, adaptive cycle features; an efficient, wide-flow range compressor; an efficient, high temperature turbine capable of operating over large swings in required work; and an efficient, lightweight, low observable (LO)-compatible exhaust system. Rig tested an efficient, very high pressure ratio compressor and associated thermal management features that will offer a step change improvement in engine specific fuel consumption (SFC).</p> <p>FY 2011 Plans: Develop and apply advanced modeling and simulation rules and tools for advanced components. Develop computational fluid dynamics methodology for analyzing turbine flows. Develop ceramic matrix composite lifing models. Conduct bench and rig tests for validation of components with significantly improved efficiency. Perform rig testing of lightweight, simple, adaptive cycle features, an efficient, wide-flow range compressor, an efficient,</p>	42.589	41.097	41.166	-	41.166

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623066: <i>Turbine Engine Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>high temperature turbine capable of operating over large swings in required work, and an efficient, lightweight, LO-compatible exhaust system. Develop and apply advanced modeling and simulation rules and tools to initiate definition and design of efficient, very high pressure ratio core component technologies that will offer a step change improvement in engine specific fuel consumption.</p> <p>FY 2012 Base Plans: Develop modeling and simulation rules and tools for advanced components including advanced interactive cost analysis tools for adaptive core components and unsteady aerodynamics/aeromechanics models. Conduct bench and rig tests to validate unsteady aerodynamics/aeromechanics models. Continue rig testing adaptive cycle features, an efficient compressor, an efficient turbine, and an efficient exhaust system. Continue to develop and apply advanced modeling and simulation rules and tools to initiate definition and design of efficient, very high pressure ratio core component technologies.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop turbofan/turbojet engine components (i.e. fans, nozzles, etc.) used in engines for fighters, bombers, sustained supersonic strike and hypersonic cruise vehicles, and transports.</p> <p>FY 2010 Accomplishments: Developed and applied advanced modeling and simulation rules and tools for advanced components. Developed durable damping/erosion coating systems. Conducted rig testing of advanced fan design for application to a variable cycle engine concept. Conducted rig testing of advanced low pressure turbine design for application to a variable cycle engine concept. Rig tested a lightweight, simple, LO-compatible inlet and exhaust system.</p> <p>FY 2011 Plans: Develop and apply advanced modeling and simulation rules and tools for advanced components. Develop durable damping/erosion coating systems. Conduct rig testing of advanced fan design for application to a variable cycle engine concept. Conduct rig testing of advanced low pressure turbine design for application to a variable cycle engine concept. Rig test of lightweight, simple, LO-compatible inlet and exhaust system. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.</p> <p>FY 2012 Base Plans: Develop and modeling and simulation rules and tools for advanced components including: advanced interactive cost analysis tools for adaptive engine components; unsteady aerodynamics and aeromechanics models;</p>	14.485	19.237	19.510	-	19.510

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>		PROJECT 623066: <i>Turbine Engine Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>augmentor combustion processes; and probability-based cooled turbine airfoil high cycle fatigue prediction methods. Conduct bench and rig tests to validate unsteady aerodynamics/aeromechanics models and probabilistic cooled turbine airfoil high cycle fatigue prediction methods. Develop and validate test protocols and improved augmentor rig test capabilities. Continue rig testing of advanced fan design, advanced low pressure turbine design, and lightweight, simple, LO-compatible inlet and exhaust systems.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Develop limited life engine components for missile and remotely piloted aircraft (RPA) applications, including long-range supersonic and hypersonic vehicles.</p> <p>FY 2010 Accomplishments: Developed and applied advanced modeling and simulation rules and tools for advanced limited life components. Designed and rig tested advanced limited life components. Note: In FY 2010, efforts in this thrust were reduced due to higher AF priorities.</p> <p>FY 2011 Plans: Develop and apply advanced modeling and simulation rules and tools for advanced limited life components. Design and rig test advanced limited life components.</p> <p>FY 2012 Base Plans: Develop and apply advanced modeling and simulation rules and tools for ceramic material small turbine blades, variable area turbines, and integration/performance of lubeless bearings. Develop and evaluate components to increase pressure ratio by 50% in this size class with minimum efficiency loss.</p> <p>FY 2012 OCO Plans:</p>	0.868	5.309	5.400	-	5.400
<p>Title: Major Thrust 4.</p> <p>Description: Develop components for turboshaft/turboprop and small turbofan engines for trainers, rotorcraft, special operations aircraft, and theater transports.</p> <p>FY 2010 Accomplishments: Developed and applied advanced modeling and simulation rules and tools for advanced limited life components.</p> <p>FY 2011 Plans:</p>	1.203	1.631	1.659	-	1.659

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623066: <i>Turbine Engine Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop and apply advanced modeling and simulation rules and tools for advanced limited life components. FY 2012 Base Plans: Develop and apply advanced modeling and simulation rules and tools for emissions and noise to decrease detection. Develop and evaluate components to increase thrust-to-weight ratio and to decrease specific fuel consumption, production cost, and development cost. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	59.145	67.274	67.735	-	67.735

	FY 2010	FY 2011
Congressional Add: Split Discharge Variable Delivery Pump for Military Aircraft. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Adds Subtotals	1.593	-

C. Other Program Funding Summary (\$ in Millions)										Cost To	
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 623145: <i>Aerospace Power Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
623145: <i>Aerospace Power Technology</i>	40.488	32.604	32.655	-	32.655	32.768	31.623	32.361	32.963	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops electrical and thermal management technologies 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 megawatt level power and thermal management needs. This project supports development of electrical power and thermal management component 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop electrical power and thermal management component and subsystem technologies with low volume displacement for delivery of high power for manned and unmanned systems.</p> <p>FY 2010 Accomplishments: Assessed component performance objectives needed to meet systems level, energy optimized performance goals. Completed investigation of high-rate thermal energy storage for directed energy applications.</p> <p>FY 2011 Plans: Perform hardware-in-the-loop simulation tests to validate power and thermal management systems that provide continuous thermal balancing of critical systems over a range of mission profiles. Assess component technologies for application to directed energy weapon concepts.</p> <p>FY 2012 Base Plans: Perform tip-to-tail modeling and simulation to identify solutions for platform level power and thermal management needs of next generation military air platforms.</p> <p>FY 2012 OCO Plans:</p>	25.973	28.624	25.530	-	25.530
<p>Title: Major Thrust 2.</p> <p>Description: Develop technologies for special purpose applications, including hybrid electrical power, thermal management systems, and energy conversion/storage components and subsystems.</p>	4.159	3.980	7.125	-	7.125

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623145: <i>Aerospace Power Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><i>FY 2010 Accomplishments:</i> Investigated and developed hybrid energy harvesting storage, management, and distribution architectures. Integrated the energy harvesting technologies with novel battery and fuel cell technologies. Integrated and tested thermal management components and subsystems. Implemented methods of energy harvesting and increased energy savings for special purpose applications. Demonstrated long endurance flight tests of integrated systems for remotely piloted aircraft (RPAs).</p> <p><i>FY 2011 Plans:</i> Develop increased fuel flexibility and integrated energy harvesting technologies for expanded special purpose applications for improved power and energy density. Perform integrated flight-weight subsystems flight tests to demonstrate power and energy density goals.</p> <p><i>FY 2012 Base Plans:</i> Perform energy harvesting component flight tests to demonstrate achievement of power and energy dense goals for special purpose applications. Explore technology set for development of power systems for micro air vehicles. Note: In FY 2012, efforts in this thrust are increased due to higher AF priorities.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	30.132	32.604	32.655	-	32.655

	FY 2010	FY 2011
<p><i>Congressional Add:</i> Advanced Lithium Battery Scale-Up and Manufacturing.</p> <p><i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.</p> <p><i>FY 2011 Plans:</i></p>	1.593	-
<p><i>Congressional Add:</i> Energy Superior Lithium Battery Technology for Defense Applications.</p> <p><i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.</p> <p><i>FY 2011 Plans:</i></p>	1.593	-
<p><i>Congressional Add:</i> High-Energy Li-Ion Technology for Aviation Batteries.</p>	1.195	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 623145: <i>Aerospace Power Technology</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		
Congressional Add: Integrated Engine Starter/Generator. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Thermal and Energy Management for Aerospace. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.187	-
Congressional Add: Wavelength Agile Spectral Harmonic Oxygen Sensor and Cell-Level Battery Controller. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.195	-
Congressional Adds Subtotals	10.356	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2012</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>				PROJECT 624847: <i>Rocket Propulsion Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624847: <i>Rocket Propulsion Technology</i>	74.121	58.954	60.420	-	60.420	60.144	61.312	62.432	63.633	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops rocket propulsion technologies for space access, space maneuver, missiles, 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, technology for sustainment of strategic systems, and innovative space propulsion concepts. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of these systems. Technologies are developed 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. Technologies developed under this program enable capabilities of interest to both the Department of Defense and NASA. Efforts include modeling and simulation, proof of concept tests of critical components, advanced component development, and ground-based tests. Aging and surveillance efforts could reduce lifetime prediction uncertainties for individual motors by 50 percent, enabling motor replacement for cause.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	4.109	4.152	5.001	-	5.001
Description: Develop, characterize, and test advanced hydrocarbons, energetics, solid propellants, and monopropellants to increase space launch payload capability and refine new synthesis methods.					
FY 2010 Accomplishments: Performed screening analysis of potential hydrocarbon fuel additives to improve performance of kerosene. Proceeded with downselect and scale-up promising high energy-density materials candidates. Evaluated scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Explored and developed ionic liquids. Initiated scale-up of promising ionic liquids for further characterization. Conducted proof of concept for new computational code to predict molecular properties of promising propellant ingredients. Evaluated suitability for ionic liquid propellants for missile defense interceptor and spacecraft propulsion demonstrations. Initiated technology transfer to industry for production of downselected propellants. Initiated high performance bi-propellant identification program.					
FY 2011 Plans: Conduct experimental and analytical evaluation of potential hydrocarbon fuel additives to improve performance of kerosene. Continue synthesis and downselect process and scale-up of promising high energy-density					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>materials candidates. Evaluate scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Explore and develop advanced ionic liquids. Continue scale up experiments of promising ionic liquids for further characterization. Continue proof of concept for new computational code to predict molecular properties of various promising propellant ingredients. Continue evaluation of suitability for ionic liquid propellants for missile defense interceptor and spacecraft propulsion demonstrations. Continue technology transfer to industry for production of downselected propellants. Continue high performance bi-propellant identification and synthesis program.</p> <p>FY 2012 Base Plans: Conduct experimental and analytical evaluation of potential hydrocarbon fuel additives to improve performance of kerosene. Continue synthesis and downselect process and scale-up of promising high energy-density materials candidates. Evaluate scaled-up propellants in advanced combustion devices to determine materials compatibility and performance to include supporting large-scale motor tests. Explore and develop of advanced ionic liquids including synthesis and characterization. Continue scale up experiments of promising ionic liquids for further characterization. Continue evaluation of suitability for ionic liquid propellants for missile defense interceptor and spacecraft propulsion demonstrations. Continue technology transfer to industry for production of downselected propellants. Continue high performance bi-propellant identification and synthesis program.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop advanced liquid engine combustion technology for improved performance, while preserving chamber lifetime and reliability needs for engine uses in heavy lift space vehicles.</p> <p>FY 2010 Accomplishments: Characterized, studied, and evaluated shear injector performance to ensure chamber/injector compatibility and prevent damage to engines. Developed, analyzed, and transitioned advanced combustion device technology, including injectors and chambers. Developed improved understanding of fundamental combustion and fluid flow/heat transfer processes leading to new methodologies for thermal management, scaling, and combustion instabilities in hydrocarbon fueled liquid rocket engines, reducing the need for conducting large numbers of costly full-scale component and engine tests. Performed pre-selection of most promising advanced propulsion concepts. Applied realistic computational models to optimize performance. Refined experimental demonstrations</p>	6.536	7.095	6.688	-	6.688

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>of proof-of-concepts. Continued development of realistic computational models. Conducted system trade studies with improved performance models to evaluate potential return on investment.</p> <p>FY 2011 Plans: Characterize, study, and evaluate shear injector performance to ensure chamber/injector compatibility and prevent damage to engines. Validate study results in more realistic rocket-chamber conditions and begin transition of predictive tools to industry. Develop, analyze, and transition advanced combustion device technology, including injectors and chambers. Develop improved understanding of fundamental combustion and fluid flow/heat transfer processes leading to new methodologies for thermal management, scaling, and combustion instabilities in hydrocarbon fueled liquid rocket engines, reducing the need for conducting large numbers of costly full-scale component and engine tests. Characterize design changes in high heat flux test rig in preparation for evaluating cooling channel designs. Conduct validation and verification of advanced modeling and simulation capabilities. Perform pre-selection of most promising advanced propulsion concepts; apply realistic computational models to optimize performance. Refine experimental demonstrations of proof-of-concepts, continue development of realistic computational models. Conduct system trade studies with improved performance models to evaluate potential return on investment.</p> <p>FY 2012 Base Plans: Using data obtained from a hydrocarbon demonstrator engine, characterize, study, and evaluate injector performance to ensure chamber/injector compatibility and prevent damage to engines. Validate study results in more realistic rocket-chamber conditions and transition of predictive tools to industry. Feed advanced combustion device technology into Hydrocarbon Boost Demo and to various contractor designs, continue additional analysis on changing designs and concepts. Develop improved understanding of fundamental combustion and fluid flow/heat transfer processes leading to new methodologies for thermal management, scaling, and combustion instabilities in hydrocarbon fueled liquid rocket engines, reducing the need for conducting large numbers of costly full-scale component and engine tests. Evaluate novel nozzle cooling channels for use with hydrocarbon fuels in the high heat flux test rig. Conduct validation and verification of advanced modeling and simulation capabilities. Perform pre-selection of most promising advanced propulsion concepts; apply realistic computational models to optimize performance. Refine experimental demonstrations of proof-of-concepts, continue development of realistic computational models. Conduct system trade studies with improved performance models to evaluate potential return on investment.</p> <p>FY 2012 OCO Plans:</p>					

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 624847: <i>Rocket Propulsion Technology</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 3.</p> <p>Description: Develop advanced material applications for lightweight components and material property enhancements for current and future rocket propulsion systems.</p> <p>FY 2010 Accomplishments: Developed new advanced ablative components using hybrid polymers. Characterized and refined processing parameters of new nano-reinforced high temperature polymers and scale-up processing of carbon-carbon materials. Developed new advanced materials for use with high-energy propellants. Continued to explore using nanocomposites for liquid rocket engine components and optimized processing technology using multifunctional nanomaterials. Characterized and understood the mechanisms behind a new class of hydrophobic and oleophobic materials exploring various transition opportunities.</p> <p>FY 2011 Plans: Develop new advanced ablative components using hybrid polymers. Continue to characterize and finalize processing parameters of new nano-reinforced high temperature polymers and scale-up processing of carbon-carbon materials. Develop new advanced materials for use with high-energy propellants. Continue to explore applications of nanocomposites for the hydrocarbon boost demo and other liquid rocket engine components and optimize processing technology using multifunctional nanomaterials. Continue to characterize and understand the mechanisms behind a new class of hydrophobic and oleophobic materials exploring various transition opportunities.</p> <p>FY 2012 Base Plans: Develop new material formulations that better address the challenges inside solid rockets. Continue to characterize and finalize processing parameters of new reinforced high temperature polymers and scale-up processing of carbon-carbon materials. Refine formulations of polymers for use in various liquid rocket engine components. Continue to characterize and understand the mechanisms behind a new class of hydrophobic and oleophobic materials exploring various transition opportunities.</p> <p>FY 2012 OCO Plans:</p>	5.420	5.941	5.857	-	5.857
<p>Title: Major Thrust 4.</p> <p>Description: Develop advanced liquid engine technologies for improved performance, while increasing life and reliability needs for engine uses in expendable and reusable launch vehicles.</p>	18.146	23.652	16.569	-	16.569

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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FY 2010 Accomplishments:
Updated advanced modeling, simulation, and analysis tools with results from full-scale component testing. Developed enabling hydrocarbon boost technology for future spacelift concepts and initiated risk reduction activities. Developed engine health monitoring technologies supporting the hydrocarbon engine technology development effort. Developed advanced hydrocarbon engine technologies using fuels other than kerosene. Developed and demonstrated in-house, moderate scale liquid rocket component testing capability. Initiated evaluation of high performance compact liquid rocket engine technology and bipropellant liquid rocket engine technologies.

FY 2011 Plans:
Develop enabling hydrocarbon boost technology for future spacelift concepts and continue risk reduction activities. Continue development of engine health monitoring technologies supporting the hydrocarbon boost technology development effort. Develop advanced hydrocarbon engine technologies using fuels other than kerosene. Develop and demonstrate in-house, moderate scale liquid rocket component testing capability. Develop high performance compact liquid rocket engine technologies. Continue development and evaluation of bipropellant technologies. Note: In FY 2011, efforts in this thrust are increased due to multiple programs scheduled for major hardware scale-up and production.

FY 2012 Base Plans:
Develop enabling hydrocarbon boost technology for future spacelift concepts and continue risk reduction activities for the development of hydrocarbon boost technologies. Continue development of engine health monitoring technologies supporting the hydrocarbon boost technology development effort. Develop advanced hydrocarbon engine technologies using fuels other than kerosene. Develop and demonstrate in-house, moderate scale liquid rocket component testing capability. Develop high performance compact liquid rocket engine technologies. Continue development and evaluation of bipropellant technologies. Note: In FY 2012, efforts in this thrust are decreased due to higher AF priorities.

FY 2012 OCO Plans:

Title: Major Thrust 5. 5.648 5.831 4.987 - 4.987

Description: Develop solar electric, solar thermal, chemical, and advanced propulsion technologies for station-keeping, repositioning, and orbit transfer for satellites and satellite constellations.

FY 2010 Accomplishments:

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>advanced tactical propulsion technologies. Evaluated next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications.</p> <p>FY 2011 Plans: Continue the component development and risk reduction efforts for future Missile Propulsion demonstration. Demonstrate components for solid rocket motors. Develop advanced tactical propulsion technologies. Continue development and evaluation of next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications. Complete sub-scale propellant development efforts. Note: In FY 2011, efforts in this thrust are decreased due to higher AF priorities.</p> <p>FY 2012 Base Plans: Test components as part of risk reduction efforts for future missile propulsion demonstration. Develop advanced tactical propulsion technologies. Continue development and evaluation of next generation of updated, physics-based modeling, simulation, and analysis tools for missile propulsion components and applications.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 7.</p> <p>Description: Develop missile propulsion technologies and aging and surveillance technologies for ballistic missiles.</p> <p>FY 2010 Accomplishments: Conducted advanced service life prediction technology program. Developed and applied existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Continued efforts to integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior. Continued development of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools.</p> <p>FY 2011 Plans: Conduct advanced service life prediction technology program. Develop and apply existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Continue efforts to integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior.</p>	2.563	2.986	6.182	-	6.182

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue development of next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools. FY 2012 Base Plans: Conduct sub-scale testing of existing and advanced sensors to be attached to solid rocket motors, and tools that can integrate sensor data into existing aging and surveillance tool suite. Integrate advanced aging and surveillance technologies into demonstrations to validate and verify efforts to reduce uncertainties and accurately model motor behavior. Apply next generation of chemical and aging mechanism modeling, simulation, and analysis tools, sensor schemes and tools, and non-destructive analysis tools. Note: In FY 2012, efforts in this thrust are increased due to higher AF priorities. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	57.391	58.954	60.420	-	60.420

	FY 2010	FY 2011
Congressional Add: Advanced Vehicle Propulsion Center. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-
Congressional Add: Aerospace Lab Equipment Upgrade. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.195	-
Congressional Add: AFRL Edwards Rocket Test Stand 2-A Technical Improvements. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.187	-
Congressional Add: Development and Testing of Advanced Hybrid Rockets for Space Applications. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.788	-
Congressional Add: Integrated Propulsion Analysis and Spacecraft Engineering Tools (IPAT/ISET).	4.780	-

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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		
Congressional Add: Multi-Mode Propulsion Phase II-A: High Performance Green Propellant. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Next Generation Solar Electric In-Space Propulsion. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	0.797	-
Congressional Adds Subtotals	16.730	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625330: <i>Aerospace Fuel Technology</i>	6.744	6.679	6.242	-	6.242	6.540	6.534	6.505	6.624	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project evaluates hydrocarbon-based fuels for legacy and advanced turbine engines, scramjets, pulse 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, and responsive space launch. Analytical and experimental areas of emphasis include evaluations of fuel properties and characteristics of alternative fuels developed from unconventional sources (such as coal, natural gas, biomass, and combinations thereof), unique/alternate fuels and components 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Conduct evaluations and perform technical assessments of alternative hydrocarbon fuels derived from coal, natural gas, and biomass for use in legacy and advanced aerospace systems.</p> <p>FY 2010 Accomplishments: Completed component evaluations of 50 percent synthetic paraffinic kerosene (SPK) produced by Fischer-Tropsch synthesis blended with 50 percent conventional aviation fuel. Conducted component "fit-for-purpose" evaluations of up to 100 percent SPK. Conducted initial evaluations of biomass derived aviation fuels, both blended with conventional aviation fuel and used 100 percent. Assessed analytical tools being developed to assess CO2 footprint of coal and biomass derived alternative fuels.</p> <p>FY 2011 Plans: Complete component "fit-for-purpose" evaluations of up to 100 percent SPK and make recommendation as to maximum SPK in blend use. Complete initial evaluations of biomass derived aviation fuels and assessment of associated CO2 footprint. Conduct follow-on component evaluations as available fuel quantities permit.</p> <p>FY 2012 Base Plans: Develop link between fully-synthetic fuel composition and basic physical properties and rig test performance.</p> <p>FY 2012 OCO Plans:</p>	2.821	3.200	3.153	-	3.153
<p>Title: Major Thrust 2.</p>	0.780	1.100	1.089	-	1.089

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop biological growth mitigation approaches for commercial jet fuels in support of AF effort to implement commercial off-the-shelf jet fuels. Evaluate approaches for portable hydrogen generation to support emergency field power generation. FY 2012 OCO Plans:					
Title: Major Thrust 4. Description: Develop and test advanced emissions diagnostic techniques for airbreathing propulsion systems. Conduct evaluations of the combustion and emissions characteristics of aviation fuels. FY 2010 Accomplishments: Completed combustion emissions evaluations of high pressure combustor sectors operating on 100 percent pure and blends of synthetic paraffinic kerosene with conventional aviation fuel and compared to analytical predictions. Developed diagnostic protocols for aircraft ground emissions measurements and perform emissions evaluations on fielded engines to investigate particulate formation and composition. Initiated development of emissions diagnostics applicable to advanced high pressure combustor systems. Conducted preliminary assessment of combustion emissions from biomass derived aviation fuels. FY 2011 Plans: Develop diagnostic protocols for aircraft ground emissions measurements and perform emissions evaluations on fielded engines to investigate particulate formation and composition. Develop emissions diagnostics applicable to advanced high pressure combustor systems. Assess combustion emissions from biomass derived aviation fuels. Conduct assessment of combustion emissions from blends of coal/biomass derived aviation fuels. FY 2012 Base Plans: Implement advanced particulate diagnostics in high-pressure combustor test rig. Assess emissions from fully-synthetic fuels relative to JP-8 and JP-8/synthetic blends. FY 2012 OCO Plans:	0.861	1.379	1.000	-	1.000
Accomplishments/Planned Programs Subtotals	5.438	6.679	6.242	-	6.242
	FY 2010	FY 2011			
Congressional Add: National Test Facility for Aerospace Fuels Propulsion.	1.306	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602203F: <i>Aerospace Propulsion</i>	PROJECT 625330: <i>Aerospace Fuel Technology</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	1.306	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	136.335	157.497	134.787	-	134.787	137.101	141.434	144.405	147.299	Continuing	Continuing
622002: <i>Electronic Component Technology</i>	40.304	34.458	42.872	-	42.872	43.623	50.231	51.825	52.860	Continuing	Continuing
622003: <i>EO Sensors & Countermeasures Tech</i>	18.298	21.430	28.051	-	28.051	29.005	29.940	30.534	31.159	Continuing	Continuing
624916: <i>Electromagnetic Tech</i>	18.712	18.905	-	-	-	-	-	-	-	Continuing	Continuing
626095: <i>Sensor Fusion Technology</i>	23.249	27.008	24.545	-	24.545	25.014	25.512	25.731	26.234	Continuing	Continuing
627622: <i>RF Sensors & Countermeasures Tech</i>	35.772	55.696	39.319	-	39.319	39.459	35.751	36.315	37.046	Continuing	Continuing

Note

Note: In FY 2012 the efforts in Project 624916 move from Hanscom AFB, MA to Wright Patterson AFB, OH due to the decisions of the Base Realignment and Closure Commission. The individual efforts from Project 624916 are merged into other existing Projects in this PE.

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 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) 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 sensors; 4) technologies to manage and fuse on-board sensor information for timely, comprehensive situational awareness; and 5) technology for reliable, all-weather surveillance, reconnaissance, and precision strike radio frequency sensors and electronic combat systems. This program has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary sensor, electronics, and electronic combat technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY	R-1 ITEM NOMENCLATURE
3600: <i>Research, Development, Test & Evaluation, Air Force</i>	PE 0602204F: <i>Aerospace Sensors</i>
BA 2: <i>Applied Research</i>	

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	136.012	157.497	137.261	-	137.261
Current President's Budget	136.335	157.497	134.787	-	134.787
Total Adjustments	0.323	-	-2.474	-	-2.474
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	1.520	-			
• SBIR/STTR Transfer	-1.123	-			
• Other Adjustments	-0.074	-	-2.474	-	-2.474

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

		FY 2010	FY 2011
Project: 622002: <i>Electronic Component Technology</i>			
Congressional Add: <i>Advanced Electronic Components for Sensor Arrays</i>		2.390	-
Congressional Add: <i>Advanced Integrated Microsystems for Military Electronic Systems</i>		2.470	-
Congressional Add: <i>On-Chip Integrated Photonic Polymer Transceiver</i>		4.481	-
Congressional Add Subtotals for Project: 622002		9.341	-
Project: 622003: <i>EO Sensors & Countermeasures Tech</i>			
Congressional Add: <i>Watchkeeper</i>		1.593	-
Congressional Add Subtotals for Project: 622003		1.593	-
Project: 626095: <i>Sensor Fusion Technology</i>			
Congressional Add: <i>Information Quality Tools for Persistent Surveillance Data Sets.</i>		1.434	-
Congressional Add: <i>Net-centric Sensor Grids.</i>		2.390	-
Congressional Add Subtotals for Project: 626095		3.824	-
Congressional Add Totals for all Projects		14.758	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 622002: <i>Electronic Component Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622002: <i>Electronic Component Technology</i>	40.304	34.458	42.872	-	42.872	43.623	50.231	51.825	52.860	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project focuses on generating, controlling, receiving, and processing electronic signals for radio-frequency sensor aerospace applications. The enabling technologies developed under this project will be used for intelligence, surveillance, reconnaissance (ISR), electronic warfare, battlespace access, and precision engagement capabilities. The technologies developed include exploratory device concepts; solid state power devices and amplifiers; low noise and signal control components; photonic components; high-temperature electronics; signal control and distribution; signal processing; multi-function monolithic integrated circuits; high-speed analog-to-digital and digital-to-analog mixed mode integrated circuits; reconfigurable electronics; power distribution; multi-chip modules; and high density packaging and interconnect technologies. This project also designs, develops, fabricates, and evaluates techniques for integrating combinations of these electronic component technologies. The project aims to demonstrate significantly improved military sensors of smaller size, lower weight, lower cost, lower power dissipation, higher reliability, and improved performance. The device and component 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, navigation, and smart weapons.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop compact, affordable, multi-function components for aerospace sensors. Develop advanced electronic and optoelectronic aperture subsystems for affordable and scalable sensors.</p> <p>FY 2010 Accomplishments: Demonstrated prototype wideband digital channel. Developed and exploited metamaterials for electronic and optoelectronic applications. Demonstrated sensing subsystem using most promising metamaterials technology.</p> <p>FY 2011 Plans: Demonstrate and transition sensing and/or electronic warfare subsystem using metamaterials approaches.</p> <p>FY 2012 Base Plans: Continue to demonstrate and transition sensing and/or electronic warfare subsystems using metamaterials approaches.</p> <p>FY 2012 OCO Plans:</p>	6.368	9.975	12.237	-	12.237
<p>Title: Major Thrust 2.</p>	4.255	4.692	6.033	-	6.033

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop new microelectronic component and fabrication technologies for sensors and communications to support ISR, precision strike, and battlespace access.</p> <p>FY 2010 Accomplishments: Demonstrated closed-loop modeling and prediction capability for emerging electronic device performance versus lifetime in militarily relevant environments. Investigated and tested innovative electronic device concepts for wideband, reconfigurable and tunable applications.</p> <p>FY 2011 Plans: Demonstrate predictive capability for a larger variety of emerging electronic devices to map performance versus lifetime in militarily relevant environments. Identify key failure mechanisms for previously prioritized electronic device technologies and their corresponding accelerants and chemistry. Fabricate and test innovative electronic device concepts for wideband, reconfigurable and tunable applications.</p> <p>FY 2012 Base Plans: Continue to fabricate and characterize innovative electronic device concepts for wideband, reconfigurable and tunable applications.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Develop optoelectronics for next generation imaging and electronic warfare sensors. Develop electro-optical devices for next-generation warfighter applications.</p> <p>FY 2010 Accomplishments: Demonstrated compact, efficient, high-brightness sources, optically- and/or electrically-pumped. Started the development for compact, tunable detector technology for advanced multi-spectral applications. Developed optical waveform generation subsystems. Initiated effort for combined spectral and polarimetric filtering at detector pixel level, extending to next-generation spectro-polarimetric focal plane array development.</p> <p>FY 2011 Plans:</p>	3.817	4.692	6.033	-	6.033

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue development of agile/affordable advanced detector arrays with emphasis on combined spectro-polarimetric filtering. Start application development of high-brightness and agile waveform sources for integration into components and subsystems.</p> <p>FY 2012 Base Plans: Demonstrate prototype hardware for agile/affordable advanced detector arrays with emphasis on combined spectro-polarimetric filtering. Continue application development of high-brightness and agile waveform sources for integration into components and subsystems.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Develop, fabricate, and test electronic and optoelectronic devices and techniques to reduce power loss and power consumption for future imaging, electronic warfare, and ISR sensors.</p> <p>FY 2010 Accomplishments: Demonstrated tunable and reconfigurable electronic and optoelectronic components for combined imaging and electronic warfare applications. Developed solutions for energy starved applications.</p> <p>FY 2011 Plans: Refine and transition solutions for multi-function electronic and optoelectronic components for imaging and electronic warfare applications.</p> <p>FY 2012 Base Plans: Continue to refine and transition solutions for multi-function electronic and optoelectronic components for imaging and electronic warfare applications.</p> <p>FY 2012 OCO Plans:</p>	8.689	8.024	10.071	-	10.071
<p>Title: Major Thrust 5.</p> <p>Description: Develop and demonstrate innovative radio-frequency component technology to lower system cost through reduction of part count, chip size, and design, production, and integration costs.</p> <p>FY 2010 Accomplishments:</p>	1.066	-	-	-	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Designed and developed highly reconfigurable fully programmable microwave array and flexible optoelectronic integrated circuits using highly integrated techniques for lighter weight radio-frequency and optical apertures.</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 6.</p> <p>Description: Develop integrated design, modeling and simulation tools, and integration techniques for complex mixed-signal component development in advanced electronic component technologies.</p> <p>FY 2010 Accomplishments: Extended design and characterization capability to tunable, reconfigurable and multi-function electronic and optoelectronic devices and components.</p> <p>FY 2011 Plans: Employ design, modeling, and simulation tools and integration techniques for complex mixed-technology (digital, radio-frequency, microwave, optical, mechanical) component development in both advanced and emerging electronic component technologies.</p> <p>FY 2012 Base Plans: Develop and demonstrate prototypes of complex mixed-technology (digital, radio-frequency, microwave, optical, and mechanical) components using both advanced and emerging electronic component technologies.</p> <p>FY 2012 OCO Plans:</p>	5.127	5.670	7.327	-	7.327
<p>Title: Major Thrust 7.</p> <p>Description: Develop advanced component and subsystem technologies for space-base sensors that focuses on improving performance and reducing size, mass, and prime power.</p> <p>FY 2010 Accomplishments:</p>	1.641	1.405	1.171	-	1.171

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Developed reconfigurable/tunable high performance electronics/circuits. Investigated pre-space qualification issues associated with newer component technologies to ensure more rapid and accurate transitions. Developed scalable/reconfigurable plug-and-play payload building blocks. FY 2011 Plans: Develop and demonstrate a capability to predict performance versus lifetime in military relevant environments for a larger variety of emerging electronic devices. Identify key failure mechanisms for electronic device technologies and their corresponding accelerants and chemistry. FY 2012 Base Plans: Continue to develop and demonstrate a capability to predict performance versus lifetime in military relevant environments for a larger variety of emerging electronic devices. Identify key failure mechanisms for electronic device technologies and their corresponding accelerants and chemistry. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	30.963	34.458	42.872	-	42.872

	FY 2010	FY 2011
Congressional Add: Advanced Electronic Components for Sensor Arrays FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-
Congressional Add: Advanced Integrated Microsystems for Military Electronic Systems FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.470	-
Congressional Add: On-Chip Integrated Photonic Polymer Transceiver FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	4.481	-
Congressional Adds Subtotals	9.341	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622002: <i>Electronic Component Technology</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 622003: <i>EO Sensors & Countermeasures Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622003: <i>EO Sensors & Countermeasures Tech</i>	18.298	21.430	28.051	-	28.051	29.005	29.940	30.534	31.159	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 main 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. 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	2.292	10.972	16.373	-	16.373
Description: Develop technology for non-cooperative detection and identification of airborne and ground-based targets.					
FY 2010 Accomplishments: Performed sensor concept demonstrations for long range target identification using passive and active techniques, including multispectral/polarimetric imaging, vibrometry, sparse aperture and synthetic aperture laser radar. Developed fused active and passive, multi-discriminant image products based on individual and combined measurement performance. Characterized hybrid focal planes and demonstrated in short range laser radar systems. Began design of multi-discriminant system utilizing common components to minimize size and optimize utility. Enhanced optical sensor for improved space situation awareness experiments.					
FY 2011 Plans: Continue sensor concept demonstrations for long range target identification using passive and active techniques, including multispectral/polarimetric imaging, vibrometry, 3-D, sparse aperture and synthetic aperture laser radar. Refine techniques for long range object reconstruction based on either multi-aspect multispectral and polarimetric images or coherent laser radar data, with particular emphasis on synthetic and sparse aperture imaging techniques. Continue signature collection experiments with multispectral/polarimetric imaging systems to assess military utility. Perform proof of concept experiments to assess potential utility.					
FY 2012 Base Plans:					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue sensor concept demonstrations for long range target identification using passive and active techniques, including multispectral/polarimetric imaging, vibrometry, 3-D, sparse aperture and synthetic aperture laser radar. Demonstrate techniques for long range object reconstruction based on multi-aspect multispectral and polarimetric images and coherent laser radar data. Extend signature collection experiments with multispectral/polarimetric imaging systems to incorporate the impact of multi-aspect imaging for shape extraction. Investigate atmospheric turbulence issues related to synthetic aperture imaging. Perform field experiments, quantify potential utility, and initiate concept development for airborne demonstrations. Develop model-based algorithms for longwave hyperspectral change detection.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop optical transmitter and agile aperture technology capable of sensing multiple target characteristics for robust non-cooperative target identification.</p> <p>FY 2010 Accomplishments: Completed testing of optical transmitter technologies for non-cooperative target identification at long standoff ranges. Refined optimal system concepts using advanced active and passive sensor models with emphasis on imaging through scattering media such as clouds and foliage. Developed enabling sensor components for a demonstration system.</p> <p>FY 2011 Plans: Initiate development of beamsteering technology for long range sparse aperture and compact 3-D laser radar systems. Assess characteristics of beamsteering component technologies based on liquid crystal, micro electro-mechanical systems, and other optical phased array concepts.</p> <p>FY 2012 Base Plans: Continue development of beamsteering technology for sparse aperture and compact 3-D laser radar systems. Perform characterization of beamsteering component technologies based on liquid crystal, microwave electro-mechanical modules, and other optical phased array concepts. Initiate proof of concept experiments for an agile aperture assembly. Develop design concepts for wideband optical detector arrays suitable for coherent laser radar systems. Define and implement optimized waveforms for laser-based sensing. Continue active and passive sensor phenomenology experiments and model development.</p> <p>FY 2012 OCO Plans:</p>	0.503	1.262	2.590	-	2.590

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 3.</p> <p>Description: Develop innovative techniques and components to target difficult objects in battlefield environments, including dynamic targets in urban areas.</p> <p>FY 2010 Accomplishments: Developed techniques for targeting difficult objects in dynamic urban environments. Explored compact active and passive sensor components with advanced signal processing for distributed operation from small platforms to provide close-in sensing of difficult targets in obscured and urban areas. Demonstrated individual sensor components for close in sensing from small remotely piloted aircraft (SRPA) in difficult environments. Conducted flight phenomenology experiments supporting ladar applications on SRPA.</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	5.958	-	-	-	-
<p>Title: Major Thrust 4.</p> <p>Description: Develop countermeasure technologies for use against infrared- and electro-optical guided missiles threats.</p> <p>FY 2010 Accomplishments: Assessed technologies to defeat advanced infrared missiles and infrared acquisition sensors. Supported demonstration of proactive detection, discrimination, and defeat of second-generation infrared-imaging missile seekers and sensors systems. Refined techniques and discrimination processes test data. Developed and refined simulation capability to evaluate effectiveness across mission concepts of employment.</p> <p>FY 2011 Plans: Continue the assessment of advanced infrared missiles and infrared acquisition sensors. Continue to develop proactive infrared countermeasures including the detection, discrimination, and defeat of second-generation, infrared, imaging missile seekers and sensors systems. Refine modeling and simulation capability to assess effectiveness of countermeasure techniques across mission concepts of employment.</p> <p>FY 2012 Base Plans:</p>	7.503	8.469	8.538	-	8.538

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue the assessment of advanced infrared missiles and infrared acquisition sensors. Continue to develop requirements for advanced electro-optical and infrared countermeasure concepts across mission concepts of employment. Continue to develop simulation and hardware-in-the-loop test capability to evaluate and test countermeasure concepts. FY 2012 OCO Plans:					
Title: Major Thrust 5. Description: Develop aerospace missile and laser warning technologies to accurately cue countermeasures. FY 2010 Accomplishments: Supported integration of new laser warning sensors with countermeasures system prototypes to provide robust capability to detect threats and cue defeat techniques. Refined sensor hardware and software design based on test data. Conducted demonstration testing of integrated capabilities. Developed new laser warning concepts to address emerging directed energy threats. FY 2011 Plans: Demonstrate integrated beam rider laser, direct tactical and indirect tactical laser detection sensors supporting proactive infrared countermeasure hand-off goals. FY 2012 Base Plans: Continue integrating advanced laser threat detection sensors to demonstrate situational awareness and countermeasure hand-off capabilities. Continue to develop new laser warning concepts to address emerging directed energy threats and develop requirements for Combat Mission Infrared Countermeasures Advanced Technology Demonstration. Continue developing tactical aerospace laser optical simulation for laser sensor characterization and countermeasure concepts. FY 2012 OCO Plans:	0.449	0.727	0.550	-	0.550
Accomplishments/Planned Programs Subtotals	16.705	21.430	28.051	-	28.051
	FY 2010	FY 2011			
Congressional Add: Watchkeeper	1.593	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 622003: <i>EO Sensors & Countermeasures Tech</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	1.593	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 624916: <i>Electromagnetic Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624916: <i>Electromagnetic Tech</i>	18.712	18.905	-	-	-	-	-	-	-	Continuing	Continuing

Note
Note: In FY 2012 the efforts in Project 624916 move from Hanscom AFB, MA to Wright Patterson AFB, OH due to the decisions of the Base Realignment and Closure Commission. The individual efforts from Project 624916 are merged into other existing Projects in this PE.

A. Mission Description and Budget Item Justification

This project develops technologies for sensor systems that cover the electromagnetic spectrum from radio-frequency to electro-optical. It develops radio-frequency antennas and associated electronics for airborne and space-based surveillance. It also investigates radio-frequency scattering phenomenology for applications in ground and air moving target indicators in extremely cluttered environments. The project develops active and passive electro-optical sensors for use in concert with radio-frequency sensors. It develops low-cost active sensors that use reliable high-performance solid state components for target detection and identification and missile threat warning. The project also develops passive multi-dimensional sensors to improve battlefield awareness and identify threats at long-range.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate detection of difficult airborne and ground-based targets in clutter from airborne or space-based surveillance platforms.</p> <p>FY 2010 Accomplishments: Developed analytical and computationally efficient tools for multi-sensor integration for target detection, tracking, and classification in a knowledge-aided framework exploiting physics-based and data dependent electromagnetic models of targets and clutter.</p> <p>FY 2011 Plans: Complete development of analytical and computationally efficient tools for multi-sensor integration for target detection, tracking, and classification in a knowledge-aided framework exploiting physics-based and data dependent electromagnetic models of targets and clutter, as well as waveform diversity and dynamic sensor responses to the evolving problem solution.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	3.074	3.489	-	-	-
<p>Title: Major Thrust 2.</p>	6.655	6.255	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Design and develop antennas for airborne and space-based surveillance. Develop metamaterials for conformal arrays.</p> <p>FY 2010 Accomplishments: Developed new low-cost digital beamforming techniques for miniature remotely piloted aircraft. Integrated new detection algorithm with low cost seeker hardware. Integrated and tested new conformal digital beamforming phased array antennas on airborne radar platforms. Developed new hardware to exploit emerging metamaterials for compact radiating sensor applications including conformal array antennas and electronics based upon complex media. Assessed the viability of obtaining metamaterial properties consistent with the demonstration of highly integrated subsystems based upon radio frequency integrated circuit applications to enable small, highly directional antenna element device drivers.</p> <p>FY 2011 Plans: Continue integration of new detection algorithm with low cost seeker hardware. Continue integration and test of new conformal digital beamforming phased array antennas on airborne radar platforms. Continue to develop new hardware to exploit emerging metamaterials for compact radiating sensor applications including conformal array antennas and electronics based upon complex media. Continue to assess the viability of obtaining metamaterial properties consistent with the demonstration of highly integrated subsystems based upon radio frequency integrated circuit applications to enable small, highly directional antenna element device drivers.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Design and develop new electro-optical techniques and components for detecting and identifying concealed targets.</p> <p>FY 2010 Accomplishments: Developed new quasi-phase matched materials such as Gallium Phosphate and techniques for efficient optical sources in the mid- and long-wave infrared applications. Developed new materials systems to enable conversion from pump wavelengths between one and two microns. Tested integrated focal plane arrays.</p> <p>FY 2011 Plans:</p>	5.401	5.456	-	-	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>				PROJECT 626095: <i>Sensor Fusion Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
626095: <i>Sensor Fusion Technology</i>	23.249	27.008	24.545	-	24.545	25.014	25.512	25.731	26.234	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies required to perform management and fusion of sensor information for timely, comprehensive situational awareness, automatic target recognition, integrated fire control, and bomb damage assessment. This project determines the feasibility of technologies and concepts for fire control that help to precisely locate, identify, and target airborne and surface targets. The project emphasizes finding reduced signature targets and targets of opportunity. It will enable new covert tactics for successful air-to-air and air-to-surface strikes. This project also develops the technologies required to create trusted autonomic, distributed, collaborative, and self-organizing sensor systems that provide anticipatory and persistent intelligence, surveillance, and reconnaissance (ISR), situational awareness, and decision support for multi-layered sensing. This program provides the technologies for: 1) trusted sensors and trusted sensor systems that will deter reverse engineering and exploitation of our critical hardware and software technology and impede unwanted technology transfer, alteration of system capability, and prevent the development of countermeasures to U.S. systems; 2) collaborative tasking of our own distributed heterogeneous sensor networks across a region and co-opted tasking of both traditional and non-traditional adversary sensors; 3) secure sensor web backbone technologies, sensor web physical topologies, and related protocols to assure reliable trusted sensor interactions; and 4) defining architectures for distributed trusted collaborative heterogeneous sensor systems and semantic sensor networks, developing new methodologies for system of systems sensor engineering and analysis, and new techniques for sensor network situation awareness and predictive analytics.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	2.127	7.261	7.529	-	7.529
Description: Develop and assess single and multi-sensor automatic target recognition (ATR) and sensor fusion algorithms for rapidly finding, tracking, and targeting mobile targets.					
FY 2010 Accomplishments: Assessed the image formation and processing of synthetic aperture radar, electro-optical/infrared/hyper-spectral imagery data from research and development data collections taking advantage of disparate phenomenology to improve automatic target recognition detection, classification and identification performance. Developed and validated multi-sensor/multi-frequency synthetic data generation tools required to augment and enhance collected research, development, and operational data sets. Searched out unexploited phenomenological features and initiated development of tools and technology required to exploit said features. Conducted laboratory tests and assessment of multi-sensor and sensor fusion algorithms for automated exploitation and weapon delivery systems. Enhanced databases, tools and laboratory environments as required to support					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>assessment and validation of models and exploitation technologies. Improved automatic target recognition performance evaluation theory for automatic target recognition technologies.</p> <p><i>FY 2011 Plans:</i> Complete initial assessment of image formation and processing of synthetic aperture radar, electro-optical/infrared/hyper-spectral imagery data from research and development data collections taking advantage of disparate phenomenology to improve automatic target recognition detection, classification and identification performance. Continue to develop and perform initial validation of multi-sensor/multi-frequency synthetic data generation tools required to augment and enhance collected research, development, and operational data sets. Search out unexploited phenomenological features and continue development of tools and technology required to exploit said features. Continue laboratory tests and assessment of multi-sensor and sensor fusion algorithms for automated exploitation and weapon delivery systems. Continue enhancements to databases, tools and laboratory environments as required to support assessment and validation of models and exploitation technologies. Continue to improve automatic target recognition performance evaluation theory for automatic target recognition technologies.</p> <p><i>FY 2012 Base Plans:</i> Build upon initial assessment of image formation and processing of synthetic aperture radar, electro-optical/infrared/hyper-spectral imagery data from research and development data collections to develop the theories and basic techniques needed to create a three dimensional, time independent, large area automated and/or assisted exploitation capability. Continue to develop technologies requiring further research in areas discovered previously during initial validation of multi-sensor/multi-frequency synthetic data generation tools required to augment and enhance collected research, development, and operational data sets. Continue to search out unexploited phenomenological features and continue development of tools and technology required to exploit said features. Continue laboratory tests and assessment of multi-sensor and sensor fusion algorithms for automated exploitation and weapon delivery systems. Assess state of the art in databases, tools and laboratory environments supporting ATR technology development and research those areas discovered as lacking in sufficient capability required to support assessment and validation of models and exploitation technologies. Continue to assess and improve automatic target recognition performance evaluation theory for automatic target recognition technologies.</p> <p><i>FY 2012 OCO Plans:</i></p> <p><i>Title:</i> Major Thrust 2.</p>	5.097	6.250	5.043	-	5.043

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop, evaluate, and demonstrate target signature models to support ATR and sensor fusion algorithm development and testing for reconnaissance and strike mission applications.</p> <p>FY 2010 Accomplishments: Matured target signature models for signature exploitation of radio-frequency sensors, electro-optical multi-spectral systems, and signals intelligence sensors emphasizing one target model for application to all parts of the spectrum. Developed signatures, algorithms, and modeling support for multiple radio-frequency and electro-optical phenomenology automatic target recognition of ground targets. Developed signatures, algorithms, target modeling and modeling of other phenomenological features that heretofore have not been exploited. Generated synthetic air and ground target signatures with sufficient fidelity to support development and assessment of automatic recognition of targets in operationally realistic mission environments. Demonstrated large area, reconnaissance coverage, synthetic scene data generation capability for radio-frequency and electro-optical sensors. Investigated model-driven spectral signal processing and exploitation techniques.</p> <p>FY 2011 Plans: Complete initial target signature models for signature exploitation of radio-frequency sensors, electro-optical multi-spectral systems, and signals intelligence sensors emphasizing one target model for application to all parts of the spectrum. Continue to develop signatures, algorithms, and modeling support for multiple radio-frequency and electro-optical phenomenology automatic target recognition of ground targets. Continue the development of signatures, algorithms, target modeling, and modeling of other phenomenological features not previously exploited. Continue to generate synthetic air and ground target signatures with sufficient fidelity to support development and assessment of automatic recognition of targets in operationally realistic mission environments. Continue investigation of model-driven spectral signal processing and exploitation techniques. Continue development of automatic target recognition algorithm-driven radio-frequency sensor design, new modes of operation for existing sensors, and signal processing/exploitation for high-diversity data.</p> <p>FY 2012 Base Plans: Assess the state of the art to determine remaining technology shortfalls and develop signatures, algorithms, and modeling support for multiple radio-frequency and electro-optical phenomenology automatic target recognition of ground targets addressing those technology needs. Continue the development of signatures, algorithms, target modeling, and modeling of other phenomenological features not previously exploited. Assess current technology capability and with predicted fidelity requirements to meet anticipated mission requirements and</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>research of bio-inspired automatic target recognition technologies and continue to assess and evaluate these techniques for all missions with emphasis on urban applications.</p> <p>FY 2012 Base Plans: Build upon initial assessment of image formation and processing of synthetic aperture radar, electro-optical/infrared/hyper-spectral imagery data from research and development data collections to develop the theories and basic techniques needed to create a three dimensional, time independent, large area automated and/or assisted exploitation capability. Continue to develop technologies requiring further research in areas discovered previously during initial validation of multi-sensor/multi-frequency synthetic data generation tools required to augment and enhance collected research, development, and operational data sets. Continue to search out unexploited phenomenological features and continue development of tools and technology required to exploit said features. Continue laboratory tests and assessment of multi-sensor and sensor fusion algorithms for automated exploitation and weapon delivery systems. Assess state of the art in databases, tools and laboratory environments supporting ATR technology development and research those areas discovered as lacking in sufficient capability required to support assessment and validation of models and exploitation technologies. Continue to assess and improve automatic target recognition performance evaluation theory for automatic target recognition technologies.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Develop technical methods required for algorithm performance models, ATR driven sensing, layered sensing and other sensing and exploitation technologies impacted by ATR capabilities.</p> <p>FY 2010 Accomplishments: Evaluated new innovations in automatic target recognition-related technologies. Developed fundamental automatic target recognition approaches for subcomponents. Began development of a capability to model the performance of these technologies. Determined methods of performance modeling validation. Developed databases and tools required to support performance modeling and assessment. Developed an integrated, unified automatic target recognition methodology building upon the modeling and assessment tools developed.</p> <p>FY 2011 Plans:</p>	1.557	5.638	6.325	-	6.325

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue investigations of sensor exploitation techniques. Continue development of a capability to model the performance of these technologies. Initiate validation of algorithm performance models. Continue development of databases and tools required to support performance modeling and assessment. Continue and enhance development of an integrated, unified automatic target recognition methodology building upon the modeling and assessment tools developed.</p> <p>FY 2012 Base Plans: Continue investigations of sensor exploitation techniques. Continue development of a capability to model the performance of these technologies. Validate algorithm performance models and determine capability shortfalls. Continue development of databases and tools required to support performance modeling and assessment. Continue and enhance development of an integrated, unified automatic target recognition methodology building upon the modeling and assessment tools developed.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 5.</p> <p>Description: Develop, evaluate, and demonstrate methodologies, techniques, and strategies to instill trust in distributed, heterogeneous sensing systems within air, space, and cyber domains.</p> <p>FY 2010 Accomplishments: Completed development of new techniques for systems sensor engineering and analysis. Completed development of new techniques for sensor network situational awareness and global measures of trust for multi-layered sensing. Completed development of representative measures of system trustworthiness for collaborative and distributed heterogeneous sensing system architectures and semantic sensor networks. Developed new technologies and methodologies for producing adaptive, trusted architectures for multi-layered sensing.</p> <p>FY 2011 Plans: Complete development of new technologies and methodologies for producing adaptive, trusted architectures for multi-layered sensing. Initiate development of advanced trusted sensor web services, middleware, and frameworks for multi-layered sensing and cyber sensing. Initiate development of methodologies and techniques for visualization and portrayal of a global trust picture. Initiate development of technologies for assessing, evaluating, and managing trust at a distance in distributed heterogeneous sensor systems.</p> <p>FY 2012 Base Plans:</p>	5.064	2.496	1.694	-	1.694

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
and mission operations during an attack. Develop software protection and anti-tamper solutions that integrate universal situational awareness to improve attack monitoring and prediction capabilities.					
FY 2012 OCO Plans:					
Title: Major Thrust 7.	2.373	1.644	1.237	-	1.237
Description: Develop secure backplane, integration technology, physical topologies, and protocols to support multi-layered sensing and trusted sensor networks for air, space, and cyber domains.					
FY 2010 Accomplishments: Completed conceptual design of sensor web backbone technology to assure trusted sensor interactions for multi-layered persistent ISR sensing. Developed sensor web backbone integration laboratory. Completed initial assessment of available sensor technologies for trusted sensing. Initiated development of advanced sensor bus technologies for trusted sensing. Initiated analysis to exploit wired and wireless sensor web systems.					
FY 2011 Plans: Continue demonstration of laboratory prototype of sensor web backbone and physical topologies. Continue development of advanced sensor bus technologies for trusted sensing. Continue analysis to exploit wired and wireless sensor web systems and begin analysis of technologies to defend sensor web systems. Complete development of the sensor web backbone integration laboratory.					
FY 2012 Base Plans: Continue demonstration of laboratory prototype of sensor web backbone and physical topologies. Continue development of advanced sensor bus technologies for trusted sensing. Continue analysis to exploit wired and wireless sensor web systems and begin analysis of technologies to defend sensor web systems. Expand applicability of the sensor web backbone integration laboratory to various avionic systems.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	19.425	27.008	24.545	-	24.545
	FY 2010	FY 2011			
Congressional Add: Information Quality Tools for Persistent Surveillance Data Sets.	1.434	-			

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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Add: Net-centric Sensor Grids.	2.390	-
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	3.824	-

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

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
627622: <i>RF Sensors & Countermeasures Tech</i>	35.772	55.696	39.319	-	39.319	39.459	35.751	36.315	37.046	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, reconnaissance, 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 the radio-frequency warning and countermeasure technology for advanced electronic warfare and information operations applications. Specifically, it develops techniques and technologies to detect and counter the communications links and sensors of threat air defense systems and hostile command and control networks. The project also exploits emerging technologies and components to provide increased capability for offensive and defensive radio-frequency sensors, including radar warning, radio-frequency electronic warfare, and electronic intelligence applications.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop technology to reduce size, weight, and power of radio frequency (RF) sensors. Develop technology to enable affordable upgrades and optimally control RF and multi-intelligence sensors.</p> <p>FY 2010 Accomplishments: Demonstrated advanced RF receiver hardware and digital receiver/techniques generators technologies. Initiated new effort for the development of an adaptable (cognitive) electronic support (ES) and/or electronic attack (EA) capability.</p> <p>FY 2011 Plans: Continue the research and exploration of an adaptable ES/EA capability, including exploration of the synergy of real-time ES coupled with tailorable EA techniques.</p> <p>FY 2012 Base Plans:</p>	5.357	8.827	8.662	-	8.662

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Initiate research and modeling of layered electronic warfare (EW) effects (i.e., multiple jammers or jamming techniques). Explore and analyze a future/on-coming RF-based threat for potential counters and perform initial vulnerability assessment. Research advanced ES concepts. FY 2012 OCO Plans:					
Title: Major Thrust 2. Description: Develop robust, ultra-wide bandwidth aerospace electronic aperture technologies and next generation applied radio-frequency aperture technology for manned and unmanned platforms. FY 2010 Accomplishments: Completed design and development of multi-function thin-profile array with integrated receiver and exciter. FY 2011 Plans: FY 2012 Base Plans: FY 2012 OCO Plans:	4.858	-	-	-	-
Title: Major Thrust 3. Description: Develop RF sensing and electronic warfare/information operations concepts and technologies for concurrent multi-mode operation and digital beam forming. FY 2010 Accomplishments: Designed and developed highly digital electronically scanned array with transmit and receive capabilities for multi-mode radio frequency sensing. Developed integrated receiver/exciter and digital beamforming concepts to support wideband multiple intelligence (multi-INT) sensing systems including modeling and simulation capability, critical components, algorithms, and subsystem architectures. FY 2011 Plans: Continue development of highly digital electronically scanned array. Design and develop an integrated receiver, exciter and digital beamforming subsystem to support wideband multi-INT sensing systems. Characterize and assess emerging over-the-horizon (OTH) radar technologies using modeling and simulation, experimentation,	2.772	15.302	4.169	-	4.169

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
and demonstrations. Identify further research and development needed to advance the state-of-the-art in OTH radar.					
<p><i>FY 2012 Base Plans:</i> Demonstrate prototype elements for highly digital electronically scanned array. Continue to design and develop an integrated receiver, exciter and digital beamforming subsystem to support wideband multi-INT sensing systems.</p> <p><i>FY 2012 OCO Plans:</i></p>					
<p><i>Title:</i> Major Thrust 4.</p> <p><i>Description:</i> Develop waveforms using transmit adaptivity and multi-mode operation, and multi-platform, multi-mission sensor and EW adaptive processing algorithms to improve sensor performance.</p> <p><i>FY 2010 Accomplishments:</i> Investigated and evaluated waveform diversity techniques and multiple-input/multiple-output adaptive processing algorithms to improve electronic protection functions in conventional and advanced radio-frequency systems. Developed distributed signal processing techniques to obtain high spatial resolution with limited transmit bandwidth, and to detect challenging targets such as those with low radar cross-section.</p> <p><i>FY 2011 Plans:</i> Develop new electronic protection techniques exploiting waveform diversity techniques and multiple-input/multiple-output adaptive processing algorithms. Develop operationally relevant approaches to the employment of distributed signal processing techniques to obtain high spatial resolution with limited transmit bandwidth, and to detect challenging targets such as those with low radar cross-section. Characterize and assess emerging over-the-horizon (OTH) radar technologies using modeling and simulation, experimentation, and demonstrations. Identify further research and development needed to advance the state-of-the-art in OTH radar.</p> <p><i>FY 2012 Base Plans:</i> Continue to develop radar electronic protection techniques based upon technical advances in waveform diversity, multiple inputs, multiple outputs (MIMO) array configurations, and multi-channel adaptive processing. Demonstrate the use of RF tomography to create imagery and detect movers in a complex spectral environment. Continue modeling simulation, experimentation, and demonstrations of advanced technologies to field over</p>	14.574	22.423	17.650	-	17.650

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
horizon radar technologies. Build and test a prototype OTH radar to evaluate candidate technologies to include MIMO and adaptive processing to improve our understanding of ionosphere phenomenology.					
<i>FY 2012 OCO Plans:</i>					
<i>Title:</i> Major Thrust 5. <i>Description:</i> Develop hybrid space-based sensor solutions to be responsive to space needs and detect difficult targets. Develop jam-resistant space-qualified time, position, and velocity sensors. <i>FY 2010 Accomplishments:</i> Investigated optimal means of tightly coupling networked sensing platforms with their reference systems by leveraging onboard sensors observations as feedback to robustly calibrate the distributed, multi-platform reference. Conducted ground-based demonstration of modular payload building blocks compatible with operationally responsive space rapid integration requirements. <i>FY 2011 Plans:</i> Continue to investigate optimal means of tightly coupling networked sensing platforms with their reference systems by leveraging onboard sensor observations as feedback to robustly calibrate the distributed, multi-platform reference. Demonstrate tightly coupled reference system technology both non-real-time and real time. <i>FY 2012 Base Plans:</i> Develop strategies to optimize reference technologies for distributed sensing missions. Explore alternatives when GPS is degraded or denied. Reduce size, weight, and power of inertial components. Enhance precision of GPS and non-GPS reference technologies. <i>FY 2012 OCO Plans:</i>	5.221	4.103	4.931	-	4.931
<i>Title:</i> Major Thrust 6. <i>Description:</i> Study adaptive processing techniques for large, multi-mission, space-based conformal arrays to meet the demands of wide area sensing in severe clutter and interference environments. <i>FY 2010 Accomplishments:</i>	1.718	0.821	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 627622: <i>RF Sensors & Countermeasures Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Evaluated advanced surface moving target indication algorithms and computing architectures for high altitude, environmentally constrained radio frequency sensing system applications. Evaluated emissions mapping and bistatic radar techniques for providing space situational awareness.</p> <p>FY 2011 Plans: Demonstrate an integrated radio frequency and electro-optical modeling and simulation toolset for an advanced space situational awareness architecture. Develop electronic protection (EP) techniques for space-based sensors, exploiting waveform diversity techniques and multiple-input/multiple-output adaptive processing algorithms.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 7.</p> <p>Description: Develop multi-band and multi-beam forming technologies. Address technologies for antenna array operations in dynamic sensor networks.</p> <p>FY 2010 Accomplishments: Demonstrated a responsive space payload.</p> <p>FY 2011 Plans: Develop an electronic chassis framework (toolkit) for applying Open Architectures (OA) to DOD sensing systems. Develop W-band solid state power amplifier for wideband SATCOM applications.</p> <p>FY 2012 Base Plans: Further develop an electronic chassis framework (toolkit) for applying Open Architectures (OA) to DOD sensing systems. Further develop and demonstrate a W-band solid state power amplifier for wideband SATCOM applications.</p> <p>FY 2012 OCO Plans:</p>	0.160	1.902	3.907	-	3.907
<p>Title: Major Thrust 8.</p> <p>Description: Develop sensor techniques to achieve highly accurate and robust navigation performance for hypersonic air vehicles in prompt global strike applications.</p>	1.112	2.318	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602204F: <i>Aerospace Sensors</i>	PROJECT 627622: <i>RF Sensors & Countermeasures Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><i>FY 2010 Accomplishments:</i> Designed a radio-frequency hardware-in-the-loop testbed to implement hypersonic air vehicle plasma characteristics, platform trajectories, and highly accurate and robust navigation techniques for space-based applications. Demonstrated a constructive systems engineering model to assess hypersonic navigation techniques in terms of measures of performance and warfighter utility.</p> <p><i>FY 2011 Plans:</i> Complete the design of a radio-frequency hardware-in-the-loop testbed to implement hypersonic air vehicle plasma characteristics, platform trajectories, and highly accurate and robust navigation techniques for space-based applications. Continue to demonstrate a constructive systems engineering model to assess hypersonic navigation techniques in terms of measures of performance and warfighter utility.</p> <p><i>FY 2012 Base Plans:</i></p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	35.772	55.696	39.319	-	39.319

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	117.324	111.857	115.285	-	115.285	114.885	119.442	125.677	128.067	Continuing	Continuing
621010: <i>Space Survivability & Surveillance</i>	52.736	48.216	43.259	-	43.259	42.315	42.214	42.628	43.435	Continuing	Continuing
624846: <i>Spacecraft Payload Technologies</i>	16.545	20.299	21.601	-	21.601	21.767	20.705	17.846	18.188	Continuing	Continuing
625018: <i>Spacecraft Protection Technology</i>	6.505	7.556	5.922	-	5.922	7.249	8.723	9.944	10.125	Continuing	Continuing
628809: <i>Spacecraft Vehicle Technologies</i>	41.538	35.786	44.503	-	44.503	43.554	47.800	55.259	56.319	Continuing	Continuing

Note
In FY 2011, increases in funding are due to the movement of technologies from PE 0603401F, Advanced Spacecraft Technology, to this PE in order to better align the technology readiness levels of these efforts.

A. Mission Description and Budget Item Justification
This PE focuses on four major areas. First, space environmental protection develops technologies to understand, mitigate, and exploit effects of weather and geophysics environments on the design and operation of Air Force systems. Second, spacecraft payload technologies improve satellite payload operations by investigating advanced component and subsystem capabilities. Third, spacecraft protection develops technologies for protecting U.S. space assets in potential hostile settings. The last major area, spacecraft vehicles, focuses on spacecraft platform and control technologies, and their interactions. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary space technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	119.125	111.857	117.238	-	117.238
Current President's Budget	117.324	111.857	115.285	-	115.285
Total Adjustments	-1.801	-	-1.953	-	-1.953
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.665	-			
• Other Adjustments	-0.136	-	-1.953	-	-1.953

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

	FY 2010	FY 2011
Project: 621010: <i>Space Survivability & Surveillance</i>		
Congressional Add: <i>AFRL Seismic Research Program.</i>	4.979	-
Congressional Add Subtotals for Project: 621010	4.979	-
Project: 624846: <i>Spacecraft Payload Technologies</i>		
Congressional Add: <i>Reconfigurable Electronic and Non-Volatile Memory Research.</i>	0.797	-
Congressional Add Subtotals for Project: 624846	0.797	-
Project: 628809: <i>Spacecraft Vehicle Technologies</i>		
Congressional Add: <i>Center for Solar Electricity and Hydrogen.</i>	3.983	-
Congressional Add: <i>Advanced Modular Avionics for Operationally Responsive Satellite Use.</i>	2.470	-
Congressional Add: <i>Center for Space Entrepreneurship.</i>	1.593	-
Congressional Add: <i>Mission Design and Analysis Tool.</i>	1.593	-
Congressional Add Subtotals for Project: 628809	9.639	-
Congressional Add Totals for all Projects	15.415	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 621010: <i>Space Survivability & Surveillance</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
621010: <i>Space Survivability & Surveillance</i>	52.736	48.216	43.259	-	43.259	42.315	42.214	42.628	43.435	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies to exploit the space environment for warfighter's future capabilities. The project focuses on characterizing and forecasting the battlespace environment for realistic space system design, modeling, and simulation, as well as the battlespace environment's effect on space systems' performance. It includes technologies to specify and forecast the environment from 'mud to sun' for planning operations and ensuring uninterrupted system performance, optimize space-based surveillance operations, and allow the opportunity to mitigate or exploit the space environment for both offensive and defensive operations. Finally, this project includes the seismic research program that supports national requirements for monitoring nuclear explosions.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop technologies for specifying, monitoring, predicting, and controlling space environmental conditions hazardous to Department of Defense (DoD) operational space systems.</p> <p>FY 2010 Accomplishments: Completed trade studies for measuring coronal and interplanetary magnetic fields using new wide-field radio arrays. Developed empirical flare prediction models and started development of physics-based flare forecast models. Analyzed energetic particle measurements to understand the dynamics of the radiation belts. Investigated new technologies for simulation and mitigation of hazards due to spacecraft electrostatic charging and discharging.</p> <p>FY 2011 Plans: Develop improved solar energetic particle models. Complete validation of energetic particle measurements in multiple orbital regimes. Incorporate new simulation technologies into model of spacecraft electromagnetic and plasma environment.</p> <p>FY 2012 Base Plans: Complete Improved Solar Observing Optical Network-data-based solar flare prediction tool. Develop a new instrument to measure energetic electrons, ions, and neutral atoms in low earth orbit. Refine and expand models of the radiation belts using new data sets from recently launched spacecraft.</p> <p>FY 2012 OCO Plans:</p>	8.109	8.800	7.662	-	7.662

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2.</p> <p>Description: Develop spectral signature libraries, target detection techniques, and decision aids for application to space-based sensors and surveillance systems.</p> <p>FY 2010 Accomplishments: Demonstrated aircraft-based detection of large booster missile launch through optically thick sunlit clouds using existing hypertextual (HT) image processing. Started focused effort on thermal atmospheric model validation and inversion. Initiated development of sensor system to characterize space object orbital maneuver. Developed space-based multi-phenomenology Space Situational Awareness (SSA) sensor payload. Initiated thermal infrared (IR) imaging spectrometer feasibility for space missions.</p> <p>FY 2011 Plans: Demonstrate space-based detection of large booster missile launch through optically thick sunlit clouds. Conduct critical test of maneuver characterization sensor system with go-no-go decision point. Develop multi-phenomenology SSA sensor system for space-based SSA. Continue study of thermal IR imaging spectrometer feasibility for space missions.</p> <p>FY 2012 Base Plans: Investigate space-based HT detection methods. Continue to develop a space-based wide area search sensor system to monitor and characterize resident space objects and maneuver signatures. Refine concepts for space-based thermal IR hyperspectral imaging payloads. Develop atmospheric compensation and temperature-emissivity separation models for space-based thermal infrared hyperspectral imaging.</p> <p>FY 2012 OCO Plans:</p>	12.254	12.854	10.935	-	10.935
<p>Title: Major Thrust 3.</p> <p>Description: Develop techniques, forecasting tools, and sensors for ionospheric specification and forecasting, space-based geolocation demonstrations, and determination of radar degradation.</p> <p>FY 2010 Accomplishments: Developed more capable, less costly ground sensors for ionospheric electron density and scintillation parameters using digital radio technology and newly available satellite signals. Validated Communications/Navigation Outage Forecasting System instruments and products for operational uses. Implemented semi-empirical high-latitude model to couple solar storm effects to the low latitude ionosphere to improve scintillation</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>forecasts. Assessed ionospheric effects on the performance of lower frequency space-radar applications. Validated scintillation and electron density profiles from radio occultation techniques for operational algorithm development.</p> <p>FY 2011 Plans: Deliver validated algorithm to simulate ionospheric effects on wideband radio frequency waveforms for arbitrary propagation paths to support many applications. Improve assimilative ionospheric nowcast models and identify deficiencies in forecast models. Test physics-based neutral density models forecasting capabilities, particularly during magnetic storms.</p> <p>FY 2012 Base Plans: Investigate methods to exploit grid-free calculations of plasma processes in the magnetosphere and ionosphere, as well as in the solar atmosphere and solar wind. Study energy flow between solar and terrestrial environments. Study plasma instabilities and plasma processes in the equatorial and solar ionospheres. Incorporate coupled physics-based models into space weather forecasts.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Develop High-frequency Active Auroral Research Program (HAARP) site transmitting and diagnostic instrument infrastructure.</p> <p>FY 2010 Accomplishments: Conducted research to mitigate charged particle effects on space systems and operations with coordinated Demonstration and Science Experiment (DSX) satellite studies and feedback from physical models.</p> <p>FY 2011 Plans: Conduct research programs to develop controlled processes of triggered optical and infrared emissions and radio scintillation for potential DoD applications. Develop experiment using DSX satellite and HAARP based on studies and feedback from physical models.</p> <p>FY 2012 Base Plans: Conduct research to characterize the interactions of radio waves and charged particles in the earth's radiation belts, using DSX satellite experiments. Conduct applications-related demonstrations exploiting ionosphere ducts for very long range, beyond the horizon, communications and surveillance purposes. Develop Radiation Belt</p>	12.020	11.059	10.902	-	10.902

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 621010: <i>Space Survivability & Surveillance</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Remediation (RBR) end-to-end model and validate to improve understanding of wave particle interaction, space transmitter, and lightning phenomenology.					
FY 2012 OCO Plans:					
Title: Major Thrust 5.	6.109	6.388	6.151	-	6.151
Description: Develop seismic technologies to support national requirements for monitoring nuclear explosions with special focus on regional distances less than 2,000 kilometers from the sensors.					
FY 2010 Accomplishments: Refined and expanded the applicability of different techniques for automated processing of increasing numbers of seismic events. Conducted research on causes of challenges in high-frequency regional discrimination. Integrated results of seismic calibration and observational studies of seismic wave propagation, including propagation in Eurasia, into a unified model. Conducted detailed studies of particular challenge areas in local seismic monitoring.					
FY 2011 Plans: Test and implement refined techniques for automated processing of increasing numbers of seismic events. Test and refine unified model results of seismic calibration and observational studies of seismic wave propagation, including propagation in Eurasia. Conduct detailed studies of particular challenge areas in local seismic monitoring.					
FY 2012 Base Plans: Migrate unified models of seismic calibration and wave propagation in Eurasia to three-dimensional physics-based models. Evaluate the results of using three-dimensional earth models in automated processing of seismic events for some regions of high interest. Test potential improvements in high-frequency regional discrimination. Continue detailed studies of particular challenge areas in local seismic monitoring.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	47.757	48.216	43.259	-	43.259
	FY 2010	FY 2011			
Congressional Add: AFRL Seismic Research Program.	4.979	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 621010: <i>Space Survivability & Surveillance</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	4.979	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 624846: <i>Spacecraft Payload Technologies</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624846: <i>Spacecraft Payload Technologies</i>	16.545	20.299	21.601	-	21.601	21.767	20.705	17.846	18.188	Continuing	Continuing

Note

NOTE: In FY 2011, increases in funding are due the movement of technologies from PE 0603401F, Advanced Spacecraft Technology, to this PE in order to better align the technology readiness levels of these efforts.

A. Mission Description and Budget Item Justification

This project develops advanced technologies that enhance spacecraft payload operations by improving component and subsystem capabilities. The project focuses on four primary areas: (1) development of advanced, space-qualified, survivable electronics, and electronics packaging technologies; (2) development of advanced space data generation and exploitation technologies, including infrared, Fourier transform hyperspectral imaging, polarimetric sensing, and satellite antenna subsystem technologies; (3) development of high-fidelity space simulation models that support space-based surveillance and space asset protection research and development for the warfighter; and (4) development of advanced networking, radio frequency, and laser communications technologies to support next generation satellite communication systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop advanced infrared device technologies that enable hardened space detector arrays with improved detection to perform acquisition, tracking, and discrimination of space objects.</p> <p>FY 2010 Accomplishments: Expanded investigation of spectral agility to longer wavelengths. Expanded investigation of field enhancement technologies. Completed final demonstration of optical amplification using quantum interference.</p> <p>FY 2011 Plans: Demonstrate tuning from 15 to 20 microns in 1 micron increments. Demonstrate field enhancement technology. Complete predictive capability for next generation of large format technology challenges. Initiate predictive capability for next generation of large format detector array and readout array technology challenges. Begin space object remote characterization study.</p> <p>FY 2012 Base Plans: Expand predictive capability for next generation large format detector array and readout array technology challenges toward Wide Area, Global Access Detection and Tracking. Further explore space object remote</p>	3.901	4.207	6.099	-	6.099

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>		R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>		PROJECT 624846: <i>Spacecraft Payload Technologies</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
<p>characterization for adaptive, comprehensive space situational awareness (SSA). Study effects of surface roughness on distant object polarization signature. Develop methodologies and technologies for on-orbit payload calibration and planning, emphasizing electro-optical payloads.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop spectral sensing and data exploitation methodologies for military imaging and remote sensing applications.</p> <p>FY 2010 Accomplishments: Completed validation of advanced imaging technology predictive models for SSA concepts of operation. Advanced simulation capability to enhance accuracy and usability of these models.</p> <p>FY 2011 Plans: Further refine models for space-based spectral imaging to include additional space-based situational awareness imaging concepts and operationally responsive SSA scenarios.</p> <p>FY 2012 Base Plans: Continue analysis and basic experimentation in new sensing methods using radio frequency (RF) bands, polarimetry, and non-traditional interferometric techniques.</p> <p>FY 2012 OCO Plans:</p>					
	3.828	5.485	5.388	-	5.388
<p>Title: Major Thrust 3.</p> <p>Description: Develop technologies for space-based payload components such as radiation-hardened electronic devices, micro-electro-mechanical system devices, and advanced electronics packaging.</p> <p>FY 2010 Accomplishments: Initiated study of phase change materials and began to develop new classes of electronics that enable efficient analog computing. Developed methods of hardening generation-after-next electronic devices to enable a factor of two increases in computing performance. Incorporated nanoelectronic devices into new classes of detectors and transistors to enable terahertz operation. Investigated development of radiation hardened plug-and-play interface module to support rapid development or reconfiguration of spacecraft hardware.</p> <p>FY 2011 Plans:</p>					
	3.411	5.241	4.866	-	4.866

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Apply the basic physical understanding of the operation of phase change materials to analog computing and device trimming applications. Transition radiation mitigation processes using minimally invasive techniques into libraries at major commercial foundries at the 95 nanometer (nm) and 65nm nodes. Initiate program to capitalize on high performance thermoelectric cooling devices applied to focal plane arrays.</p> <p>FY 2012 Base Plans: Investigate high power microwave hardening techniques for satellite systems to develop methodologies to mitigate against narrowband high power microwaves in a wide frequency band. Begin research on advanced system-on-chip integration for improved performance of space sensor systems. Complete development of radiation hardened plug-and-play interface module for reconfigurable spacecraft hardware. Initiate development of integrated modules using three-dimensional techniques to reduce size, weight, and power and increase performance.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Modeling and simulation tools for space-based ground surveillance systems, rendezvous and proximity operations, imaging of space systems, distributed satellite architecture, and space control payloads.</p> <p>FY 2010 Accomplishments: Completed SSA detection analysis tools and began developing engineering and military utility models for object identification to support SSA and defensive space control (DSC). Refined development of first-generation decision support tools for space superiority. Finalized software system testbed. Began testing of tools on testbed. Began development of resource management tools for space superiority.</p> <p>FY 2011 Plans: Begin development of engineering, military utility, and cost tools that model object characterization for space superiority analysis of SSA and DSC technologies. Integrate data from flight experiments to refine simulations. Finish development of first-generation decision support tools for space superiority. Expand testbed to include resource management testing capability.</p> <p>FY 2012 Base Plans:</p>	3.699	4.481	4.697	-	4.697

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop engineering and military utility models for space superiority analysis of SSA and defensive operations technologies. Support autonomous and responsive space flight experiments with cost modeling and trade studies.					
<i>FY 2012 OCO Plans:</i>					
<i>Title:</i> Major Thrust 5.					
<i>Description:</i> Develop technologies for next-generation space communications terminals and equipment and methods/techniques to enable future space system operational command and control concepts.					
<i>FY 2010 Accomplishments:</i> Began development of engineering model of critical technology to satellite communication and ground terminals.	0.909	0.885	0.551	-	0.551
<i>FY 2011 Plans:</i> Complete engineering model and select technology for space experiment on enhanced communication platform.					
<i>FY 2012 Base Plans:</i> Research technologies/components that support optical communication, reconfigurable and cognitive communication, advanced RF communication, and communication security to increase the capacity and flexibility of current and future space protected communication system concepts.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	15.748	20.299	21.601	-	21.601
	FY 2010	FY 2011			
<i>Congressional Add:</i> Reconfigurable Electronic and Non-Volatile Memory Research.	0.797	-			
<i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.					
<i>FY 2011 Plans:</i>					
Congressional Adds Subtotals	0.797	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 624846: <i>Spacecraft Payload Technologies</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 625018: <i>Spacecraft Protection Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625018: <i>Spacecraft Protection Technology</i>	6.505	7.556	5.922	-	5.922	7.249	8.723	9.944	10.125	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops the technologies for protecting U.S. space assets in potential hostile environments to assure continued space system operation without performance loss in support of warfighter requirements. The project focuses on identifying and assessing spacecraft system vulnerabilities, developing threat warning technologies, and developing technologies to mitigate the effects of both intentional and unintentional threats.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	6.505	7.556	5.922	-	5.922
Description: Develop satellite threat warning technologies and tools for space defense. Exploit on-board inherent satellite resources, satellite-as-a-sensor, and self-aware satellite technologies.					
FY 2010 Accomplishments: Explored capabilities of potential defensive subsystems through laboratory testing. Developed techniques to exploit existing satellite sensors for defense.					
FY 2011 Plans: Complete laboratory testing of potential defensive subsystems. Develop performance goals using engineering models. Transition dual usage sensor technology to multiple satellite systems.					
FY 2012 Base Plans: Develop technologies for on-orbit threat detection, assessment, and response, including development of algorithms for pursuit-evasion, space-based tasking, and co-orbital threat detection. Reduce size, weight, and power requirements for next generation proximity detection sensors.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	6.505	7.556	5.922	-	5.922

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 625018: <i>Spacecraft Protection Technology</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>				PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
628809: <i>Spacecraft Vehicle Technologies</i>	41.538	35.786	44.503	-	44.503	43.554	47.800	55.259	56.319	Continuing	Continuing

Note

NOTE: In FY 2011, increases in funding are due to realignment of technologies from PE 0603401F, Advanced Spacecraft Technology, to this PE in order to better align the technology readiness levels of these efforts.

A. Mission Description and Budget Item Justification

This project focuses on three major space technology areas: spacecraft platforms (e.g., structures, controls, power, and thermal management); satellite control (e.g., signal processing and control); and space experiments of maturing technologies for space qualification.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop technologies for advanced space platform subsystems such as cryocoolers, compact, high efficiency solar power cells and arrays, and innovative power generation concepts.</p> <p>FY 2010 Accomplishments: Refined and validated cryocooler component and system models with experimental data. Completed models/validation of pulse tube and started models/validation of inertance tube, regenerator, and compressor. Investigated thermodynamic loss mechanisms in regenerative cycle cryocoolers through computational fluid dynamics (CFD) models, including two-stage pulse-tube cryocoolers and multi-stage coolers from 110 degrees Kelvin to 10 degrees Kelvin. Developed subcell technology for thin-film tandem solar cell traceable to greater than 20% efficiency. Explored the development of material growth and device structures for solar cells traceable to 40% or higher ultra-high efficiency solar cells.</p> <p>FY 2011 Plans: Complete cryocooler component and system models with experimental data, and begin to analyze cryocoolers as a single unit. Begin to develop full-scale design equations for cryocoolers, increasing efficiency by 20% and decreasing manufacturing time by 200%. Demonstrate integrated, monolithic thin-film tandem solar cell. Demonstrate subcomponents of ultra high efficiency solar cell.</p> <p>FY 2012 Base Plans:</p>	4.543	4.792	7.583	-	7.583

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Increase cryocooler efficiency from 12% to 30% through in-house modeling, energy analysis of single and multi-stage coolers, and distributed cooling. Model spacecraft thermal radiation signature phenomenology to understand the physics of IR sensing of resident space objects. Continue development of materials and concepts for 40% or greater solar cells. Demonstrate cell interconnect and module technologies to enable flexible arrays.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop revolutionary and enabling technologies, including lighter weight, lower cost, high performance structures for space platforms; guidance, navigation, and controls hardware and software for next generation responsive space and space superiority space systems; and to minimize spacecraft development schedules and cost.</p> <p>FY 2010 Accomplishments: Developed system-level deployable structures for RF frequencies. Initiated development of integrated thermal management subsystems for responsive space class of satellites. Began development of guidance, navigation, and control algorithms for rapid integration and test of satellite hardware. Began development of advanced data association algorithms for space object tracking. Investigated development of modular plug-and-play spacecraft structural panels.</p> <p>FY 2011 Plans: Refine development of integrated thermal management subsystems for responsive space satellites. Develop nano-reinforced structures for space applications. Develop advanced guidance, navigation, and control algorithms for rapid integration and test of satellite hardware. Develop autonomous guidance, navigation, and control algorithms for proximity operations.</p> <p>FY 2012 Base Plans: Complete integrated thermal management subsystem for responsive space satellites. Develop novel technologies for high-efficiency deployable structures for RF frequencies and electro-optical payloads for SSA. Develop automated guidance, navigation, and control subsystem design tools for responsive space. Investigate non-cooperative control techniques for orbital debris removal applications. Develop radiation-hardened plug-</p>	12.350	16.906	15.700	-	15.700

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
and-play electronics to enable rapid spacecraft build and reduce spacecraft cost. Develop technologies for integrated satellite bus checkout and sensor calibration using autonomous flight architecture.					
<i>FY 2012 OCO Plans:</i>					
<i>Title:</i> Major Thrust 3.	15.006	14.088	21.220	-	21.220
<i>Description:</i> Develop flight experiments to improve the capabilities of existing operational space systems and to enable new transformational space capabilities.					
<i>FY 2010 Accomplishments:</i> Conducted ground-based experiments. Began Demonstration and Science Experiment (DSX) system-level integration and test. Completed DSX payload system-level functional and environmental tests. Developed ground support equipment and software.					
<i>FY 2011 Plans:</i> Continue ground-based experiments in support of radiation belt remediation technologies. Complete DSX and payload integration and functional/environmental testing for radiation belt remediation payload. Complete development of ground support equipment and software.					
<i>FY 2012 Base Plans:</i> Complete assembly, integration, and test of the DSX satellite to launch ready. Begin launch readiness preparations, electrical trailblazer, insertion of flight batteries and communications security equipment, and regression testing with satellite operations center in preparation for integration on the launch vehicle.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	31.899	35.786	44.503	-	44.503

	FY 2010	FY 2011
<i>Congressional Add:</i> Center for Solar Electricity and Hydrogen.	3.983	-
<i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.		
<i>FY 2011 Plans:</i>		
<i>Congressional Add:</i> Advanced Modular Avionics for Operationally Responsive Satellite Use.	2.470	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602601F: <i>Space Technology</i>	PROJECT 628809: <i>Spacecraft Vehicle Technologies</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:		
Congressional Add: Center for Space Entrepreneurship. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Mission Design and Analysis Tool. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Adds Subtotals	9.639	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	57.598	61.330	60.692	-	60.692	64.676	71.780	74.415	75.978	Continuing	Continuing
622068: <i>Advanced Guidance Technology</i>	17.622	20.039	20.832	-	20.832	22.093	24.351	25.446	25.970	Continuing	Continuing
622502: <i>Ordnance Technology</i>	39.976	41.291	39.860	-	39.860	42.583	47.429	48.969	50.008	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program investigates, develops, and establishes the technical feasibility and military utility of advanced guidance and ordnance technologies for conventional air-launched munitions. Program supports core technical competencies of target identification and tracking, guidance navigation and control, munition systems, explosives, fuzes, and warheads/damage mechanisms. Technologies to be developed include blast, fragmentation, penetrating and low-collateral damage warheads, variable height/depth fuzing, precise guidance, and high performance and insensitive explosives. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	58.044	61.330	60.765	-	60.765
Current President's Budget	57.598	61.330	60.692	-	60.692
Total Adjustments	-0.446	-	-0.073	-	-0.073
• Congressional General Reductions	-	-	-	-	-
• Congressional Directed Reductions	-	-	-	-	-
• Congressional Rescissions	-	-	-	-	-
• Congressional Adds	-	-	-	-	-
• Congressional Directed Transfers	-	-	-	-	-
• Reprogrammings	-	-	-	-	-
• SBIR/STTR Transfer	-0.448	-	-	-	-
• Other Adjustments	0.002	-	-0.073	-	-0.073

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622068: <i>Advanced Guidance Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622068: <i>Advanced Guidance Technology</i>	17.622	20.039	20.832	-	20.832	22.093	24.351	25.446	25.970	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project investigates, develops, and evaluates conventional munitions advanced guidance technologies to establish technical feasibility and military utility of advanced guidance seekers, weapon aerodynamics, navigation and control, and guidance subsystem integration/simulation. Project payoffs include: adverse-weather, networked, and autonomous precision guidance capability; increased number of kills per sortie; increased aerospace vehicle survivability; improved reliability and affordability; and improved survivability and effectiveness of conventional weapons.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop advanced seeker technologies for air-delivered munitions to provide high confidence target discrimination and classification, precise target location, and robust terminal tracking.</p> <p>FY 2010 Accomplishments: Continued laboratory demonstration of test components for laser ranging seeker and optical seeker that uses multi-discriminate signatures to improve targeting obscure targets. Continued development of multimode seeker that provides improved performance using two complimentary wavelength bands, verified polarization theory models through simulation, conducted tests on optical flow enhanced seeker, and applied the neuro-physiology of insects to guide small vehicles to moving targets in urban-like environments.</p> <p>FY 2011 Plans: Complete model verification and demonstration of optical seeker technologies to improve targeting of obscure targets. Continue development and evaluation of test components for laser ranging, multimode, and synthetic aperture and high resolution radar seeker technologies for guidance in adverse weather. Continue developing theory for seeker/sensor fusion, autonomous target recognition using differential geometry and topology, and application of neuro-physiology of insects to guide small vehicles to moving targets. Investigate guidance technologies that optimize delivery of selectable effects munitions through countermeasures. Begin development of seeker technology for adverse weather capability for small weapons, hypersonic environments, and discriminating tunnels and surface aimpoints for boosted/high speed penetrators.</p> <p>FY 2012 Base Plans:</p>	1.707	1.940	2.025	-	2.025

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622068: <i>Advanced Guidance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue laboratory development and evaluation of test components for laser ranging, improved multimode, adverse weather synthetic aperture and high resolution radar modes seekers. Begin technology development of very low cost, adverse weather capable, radar seeker for small weapons. Develop theory for seeker sensor fusion and autonomous target recognition, and study multi weapon and conformal apertures for enhanced resolution and beam forming on small cooperative weapons. Continue applying the neuro-physiology of insects to guide small vehicles to moving targets, investigate guidance technologies that optimize delivery of selectable effects munitions through countermeasures and develop dual mode seeker for hypersonic environments and discriminating tunnels and surface aimpoints for boosted/high speed penetrators.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2</p> <p>Description: Develop advanced weapon aerodynamic, control, navigation, and networking technologies for air-delivered munitions to provide precise, agile flight, networked effects, and immunity to countermeasures.</p> <p>FY 2010 Accomplishments: Continued evaluating navigation systems within Global Positioning System (GPS) jamming environments. Developed algorithms to use wide field of view optical imager data to augment map-matching techniques, enabling navigation under GPS-denied conditions. Continued maturing technologies allowing weapons to communicate in a secure, low probability of detection mode with launch platforms, submunitions, and/or ground elements.</p> <p>FY 2011 Plans: Continue developing and evaluating advanced weapon airframe and control concepts to achieve high levels of agility and maneuverability, developing multi functional structures, and evaluating navigation systems within GPS jamming environments. Continue development of algorithms to use wide field of view optical imager data, enabling navigation under GPS-denied conditions. Determine feasibility of highly compact, high throughput avionics processors and mature technologies allowing weapons to communicate and exploit information in a secure, low probability of detection mode with launch platforms, other weapons, and/or ground elements. Begin developing robust control methodologies for terminal guidance and control and actuation technologies for future weapon concepts.</p> <p>FY 2012 Base Plans:</p>	7.909	8.990	9.343	-	9.343

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622068: <i>Advanced Guidance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue development of advanced weapon airframe and control concepts to achieve high levels of agility and maneuverability, development of multi functional structures, and evaluating navigation systems within GPS jamming environments. Continue development of algorithms to use wide field of view optical imager data, enabling navigation under GPS-denied conditions. Develop highly compact, high throughput avionics processors, and continue maturing technologies allowing weapons to communicate and exploit information in a secure, low probability of detection mode with other systems. Continue developing nonlinear, robust control methodologies for future weapons, such as high speed terminal guidance on long range strike weapons and control and actuation technologies for boosted penetrators.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3</p> <p>Description: Develop guidance subsystem integration and evaluation technologies to provide open and closed loop ground testing, flight test risk reduction, and digital simulation of advanced concepts.</p> <p>FY 2010 Accomplishments: For precision guided munitions, investigated issues of integrating miniaturized components and functionality in various flight environments, and refined the set of interoperable simulations to evaluate emerging munitions guidance technologies. Simulated different highly innovative concepts and approaches in guidance and control technology. Began integrated multi-weapon search and attack demonstration on a time critical moving target.</p> <p>FY 2011 Plans: Continue investigating precision guided munition integration technology issues and functionality in various flight environments and refining the set of interoperable simulations to evaluate emerging munitions guidance technologies. Continue evaluating multi-weapon search and attack technologies on a time critical moving target. Simulate highly innovative concepts and approaches in guidance and control technology, and develop capability to test and refine development programs and future weapon concepts in a realistic operational environment. Begin development of seeker scene projection technologies and dynamic simulation technologies for terminally guided weapons.</p> <p>FY 2012 Base Plans: Investigate precision guided munition integration technology issues and functionality in various flight environments and refine the set of interoperable simulations to evaluate emerging munitions technologies. Simulate highly innovative concepts and approaches in guidance and control technology. Develop capability</p>	8.006	9.109	9.464	-	9.464

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
to test and refine development programs and future weapon concepts in a realistic operational environment. Continue multi-weapon search and attack technologies on a time critical moving target. Begin build-up of test technologies for evaluating higher speed weapon guidance subsystem. <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	17.622	20.039	20.832	-	20.832

C. Other Program Funding Summary (\$ in Millions)										
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy
Not Applicable.

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622502: <i>Ordnance Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
622502: <i>Ordnance Technology</i>	39.976	41.291	39.860	-	39.860	42.583	47.429	48.969	50.008	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, submunitions, 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 submunition dispensing; low-cost airframe/subsystem components and structures; and reduced aerospace vehicle and weapon drag.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate and develop energetic materials technology that can maximize weapon lethality, while applying appropriate safety and security features.</p> <p>FY 2010 Accomplishments: Continued developing the materials properties database to develop system-level models for predicting initiation. Continued development of explosive fills that reduce pre-detonation during high "G" loading. Investigated low-density energetic materials for use in micro-munitions. Investigated high-density case materials capable of tailoring or enhancing warhead performance.</p> <p>FY 2011 Plans: Complete the materials properties data base to develop system level models for predicting initiation. Test and model explosive fills that reduce pre-detonation during high "G" loading. Develop low-density energetic materials for micro-munitions applications. Investigate high-density case materials to tailor or improve warhead performance.</p> <p>FY 2012 Base Plans: Test and model explosive fills that reduce pre-detonation during high "G" loading. Develop low-density energetic materials for micro-munitions applications. Investigate high-density case materials to tailor or improve warhead performance.</p> <p>FY 2012 OCO Plans:</p>	5.622	5.810	5.589	-	5.589
<p>Title: Major Thrust 2.</p>	6.103	6.300	6.072	-	6.072

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622502: <i>Ordnance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Investigate and develop fuzes for air-delivered weapon applications to develop novel energetic initiation concepts, penetration fuzing, point burst fuzes, and develop predictive models.</p> <p>FY 2010 Accomplishments: Continued investigation of novel methods to initiate explosives, including new modeling and testing techniques. Investigated the mechanical environment that a fuze must survive during hard target penetration events. Explored ground profiling imaging fuze technology. Began investigating a hardened chip fuze that uses integrated logic.</p> <p>FY 2011 Plans: Continue investigating novel methods to initiate explosives, including new modeling and testing techniques. Continue to investigate and characterize the mechanical environment that a fuze must survive during hard target penetration events. Continue to explore ground profiling imaging fuze technology. Continue development of a hardened chip fuze that uses integrated logic.</p> <p>FY 2012 Base Plans: Continue investigating novel methods to initiate explosives, including new modeling and testing techniques. Continue to investigate and characterize the mechanical environment that a fuze must survive during hard target penetration events. Continue to explore ground profiling imaging fuze technology. Continue development of a hardened chip fuze that uses integrated logic.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 3.</p>					
<p>Description: Investigate and develop advanced warhead kill mechanisms, such as adaptable warheads, directional control, fragmenting warheads, and application of reactive metals.</p> <p>FY 2010 Accomplishments: Continued investigation of high strength next generation warhead cases with the eventual goal of terradynamic steering. Continued evaluation of shaped charges to defeat medium and heavy armor. Continued investigation of micro-damage technologies to neutralize electronics with air delivered small robotic weapons. Explored compact lethality warhead technologies for use in urban terrain. Began investigating directional warhead concepts employing reactive fragments to improve standoff kills for non-direct hit encounters. Developed numerical algorithms for material-to-material interface dynamics, loading, and vibration during high speed</p>	6.817	7.040	6.791	-	6.791

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622502: <i>Ordnance Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>penetration. Investigated techniques to control, direct, and focus the energy release from explosives in real-time by means of applying small amounts of electromagnetic energy.</p> <p>FY 2011 Plans: Develop compact lethality warhead technologies for use in urban terrain. Continue investigating directional warhead concepts employing reactive fragments to improve standoff kills for non-direct hit encounters. Continue developing numerical algorithms for material-to-material interface dynamics, loading, and vibration during high speed penetration. Continue investigating techniques to control, direct, and focus the energy release from explosives in real-time by means of applying small amounts of electromagnetic energy. Investigate novel warhead designs that provide warfighting capability to deliver selectable effects on targets.</p> <p>FY 2012 Base Plans: Develop compact lethality warhead technologies for use in urban terrain. Continue investigating directional warhead concepts employing reactive fragments to improve standoff kills for non-direct hit encounters. Continue developing numerical algorithms for material-to-material interface dynamics, loading, and vibration during high speed penetration. Continue investigating techniques to control, direct, and focus the energy release from explosives in real-time by means of applying small amounts of electromagnetic energy. Investigate novel warhead designs that provide warfighting capability to deliver selectable effects on targets.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Using a system approach, investigate and develop ordnance concepts by making technology trades between fuzes, warheads, and explosives and by improving weapon carriage, release, and dispensing.</p> <p>FY 2010 Accomplishments: Completed investigation of reaction jet control for dual role missile technology. For precision guided munitions, investigated issues of integrating miniaturized components and functionality in various flight environments. Developed and used a set of interoperable simulations to evaluate emerging munition technologies. Developed and enhanced models for micromunitions, penetrators, and counter-chemical, biological, radiological, and nuclear effects.</p> <p>FY 2011 Plans: Continue investigation of precision guided munition integration issues and functionality in various flight environments. Continue building and using interoperable simulations to evaluate emerging technologies.</p>	21.434	22.141	21.408	-	21.408

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602602F: <i>Conventional Munitions</i>	PROJECT 622502: <i>Ordnance Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue developing and enhancing new models and improvements for micromunitions, penetrators, and counter-chemical, biological, radiological, and nuclear effects. FY 2012 Base Plans: Continue investigation of precision guided munition integration issues and functionality in various flight environments. Continue building and using interoperable simulations to evaluate emerging technologies. Continue developing and enhancing new models and improvements for micromunitions, penetrators, and counter-chemical, biological, radiological, and nuclear effects. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	39.976	41.291	39.860	-	39.860

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	102.906	103.596	111.156	-	111.156	117.496	121.197	124.272	126.586	Continuing	Continuing
624866: <i>Lasers & Imaging Technology</i>	72.450	77.821	84.402	-	84.402	87.813	90.647	93.324	95.029	Continuing	Continuing
624867: <i>Advanced Weapons & Survivability Technology</i>	30.456	25.775	26.754	-	26.754	29.683	30.550	30.948	31.557	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program covers research in directed energy (DE) technologies, primarily laser devices, optical beam control, and high power microwaves. In laser devices, this research includes moderate to high power laser devices that are applicable to a wide range of applications. In beam control, this research includes optical technologies to propagate lasers beams from a device and to provide ground-based optical space situational awareness. In high power microwaves, this research examines technologies for applications such as counter-electronics and non-lethal weapons. Vulnerability/lethality assessments are conducted for representative DE technologies. Research into other advanced non-conventional weapons will be conducted. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	105.231	103.596	112.629	-	112.629
Current President's Budget	102.906	103.596	111.156	-	111.156
Total Adjustments	-2.325	-	-1.473	-	-1.473
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.307	-			
• Other Adjustments	-0.018	-	-1.473	-	-1.473

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624866: <i>Lasers & Imaging Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624866: <i>Lasers & Imaging Technology</i>	72.450	77.821	84.402	-	84.402	87.813	90.647	93.324	95.029	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. This project investigates the effects of laser weapons. Research in ground based optical space situational awareness is conducted.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop high energy laser device technologies for Air Force applications.</p> <p>FY 2010 Accomplishments: Developed technologies, incorporating joint service and agency technology advances, to support the design of a weapon-class electric laser demonstrator for inclusion on a large aircraft. Enhanced design of laser sources for aircraft self-protection and refined system packaging. Improved laser nozzle and generator designs to enhance performance of chemical oxygen-iodine lasers. Demonstrated initial diode-pumped atomic laser concept scaling capability.</p> <p>FY 2011 Plans: Test laser components and subsystems incorporating advances for thermal management. Ruggedize laser sources for aircraft self-protection and improve system packaging. Demonstrate operation of a flowing diode-pumped alkaline laser. Conduct damage/vulnerability tests against real and simulated systems.</p> <p>FY 2012 Base Plans: Conduct research supporting design and fabrication of weapons-class laser components, including hybrid and fiber lasers, for potential inclusion on an aircraft. Develop, design, and test selected components and subsystems for an electric laser weapon demonstrator on a large aircraft. Develop advanced electrically-powered laser concepts.</p> <p>FY 2012 OCO Plans:</p>	33.811	36.044	36.807	-	36.807
<p>Title: Major Thrust 2.</p>	13.347	14.401	17.173	-	17.173

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624866: <i>Lasers & Imaging Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop and demonstrate optical laser beam control technologies including atmospheric compensation and pointing and tracking. Demonstrate the integration of optical beam control technologies with laser device technologies.</p> <p>FY 2010 Accomplishments: Demonstrated in the laboratory selected atmospheric compensation concepts for laboratory long horizontal path propagation. Began laboratory testing of major subsystems for the tactical relay mirror demonstrator. Completed component research and modeling and simulation efforts supporting the joint Air Force/Defense Advanced Research Projects Agency (AF/DARPA) field demonstration of a high power solid state laser with a beam control system.</p> <p>FY 2011 Plans: Upgrade horizontal propagation compensation concepts for field demonstrations. Begin tactical relay mirror demonstrations at low power. Conduct spin-off laser communications research focused on ultra-high data rate, free-space, secure communications including atmospheric signal degradation.</p> <p>FY 2012 Base Plans: Conduct laboratory testing on horizontal propagation compensation concepts and begin planning for field testing. Complete tactical relay mirror demonstrations at low and high power. Demonstrate a high power solid state laser with a beam control system on the ground.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 3.</p>					
<p>Description: Develop advanced, long-range, optical technologies that support ground-based optical space situational awareness.</p> <p>FY 2010 Accomplishments: Completed system tests of second-generation sodium beacon adaptive optics system on 3.5 meter telescope. Performed demonstrations of compensated imaging and detection of very dim objects at visible and near-infrared wavelengths. Investigated passive and active imaging techniques and demonstrated imaging and non-imaging space-object identification techniques.</p> <p>FY 2011 Plans:</p>	25.292	27.376	30.422	-	30.422

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624866: <i>Lasers & Imaging Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Assess capabilities of second-generation sodium beacon adaptive optics system on 3.5 meter telescope at visible and near-infrared wavelengths. Develop and refine technologies to advance space situational awareness. FY 2012 Base Plans: Conduct research, including data analysis, and demonstrate compensated imaging and detection of very dim objects at visible and near-infrared wavelengths using advanced adaptive optics systems at Starfire Optical Range and Maui Space Surveillance Systems site. Integrate and test technologies to advance ground-based optical space situational awareness. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	72.450	77.821	84.402	-	84.402

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624867: <i>Advanced Weapons & Survivability Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
624867: <i>Advanced Weapons & Survivability Technology</i>	30.456	25.775	26.754	-	26.754	29.683	30.550	30.948	31.557	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project explores high power microwave (HPM) and other non-conventional/innovative weapon concepts such as disruption, degradation, and damage of electronic infrastructure and non-lethal anti-personal. This research will allow effects to be covert with no collateral structural or human damage. This project also investigates the effects of HPM weapons and HPM mitigation technologies.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate technologies for HPM components. Investigate HPM and other unconventional weapon concepts using innovative technologies.</p> <p>FY 2010 Accomplishments: Developed and evaluated components of the narrowband HPM aerial demonstrator including electromagnetic interference/electromagnetic capability. Conducted laboratory experiments using new types of HPM waveforms for counter-electronics applications. Designed hardware to generate high energy density plasmas, based on experimental validation, for applications such as countering weapons of mass destruction.</p> <p>FY 2011 Plans: Refine HPM devices and antennas to reduce size/increase effectiveness. Investigate state-of-the-art energy storage components.</p> <p>FY 2012 Base Plans: Investigate technologies to enhance standoff capabilities of HPM components used for electronic attack. Conduct high energy density plasma experiments.</p> <p>FY 2012 OCO Plans:</p>	15.346	10.922	20.285	-	20.285
<p>Title: Major Thrust 2.</p> <p>Description: Assess the effects/lethality of HPM technologies. Develop and apply sophisticated models to enhance the development of HPM and related technology. Investigate technologies to counter the effects of HPM.</p>	5.853	6.241	6.469	-	6.469

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602605F: <i>DIRECTED ENERGY TECHNOLOGY</i>	PROJECT 624867: <i>Advanced Weapons & Survivability Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	30.456	25.775	26.754	-	26.754

C. Other Program Funding Summary (\$ in Millions)											
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	115.369	117.283	127.866	-	127.866	129.579	132.253	134.768	137.384	Continuing	Continuing
625315: <i>Connectivity and Protection Tech</i>	45.882	46.780	52.547	-	52.547	52.594	53.237	53.953	48.062	Continuing	Continuing
625316: <i>Info Mgt and Computational Tech</i>	33.258	30.804	32.108	-	32.108	31.807	34.269	35.087	38.752	Continuing	Continuing
625317: <i>Information Decision Making Tech</i>	16.660	18.835	17.727	-	17.727	18.443	20.044	20.105	20.528	Continuing	Continuing
625318: <i>Operational Awareness Tech</i>	19.569	20.864	25.484	-	25.484	26.735	24.703	25.623	30.042	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops enterprise-centric information technology for 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 Connectivity and Protection Tech project provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques, as well as technologies that deter any adversary from attacking computer systems while allowing access to, presence on, manipulation of, and operational effects on adversary computer systems. This project also develops the technology base for the next generation of ultra-wide-bandwidth, multi-channelled, air and space-based communications networks. The Info Mgmt and Computational Tech project provides advances in information management and dissemination technologies to ensure the delivery of high-quality, timely, secure information to the warfighter, and develop technologies to produce both advanced on-demand computational processing and computer architectures with greater capacity and sophistication for addressing dynamic mission objectives under constraints imposed by AF systems. The Information Decision Making Tech project develops the technology to support the commander and staff's ability to command all viable options to achieve desired effects across the full spectrum of operations. The Operational Awareness Tech project develops technologies that improve their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This program has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, since it develops and demonstrates the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	116.785	117.283	129.320	-	129.320
Current President's Budget	115.369	117.283	127.866	-	127.866
Total Adjustments	-1.416	-	-1.454	-	-1.454
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.420	-			
• Other Adjustments	0.004	-	-1.454	-	-1.454

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

Project: 625315: *Connectivity and Protection Tech*

Congressional Add: *Efficient Utilization of Transmission Hyperspace.*

	FY 2010	FY 2011
	1.992	-
Congressional Add Subtotals for Project: 625315	1.992	-
Congressional Add Totals for all Projects	1.992	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>				PROJECT 625315: <i>Connectivity and Protection Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625315: <i>Connectivity and Protection Tech</i>	45.882	46.780	52.547	-	52.547	52.594	53.237	53.953	48.062	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force requires technologies that enable assured, worldwide communications for an agile Expeditionary Aerospace Force (EAF). These communication technologies will provide en-route and deployed reachback communications for distributed collaborative military operations. 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, dynamic policy based network management capabilities; and modular, programmable, low-cost software radios. This project also develops both the technology base for the next generation of ultra-wide bandwidth, multi-channeled air and space-based communications networks on and between platforms using the technologies for implementing photonic chip scale optical Code Division Multiple Access (CDMA) and Wavelength Division Multiplexed (WMD) transceivers and prototype networks associated with advanced fiber optics and the technology to integrate current Radio Frequency (RF) with high data rate Optical Laser communications, along with network management techniques, tools, and software to support them. In addition, the Air Force requires technologies to deliver a full range of options in cyberspace at 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 provides the technologies required to successfully deter any adversary from attacking computer systems anytime, anywhere by ensuring the Air Force's ability to: 1) access, maintain presence on, and deliver effects to adversary systems; 2) detect, defend, and respond to attacks on friendly computer systems as well as provide forensic analysis concerning those attack attempts; and 3) provide cyber situational awareness to Air Force commanders.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	24.036	21.481	20.725	-	20.725
Description: Develop improved, survivable, higher bandwidth communications, networking, and signal processing technologies to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity.					
FY 2010 Accomplishments: Completed demonstrations of: 1) an automated reasoning network management agent system, 2) an assured access, anti-jam communications capability that combines multi-dimensional (space, time, frequency, coding) transmission techniques and cognitive networking technology, and 3) an advanced, automated, wireless airborne networking and communications link emulation capability. Developed low probability of intercept, low probability of detection waveform for hand held multi data rate radio. Initiated development of capability to enhance both trust and V/W band (50GHz to 110 GHz) within airborne networks, and leading wireless protocols					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>		PROJECT 625315: <i>Connectivity and Protection Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>for use in the remotely piloted aircraft environment. Initiated in-house and university development of next generation advanced networking technologies for distributed military operations in an airborne environment.</p> <p>FY 2011 Plans: Continue in-house and university development of next generation advanced networking technologies for distributed military operations in an airborne environment. Complete development of low probability of intercept, and low probability of detection waveform for hand held multi data rate radio which has a small form-factor networking and reachback capability with reduced size, weight, and power. Complete development of capability to enhance trust within airborne networks and leading wireless protocols for use in the remotely piloted aircraft environment and continue development of capability for increased V/W bandwidth communication to a variety of airborne platforms. Initiate investigation of mission essential functions, including mini-Common Data Link, assessing threat tolerance in contested environments, and developing mitigation strategies to alleviate risk due to cyber vulnerabilities. Initiate both development of secure video distribution over tactical internets on demand and design of optimized, distributed, cross-layer protocol stacks for cognitive radio ad hoc networks with decentralized control. Initiate investigation of spatial multiplex multiple-input and multiple-output (MIMO) techniques to increase channel capacity and the development of a cognitive cooperation protocol for wireless networks.</p> <p>FY 2012 Base Plans: Continue in-house and university development of next generation advanced networking technologies for distributed military operations in an airborne environment. Continue both development of secure video distribution over tactical internets on demand and design of optimized, distributed, cross-layer protocol stacks for cognitive radio ad hoc networks with decentralized control. Continue investigation of spatial multiplex multiple-input and multiple-output (MIMO) techniques to increase channel capacity and the development of a cognitive cooperation protocol for wireless networks. Complete development of capability for increased V/W bandwidth communication and characterization to a variety of airborne platforms with varying data rates. Complete investigation of mission essential functions, including mini-CDL, assessing threat tolerance in contested environments, and developing mitigation strategies to alleviate risk due to cyber vulnerabilities.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 2.</p> <p>Description: Develop cyber defense and supporting technologies to detect, defend, and respond to attacks on computer systems as well as provide forensic analysis concerning the attacks.</p>					
	3.082	4.910	5.367	-	5.367

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>		PROJECT 625315: <i>Connectivity and Protection Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><i>FY 2010 Accomplishments:</i> Completed investigation of cyber defense metrics and their applicability to increase situational awareness of enterprise systems and malicious activities occurring therein. Initiated development of technology to assure operations of our networked forces (a trusted execution environment) in high threat, contested cyber environments by demonstrating a trusted cyber delivery vehicle/platform to support nearly all types cyber operations. Initiated development of technologies to support the ability to avoid cyber attacks by increasing redundancy, diversity, and agility in AF networks to disrupt adversary attack planning by pursuing defensive cyber maneuver and agility, polymorphic code development, and concealment and obfuscation of our networks. Completed development of technology to provide a trusted verification of information system hardware resources. Initiated the development of remote rendering services and thin client technology to protect end user information systems from network-delivered threats.</p> <p><i>FY 2011 Plans:</i> Continue development of technology to assure operations of our networked forces (a trusted execution environment) in high threat, contested cyber environments by demonstrating a trusted cyber delivery vehicle/platform to support nearly all types cyber operations. Continue development of technologies to support the ability to avoid cyber attacks by increasing redundancy, diversity, and agility in AF networks to disrupt adversary attack planning by pursuing defensive cyber maneuver and agility, polymorphic code development, and concealment and obfuscation of our networks. Complete the development of remote rendering services and thin client technology to protect end user information systems from network-delivered threats.</p> <p><i>FY 2012 Base Plans:</i> Continue development of technology to assure operations of our networked forces (a trusted execution environment) in high threat, contested cyber environments by demonstrating a trusted cyber delivery vehicle/platform to support nearly all types cyber operations. Complete development of technologies to support the ability to avoid cyber attacks by increasing redundancy, diversity, and agility in AF networks to disrupt adversary attack planning by pursuing defensive cyber maneuver and agility, polymorphic code development, and concealment and obfuscation of our networks.</p> <p><i>FY 2012 OCO Plans:</i></p> <p><i>Title:</i> Major Thrust 3.</p> <p><i>Description:</i> Develop offensive cyber operations technologies to access, maintain presence on, and deliver effects to adversary systems.</p>					
	6.458	9.390	14.338	-	14.338

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p><i>FY 2010 Accomplishments:</i> Developed information system access methods and development of propagation techniques. Developed stealth and persistence technologies including efforts to develop autonomic technologies for operating within adversary information systems. Initiated development of the capability to exfiltrate information from adversary information systems and developed methods for increased cyber situational awareness and understanding of the battlefield. Developed technology to deliver D5 (deceive, deny, disrupt, degrade, and destroy) effects in concert with cyber platforms. Initiated development of ability to identify foreign languages as a part of a cyber intelligence (CybINT) capability.</p> <p><i>FY 2011 Plans:</i> Continue development of information system access methods and development of propagation techniques. Continue development of the capability to exfiltrate information from adversary information systems, continue development of methods for increased cyber situational awareness and understanding of the battlefield and initiate development of methods for covert data exchange. Continue development of technology to deliver D5 effects in concert with cyber platforms. Continue development of stealth and persistence technologies to include autonomic technologies for operating within adversary information systems. Complete demonstrated ability to identify foreign languages as a part of a CybINT capability.</p> <p><i>FY 2012 Base Plans:</i> Continue development of information system access methods and development of propagation techniques. Continue development of stealth and persistence technologies and initiate investigation into anti-reverse engineering methods. Continue development of the capability to exfiltrate information from adversary information systems, continue development of methods for increased cyber situational awareness and understanding of the battlefield, and continue the development of methods for covert data exchange. Continue development of technology to deliver D5 effects in concert with cyber platforms. Initiate development of a publish/subscribe architecture for exchange and exfiltration of information while operating within adversary information systems.</p> <p><i>FY 2012 OCO Plans:</i></p> <p><i>Title:</i> Major Thrust 4.</p> <p><i>Description:</i> Develop methods and technologies for controlled operation of information systems during attacks and fault conditions, minimizing vulnerabilities of cyber attacks, and guaranteeing the correctness of data and codes.</p>					
	3.645	9.233	6.672	-	6.672

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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FY 2010 Accomplishments:
Initiated development of assured end-to-end quality of service (QoS) and quality of information assurance (QoIA) integration to the information system during attacks and faults to provide the ability to degrade gracefully in a controlled trade space. Developed a resilient and self-regenerating information enterprise that dynamically recognizes, characterizes, and understands novel cyber attacks and service anomalies, aids in the creation of synthetically diverse, functionally equivalent software, and continuously monitors, reconfigures, and self optimizes the mission critical enterprise to resist new attacks. Initiated challenge problem in-house and university research investigations for development of cyber domain capabilities supporting AF information systems. Developed defensive techniques for wireless, mobile, and embedded systems.

FY 2011 Plans:
Complete development of assured end-to-end QoS and QoIA integration to the information system during attacks and faults to provide the ability to degrade gracefully in a controlled trade space. Continue development of a resilient and self-regenerating information enterprise and initiate development of automatic machine regeneration of software to recover with immunity from cyber attack. Continue challenge problem in-house and university research investigations for development of cyber domain capabilities supporting AF information systems including research in assured cyber operations in complex networks. Investigate information assurance tenants in infrastructure as a service cloud environment, concentrating on ensuring secure processing, data storage and communication in a cloud. Continue to develop defensive techniques for wireless, mobile, and embedded systems. Initiate development of methods for disruption of malware and covert channels in data transmissions without having to detect whether malware or covert channels exist in the transmission.

FY 2012 Base Plans:
Complete development of methods for disruption of malware and covert channels in data transmissions without having to detect whether malware or covert channels exist in the transmission. Initiate development of defensive cyber technologies to increase system survivability while under a cyber attack. Complete development of a resilient and self-regenerating information enterprise and continue development of automatic machine regeneration of software to recover with immunity from cyber attack. Continue challenge problem in-house and university research investigations for development of cyber domain capabilities supporting AF information systems including research in assured cyber operations in complex networks. Complete investigation of information assurance tenants in infrastructure as a service cloud environments, concentrating on ensuring secure processing, data storage and communication in a cloud. Complete development of defensive techniques

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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for wireless, mobile, and embedded systems with vulnerability analysis and threat identification for emerging commercial wireless standards.

FY 2012 OCO Plans:

<i>Title:</i> Major Thrust 5.	6.669	1.766	5.445	-	5.445
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Description: Develop and assess optical network technologies for application in the space environment, including existing and emerging modulation schemes and protocols, for use in space-based optical networks and develop flight ready systems consisting of high capacity RF and optical components and architectures for next generation platform communications for avionics and satellite systems and wireless in-flight communications systems.

FY 2010 Accomplishments:

Designed and developed a flight test system with a Dense Wavelength Division Multiplexed (DWDM) broadcast architecture as well as a 40 channel multi wavelength optical network for on-board air and space applications. Characterized high throughput RF waveform data link technology, and initiated development of optical communications link hardware and software for flight testing.

FY 2011 Plans:

Complete in-flight verification of the DWDM single mode system by testing data integrity, switching times and latency, total throughput, reconfigurability, bit error rates, and wavelength to wavelength switching during flight operations, and complete development of 40 channel multi wavelength optical network for on-board air and space applications. Continue ground tests of RF waveform generation to demonstrate high capacity persistent sensor data transmission, and complete the fabrication, integration and flight tests of flight test ready optical data link system.

FY 2012 Base Plans:

Initiate development of an all-optical communications system for airborne and satellite platforms, that can distribute very high rate digital data and RF signals in high shock, vibration, and radiation environments. Initiate development of next generation of high capacity data links supporting transmission requirements of airborne and spaceborne sensors. Continue ground tests of RF waveform generation to demonstrate high capacity persistent sensor data transmission.

FY 2012 OCO Plans:

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	43.890	46.780	52.547	-	52.547
	FY 2010	FY 2011			
Congressional Add: Efficient Utilization of Transmission Hyperspace.	1.992	-			
FY 2010 Accomplishments: Conducted Congressionally-directed effort.					
FY 2011 Plans:					
Congressional Adds Subtotals	1.992	-			

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				PE 0602788F: <i>Dominant Information Technology</i>				625316: <i>Info Mgt and Computational Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625316: <i>Info Mgt and Computational Tech</i>	33.258	30.804	32.108	-	32.108	31.807	34.269	35.087	38.752	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force requires the capability to maximize the value, sharing, management, and use of its information and information assets in achieving its mission objectives as the importance of information grows in the current net centric environment. Technology development in this project must be capable of taking advantage of future net-centric environments including new structured and ad hoc processes in response to rapidly changing warfare challenges. Advances in robust information management focus on quality of service and flow of information within the enterprise, information transformation and brokering, secure information sharing across and among domains, and collaboration of workflow within the enterprise. Technologies addressed in this project include 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 Air Force net-centric information management environment. In addition, the Air Force requires the development of superior, intelligent, on-demand computing to enable information superiority. Technology development in this project focuses on producing: 1) computer architectures with greater capacity and sophistication for addressing constrained, dynamic mission objectives, 2) "game-changing" computing power to the warfighter, 3) disruptive computing technology power at the edge and the power behind grid services, and 4) interactive and real-time computing improving the usability of high performance computing to the Air Force. It includes technologies in computational sciences and engineering, computer architectures, and software intensive systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Investigate and develop technologies for decision quality information dissemination services via publish, subscribe, and query with coalition partners as part of the Global Information Grid (GIG).</p> <p>FY 2010 Accomplishments: Developed secure cross domain discovery and sharing of web services. Completed development of content-based dissemination mechanisms and quality of service provisioning. Initiated development of mechanisms to federate and share information across disbursed locations and establish the means to maintain provenance and authoritative control over the information and complete development of prioritized queuing mechanisms to maximize value of delivered information based upon its context. Initiated research of service oriented architecture (SOA) based architectures and services for tactical and enterprise environments that are secure, survivable and resilient to cyber attack and failures.</p> <p>FY 2011 Plans:</p>	14.339	7.530	2.766	-	2.766

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Initiate development of tools and safeguards required to quickly and reliably transfer information from a higher classification domain to a lower classification domain, as well as to coalition partners. Complete development of secure cross-domain information brokering for the discovery and sharing of web services. Continue research of service oriented architecture (SOA) based architectures and services for tactical and enterprise environments that are secure, survivable, and resilient to cyber attack and failures. Complete research into dynamic information management system infrastructure.</p> <p>FY 2012 Base Plans: Continue development of tools and safeguards required to quickly and reliably transfer information from a higher classification domain to a lower classification domain, as well as to coalition partners. Complete research of service oriented architecture (SOA) based architectures and services for tactical and enterprise environments that are secure, survivable, and resilient to cyber attack and failures.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2</p> <p>Description: Develop collaborative services technologies and virtual environments to facilitate the development and fielding of next generation decision support systems.</p> <p>FY 2010 Accomplishments: Based on study results, began development of an information service orchestration framework that leverages open system standards and technologies to implement workflow capabilities that can adapt the execution of information services to the changing requirements of dynamic military environments.</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	0.649	-	-	-	-
<p>Title: Major Thrust 3.</p> <p>Description: Develop automatic and dynamically reconfigurable, affordable, scalable, distributed petaflop processing technologies for real-time global information systems.</p> <p>FY 2010 Accomplishments:</p>	7.934	9.074	14.161	-	14.161

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Initiated the development of high capacity processing on demand which will reduce the ever increasing amounts of raw data to actionable information by evaluating current processor functionality and identify functionality necessary for system on chip capability. Initiated scalable quantum information science testbed for optimized information searching and processing by developing algorithms and simulations of select computationally challenging and relevant problems. Initiated development of next generation advanced computing techniques, enabling superior information processing for AF warfighters through in-house and university research. Initiated development of advanced processing capabilities to enable the collection and processing of information as close to the sensor as feasible. Initiated nano-computer technology development to provide high performance, secure, scalable, and survivable information dissemination.</p> <p>FY 2011 Plans: Complete development of algorithms and simulations of select computationally challenging and relevant problems in the scalable quantum information science testbed for optimized information searching and processing. Continue research of petaflops embedded processing on-demand and multi-core computing by completing the design and the fabrication of a prototype for increased control of power. Continue development of next generation advanced computing techniques, enabling superior information processing for AF warfighters through in-house and university research. Continue development of advanced processing capabilities to enable the collection and processing of information as close to the sensor as feasible. Complete nano-computer technology development to provide high performance, secure, scalable, and survivable information dissemination. Initiate study of quantum cores as the foundational building blocks for a multi-core quantum processor. Initiate study of reconfigurable electronics to enable intelligent AF systems to perform autonomous operations.</p> <p>FY 2012 Base Plans: Continue development of next generation advanced computing techniques, enabling superior information processing for AF warfighters through in-house and university research. Complete study of reconfigurable electronics to enable intelligent AF systems to perform autonomous operations. Continue development of tools to analyze codes and dynamic execution profiles and extract threads suitable for multi-core computation. Complete development of advanced processing capabilities to enable the collection and processing of information as close to the sensor as feasible. Continue development of petaflops embedded processing on-demand and multi-core computing by demonstrating increased control of power of fabricated prototype. Continue study of quantum cores as the foundational building blocks for a multi-core quantum processor.</p> <p>FY 2012 OCO Plans:</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Title: Major Thrust 4.</p> <p>Description: Develop secure cross domain discovery services for access to services outside of existing domain. Develop the tools to allow collaboration of workflows required by the AF net-centric information management environment.</p> <p>FY 2010 Accomplishments: Initiated investigation of current lightweight directory access protocol (LDAP) best practices and design multi-level LDAP capability. Initiated development of flexible sensor interfaces to support rapid sensor replacement and configuration without modification of backend hardware or software infrastructure and develop prioritized delivery mechanisms by integrating information management and networking complementary capabilities. Researched cross domain information sharing technologies by investigating cognitively assisted information technologies to provide automated assistance to the current labor-intensive process of human review and release of sensitive information to other security domains and enclaves. Initiated development of novel information management techniques as applied to all domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG.</p> <p>FY 2011 Plans: Complete implementation of multi-level LDAP prototype solution into a fully SOA compliant architecture, leveraging the existing multi-level repository (MLR) technology. Continue development of a flexible fusion container to allow upstream processing without affecting core critical infrastructure and demonstrate its application to tracking of evasive non-linear targets. Initiate development of advanced technologies to effectively manage large data storage warehouses within agile enterprise environments by developing quality of service enabled information management services coupled to network routing and management for tactical edge IP-based networks. Complete research efforts to improve the timeliness and accuracy of the human review process using advanced information technology. Continue development of novel information management techniques as applied to all domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG. Develop information management capabilities in support of force protection.</p> <p>FY 2012 Base Plans: Initiate development of an automated security annotation framework that provides safeguarding mechanisms for the AF enterprise. Complete an open architecture for the efficient integration of sensors, algorithms, and computing and communications hardware to support real-time tactical information collection, exploitation, and</p>	5.839	8.592	8.776	-	8.776
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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command and control. Complete development of advanced technologies to effectively manage large data storage warehouses within agile enterprise environments by developing quality of service enabled information management services coupled to network routing and management for tactical edge IP-based networks. Continue development of novel information management techniques as applied to all domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG Continue to develop information management capabilities in support of force protection.

FY 2012 OCO Plans:

Title: Major Thrust 5.

Description: Develop the architectural mechanisms that form the basis for predictable software and high assurance systems.

FY 2010 Accomplishments:

Initiated development and design of a modular trusted computing base architecture composed of the foundational hardware and software necessary to ensure overall system security. Developed the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Initiated architectures for cognitive systems by identifying nodal design hierarchy for modular systems. Initiated development of a trusted, automated cyber defense capability to reduce response time down to milli-seconds vice hours.

FY 2011 Plans:

Complete prototype design and demonstrate functionality of a modular trusted computing base architecture. Continue development of a trusted, automated cyber defense capability to reduce response time down to milli-seconds vice hours. Continue the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Complete architectures for cognitive systems and demonstrate hierarchical prototype. Initiate development of a co-design of a multi-core Tagged Secure Processor, a Zero-Kernel Operating System, and Application Development Environment inherently resistant to malicious software and inherently compliant with multiple-independent-levels-of-security (MILS) systems. Initiate design of a hybrid complementary metal-oxide semiconductor (CMOS)/memristor logic unit that is compact and efficient for encryption algorithm implementation.

FY 2012 Base Plans:

	4.497	5.608	6.405	-	6.405

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Initiate developing architectures for a compact large array of many node clusters with very low power demand for intelligent systems. Complete development of trusted, automated cyber defense capability to reduce response time down to milli-seconds vice hours. Continue development of a co-design of a multi-core Tagged Secure Processor, a Zero-Kernel Operating System, and Application Development Environment inherently resistant to malicious software and inherently compliant with multiple-independent-levels-of-security (MILS) systems. Continue design of a hybrid complementary metal-oxide semiconductor (CMOS)/memristor logic unit that is compact and efficient for encryption algorithm implementation. Continue the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems including correct concurrent code for trusted embedded multi-core systems.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	33.258	30.804	32.108	-	32.108

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625317: <i>Information Decision Making Tech</i>	16.660	18.835	17.727	-	17.727	18.443	20.044	20.105	20.528	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force requires advances in 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 (pre-conflict, conflict through stability operations). Technology development in this project addressing this requirement include anticipatory decision support and course of action development, planning, scheduling and assessment, and the real time effective portrayal of complex data sets.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop next generation monitoring, planning, and assessment technologies enabling aerospace commanders to develop effects based campaigns.</p> <p>FY 2010 Accomplishments: Completed the development of capability for a full-spectrum analysis for effects attainment at all levels of a campaign, linking leading indicators to desired and undesirable effects. Initiated development of the capability, including wargaming technologies, to mix kinetic and non-kinetic options, incrementally forecast the direct and indirect effects of each COA, and play COAs forward in time to identify key plan dependencies, decision points, and the foreclosure of options. Initiated investigation of methods to seamlessly move between geospatial and non-geospatial data to enhance situational awareness and enable integrated decisions over the air, space, and cyber domains.</p> <p>FY 2011 Plans: Initiate the development of capability for a full-spectrum analysis for effects attainment at all levels of a campaign, linking leading indicators to desired and undesirable effects. Continue to develop and begin demonstrating capabilities, including wargaming technologies, to mix kinetic and non-kinetic options, continuously forecast the direct, indirect, and cascading effects of each COA, and play COAs forward in time to identify key plan dependencies, decision points, and the foreclosure of options. Initiate the development and demonstration of decision workflow and workload management capabilities to manage the command and control constellation of resources focused on specific missions. Complete investigation of methods to seamlessly move</p>	4.972	7.791	8.995	-	8.995

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>between geospatial and non-geospatial data to enhance situational awareness and enable integrated decisions over the air, space, and cyberspace domains.</p> <p>FY 2012 Base Plans: Initiate development of a hybrid war gaming concept of decision theory and game theory to provide safeguarded courses of action in adversarial environments with varying degrees of partial information. Complete development and demonstrate capabilities to mix kinetic and non-kinetic options, continuously forecast the direct, indirect, and cascading effects of each COA, and play COAs forward in time to identify key plan dependencies, decision points, and the foreclosure of options. Continue investigation of full-spectrum, quantitative analysis techniques that aid operational assessor's ability to link actions to effects to desired objectives. Continue the development and demonstration of decision workflow and workload management capabilities to analyze and prioritize courses of action for space control missions and space situational awareness.</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 2.</p> <p>Description: Investigate, analyze, and develop technologies for planning, execution and automatic rapid reconfiguration of distributed intelligent and integrated C2 information systems to achieve the commander's intent throughout varying crisis levels.</p> <p>FY 2010 Accomplishments: Developed advanced interactive displays, including information visualizations, suitable for both high fidelity, accurate wargames and for rapid deployment in harsh environments with C2 applications and command centers. Completed development of the ability for timely kinetic/non-kinetic option generation, selection, and coordination capabilities that account for uncertainty and missing and erroneous information, and supports intuitive decision making process between man and machine collaborating on complex, dynamic problems. Conducted research to achieve the capability to analyze multiple courses of action (COA) having cascading effects in near real-time. Initiated in-house and university development of next generation planning, decision making, and COA tools supporting the commander's ability to exercise a wide range of command and execution options for AF forces. Initiated investigation of processes and technologies and recommend solutions to enable the Air and Space Operations Center (AOC) to conduct kinetic/non-kinetic Monitor, Assess, Plan, and Execute (MAPE) while under</p>	11.688	11.044	8.732	-	8.732
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625317: <i>Information Decision Making Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>degraded conditions due to cyber attacks. Completed development of predictive decision support techniques for space command and control taskings.</p> <p>FY 2011 Plans: Complete development of advanced interactive displays, including information visualizations, suitable for both high fidelity, accurate wargames and for rapid deployment in harsh environments with C2 applications and command centers. Initiate development of capabilities to be more agile within a net centric enabled environment by developing models of cyber network attacks to enable better operation of cyber assets with air and space assets. Continue in-house and university development of next generation planning, decision making, and COA tools supporting the commander's ability to exercise a wide range of command and execution options for AF forces. Complete research to achieve the capability to analyze multiple COA having cascading effects in near real-time. Complete the investigation of processes and technologies and recommend solutions to enable the AOC to conduct kinetic/non-kinetic MAPE procedures while under degraded conditions due to cyber attacks. Develop the capability to rapidly integrate and analyze C2 systems within a developmental environment. Initiate development of a cooperative multi-agent system to maximize sensor task completions and provide an adaptive and flexible solution to deal with the dynamics of new asset task allocations.</p> <p>FY 2012 Base Plans: Continue development of capabilities to be more agile within a net centric enabled environment by developing models of cyber network attacks to enable better operation of cyber assets with air and space assets. Complete development of a cooperative multi-agent system to maximize sensor task completions and provide an adaptive and flexible solution to deal with the dynamics of new asset task allocations. Continue in-house and university development of next generation planning, decision making, and COA tools supporting the commander's ability to exercise a wide range of command and execution options for AF forces.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	16.660	18.835	17.727	-	17.727

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625317: <i>Information Decision Making Tech</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>				PROJECT 625318: <i>Operational Awareness Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625318: <i>Operational Awareness Tech</i>	19.569	20.864	25.484	-	25.484	26.735	24.703	25.623	30.042	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force requires technologies that improve and automate their 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 situation awareness, understanding, and anticipation of the threats in the battle space, 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. It leads the research, discovery, and development of technology that enables the fusion of multi-intelligence sources to provide accurate object tracking and ID, situational awareness, understanding, and anticipation of the threats in the battlespace (air, ground, space, and cyber). It also leads in the development of advanced exploitation technologies to maximize the intelligence gained from our adversaries in the areas of spectral detection and geolocation, signal recognition and analysis, and the data tagging, tracking, and tracing via the insertion of secure, imperceptible signal embedding for future fusion and understanding of the information.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	8.760	8.102	13.456	-	13.456
Description: Develop higher-level fusion and the enabling text information/knowledge base technologies to achieve situational awareness and understanding at all command levels for dynamic planning, assessment, and execution processes.					
FY 2010 Accomplishments: Completed Hybrid Multi-INT association algorithms based on contextual knowledge/advanced reasoning and complete experimentation of net centric fusion of pub/sub information environments. Explored tracking techniques in combination with Multi-INT feature data to improve the probability of correct association and extend track lifetimes for moving targets. Completed development of both the capability to utilize detected movement information and social network analysis to define and exploit the structure and behavior of the enemy and the techniques for analysis of audio sources as well as alternate sources by applying social network analysis metrics to determine high value targets. Completed development of automated reasoning techniques for assessing current situations using adversarial capabilities. Initiated development of techniques for analyzing and assessing activities to support situation assessment. Initiated in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the AF capability to anticipate the variety of threats from the ground, air, and cyber domains. Completed development of a framework for document level discourse analysis and inference based on information extracted from the text and ontological					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625318: <i>Operational Awareness Tech</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>world knowledge. Initiated design of an automated feature aided tracking and pattern recognition capability for processing onboard a high-resolution, wide-area video staring sensor with cueing from lower bandwidth sensors.</p> <p>FY 2011 Plans: Complete demonstration of the ability to track targets, exploiting feature data, for an average of greater than 1 hour in moderate traffic density. Begin development and implementation of techniques to increase the scalability of tracking algorithms from 10's to 1000's of ground targets in a large rural-urban environment. Initiate development of techniques and algorithms to improve analysis of multi-sensor data for mining data across multi-INT repositories for behavioral patterns to identify terrorist networks and track movement and that process moving-target indication data from airborne sensors, and automatically classify airborne targets, including remotely piloted aircraft(RPA). Continue development of techniques for analyzing and assessing activities to support situation assessment. Continue in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the AF capability to anticipate the variety of threats from the ground, air, and cyber domains. Initiate development of automated generation of ontology from free-text or heterogeneous data sources and develop augmented analyst workflow techniques. Continue design of an automated feature aided tracking and pattern recognition capability for processing onboard a high-resolution, wide-area video staring sensor with cueing from lower bandwidth sensors.</p> <p>FY 2012 Base Plans: Continue development and implementation of techniques to increase the scalability of tracking algorithms from 10's to 1000's of ground targets in a large rural-urban environment. Initiate development of techniques for performing indications and warnings, pattern recognition, and information fusion for information exploitation. Continue development of techniques and algorithms to improve analysis of multi-sensor data for mining data across multi-INT repositories for behavioral patterns to identify terrorist networks and track movement and that process moving-target indication data from airborne sensors, and automatically classify airborne targets, including RPA. Complete design and demonstration of an automated feature aided tracking and pattern recognition capability for processing onboard a high-resolution, wide-area video staring sensor with cueing from lower bandwidth sensors. Continue in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the AF capability to anticipate the variety of threats from the ground, air, and cyber domains. Complete development of techniques for analyzing and assessing activities to support situation assessment. Initiate developing software to aid the analyst in determining the entity's behavior, including direction, speed, maneuvers, and operation of equipment. Complete development of</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602788F: <i>Dominant Information Technology</i>	PROJECT 625318: <i>Operational Awareness Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
automated generation of ontology from free-text or heterogeneous data sources, and automated task suggestion in response to requests for intelligence information and assessments.					
<i>FY 2012 OCO Plans:</i>					
<i>Title:</i> Major Thrust 2	6.446	9.846	10.238	-	10.238
<i>Description:</i> Develop digital information exploitation technologies for electronic communications and special signals intelligence, imagery, and measurement signatures to increase accuracy, correlation, and timeliness of the information.					
<i>FY 2010 Accomplishments:</i> Developed and evaluated watermarking techniques, extending to include streaming data and multimedia data technologies for additional applications. Developed audio processing technologies in the area of vocal tract modification. Initiated the development of algorithms to identify and classify an application layer (request/reply) messaging protocol for supervisory control and data acquisition (SCADA) systems. Initiated in-house and university research in advanced exploitation techniques that maximize the AF ability to gather, process, and display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. Initiated the development of optimizing exploitation across sensors to enhance multi-intelligence fusion and a capability to detect and geo-locate surveillance and mobile threat emitters.					
<i>FY 2011 Plans:</i> Continue the development and evaluation of watermarking techniques for multimedia, beginning extensions to non-multimedia data and executable code. Complete SCADA protocols, integrate all algorithms, demonstrate and test a prototype analysis suite as an extensible proof-of-concept, and verify and validate algorithm performance against simulated real-world data. Continue in-house and university research in advanced exploitation techniques that maximize the AF ability to gather, process, and display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. Continue the development of optimizing exploitation across sensors to enhance multi-intelligence fusion and initiate investigation into a deeper understanding of and linguistic decomposition of tonal languages. Continue development of a capability to detect and geo-locate surveillance and mobile threat emitters and initiate investigation to perform specific emitter identification to exploit differences in transient characteristics and aid in intercept disambiguations. Initiate development of a signal processing methodology for exploiting multi-sensor data to detect, identify, and geo-locate emerging signals. Initiate development of a target-specific baseline to test and integrate a capability					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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to assess and exploit passive, semi-active and active radio frequency identification devices and biologically motivated techniques for object detection, recognition, and tracking in video and imagery data.

FY 2012 Base Plans:

Complete the development and evaluation of watermarking techniques, focused on streaming media. Complete investigation of combined temporal, spatial, and frequency techniques to provide a multi-domain approach for information provenance, pedigree, and assurance. Continue the development, test, and evaluation of real time, tactical information exploitation software using laboratory tools and operational data. Develop a wide variety of exploitation methods to enhance signals situational awareness. Continue in-house and university research in advanced exploitation techniques that maximize the AF ability to gather, process, and display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. Complete the development of optimizing exploitation across sensors to enhance multi-intelligence fusion.

FY 2012 OCO Plans:

Title: Major Thrust 3.

Description: Develop modeling and simulation technologies for the next generation of planning, assessment, and execution environments.

FY 2010 Accomplishments:

Completed research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue course of action for rapid decide, act, and adapt. Initiated development to model and explore policy actions and reactions taken by the different modeled entities activities. Initiated development of the nation state model (to include both the physical and social subsystems) to provide an initial capability for the decision maker to understand varying degree of effects, their interactions and interdependencies caused by "blue's" potential actions. Initiated verification and validation for integration of the various frameworks. Completed investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s).

FY 2011 Plans:

Complete development of the "core" nation state model (to include both the physical and social subsystems). Complete development to model and explore policy actions and reactions taken by the different modeled entities activities. Initiate development of tools for the analyst to identify the optimum set of leverage points to meet commander's objectives. Initiate the identification of degree to which the adversary can achieve hypothesized

	4.363	2.916	1.790	-	1.790

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
eCOAs based on predicted goals. Complete verification and validation for integration of the various frameworks. Initiate development of an integrated set of possible combinations of adversary COAs and adversarial intentions based on the adversary's abilities and capabilities to perform activities associated with various domains. <i>FY 2012 Base Plans:</i> Continue development of tools for the analyst to identify the optimum set of leverage points to meet commander's objectives. Continue the identification of degree to which the adversary can achieve hypothesized eCOAs based on predicted goals. Continue development of an integrated set of possible combinations of adversary COAs and adversarial intentions based on the adversary's abilities and capabilities to perform activities associated with various domains. <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	19.569	20.864	25.484	-	25.484

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	51.647	53.384	54.059	-	54.059	52.297	54.174	55.038	55.974	Continuing	Continuing
625096: <i>High Energy Laser Research</i>	51.647	53.384	54.059	-	54.059	52.297	54.174	55.038	55.974	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the HEL Joint Technology Office (JTO). HEL weapon systems have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase; defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles; and the ultra-precision negation of targets in urban environments with no/little collateral damage. This program is part of an overall DoD HEL Science and Technology program. In general, efforts funded under this program are chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complimenting Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as chemical lasers, solid state lasers, free electron lasers, laser beam control, and laser lethality mechanisms. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	53.229	53.384	54.059	-	54.059
Current President's Budget	51.647	53.384	54.059	-	54.059
Total Adjustments	-1.582	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.386	-			
• Other Adjustments	-0.196	-		-	-

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

Project: 625096: *High Energy Laser Research*

Congressional Add: *Advanced Deformable Mirrors for High Energy Laser Weapons.*

Congressional Add: *High Bandwidth, High Energy Storage, Exawatt Laser Glass Development.*

FY 2010	FY 2011
1.593	-
2.788	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Planar Lightwave Circuit Development for High Power Military Laser Applications.*

Congressional Add Subtotals for Project: 625096

Congressional Add Totals for all Projects

	FY 2010	FY 2011
Congressional Add: <i>Planar Lightwave Circuit Development for High Power Military Laser Applications.</i>	2.390	-
Congressional Add Subtotals for Project: 625096	6.771	-
Congressional Add Totals for all Projects	6.771	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>				R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>				PROJECT 625096: <i>High Energy Laser Research</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
625096: <i>High Energy Laser Research</i>	51.647	53.384	54.059	-	54.059	52.297	54.174	55.038	55.974	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds Department of Defense (DoD) high energy laser (HEL) applied research through the HEL Joint Technology Office (JTO). HEL weapon systems have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HELs have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase; defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles; and the ultra-precision negation of targets in urban environments with no/little collateral damage. This program is part of an overall DoD HEL Science and Technology program. In general, efforts funded under this program are chosen for their potential to have an impact on multiple HEL systems and multiple Service missions while complimenting Service/Agency programs that are directed at specific Service needs. A broad range of technologies are addressed in key areas such as chemical lasers, solid state lasers, free electron lasers, laser beam control, and laser lethality mechanisms. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Advance solid-state laser development.</p> <p>FY 2010 Accomplishments: Initiated a joint-high power electric laser product improvement program that emphasizes efficiency, affordability, and ruggedization. Established parameters for efficiency improvements into size, weight and packing reductions. With Space and Missile Defense Command and Air Force Research Laboratory jointly awarded four contracts under the Robust Electric Laser Initiative.</p> <p>FY 2011 Plans: Conduct a joint-high power electric laser product improvement program. Design verification experiments will be conducted as risk-reduction efforts.</p> <p>FY 2012 Base Plans: Conduct a joint high power electric laser product improvement program. Prepare for government-sponsored measurements to validate performance.</p> <p>FY 2012 OCO Plans:</p>	8.230	12.650	12.759	-	12.759

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2.</p> <p>Description: Mature solid state laser device technologies that will provide improved system level performance.</p> <p>FY 2010 Accomplishments: Combined high performance single modules in optimum module combination schemes to demonstrate the path to weapons-class scaling. Continued development of high reliability diode pump sources. Investigated eye-safer laser technologies. Conducted an industry proposal call for FY 2010.</p> <p>FY 2011 Plans: Demonstrate building block for highly efficient, compact, modular laser system with weapons-class applications. Demonstrate high reliability of diode pump sources. Scale eye-safer laser technologies to higher powers. Conduct Service and Agency proposal call for FY 2011.</p> <p>FY 2012 Base Plans: Develop high reliability/cost efficient diode pump sources. Scale eye-safer laser technologies to higher powers. Conduct an industry proposal call for FY 2012.</p> <p>FY 2012 OCO Plans:</p>	9.189	9.880	9.830	-	9.830
<p>Title: Major Thrust 3.</p> <p>Description: Investigate new technologies that have revolutionary potential for HEL applications.</p> <p>FY 2010 Accomplishments: Incorporated new materials into a laser device and demonstrate properties in terms of wavelength selection, thermal handling, and overall laser efficiency. Scaled short pulse laser technologies for military applications. Conducted an industry proposal call for FY 2010.</p> <p>FY 2011 Plans: Explore novel laser technologies to improve efficiency and decrease mass/volume. Demonstrate applications for short pulse laser technology. Scale electrically pumped alkali lasers to moderate power levels. Conduct a Service and Agency proposal call for FY 2011.</p> <p>FY 2012 Base Plans:</p>	6.897	8.950	9.700	-	9.700

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Explore novel laser technologies to improve efficiency and decrease mass/volume. Demonstrate applications for short pulse laser technology. Scale electrically pumped alkali lasers to moderate power levels. Conduct an industry proposal call for FY 2012. FY 2012 OCO Plans:					
Title: Major Thrust 4. Description: Conduct system level technology development and trade studies to facilitate scaling free electron lasers (FELs) to weapons-class power levels and shipboard integration. FY 2010 Accomplishments: Continued the development path for scaling to a 100 kW (kilowatt) laboratory demonstration, with emphasis on technologies that can support one megawatt (MW) future FEL performance. Conducted an industry proposal call for FY 2010. FY 2011 Plans: Demonstrate scaling to a 100 kW laboratory demonstration, with emphasis on technologies that can support one MW future FEL performance. Conduct a Service and Agency proposal call for FY 2011. FY 2012 Base Plans: Demonstrate scaling to a 100 kW laboratory demonstration, with emphasis on technologies that can support one MW future FEL performance. Conduct a Service and Agency proposal call for FY 2012. FY 2012 OCO Plans:	4.120	4.460	4.320	-	4.320
Title: Major Thrust 5. Description: Develop technology to support high performance beam control systems and integrated demonstrations. FY 2010 Accomplishments: Demonstrated advanced component and control techniques for difficult environments, such as high speed flight, high turbulence, and extended ranges. Conducted an industry proposal call for FY 2010. FY 2011 Plans:	9.333	9.980	9.890	-	9.890

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Implement beam control technology options for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Conduct a Service and Agency proposal call for FY 2011.</p> <p>FY 2012 Base Plans: Implement beam control technology options for laser weapon use on multiple platforms (aircraft, ground vehicles and shipboard systems) in stressing environments. Conduct an industry proposal call for FY 2012.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 6.</p> <p>Description: Conduct laser vulnerability experiments on materials, components, and targets. Develop a lethality database, and integrate into a systems-level architecture plan and lethality models.</p> <p>FY 2010 Accomplishments: In close coordination with existing HEL models, integrated lethality data into campaign-level HEL system models. Conducted laser vulnerability experiments on materials, components, and targets. Updated laser systems inputs for the Joint Munitions Effect Manual.</p> <p>FY 2011 Plans: In close coordination with existing HEL models, integrate lethality data into campaign-level HEL system models. Conduct laser vulnerability experiments on materials, components, and targets. Update laser systems inputs for the Joint Munitions Effect Manual.</p> <p>FY 2012 Base Plans: In close coordination with existing HEL models, integrate lethality data into campaign-level HEL system models. Conduct laser vulnerability experiments on materials, components, and targets. Update laser systems inputs for the Joint Munitions Effect Manual.</p> <p>FY 2012 OCO Plans:</p>	4.323	4.544	4.580	-	4.580
<p>Title: Major Thrust 7.</p> <p>Description: Maintain and evaluate high-fidelity engineering models for HEL scenario evaluation. Provide for HEL system modeling for mission-level wargaming activities.</p> <p>FY 2010 Accomplishments:</p>	2.784	2.920	2.980	-	2.980

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>	PROJECT 625096: <i>High Energy Laser Research</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Completed, tested, and demonstrated solid state laser model. Completed HEL system scenario model and demonstrated engagement applications. FY 2011 Plans: Provide maintenance, verification, validation, and accreditation for updated system level HEL models. Conduct mission-level HEL engagement scenarios and wargame HEL concepts. Incorporate predictive avoidance modeling into existing HEL toolkit. FY 2012 Base Plans: Provide maintenance, verification, validation, and accreditation for updated system level HEL models. Conduct mission-level HEL engagement scenarios and wargame HEL concepts. Incorporate predictive avoidance modeling into existing HEL toolkit. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	44.876	53.384	54.059	-	54.059

	FY 2010	FY 2011
Congressional Add: Advanced Deformable Mirrors for High Energy Laser Weapons. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: High Bandwidth, High Energy Storage, Exawatt Laser Glass Development. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.788	-
Congressional Add: Planar Lightwave Circuit Development for High Power Military Laser Applications. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-
Congressional Adds Subtotals	6.771	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 2: <i>Applied Research</i>	R-1 ITEM NOMENCLATURE PE 0602890F: <i>High Energy Laser Research</i>	PROJECT 625096: <i>High Energy Laser Research</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	66.972	33.414	39.738	-	39.738	41.699	43.450	42.495	43.194	Continuing	Continuing
632100: <i>Laser Hardened Materials</i>	23.611	19.853	23.019	-	23.019	22.337	23.821	25.176	25.590	Continuing	Continuing
633153: <i>Non-Destructive Inspection Development</i>	4.000	2.260	5.144	-	5.144	7.384	7.453	5.350	5.439	Continuing	Continuing
633946: <i>Materials Transition</i>	28.278	9.039	9.218	-	9.218	9.096	9.174	9.447	9.601	Continuing	Continuing
634918: <i>Deployed Air Base Demonstrations</i>	11.083	2.262	2.357	-	2.357	2.882	3.002	2.522	2.564	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates materials technology for transition into Air Force systems. The program has five projects which develop: (1) hardened materials technologies for the protection of aircrews and sensors; (2) non-destructive inspection and evaluation technologies; (3) transition data on structural and non-structural materials for aerospace applications; (4) airbase operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities; and (5) advanced materials for space applications. Efforts in the program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	67.856	33.414	40.341	-	40.341
Current President's Budget	66.972	33.414	39.738	-	39.738
Total Adjustments	-0.884	-	-0.603	-	-0.603
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.885	-			
• Other Adjustments	0.001	-	-0.603	-	-0.603

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

Project: 633153: *Non-Destructive Inspection Development*

Congressional Add: *Aircraft Evaluation Readiness Initiative (AERI)*

FY 2010	FY 2011
2.390	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Congressional Add Subtotals for Project: 633153	2.390	-
Project: 633946: <i>Materials Transition</i>		
Congressional Add: <i>Metals Affordability Initiative</i>	9.958	-
Congressional Add: <i>EMI Grid Fabrication Technology</i>	2.390	-
Congressional Add: <i>Silicon Carbide Electronics Material Producibility Initiative</i>	5.019	-
Congressional Add: <i>SiC-RF Power for Avionics Systems</i>	1.593	-
Congressional Add Subtotals for Project: 633946	18.960	-
Project: 634918: <i>Deployed Air Base Demonstrations</i>		
Congressional Add: <i>Body Armor Improved Ballistic Protection</i>	1.753	-
Congressional Add: <i>Strategic Biofuels Supply System</i>	1.593	-
Congressional Add: <i>Sewage-Derived Biofuels Program</i>	3.824	-
Congressional Add: <i>Military Waste-to-Energy Project Using the Hydro-Thermal Energy Conversion (Hy-TEC) Process</i>	1.593	-
Congressional Add Subtotals for Project: 634918	8.763	-
Congressional Add Totals for all Projects	30.113	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 632100: <i>Laser Hardened Materials</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
632100: <i>Laser Hardened Materials</i>	23.611	19.853	23.019	-	23.019	22.337	23.821	25.176	25.590	Continuing	Continuing

Note

Note: Beginning in FY 2011, funds from Project 2100 are moved to Program Element 0602102F Project 4348 to increase emphasis on applied research.

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrews to perform required missions in threat environments. Advanced materials technologies are also developed and demonstrated to enhance protection for Air Force sensor systems to ensure safety, survivability, and operability in threat environments.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop and demonstrate materials technologies that enhance hardening for sensors, avionics, and components to increase survivability and mission effectiveness of aerospace systems.</p> <p>FY 2010 Accomplishments: Investigated performance of dual band limiter materials in tactical systems. Demonstrated protection strategies for large format multi-chip Charge Coupled Devices (CCDs). Fabricated and demonstrated solid state limiter and filter technology for protection of space systems. Evaluated materials survivability for space environments. Analyzed the effect of laser energy on optical materials and electro-optical sensors and space structural materials.</p> <p>FY 2011 Plans: Evaluate hardening performance of current materials and technologies to threats. Demonstrate detector hardening for next generation United States Air Force targeting platforms. Develop new persistent surveillance detectors with increased survivability. Design more robust Visible/Near Infrared (Vis/NIR) detectors. Incorporate materials in optical test bed configuration and test performance in relevant environments. Demonstrate optimized nonlinear optical limiter materials for damage protection. Demonstrate semiconductor optical limiter materials performance for damage protection. Verify performance of hardening Short Wavelength Infrared (SWIR) sensor systems. Evaluate materials survivability for relevant environments. Develop advanced thin film concepts for enhanced fixed filter performance.</p> <p>FY 2012 Base Plans:</p>	19.542	16.792	18.929	-	18.929

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 632100: <i>Laser Hardened Materials</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Continue to evaluate and prioritize advanced rugate coatings and liquid crystal materials technologies as protection against laser and directed energy threats aimed at sensors and avionics. Transition most mature coatings and liquid crystal hardening technologies for next generation targeting platforms. Initiate demonstrations of promising and viable coating and liquid crystal technologies into next generation of persistent surveillance sensor designs as well as demonstrating strategies to mitigate directed energy damage for visible/near infrared (Vis/NIR) detectors and Short Wave Infrared (SWIR) detectors that are critical for intelligence, surveillance, and reconnaissance (ISR) sensors. Continue testing of damage limiting semiconductor materials in test bed configuration to determine viability for protection of tactical and strategic space sensors and for short wave infrared systems. Assess vulnerability of current seekers/munitions against emerging countermeasure threats. Develop and demonstrate personnel protection technologies - including tailored rugate coatings and liquid crystal materials technologies specific for visor applications -against visible and SWIR directed energy laser threats.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2</p> <p>Description: Develop and demonstrate materials technologies that enhance protection for Air Force aircrews to ensure safety and to enable aircrew to perform required missions in a threat environment.</p> <p>FY 2010 Accomplishments: Integrated fixed optical coatings within visor applications for demonstration.</p> <p>FY 2011 Plans: Investigate susceptibility of candidate detectors for Head Mounted Display (HMD) systems. Demonstrate enhanced photorefractive hybrid materials concepts for Air Force passive protection applications. Identify personnel protection technologies for the visible and SWIR. Evaluate performance of optical coatings within visor applications.</p> <p>FY 2012 Base Plans: Develop and demonstrate personnel protection technologies for the visible and SWIR. Continue to evaluate performance and initiate process development of optical coatings within visor applications.</p> <p>FY 2012 OCO Plans:</p>	4.069	3.061	4.090	-	4.090
Accomplishments/Planned Programs Subtotals	23.611	19.853	23.019	-	23.019

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 632100: <i>Laser Hardened Materials</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603112F: <i>Advanced Materials for Weapon Systems</i>					633153: <i>Non-Destructive Inspection Development</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633153: <i>Non-Destructive Inspection Development</i>	4.000	2.260	5.144	-	5.144	7.384	7.453	5.350	5.439	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced nondestructive inspection/evaluation (NDI/E) technologies to monitor performance integrity and to detect failure causing conditions in weapon systems components and materials. NDI/E capabilities greatly influence and/or limit many design, manufacturing, and maintenance practices. This project provides technology to satisfy 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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop and demonstrate advanced technologies to improve capabilities to inspect for cracks and other damage to extend the total safe life of turbine engines.</p> <p>FY 2010 Accomplishments: Validated NDI/E approaches to extend the life of fracture-critical gas turbine engine components.</p> <p>FY 2011 Plans: Transition NDI/E approaches to extend the life of fracture-critical gas turbine engine components.</p> <p>FY 2012 Base Plans: Investigate NDI/E approaches to measure material properties to extend the life and increase durability of fracture-critical gas turbine engine components.</p> <p>FY 2012 OCO Plans:</p>	0.195	0.650	1.378	-	1.378
<p>Title: Major Thrust 2</p> <p>Description: Develop and demonstrate advanced inspection technologies supporting low-observable (LO) systems to enhance affordability and ensure full performance and survivability.</p> <p>FY 2010 Accomplishments: Transitioned a common, multiuse, multiplatform, handheld LO NDI/E point inspection tool/sensor system.</p> <p>FY 2011 Plans:</p>	0.761	0.351	0.421	-	0.421

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633153: <i>Non-Destructive Inspection Development</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop inspection methods and sensor technology for signature and material integrity of next generation LO material systems. FY 2012 Base Plans: Advance inspection methods and sensor technology for signature and material integrity of next generation LO material systems. FY 2012 OCO Plans:					
Title: Major Thrust 3 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. FY 2010 Accomplishments: Developed and demonstrated optimal sensing approaches for real-time health monitoring of high-temperature protection and advanced material systems and characterize power scavenging and signal transmission issues. Validated smart sensor technologies for wiring health analysis. Validated field and depot-level inspection tools for assessing the structural health of airframes. FY 2011 Plans: Demonstrate optimal sensing approaches for real-time health monitoring of high-temperature protection and advanced material systems and characterize power scavenging and signal transmission issues. Transition smart sensor technologies for wiring health analysis. Transition field and depot-level inspection tools for assessing the structural health of airframes. FY 2012 Base Plans: Continue to transition smart sensor technologies for wiring health analysis. Continue to transition field and depot-level inspection tools for assessing the structural health of airframes. FY 2012 OCO Plans:	0.654	1.259	3.345	-	3.345
Accomplishments/Planned Programs Subtotals	1.610	2.260	5.144	-	5.144
	FY 2010	FY 2011			
Congressional Add: Aircraft Evaluation Readiness Initiative (AERI)	2.390	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633153: <i>Non-Destructive Inspection Development</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	2.390	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>				PROJECT 633946: <i>Materials Transition</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633946: <i>Materials Transition</i>	28.278	9.039	9.218	-	9.218	9.096	9.174	9.447	9.601	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced materials and processing technologies for fielded and planned Air Force weapon, airframe, 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. These design and scale-up data improve the overall affordability of promising materials and processing technologies, providing needed initial incentives for their industrial development.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	3.066	4.254	4.168	-	4.168
Description: Develop and demonstrate Materials and Processes (M&P) technologies for air vehicle and subsystems to enhance lift, propulsion, low-observable performance, power generation management, and affordability of air vehicles.					
FY 2010 Accomplishments: Refined processes for producing large area, high-quality diamond windows for airborne high power microwave directed energy weapons. Initially developed nanostructured materials using multiple approaches for high energy density capacitors for pulsed power applications. Transitioned and validate the methodology to characterize LO materials during production for process control and process validation.					
FY 2011 Plans: Develop and transition production-level capable processes for producing large area, high-quality diamond windows for airborne high power microwave directed energy weapons. Demonstrate and compare advantages of approaches for high energy density capacitors for pulsed power applications. Initiate validation of processing methods and lifing tools for hybrid disk concepts. Initiate validation of processing methods and lifing methodologies for advanced (Silicon Carbide) SiC/SiC composites. Develop and demonstrate methodology for process control and validation of next generation Low Observable (LO) material systems.					
FY 2012 Base Plans: Demonstrate high rate production-capable processes for producing large area, high quality diamond windows for airborne high power microwave directed energy weapons. Develop materials enabling critical components for next-generation airborne high energy lasers that are solid-state, electrically-powered, and significantly					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633946: <i>Materials Transition</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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higher efficiency. Advance validation of processing methods and lifing tools for graded microstructure turbine engine disk concepts. Advance validation of processing methods and lifing methodologies for advanced high temperature SiC/SiC-based composites. Develop and validate next generation NDE/I sensor systems for advanced LO material systems.

FY 2012 OCO Plans:

Title: Major Thrust 2	4.299	0.711	0.750	-	0.750
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Description: Develop and demonstrate M&P technologies to enhance the sustainability of aerospace systems by lowering Operations and Maintenance (O&M) costs to ensure the full operability and safety of systems and personnel.

FY 2010 Accomplishments:

Demonstrated innovative technologies for bare base utilities. Developed new design and manufacturing processes to achieve dramatic reductions in nonrecurring fabrication and assembly tooling costs and schedules for composite and metallic aircraft utilizing bonded structures and friction stir welding.

FY 2011 Plans:

Demonstrate and transition innovative technologies for bare base utilities.

FY 2012 Base Plans:

Demonstrate and transition innovative technologies for bare base utilities.

FY 2012 OCO Plans:

Title: Major Thrust 3	1.953	4.074	4.300	-	4.300
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Description: Develop and demonstrate affordable, novel high temperature materials/structures and thermal management concepts to enable future defense capabilities for prompt global strike concepts.

FY 2010 Accomplishments:

Identified key issues and structural concepts for hot structure and thermal protection systems to be fabricated from advanced ceramics, ceramic matrix composites, hybrids, and advanced metals and intermetallics.

FY 2011 Plans:

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633946: <i>Materials Transition</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Explore fabrication techniques for hot structure and thermal protection systems from advanced ceramics, ceramic matrix composites, hybrids and advanced metals and intermetallics. FY 2012 Base Plans: Advance multi-material structure to optimally address operational temperature zones for hot structure and thermal protection systems from advanced ceramics, ceramic matrix composites, hybrids and advanced metals and intermetallics. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	9.318	9.039	9.218	-	9.218

	FY 2010	FY 2011
Congressional Add: Metals Affordability Initiative FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	9.958	-
Congressional Add: EMI Grid Fabrication Technology FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	2.390	-
Congressional Add: Silicon Carbide Electronics Material Producibility Initiative FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	5.019	-
Congressional Add: SiC-RF Power for Avionics Systems FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Adds Subtotals	18.960	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 633946: <i>Materials Transition</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>				PROJECT 634918: <i>Deployed Air Base Demonstrations</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634918: <i>Deployed Air Base Demonstrations</i>	11.083	2.262	2.357	-	2.357	2.882	3.002	2.522	2.564	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced, rapidly deployable airbase technologies that enable agile combat support by reducing airbase manpower requirements, reducing airbase setup times and improving the protection and survivability of deployed Air Force Expeditionary (AFE) warfighters. Affordable, efficient technologies are developed and demonstrated to provide deployable infrastructure, weapon system support, blast and munition force protection and firefighting capability for deployed AEF operations.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Demonstrate and transition deployable infrastructure airbase technologies, to reduce airlift and manpower requirements, setup time, and sustainment costs in support of AEF operations.</p> <p>FY 2010 Accomplishments: Demonstrated and transitioned methods for integrated, advanced power generation and distribution. Demonstrated methods and technologies for performing aircraft operating surface evaluations for ability to sustain aircraft operations. Demonstrated and analyzed rapid temporary and permanent high temperature operating surface repairs.</p> <p>FY 2011 Plans: Continue to demonstrate and transition integrated, advanced power generation and distribution methods. Demonstrate methods and technologies to evaluate operating surfaces for ability to sustain remote and autonomous aircraft operations. Demonstrate and optimize rapid temporary and permanent high temperature operating surface repairs.</p> <p>FY 2012 Base Plans: Characterize, demonstrate and fabricate airbase alternative energy generation, power grid conditioning and distribution methods. Characterize and develop best practices for aircraft operating surface evaluation and repair technologies. Characterize, fabricate and demonstrate aircraft operating surface high operating temperature materials and technologies.</p> <p>FY 2012 OCO Plans:</p>	1.130	1.074	1.098	-	1.098

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 634918: <i>Deployed Air Base Demonstrations</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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Title: Major Thrust 2	1.190	1.188	1.259	-	1.259
Description: Demonstrate and transition technologies to provide force protection and fire fighting capability for deployed AEF operations.					
FY 2010 Accomplishments: Demonstrated agile and lightweight adaptive blast suppression materials in representative structures. Integrated and demonstrated candidate fire fighter safety technologies against representative environments and threats. Integrated and demonstrated candidate ultrahigh pressure nozzles, and other technologies in fire safety systems. Demonstrated air filtration and reactive filtration effectiveness for expeditionary structures and personnel protection.					
FY 2011 Plans: Demonstrate and transition agile, lightweight adaptive blast suppression materials in representative structures. Demonstrate and optimize candidate fire fighter safety technologies against representative environments and threats. Demonstrate and transition candidate ultrahigh pressure nozzles, and other technologies in fire safety systems. Develop and demonstrate reactive and responsive materials for platforms, expeditionary structures and personnel protection.					
FY 2012 Base Plans: Characterize and maintain competency for fabrication and demonstration of technologies for airbase structural protection against blast and fragmentation. Characterize and develop technologies for airbase firefighting and composite materials combustion.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals					
	2.320	2.262	2.357	-	2.357

	FY 2010	FY 2011
Congressional Add: Body Armor Improved Ballistic Protection	1.753	-
FY 2010 Accomplishments: Conduct Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Add: Strategic Biofuels Supply System	1.593	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603112F: <i>Advanced Materials for Weapon Systems</i>	PROJECT 634918: <i>Deployed Air Base Demonstrations</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:		
Congressional Add: Sewage-Derived Biofuels Program FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	3.824	-
Congressional Add: Military Waste-to-Energy Project Using the Hydro-Thermal Energy Conversion (Hy-TEC) Process FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Adds Subtotals	8.763	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>								
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	2.852	2.935	5.780	-	5.780	6.744	9.582	9.548	9.705	Continuing	Continuing
635351: <i>Technology Sustainment</i>	2.852	2.935	5.780	-	5.780	6.744	9.582	9.548	9.705	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates sustainment technologies such as materials, corrosion, and structures for transition into Air Force systems to increase readiness and reduce life cycle costs. Technologies matured and demonstrated in this program impact affordability and availability of fielded and future aerospace weapon systems by extending service life, ensuring flight safety, reducing sustainment costs, and ensuring mission readiness and capability. This project develops and demonstrates technologies that can be implemented to address operational sustainment issues on existing systems as well as supports new system sustainability through demonstration of technologies related to robust life cycle management, system design, fleet management decision making, and mission capability. Studies are conducted to identify and analyze design methodologies that focus on building in sustainability into future applications. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for sustaining existing and future aerospace systems that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	2.943	2.935	5.876	-	5.876
Current President's Budget	2.852	2.935	5.780	-	5.780
Total Adjustments	-0.091	-	-0.096	-	-0.096
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.091	-			
• Other Adjustments	-	-	-0.096	-	-0.096

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>	PROJECT 635351: <i>Technology Sustainment</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635351: <i>Technology Sustainment</i>	2.852	2.935	5.780	-	5.780	6.744	9.582	9.548	9.705	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates sustainment technologies such as materials, corrosion, and structures for transition into Air Force systems to increase readiness and reduce life cycle costs. Technologies matured and demonstrated in this program impact affordability and availability of fielded and future aerospace weapon systems by extending service life, ensuring flight safety, reducing sustainment costs, and ensuring mission readiness and capability. This project develops and demonstrates technologies that can be implemented to address operational sustainment issues on existing systems as well as supports new system sustainability through demonstration of technologies related to robust life cycle management, system design, fleet management decision making, and mission capability. Studies are conducted to identify and analyze design methodologies that focus on building in sustainability into future applications. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for sustaining existing and future aerospace systems that have military utility and address warfighter needs.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop, demonstrate, and transition system health management technologies. Conduct studies and analyses to design in sustainability into future applications.</p> <p>FY 2010 Accomplishments: Developed and demonstrated fatigue/corrosion diagnostics sensors and algorithms for interpreting sensor data. Demonstrated real time diagnostic technologies and develop life prediction model capability to support risk-based decision making and prognostics.</p> <p>FY 2011 Plans: Continue efforts related to fatigue/corrosion diagnostics sensors and algorithms. Refine efforts to verify and validate real time material state awareness capability for engine and airframe structural components. Incorporate health assessment technologies into system data environment.</p> <p>FY 2012 Base Plans: Verify capability of state of the art reasoners to assess component health and real time awareness for engine components. Develop and demonstrate real time diagnostic technologies. Develop life prediction model</p>	1.412	1.475	2.842	-	2.842

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>	PROJECT 635351: <i>Technology Sustainment</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
capability to support risk based decision making and prognostics. Incorporate health assessment technologies into system data environment.					
FY 2012 OCO Plans:					
Title: Major Thrust 2. Description: Develop, demonstrate, and transition technologies to improve component design, maintenance, replacement, and concepts for performance improvement and reduced maintenance burden. FY 2010 Accomplishments: Evaluated low maintenance materials and structural concepts. Demonstrated capability of certification by analysis. Developed technology options to improve sustainability of systems. FY 2011 Plans: Integrate structural life enhancement/replacement application concepts. Demonstrate risk-based approach to structural integrity decision making. Demonstrate capability of certification by analysis to reduce design time, implementation, and sustainment costs. FY 2012 Base Plans: Continue to evaluate concepts for integrated structural life enhancement/replacement concepts. Demonstrate risk-based approach to structural integrity decision making. Assess capability of certification by analysis to reduce design time, implementation, and sustainment costs. FY 2012 OCO Plans:	0.480	0.480	0.940	-	0.940
Title: Major Thrust 3. Description: Develop, demonstrate, and transition technologies to improve on existing and new components to decrease downtime, costs, and increase reliability. FY 2010 Accomplishments: Began to develop and demonstrate technologies that directly respond to sustainment needs identified by existing Air Force systems. Initiated efforts to demonstrate high reliability maintenance free repair technologies. FY 2011 Plans:	0.960	0.980	1.998	-	1.998

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603199F: <i>Sustainment Science and Technology (S&T)</i>	PROJECT 635351: <i>Technology Sustainment</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Evaluate technological means to adjust maintenance management and operational sustainment. Demonstrate high reliability maintenance free repair technologies. Demonstrate improved maintenance and repair data base systems. FY 2012 Base Plans: Evaluate technological means to adjust system management and operational sustainment. Demonstrate high reliability repair technologies. Demonstrate improved maintenance and repair data base systems. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	2.852	2.935	5.780	-	5.780

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE								
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603203F: <i>Advanced Aerospace Sensors</i>								
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	71.700	44.677	53.075	-	53.075	52.615	53.871	52.128	52.985	Continuing	Continuing
63665A: <i>Advanced Aerospace Sensors Technology</i>	26.202	22.996	27.449	-	27.449	27.196	27.259	24.329	24.729	Continuing	Continuing
6369DF: <i>Target Attack and Recognition Technology</i>	45.498	21.681	25.626	-	25.626	25.419	26.612	27.799	28.256	Continuing	Continuing

A. Mission Description and Budget Item Justification

Divided into two broad project areas, this program develops technologies to enable the continued superiority of sensors from aerospace platforms. The first project develops and demonstrates advanced technologies for electro-optical sensors, radar sensors and electronic counter-countermeasures, and components and algorithms. The second project develops and demonstrates radio frequency and electro-optical sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets obscured by natural or man-made means. Together, the projects in this program develop the means to find, fix, target, track, and engage air and ground targets anytime, anywhere, and in any weather. This program has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and electronic combat system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	52.786	44.677	50.650	-	50.650
Current President's Budget	71.700	44.677	53.075	-	53.075
Total Adjustments	18.914	-	2.425	-	2.425
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	4.084	-			
• SBIR/STTR Transfer	-1.170	-			
• Other Adjustments	16.000	-	2.425	-	2.425

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

Project: 6369DF: *Target Attack and Recognition Technology*

Congressional Add: *Reconfigurable Secure Computing Technologies*

	FY 2010	FY 2011
	1.593	-
	1.593	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>
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<u>Congressional Add Details (\$ in Millions, and Includes General Reductions)</u>	FY 2010	FY 2011
Congressional Add Subtotals for Project: 6369DF		
Congressional Add Totals for all Projects	1.593	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>				PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63665A: <i>Advanced Aerospace Sensors Technology</i>	26.202	22.996	27.449	-	27.449	27.196	27.259	24.329	24.729	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project 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. Desired warfighting capabilities include the ability to detect concealed targets in difficult background conditions.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop electro-optical sensor technology to detect, locate, and identify air and ground targets at long ranges, including those that are low-observable, or use deception or camouflage.</p> <p>FY 2010 Accomplishments: Completed end-to-end performance characterization, via airborne flight test, of high-resolution, three-dimensional laser radar for high confidence target identification coupled with passive spectral imaging for low false alarm rate detection utilizing change detection and spatial-spectral discrimination techniques. Designed airborne multispectral/polarimetric sensor module for long range target discrimination and integrated laser radar for long range identification of stationary and moving targets.</p> <p>FY 2011 Plans: Perform concept validation and signature utility experiments for long range multispectral/polarimetric and synthetic aperture laser radar imaging. Continue signature collection experiments with multispectral/polarimetric imaging systems to assess military utility. Initiate laboratory and field experiments for mitigating primary risk areas associated with synthetic aperture laser radar imaging from airborne platforms.</p> <p>FY 2012 Base Plans:</p>	3.837	1.317	1.404	-	1.404

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>		PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Perform concept validation and signature utility experiments for long range synthetic aperture laser radar imaging. Continue laboratory and field experiments for mitigating primary risk areas associated with synthetic aperture laser radar imaging from airborne platforms. Initiate development of master oscillator technology. FY 2012 OCO Plans:					
Title: Major Thrust 2. Description: Develop technologies to maximize positional accuracy, timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities. FY 2010 Accomplishments: Demonstrated optimized reference for precise emitter geolocation, utilizing advanced two-way time transfer techniques. Explored feasibility and goals for reference optimization for bi-static and multi-static radar application. FY 2011 Plans: Develop reference optimization components necessary to support bi-static and multi-static radar technologies. Evaluate progress and determine next spiral requirements. FY 2012 Base Plans: Develop geo-spatial, time independent technologies addressing the shortfalls discovered during assessment of bi-static and multi-static radar technologies. FY 2012 OCO Plans:	0.700	1.232	1.462	-	1.462
Title: Major Thrust 3. Description: Develop light, low power, compact RF sensors to use against difficult-to-detect targets, enable persistent ISR from remotely piloted aircraft (RPA), and detect advanced air and ground targets. FY 2010 Accomplishments: Demonstrated radio-frequency sensors (Ultra-High Frequency (UHF) radar, X-band radar, electronic support sensors) of an integrated electro-optical/radio-frequency sensor suite for RPA with severe size, weight, and power constraints to enable persistent intelligence, surveillance, and reconnaissance capabilities compatible with a system of systems architecture. Used the modeling, simulation, and analysis test bed, including radio-frequency and electro-optical sensing modes, to provide input into the required design for an integrated electro-	17.121	14.899	18.045	-	18.045

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>		PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>optical/radio-frequency sensor suite, including required data processing and exploitation. Provided sensor systems engineering support fostering the transition of developed enabling technologies and concepts to weapon systems and intelligence, surveillance, and reconnaissance assets. Enhanced the systems engineering to consider the optimal use of a high-altitude, long-endurance sensor platform within a layered sensing architecture.</p> <p>FY 2011 Plans: Complete demonstration of the radio-frequency sensors (Ultra-High Frequency (UHF) radar, X-band radar, electronic support sensors) of an integrated electro-optical/radio-frequency sensor suite for RPA with severe size, weight, and power constraints to enable single platform persistent intelligence, surveillance, and reconnaissance capabilities compatible with a system of systems architecture. Include in the demonstration simultaneous air and ground target tracking. Design and demonstrate multiple radio frequency emitter/receiver sensor operation to include waveform diversity electronic protection techniques and advanced high range resolution target response characteristics. Continue to improve the capabilities of receivers in a passive mode to enhance the detection and tracking of airborne and ground based targets with low radar cross section (including dismounts), concealment capabilities, or employment of electronic counter-countermeasures. Emphasis is on low cost sensing capability to bolster system ubiquity.</p> <p>FY 2012 Base Plans: Complete dismount detection systems engineering analysis and demonstration. Initiate test and evaluation of dismount radar detection back end and algorithms in conjunction with the outdoor range. Initiate persistent multiple intelligence sources (multi-INT) layered sensing demonstration. Continue development of common RF backend (demonstration of open systems architecture) for combined radar and signals intelligence (SIGINT) processing for eventual integration into the outdoor range. Complete development and testing of reconfigurable array manifold and initiate integration with multi-channel receiver for system demonstration. Continue outdoor range operations and experiments and enhance capabilities including multi-channel X-band radar, develop dual channel, solid state S-band transmitter for polarization experimentation and 3D imaging with noise radars. Provide technical support to a high altitude radar demonstration.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 4.</p> <p>Description: Develop technologies to provide precision position and timing information to enable distributed, layered sensing on large air and space vehicles in a global position system (GPS)-denied environments.</p>					
	2.055	3.969	4.422	-	4.422

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
technology developed under other component development projects and assess utility for high altitude and space platforms. FY 2012 Base Plans: Continue concept demonstration experiments for exploiting infrared persistent surveillance imagery to detect, track, and characterize targets in urban areas. Perform utility assessment experiments to quantify system performance and develop image processing techniques. Continue development of large format infrared camera technology for distributed airborne surveillance. FY 2012 OCO Plans: Title: Major Thrust 6. Description: Reduce technology risk for space sensor platform payload components and exploitation of infrastructure integration. FY 2010 Accomplishments: Developed Mission Design Tool kit and experimental hardware for class III (scalable payloads) sensors. Begin to address PnP (Plug and Play) concepts for large satellite systems. FY 2011 Plans: FY 2012 Base Plans: FY 2012 OCO Plans:	1.560	-	-	-	-
Accomplishments/Planned Programs Subtotals	26.202	22.996	27.449	-	27.449

C. Other Program Funding Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 63665A: <i>Advanced Aerospace Sensors Technology</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
6369DF: <i>Target Attack and Recognition Technology</i>	45.498	21.681	25.626	-	25.626	25.419	26.612	27.799	28.256	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for attack management, fire control, and target identification and recognition. This includes developing and demonstrating integrated and cooperative fire control techniques to provide for adverse-weather precision air strikes against multiple targets per pass and at maximum weapon launch ranges. Specific fire control technologies under development include attack management, sensor fusion, automated decision aids, advanced tracking for low radar cross section threats, and targeting using both on-board and off-board sensor information. This project also evaluates targeting techniques to support theater missile defense efforts in surveillance and attack. These fire control technologies will provide force multiplication and reduce warfighter exposure to hostile fire. This project also develops and demonstrates target identification and recognition technologies for positive, high confidence cueing, recognition, and identification of airborne and ground-based, high-value, time-critical targets at longer ranges than are currently possible. The goal is to apply these technologies to tactical air-to-air and air-to-surface weapon systems so they are able to operate in all weather conditions, during day or night, and in high-threat, multiple target environments. Model-based vision algorithms and target signature development techniques are the key to target identification and recognition. This project is maturing these technologies in partnership with the Defense Advanced Research Projects Agency and evaluating the techniques to support theater missile defense efforts in surveillance and attack. Fire control and recognition technologies developed and demonstrated in this project are high leverage efforts, providing for significant advancements in operational capabilities largely through software improvements readily transitionable to new and existing weapon systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop and test an automatic target recognition system for tracking and identifying moving and stationary ground targets for use in strike and reconnaissance platforms.</p> <p>FY 2010 Accomplishments: Completed the transition of moving target algorithm technology to operational strike and reconnaissance platforms.</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	0.096	-	-	-	-
<p>Title: Major Thrust 2.</p>	1.905	3.077	4.721	-	4.721

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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Description: Develop and assess multi-sensor automatic target recognition for intelligence, surveillance, reconnaissance, strike, and weapon systems.

FY 2010 Accomplishments:
Conducted spiral development and assessment of multi-sensor automatic target recognition fusion algorithms. Conducted assessment of technology supporting intelligence, surveillance, reconnaissance, strike, and weapon systems using the Air Force automatic target recognition test and evaluation facility. Conducted spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Developed an automatic target recognition fusion sensor data exploitation capability utilizing analysis and experimentation of data independence and interdependence of features to support development of an optimum data fusion exploitation capability. Enhanced the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced automatic target recognition fusion capabilities. Determined technology shortfalls and developed automatic target recognition fusion technologies to overcome these shortfalls. Executed a laboratory demonstration of technology developed to date.

FY 2011 Plans:
Continue spiral development and assessment of multi-sensor automatic target recognition fusion algorithms. Continue assessment of technology supporting intelligence, surveillance, reconnaissance, strike, and weapon systems using the Air Force automatic target recognition test and evaluation facility. Continue spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Begin development of signature science for automatic target recognition database development. Continue development of an automatic target recognition fusion sensor data exploitation capability utilizing analysis and experimentation of data independence and interdependence of features to support development of an optimum data fusion exploitation capability. Enhance the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced automatic target recognition fusion capabilities. Determine technology shortfalls and develop automatic target recognition fusion technologies to overcome these shortfalls. Execute a field demonstration of technology developed to date.

FY 2012 Base Plans:
Continue spiral development and assessment of multi-sensor automatic target recognition fusion algorithms. Continue assessment of technology supporting intelligence, surveillance, reconnaissance, strike, and

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p><i>FY 2010 Accomplishments:</i> Assessed performance of developed technology and developed enhancements to automatic target recognition, automatic target cueing, geo-registration, and change detection technology to meet warfighter needs. Assessed and enhanced technology supporting time-critical targeting systems in the Air Force automatic target recognition test and evaluation facility. Conducted spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Enhanced the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced time-critical targeting capabilities. Conducted spiral development and assessment development of time-critical targeting and advanced target tracking technologies required to meet warfighter requirements.</p> <p><i>FY 2011 Plans:</i> Determine state of the art technology capabilities and spirally develop enhancements to automatic target recognition, automatic target cueing, geo-registration, and change detection technology to meet warfighter needs. Continue assessment and enhancement of technology supporting time-critical targeting systems in the Air Force automatic target recognition test and evaluation facility. Continue spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Enhance the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced time-critical targeting capabilities.</p> <p><i>FY 2012 Base Plans:</i> Determine technology shortfalls in automatic target recognition, automatic target cueing, geo-registration, and change detection technology to meet warfighter needs. Begin technology development addressing identified shortfalls. Continue assessment and enhancement of technology supporting time-critical targeting systems in the Air Force automatic target recognition test and evaluation facility. Continue spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Enhance the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced time-critical targeting capabilities.</p> <p><i>FY 2012 OCO Plans:</i></p> <p><i>Title:</i> Major Thrust 5.</p> <p><i>Description:</i> Develop an identify friend, foe, or neutral, air-to-ground capability using cooperative and non-cooperative identification techniques.</p>	1.355	1.018	0.966	-	0.966
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p><i>FY 2010 Accomplishments:</i> Developed, integrated, and tested the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the individual component stage. Integrated, demonstrated, and tested the enhanced, spiral two, wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses in the Air Force automatic target recognition test and evaluation facility. Conducted spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter. Identified emerging technologies for a sense and avoid capability for Reaper-class remotely piloted aircraft.</p> <p><i>FY 2011 Plans:</i> Develop, integrate and test to technology readiness level (TRL) 5, the next spiral engineering model of the multi-sensor, multi-wavelength wide-angle, continuously-staring capability building upon the technologies developed during the previous demonstration. Integrate, demonstrate and test the enhanced, TRL 5, wide angle, continuously-staring component technologies via a combination of exercises and scientific analyses in the Air Force automatic target recognition test and evaluation facility. Continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter. Increase TRL to 5 and demonstrate in a militarily significant scenario, evaluate results and begin transition. Demonstrate open and closed-loop autonomous sense and avoid capability on a surrogate aircraft.</p> <p><i>FY 2012 Base Plans:</i> Assess wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases for sufficiency in supporting mission requirements. Based on identified shortfalls, continue spiral development of wide angle, continuous staring exploitation algorithms, phenomenological modeling, target and scenario databases necessary to support transition to the warfighter.</p> <p><i>FY 2012 OCO Plans:</i></p>					
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<p><i>Title:</i> Major Thrust 7.</p> <p><i>Description:</i> Develop an advanced suite of sensors with automatic target recognition, fusion, and target tracking, all working in concert to provide a high-confidence identification capability.</p> <p><i>FY 2010 Accomplishments:</i></p>	9.627	6.048	8.671	-	8.671
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603203F: <i>Advanced Aerospace Sensors</i>	PROJECT 6369DF: <i>Target Attack and Recognition Technology</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Integrated the advanced aimpoint tracking, electro-optical automatic target recognition, synthetic aperture radar automatic target recognition and the multi-sensor fusion algorithms. Tested the integrated system and develop the second spiral requirements. Enhanced phenomenological modeling, target and scenario databases and exploitation tools necessary to support spiral two technology development. Assessed maturity of technology during the spiral process via the Air Force automatic target recognition test and evaluation facility and other sensor test facilities.</p> <p>FY 2011 Plans: Identify candidate technologies to improve aimpoint tracking, electro-optical automatic target recognition, synthetic aperture radar automatic target recognition and the multi-sensor fusion algorithms. Predict performance of the integrated technologies and system. Enhance phenomenological modeling, target and scenario databases and exploitation tools necessary to support technology development. Assess maturity of applicable technology during the Air Force automatic target recognition test and evaluation facility and other sensor test facilities.</p> <p>FY 2012 Base Plans: Continue development of technologies to address deficiencies to improve aimpoint tracking, electro-optical automatic target recognition, synthetic aperture radar automatic target recognition and the multi-sensor fusion algorithms. Validate prediction performance of the integrated technologies and system and determine technology shortfalls. Continue enhancement of phenomenological modeling, target and scenario databases and exploitation tools necessary to support technology development. Continue assessment of applicable technology during the via the Air Force automatic target recognition test and evaluation facility and other sensor test facilities. Improve and enhance capabilities in spiral fashion.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 8.</p> <p>Description: Investigate airborne techniques and algorithms for space object identification and characterization, and airborne technology for multi-sensor data fusion for better characterization.</p> <p>FY 2010 Accomplishments:</p>					
	0.312	0.104	0.088	-	0.088

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Initiated an effort to process multiple sources of ground based space situational awareness data on various space objects using upgraded space object ID algorithms for validation, along with upgrades to a space object ID database.</p> <p>FY 2011 Plans: Begin spiral development and assessment of multi-sensor, space object focused, automatic target recognition fusion algorithms. Assess technology supporting space object recognition in the Air Force automatic target recognition test and evaluation facility. Continue spiral development and validation of synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Critically examine target and scenario data to determine independence and interdependence of features to support development of an optimum data fusion exploitation capability. Incorporate enhanced Space Object Identification models into advanced space situational awareness experiments. Continue enhancement of the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced space situational awareness automatic target recognition fusion capabilities.</p> <p>FY 2012 Base Plans: Continue spiral development and assessment of multi-sensor, space object focused, automatic target recognition fusion algorithms. Assess technology supporting space object recognition in the Air Force automatic target recognition test and evaluation facility. Validate synthetic data generation capability critically needed to augment collected research, development, and operational data sets. Initiate research into techniques to address discovered shortfalls. Critically examine target and scenario data to determine independence and interdependence of features to support development of an optimum data fusion exploitation capability. Continue to incorporate enhanced Space Object Identification (SOI) models into advanced space situational awareness experiments. Continue enhancement of the Air Force automatic target recognition test and evaluation facility and data sets as required to support enhanced space situational awareness automatic target recognition fusion capabilities.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 9.</p> <p>Description: Develop an airship for the Blue Devil 2 demonstration. Note: This funding was added by Congress in the FY10 Overseas Contingency Operations bill.</p>	16.000	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><i>FY 2010 Accomplishments:</i> Develop an airship for the Blue Devil Block 2 demonstration. A portion of development funding was provided by the Army using funds added by Congress in the FY10 Overseas Contingency Operations bill.</p> <p><i>FY 2011 Plans:</i></p> <p><i>FY 2012 Base Plans:</i></p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	43.905	21.681	25.626	-	25.626

	FY 2010	FY 2011
<p><i>Congressional Add:</i> Reconfigurable Secure Computing Technologies</p> <p><i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.</p> <p><i>FY 2011 Plans:</i></p>	1.593	-
Congressional Adds Subtotals	1.593	-

C. Other Program Funding Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603211F: <i>Aerospace Technology Dev/Demo</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	73.589	53.588	67.474	-	67.474	64.058	66.450	68.955	70.107	Continuing	Continuing
63486U: <i>Advanced Aerospace Structures</i>	11.700	-	-	-	-	-	-	-	-	Continuing	Continuing
634920: <i>Flight Vehicle Tech Integration</i>	61.889	53.588	67.474	-	67.474	64.058	66.450	68.955	70.107	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program demonstrates advanced aerospace vehicle technologies. Advanced aerospace structures are demonstrated to enhance the capability of current and future aerospace vehicles. Aerospace vehicle technology integration is accomplished through integration of various technologies to include avionics, advanced propulsion, and weapon systems for demonstration in near-realistic operational environments. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing aerospace vehicle system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	88.226	53.588	55.562	-	55.562
Current President's Budget	73.589	53.588	67.474	-	67.474
Total Adjustments	-14.637	-	11.912	-	11.912
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.002	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-12.366	-			
• SBIR/STTR Transfer	-2.269	-			
• Other Adjustments	-	-	11.912	-	11.912

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

Project: 63486U: *Advanced Aerospace Structures*

Congressional Add: *Big Antennas Small Structures Efficient Tactical Unmanned Air Vehicles.*

Congressional Add: *3D Bais Woven Preform Development.*

Congressional Add: *Long-Loiter, Load Bearing Antenna Platform for Pervasive Airborne Intelligence*

	FY 2010	FY 2011
	1.593	-
	2.390	-
	3.983	-

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/Demo</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Program Increase*

Congressional Add Subtotals for Project: 63486U

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	3.734	-
	11.700	-
	11.700	-

Change Summary Explanation

Increased funding in FY 2012 and out is due to emphasis being placed on fuel efficiencies and mobility-related efforts involving the X-55 Advanced Composite Cargo Aircraft.

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APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>				63486U: <i>Advanced Aerospace Structures</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63486U: <i>Advanced Aerospace Structures</i>	11.700	-	-	-	-	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is used to provide visibility for Congressionally direct efforts related to developing or demonstrating aerospace vehicle technologies.

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

	FY 2010	FY 2011
Congressional Add: Big Antennas Small Structures Efficient Tactical Unmanned Air Vehicles. FY 2010 Accomplishments: Conducted Congressionally directed effort. FY 2011 Plans:	1.593	-
Congressional Add: 3D Bais Woven Preform Development. FY 2010 Accomplishments: Conducted Congressionally directed effort. FY 2011 Plans:	2.390	-
Congressional Add: Long-Loiter, Load Bearing Antenna Platform for Pervasive Airborne Intelligence FY 2010 Accomplishments: Conducted Congressionally directed effort. FY 2011 Plans:	3.983	-
Congressional Add: Program Increase FY 2010 Accomplishments: Conducted Congressionally directed effort. FY 2011 Plans:	3.734	-
Congressional Adds Subtotals	11.700	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Not Applicable.</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634920: <i>Flight Vehicle Tech Integration</i>	61.889	53.588	67.474	-	67.474	64.058	66.450	68.955	70.107	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project 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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop autonomous flight controls for safe flight and cooperative operations between manned and remotely piloted air platforms.</p> <p>FY 2010 Accomplishments: Furthered the development and demonstration of situational awareness, autonomous control, and survivability technologies for air vehicles. Continued development and demonstration of cooperative teaming of small unmanned air vehicles in complex, low altitude environments. Continued development of autonomous launch, recovery, and safe airspace interoperability technologies for remotely piloted systems.</p> <p>FY 2011 Plans: Further the development and demonstration process for situational awareness, autonomous control, and survivability technologies. Continue efforts for cooperative teaming of small remotely piloted aircraft in complex, low altitude environments. Continue development of autonomous launch and safe airspace interoperability technologies for multiple remotely piloted systems.</p> <p>FY 2012 Base Plans: Develop and demonstrate technologies that provide situational awareness, autonomous control, and survivability for remotely piloted systems and manned platforms. Continue efforts for cooperative teaming of small remotely piloted platforms in complex, low altitude environments. Initiate testing of advanced control systems. Continue development of autonomous launch and safe airspace interoperability technologies for multiple remotely piloted systems.</p> <p>FY 2012 OCO Plans:</p>	6.963	13.197	13.906	-	13.906

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2.</p> <p>Description: Develop, simulate, and demonstrate integrated technologies to improve the performance of aerospace platform capabilities.</p> <p>FY 2010 Accomplishments: Developed and demonstrated flow control for reducing acoustic loading and enhancing weapon separation from future strike platforms. Developed a simulation environment for evaluating network centric technologies. Conducted flight demonstration efforts of an X-type cargo aircraft.</p> <p>FY 2011 Plans: Continue work to develop and demonstrate flow control for reducing acoustic loading and enhancing weapon separation from future strike platforms.</p> <p>FY 2012 Base Plans: Continue work to develop and demonstrate flow control for reducing acoustic loading and enhancing weapon separation from future strike platforms. Continue development efforts for cargo type platforms. Initiate combined inlet and large bypass ratio fan demonstration.</p> <p>FY 2012 OCO Plans:</p>	25.960	0.567	11.680	-	11.680
<p>Title: Major Thrust 3.</p> <p>Description: Develop aircraft structures that have embedded components, which have previously been separate components that were attached to the air platforms.</p> <p>FY 2010 Accomplishments: Completed assessment of flight demonstration of the large X-band electronically scanned antenna array embedded in a load-bearing structure. Assessed results of ultra lightweight multi-functional airframes. Demonstrated key high altitude persistent Intelligence, Surveillance, and Reconnaissance technologies.</p> <p>FY 2011 Plans: Complete assessment of test results for electronically scanned antenna array embedded in a load-bearing structure. Flight test of antenna integration into load-bearing structures. Initiate demonstration efforts for</p>	12.422	21.204	22.169	-	22.169

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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reliability of unitized multi-role structures. Demonstrate key high altitude persistent Intelligence, Surveillance, and Reconnaissance technologies.

FY 2012 Base Plans:
Flight test of antenna integration into load-bearing structures. Initiate demonstration efforts for reliability of unitized multi-role structures. Demonstrate key high altitude persistent Intelligence, Surveillance, and Reconnaissance technologies.

FY 2012 OCO Plans:

<p>Title: Major Thrust 4.</p> <p>Description: Develop adaptive structures to provide in-flight modifications offering improved performance.</p> <p>FY 2010 Accomplishments: Demonstrated thermal protection systems for leading edge of high-speed vehicle components. Continued assessment of advanced efficient wing concepts. Demonstrated reusable hypersonic vehicle integrated structural health management technologies.</p> <p>FY 2011 Plans: Further demonstrate technologies necessary for reusable hypersonic vehicles. Assess integrated structural health management for lightweight remotely piloted air vehicles from subsonic to hypersonic speeds. Develop and assess detailed integrated flight and ground systems concepts for operationally responsive space lift.</p> <p>FY 2012 Base Plans: Further demonstrate technologies necessary for reusable hypersonic vehicles. Assess integrated structural health management for lightweight remotely piloted air vehicles from subsonic to hypersonic speeds. Develop and assess detailed integrated flight and ground systems concepts for operationally responsive space lift.</p> <p>FY 2012 OCO Plans:</p>	13.190	11.064	11.627	-	11.627
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<p>Title: Major Thrust 5.</p> <p>Description: Develop, simulate, and demonstrate integrated technologies to enable, and improve the performance of high-speed and hypersonic air vehicles.</p> <p>FY 2010 Accomplishments:</p>	3.354	7.556	8.092	-	8.092
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603211F: <i>Aerospace Technology Dev/ Demo</i>	PROJECT 634920: <i>Flight Vehicle Tech Integration</i>
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Developed and demonstrated hypersonic ablation shape-change measurement and prediction capabilities. Conducted risk reduction research in the areas of aeromechanics, propulsion integration, controls, and hot structures.					
<i>FY 2011 Plans:</i> Continue efforts related hypersonic ablation /shape-change measurement. Initiate work for expendable and reusable hypersonic air-breathing concepts.					
<i>FY 2012 Base Plans:</i> Continue efforts related to hypersonic ablation /shape-change measurement and prediction capabilities. Conduct hypersonic flight experiments. Continue efforts to study potential applications for utilizing high speed vehicles in ISR and strike missions.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	61.889	53.588	67.474	-	67.474

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	187.212	136.135	120.953	-	120.953	113.398	118.245	126.823	128.907	Continuing	Continuing
632480: <i>Aerospace Fuels</i>	27.254	9.393	6.770	-	6.770	6.619	7.539	7.828	7.956	Continuing	Continuing
633035: <i>Aerospace Power Technology</i>	13.829	5.556	5.747	-	5.747	5.670	8.379	10.048	10.213	Continuing	Continuing
634921: <i>Aircraft Propulsion Subsystems Int</i>	38.383	41.403	17.713	-	17.713	17.874	17.567	19.144	19.458	Continuing	Continuing
634922: <i>Space & Missile Rocket Propulsion</i>	28.535	31.840	27.603	-	27.603	31.395	39.196	40.894	41.566	Continuing	Continuing
635098: <i>Advanced Aerospace Propulsion</i>	23.043	13.177	30.124	-	30.124	17.661	18.304	20.006	20.336	Continuing	Continuing
63681B: <i>Advanced Turbine Engine Gas Generator</i>	56.168	34.766	32.996	-	32.996	34.179	27.260	28.903	29.378	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, and rocket propulsion, as well as electrical power thermal management, and fuels. The program has six projects, each focusing on technologies with a high potential to enhance the performance of existing and future Air Force weapons systems. The Aerospace Fuels project develops and demonstrates improved hydrocarbon fuels and advanced propulsion systems for high-speed/hypersonic flight. The Aerospace Power Technology project develops and demonstrates power and thermal management systems for weapons and aircraft as part of energy optimized aircraft development. The Aerospace Propulsion Subsystems Integration project integrates the engine cores demonstrated in the Advanced Turbine Engine Gas Generator project with low-pressure components into demonstrator engines. The Space and Missile Rocket Propulsion project develops and demonstrates innovative rocket propulsion technologies, propellants, manufacturing techniques. 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. Portions of the Aerospace Fuels, Advanced Turbine Engine Gas Generator, and Aerospace Propulsion Subsystems Integration projects support adaptive cycle technology demonstrations which develop component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	192.241	136.135	112.786	-	112.786
Current President's Budget	187.212	136.135	120.953	-	120.953
Total Adjustments	-5.029	-	8.167	-	8.167
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.006	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.797	-			
• SBIR/STTR Transfer	-4.226	-			
• Other Adjustments	-	-	8.167	-	8.167

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

Project: 632480: Aerospace Fuels

Congressional Add: *Algal Biofuels for Aviation.*

Congressional Add: *Algal-Derived Jet Fuel for Air Force Applications.*

Congressional Add: *Bio-JP8 Fuel Development.*

Congressional Add: *Hawaii Microalgae Biofuel Project.*

Congressional Add: *Renewable Hydrocarbon Fuels for Military Applications.*

Congressional Add Subtotals for Project: 632480

Project: 633035: Aerospace Power Technology

Congressional Add: *Methanol Fuel Cell Development for USAF Battlefield Integrated Tactical Energy System (BRITES).*

Congressional Add: *Silicon Carbide Power Modules for the F-35 Joint Strike Fighter.*

Congressional Add: *Texas Research Institute for Environmental Studies.*

Congressional Add Subtotals for Project: 633035

Project: 634921: Aircraft Propulsion Subsystems Int

Congressional Add: *Small Turbofan Versatile Affordable Advanced Turbine Engine Program.*

	FY 2010	FY 2011
	2.390	-
	2.689	-
	3.983	-
	3.505	-
	1.992	-
Congressional Add Subtotals for Project: 632480	14.559	-
	2.390	-
	2.390	-
	0.797	-
Congressional Add Subtotals for Project: 633035	5.577	-
	3.187	-
	3.187	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Congressional Add Subtotals for Project: 634921		
Congressional Add Totals for all Projects	23.323	-

Change Summary Explanation

Note: Increase in funding in FY 2012 is to complete scramjet engine flight demonstrations in the Advanced Aerospace Propulsion project.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				PROJECT 632480: <i>Aerospace Fuels</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
632480: <i>Aerospace Fuels</i>	27.254	9.393	6.770	-	6.770	6.619	7.539	7.828	7.956	Continuing	Continuing

Note

Note: The funding in this project has decreases in FY 2011 and beyond due to planned taper of turbine engine technologies.

A. Mission Description and Budget Item Justification

This project evaluates and demonstrates improved hydrocarbon fuels, unique/alternate fuels and advanced, novel aerospace propulsion technologies for Air Force applications; including high-speed/hypersonic flight and technologies to increase turbine engine operational reliability, durability, mission flexibility, and performance while reducing weight, fuel consumption, and cost of ownership. The advanced fuel emphasis is on demonstrating new thermally stable, high-heat sink, and controlled chemically reacting fuels for a conventional turbine engine, turbine-based combined cycle engines, and other advanced propulsion systems. The project also evaluates and demonstrates fuel system components that minimize cost, reduce maintenance, and improve performance of future aerospace systems. The advanced propulsion emphasis is on demonstrating concepts for combined cycle, ramjet, and scramjet engines. A portion of this project supports the demonstration of adaptive cycle technologies. This project develops component technology for an adaptive cycle engine architecture that provides optimized performance, fuel efficiency, and durability for widely varying mission needs.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	3.183	2.866	1.000	-	1.000
Description: Demonstrate thermally stable fuels and fuel system hardware concepts to enhance cooling capacity (performance), minimize fuel coking, and reduce fuel system maintenance.					
FY 2010 Accomplishments: Demonstrated adaptive engine cycles for high efficiency and ultra efficient turbine engine technologies integrated power/thermal management systems that include cooled cooling air systems, as well as approaches to deoxygenate fuel to improve thermal stability.					
FY 2011 Plans: Demonstrate adaptive engine cycles for high efficiency and ultra efficient turbine engine technologies integrated power/thermal management systems that include cooled cooling air systems, as well as approaches to deoxygenate fuel to improve thermal stability.					
FY 2012 Base Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 632480: <i>Aerospace Fuels</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Demonstrate effective structural cooling of 2nd generation endothermic fuels for hypersonic vehicles.					
FY 2012 OCO Plans:					
Title: Major Thrust 4.					
Description: Identify, develop, and demonstrate low-cost approaches to reducing the fuel logistics footprint for the Expeditionary Air Force.					
FY 2010 Accomplishments: Modeled spread of biological materials (fungus, bacteria, etc.) through fuel handling systems. Demonstrated advanced additives for mitigation of biological growth.					
FY 2011 Plans: Model spread of biological materials (fungus, bacteria, etc.) through fuel handling systems. Demonstrate advanced additives for mitigation of biological growth.					
FY 2012 Base Plans: Evaluate fuel compositional relationship to biological growth.					
FY 2012 OCO Plans:					
Title: Major Thrust 5.					
Description: Characterize and demonstrate the use of alternative hydrocarbon jet fuel to comply with Air Force certifications and standards for jet fuels.					
FY 2010 Accomplishments: Investigated biomass-derived fuel and specification requirements. Studied elastomer swell agents for 100 percent synthetic paraffinic kerosene fuels. Initiated study of greenhouse gas footprint assessment for alternative aviation fuels.					
FY 2011 Plans: Demonstrate biomass-derived fuel and specification requirements, focusing on yield potential from varying feedstocks. Study greenhouse gas footprint assessment for alternative aviation fuels. Note: In FY 2011, efforts in this thrust are decreased due to higher AF priorities.					
FY 2012 Base Plans:					
	1.081	1.097	0.770	-	0.770
	5.247	3.191	3.000	-	3.000

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 632480: <i>Aerospace Fuels</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Demonstrate improved alternative fuel combustion evaluation process to enable more rapid certification. Evaluate fully-synthetic biofuels in "fit-for-purpose" and rig testing to demonstrate durability. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	12.695	9.393	6.770	-	6.770
	FY 2010	FY 2011			
Congressional Add: Algal Biofuels for Aviation. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-			
Congressional Add: Algal-Derived Jet Fuel for Air Force Applications. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.689	-			
Congressional Add: Bio-JP8 Fuel Development. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.983	-			
Congressional Add: Hawaii Microalgae Biofuel Project. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.505	-			
Congressional Add: Renewable Hydrocarbon Fuels for Military Applications. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.992	-			
Congressional Adds Subtotals	14.559	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 632480: <i>Aerospace Fuels</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				633035: <i>Aerospace Power Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633035: <i>Aerospace Power Technology</i>	13.829	5.556	5.747	-	5.747	5.670	8.379	10.048	10.213	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates electrical power, thermal management, and distribution for aerospace applications. This technology enhances reliability and survivability, and reduces vulnerability, weight, and life cycle costs for manned and remotely piloted aircraft. The electrical power system components developed are projected to provide a two- 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. This project also develops and demonstrates electrical power and thermal management technologies to enable solid state high power density sources for directed energy weapons.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop electrical power and thermal management component subsystem technologies for integration with directed energy weapons (DEW) to deliver high power for DEW operation.</p> <p>FY 2010 Accomplishments: Initiated development of high energy laser flight demonstration power and thermal management systems.</p> <p>FY 2011 Plans: Support development of energy storage, power conditioning, and thermal management subsystems to support flight demonstration of a high energy laser.</p> <p>FY 2012 Base Plans: Support integration of power and thermal management subsystems for flight demonstration of a high energy laser.</p> <p>FY 2012 OCO Plans:</p>	0.207	0.250	0.200	-	0.200
<p>Title: Major Thrust 2.</p> <p>Description: Develop power generation/conditioning/distribution component, energy storage, and thermal management components and subsystem technologies for integration into high power aircraft.</p> <p>FY 2010 Accomplishments:</p>	7.699	4.822	5.056	-	5.056

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 633035: <i>Aerospace Power Technology</i>		
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Completed detailed design of high temperature, energy optimized demonstrator and initiated fabrication of power and thermal management components. Fabricated rugged/robust power electronics, motor controls, high performance electric actuators, and adaptive power and thermal management subsystems. Developed subsystems modifications to support integrated subsystems testing.</p> <p>FY 2011 Plans: Integrate, fabricate, and modify high temperature, energy optimized power and thermal management components. Integrate subsystems (including rugged/robust power electronics, motor controls, high performance electric actuators, and adaptive power and thermal management technologies) and perform integrated system level evaluation testing. Perform system modifications as necessary to demonstrate that integrated subsystems meet design criteria and performance objectives. Note: In FY 2011, decrease in funding is due to the movement of technologies to PE 0602203F, Aerospace Propulsion.</p> <p>FY 2012 Base Plans: Demonstrate robust, high power, high temperature power and thermal management subsystems as part of hardware in the loop validation and verification of system level energy optimized air platform models.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 3.</p> <p>Description: Develop hybrid electrical power and thermal management components and subsystem technologies for special purpose applications, enabling long endurance small remotely piloted aircraft (RPA).</p> <p>FY 2010 Accomplishments: Investigated optimization of advanced hybrid fuel cell/battery subsystem designs to achieve minimum volume/weight, maximum power/energy density, and increased battery/fuel cell ruggedness, efficiency, and reliability. Assessed hybrid energy management systems for expanded special purpose applications to address needed strike, intelligence, surveillance, and reconnaissance capabilities. Integrated hybridized energy electrical power, and thermal management components with end-user operational subsystems such as sensors and communication devices.</p> <p>FY 2011 Plans:</p>					
	0.346	0.484	0.491	-	0.491

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 633035: <i>Aerospace Power Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop and fabricate energy optimized, lightweight, hybrid electrical power and thermal management subsystems for increased endurance RPA and ground based special purpose applications. FY 2012 Base Plans: Demonstrate high endurance small RPA hybrid energy harvesting power and thermal management subsystems. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	8.252	5.556	5.747	-	5.747

	FY 2010	FY 2011
Congressional Add: Methanol Fuel Cell Development for USAF Battlefield Integrated Tactical Energy System (BRITES). FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-
Congressional Add: Silicon Carbide Power Modules for the F-35 Joint Strike Fighter. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-
Congressional Add: Texas Research Institute for Environmental Studies. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	0.797	-
Congressional Adds Subtotals	5.577	-

C. Other Program Funding Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 633035: <i>Aerospace Power Technology</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				634921: <i>Aircraft Propulsion Subsystems Int</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634921: <i>Aircraft Propulsion Subsystems Int</i>	38.383	41.403	17.713	-	17.713	17.874	17.567	19.144	19.458	Continuing	Continuing

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 Aerospace Propulsion Subsystems Integration (APSI) project includes demonstrator engines for manned systems and concept 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 the Advanced Turbine Engine Gas Generator 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/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 APSI 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 10 times the power output for surveillance aircraft and propulsion for a high speed supersonic missile with double the range for time sensitive targets. 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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Design, fabricate, and demonstrate durability and integration technologies for turbofan/turbojet engines to improve durability, supportability, and affordability of AF aircraft.</p> <p>FY 2010 Accomplishments: Completed preliminary design and began detailed design of advanced features for durable fans, turbines, mechanical systems, interactions between the inlet and fan, and controls/accessories, to include advanced cooling design for low pressure turbine blades, health monitoring, light weight externals, and repair validation.</p> <p>FY 2011 Plans: Complete detailed design and begin fabricate hardware for advanced features for durable fans, turbines, mechanical systems, interactions between the inlet and fan, and controls/accessories, to include advanced cooling design for low pressure turbine blades, health monitoring, light weight externals, and repair validation.</p>	2.625	7.267	1.800	-	1.800

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 634921: <i>Aircraft Propulsion Subsystems Int</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
<p>Note: In FY 2011, funding is increased due to shift in emphasis from preliminary design to detailed design of durable turbine engines.</p> <p>FY 2012 Base Plans: Continue fabrication of low spool engine components. Investigate inlet and exhaust interactions. Continue to develop controls and accessories, health monitoring technologies, and light weight external components. Continue to assess and validate repair techniques.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Design, fabricate, and test advanced component technologies for improved performance and fuel consumption of turbofan/turbojet engines.</p> <p>FY 2010 Accomplishments: Initiated assembly testing of engine designs for a supersonic and subsonic engine using variable cycle features, an advanced fan, improved turbine using cooled metal and ceramic matrix composites, advanced augmentor, and lightweight organic matrix composite cases and ducts. Began to fabricate advanced adaptive cycle (third air stream) engine technologies, including an advanced fan, high work variable low turbine for long dwell time, controls, inlet integration, and advanced exhaust nozzle for subsonic to sustained supersonic flight. Initiated preliminary design for a high bypass/high overall pressure ratio engine for improved fuel consumption.</p> <p>FY 2011 Plans: Continue fabrication and begin assembly of advanced adaptive cycle (third air stream) engine technologies, including an advanced fan, high work variable low turbine for long dwell time, controls, inlet integration, and advanced exhaust nozzle for subsonic to sustained supersonic flight. Continue preliminary design for a high bypass/high overall pressure ratio engine technologies for improved fuel consumption.</p> <p>FY 2012 Base Plans: Complete assembly and instrumentation of advanced adaptive cycle (third air stream) engine technologies, including an advanced fan, high work variable low turbine for long dwell time, controls, inlet integration, and advanced exhaust nozzle for subsonic to sustained supersonic flight. Conduct experimental testing of engine technologies. Complete preliminary design and initiate detailed design for high bypass/high overall pressure ratio</p>					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	27.577	26.142	14.713	-	14.713

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634921: <i>Aircraft Propulsion Subsystems Int</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
engine technologies for improved fuel consumption. Note: In FY 2012, efforts in this thrust are decreased due to higher AF priorities. FY 2012 OCO Plans:					
Title: Major Thrust 3. 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. FY 2010 Accomplishments: Conducted preliminary design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency to significantly improve range. Conducted preliminary design of advanced fan, advanced low spool turbine, and advanced engine components for improved fuel efficient subsonic unmanned turbofan engines. Conducted durability testing of advanced efficient small scale propulsion demonstrator engine. FY 2011 Plans: Conduct detailed design of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency to significantly improve range. Conduct detailed design of advanced fan, advanced low spool turbine spool, and advanced engine components for fuel efficient subsonic unmanned turbofan engines. FY 2012 Base Plans: Complete detailed design and initiate fabrication of components of a higher specific thrust, low cost expendable turbine engine for improved fuel efficiency to significantly improve range. Complete detailed design of advanced fan, advanced low spool turbine spool, and advanced engine components for fuel efficient subsonic unmanned turbofan engines. Note: In FY 2012, efforts in this thrust are decreased due to higher AF priorities. FY 2012 OCO Plans:	4.994	7.994	1.200	-	1.200
Accomplishments/Planned Programs Subtotals	35.196	41.403	17.713	-	17.713
	FY 2010	FY 2011			
Congressional Add: Small Turbofan Versatile Affordable Advanced Turbine Engine Program.	3.187	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634921: <i>Aircraft Propulsion Subsystems Int</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	3.187	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				634922: <i>Space & Missile Rocket Propulsion</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634922: <i>Space & Missile Rocket Propulsion</i>	28.535	31.840	27.603	-	27.603	31.395	39.196	40.894	41.566	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced and innovative low-cost rocket turbo-machinery and components, low-cost space launch propulsion technologies, and advanced propellants for launch and orbit transfer propulsion. Additionally, this project develops technologies for the sustainment of strategic systems (including solid boost/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. This project also develops chemical, electrical, and solar rocket propulsion technologies for station-keeping and on-orbit maneuvering applications. Technology areas investigated include ground demonstrations of compact, lightweight, advanced propulsion technologies, higher efficiency energy conversion systems (derived from an improved understanding of combustion fundamentals), and high-energy propellants. Technological advances developed in this program could improve the performance of expendable payload capabilities by approximately 20-50 percent and reduce launch, operations, and support costs by approximately 30 percent. Responsiveness and operability of propulsion systems will be enhanced for reusable launch systems. Technology advances could also lead to seven-year increase in satellite on-orbit time, a 50 percent increase in satellite maneuvering capability, a 25 percent reduction in orbit transfer operational costs, and a 15 percent increase in satellite payload. Aging and surveillance efforts for solid rocket motors could reduce lifetime prediction uncertainties for individual motors by 50 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 and often NASA.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop liquid rocket propulsion technology for current and future space launch vehicles.</p> <p>FY 2010 Accomplishments: Demonstrated through hot fire testing advanced cryogenic upper stage hardware to validate and verify modeling and simulation tools developed. Continued development of hydrocarbon engine components for integration and demonstration in advanced hydrocarbon engine concepts for future reusable launch vehicles. Initiated sub-scale component testing to demonstrate hydrocarbon boost technologies. Continued material manufacturing scale-up effort to support hydrocarbon boost demonstration program.</p> <p>FY 2011 Plans: Continue, through hot fire testing, the validation and verification of modeling and simulation tools developed for advanced cryogenic upper stage technologies. Continue development of hydrocarbon engine components for</p>	18.596	26.421	20.499	-	20.499

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>integration and demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continue sub-scale component testing to demonstrate hydrocarbon boost technologies. Continue material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Note: In FY 2011, efforts in this thrust are increased due to higher AF priorities.</p> <p>FY 2012 Base Plans: Complete the validation and verification of modeling and simulation tools developed for advanced cryogenic upper stage technologies. Continue development of hydrocarbon engine components for integration and demonstration in an advanced hydrocarbon engine concept for future reusable launch vehicles. Continue sub-scale preburner and turbine component testing to demonstrate hydrocarbon boost technologies. Continue ox-rich material manufacturing scale-up effort to support hydrocarbon boost demonstration program. Conduct component scale-up and characterization for advanced hydrocarbon engine technologies using fuels other than kerosene. Note: In FY 2012, funding is decreased due to higher Air Force priorities.</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 2.</p> <p>Description: Develop solar electric, electric, and monopropellant propulsion technologies for existing and future satellites, upper stages, orbit transfer vehicles, and satellite maneuvering.</p> <p>FY 2010 Accomplishments: Continued hardware scale-up for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Completed demonstration of advanced chemical propulsion system for satellites. Completed development and demonstration of monopropellant thruster technologies for spacecraft.</p> <p>FY 2011 Plans: Initiate scale-up of micro propulsion technologies for spacecraft with the need for high mobility on orbit. Continue hardware scale-up and prepare to conduct testing of hardware for an advanced multi-mode (high thrust or high efficiency) propulsion system for satellites. Scale-up of next generation of chemical thrusters for spacecraft propulsion systems. Note: In FY 2011, efforts in this thrust are decreased due to higher AF priorities.</p> <p>FY 2012 Base Plans: Conduct scale-up of propulsion technologies for spacecraft with the need for high mobility on orbit. Complete hardware scale-up and conduct testing of hardware for an advanced multi-mode (high thrust or high efficiency)</p>	6.435	3.388	3.953	-	3.953
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
propulsion system for satellites. Build components for integration and demonstration of next generation of chemical thrusters for spacecraft propulsion systems.					
FY 2012 OCO Plans:					
Title: Major Thrust 3.					
Description: Develop and demonstrate missile propulsion and Post Boost Control Systems technologies for ballistic missiles.					
FY 2010 Accomplishments: Developed advanced missile propulsion technologies. Conducted sub-scale component developments providing sub-scale validation of modeling and simulation tools.					
FY 2011 Plans: Continue development of advanced missile propulsion technologies. Continue sub-scale component developments providing sub-scale validation of modeling and simulation tools. Note: In FY 2011, efforts in this thrust are decreased due to higher AF priorities.					
FY 2012 Base Plans: Continue development of advanced missile case, insulation, and nozzle technologies. Continue sub-scale component developments providing sub-scale validation of modeling and simulation tools. Complete propellant component development and transition into next generation integrated motor demonstration.					
FY 2012 OCO Plans:					
Title: Major Thrust 4.					
Description: Develop and demonstrate aging and surveillance technologies for strategic systems to reduce lifetime prediction uncertainty for individual motors, enabling motor replacement for cause.					
FY 2010 Accomplishments: Conducted full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies.					
FY 2011 Plans:					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	2.686	1.263	1.762	-	1.762
	0.818	0.768	1.389	-	1.389

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 634922: <i>Space & Missile Rocket Propulsion</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue integration and full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies. Complete assessment of effort modeling critical defects in solid rocket motors. FY 2012 Base Plans: Continue integration and full-scale demonstration of advanced aging and surveillance tools for solid rocket motors to validate and verify modeling and simulation tools and component technologies. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	28.535	31.840	27.603	-	27.603

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				635098: <i>Advanced Aerospace Propulsion</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635098: <i>Advanced Aerospace Propulsion</i>	23.043	13.177	30.124	-	30.124	17.661	18.304	20.006	20.336	Continuing	Continuing

Note

Note: In FY 2012, funding in this project is increased to complete scramjet engine flight demonstrations.

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 operating over the range of Mach 0 to 8+. 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	23.043	13.177	30.124	-	30.124
Description: Develop and demonstrate technologies for a hydrocarbon-fueled scramjet with robust operation over a range of Mach 4 to 8.					
FY 2010 Accomplishments: Completed first integrated air vehicle/propulsion flight tests. Conducted post test data reduction.					
FY 2011 Plans: Continue flight testing of a scramjet engine demonstrator. Analyze flight test data and begin preparing a final report. Demonstrate small scale scramjet engine to technology readiness level 6. Note: In FY 2011, efforts in this thrust are decreased due to higher AF priorities.					
FY 2012 Base Plans: Complete flight testing of a scramjet engine demonstrator. Analyze flight test data and complete a final report. Develop and demonstrate tactically compliant subsystems, including scramjet engine start system, fuel system,					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 635098: <i>Advanced Aerospace Propulsion</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
and engine controls. Note: In FY 2012, efforts in this thrust are increased to complete scramjet engine flight demonstrations. <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	23.043	13.177	30.124	-	30.124

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>				63681B: <i>Advanced Turbine Engine Gas Generator</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63681B: <i>Advanced Turbine Engine Gas Generator</i>	56.168	34.766	32.996	-	32.996	34.179	27.260	28.903	29.378	Continuing	Continuing

Note

Note: The funding in this project decreases in FY 2011 due to planned taper of turbine engine technologies.

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 the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, reparability, 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, and exhaust systems) and system level technologies (such as integrated power generators and thermal management systems) on core engine performance and durability in "core-centric engine" demonstration. The core performances of this project are validated on demonstrator engines in Project 4921 of this Program Element. 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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	45.298	21.410	19.798	-	19.798
Description: Design, fabricate, and demonstrate performance predictions in core engines, using innovative engine cycles and advanced materials for turbofan/turbojet engines.					
FY 2010 Accomplishments: Completed detailed design and initiated hardware fabrication of high temperature capable, durable compressor, combustor, and turbine for adaptive core engine. Completed preliminary design and initiated detailed design of component technologies for a core-centric durability engine demonstration. Conducted detailed design of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conducted analysis and conceptual design of system-level technologies and weapon systems					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>		PROJECT 63681B: <i>Advanced Turbine Engine Gas Generator</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
integration on core engine performance. Note: In FY 2010, efforts in this thrust are increased to complete hardware fabrication and conduct engine demonstrations.					
FY 2011 Plans: Continue hardware fabrication and initiate assembly of high temperature capable, durable compressor, combustor, and turbine for adaptive core engine. Complete detailed design and initiate fabrication of component technologies for a core-centric durability engine demonstration. Conduct fabrication of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conduct preliminary design and initiate detailed design of system-level technologies and weapon systems integration on core engine performance. Note: In FY 2011, efforts in this thrust are decreased due to completion of hardware fabrication and engine demonstrations.					
FY 2012 Base Plans: Complete hardware fabrication, assembly and experimental demonstration of high temperature capable, durable compressor, combustor, and turbine for adaptive core engine. Complete fabrication of component technologies and initiate assembly for a core-centric durability engine demonstration. Continue fabrication of component technologies for increased reliability, maintainability, and affordability for potential transition to fielded systems. Conduct detailed design of system-level technologies and weapon systems integration on core engine performance.					
FY 2012 OCO Plans:					
Title: Major Thrust 2.					
Description: Design, fabricate, and demonstrate high overall pressure ratio cores to provide increased durability and affordability with lower fuel consumption for turbofan/turboshaft engines.					
FY 2010 Accomplishments: Continued preliminary design and initiated long lead fabrication of core for efficient core engine concept with advanced core technologies including high efficiency, high pressure ratio, high temperature capability compressor, high efficiency, high heat release combustor, and high work, high cooling effectiveness turbine with an integrated thermal management system and advanced mechanical systems. Completed hardware fabrication, and continued selective risk reduction experimental demonstrations of remotely piloted aircraft (RPA) small versatile affordable advanced core engine technologies including a high heat release combustor, durable high performance turbine, and systems for thermal management and advanced power extraction. Completed					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	10.870	13.356	13.198	-	13.198

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603216F: <i>Aerospace Propulsion and Power Technology</i>	PROJECT 63681B: <i>Advanced Turbine Engine Gas Generator</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	31.456	16.992	22.268	-	22.268	23.325	23.958	23.605	23.992	Continuing	Continuing
632432: <i>Defensive System Fusion Technology</i>	4.455	4.707	6.190	-	6.190	6.252	6.039	5.824	5.920	Continuing	Continuing
63431G: <i>RF Warning & Countermeasures Tech</i>	20.000	4.142	5.412	-	5.412	6.741	7.069	6.907	7.020	Continuing	Continuing
63691X: <i>EO/IR Warning & Countermeasures Tech</i>	7.001	8.143	10.666	-	10.666	10.332	10.850	10.874	11.052	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 combat, special operations, and airlift electronic combat applications in three project areas. The first project develops and demonstrates technologies for integrating electronic combat sensors and systems into a fused and seamless whole. The second project develops and demonstrates advanced technologies for radio-frequency electronic combat suites. The third project develops and demonstrates advanced warning and countermeasure technologies to defeat electro-optical, infrared, and laser threats to aerospace platforms. This program has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and electronic combat system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>
Previous President's Budget	32.056	16.992	22.636	-	22.636
Current President's Budget	31.456	16.992	22.268	-	22.268
Total Adjustments	-0.600	-	-0.368	-	-0.368
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.600	-			
• Other Adjustments	-	-	-0.368	-	-0.368

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

Project: 63431G: *RF Warning & Countermeasures Tech*

FY 2010	FY 2011

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Advanced Electromagnetic Location of IEDs Defeat System.*

Congressional Add Subtotals for Project: 63431G

Congressional Add Totals for all Projects

FY 2010	FY 2011
1.195	-
1.195	-
1.195	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>				PROJECT 632432: <i>Defensive System Fusion Technology</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
632432: <i>Defensive System Fusion Technology</i>	4.455	4.707	6.190	-	6.190	6.252	6.039	5.824	5.920	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates technologies for integrating electronic combat sensors and electronic combat system fusion. It develops advanced algorithms and assessment techniques needed to evaluate and enable combat aircraft operations in multi-spectral threat and countermeasure environments. It also matures technologies required for command-and-control warfare, standoff jamming, and electronic support measures for the denial, disruption, and suppression of adversary air defense operations. Technologies include: advanced components and techniques needed to jam enemy radars; advanced standoff jammer technologies; and electronic collection methods to inform field commanders of changes in the electronic environment.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust.</p> <p>Description: Develop affordable radio-frequency and electro-optical emitter warning and electronic warfare (EW) battle management technologies, integrating EW and information operations.</p> <p>FY 2010 Accomplishments: Conducted research into electronic warfare battle management techniques and protocols in the Virtual Combat Environment for Electronic Conflict. Investigated and demonstrated electronic attack techniques from multiple nodes. Initiated a project to demonstrate a distributed (multi-node) electronic support/electronic attack architecture. Conducted research into integration of electronic attack and information operations to defeat an adversary integrated air defense system.</p> <p>FY 2011 Plans: Initiate a critical experiment to demonstrate synergistic electronic warfare (EW) and information operations (IO) techniques against a representative integrated air defense system. Initiate an effort to develop a virtual EW/IO battlespace environment for future project demonstrations, experiments, and assessments. Conduct a demonstration of electronic warfare battle management techniques and algorithms. Continue with the development of a distributed (multi-node) electronic support/electronic attack architecture.</p> <p>FY 2012 Base Plans: Increase maturity and perform demonstrations of electronic warfare battle management (EWBM) capabilities. Focus efforts on Distributed Electronic Attack concepts for specific threats and radar classes. Initiate effort in understanding and countering traditional and non-traditional targets in support of irregular warfare (IW).</p>	4.455	4.707	6.190	-	6.190

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 632432: <i>Defensive System Fusion Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue an effort to develop a virtual EW/IO battlespace environment for future project demonstrations, experiments, and assessments.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	4.455	4.707	6.190	-	6.190

C. Other Program Funding Summary (\$ in Millions)												
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 63431G: <i>RF Warning & Countermeasures Tech</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63431G: <i>RF Warning & Countermeasures Tech</i>	20.000	4.142	5.412	-	5.412	6.741	7.069	6.907	7.020	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for radio-frequency electronic combat suites to enhance the survivability of aerospace vehicles and to provide crew situational awareness. One major area 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. Another major technology area 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.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust.</p> <p>Description: Develop aerospace platform jamming technologies and techniques to counter advanced radio-frequency threats associated with current and future aerospace weapon systems.</p> <p>FY 2010 Accomplishments: Initiated advanced electronic attack jamming algorithms development for network operations to defeat future advanced threats. Conducted research on the synergy between electronic protection and electronic attack technologies to realize more effective jamming. Demonstrated a distributed, multi-node electronic support/ electronic attack concept. Conducted research to tailor electronic attack techniques in combination with simultaneous information operations to counter the increasing adversary air defense systems moves to increased digital integration of defense sensors. Developed and assessed advanced technology, concepts, and algorithms to mitigate the effects of advanced signals on radio frequency receiver-processors.</p> <p>FY 2011 Plans: Initiate next-generation electronic attack techniques concept definition studies. Initiate a distributed tactical electronic combat receiver development effort. Demonstrate cognitive and adaptable electronic combat techniques and algorithms. Provide active electronic protection architecture concepts for transition.</p> <p>FY 2012 Base Plans: Demonstrate adaptable electronic attack (EA) technique concepts against a modeled threat environment. Initiate effort to develop a Network electronic support/electronic attack (ES/EA) Experiments Lab. Demonstrate a</p>	18.805	4.142	5.412	-	5.412

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 63431G: <i>RF Warning & Countermeasures Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
cognitive jammer system concept in a laboratory environment. Define and analyze proactive electronic protection (EP) concepts. Continue effort to focus on next generation RF threats and potential EW concepts. <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	18.805	4.142	5.412	-	5.412

	FY 2010	FY 2011
Congressional Add: Advanced Electromagnetic Location of IEDs Defeat System. <i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort. <i>FY 2011 Plans:</i>	1.195	-
Congressional Adds Subtotals	1.195	-

C. Other Program Funding Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	<u>Cost To</u> Complete	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE					PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603270F: <i>Electronic Combat Technology</i>					63691X: <i>EO/IR Warning & Countermeasures Tech</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63691X: <i>EO/IR Warning & Countermeasures Tech</i>	7.001	8.143	10.666	-	10.666	10.332	10.850	10.874	11.052	Continuing	Continuing

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. Off-board (decoys and expendables) and on-board countermeasure technologies developed for aircraft self-protection will provide robust, affordable solutions for protection against infrared missiles with autonomous seekers, multi-spectral threats, laser-guided weapons, and electro-optical and infrared tracking systems used to direct electro-optical, infrared, and radar-guided missiles.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Analyze the vulnerabilities of current infrared missile systems and future imaging infrared sensors.</p> <p>FY 2010 Accomplishments: Performed laboratory analyses and assessments on infrared guided missiles and future imaging systems. Investigated countermeasures techniques that include laser jamming and jamming with expendables combinations. Conducted digital, injection, hardware-in-loop simulation to develop and assess countermeasures (CM) effectiveness. Obtained imaging threat to enable evaluation of postulated CM concepts. Supported major advanced technology demonstrations through developmental test and evaluation.</p> <p>FY 2011 Plans: Continue laboratory development and testing of infrared countermeasures against current and advanced (i.e. imaging) missiles. Evaluate impact of confronting current and next generation threats on countermeasure design. Continue effort to obtain imaging threats. Continue support of major advanced technology demonstrations.</p> <p>FY 2012 Base Plans: Continue laboratory development and testing of infrared countermeasures against current infrared missile systems and future advanced threat sensors. Continue development of surrogate imaging sensors, processors and track algorithms to test and evaluate countermeasure concepts against advanced threat systems. Continue</p>	3.246	2.374	3.137	-	3.137

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>		PROJECT 63691X: <i>EO/IR Warning & Countermeasures Tech</i>		
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
to develop countermeasure requirements for Combat Mission Infrared Countermeasures Advanced Technology Demonstration.					
FY 2012 OCO Plans:					
Title: Major Thrust 2.	0.562	2.299	3.201	-	3.201
Description: Develop aerospace laser warning sensor technologies for timely alert to advanced laser acquisition/tracking sensors, including detecting and locating both high and low power signals.					
FY 2010 Accomplishments: Developed laser warning sensors to address emerging laser threats. Demonstrated integration of miniaturized laser warning sensors in sensor protection, personnel protection and countermeasures cueing. Developed laser detection/warning/geolocation concepts for air based defense against medium and high energy lasers. Investigated advanced concepts for laser beam rider (laser augmented manpad) detection and geolocation. Demonstrated hardware-in-the-loop laser threat/sensor engagement testing for mission survivability testing.					
FY 2011 Plans: Demonstrate advanced concepts for full spectrum laser threat detection/geolocation for countermeasure hand-off capable of supporting Combat Laser Infrared Countermeasure Survivability System program goals. Demonstrate advanced concepts supporting airbase defense against medium and high energy lasers.					
FY 2012 Base Plans: Continue to develop new laser warning concepts to address emerging directed energy threats. Continue to develop requirements for Combat Mission Infrared Countermeasures Advanced Technology Demonstration. Continue developing tactical aerospace laser optical simulation for laser sensor characterization and countermeasure concepts.					
FY 2012 OCO Plans:					
Title: Major Thrust 3.	0.677	1.205	1.609	-	1.609
Description: Develop a countermeasure technology to defeat passive electro-optical and infrared aircraft tracking sensors and ordnance guidance.					
FY 2010 Accomplishments:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 63691X: <i>EO/IR Warning & Countermeasures Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Investigated countermeasures (CM) concepts and techniques that include laser jamming and combined countermeasures to defeat the advanced threat class. Conducted digital, signal injection and hardware in the loop testing to develop and assess countermeasure effectiveness. Supported the development of major advanced technology demonstration for transition of directed infrared countermeasures (DIRCM) technology to combat aircraft.</p> <p>FY 2011 Plans: Continue to develop, test and refine infrared countermeasures against current and advanced threats including imaging threats. Evaluate the impact on countermeasures design and simulation and investigative processes for new imaging and digital seeker and sensor threats. Initiate the development process for major advanced technology demonstration (Combat Missions IRCM) to transition laser jammer concept to protect combat aircraft against advanced threat class.</p> <p>FY 2012 Base Plans: Combat Missions IRCM Advanced Technology Demonstration (ATD) for development of laser jammer on Combat Aircraft moves into hardware development phase. Continue to test and refine infrared countermeasures techniques for integration into the ATD system for demonstration testing. Development of concepts for protection of postulated future threats to generation 6 aircraft including component and subsystem functional requirements and technologies.</p> <p>FY 2012 OCO Plans:</p> <p>Title: Major Thrust 4.</p> <p>Description: Develop electro-optical sensor component technology to advance multiple space mission areas. Develop new sensor components, topologies, and architectures for space.</p> <p>FY 2010 Accomplishments: Conducted space situational awareness (SSA) sensor prototype experiments.</p> <p>FY 2011 Plans: Continue SSA sensor prototype experiments.</p> <p>FY 2012 Base Plans: Continue SSA sensor prototype experiment phase II.</p> <p>FY 2012 OCO Plans:</p>	2.516	2.265	2.719	-	2.719

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603270F: <i>Electronic Combat Technology</i>	PROJECT 63691X: <i>EO/IR Warning & Countermeasures Tech</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Accomplishments/Planned Programs Subtotals	7.001	8.143	10.666	-	10.666

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	106.852	83.705	74.636	-	74.636	75.715	77.290	76.985	78.251	Continuing	Continuing
632181: <i>Spacecraft Payloads</i>	33.317	20.548	18.958	-	18.958	19.455	21.485	20.035	20.368	Continuing	Continuing
633834: <i>Integrated Space Technology Demonstrations</i>	38.350	41.188	35.441	-	35.441	32.840	31.725	32.408	32.941	Continuing	Continuing
634400: <i>Space Systems Protection</i>	7.891	5.316	4.513	-	4.513	6.763	7.203	7.805	7.929	Continuing	Continuing
635021: <i>Space Systems Survivability</i>	4.734	3.845	3.277	-	3.277	3.302	3.467	3.606	3.666	Continuing	Continuing
635083: <i>Ballistic Missiles Technology</i>	11.789	5.256	5.260	-	5.260	5.256	5.487	6.356	6.460	Continuing	Continuing
63682J: <i>Spacecraft Vehicles</i>	10.771	7.552	7.187	-	7.187	8.099	7.923	6.775	6.887	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

A. Mission Description and Budget Item Justification

This program develops, integrates, and demonstrates space technologies in the areas of spacecraft payloads, spacecraft protection, spacecraft and launch vehicles, ballistic missiles, space systems survivability, and development of advanced laser communications technologies to support next generation satellite communication systems. The integrated space technologies are demonstrated by component or system level tests on the ground or in flight. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing space system upgrades and/or new space system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	98.708	83.705	75.985	-	75.985
Current President's Budget	106.852	83.705	74.636	-	74.636
Total Adjustments	8.144	-	-1.349	-	-1.349
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.001	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	10.000	-			
• SBIR/STTR Transfer	-1.855	-			
• Other Adjustments	-	-	-1.349	-	-1.349

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

Project: 632181: Spacecraft Payloads

Congressional Add: *Micromachined Switches for Next-Generation Modular Satellites.*

Congressional Add: *Domestic Manufacturing of 45nm Electronics.*

Congressional Add: *Integrated Passive Electronic Components.*

Congressional Add Subtotals for Project: 632181

Project: 635083: Ballistic Missiles Technology

Congressional Add: *Ballistic Missile Technology.*

Congressional Add: *Florida National Guard Total Force Integration.*

Congressional Add: *P-Net Ballistic Missile Technology.*

Congressional Add Subtotals for Project: 635083

Project: 63682J: Spacecraft Vehicles

Congressional Add: *Small Responsive Spacecraft at Low-Cost.*

Congressional Add Subtotals for Project: 63682J

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	2.390	-
	3.187	-
	1.354	-
	6.931	-
	1.593	-
	2.390	-
	1.992	-
	5.975	-
	2.390	-
	2.390	-
	15.296	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603401F: <i>Advanced Spacecraft Technology</i>				632181: <i>Spacecraft Payloads</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
632181: <i>Spacecraft Payloads</i>	33.317	20.548	18.958	-	18.958	19.455	21.485	20.035	20.368	Continuing	Continuing

Note
NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

A. Mission Description and Budget Item Justification

This project funds the development, demonstration, and evaluation of radiation-hardened space electronic hardware, satellite control hardware, and software for advanced satellite surveillance operations and development of advanced laser communications technologies to support next-generation satellite communications systems. Improved space-qualifiable electronics and software for data and signal processing will be more interchangeable, interoperable, and standardized. In the near-term, this project's work concentrates on converting (i.e., radiation-hardening) commercial data and signal processor technologies for use in Air Force space systems. For mid-term applications, merge advanced, radiation-hardened space processor, memory, and interconnect technologies with commercially-derived, open system architectures to develop and demonstrate robust, on-board processing capabilities for 21st century Department of Defense satellites. In the long-term, this project area focuses on developing low-cost, easily modifiable software and hardware architectures for fully autonomous constellations of intelligent satellites capable of performing all mission related functions without operator intervention.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop microelectronic devices, including radiation-hardened data processors and high-density hardened memories, advanced packaging technology, and micro-electro-mechanical system components and applications.</p> <p>FY 2010 Accomplishments: Demonstrated improved radiation-hardened space sensor interface modules allocating standardized data messages protocols from sensors for easy device control of sensors and actuators. Further developed high-density volatile memory. Initiated multiprocessor architecture development.</p> <p>FY 2011 Plans: Demonstrate engineering model of high-density volatile memory. Continue multiprocessor architecture development. Initiate multiprocessor component development.</p> <p>FY 2012 Base Plans:</p>	8.360	6.431	7.336	-	7.336

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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FY 2010 Accomplishments:
Developed physics-to-engineering-to-engagement level models for systems engineering, technology trades, mission planning and operations, and utility analysis for systems-level analysis, experimental support, and concept of operations of flight programs. Completed integration of tools to model detection, identification, and characterization technologies for situational awareness. Refined and validated military utility and sensor analysis tools for external organizations.

FY 2011 Plans:
Develop graphic interfaces for simulation and analysis tools. Transition validated tools for use in customer flight programs. Apply lessons learned from analytical support, flight program participation, and external space organizations into refined modeling, simulation, and analysis tools that reduce cost and risk of flight programs and better model schedule limitations.

FY 2012 Base Plans:
Complete integration of autonomous flight software technologies with command, control, guidance, and navigation technologies. Apply additional physics-to-engineering-to-engagement level models for systems engineering, technology trades, mission planning and operations, and utility analysis to flight experiments in tactical, responsive, and space situational awareness (SSA) experiments and concepts.

FY 2012 OCO Plans:

Title: Major Thrust 4. 5.778 5.172 4.396 - 4.396

Description: Develop space infrared technology and hardened focal plane detector arrays to enable acquisition, tracking, and discrimination of hot targets, as well as "cold body" targets.

FY 2010 Accomplishments:
Further developed full focal plane array for exquisite imaging. Completed visible sensor development. Developed higher operating temperature sensors. Developed large format infrared sensors.

FY 2011 Plans:
Refine full focal plane array for exquisite imaging for space applications. Refine higher operating temperature sensor development and large format infrared sensor development.

FY 2012 Base Plans:

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop full focal plane array for exquisite imaging for adaptive, comprehensive SSA. Initiate higher operating temperature, large format medium wavelength infrared sensor development for wide area, global access detection and tracking. FY 2012 OCO Plans:					
Title: Major Thrust 5. Description: Develop spectral/polarimetric sensing and data exploitation demonstrations for military imaging and remote sensing applications. FY 2010 Accomplishments: Conducted studies and analyses of integrated radio frequency (RF)/optical/polarimetric sensing techniques. FY 2011 Plans: FY 2012 Base Plans: FY 2012 OCO Plans:	1.552	-	-	-	-
Accomplishments/Planned Programs Subtotals	26.386	20.548	18.958	-	18.958
	FY 2010	FY 2011			
Congressional Add: Micromachined Switches for Next-Generation Modular Satellites. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.390	-			
Congressional Add: Domestic Manufacturing of 45nm Electronics. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.187	-			
Congressional Add: Integrated Passive Electronic Components. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	1.354	-			
Congressional Adds Subtotals	6.931	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 632181: <i>Spacecraft Payloads</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603401F: <i>Advanced Spacecraft Technology</i>				633834: <i>Integrated Space Technology Demonstrations</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633834: <i>Integrated Space Technology Demonstrations</i>	38.350	41.188	35.441	-	35.441	32.840	31.725	32.408	32.941	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project is a series of advanced technology demonstrations designed to address mission needs by applying emerging technologies from the Air Force Research Laboratory, other U.S. Government laboratories, and industry. These technologies are integrated into system-level demonstrations that are used to test, evaluate, and validate the technologies in a relevant environment.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop microsatellite technologies for integrated, robust, flexible, microsatellite demonstrations building on previous work and leveraging investments by other organizations.</p> <p>FY 2010 Accomplishments: Completed lightweight visible and infrared sensors development. Completed bus designs and began integration.</p> <p>FY 2011 Plans: Complete integration of experimental microsatellite for geosynchronous orbit. Complete design for next generation plug-and-play bus.</p> <p>FY 2012 Base Plans: Complete integration/test and space environmental testing in preparation for launch of experimental microsatellite for geosynchronous orbit, an important enabler of future operational SSA capability for the warfighter. Explore processes for rapid integration and test that can be employed to rapidly field capabilities addressing urgent warfighter needs.</p> <p>FY 2012 OCO Plans:</p>	38.350	41.188	35.441	-	35.441
Accomplishments/Planned Programs Subtotals	38.350	41.188	35.441	-	35.441

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 633834: <i>Integrated Space Technology Demonstrations</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>				PROJECT 634400: <i>Space Systems Protection</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634400: <i>Space Systems Protection</i>	7.891	5.316	4.513	-	4.513	6.763	7.203	7.805	7.929	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates tools, instruments, and mitigation techniques required to assure operation of U.S. space assets in potentially hostile warfighting environments. The project performs assessments of critical components and subsystems, and evaluates susceptibility and vulnerability to radio frequency (RF) and laser threats. This project also develops technologies that mitigate identified vulnerabilities. Technologies are developed and demonstrated to support balanced satellite protection strategies for detecting, avoiding, and operating in a hostile space environment.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	2.186	2.325	2.426	-	2.426
Description: Multi-threat assessment tools to assess space-based electro-optical, and communication, and other responses to various candidate RF and laser countermeasures and directed energy threats.					
FY 2010 Accomplishments: Demonstrated additional subsystem performance in laboratory. Identified additional transition opportunities and prepared engineering models to assess performance.					
FY 2011 Plans: Conduct extensive engineering analysis and down select final systems. Perform subsystem testing of RF and laser countermeasures.					
FY 2012 Base Plans: Conduct algorithm development and performance simulation to synthesize sensor input from multiple sources, on-board and off-board, to provide executable defensively based situational awareness.					
FY 2012 OCO Plans:					
Title: Major Thrust 2.	2.074	1.297	0.837	-	0.837

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 634400: <i>Space Systems Protection</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Conducted in-depth study of current capabilities and analysis of data available to satellite operators. Demonstrated active subsystems through laboratory testing. Prepared engineering performance models.</p> <p>FY 2011 Plans: Develop performance goals using engineering models. Begin design of flight demonstration unit for potential SSA applications.</p> <p>FY 2012 Base Plans: Design on-orbit threat detection, assessment, and response software systems. Focus technology development effort on on-orbit intelligent control of on-orbit surveillance payloads. Explore technology for miniaturization of sensor concepts and improved dynamic sensitivity of sensor components.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 5.</p> <p>Description: Develop RF characterization methods and performance analysis technology. NOTE: This thrust has been broken out from other efforts due to increased interest in space superiority technologies.</p> <p>FY 2010 Accomplishments:</p> <p>FY 2011 Plans: Identify technology options that provide passive or active detection of satellites in the RF spectrum. Develop and complete engineering designs for systems used to support active space superiority technologies. Demonstrate subsystems through laboratory testing.</p> <p>FY 2012 Base Plans: Evaluate additional RF scanning techniques for potential active and/or passive threat detection capabilities. Develop prototype sub-system concepts. Begin fabrication of model Light Detection and Ranging laser sub-system for near-field tracking.</p> <p>FY 2012 OCO Plans:</p>	-	0.477	0.300	-	0.300
Accomplishments/Planned Programs Subtotals	7.891	5.316	4.513	-	4.513

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 634400: <i>Space Systems Protection</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603401F: <i>Advanced Spacecraft Technology</i>				635021: <i>Space Systems Survivability</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635021: <i>Space Systems Survivability</i>	4.734	3.845	3.277	-	3.277	3.302	3.467	3.606	3.666	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates technologies to improve space system survivability and reliability of current and future Department of Defense space systems that must continue operation despite natural space hazards. It develops and demonstrates cost-effective solutions to mitigate hazardous space environmental interactions including electrical charge buildup and electronics failures due to both single radiation events and long-term radiation doses.

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

Title: Major Thrust 1.

Description: Develop technologies to provide improved space radiation and ionospheric hazard specification and forecasting.

FY 2010 Accomplishments:

Developed new standard model of radiation belts to specify space hazards for spacecraft design. Designed second-generation heliospheric imager as joint agency initiative.

FY 2011 Plans:

Complete initial version of new standard model of radiation belts. Begin space test of miniaturized space weather sensors. Complete design and begin construction of second-generation heliospheric imager as joint agency initiative.

FY 2012 Base Plans:

Develop advanced standard model of radiation belts, using data from recently launched space environment instruments. Complete trade studies to narrow alternatives for a second-generation heliospheric imager for detecting and tracking solar coronal mass ejections (CMEs) which threaten space systems and degrade communications. Complete development of a more precise CME propagation model to enhance space weather forecasting tools.

FY 2012 OCO Plans:

FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
3.916	3.845	3.277	-	3.277

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635021: <i>Space Systems Survivability</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2.</p> <p>Description: Develop technology to warn of spacecraft radiation, charging, and kinetic impact hazards and to provide space environment situational awareness and anomaly resolution capability. NOTE: In FY 2011, these efforts are moving to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.</p> <p>FY 2010 Accomplishments: Developed engineering model of micrometeoroid impact detector as a component of a spacecraft anomaly resolution system. Initiated development of radiation dosimeter, spacecraft charge sensors, and common satellite interface architecture for spacecraft protection.</p> <p>FY 2011 Plans:</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans: These efforts are moving to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.</p>	0.818	-	-	-	-
Accomplishments/Planned Programs Subtotals	4.734	3.845	3.277	-	3.277

C. Other Program Funding Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635083: <i>Ballistic Missiles Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635083: <i>Ballistic Missiles Technology</i>	11.789	5.256	5.260	-	5.260	5.256	5.487	6.356	6.460	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, integrates, and demonstrates advanced technologies for sustainment and modernization of strategic ballistic missiles. The project focuses on developing robust, low maintenance inertial navigation instruments to sustain current ballistic missile systems, as well as provide new, small, low-powered, high-precision instrumentation for next generation missile systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop, integrate, and demonstrate advanced navigation instrumentation applied to emerging vehicle designs and other technologies that sustain current strategic missile systems.</p> <p>FY 2010 Accomplishments: Performed verification and integration of demonstration units. Began advanced navigation instrument engineering model designs with common mission requirements for better accuracy, lower cost, increased robustness, and smaller size. Commenced initial planning for advanced guidance risk reduction ground and flight demonstrations.</p> <p>FY 2011 Plans: Develop, build, and test advanced navigation instrument engineering model. Reduce advanced guidance risk through ground testing, sled testing, and flight test planning. Initiate build and test of flight capable advanced guidance system demonstration units integrated with strategic vehicle designs and interfaces.</p> <p>FY 2012 Base Plans: Start follow-on effort to address next generation guidance and navigation technologies for future systems. Develop technologies that facilitate planned Analysis of Alternatives on next generation strategic weapons.</p> <p>FY 2012 OCO Plans:</p>	2.907	2.630	2.630	-	2.630
<p>Title: Major Thrust 2.</p> <p>Description: Develop, integrate, and demonstrate navigation technologies with new vehicle designs to provide robust, flexible, lower cost solutions for sustaining current strategic missile systems.</p>	2.907	2.626	2.630	-	2.630

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635083: <i>Ballistic Missiles Technology</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p><i>FY 2010 Accomplishments:</i> Completed hardware procurement and initiated the build and test of advanced navigation instrumentation and range safety devices with new vehicle design interfaces. Performed qualification testing of designs against validated system level interfaces. Began dynamic and hostile environments analysis and testing of common advanced navigation instrumentation in support of strategic missile system development.</p> <p><i>FY 2011 Plans:</i> Complete qualification testing of designs against validated system level interfaces. Complete build and continue test and evaluation of advanced navigation instrumentation and range safety devices with new vehicle design interfaces. Integrate advanced guidance technologies with common vehicle designs and interfaces focused on lower cost solutions with increased accuracy, flexibility, and robustness.</p> <p><i>FY 2012 Base Plans:</i> Build and test Advanced Inertial Measurement engineering model for enhanced ground testing and preparation for flight test. Focus integration studies of advanced technologies into strategic systems to reduce cost and increase security, robustness, accuracy, and flexibility.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	5.814	5.256	5.260	-	5.260

	FY 2010	FY 2011
<p><i>Congressional Add:</i> Ballistic Missile Technology.</p> <p><i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.</p> <p><i>FY 2011 Plans:</i></p>	1.593	-
<p><i>Congressional Add:</i> Florida National Guard Total Force Integration.</p> <p><i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort.</p> <p><i>FY 2011 Plans:</i></p>	2.390	-
<p><i>Congressional Add:</i> P-Net Ballistic Missile Technology.</p>	1.992	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 635083: <i>Ballistic Missiles Technology</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	5.975	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force								DATE: February 2011			
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>				PROJECT 63682J: <i>Spacecraft Vehicles</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63682J: <i>Spacecraft Vehicles</i>	10.771	7.552	7.187	-	7.187	8.099	7.923	6.775	6.887	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

A. Mission Description and Budget Item Justification

This project develops and demonstrates compact, low-cost, spacecraft and launch vehicle power generation, storage, distribution, and thermal management technologies, including cryogenic cooling technologies. Power generation activities focus on lightweight, low-cost, low-volume, and survivable solar cell arrays. Energy storage work focuses on lightweight nickel hydrogen and sodium sulfur spacecraft batteries and flywheel energy storage systems for extended (five to ten year) satellite missions. The project's power distribution efforts focus on producing lightweight, high-efficiency, standardized power busses for use on future space systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	2.359	1.978	1.468	-	1.468
Description: Develop power generation space technologies such as multi-junction solar cells, thin-film solar cells, lightweight solar cell arrays, and radiation resistant solar cell modules.					
FY 2010 Accomplishments: Demonstrated large area solar cells based on the inverted metamorphic structure. Developed integration schemes and module technology for inverted metamorphic solar cells. Conducted environmental testing of inverted metamorphic solar cells.					
FY 2011 Plans: Demonstrate module technology traceable to greater than 300 watts/kilograms (W/kg) arrays.					
FY 2012 Base Plans: Extend inverted metamorphic (IMM)-based solar cell development toward 35-37%. Conduct maturity development of quantum dot-enhanced IMM solar cells.					
FY 2012 OCO Plans:					
Title: Major Thrust 2.	0.818	0.706	1.651	-	1.651

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>		PROJECT 63682J: <i>Spacecraft Vehicles</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
Description: Develop technologies for long-life, efficient, low-vibration, lightweight mechanical cryocoolers and integration components for space applications.					
FY 2010 Accomplishments: Provided continued support of missile launch detection thermal and cryogenic efforts. Developed non-moving parts compressor using proton biased membrane technology. Developed low-vibration conductance, cross gimbal 35K cooling loop interface to support space tracking missions. Expanded technology development of satellite cryogenic interface requirements and improved technologies to support space tracking applications.					
FY 2011 Plans: Support of missile launch detection thermal and cryogenic SSA missions. Develop a non-moving parts compressor using proton biased membrane technology. Design a low-vibration conductance, cross gimbal 35K cooling loop interface to support space tracking missions. Advance technology development of satellite cryogenic interface requirements and improved technologies to support space tracking applications.					
FY 2012 Base Plans: Work to reduce size, weight, and power requirements, ease integration, and increase reliability of cryocoolers and supporting payload thermal management systems for very large format focal plane arrays for missile warning capability and for responsive, modular systems. Evaluate passive versus active cooling, based on heat loads, power requirements, size, and payload thermal modeling. Provide correlated computer modeling results to industry to improve overall cryocooler design.					
FY 2012 OCO Plans:					
Title: Major Thrust 3.					
Description: Develop composites for launch vehicle and spacecraft structures and space applications, such as launch vehicle shrouds, thermal protection structures, and space antennas.					
FY 2010 Accomplishments: Demonstrated symbiotic structural technologies for space applications through sub-scale laboratory testing or sub-orbital launch demonstration. Developed thermal management testbed for space structures developed for responsive space class satellites. Initiated development of rapid fabrication processes to build tailored spacecraft panels in days rather than weeks.					
FY 2011 Plans:					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	2.167	2.350	1.417	-	1.417

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 63682J: <i>Spacecraft Vehicles</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Demonstrate novel deployable structural architectures. Demonstrate novel optical structures in relevant sub-system environment. Develop rapid fabrication processes to build tailored spacecraft panels in days, rather than weeks, and demonstrate and test rapidly fabricated engineering model panels. FY 2012 Base Plans: Complete development of thermal management testbed for space structures developed for responsive space satellites. Initiate development of system-level deployable architectures for advanced optical systems and low-cost RF reflectors. FY 2012 OCO Plans:					
Title: Major Thrust 4. Description: Develop technologies for spacecraft structural controls and mechanisms for on-orbit applications. FY 2010 Accomplishments: Finished development and integration of advanced estimation algorithms for improved local situational awareness. Began development of guidance, navigation, and control hardware for rapid integration and test. FY 2011 Plans: Develop advanced guidance, navigation, and control hardware such as control moment gyroscopes and reaction wheels for rapid integration and test. Increase performance of hardware systems while maintaining rapid integration capability. Begin development of hardware testbed for verifying performance of guidance, navigation, and control hardware systems. FY 2012 Base Plans: Transition high accuracy star tracker flight unit for use in customer flight program. Refine SSA camera tracking software in preparation for 2013 flight test. Design an autonomous mission manager for flight autonomy and on-orbit planning systems. Implement flight-like processors with hardware-in-the-loop to increase technology readiness levels. FY 2012 OCO Plans:	3.037	2.518	2.651	-	2.651
Accomplishments/Planned Programs Subtotals	8.381	7.552	7.187	-	7.187
	FY 2010	FY 2011			
Congressional Add: Small Responsive Spacecraft at Low-Cost.	2.390	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603401F: <i>Advanced Spacecraft Technology</i>	PROJECT 63682J: <i>Spacecraft Vehicles</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	2.390	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	36.582	5.899	13.555	-	13.555	13.927	14.445	14.973	15.522	Continuing	Continuing
634868: <i>Maui Space Surveillance System</i>	36.582	5.899	13.555	-	13.555	13.927	14.445	14.973	15.522	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds 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 have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	36.661	5.899	5.563	-	5.563
Current President's Budget	36.582	5.899	13.555	-	13.555
Total Adjustments	-0.079	-	7.992	-	7.992
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.002	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.077	-			
• Other Adjustments	-	-	7.992	-	7.992

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

Project: 634868: *Maui Space Surveillance System*

Congressional Add: *Panoramic Survey Telescope And Rapid Response System (Pan-STARRS).*

Congressional Add: *Flash Hyper-Dimensional Imaging System for Space Situational Awareness and Ballistic Missile Defense.*

Congressional Add Subtotals for Project: 634868

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	9.461	-
	1.992	-
	11.453	-
	11.453	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>
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Change Summary Explanation

Increase in funding in FY 2012 represents an increase in the Air Force priority for ground-based optical space situational awareness.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>				634868: <i>Maui Space Surveillance System</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634868: <i>Maui Space Surveillance System</i>	36.582	5.899	13.555	-	13.555	13.927	14.445	14.973	15.522	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds 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 have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1/Congressional Add	25.129	5.899	13.555	-	13.555
Description: Develop, demonstrate, and integrate ground-based optical SSA technology at MSSS, as well as operate and upgrade the facility.					
FY 2010 Accomplishments: Refurbished and upgraded MSSS to accommodate SSA research and technology development and to maintain requirements for safety and security in accordance with Air Force regulations. Removed inoperable motor on 3.5 meter telescope. Developed and demonstrated ground-based optical SSA technologies. This effort includes Congressional Add of \$19.5 million in FY 2010.					
FY 2011 Plans: Refurbish and upgrade MSSS to accommodate SSA research and technology development and to maintain requirements for safety and security in accordance with Air Force regulations. Repair inoperable motor on 3.5 meter telescope. Develop and demonstrate ground-based optical SSA technologies.					
FY 2012 Base Plans: Refurbish and upgrade MSSS to accommodate SSA research and technology development and to maintain requirements for safety and security in accordance with Air Force regulations. Use 3.5 meter telescope to develop and demonstrate ground-based optical SSA technologies.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	25.129	5.899	13.555	-	13.555

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603444F: <i>MAUI SPACE SURVEILLANCE SYSTEM</i>	PROJECT 634868: <i>Mauui Space Surveillance System</i>
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	FY 2010	FY 2011
Congressional Add: Panoramic Survey Telescope And Rapid Response System (Pan-STARRS). <i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort. <i>FY 2011 Plans:</i>	9.461	-
Congressional Add: Flash Hyper-Dimensional Imaging System for Space Situational Awareness and Ballistic Missile Defense. <i>FY 2010 Accomplishments:</i> Conducted Congressionally-directed effort. <i>FY 2011 Plans:</i>	1.992	-
Congressional Adds Subtotals	11.453	-

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

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	26.915	24.814	25.319	-	25.319	26.218	27.756	29.566	30.050	Continuing	Continuing
635323: <i>Directed Energy Bioeffects Parameters</i>	1.650	2.270	2.289	-	2.289	2.240	2.332	2.456	2.496	Continuing	Continuing
635324: <i>Human Dynamics and Terrain Demonstration</i>	6.213	6.426	6.126	-	6.126	6.115	8.152	9.034	9.182	Continuing	Continuing
635325: <i>Mission Effective Performance</i>	4.008	4.530	5.156	-	5.156	5.407	4.712	5.011	5.094	Continuing	Continuing
635326: <i>Performance Enhancement Demonstration</i>	6.959	4.377	4.153	-	4.153	4.143	4.310	4.592	4.667	Continuing	Continuing
635327: <i>Warfighter Interfaces</i>	8.085	7.211	7.595	-	7.595	8.313	8.250	8.473	8.611	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to enhance human 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 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 human operators synergistically use Air Force systems, including autonomous machines and adaptive teams of humans and machines. 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 Performance Enhancement Demonstration project develops, demonstrates, and transitions technologies to increase survivability and performance of personnel during military operations. The Human Dynamics and Terrain Demonstration project develops, demonstrates, and transitions technologies to anticipate and influence adversarial behavior within the air, space, and cyber domains. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	27.390	24.814	27.874	-	27.874
Current President's Budget	26.915	24.814	25.319	-	25.319
Total Adjustments	-0.475	-	-2.555	-	-2.555
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.475	-			
• Other Adjustments	-	-	-2.555	-	-2.555

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

Project: 635326: *Performance Enhancement Demonstration*

Congressional Add: *Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials*

Congressional Add Subtotals for Project: 635326

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	2.928	-
	2.928	-
	2.928	-

Change Summary Explanation

The decrease in funding in FY 2012 is due to an adjustment to properly align the science and technology portfolio to Air Force priorities.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635323: <i>Directed Energy Bioeffects Parameters</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635323: <i>Directed Energy Bioeffects Parameters</i>	1.650	2.270	2.289	-	2.289	2.240	2.332	2.456	2.496	Continuing	Continuing

A. Mission Description and Budget Item Justification

This 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. This project also 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 enhance the effectiveness of these weapon systems in air, space, and cyber operations. The optical radiation bioeffects research develops and demonstrates technologies that counter optical threats, while exploiting optical systems for non-lethal applications. Radio frequency radiation bioeffects research develops, demonstrates, and transitions technologies to the warfighters. Biobehavioral systems efforts focus on the design and characterization of scalable non-lethal directed energy and novel effects weapons, including quantification of physiological and psychological effectiveness and risks associated with these weapons.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop and demonstrate protective technologies for aircrew and ground personnel to provide protection against directed energy threats.</p> <p>FY 2010 Accomplishments: Completed validation and verification of human systems integration tool for directed energy protective equipment (optical radiation only). Continued assessment of radio frequency radiation personnel protection technologies. Began monitoring optical radiation skin protection technologies.</p> <p>FY 2011 Plans: Incorporate validated human systems integration tools and techniques into vulnerability models. Continue monitoring optical radiation skin protection material technologies and radio frequency radiation personnel protection technologies. Initiate research into advanced modeling and simulation of the bioeffects of high energy directed energy weapon systems. Continue research into advanced modeling and simulation software to predict target and collateral effects of high energy directed energy systems.</p> <p>FY 2012 Base Plans: Test end-to-end laser eye protection (LEP) design capability by merging frame and format design capability with a visual performance metrics and modeling capability to create a single, integrated package allowing complete human systems integration of LEP. Validate microwave modeling and simulation tool. Develop software to</p>	0.791	0.770	0.820	-	0.820

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635323: <i>Directed Energy Bioeffects Parameters</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
incorporate radio frequency energy-induced human effects from collateral hazard predictions into war-gaming scenarios. Increase computational speed of collateral hazard predictions for near real-time modules for weapon system fire control and mission planning applications. FY 2012 OCO Plans:					
Title: Major Thrust 2 Description: Develop and demonstrate technologies to assess bioeffects and collateral hazards from directed energy systems. FY 2010 Accomplishments: Combined angular-dependent and individual/crowd behavior models as function of directed energy parameters. Integrated target effects across directed energy spectrum into collateral damage tool development. Conducted field validation studies of model predictions. Developed conceptual design for mission planning tools. FY 2011 Plans: Perform field and laboratory experiments to verify and validate collateral hazard assessment software models on high energy laser systems and evaluate next generation of directed energy hazard assessment tools. Initiate software development to incorporate directed energy human effects from collateral hazard predictions into war-gaming scenarios. Increase computational speed of collateral hazard predictions for near real-time modules for weapon system fire control and mission planning applications. FY 2012 Base Plans: Continue testing and validation of high energy laser collateral effects real-time predictive models for directed energy weapon systems. Continue integration of directed energy hazard assessment tools in war-gaming scenarios. Test and validate near real-time modules for weapon system fire control and mission planning applications. FY 2012 OCO Plans:	0.859	1.500	1.469	-	1.469
Accomplishments/Planned Programs Subtotals	1.650	2.270	2.289	-	2.289

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635323: <i>Directed Energy Bioeffects Parameters</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				635324: <i>Human Dynamics and Terrain Demonstration</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635324: <i>Human Dynamics and Terrain Demonstration</i>	6.213	6.426	6.126	-	6.126	6.115	8.152	9.034	9.182	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to anticipate and influence adversarial behavior within the air, space, and cyber domains. These technologies will enhance Air Force capabilities in intelligence, surveillance, and reconnaissance (ISR), layered sensing, decision aids for computer network attack/defense/support, cyber force development and training, anticipatory command, control, and intelligence (C2I), measures of effectiveness for psychological operations, cross-cultural communication, and human-centric exploitation of measurement and signatures intelligence.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop, mature, and demonstrate technology to provide mission-essential capabilities for Air Force cyber operator performance enhancement and situational awareness.</p> <p>FY 2010 Accomplishments: Developed technologies to enhance cyber operator situational awareness capabilities. Developed advanced cyber mission/ campaign planning tools that optimize blue force readiness and operational effectiveness. Developed, integrated, and assessed advanced cyber mission/ campaign planning tools that facilitate the operator's ability to anticipate and influence an adversary's behavior.</p> <p>FY 2011 Plans: Develop technologies to increase cyber operator situational awareness capabilities. Evaluate suitability of technologies to transition cyber operator tools that integrate advanced influence operations technologies designed to anticipate and influence an adversary's behavior. Identify, integrate, demonstrate, and evaluate readiness for transition of technologies that increase human performance within cyber domain operations.</p> <p>FY 2012 Base Plans: Continue cyber situational awareness integration technologies and develop technologies to enhance human performance in the cyber performance area.</p> <p>FY 2012 OCO Plans:</p>	2.181	2.365	0.253	-	0.253
<p>Title: Major Thrust 2</p>	0.987	1.045	2.342	-	2.342

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635324: <i>Human Dynamics and Terrain Demonstration</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Description: Develop/demonstrate human-centered design processes and operational tools that optimize ISR information flows in a distributed, multi-source mission planning environment.</p> <p>FY 2010 Accomplishments: Developed and demonstrated automated tools and techniques designed to decrease an intelligence analyst's data overload condition and improve productivity. Concentrated technology development in the areas of ISR processes, ISR mission planning, and tool integration utilizing net-centric automated services to increase ISR enterprise capabilities, effectiveness, and quality, while reducing complexity, cost, and intelligence production cycle times. Demonstrated and transitioned technologies for ISR dynamic planning, geospatial intelligence tools, and multi-intelligence information operations tools used in Air Force ISR weapon systems. Developed and assessed the effectiveness of anticipatory approaches to enhance C2I.</p> <p>FY 2011 Plans: Develop and demonstrate advanced ISR analyst productivity tools. Demonstrate, validate, and transition human-centric decision-aids, tools, and process improvements in integrated, computer-based ISR system tools and related techniques supporting ISR weapon systems with an emphasis on anticipatory approaches to enhance C2I. Develop, mature, assess, and transition tools designed to increase ISR productivity by focusing on the interactions between humans and their automated planning and assessment tools.</p> <p>FY 2012 Base Plans: Deliver software prototype of unified analytical tool kit and work environment to support increased analyst speed and more robust, inclusive decision-making with lower cognitive overhead. Deliver prototype human-inspired cueing system to speed image analysis.</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 3</p> <p>Description: Develop/demonstrate anticipatory C2I decision-aiding technologies to rapidly assess battlefield situation, predict likely adversary behaviors, and select/prioritize courses of action.</p> <p>FY 2010 Accomplishments: Integrated decision-aiding tools into identified technology demonstration programs. Evaluated the methodologies developed to quantifiably measure the effectiveness of the commander's predictive environment decision</p>	1.096	0.495	1.951	-	1.951
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>		PROJECT 635324: <i>Human Dynamics and Terrain Demonstration</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
aids and simulation tools. Refined tools with emphasis on intelligence analysis and the anticipation elements. Evaluated the expanded operational benefits and utility of the decision aid tools and simulation in field exercises.					
FY 2011 Plans: Evaluate the suitability, maturity, and readiness of demonstrated decision-aiding technologies for transition to component users. Incorporate final improvements into end-products.					
FY 2012 Base Plans: Develop and test new methods to support visualization and manipulation of large, abstract data sets through combining recent advanced in neuroscience and neuro-imaging techniques with neural-based feature extraction and data filtering. Build in-house prototype to rapidly and effectively detect and correlate relationships with patterns of life and anomalous threat detection and identification.					
FY 2012 OCO Plans:					
Title: Major Thrust 4					
Description: Develop/demonstrate technology to optimize human operator performance, adversarial modeling techniques, and automated speech translation tools to aid Air Force information/influence operations.					
FY 2010 Accomplishments: Identified, integrated, demonstrated, and transitioned technology that optimizes human operator performance within Air Force influence operations. Illustrated adversarial cultural modeling techniques used to gauge adversarial threats. Matured and transitioned research into influence operations human performance training effectiveness, mission rehearsal, simulations, and combat readiness. Matured quantitative measures of effectiveness for psychological operations and selected influence operations capabilities. Developed and demonstrated next-generation information operations and cyber influence capabilities yielding non-kinetic warfighting options. Demonstrated and transitioned advanced speech-to-speech translation tools which support automated, cross-cultural communications.					
FY 2011 Plans: Demonstrate and determine the suitability, maturity, and readiness of next-generation information operations and cyber influence capabilities which yield non-kinetic warfighting options. Demonstrate and assess the effectiveness of advanced adversarial cultural modeling techniques used to gauge adversarial threats and behavior signatures. Develop, demonstrate, and assess the suitability of technology to transition advanced speech-to-speech translation tools that support automated, cross-cultural communications. Validate and					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	1.949	2.521	1.580	-	1.580

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635324: <i>Human Dynamics and Terrain Demonstration</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
improve models used to demonstrate measures of effectiveness for selected Air Force influence operations capabilities. FY 2012 Base Plans: Develop advanced techniques to rapidly develop and easily maintain speech-to-speech translation systems in multiple languages and application domains with limited data availability. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	6.213	6.426	6.126	-	6.126

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				635325: <i>Mission Effective Performance</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635325: <i>Mission Effective Performance</i>	4.008	4.530	5.156	-	5.156	5.407	4.712	5.011	5.094	Continuing	Continuing

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, and constructive (LVC) environments for performance-aiding methods and technologies. Activities include development of computer-generated entities to support training, simulation, and mission rehearsal; integrated high-fidelity weapon-systems training technologies for air, space, and cyber; tailored immersive simulation environments for Airmen at the tactical and operational levels; robust performance assessment and feedback tools; and maturation of game-based technologies for effective and efficient training. These methods and technologies facilitate the development of mission-essential competencies.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Advance aerospace/organizational behavior models for integrated warfighter training and rehearsal. Add realistic operations, command and control, force protection, and air base defense.</p> <p>FY 2010 Accomplishments: Evaluated and validated learning and mission performance impacts associated with common tools for mission planning, briefing, and after action review. Identified specific methods and tools of relevance within and across mission contexts and levels of decision making (e.g., tactical, operational, and strategic). Validated immersive training alternative environments for coalition training for close air support and air-to-ground coordination. Conducted schoolhouse and field training, rehearsal, and exercise evaluations and demonstrations in LVC contexts for close air support and command and control. Demonstrated integration of distributed air and space operations center (AOC) teams with tactical LVC operations for kill-chain training and operations. Fielded deployable distributed mission operations (DMO) training exemplars and conduct mission impact evaluations on their integration into routine operations training events. Completed development for deployable trainers and mission planning and after action review toolsets and update field deployed systems for further evaluation and training assessment.</p> <p>FY 2011 Plans: Complete field deployment and evaluation of embedded performance measurement and reporting system for combat mission readiness. Develop preliminary functionality for a learning management system for distributed</p>	2.002	1.753	1.964	-	1.964

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635325: <i>Mission Effective Performance</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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mission operations and LVC training, rehearsal, and exercise. Develop and evaluate an integrated environment for learning and assessment that includes live, virtual, and constructive air operations center planners, ground command and control, close air support aircraft, terminal attack and control personnel, and air combat assets. Complete development and field assessment of tailored training inside the ready aircrew program allocation of sorties and mission types for at least three mission areas and operational systems. Develop specifications for interface and data control approaches for managing learning in LVC contexts. Begin development of a reconfigurable and deployable training environment for combat training and rehearsal.

FY 2012 Base Plans:
Conduct initial evaluations of the reconfigurable and deployable training environment for Air Force applications. Complete evaluation for deployable training for Combatant Commander capability assessment across LVC contexts. Complete specification development for an integrated learning assessment and management system for DMO and LVC operations. Complete and demonstrate team communication tracking and assessment methods in AOC and cyber operations training. Define data and interoperability standards for remotely piloted aircraft sensor and pilot training integration in LVC operations. Develop and demonstrate learning management tools. Demonstrate integration of performance metrics in the after action review tool kit.

FY 2012 OCO Plans:

Title: Major Thrust 2	2.006	2.777	3.192	-	3.192
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Description: Develop/demonstrate high-fidelity DMO training/rehearsal capability for AOC operators and electronic warfare (EW) training technologies for future threat systems/capabilities.

FY 2010 Accomplishments:
Developed the integrated strategy and plans division trainer based on competency-based training requirements and optimum mission rehearsal strategies. Developed individual interfaces between component simulations and AOC equipment systems. Began to code, integrate, and test the execution management capabilities for the simulation set. Began development of a DMO and C2ISR common database generation system and live EW range integration into DMO. Demonstrated an on-range live fly of LVC EW training with live emitters/ platforms.

FY 2011 Plans:
Develop code, integrate, and test the execution management capabilities for the simulation set. Develop, integrate, and test the performance assessment capability within the simulation set. Develop scenario authoring tools and integrate with simulation components. Test and integrate the entire strategy and plans division trainer

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635325: <i>Mission Effective Performance</i>
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
and begin integration with the AOC part task trainer. Develop vendor-specific real-time database examples from the database generation system's outputs. Begin development of methodologies for real-time incorporation of data into DMO, homeland security, and C2ISR databases. Demonstrate a multi-ship/onboard networked LVC EW training concept. Conduct an integrated, on-board EW training demonstration with live aircraft and with a major test/training range.					
<i>FY 2012 Base Plans:</i> Begin definition of multi-level security rule sets for integrated LVC operations across fourth and fifth generation operational systems and different classification enclaves. Develop and demonstrate efficient multi-level rule set definition and accreditation tools for secure training and rehearsal within a single classification enclave. Complete development and demonstration of common competency-based training and assessment for cyber and LVC operations. Complete transition and field integration of embedded performance assessment system in optional mission training centers.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	4.008	4.530	5.156	-	5.156

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>				635326: <i>Performance Enhancement Demonstration</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635326: <i>Performance Enhancement Demonstration</i>	6.959	4.377	4.153	-	4.153	4.143	4.310	4.592	4.667	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to increase survivability and performance of personnel during military operations. Bioscience efforts develop advanced biotechnology, nanotechnology, and neuroscience solutions for the protection and enhanced effectiveness of battlefield airmen. Counterproliferation efforts develop biotechnology and bio-tagants to advance the ability to detect, identify, monitor, and neutralize biological threat agents. The counterproliferation effort also demonstrates and transitions modeling and simulation techniques for operational assessment of pre- and post-bio-agent attack. Biobehavioral and biomechanics focus areas develop aircrew support technologies that enhance warfighter protection and improve performance during long-duration missions. The biomechanics focus area also develops technology to rapidly integrate multi-sensor data with automated dynamic human modeling to anticipate and identify human adversarial threats.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1	1.522	1.925	2.049	-	2.049
Description: Demonstrate tailored bio-taggant and identification/neutralization capabilities to enhance force protection/enable air operations commanders to maintain operations tempo.					
FY 2010 Accomplishments: Optimized the selected bio-taggant technologies and began the development of platforms to employ the bio-tagants. Optimized the insertion/distribution of bio-tagants in target areas. Evaluated taggant technologies in simulated operational environments. Initiated research to develop capabilities to track biological warfare agents inside buildings and vehicles.					
FY 2011 Plans: Validate selected bio-taggant technologies in the laboratory. Continue to investigate suitable platforms to integrate bio-taggant technologies.					
FY 2012 Base Plans: Validate selected bio-taggant technologies in a simulated operational environment. Identify an integration platform. Demonstrate taggant technology that performs stand off detection of biological agents in an operational environment to include: line-of-sight and free-from-sight stand-off detection of biological warfare agents and personnel who have been exposed to Weapons of Mass Destruction.					
FY 2012 OCO Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635326: <i>Performance Enhancement Demonstration</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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Title: Major Thrust 2	2.509	2.452	2.104	-	2.104
Description: Apply human threat signatures to inform sensor development to develop research to enhance threat detection training for intelligence analysts, reconnaissance patrol, and force protection security operators.					
FY 2010 Accomplishments: Developed methods to identify key human threat indicators to reduce bandwidth requirements and enable real-time threat assessment from the air. Developed enhanced anthropometric visualization techniques that integrate heterogeneous sensor data of potential adversaries.					
FY 2011 Plans: Demonstrate a morphable 3D dynamic human model that adapts to different sensor input, predicts threat, and optimizes sensor combination and placement for human threat detection. Develop new human shape variation and visualization for threat awareness capability for the deployed airmen.					
FY 2012 Base Plans: Develop training based on physical/physiological indicators of deceptive behavior. Initiate development of software training module for human threat indicators. Provide requirements for sensor resolution and optimized sensor placement for human threat indicator detection.					
FY 2012 OCO Plans:					

Accomplishments/Planned Programs Subtotals	4.031	4.377	4.153	-	4.153
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	FY 2010	FY 2011			
Congressional Add: Water for Injection and Air Purification with Carbon Nanotube Nanostructured Materials	2.928	-			
FY 2010 Accomplishments: Conducted Congressionally-directed effort.					
FY 2011 Plans:					
Congressional Adds Subtotals	2.928	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635326: <i>Performance Enhancement Demonstration</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635327: <i>Warfighter Interfaces</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635327: <i>Warfighter Interfaces</i>	8.085	7.211	7.595	-	7.595	8.313	8.250	8.473	8.611	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops, demonstrates, and transitions technologies to revolutionize the way human operators optimize the capabilities of Air Force systems, including autonomous machines and adaptive teams of humans 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, multi-sensory 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 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop immersion technologies and augmented vision, to facilitate team building and workflow in a distributed C2 environment and exploit telepresence in urban operations.</p> <p>FY 2010 Accomplishments: Analyzed the hardware and software trade-space options for a future C2 collaborative interface environment. Began concept development of sensemaking technologies and collaborative decision support tools for the resulting net-centric C2 environment infrastructure.</p> <p>FY 2011 Plans: Develop flexible and modular proof-of-concept interface tools used for team formation, intense collaboration, sensemaking, distributed decision support, and workflow. These tools will be used by C2 collaborators under cyber fight-through conditions and when conducting cyber-supported mission assurance activities. Integrate and test functionality of the modular distributed tools for demonstration in various C2 team decision making environments. Initiate technology demonstrations in representative users' cyber environments.</p> <p>FY 2012 Base Plans: Develop technology to assess the value of operator immersion and related virtual presence technology for improving human and mission performance, design novel warfighter visualizations, and develop intuitive control methods for exercising telepresence in the urban battlespace. Develop conceptual operator telepresence</p>	1.002	1.550	3.545	-	3.545

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011		
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635327: <i>Warfighter Interfaces</i>			
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
interfaces (remote and on-scene) for the larger context of supervisory control of the sensor networks and ISR services.					
FY 2012 OCO Plans:					
Title: Major Thrust 2	2.995	1.500	0.973	-	0.973
Description: Demonstrate technologies to interface between airmen and visual/auditory displays for battlefield airmen. Demonstrate ability to forecast acoustic profiles for any atmospheric/terrain condition.					
FY 2010 Accomplishments: Developed integrated multi-sensory interfaces for ground-based combat controllers. Developed and demonstrated advanced cabling and wireless technologies to improve operator mobility, decrease system setup time, and reduce the probability of user errors or system malfunctions. Demonstrated integrated human-centered concepts for enhanced portability, maintainability, and usability. Refined audio and visual interfaces to enhance operator survivability, improve communication effectiveness, and allow effective use of wearable computers without impairing the mobility of dismounted combat controllers.					
FY 2011 Plans: Complete final evaluations of integrated components. Demonstrate the integrated system concept, including advanced audio, speech, and visual interfaces, improved human-centric software applications, wearable power management systems, and ergonomically improved cabling and carriage concepts. Conduct laboratory evaluations to assess effectiveness of integrated system and compare performance to original baseline. Conduct field evaluations of technology components and prepare for transition to operational capability.					
FY 2012 Base Plans: Integrate a high fidelity acoustic simulation model into existing Air Force fielded software applications to demonstrate technology in the user's environment. Perform initial proof-of-concept verification and validation of the integrated acoustic model. Develop and test field data collection procedures to validate the acoustic predictions of sound propagation and source characterization. Collect soundscape data for a background noise database. Perform related research on human hearing and vigilance.					
FY 2012 OCO Plans:					
Title: Major Thrust 3	1.532	1.458	1.034	-	1.034

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Description: Develop and demonstrate an integrated human-centered interface to control multiple remotely piloted aircraft (RPA) that have various levels of autonomy and that optimize net-centric information flow.</p> <p>FY 2010 Accomplishments: Developed warfighter interface control station technologies permitting the effective conduct of cooperative dynamic reconnaissance, surveillance, and target acquisition missions either by a single warfighter or by a two-person crew in the next-generation supervisory control station. Integrated advanced mission and sensor management controls, displays, and decision aids with multi-RPA cooperative control automation for demonstration of the next-generation supervisory control station. Began to demonstrate and assess system performance and mission effectiveness in high-fidelity virtual simulation and flight test environments.</p> <p>FY 2011 Plans: Complete the development of advanced multi-RPA control station technology for dynamic reconnaissance, surveillance, and time-critical target acquisition missions. Complete the integration of cooperative engagement algorithms and operator interface technologies for technology demonstration. Complete the demonstration and assessment of system performance and mission effectiveness enabled by the next-generation supervisory control station, using high-fidelity virtual simulation and flight test environments. Determine how many vehicles an RPA operator can effectively manage/supervise.</p> <p>FY 2012 Base Plans: Analyze warfighter requirements for a future generation control station that will accommodate advanced and legacy RPAs. Develop and integrate operator interface controls, displays, and decision-aid technologies for effective situation assessment, decision-making, and action implementation to manage semi-autonomous, multi-mission RPAs and heterogeneous payloads. Test control station technology to determine baseline functionality and performance.</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 4</p> <p>Description: Develop job performance aiding technologies that assess workload and performance to more effectively determine work re-allocation in a command and control distributed environment.</p> <p>FY 2010 Accomplishments:</p>	0.551	1.112	1.013	-	1.013
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Began to develop a visual interface concept that planners may use to visualize the primary constraints within capacity-based planning. Included alternative planning algorithms that exploit cognitive engineering and work-centered design principles. Outlined a program plan featuring interactive simulations as a way to optimize resource allocation in complex time-sensitive deployments.</p> <p>FY 2011 Plans: Develop visual interface and incorporate advanced algorithms for planning military mobility operations. Demonstrate the ability to exploit automated planning to optimize the use of resources within Joint Deployment and Distribution Enterprise capacity constraints. Provide for real-time operator interaction within the capacity-based planner and begin to quantify the benefits of the human-automation interaction relative to current capabilities.</p> <p>FY 2012 Base Plans: Assess hardware and software technology options for developing team workload and performance detection capability and visualization requirements. Begin to develop and plan to integrate both on-human and off-human sensors. Work with command and control operational users from Control and Reporting Centers to identify characteristics of team membership and visualization requirements.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 5</p> <p>Description: Develop cognitive-based analytic/design methods and computer software tools for C2 operations to synchronize personnel in distributed locations and obtain visually intuitive battlespace awareness.</p> <p>FY 2010 Accomplishments: Began analysis and refined analytic methods and techniques to support unified action for large, cross-organizational C2 teams and teams-of-teams. Began concept development of an extensible work-aiding framework that integrates future and current work aids into a coherently unified framework that affords efficient and effective action of large distributed and semi-independent teams and individuals.</p> <p>FY 2011 Plans: Demonstrate and evaluate a unifying C2 work-aiding framework supporting distributed cross-organizational teams and individuals, including integration of a representative set of existing tools. Examine results and refine</p>	2.005	1.591	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
work-centered analytic, design, and development methods and techniques as applied to teams. This effort completes in FY 2011. FY 2012 Base Plans: FY 2012 OCO Plans:					
Title: Major Thrust 6 Description: Develop and demonstrate space visualization technologies that provide visually intuitive awareness of the battlespace, including trend portrayal useful for decision making. NOTE: The increase in FY12 is due to greater emphasis in this area. FY 2010 Accomplishments: FY 2011 Plans: FY 2012 Base Plans: Examine and analyze the workflow and information required to provide warfighters with an inherent awareness of the operational space situation. Exploit available cognitive task analyses of space operations and develop user requirements for visualization tools that simplify the process of portraying relevant data from large data sets. Develop and test laboratory prototypes of visualization tools developed from user-derived requirements. FY 2012 OCO Plans:	-	-	1.030	-	1.030
Accomplishments/Planned Programs Subtotals	8.085	7.211	7.595	-	7.595

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603456F: <i>Human Effectiveness Adv Tech Dev</i>	PROJECT 635327: <i>Warfighter Interfaces</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	13.991	15.755	54.042	-	54.042	26.852	20.996	17.389	17.675	Continuing	Continuing
63670A: <i>Conventional Weapons Development</i>	13.991	15.755	54.042	-	54.042	26.852	20.996	17.389	17.675	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops, demonstrates, and integrates ordnance and advanced guidance technologies for air-launched conventional weapons. The program includes development of conventional ordnance technologies including warheads, fuzes, and explosives; and development of advanced guidance technologies including seekers, navigation and control, and guidance. Technologies to be developed, demonstrated and integrated include blast, fragmentation, penetration, low-collateral damage warheads, variable depth/location fuzing, precise guidance, and high performance and insensitive explosives. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in the Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	14.296	15.755	19.357	-	19.357
Current President's Budget	13.991	15.755	54.042	-	54.042
Total Adjustments	-0.305	-	34.685	-	34.685
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.305	-			
• Other Adjustments	-	-	34.685	-	34.685

Change Summary Explanation

NOTE: Increase in FY12 is due to an increase in Air Force priority for a hard target defeat capability.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>				PROJECT 63670A: <i>Conventional Weapons Development</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63670A: <i>Conventional Weapons Development</i>	13.991	15.755	54.042	-	54.042	26.852	20.996	17.389	17.675	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops, demonstrates, and integrates ordnance and advanced guidance technologies for air-launched conventional weapons. The program includes development of conventional ordnance technologies including warheads, fuzes, and explosives; and development of advanced guidance technologies including seekers, navigation and control, and guidance. Technologies to be developed, demonstrated and integrated include blast, fragmentation, penetration, low-collateral damage warheads, variable depth/location fuzing, precise guidance, and high performance and insensitive explosives. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in the Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop and demonstrate ordnance technologies to improve conventional, air delivered munitions. Specific technical areas of focus include fuzes, energetic materials, warheads, and integration.</p> <p>FY 2010 Accomplishments: Completed development of an active imaging target device that can provide warhead aimpoint selection for mass focused warheads. Began developing a conventional ordnance package consisting of a case, fuze, fuzewell, and explosive fill capable of penetrating high performance concrete at velocities up to 2500 feet per second.</p> <p>FY 2011 Plans: Continue developing a conventional ordnance package capable of penetrating high performance concrete at velocities up to 2500 feet per second.</p> <p>FY 2012 Base Plans: Continue developing a conventional ordnance package capable of penetrating high performance concrete at velocities up to 2500 feet per second. Develop and demonstrate technologies and approaches that incorporate velocity augmentation capability for penetrating weapons. Develop an ordnance package that enables the warfighter to tailor the weapon effects for the target and its surrounding environment.</p> <p>FY 2012 OCO Plans:</p>	5.800	9.255	29.257	-	29.257

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>	PROJECT 63670A: <i>Conventional Weapons Development</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 2</p> <p>Description: Develop and demonstrate guidance technologies to improve the precision, controlled lethality, and flexibility of conventional, air-delivered munitions.</p> <p>FY 2010 Accomplishments: Completed demonstration of a low cost laser detection ordnance seeker to increase data rates. Continued demonstration of advanced guidance technologies to enable small guided munitions to attack multiple moving targets.</p> <p>FY 2011 Plans: Continue demonstration of advanced guidance technologies to enable small guided munitions to attack multiple moving targets.</p> <p>FY 2012 Base Plans: Continue demonstration of dynamic path planning and target engagement technologies to enable close controlled strike munitions concepts. Develop technology for precision weapon navigation in Global Positioning System - degraded environments.</p> <p>FY 2012 OCO Plans:</p>	4.061	1.531	18.515	-	18.515
<p>Title: Major Thrust 3</p> <p>Description: Demonstrate advanced conventional munition concepts. These innovative concepts integrate ordnance, guidance, and carriage and release technologies to demonstrate a warfighter capability.</p> <p>FY 2010 Accomplishments: Continued maturing missile technologies to defeat broad range of small and highly agile air targets as well as high value ground targets, such as enemy air defenses. Continued development of a small short-range precision-guided munition capable of attacking multiple moving targets.</p> <p>FY 2011 Plans: Continue maturing missile technologies to defeat a broad range of small and</p>	4.130	4.969	6.270	-	6.270

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603601F: <i>Conventional Weapons Technology</i>	PROJECT 63670A: <i>Conventional Weapons Development</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
highly agile air targets as well as high value ground targets, such as enemy air defenses. Continue development of a small short range precision-guided munition capable of attacking multiple moving targets. <i>FY 2012 Base Plans:</i> Continue maturing missile technologies to defeat a broad range of small and highly agile air targets as well as high value ground targets, such as enemy air defenses. Begin demonstration of technologies that enable a munition to provide effects tailorable to the target and surrounding environment. Further refine employment concepts and system technologies for high speed penetrating weapons with velocity augmentation. Begin development of a munition concept to incorporate technologies for carriage and terminal impact at high speed. Continue demonstration of technologies that enable a small short range precision guided munition to attack multiple moving targets. <i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	13.991	15.755	54.042	-	54.042

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603605F: <i>Advanced Weapons Technology</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	44.045	17.461	28.683	-	28.683	32.749	34.542	35.944	36.555	Continuing	Continuing
633150: <i>Advanced Optics Technology</i>	9.460	-	-	-	-	-	-	-	-	Continuing	Continuing
633151: <i>Lasers and Imaging Development and Integration</i>	21.084	6.883	16.487	-	16.487	21.563	22.887	23.452	23.851	Continuing	Continuing
633152: <i>High Power Microwave Development and Integration</i>	13.501	10.578	12.196	-	12.196	11.186	11.655	12.492	12.704	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program provides for the development, integration, demonstration, and detailed assessment of directed energy weapon technologies including high energy laser, high power microwave (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 data base for directed energy weapons. This program also develops and demonstrates technologies, derived from laser beam control, that support optical ground-based space situational awareness. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	44.794	17.461	28.683	-	28.683
Current President's Budget	44.045	17.461	28.683	-	28.683
Total Adjustments	-0.749	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.001	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.748	-			
• Other Adjustments	-	-			

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

Project: 633150: *Advanced Optics Technology*

Congressional Add: *Applications of LIDAR to Vehicles with Analysis (ALVA)*.

FY 2010	FY 2011
5.975	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)

Congressional Add: *Real-time Optical Surveillance Applications (ROSA).*

Congressional Add Subtotals for Project: 633150

Project: 633151: *Lasers and Imaging Development and Integration*

Congressional Add: *Advanced Tactical Laser.*

Congressional Add: *Advanced Fiber Lasers Systems and Components.*

Congressional Add Subtotals for Project: 633151

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	3.485	-
	9.460	-
	2.231	-
	3.187	-
	5.418	-
	14.878	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633150: <i>Advanced Optics Technology</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633150: <i>Advanced Optics Technology</i>	9.460	-	-	-	-	-	-	-	-	Continuing	Continuing

Note

Note: Funding in this project is due to Congressional adds.

A. Mission Description and Budget Item Justification

This project develops advanced optical technologies for various strategic and tactical beam control applications.

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

	FY 2010	FY 2011
Congressional Add: Applications of LIDAR to Vehicles with Analysis (ALVA). FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	5.975	-
Congressional Add: Real-time Optical Surveillance Applications (ROSA). FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.485	-
Congressional Adds Subtotals	9.460	-

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

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633151: <i>Lasers and Imaging Development and Integration</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633151: <i>Lasers and Imaging Development and Integration</i>	21.084	6.883	16.487	-	16.487	21.563	22.887	23.452	23.851	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project provides for the development, integration, demonstration, and detailed assessment of high energy laser and beam control technologies needed for applications such as aircraft self-protection, force protection, force application, precision engagement. It also develops and demonstrates ground-based optical space situational awareness technologies. Laser system concept assessments to include vulnerability assessments and target effect testing are preformed.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop and demonstrate laser technologies for applications such as aircraft self-protection.</p> <p>FY 2010 Accomplishments: Developed and demonstrated aircraft self-protection components to counter missile threats.</p> <p>FY 2011 Plans: Investigate integrated breadboard aircraft self-protection technologies compatible with mid-wave infrared detection and jamming capabilities. Validate aircraft self-protection fly-out model codes with effects/lethality data.</p> <p>FY 2012 Base Plans: Develop an integrated breadboard to demonstrate focal plane array damage technologies for aircraft self-protection.</p> <p>FY 2012 OCO Plans:</p>	2.209	2.693	1.733	-	1.733
<p>Title: Major Thrust 2.</p> <p>Description: Develop and demonstrate advanced beam control technologies and demonstrate beam control components integrated with high energy lasers.</p> <p>FY 2010 Accomplishments:</p>	5.758	4.190	14.754	-	14.754

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633151: <i>Lasers and Imaging Development and Integration</i>
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	FY 2010	FY 2011
Congressional Add: Advanced Tactical Laser. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	2.231	-
Congressional Add: Advanced Fiber Lasers Systems and Components. FY 2010 Accomplishments: Conducted Congressionally-directed effort. FY 2011 Plans:	3.187	-
Congressional Adds Subtotals	5.418	-

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

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>				PROJECT 633152: <i>High Power Microwave Development and Integration</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633152: <i>High Power Microwave Development and Integration</i>	13.501	10.578	12.196	-	12.196	11.186	11.655	12.492	12.704	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project develops and demonstrates high power microwave (HPM) and other unconventional weapon generation and transmission technologies that support a wide range of Air Force missions such as the potential disruption, degradation, damage, or destruction of an adversary's electronic infrastructure and military capability. It also develops a susceptibility, vulnerability, and lethality data base.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop and evaluate HPM technologies for non-lethal, anti-personnel weapon applications such as ground force protection from a stand-off aircraft.</p> <p>FY 2010 Accomplishments: Conducted engagement modeling and simulation supporting next generation system requirements refinement and associated flowdown to technical system requirements. Developed, analyzed, and evaluated source and thermal subsystem options for next-generation non-lethal systems. Provided technical expertise and background to external organizations tailoring Active Denial concepts and capabilities to their needs and glean data relevant to airborne applications.</p> <p>FY 2011 Plans: Develop and evaluate technologies for Air Force non-lethal weapons applications. Begin prime power hardware development for next generation transmitters. Provide technical expertise and background to external organizations tailoring Active Denial concepts and capabilities to their needs and glean data relevant to airborne applications.</p> <p>FY 2012 Base Plans: This thrust has been temporarily zeroed due to higher Air Force priorities.</p> <p>FY 2012 OCO Plans:</p>	0.550	0.652	-	-	-
<p>Title: Major Thrust 2.</p>	12.951	9.926	12.196	-	12.196

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633152: <i>High Power Microwave Development and Integration</i>
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Description: Develop and evaluate HPM and other unconventional weapon technologies including integration on various platforms, including aerial for applications such as counter-electronics.</p> <p>FY 2010 Accomplishments: As a part of Counter-electronics HPM Advance Missile Project (CHAMP) Joint Capability Technology Demonstration (JCTD), integrated narrowband HPM components into a aerial platform for counter-electronics demonstrations. Conducted ground testing of CHAMP including effects testing and environmental testing of the integrated system. Refined and implemented HPM source component technology to overcome unforeseen issues in application systems.</p> <p>FY 2011 Plans: Complete the integration of narrowband HPM components into the CHAMP aerial platform. Conduct additional ground testing of the CHAMP HPM system including effects testing and characterization of the performance. Conduct an inert flight test with the aerial platform to verify the guidance system accuracy, platform controllability for beam pointing, and timing for triggering of the HPM payload.</p> <p>FY 2012 Base Plans: Complete the integration of narrowband HPM components into the CHAMP aerial platform. Conduct flight test of the HPM payload for the CHAMP JCTD.</p> <p>FY 2012 OCO Plans:</p>					
Accomplishments/Planned Programs Subtotals	13.501	10.578	12.196	-	12.196

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603605F: <i>Advanced Weapons Technology</i>	PROJECT 633152: <i>High Power Microwave Development and Integration</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	49.507	39.701	40.103	-	40.103	40.534	41.191	41.826	42.511	Continuing	Continuing
635280: <i>Manufacturing Technologies</i>	45.632	37.701	39.119	-	39.119	40.534	41.191	41.826	42.511	Continuing	Continuing
635281: <i>Manufacturing Readiness</i>	3.875	2.000	0.984	-	0.984	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Manufacturing Technology (ManTech) program executes technical programs to maintain and develop an affordable and reliable industrial base and manufacturing capability that will be responsive to warfighter needs. The program develops and improves manufacturing technologies and processes to enable cost reduction, improve component and system quality, and enhance industrial capability. Further, value stream modifications and manufacturing throughput improvements are effected to shorten cycle times of weapon systems during design, development, production and sustainment. ManTech objectives are conducted through industrial partnerships which enable the demonstration of manufacturing technologies for existing weapon system upgrades and/or for new warfighter systems. Efforts in the program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. Manufacturing Technologies is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates manufacturing technologies for existing upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)

	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>
Previous President's Budget	50.502	39.701	40.359	-	40.359
Current President's Budget	49.507	39.701	40.103	-	40.103
Total Adjustments	-0.995	-	-0.256	-	-0.256
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.001	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.994	-			
• Other Adjustments	-	-	-0.256	-	-0.256

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

Project: 635280: *Manufacturing Technologies*

Congressional Add: *Laser Peening for Friction Stir Welded Aerospace Structures*

Congressional Add: *Production of Nanocomposites for Aerospace Applications*

FY 2010	FY 2011
1.593	-
1.593	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>
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Congressional Add Details (\$ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Congressional Add: <i>Mobil Laser Systems for Aircraft Structures (MLSAS)</i>	0.797	-
Congressional Add: <i>Wire Integrity Technology</i>	1.593	-
Congressional Add: <i>Next Generation Casting Initiative</i>	3.983	-
Congressional Add: <i>Automated Processing of Advanced Low Observables (RAPALO)</i>	1.195	-
Congressional Add Subtotals for Project: 635280	10.754	-
Congressional Add Totals for all Projects	10.754	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY			R-1 ITEM NOMENCLATURE				PROJECT				
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>			PE 0603680F: <i>Manufacturing Technologies</i>				635280: <i>Manufacturing Technologies</i>				
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635280: <i>Manufacturing Technologies</i>	45.632	37.701	39.119	-	39.119	40.534	41.191	41.826	42.511	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Manufacturing Technology (ManTech) program executes technical programs to maintain and develop an affordable and reliable industrial base and manufacturing capability that will be responsive to warfighter needs. The projects include development and improvement of manufacturing technologies and processes; collaboration with government program offices, industry, and academia; investments in generic technologies that can be applied to different applications, cost-sharing; multiple system/customer applications; potential for significant return on investment; and customer commitment to implement. To this end, ManTech develops and demonstrates advanced manufacturing processes and technologies to reduce costs, improve quality/capability, and shorten cycle times of weapon systems during design, development, production, and sustainment. Where mature processes are not available, laboratory-developed and demonstrated initial process capabilities are made available for transition into weapon system programs. ManTech objectives are conducted through partnerships with all industry levels, from large prime contractors to small material and parts vendors.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Develop and implement cost-effective maintenance, repair, and manufacturing technologies for sustainment of Air Force weapon systems.</p> <p>FY 2010 Accomplishments: Continued cost-effective repair and manufacturing technologies for affordable sustainment of both aircraft and turbine engine components. Continued assessments and manufacturing technology development to reduce logistic support costs, lead times for high value supply chain commodities, and cycle times for depot repair. Continued rapid response productivity improvement efforts with selected high value programs.</p> <p>FY 2011 Plans: Continue efforts for cost-effective repair and manufacturing technologies enabling affordable sustainment of both conventional and low observable aircraft, and turbine engine components. Continue assessments and manufacturing technology development to reduce logistics support costs, lead times for high value supply chain commodities, and cycle times for depot repair. Continue demonstration of productivity improvement efforts with</p>	13.632	15.080	16.309	-	16.309

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force				DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>		R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>		PROJECT 635280: <i>Manufacturing Technologies</i>	
B. Accomplishments/Planned Programs (\$ in Millions)					
selected high value programs. Conduct efforts supporting High Velocity Maintenance concept at Air Logistics Centers to reduce Programmed Depot Maintenance cycle times and cost.					
FY 2012 Base Plans: Continue efforts for cost-effective development of conventional and low-observable repair and manufacturing technologies enabling affordable sustainment of aircraft and turbine engine components. Continue assessments and manufacturing technology development to reduce logistics support costs, lead times for high value supply chain commodities, and cycle times for depot repair. Continue efforts supporting High Velocity Maintenance concept at Air Logistics Centers to reduce Program Depot Maintenance cycle times and cost. Pursue improvements in energy consumption required during manufacturing operations to reduce processing costs. Training responsibilities have been transitioned to AFIT and commercial activities can be utilized for Manufacturing Readiness Assessment (MRA) and Manufacturing Readiness Level (MRL) support.					
FY 2012 OCO Plans:					
Title: Major Thrust 2					
Description: Develop and transition pervasive affordability and producibility technologies for weapon systems and processes.					
FY 2010 Accomplishments: Continued development of rapid response and flexible manufacturing methods, commercial / military integration, quality processing and supply stream improvements. Continued development and demonstration of manufacturing capabilities for more affordable low-observable structures, advanced propulsion technologies, electronics manufacturing technologies for Command, Control, Intelligence, Surveillance, and Reconnaissance (C2ISR), space and advanced radar applications.					
FY 2011 Plans: Continue development and demonstration of rapid response and flexible manufacturing methods, commercial/ military integration, quality processing and supply stream improvements. Advance development and demonstration of manufacturing capabilities for more affordable low-observable structures, advanced propulsion technologies, electronics manufacturing technologies for C2ISR, space and advanced radar applications.					
FY 2012 Base Plans: Continue development demonstration of rapid response and flexible manufacturing methods, commercial/military integration, quality processing and supply stream improvements. Continue demonstration of manufacturing					
	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
	21.246	22.621	22.810	-	22.810

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635280: <i>Manufacturing Technologies</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
capabilities for more affordable low-observable structures, advanced propulsion technologies, electronics manufacturing technologies for C2ISR, space and advanced radar applications. FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	34.878	37.701	39.119	-	39.119

	FY 2010	FY 2011
Congressional Add: Laser Peening for Friction Stir Welded Aerospace Structures FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Production of Nanocomposites for Aerospace Applications FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Mobil Laser Systems for Aircraft Structures (MLSAS) FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	0.797	-
Congressional Add: Wire Integrity Technology FY 2010 Accomplishments: Conduct Congressionally-directed effort. FY 2011 Plans:	1.593	-
Congressional Add: Next Generation Casting Initiative FY 2010 Accomplishments: Conduct Congressionally directed effort. FY 2011 Plans:	3.983	-
Congressional Add: Automated Processing of Advanced Low Observables (RAPALO)	1.195	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635280: <i>Manufacturing Technologies</i>
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conduct Congressionally directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	10.754	-

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635281: <i>Manufacturing Readiness</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635281: <i>Manufacturing Readiness</i>	3.875	2.000	0.984	-	0.984	-	-	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

Manufacturing readiness of technologies is a key concern when identifying and mitigating risk to successfully transition these technologies and systems into production. Within each product sector (aeronautical, space, munitions/directed energy, and C2ISR), manufacturing readiness assessments (MRAs) will be applied and manufacturing readiness levels (MRLs) utilized to gauge and manage manufacturing related issues. Advanced Technology Demonstrations (ATDs) will be used when appropriate to aid in efficient transition. Selected acquisition programs will also be assessed to determine readiness for milestone decisions and/or to reduce manufacturing risk. Pervasive, generic and system-specific manufacturing maturation plans will be developed and implemented based on the assessments to reduce overall program risk and to provide an increased awareness of manufacturing issues throughout major weapon system life cycles. Generic and pervasive manufacturing issues will be identified and considered as potential ManTech programs to transition advanced manufacturing technologies into multiple sectors.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1</p> <p>Description: Through application of Manufacturing Readiness Assessments (MRAs), develop and implement manufacturing maturation plans to improve affordability and producibility and mitigate transition risk from development to production.</p> <p>FY 2010 Accomplishments: Continued development of Manufacturing Maturation Plans (MMPs) for Category I ATDs and selected high-visibility programs based on MRA. Executed selected MMPs to increase the MRL and improve technology transition to production. Conducted MRAs on selected Air Force acquisition programs to aid in Milestone Decision Reviews and/or to mitigate cost, schedule, or rate issues. Documented manufacturing risk based on the assessments and deliver to the appropriate program offices. Vetted pervasive manufacturing issues discovered during the assessments through the ManTech requirements process.</p> <p>FY 2011 Plans: Continue development of Manufacturing Maturation Plans (MMPs) for Category I ATDs and selected high-visibility programs based on MRAs. Execute selected MMPs to increase the MRL and improve technology transition to production. Conduct MRAs on selected Air Force acquisition programs to aid in Milestone Decision Reviews and/or to mitigate cost, schedule, or rate issues. Document manufacturing risk based on</p>	3.875	2.000	0.984	-	0.984

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603680F: <i>Manufacturing Technologies</i>	PROJECT 635281: <i>Manufacturing Readiness</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
the assessments and deliver results to the appropriate program offices. Vet pervasive manufacturing issues discovered during the assessments through the ManTech requirements process.					
<i>FY 2012 Base Plans:</i> Continue development of Manufacturing Maturation Plans (MMPs) for Category I Advanced Technology Demonstrations (ATDs) and selected high-visibility programs based on MRAs. Conduct MRAs on selected Air Force acquisition programs to aid in Milestone Decision Reviews and/or to mitigate cost, schedule, or rate issues.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	3.875	2.000	0.984	-	0.984

C. Other Program Funding Summary (\$ in Millions)												
<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>	
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	45.228	32.382	38.656	-	38.656	43.536	46.125	47.669	48.453	Continuing	Continuing
635319: <i>Anticipatory OPS Intent and Response</i>	10.252	8.031	8.744	-	8.744	9.747	8.503	7.245	7.348	Continuing	Continuing
635320: <i>Assured Worldwide Connectivity</i>	18.221	8.216	11.880	-	11.880	12.847	17.663	19.870	14.229	Continuing	Continuing
635321: <i>Global Battlespace Awareness</i>	9.534	9.318	10.502	-	10.502	10.620	13.127	13.189	16.390	Continuing	Continuing
635322: <i>Knowledge Management and Computing</i>	7.221	6.817	7.530	-	7.530	10.322	6.832	7.365	10.486	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops and demonstrates Air Force Enterprise-Centric Information technologies for the warfighter. The Global Battlespace Awareness project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and total battlespace awareness by using and exploiting information from all sources. The Assured Worldwide Connectivity project provides advanced net-enabled architectures and communications technologies in support of global military operations, including a secure information grid for worldwide information exchange of near-real-time multimedia (i.e., voice, data, video, and imagery) information. In addition, this project develops and demonstrates advanced optical networking and communications for Air Force air- and space-based information exchange on and between platforms. These optical networks will be rapidly deployable, mobile, interoperable, and seamless between Air and Space Operations Centers (AOC) and air- and space- based platforms either en route or in theater. This project also provides the tools and applications leading to the development and integration of cyber deterrence technologies resulting in a strategic capability of cyber dominance within the secure information grid. The Knowledge Management and Computing project develops the technology applications that will provide for a secure, tailored, seamless exchange of information among producers, consumers, and managers of information relevant to a particular community of interest (COI). The project also provides the development of interactive and real-time computing technologies that greatly improve the usability of high performance computing for the exchange, utilization, and management of information in the enterprise. The Anticipatory Ops Intent and Response project develops the technologies for dynamic planning and execution with the accuracy, fidelity, and timeliness needed to dominate the battlespace. This program has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing upgrades and/or new system developments that have military utility and address warfighter needs.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>
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B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	46.414	32.382	39.295	-	39.295
Current President's Budget	45.228	32.382	38.656	-	38.656
Total Adjustments	-1.186	-	-0.639	-	-0.639
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.186	-			
• Other Adjustments	-	-	-0.639	-	-0.639

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

Project: 635320: *Assured Worldwide Connectivity*

Congressional Add: *Massively Parallel Optical Interconnects for Battlespace Information Exchange.*

Congressional Add: *Cyber Attack and Security Environment.*

Congressional Add Subtotals for Project: 635320

Congressional Add Totals for all Projects

	FY 2010	FY 2011
	3.983	-
	2.888	-
Congressional Add Subtotals for Project: 635320	6.871	-
Congressional Add Totals for all Projects	6.871	-

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635319: <i>Anticipatory OPS Intent and Response</i>	10.252	8.031	8.744	-	8.744	9.747	8.503	7.245	7.348	Continuing	Continuing

A. Mission Description and Budget Item Justification

In order to achieve information dominance, the Air Force must be able to monitor, assess, plan, and execute (MAPE) missions rapidly 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 (pre-conflict, conflict through stability operations). This project develops and integrates decision support technologies that will enhance the commander's ability to anticipate and dominate the future battlespace by more effectively forecasting the evolution of the battlespace and by more rapidly generating options to "virtually checkmate" the adversary. It develops the decision aid technologies and processes to plan the use of various assets and assess their effects in the battlespace. It provides a tailorable information environment to effectively portray complex data sets accurately in real-time.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	1.643	1.446	1.234	-	1.234
Description: Develop and demonstrate distributed information technologies that are scalable and reconfigurable and provide seamless access to tailored multi-media and multi-spectral data.					
FY 2010 Accomplishments: Developed capabilities to allow seamless information sharing for enhanced situational awareness and understanding by the decision maker. Developed an initial capability to plan and measure effectiveness of information operations synchronized with precision munitions to determine successful achievement of command intent in time and location. Conducted campaign of experimentation to quantitatively measure transformational command and control concepts enabled by net centric warfare capabilities. Initiated an investigation of space Command and Control (C2) planning and scheduling technologies to enable enhanced space operations. Started the development of an integrated C2 tasking capability to enable seamless full spectrum options to be reasoned over and recommendations provided to the operator that will meet commander's intent. Developed capability to generate a user-defined operational picture across the air, space, and cyber domains at the strategic, operational, and tactical levels.					
FY 2011 Plans: Complete development of capabilities to allow seamless information sharing for enhanced situational awareness and understanding by the decision maker. Continue the development of an initial capability to plan and measure effectiveness of information operations synchronized with precision munitions to determine successful					

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>achievement of command intent in time and location. Continue campaign of experimentation to quantitatively measure transformational C2 concepts enabled by net centric warfare capabilities. Continue the investigation of space C2 planning and scheduling technologies to enable enhanced space operations. Continue development of an integrated C2 tasking capability to enable seamless full spectrum options to be reasoned over and recommendations provide to the operator that will meet commander's intent. Complete the development of the capability to integrate a variety of user-defined operating display technologies to visualize individual data set contexts for better situational awareness across the air, space, and cyber domains at the strategic, operational, and tactical levels. Develop and demonstrate enhanced capability to conduct space C2.</p> <p>FY 2012 Base Plans: Complete development of and demonstrate enhanced capability to conduct space C2. Complete campaign of experimentation to quantitatively measure transformational command and control concepts enabled by net centric warfare capabilities. Complete the investigation of space C2 planning and scheduling technologies to enable enhanced space operations. Complete development of an integrated C2 tasking capability to enable seamless full spectrum options to be reasoned over and recommendations provided to the operator that will meet commander's intent.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Develop and demonstrate the integration of planning tools and information-based intelligent agents for adaptive replanning and decision support tools.</p> <p>FY 2010 Accomplishments: Developed capabilities to be more agile within a net centric enabled environment. Developed timely option generation, selection, and coordination capabilities that account for uncertainty and missing and erroneous information and supports intuitive decision making processes. Developed dynamic workflow and workload management capabilities to manage the C2 enterprise. Initiated development of a capability to assess adverse events that could potentially impact air and space mobility operations and suggest courses of action (COAs) that could be initiated to continue operations. Investigated methods to evaluate mobility COAs covering planning through assessment that anticipates multiple constraints and provides prioritized feasible recommendations that</p>	4.229	3.007	3.345	-	3.345

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>meets commander's intent. Developed capability to assess the impact of cyber on air and space C2 operations and suggest COAs to be initiated to continue operations in the face of cyber threats.</p> <p>FY 2011 Plans: Continue development of capabilities to be more agile within a net centric enabled environment. Continue development of timely option generation selection and coordination capabilities that account for uncertainty and missing and erroneous information, and supports intuitive decision making processes. Continue to develop dynamic workflow and workload management capabilities to manage the C2 enterprise. Complete development of a capability to assess adverse events that could potentially impact air and space mobility operations and suggest COAs that could be initiated to continue operations. Continue the investigation of methods to evaluate mobility COAs covering planning through assessment that anticipates multiple constraints and provides prioritized feasible recommendations that meets commander's intent. Continue development of capability to assess the impact of cyber on air and space C2 operations and suggest COAs to be initiated to continue operations in the face of cyber threats.</p> <p>FY 2012 Base Plans: Complete the investigation of methods to evaluate mobility COAs covering planning through assessment that anticipates multiple constraints and provides prioritized feasible recommendations that meets commander's intent. Initiate development of net-centric mission planning and execution capabilities to support master space plan and joint space task order production and a net enabled dynamic decision support capability for a variety of air and space missions.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Develop and demonstrate an effects-based approach for the next generation of planning and assessment techniques that enable decision makers to determine operational effects.</p> <p>FY 2010 Accomplishments: Developed and demonstrated real-time information technologies that enable a decision maker to comprehend his or her current situational awareness by assessing an operation's progress against desired effects (reflective) and identifying key indicators and observables to assist in anticipating future success or failure of a campaign (predictive). Investigated the methods to enable a decision support environment that enables the decision maker to anticipate and shape all aspects of the future battlespace. Developed predictive battlespace planning</p>	4.380	3.578	4.165	-	4.165

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>tools with the ability to reason over models of the "enemy as a system." Evaluated competing approaches for the analysis of cascading effects in real-time for diverse courses of action. Initiated design of a tool suite for rapidly wargaming proposed actions against an intelligent adversary. Developed and demonstrated capability to enable integrated traditional and cyber effects based assessment for air and space operations centers. Developed capability to integrate kinetic and non-kinetic assets in an integrated tasking order to achieve desired commander's effects.</p> <p><i>FY 2011 Plans:</i> Continue the development and demonstration of real-time information technologies that enable a decision maker to comprehend their current situational awareness by assessing an operation's progress against desired effects (reflective) and identifying key indicators and observables to assist in anticipating future success or failure of a campaign (predictive). Complete investigating and evaluating methods to enable a decision support environment that enables the decision maker to anticipate and shape all aspects of the future battlespace. Continue development of predictive battlespace planning tools with the ability to reason over models of the "enemy as a system." Demonstrate a suite of interacting tools/services that assist analysts in estimating the cascading effects of proposed actions in near-real-time for diverse COAs.</p> <p><i>FY 2012 Base Plans:</i> Integrate and test decision support environment, within service oriented architectures, that enables the decision maker to anticipate and shape all aspects of the future battlespace. Complete development of predictive battlespace planning tools with the ability to reason over models of the "enemy as a system." Conduct simulation experiments to analyze courses of action and evaluate capabilities across multiple domains. Design and conduct limited technology experiments to investigate the technical and operational challenges associated with integrated air, space, and cyber C2 within and across multiple service oriented architectures. Continue the development and demonstration of real-time information technologies that enable a decision maker to comprehend their current situational awareness by assessing an operation's progress against desired effects (reflective) and identifying key indicators and observables to assist in anticipating future success or failure of a campaign (predictive). Initiate integration of cascading courses of action reasoners. Initiate development of a toolset for predictive assessment, developing insight into action, causal mechanisms, and their effects.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	10.252	8.031	8.744	-	8.744

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635319: <i>Anticipatory OPS Intent and Response</i>

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>			<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u>	
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635320: <i>Assured Worldwide Connectivity</i>
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COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635320: <i>Assured Worldwide Connectivity</i>	18.221	8.216	11.880	-	11.880	12.847	17.663	19.870	14.229	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force requires advanced net-enabled architectures and communications technologies in support of global kinetic and non-kinetic military operations including a secure information grid for worldwide information delivery and exchange of near-real-time information including voice, data, video, and imagery. This secure environment will be rapidly deployable, mobile, interoperable, and seamless between Air and Space Operations Centers (AOC) and aircraft, either en route or in theater. This project provides secure information transmission capabilities for a persistent, global, survivable communications backbone network accessible for warfighters operating in all domains; it provides self-healing, self-configuration, anti-jam communication networking capabilities; and it provides enterprise networking capabilities for agile, policy-based network management. In addition, this project develops and demonstrates advanced optical networking and communications for Air Force air- and space-based information exchange on and between platforms including development of highly integrated multi-gigabit optical and radio frequency networks, all optical data routers, optical backbone interface circuits for on board information exchange, and integrated electronic, adaptive optic systems for atmospheric mitigation. The Air Force also 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: 1) cyber attack capabilities: access, stealth and persistence, cyber intelligence, and weapons delivery, 2) cyber defense capabilities: attack detection, attack attribution, and response automation, and 3) cyber support capability: situational awareness and war gaming.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Develop and demonstrate secure wideband assured networking between weapon platforms, ground facilities, and Special Operations teams.</p> <p>FY 2010 Accomplishments: Developed a small form-factor networking and reachback capability. Initiated design and demonstration of soldier interface, performed initial flight test.</p> <p>FY 2011 Plans: Complete development of small form-factor networking and reachback capability.</p> <p>FY 2012 Base Plans:</p> <p>FY 2012 OCO Plans:</p>	1.383	0.313	-	-	-
<p>Title: Major Thrust 2.</p>	4.142	3.333	5.185	-	5.185

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635320: <i>Assured Worldwide Connectivity</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>Description: Proactively defend cyberspace through cyber situational awareness, detecting, and defeating cyber threats, and surviving through adaptation and self-generation.</p> <p>FY 2010 Accomplishments: Demonstrated a fleet of 1,000 cooperative, positively controlled, trusted agents that can defend mission critical information system assets and collect actionable cyber intelligence (CybINT) for cyber situation awareness. Conducted assured end-to-end Quality of Service (QoS) and Quality of Assurance (QoA) integration to the information system enterprise during malicious and non-malicious faults. Developed capability to geo-locate red, blue, and non-combatant internet protocol (IP) addresses and devices globally and locally to achieve better situational awareness to efficiently position cyber defenses. Initiated development of a complete situational awareness capability of cyber network assets, both red and blue forces, to include both virtual and physical cyber assets.</p> <p>FY 2011 Plans: Continue development of a comprehensive situational awareness and understanding capability of cyber network assets, both red and blue forces, to include both virtual and physical cyber assets. Continue assured end-to-end QoA and QoA integration to the information system enterprise during malicious and non-malicious faults. Develop capability to automatically discover large-scale network topologies to enhance cyber situation assessment and map the discovered topologies to mission essential functions. Initiate the development of technologies that provides knowledge of the adversary to strengthen the quality of threat assessments. Initiate the development of a cross-domain voice-over-IP (VOIP) capability to enhance the utility of voice transmissions within a mobile tactical environment. Develop cyber testbed capability for in-house investigations of cyber defense policies and offensive cyber techniques with the ability to conform to command intent for cyber indications and warning and rules of engagement.</p> <p>FY 2012 Base Plans: Complete development of capability to automatically discover large-scale network topologies to enhance cyber situation assessment and map the discovered topologies to mission essential functions. Complete the development of technologies that provides knowledge of the adversary to strengthen the quality of threat assessments. Initiate development of capability to integrate indications and warnings and observables into situation awareness and impact assessment capabilities. Continue assured end-to-end QoA and QoA integration to the information system enterprise during malicious and non-malicious faults.</p> <p>FY 2012 OCO Plans:</p>					
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635320: <i>Assured Worldwide Connectivity</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 3.</p> <p>Description: Develop and demonstrate offensive cyber operations capabilities in a series of Experimental Cyber Craft technology demonstrations.</p> <p>FY 2010 Accomplishments: Analyzed development of additional offensive cyber operations capabilities, integrated kinetic and cyber operations planning and execution capabilities, and cyber command and control (Cyber C2) operations functions. Completed selected offensive cyber capabilities to access, remain stealthy, gather intelligence, and affect adversary information and information systems. Finalized technology demonstration plans.</p> <p>FY 2011 Plans: Continue to analyze development of additional offensive cyber operations capabilities, integrated kinetic and cyber operations planning and execution capabilities, and Cyber C2 operations functions.</p> <p>FY 2012 Base Plans: Conduct experiments using testbed capability for in-house investigations of cyber defense policies and offensive cyber techniques to gain a better understanding of how an adversary might attack Air Force systems. Continue to analyze development of additional offensive cyber operations capabilities, integrated kinetic and cyber operations planning and execution capabilities, and Cyber C2 operations functions.</p> <p>FY 2012 OCO Plans:</p>	3.221	2.492	0.806	-	0.806
<p>Title: Major Thrust 4.</p> <p>Description: Develop and demonstrate intelligent networking transport and management technology to provide assured, seamless, battlespace connectivity to the Air Force.</p> <p>FY 2010 Accomplishments: Initiated advanced demonstration of high capacity assured access (anti-jam) communications for global spectrum dominance. Developed QoS-enabled information management and dissemination combined with network policy language for efficient, prioritized information exchange.</p> <p>FY 2011 Plans: Continue to develop advanced demonstration of high capacity assured access (anti-jam) communications for global spectrum dominance. Continue development of QoS-enabled information management and dissemination combined with network policy language for efficient, prioritized</p>	0.223	0.828	2.730	-	2.730

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635320: <i>Assured Worldwide Connectivity</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>information exchange in airborne networks.</p> <p>FY 2012 Base Plans: Initiate development of cognitive radio technology that will enable mission specific adaptive optimization of communications links responsive to current conditions, situations, and priorities as each mission is executed. Initiate advanced demonstration of end-to-end QoS and QoA performance for various application-dependent network configuration, management, and implementation scenarios.</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 5.</p> <p>Description: Integrate and demonstrate a resilient and self-regenerating information enterprise that dynamically recognizes, characterizes, and understands novel cyber attacks and reconfigures and self-optimizes to resist new attacks.</p> <p>FY 2010 Accomplishments: Began integration of technologies to introduce synthetic diversity into friendly information systems. Initiated integration of anti-tamper software protection technology with enterprise information systems.</p> <p>FY 2011 Plans: Continue integration technologies to recognize, characterize, and understand attacks and anomalies, aid in the creation of synthetically diverse, functionally equivalent software, and continuously monitor, reconfigure, and self-optimize.</p> <p>FY 2012 Base Plans: Continue integration technologies to recognize, characterize, and understand attacks and anomalies, aid in the creation of synthetically diverse, functionally equivalent software, and continuously monitor, reconfigure, and self-optimize. Initiate developing techniques for guaranteeing the execution of critical processes during system recovery and data reconstitution.</p> <p>FY 2012 OCO Plans:</p>	1.136	0.574	2.126	-	2.126
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<p>Title: Major Thrust 6.</p> <p>Description: Integrate technology to demonstrate an effects-based strategic approach to cyber defense that focuses on avoiding, deferring, and minimizing the threat, and rendering the adversary ineffective.</p>	-	0.676	1.033	-	1.033
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635320: <i>Assured Worldwide Connectivity</i>

	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Add: Cyber Attack and Security Environment.	2.888	-
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	6.871	-

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

Line Item	FY 2010	FY 2011	FY 2012	FY 2012	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	Cost To	
			Base	OCO	Total					Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603788F: <i>Global Information Dev/Demo</i>				635321: <i>Global Battlespace Awareness</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635321: <i>Global Battlespace Awareness</i>	9.534	9.318	10.502	-	10.502	10.620	13.127	13.189	16.390	Continuing	Continuing

A. Mission Description and Budget Item Justification

In order to achieve information dominance, the Air Force must be able to monitor, assess, plan, and execute (MAPE) missions rapidly 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 (pre-conflict, conflict through stability operations). This project develops, integrates, and demonstrates advanced technologies to achieve comprehensive net-centric operations and Predictive Battlespace Awareness using information from all sources. Technology development includes: tasking information collectors (intelligence, surveillance, and reconnaissance platforms, national intelligence sources, etc.); correlating and geo-registering the collected data; exploiting the data to extract information of military significance; fusing information from multiple sources to create a digital-n-dimensional representation of the battlespace; assessing the situation; predicting adversary courses of action (COA); and archiving the results for ready use by decision makers. This is a dynamic, complex process that involves technologies for information exploitation, fusion, processing, storage, and retrieval, as well as technologies for machine reasoning, pattern recognition, and timeline analysis.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</p> <p>Description: Demonstrate advanced signal and data exploitation technologies for detection, tracking, identification, and targeting of time-critical targets, and information extraction.</p> <p>FY 2010 Accomplishments: Completed Space Situational Awareness (SSA) research in multi-sensor exploitation tools for adversary satellite characterization and in integrated intelligence analysis products to produce anticipatory ground to space awareness picture and initiate SSA research in the development of a set of algorithms that can both automatically track space objects and detect changes in satellite images. Initiated the application of developed watermarking technologies, including audio, to development programs of record, targeting intelligence applications by providing information assurance and provenance to the data through the development of proper protocols.</p> <p>FY 2011 Plans: Develop methodologies and processing of collecting intelligence data from a collection of ever present stand-in multi-sensor ad-hoc networks. Continue SSA research in the development of a set of algorithms that can both automatically track space objects and complete demonstration of algorithms to detect changes in satellite images. Continue development to enhance signal processing techniques to fit into existing Intelligence,</p>	3.966	3.278	2.745	-	2.745

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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635321: <i>Global Battlespace Awareness</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Surveillance, and Reconnaissance (ISR) infrastructures. Continue integration of developed watermarking techniques and protocols for information assurance, provenance and pedigree leading to the integration of watermarking technologies into network-centric programs of record, and initiate development of novel steganalysis methods for identifying and disrupting embedded information.</p> <p>FY 2012 Base Plans: Complete development to enhance signal processing techniques to fit into existing ISR infrastructures. Complete the development of a set of algorithms that can automatically track space objects in support of SSA. Continue both the integration of developed watermarking techniques and protocols for information assurance, provenance and pedigree leading to the integration of watermarking technologies into network-centric programs of record, and the development of novel steganalysis methods for identifying and disrupting embedded information.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 2.</p> <p>Description: Developed and demonstrated advanced data handling, event visualization technologies, and distributed data fusion to enable a more effective utilization of data available.</p> <p>FY 2010 Accomplishments: Completed evaluation and support toolsets for advanced fusion algorithms and provide community accepted measures of performance across all efforts. Initiated development to mature and integrate models for adversarial behavior and provide support for situation analysis utilizing a service oriented architecture. Developed the capability to integrate a variety of user definable display technologies to visualize individual data set contexts for better situational awareness.</p> <p>FY 2011 Plans: Continue development to mature and integrate models for adversarial behavior and provide support for situation analysis utilizing a service oriented architecture. Develop and demonstrate the capability to conduct distributed fusion to enhance situational awareness of the battlespace. Initiate development of algorithmic tools and techniques to analyze and exploit recorded signals intelligence data across multiple missions, to provide the capability for forensic analysis of single or multi-platform data across multiple missions for increased situational awareness and intelligence.</p> <p>FY 2012 Base Plans:</p>	1.100	1.193	2.034	-	2.034

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635321: <i>Global Battlespace Awareness</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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Continue development to mature and integrate models for adversarial behavior and provide support for situation analysis utilizing a service oriented architecture. Continue development of algorithmic tools and techniques to analyze and exploit recorded signals intelligence data across multiple missions, to provide the capability for forensic analysis of single or multi-platform data across multiple missions for increased situational awareness and intelligence.

FY 2012 OCO Plans:

<i>Title:</i> Major Thrust 3.	2.372	2.877	3.076	-	3.076
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Description: Develop and demonstrate capabilities for reasoning and learning, text understanding, link and group discovery, and advanced analysis for situational awareness and understanding.

FY 2010 Accomplishments:

Initiated development of a text extraction capability that enables users to fine-tune the extractor, based on their specialized knowledge of the domain, to achieve higher performance. Initiated development of tools and services for advanced behavioral modeling techniques and advanced capabilities for analysis that integrate situation understanding, situation monitoring, and event anticipation. Initiated the development of a set of algorithms that can automatically develop, reason, dynamically update various sub-sets of the existing intelligence preparation of the battlespace products (e.g., named areas, target areas, COA, units, infrastructure areas, lines of communication). Conducted research and demonstrate the performance gains with active distributed sensing and processing and identify the limitations for further research. Initiated development to enhance signal processing techniques to fit into existing ISR infrastructures.

FY 2011 Plans:

Continue development of a text extraction capability that enables users to fine-tune the extractor, based on their specialized knowledge of the domain, to achieve higher performance. Continue development of tools and services for advanced behavioral modeling techniques and advanced capabilities for analysis that integrate situation understanding, situation monitoring, and event anticipation. Initiate development of dynamic social network analysis methods to provide the analyst with the ability to identify high value targets in social networks and anticipate their role and activity. Continue development of a set of algorithms that can automatically develop, reason, dynamically update various sub-sets of the existing intelligence preparation of the battlespace

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635321: <i>Global Battlespace Awareness</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>products, and initiate development of techniques for analyzing and assessing activities to support situation assessment.</p> <p>FY 2012 Base Plans: Complete development of a text extraction capability that enables users to fine-tune the extractor, based on their specialized knowledge of the domain, to achieve higher performance. Complete development of tools and services for advanced behavioral modeling techniques and advanced capabilities for analysis that integrate situation understanding, situation monitoring, and event anticipation. Initiate exploring general purpose bridges between the corpus of electronic text and formal reasoning systems. Continue development of dynamic social network analysis methods to provide the analyst with the ability to identify high value targets in social networks and anticipate their role and activity. Complete development of a set of algorithms that can automatically develop, reason, dynamically update various sub-sets of the existing intelligence preparation of the battlespace products, and continue development of techniques for analyzing and assessing activities to support situation assessment.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 4.</p> <p>Description: Develop models to provide detailed understanding of the adversary's probable intent and future strategy to identify adversary COAs, the most likely COA, and the COA most dangerous to friendly forces and mission accomplishment.</p> <p>FY 2010 Accomplishments: Continue research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue COA for Rapid, Decide, Act and Adapt (RDAA). Continue investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threats. Initiate investigation in the capability to manage multiple possible future adversary COAs prioritized based on current and future (projected) impact/threat. Initiate investigation in developing screening techniques that give the analyst/decision maker insight into the contribution or sensitivity of various factors on a given observable/ response.</p> <p>FY 2011 Plans: Complete research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue course of action for RDAA. Complete investigation of ability to forecast potential adversaries and</p>	2.096	1.970	2.647	-	2.647

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635321: <i>Global Battlespace Awareness</i>
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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>events based on indications of known evidence and projected known and/or anticipated threat(s). Continue investigating the capability to manage multiple possible future adversary COAs prioritized based on current and future (projected) impact/threat. Continue investigation in developing screening techniques that give the analyst/decision maker insight into the contribution or sensitivity of various factors on a given observable/response, initiate investigation of techniques that will allow model adaptation to new regions and nations, and start development of a functional graphical user environment to support output analysis. Initiate capability to model and explore policy actions and reactions taken by the different modeled entities. Initiate development and demonstrate of robust support applications to enhance multi-intelligence collection requirements.</p> <p><i>FY 2012 Base Plans:</i> Continue development of a functional graphical user environment to support output analysis and complete investigations in developing screening techniques that give the analyst/decision maker insight into the contribution or sensitivity of various factors on a given observable/response and use scenarios and conduct user testing and feedback of models for new regions and nations. Complete investigation of the capability to manage multiple possible future adversary COAs prioritized based on current and future (projected) impact/threat. Continue developing capability to model and explore policy actions and reactions taken by the different modeled entities, and start developing the capability to allow users to perform automated generation, assessment, and visualization of traces from model results to key underlying causes. Continue to develop and demonstrate robust support applications to enhance multi-intelligence collection requirements.</p> <p><i>FY 2012 OCO Plans:</i></p>					
Accomplishments/Planned Programs Subtotals	9.534	9.318	10.502	-	10.502

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

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012 Base</u>	<u>FY 2012 OCO</u>	<u>FY 2012 Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635321: <i>Global Battlespace Awareness</i>

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603788F: <i>Global Information Dev/Demo</i>				635322: <i>Knowledge Management and Computing</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635322: <i>Knowledge Management and Computing</i>	7.221	6.817	7.530	-	7.530	10.322	6.832	7.365	10.486	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Force requires technologies that will provide the decision maker and staff with seamless access to tailored information within a mobile, dynamic, and scalable, globally distributed Air and Space Operations Center (AOC), as well as among other producers, consumers, and managers of information relevant to other particular communities of interest (COI). This project demonstrates the enterprise management capabilities needed for the rapid distribution of actionable information, as well as the needed advances in high performance computing to ensure this complex capability. This project develops an agile information environment that focuses on quality of service, transformation and brokering, a federated information environment focusing the relationship among the members of the environment, a secure cross-domain information sharing capability that focuses on the security layer and inter-COI information exchange in different security domains, and a collaboration environment focusing on the information workflow layer of the enterprise. This project will also develop: 1) a computational 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, complex, software intensive systems.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>Title: Major Thrust 1.</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 2010 Accomplishments: Initiated development of petaflops embedded on-demand computing to evaluate options for on-board processing of common sensor algorithms and real-time high performance plug-and-play computing services to enhance space situational awareness. Initiated development of a stacked chip architecture for cognitive and autonomous systems. Completed development of a rapid reaction identifying and optimizing codes demonstrating at least 100x improvement through the techniques applied. Initiated predictable software testing tools to ease the complexity, understanding, and managing software in software-intensive systems. Initiated architecture and development of trusted router hardware based upon a hardware root of trust.</p> <p>FY 2011 Plans: Continue the development of petaflops embedded on-demand computing and complete demonstration of real-time high performance computing services to enhance space situational awareness and complete enhancement of firmware and software for existing high performance computer boards for plug-and play-satellite. Complete</p>	2.394	2.865	3.247	-	3.247

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635322: <i>Knowledge Management and Computing</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
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<p>development and demonstration of stacked chip architecture for cognitive and autonomous systems. Develop and demonstrate high-payoff, high performance computing applications to reduce size, weight, and power restrictions. Complete development of predictable software testing tools to ease the complexity, understanding, and managing software in software-intensive systems. Initiate development of comprehensive software and hardware solutions for parallel discrete event simulation on emerging multi-core architectures. Complete development and prototype demonstration of trusted router hardware based upon a hardware root of trust.</p> <p>FY 2012 Base Plans: Continue the development of petaflops embedded on-demand computing, and demonstrate achieved performance and functionality. Initiate development of architectures for a compact large array of many node clusters with very low power demand for intelligent systems. Initiate development and demonstration of an autocode generation capability for software intensive systems. Complete development of comprehensive software and hardware solutions for parallel discrete event simulation on emerging multi-core architectures.</p> <p>FY 2012 OCO Plans:</p>					
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<p>Title: Major Thrust 2.</p> <p>Description: Demonstrate how a publish, subscribe, and query information management paradigm can enable vertical and horizontal integration of Air Force information systems.</p> <p>FY 2010 Accomplishments: Completed development of a common security labeling methodology that promotes the automatic flow of time-sensitive information among different security domains. Completed development of approaches for applying secure information sharing concepts to mobile ad-hoc networks which are often characterized by low-bandwidth and intermittent connectivity. Initiated development of a method to securely link data and metadata. Initiated development of an adaptive security policy expression and enforcement mechanism for automated information review and release among different security domains. Initiated development and perform field demonstrations of cross domain sharing mechanisms in an operational setting to support a prototype installation command system.</p> <p>FY 2011 Plans: Continue to develop secure, accreditable cross domain information sharing techniques in an operational setting and develop a scalable integrated environment where information is easily and securely shared across multiple secure domains while preventing accidental or intentional information disclosure. Continue development of an</p>	1.242	1.086	0.761	-	0.761
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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635322: <i>Knowledge Management and Computing</i>
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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
<p>adaptive security policy expression and enforcement mechanism for automated information review and release among different security domains. Complete development of a method to securely link data and metadata.</p> <p>FY 2012 Base Plans: Complete development of an adaptive security policy expression and enforcement mechanism for automated information review and release among different security domains. Complete developments of secure, creditable cross domain information sharing techniques in an operational setting and of a scalable integrated environment where information is easily and securely shared across multiple secure domains while preventing accidental or intentional information disclosure Initiate development of attack resistant cross domain services.</p> <p>FY 2012 OCO Plans:</p>					
<p>Title: Major Thrust 3.</p> <p>Description: Demonstrate how agile information management services enable effective information sharing in a tactical environment.</p> <p>FY 2010 Accomplishments: Completed demonstration of pub/sub/query mechanisms for tactical airborne platforms. Initiated development of tactical information management pub/sub/query mechanisms focusing on stability, performance, and reliability for assured access and isolation from malicious client applications, and assured levels of QoS. Completed the development of the capability to integrate a variety of common operating display technologies to visualize individual data set contexts for better situational awareness across the air, space, and cyber domains at the strategic, operational, and tactical levels. Completed demonstrations of various elements of core information management (IM) services to include context aware IM services, quality of service enabled dissemination, service oriented IM, and advanced IM system services.</p> <p>FY 2011 Plans: Continue development of tactical information management pub/sub/query mechanisms focusing on stability, performance, and reliability for assured access and isolation from malicious client applications, and assured levels of QoS. Initiate investigating and quantifying the network burden and quality of service requirements for service oriented architecture implementations across a variety of tactical environments. Initiate development of survivable IM services that are highly adaptive and self-aware across the variety of IM architectures.</p> <p>FY 2012 Base Plans:</p>	3.585	2.866	3.522	-	3.522

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603788F: <i>Global Information Dev/Demo</i>	PROJECT 635322: <i>Knowledge Management and Computing</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Continue development of tactical information management pub/sub/query mechanisms focusing on stability, performance, and reliability for assured access and isolation from malicious client applications, and assured levels of QoS. Initiate design and development of a mission oriented, highly adaptive and self-aware unified intelligent capability to provide observable, actionable insights and visibility across information management services and their deployed platforms from inside-out and provide survivability-aware information sharing capabilities to anticipate achieving the information level mission goals under any conditions. Continue investigating and quantifying the network burden and quality of service requirements for service oriented architecture implementations across a variety of tactical environments. Continue development of survivable IM services that are highly adaptive and self-aware across the variety of IM architectures.					
<i>FY 2012 OCO Plans:</i>					
Accomplishments/Planned Programs Subtotals	7.221	6.817	7.530	-	7.530

C. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy
N/A

E. Performance Metrics
Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE							
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>							
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
Total Program Element	3.685	1.847	1.122	-	1.122	1.237	1.569	2.382	2.422	Continuing	Continuing
635095: <i>High Energy Laser Advanced Technology Program</i>	3.685	1.847	1.122	-	1.122	1.237	1.569	2.382	2.422	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds high energy laser (HEL) advanced technology development through the HEL Joint Technology Office (JTO). HEL weapons have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HEL weapons have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase, defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles, and the ultra-precision negation of targets in urban environments with little/no collateral damage. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is part of an overall Department of Defense (DoD) HEL Science and Technology program. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

B. Program Change Summary (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	3.794	1.847	1.122	-	1.122
Current President's Budget	3.685	1.847	1.122	-	1.122
Total Adjustments	-0.109	-	-	-	-
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.109	-			
• Other Adjustments	-	-			

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force **DATE:** February 2011

APPROPRIATION/BUDGET ACTIVITY				R-1 ITEM NOMENCLATURE				PROJECT			
3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>				PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>				635095: <i>High Energy Laser Advanced Technology Program</i>			
COST (\$ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635095: <i>High Energy Laser Advanced Technology Program</i>	3.685	1.847	1.122	-	1.122	1.237	1.569	2.382	2.422	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program funds high energy laser (HEL) advanced technology development through the HEL Joint Technology Office (JTO). HEL weapons have many potential advantages, including speed-of-light delivery, precision target engagement, significant magazine depth, low-cost per kill, and reduced logistics requirements. HEL weapons have the potential to perform a wide variety of military missions including interception of ballistic missiles in boost phase, defeat of high-speed, maneuvering anti-ship and anti-aircraft missiles, and the ultra-precision negation of targets in urban environments with little/no collateral damage. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. This program is part of an overall Department of Defense (DoD) HEL Science and Technology program. This program is in Budget Activity 3, Advanced Technology Development, since it enables and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

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

	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	3.685	1.847	1.122	-	1.122
Description: Advance solid state laser development. Develop beam-control technologies for surface and air mission areas.					
FY 2010 Accomplishments: Initiated a joint high-power beam director development effort, suitable for mating with a 100 kilowatt (kW)-class solid state laser device. Awarded a contract, in collaboration with the Army's High Energy Laser Test Facility (HELSTF).					
FY 2011 Plans: Integrate a joint high-power beam director, with a 100 kW-class device. Conduct integrated system tests in a field environment at HELSTF.					
FY 2012 Base Plans: Demonstrate an integrated solid-state laser capability in a field environment at HELSTF.					
FY 2012 OCO Plans:					
Accomplishments/Planned Programs Subtotals	3.685	1.847	1.122	-	1.122

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Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force	DATE: February 2011
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APPROPRIATION/BUDGET ACTIVITY 3600: <i>Research, Development, Test & Evaluation, Air Force</i> BA 3: <i>Advanced Technology Development (ATD)</i>	R-1 ITEM NOMENCLATURE PE 0603924F: <i>High Energy Laser Advanced Technology Program</i>	PROJECT 635095: <i>High Energy Laser Advanced Technology Program</i>
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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u> <u>Base</u>	<u>FY 2012</u> <u>OCO</u>	<u>FY 2012</u> <u>Total</u>	<u>FY 2013</u>	<u>FY 2014</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• Activity Not Provided: <i>Title Not Provided</i>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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