

UNCLASSIFIED

PE NUMBER: 0603790F
 PE TITLE: NATO Cooperative R&D

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2008
---	------------------------------

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603790F NATO Cooperative R&D
---	--

Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	4.003	4.253	4.334	4.437	4.503	4.592	4.686	Continuing	TBD
NATO Nato Coop R&D	4.003	4.253	4.334	4.437	4.503	4.592	4.686	Continuing	TBD

(U) A. Mission Description and Budget Item Justification

These funds will be used to help implement international cooperative research, development, and acquisition (ICRD&A) agreements with North Atlantic Treaty Organization (NATO) member states, major non-NATO allies (Argentina, Australia, Bahrain, Egypt, Israel, Japan, Jordan, and Rep. of Korea (South Korea), Kuwait, Morocco, New Zealand, Pakistan, Phillipines, Taiwan and Thailand) and friendly foreign countries (Austria, Brazil, Finland, India, Singapore, South Africa, Sweden, Switzerland, and Ukraine). The program implements the provisions of Title 10 U.S. Code, Section 2350a on NATO Cooperative Research and Development (R&D). The program was established to improve cooperation among NATO nations, and later major non-NATO allies, in research, development, and acquisition. The legislation authorized funds to significantly improve United States (US) and allied conventional defense capabilities by leveraging the best defense technologies, eliminating costly duplication of R&D efforts, accelerating the availability of defense systems, and promoting US and allied interoperability or commonality. The program will be reported as required by Title 10 U.S. Code, Section 2350a(f). This program element funds the implementation of Air Force ICRD&A agreements in (1) Basic Research (2) Applied Research (3) Advanced Technology Development (4) Advanced Component Development and Prototypes (5) System Development and Demonstration and (6) RDT&E Management Support. This PE is designated in Budget Activity 4 because most of the ICRD&A projects support specific systems, include all efforts necessary to evaluate integrated technologies in as realistic an operating environment as possible to assess the performance or cost reduction potential of advanced technology, and help expedite technology transition from the laboratory to operational use.

(U) B. Program Change Summary (\$ in Millions)

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	4.080	4.280	4.370
(U) Current PBR/President's Budget	4.003	4.253	4.334
(U) Total Adjustments	-0.077		
(U) Congressional Program Reductions			
Congressional Rescissions			
Congressional Increases			
Reprogrammings			
SBIR/STTR Transfer	-0.077		
(U) <u>Significant Program Changes:</u>			

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)				PE NUMBER AND TITLE 0603790F NATO Cooperative R&D			PROJECT NUMBER AND TITLE NATO Nato Coop R&D		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
NATO Nato Coop R&D	4.003	4.253	4.334	4.437	4.503	4.592	4.686	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) **A. Mission Description and Budget Item Justification**
 These funds will be used to help implement international cooperative research, development, and acquisition (ICRD&A) agreements with North Atlantic Treaty Organization (NATO) member states, major non-NATO allies (Argentina, Australia, Bahrain, Egypt, Israel, Japan, Jordan, and Rep. of Korea (South Korea), Kuwait, Morocco, New Zealand, Pakistan, Phillipines, Taiwan and Thailand) and friendly foreign countries (Austria, Brazil, Finland, India, Singapore, South Africa, Sweden, Switzerland, and Ukraine). The program implements the provisions of Title 10 U.S. Code, Section 2350a on NATO Cooperative Research and Development (R&D). The program was established to improve cooperation among NATO nations, and later major non-NATO allies, in research, development, and acquisition. The legislation authorized funds to significantly improve United States (US) and allied conventional defense capabilities by leveraging the best defense technologies, eliminating costly duplication of R&D efforts, accelerating the availability of defense systems, and promoting US and allied interoperability or commonality. The program will be reported as required by Title 10 U.S. Code, Section 2350a(f). This program element funds the implementation of Air Force ICRD&A agreements in (1) Basic Research (2) Applied Research (3) Advanced Technology Development (4) Advanced Component Development and Prototypes (5) System Development and Demonstration and (6) RDT&E Management Support. This PE is designated in Budget Activity 4 because most of the ICRD&A projects support specific systems, include all efforts necessary to evaluate integrated technologies in as realistic an operating environment as possible to assess the performance or cost reduction potential of advanced technology, and help expedite technology transition from the laboratory to operational use.

(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Refractive Turbulence and Transient Electronic Disconnectivity (AFRL/VS / Australia) - This cooperative project falls with the AFRL/VS thrust areas of Surveillance and Force Projection, under which is the Optical Turbulence Program, a technical area driven by the operational requirements of the Airborne Laser (ABL) Program and the High Energy Laser-Joint Technology Office (HEL-JTO) AFRL/CC Memorandum for HQ AFMC/DR, stated requirement for stratospheric turbulence research and improved forecasting capability to support of U-2 and UAV operations. The projected use of directed energy weapons, high band-width laser communication (air-to-air, air-to-ground and air-to-space) and high resolution imagery from manned and unmanned aircraft requires knowledge of and the ability to forecast the location, severity, and duration of refractive turbulence structure that limit system performance.	0.200	0.000	0.000
(U) Aero-Engine Component Life Extension, Phase II (AFRL / Australia) - Ongoing cooperative project to develop life extension techniques and strategies that can be applied to advanced military engines. The engines involved include the US Air Force F100, -220, -229 and F101 and Australia's TF30, F404 and T700. Much of the technology will be generic and flow from one engine to another. In FY03, development of NDE techniques for characterization of residual stress profiles will conclude; activities to address the shortfalls in life prediction capabilities will conclude, and; the final report will be written.	0.250	0.000	0.000
(U) Hard Target Defeat (AFRL / Germany) - PA signed April 15th 1998, established the Hard Target Defeat Technology	0.200	0.000	0.000

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE

0603790F NATO Cooperative R&D

PROJECT NUMBER AND TITLE

NATO Nato Coop R&D

(U) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
<p>Project as a Project in accordance with the Memorandum of Understanding between the Secretary of Defense on behalf of the Department of Defense of the United States of America and the Federal Minister of Defense of the Federal Republic of Germany for Research and Technology Projects. The objectives of the Hard Target Defeat (HTD) Technology Project are to investigate the lethality of conventional warheads against targets representative of hardened facilities. This new effort will be the next phase of that research and will improve the predictive accuracy of models that measure the functional degradation resulting from destruction of and/or damage to mission critical components and protective structural components due to internal and external detonations of conventional warheads. In addition, this new effort investigates methods for predicting the effect of engaging a facility containing chemical or biological materials, related research, or production equipment. The results of this proposed investigation are critical for the development, improvement and validation of computer-based methodologies used to predict the weapon effects against hard to defeat targets. Accurate predictions are necessary to provide operational command with targeting options against high value targets.</p>			
<p>(U) Network-Centric Strike Controller (AFRL/HECP) - Planned cooperative project to design and develop interface technologies to extend the effectiveness and capabilities of Air Battle Managers (ABMs) working within a network-centric framework. Using simulated AWACS and MC2A work environments, it will make use of networked data, advance data visualization tools, knowledge and context management systems, decision-aiding and automation algorithms, and advance collaboration interface technologies. This approach will enable greater shared battlespace awareness, more efficient and effective individual and team decision-making, increased speed of command, and adaptability. Cognitive engineering and user-centered design methodologies will be employed to identify the appropriate information and interface requirement for operators working within the domain.</p>	0.225	0.200	0.000
<p>(U) Resilient Structural and Blast Suppression Systems for Blast Protection Research Program (AFRL / UK) - Planned cooperative project to conduct technical research to increase the level of protection to national and coalition force troops in military facilities worldwide in the event of a terrorist bombing. These research activities and full-scale experiments will involve US Air Force (USAF) and UK Home Office personnel developing and testing blast mitigating resilient structural systems for implementation into new construction and for retrofit of existing conventional facilities.</p>	0.423	0.263	0.000
<p>(U) Multi-modal Situational Awareness Displays for Maneuvering Aircraft (AFRL / The Netherlands) - Planned project develops audio, visual, and tactile display symbology to increase situational awareness, decrease pilot workload, and reduce the risk of spatial disorientation in fast jet aircraft. Pilot-vehicle interface development is currently underway for the JSF, which will be the first USAF aircraft with a 3-D audio display capable of directionalizing the warning sounds presented to the pilot. AFRL/HE is currently researching how 3-D audio should be used, in conjunction with visual and tactile displays, to maximize pilot performance and minimize the likelihood of spatial disorientation in</p>	0.350	0.250	0.000

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE

0603790F NATO Cooperative R&D

PROJECT NUMBER AND TITLE

NATO Nato Coop R&D

(U) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
<p>USAF aircraft. However, AFRL/HE is unable to evaluate its prototype display designs under the dynamic acceleration conditions that occur in maneuvering fast jet aircraft. This is a critical deficiency, because visual-vestibular and audio-vestibular interactions are known to cause sensory illusions that might enhance or compromise a pilot's ability to make use of audio and visual information presented in a cockpit display.</p>			
<p>(U) 3-Dimensional Laser Radar Technology and Phenomenology (AFRL / Sweden) - Planned development of FLASH (that is, a sensor that captures the entire image with a single laser pulse) 3-Dimensional laser radar receiver technology. This technology has tremendous potential for improving capabilities to quickly locate and to identify difficult targets (e.g. vehicles hidden behind camouflage or under foliage). However, the data produced by these sensors have many unique properties that do not lend themselves readily to processing and analysis using traditional algorithms and procedures. AFRL/SNJM has a program to characterize these sensors, develop metrics and procedures for quantifying the quality of these data and for extracting target identification information from these data. The results of these activities will be used to determine the utility of these sensors to address mission requirements as well as to identify technical issues that require additional development. Sweden (FOI) has had an extensive effort to develop software to model imaging laser radar performance. They have also developed tools for extracting useful information from these types of data (e.g. segmenting regions of interest from background and clutter, using filters developed from CAD data to identify targets). They have also been investigating atmospheric effects on laser propagation and data quality.</p>	0.200	0.155	0.000
<p>(U) Policy Enabled Coalition Communication Environment (PECC) (AFRL/IDCP) and Australia, Canada, United Kingdom - Planned cooperative project that will allow overarching "on Paper" mission objectives to be translated into a set of rules/policies (and machine executable code) which dictate the control level of resources at any level. Initially, policies capable of altering the network posture will be implemented for each INFOCON level (Normal, Alpha, Bravo, Charlie, Delta). Other policies could address operational requirements (e.g. higher network precedence given to a specific application for a short-term mission). In all cases, the cyber commander has an understandable interface for making real-time decisions. The Command and Control Enterprise Management System (C2EMS) will also be integrated to provide: real-time readiness; and understanding of how network degradation/failure impacts mission accomplishment.</p>	0.325	0.175	0.000
<p>(U) Material and Technologies for Laser Protection (AFRL/MLPJ) and Sweden - Planned cooperative agreement to conduct research, develop, and test passive and active laser protection materials. This will be accomplished by exchanging research expertise and novel nonlinear and electro-optic materials. Each country has specialized expertise in different aspects of passive and active laser protection materials. This exchange of materials, models and data obtained from characterization and testing experiments will facilitate the development of realistic laser protection devices. The US will provide expertise in the areas of nonlinear optical, electro-optical, and matrix</p>	0.125	0.100	0.000

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
04 Advanced Component Development and Prototypes (ACD&P)	0603790F NATO Cooperative R&D	NATO Nato Coop R&D		
(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
materials, US developed materials, experimental facilities, data, and analysis. The Swedish Defence Research Agency) will provide expertise in the area of nonlinear optical, electro-optical, and matrix materials, experimental facilities, data, and analysis. Data gathered on provided samples will be shared. The results of this ICR&D project will be used by the participants, independently, in their own development of actual laser protection devices in future work.				
(U) Strike Information Displays (AFRL / UK) - Follow on project to The Strike Warrior Project Arrangement PA. Planned program was approved on 26 April 2000 and is valid through 26 April 2005. This PA has successfully enabled both nations to mutually develop and demonstrate several emerging display technologies. For example, off-boresight symbology improvements and the benefits of panoramic wide-field-of-view Night Vision Goggles (NVGs) over standard NVGs have both been demonstrated. As a result of this PA, there have been several "lessons learned" that serve as the justification for this follow-on proposal. This continuation effort will focus on 1) the exploitation of emerging display technologies that will enhance collaborative information sharing, and 2) the evaluation and implementation of common display symbologies that will foster increased warfighter effectiveness and achieve greater interoperability within the coalition. When considering display technologies, these areas have been identified as the greatest impediments in improving warfighter capabilities. Different phases of warfighter activity will be considered. The assessments will begin in the AWACS platform (AFRL MOLTKE lab) then migrate to Air Operations Centers and Strike Assets. Candidate collaborative display technologies will include on and off head, in and out of the cockpit, and wireless and tethered technologies.	0.300	0.210	0.000	
(U) Theater Battle Management Core Systems (TBMCS) and NATO Air Command and Control System Interoperability Analysis and Demonstration (HQ/ESC/AC / NATO) - This planned project is to proactively design interoperability into the operational and technical architectures of the US Air Operations Center (AOC) and NATO's parallel Combined Air Operations Center (CAOC) construct, and to then develop, test and field middleware software that will support the successful prosecution of a combined/joint air operation. This 3-year co-operative effort will begin with a comprehensive study to examine the Command and Control Systems which are the operational backbone of the US AOC (Theater Battle Management Core Systems) and NATO (Air Command and Control System). The product of FY 06 activities will be a detailed analysis of each program's design, the identification of USMTF 2006 and AdatP-3 Baseline 14 message sets that will be implemented, message standards and rules application, data fields and elements structures, as well as data base designs. FY 07 efforts will concentrate on developing prototype middleware that will tested in US and NATO lab environments for potential fielding to provide a seamless exchange of NATO and US operational data used to plan and execute the air war. FY 08 funding will be to support remaining middleware development and to address network security issues and potential resolutions. In the end, the warfighters operating in coalition environments will be able to vastly reduce the time and duplicative effort currently	0.150	0.150	0.150	

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603790F NATO Cooperative R&D	PROJECT NUMBER AND TITLE NATO Nato Coop R&D		
(U) B. Accomplishments/Planned Program (\$ in Millions)	FY 2007	FY 2008	FY 2009	
required to manipulate multiple command and control and message standards to plan and execute the air war.				
(U) Coalition/Joint Force Air Component Commander (C/JFACC) Battle Board (AFRL / Australia) - Planned collaborative project is to provide the capability for the Coalition/Joint Force Air Component Commander (C/JFACC) and senior staff to develop and continuously assess the progress and contribution of air operations to the coalition's air campaign in order to attain agile and stable control of distributed coalition military operations conducted in an uncertain and rapidly changing environment. The guiding vision of this research is a "Commanders' Virtual Collaboration Portal (CVCP)" or Battle Board (BB). The BB is a distributed, collaborative decision-making environment for commanders and senior staff to share a common knowledge base, collaborate during planning and execution, share assessments of current operations, visualize the operation across spatial and temporal domains, optimize effects-action-resource, and model and project the operational environment for predictive planning and assessment. This project will facilitate the shared research and development of technologies that provide: Faster recognition and better understanding of changing situations (Agents And Multi-Agent Systems In Dynamic Adversarial Environments) Faster and more complete exploration of available courses of action (e.g., Causal Modeling And Analysis) Faster and more accurate decision-making (e.g. Expert Team Collaboration) Concepts such as Effects Based Operations (EBO) and Predictive Battlespace Awareness (PBA) are two key enablers of this research. The grand challenge of this project is the initial research and development of technologies as the foundation for a "Battle Board" to be used by the C/JFACC and staff providing team-based strategic planning, operational anticipation, and effects-based assessment. The end result will be for both the US and Australian participants to have the technologies necessary to integrate into their separate national tools than from conducting basic and applied research alone. It is in the best interest of both parties to utilize these synergies.	0.100	0.100	0.100	
(U) Development of Electro-Optic and Infrared Countermeasures and Protection Measures (AFRL / UK) - The planned objective of this PA is to increase US and UK capabilities in the area of Electro-Optic and Infrared (EO/IR) countermeasures and protection measures for enhancing survivability and force protection. As such, this PA will provide for collaborative research and development on materials, technologies, devices, and systems for electro-optic and infrared countermeasures and protection measures. It should be noted that the PA for this activity is to span a 10-year period of research and development beginning in January 2006. ICR&D start-up funding support is being requested under this PA to establish testing to evaluate the current state-of-the-art in EO/IR countermeasures and protection measures. The ICR&D funding will allow immediate field trials that are not currently scheduled until FY08. This acceleration of testing will better focus the materials and device development proposed in the PA to better address warfighter needs	0.250	0.300	0.300	
(U) Engagement-level Modeling for HPM Weapons Applications (AFRL / UK) - The objective of this program would be to develop useful engagement modeling "modules" that could be used with	0.150	0.200	0.200	

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE

0603790F NATO Cooperative R&D

PROJECT NUMBER AND TITLE

NATO Nato Coop R&D

(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

little or no modification in USAF battlefield modeling and simulation (M&S) exercises. As the HPM technology advances to the stage where useful weapons and other applications are available for use by US forces that are engaged in military actions it becomes necessary to have companion M&S capability also available so that mission and war planners can include the HPM participation in the M&S exercises that are performed before most actual engagements. AFRL has been working on the necessary mathematical tools to develop the required modules. There are currently "one-on-one" modules that are compatible with the engagement modeling world. AFRL has sponsored the development of the RF-PROTEC code that is the first serious player in the M&S engagement code world. It's current capability is limited to straightforward scenarios with one HPM device and a very limited target set. There is a requirement to develop more complex modules that take into account the situation where there are "many" HPM weapons engaged against "many" potential targets. These "many-on-many" modules are ultimately required for HPM weapons to be effectively integrated into modern battlefield M&S. The requirement for new and more advanced modules (or "plug-ins") also includes the requirement to address more scenarios where HPM weapons might be employed. This means looking at the utilization of HPM weapons in rural and urban environments and in special situations such as hardening command centers.

(U) Hypersonic Flight Research and Development (AFRL / Australia) - The objectives of this effort are: (1) conduct hypersonic flight research experiments to mature select critical technologies required to develop future prompt global strike and operationally responsive space access systems; and, (2) develop on-board vehicle and propulsion instrumentation to significantly enrich the technology value of flight experiments. This program will consist of multiple research tasks to be jointly executed by several Directorates of the Air Force Research Laboratory and the Australian Defence Science and Technology Organization (DSTO). The scope of this effort includes key technologies for hypersonic, atmospheric flight including airbreathing propulsion, aerodynamics, aerothermodynamics, sensors, materials and structures, and advanced, non-intrusive, in-flight diagnostics.

0.600

0.600

0.595

(U) Study of Insensitive Explosives for High Speed Penetrators (AFRL / Germany) - The joint investigation is concentrated on understanding the changes in the high explosive (HE) and the effects of those changes due to forces acting on the explosive during hard impact. Preliminary studies indicate that that during the penetration event, explosive changes undergo structural changes and consequently, cause the explosive to become more sensitive.

0.000

0.375

0.300

(U) Integrally Bladed Rotor Repair Validation (AFRL / UK) - The objective of this project is to demonstrate to TRL-6 UK & US developed integrally bladed rotor repair (IBR) in US Provided spin pits and demonstrator engines. An additional objective is to jointly develop & validate best practices for evaluating damage thresholds for repair, repair methodologies, and post-repair re-validation.

0.000

0.050

0.050

(U) Coalition Airspace Information Sharing (CAIS) (AFRL / NATO) - This effort proposes to demonstrate coalition collaborative airspace management by developing and demonstrating a machine-to-machine connection between the

0.000

0.400

0.200

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603790F NATO Cooperative R&D	PROJECT NUMBER AND TITLE NATO Nato Coop R&D		
		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) B. Accomplishments/Planned Program (\$ in Millions)				
US Joint AirSpace Management And Deconfliction (JASMAD) Net-centric Information Service and NATO's Airspace Manager (ASMAN) module with the Integrated Command and Control (ICC) system. The JASSMAD Advanced Technology Demonstration (ATD) will provide the Future Capabilities required in the Air and Space Operation Center (AOC) Weapon System (WS) and is a substantial improvement over the current capability.				
(U) Distributed Collaboration for Network-Centric Command and Control (AFRL / Australia) - The recently promulgated doctrine of network-centric warfare implies that a dense networking of sensor and shooter nodes will promote enhanced situation awareness (SA) and self-synchronization of forces. The communication of this SA is expected to be achieved through the transmission of a common operational picture (COP) and by suites of collaboration technologies, most of which are commercial-off-the-shelf (COTS) products.		0.000	0.150	0.200
(U) Toxicity of Engineered Nanomaterials and Their Interaction with Biological systems (AFRL / India) - The main focus of the collaborative work in India will be animal toxicity studies required to extrapolate from in vitro to in vivo toxicity health and safety standards. This research will also significantly aid development of predictive models of nanomaterial toxicity. Work to be conducted by AFRL will address definition of: how nonparticles (NPs) are taken up by the cells: the physical characteristics (Size, Size Distribution, Aggregation, Purity, Chemical Composition, Surface Characteristics, Functionality. Zeta Potential, Stability Solubility) that impact nanomaterial interactions with biological systems; and the mechanisms of toxicity. Both organizations will collaborate to develop nanotoxicoinformatics tools to support nanomaterials R&D across a wide range of applications.		0.000	0.050	0.050
(U) Mission Planning and NATO Tasking Interoperability (MPNTI) (ESC / UK) - US aircraft mission planning systems do not read nor parse NATO Air Tasking Order (ATO) and NATO Airspace Coordinations Order (ACO) message formats. US air combat tasking is published in the US Message Test Format (USMTF), while NATO uses the Allied Data Publication 3 (AdatP3) message format.		0.000	0.375	0.200
(U) US Theater Battle Management Core Systems (TBMCS) (ESC / NATO) - The objective of this effort is to implement a process/system which will enable multiple C2 systems, each loaded on separate, multiple security networks/domains, to exchange air C2 mission data amongst each of the systems in near-real-time.		0.000	0.150	0.200
(U) Development of Animal Models to Assess the Inhalation Exposure of Engineered Nanomaterials (AFRL / Australia) - This effort will combine in vivo animal research in Australia with in vitro nanotoxicology research at AFRL to address the critical lack of existing knowledge concerning potential adverse biologic/toxic effects of nanomaterials. The main emphasis will be given to immune response induced by inhaled nanomaterials. The results will enable the development of science-based standards for safe nanomaterial research, development, manufacturing and product utilization in both military and commercial applications. Data and associated biological effects of nanomaterials with reference to their adverse affects produced under this effort will promote the protection of the health, stamina, and performance of military personnel and reduce future occupational illness, medical costs and disability		0.000	0.000	0.050

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
04 Advanced Component Development and Prototypes (ACD&P)	0603790F NATO Cooperative R&D	NATO Nato Coop R&D		
(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
compensation.				
(U) Modulation of Immune Response by Inhaled Engineered Nanoparticles (AFRL / Sweden) - This effort will combine in vivo animal research in Sweden with in vitro nanotoxicology research at AFRL to address the critical lack of existing knowledge concerning potential adverse biologic/toxic effects of nanomaterials. The main emphasis will be given to immune response induced by inhaled nanomaterials. The results will enable the development of science-based standards for safe nanomaterial research, development, manufacturing and product utilization in both military and commercial applications. Data and associated biological effects of nanomaterials with reference to their adverse affects produced under this effort will promote the protection of the health, stamina, and performance of military personnel and reduce future occupational illness, medical costs and disability compensation.		0.000	0.000	0.050
(U) Image Gyro (AFRL / Japan) - This project will leverage vision processing algorithms to reduce/eliminate the reliance on GPS for precision navigation. Toward these goals, a new image-based motion sensor known as the "Image Gyro" will be developed. The Image Gyro will be a low-cost, lightweight and highly accurate device that will achieve equivalent or higher precision drift free capabilities than that of today's accurate and more expensive inertial navigation systems. In addition to GPS free precision navigation, the Image Gyro will provide capabilities such as: passive moving target indication (MTI), 3D scene reconstruction (3D structure from motion), obstacle/collision avoidance, and automatic target recognition.		0.000	0.000	0.200
(U) Durability Assessment and Probabilistic Life Prediction of Titanium Alloys (AFRL / India) - The scope of the proposed effort comprises an exchange of R&D information in the following technical areas as related to titanium alloys: (1) Fundamental information on the microstructure of titanium alloys as affected by the conditions of their fabrication and their composition to include simulation and modeling to allow prediction of their properties. (2) Methods for life prediction of titanium alloys in service as a function of exposure conditions and fatigue, fracture and damage models in order to fully utilize those alloys for aeronautical structures and components.		0.000	0.000	0.200
(U) Next Generation Advanced Composites Processing Science (AFRL / Canada) - The proposed effort will develop and validate the next generation process models to aid in the manufacturing of advanced polymer matrix composites (PMCs) in an effort to maximize the affordable and efficient use of composite materials for aerospace applications. In addition, this project will pursue the fundamental understanding of the critical parameters absent from the state-of-the-art process models but urgently needed in order to address the issues associated with composite processing.		0.000	0.000	0.050
(U) Development of Fuel Cell Power Systems (AFRL / Singapore) - The objective of this project is to pursue the development of fuel cell-based power systems for use in military related applications. The primary focus of this collaboration will include the development of solid oxide technology and its subsequent integration into military relevant power system. An additional focus will include cooperating on fundamental research into solid oxide fuel		0.000	0.000	0.200

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
04 Advanced Component Development and Prototypes (ACD&P)	0603790F NATO Cooperative R&D	NATO Nato Coop R&D		
(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
cell (SOFC) technology capable of operation on military specific fuels (JP-8, diesel).				
(U) Aging Systems Materials and Process Technologies (AFRL / Australia) - The proposed effort will develop and/or optimize techniques aimed at improving aircraft structural and electrical integrity. When implemented, these techniques will reduce life-cycle costs associated with legacy, emerging, and future aircraft as well as improve aircraft availability and safety. Project focus will be on bonded joints and aircraft wiring.		0.000	0.000	0.075
(U) Team Based Metric Development (AFRL / Singapore) - The purpose of the proposed project is to discover and develop team based metrics that can be used to reliably measure, and therefore manage, team workload and situation awareness. In addition, these constructs will be evaluated on how they affect team performance and decision making.		0.000	0.000	0.200
(U) Performance Effects of "Microwave Hearing" (AFRL / UK) - The objective of this project is to explore the effect of "microwave hearing" (auditory effects produced by radio frequency exposure) upon different aspects of cognitive performance. The modern warfighter employs a large array of tools in battle. Many of these tools rely upon radio frequency (RF) technologies (e.g., communications, non-lethal weapons, sensing).		0.000	0.000	0.200
(U) Military Aircraft Survivability Through Improved Composite Structures (USAF 46th Test Wing / Germany) - The scope of the cooperative project will assess: the degradation of composite mechanical properties caused by brief fuel fires (e.g., aircraft dry-bay fires sustained during combat that are extinguished within seconds of initiation) and the damage resistance of aircraft skin-spar joints when subjected to high strain rate loading conditions.		0.000	0.000	0.200
(U) Use of combined Geospatial Intelligence with Social Network Analysis techniques to increase the effectiveness of Counter IED information and operations (ESC / UK) - This is a proposed research activity that will develop a framework within which data generated from Social Network Analysis software (SNA) is geo-referenced and combined with geospatial intelligence in a web based geographical information system. The program will take SNA data that has no associated geo-referencing information and develop implicit metadata that has geo-reference information. For example using data mining techniques to associate data to a location - i.e. "he lives next to the building".		0.000	0.000	0.200
(U) Testing of a Hypersonic Airbreathing Propulsion System (AEDC / Japan / Germany) - project will test a common hypersonic airbreathing propulsion system at similar test conditions in the AEDC Aerodynamic and Propulsion Test Unit, the High Enthalpy Shock Tunnel at the German Aerospace Center and the Japan Aerospace Exploration Agency Ramjet Test Facility and the High Enthalpy Shock Tunnel . The purpose of the tests is to develop an understanding of the effect different facilities have on measured hypersonic airbreathing propulsion system performance, operability, and durability. These facility differences include the facility size, the facility test medium and how it is produced, instrumentation, and operational processes such as facility starting.		0.000	0.000	0.164
(U) Management and administrative support and travel		0.155	0.000	0.000

R-1 Line Item No. 42

Page-10 of 18

Project NATO

Exhibit R-2a (PE 0603790F)

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603790F NATO Cooperative R&D	PROJECT NUMBER AND TITLE NATO Nato Coop R&D
--	---	---

(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Total Cost	4.003	4.253	4.334

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	

(U) Not Applicable.

(U) **D. Acquisition Strategy**

A principal goal of the NATO Cooperative R&D program is to effectively utilize the aggregate resources invested by the US and our allies in conventional defense R&D. This program element provides the critical funding incentive needed to pursue ICRD&A agreements and helps to (a) leverage USAF and allied resources through cost sharing and economies of scale; (b) exploit the best US and allied technologies for equipping coalition forces; (c) demonstrate areas of commonality or interoperability with our allies; and (d) accelerate the availability of defense technology and systems. Candidate projects are reviewed and approved by the USD(AT&L). An international agreement defining project objectives, responsibilities and costs is required prior to release of funds. To obtain these funds and ensure service commitment, projects are selected from existing or new RDT&E programs funded in the Future Years Defense Plan (FYDP). Project offices must show matching funds and contributions from associated program elements and equitable allied funding. As appropriate, funding responsibility for out-year requirements and follow-on efforts are transferred to the project office and associated program elements. Most contracts are awarded after full and open competition.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis

DATE

February 2008

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE
04 Advanced Component Development and Prototypes (ACD&P)	0603790F NATO Cooperative R&D	NATO Nato Coop R&D

<u>(U) Cost Categories</u> (Tailor to WBS, or System/Item Requirements) (\$ in Millions)	<u>Contract</u> <u>Method &</u> <u>Type</u>	<u>Performing</u> <u>Activity &</u> <u>Location</u>	<u>Total</u> <u>Prior to FY</u> <u>2007</u> <u>Cost</u>	<u>FY 2007</u> <u>Cost</u>	<u>FY 2007</u> <u>Award</u> <u>Date</u>	<u>FY 2008</u> <u>Cost</u>	<u>FY 2008</u> <u>Award</u> <u>Date</u>	<u>FY 2009</u> <u>Cost</u>	<u>FY 2009</u> <u>Award</u> <u>Date</u>	<u>Cost to</u> <u>Complete</u>	<u>Total Cost</u>	<u>Target Value</u> <u>of Contract</u>
(U) <u>Product Development</u>												
Sytronics Dayton, OH	CPFF									Continuing	TBD	TBD
Boston College Boston, MA	CFSR									Continuing	TBD	TBD
RADEX Bedford, MA	CPFF									Continuing	TBD	TBD
Pacific Sierra Research Santa Monica, CA	CPFF									Continuing	TBD	TBD
CPI Fairfax, VA	CPFF									Continuing	TBD	TBD
U of Massachusetts Lowell, MA	CR									Continuing	TBD	TBD
KEO Consultants Brookline, MA	CPFF									Continuing	TBD	TBD
NW Research Associates Bellevue, WA	CPFF									Continuing	TBD	TBD
Visdyne Inc.	CPFF									Continuing	TBD	TBD
U of Texas Austin, TX	CPFF									Continuing	TBD	TBD
Applied Research Lab, U of Texas Austin, TX	CPFF									Continuing	TBD	TBD
Lockheed Martin Orlando, FL	CPFF									Continuing	TBD	TBD
Raytheon TI Systems	CPFF									Continuing	TBD	TBD
Boeing Seattle, WA	CPFF									Continuing	TBD	TBD
UES, Inc Dayton, OH	CPFF									Continuing	TBD	TBD
Pratt & Whitney West Palm Beach, FL	CPFF									Continuing	TBD	TBD
AFRL WPAFB, OH	TBD			3.395	Nov-07	2.200	Nov-08	2.100	Nov-09	Continuing	TBD	TBD
Boeing Long Beach, CA	CPFF									Continuing	TBD	TBD
Boeing Seattle, WA	CPFF									Continuing	TBD	TBD
Lockheed Marietta, GA	CPFF									Continuing	TBD	TBD
Northrop Hawthorne, CA	CPFF									Continuing	TBD	TBD
Selectech Dayton, OH	CPFF									Continuing	TBD	TBD
AFRL Eglin AFB, FL	TBD									Continuing	TBD	TBD
AFRL Hanscom AFB, MA	TBD									Continuing	TBD	TBD
AFRL Mesa, AZ	TBD									Continuing	TBD	TBD
AFRL Rome, NY	TBD									Continuing	TBD	TBD
None											0.000	
Subtotal Product Development			0.000	3.395		2.200		2.100		Continuing	TBD	TBD
Remarks:												
(U) <u>Support</u>												
AFRL Hanscom AFB, MA				0.508	Nov-07	2.053	Nov-08	2.234	Nov-09	Continuing	TBD	TBD
AFRL WPAFB, OH										Continuing	TBD	TBD
45th Space Wing Patrick AFB, FL	AF 185									Continuing	TBD	TBD
AFRL Eglin AFB, FL										Continuing	TBD	TBD
Pender Technology, TN	CR									Continuing	TBD	TBD
Veridian Dayton, OH										Continuing	TBD	TBD
None											0.000	
Subtotal Support			0.000	0.508		2.053		2.234		Continuing	TBD	TBD
Remarks:												

R-1 Line Item No. 42

Page-12 of 18

Project NATO

Exhibit R-3 (PE 0603790F)

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis

DATE

February 2008

BUDGET ACTIVITY		PE NUMBER AND TITLE				PROJECT NUMBER AND TITLE			
04 Advanced Component Development and Prototypes (ACD&P)		0603790F NATO Cooperative R&D				NATO Nato Coop R&D			
(U)	<u>Test & Evaluation</u>								
	Air Force Development Test Center, FL	PO				Continuing	TBD	TBD	
	Sverdrup Technology, Inc TN	CPAF				Continuing	TBD	TBD	
	Naval Air Warfare CenterPoint Mugu, CA	MIPR				Continuing	TBD	TBD	
	Fora Laser System	PO				Continuing	TBD	TBD	
	Arnold Engineering Development Center, TN	TBD				Continuing	TBD	TBD	
	Fora laser system	PO				0.000	0.000		
	Subtotal Test & Evaluation		0.000	0.000	0.000	0.000			
	Remarks:					Continuing	TBD	TBD	
(U)	<u>Management</u>								
	Subtotal Management			0.100				0.100	
	Remarks:		0.000	0.100	0.000	0.000	0.100	0.000	
(U)	Total Cost		0.000	4.003	4.253	4.334	Continuing	TBD	TBD

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile

DATE

February 2008

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE

0603790F NATO Cooperative R&D

PROJECT NUMBER AND TITLE

NATO Nato Coop R&D

Name of ICR&D Project and International Agreement Schedule	Fiscal Year	Start Date	End IA	PE
Refractive Turbulence and transient Electric Discharge	FY05			63790F
Aero-Engine Component Life Enhancement - Phase II	FY05			63790F
Hard Target Defeat	FY06			63790F
Network-Centric Strike Controller	FY06			63790F
Resilient Structural & Blast Suppression Systems for Blast Protection Research Program	FY06			63790F
Multimodal Situational Awareness Displays for Maneuvering Aircraft	FY06			63790F
3-Dimensional Laser Radar Technology	FY06			63790F
Policy Enabled Coalition Communications Environment (PECC)	FY06			63790F
Material and technologies for Laser Protection	FY06			63790F
Strike Information Displays	FY06			63790F
Theater Battle Management Core Systems & NATO Air Command & Control System Interoperability Analysis & Demonstration	FY07			63790F
Coalition/Joint Force Air Component Commander (C/FACC)	FY07			63790F
Development of Electro-Optic & Infrared Countermeasures & Protection Measures	FY07			63790F
Engagement-Level Modeling for HPM Weapons Applications	FY07			63790F
Hypersonic Flight Research and Development	FY07			63790F
Study of Insensitive Explosives for High Speed Penetrators	FY08			63790F
Integrally Bladed Rotor Repair Validation	FY08			63790F
Coalition Airpace Information Sharing (CAIS)	FY08			63790F
Distributed Collaboration for Network Centric Command & Control	FY08			63790F
Toxicity of Engineered Nanomaterials & their Interactions w/ Biological Systems	FY08			63790F
Mission Planning & NATO Tasking Interoperability	FY08			63790F
US TBMCS Simple Cross Domain Solutions for Allied Air C2 Interoperability	FY08			63790F

R-1 Line Item No. 42

Page-14 of 18

Project NATO

Exhibit R-4 (PE 0603790F)

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile	DATE February 2008
--	------------------------------

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603790F NATO Cooperative R&D	PROJECT NUMBER AND TITLE NATO Nato Coop R&D
--	---	---

ICR&D Project	Fiscal Year	Start Date	End IA	PE
Development of Animal Models to Assess the Inhalation Exposure of Engineered Nanomaterials	FY09			63790F
Modulation of Immune Response by Inhaled Engineered Nanoparticles	FY09			63790F
Image Gyro	FY09			63790F
Durability Assessment and Probabilistic Life Prediction of Titanium Alloys	FY09			63790F
Next Generation Advanced Composites Processing Science	FY09			63790F
Development of Fuel Cell Power Systems	FY09			63790F
Aging Systems Materials and Process Technologies	FY09			63790F
Team Based Metric Development	FY09			63790F
Performance Effects of "Microwave Hearing"	FY09			63790F
Military Aircraft Survivability through Improved Composite Structures	FY09			63790F
Use of combined Geospatial Intelligence with Social Network Analysis techniques to increase the effectiveness of Counter IED information and Operations	FY09			63790F
Testing of a Hypersonic Airbreathing Propulsion System	FY09			63790F

UNCLASSIFIED

Exhibit R-4a, RDT&E Schedule Detail		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
04 Advanced Component Development and Prototypes (ACD&P)	0603790F NATO Cooperative R&D	NATO Nato Coop R&D		
		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Schedule Profile				
(U) Refractive Turbulence and Transient Electronic Disconnectivity		4Q		
(U) - Field testing		4Q		
(U) - Test report		4Q		
(U) Policy Enabled Coalition Communication Environment		4Q		
(U) - Technical Development		4Q		
(U) - Testing & Analysis			3Q	
(U) Network-Centric Strike Controller		4Q		
(U) - Testing & Analysis		3Q		
(U) Aero-Engine Component Life Extension, Phase II		4Q		
(U) - Technology Development		4Q		
(U) - Testing & Analysis		4Q		
(U) Hard Target Defeat		2Q		
(U) - Testing and analysis		3Q		
(U) - Technical report preparation		4Q		
(U) Resilient Structural and Blast Suppression Systems for Blast Protection Research		4Q		
(U) - Technical report preparation		4Q		
(U) - Design methodology development			2Q	
(U) - Full-scale blast experiments			4Q	
(U) Multi-modal Situational Awareness Displays for Maneuvering Aircraft		4Q		
(U) - Technical Development			2Q	
(U) - Testing and Analysis			3Q	
(U) 3-Dimensional Laser Radar Technology and Phenomenology		2Q		
(U) - Technical Development			1Q	
(U) - Testing and Analysis			2Q	
(U) Material and Technologies for Laser Protection		2Q		
(U) - Technology Development			3Q	
(U) Strike Information Displays		2Q		
(U) - Technical Development			1Q	
(U) - Testing and Analysis			3Q	
(U) US Theater Battle Mgmt Core System and NATO ACCS signed		4Q		
(U) - Pre-study coordination activities			1Q	
(U) - Study contract award			3Q	

UNCLASSIFIED

Exhibit R-4a, RDT&E Schedule Detail		DATE
		February 2008
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE
04 Advanced Component Development and Prototypes (ACD&P)	0603790F NATO Cooperative R&D	NATO Nato Coop R&D
(U) Coalition/Joint Force Air Component Commander (C/JFACC) Battle Board	4Q	
(U) - Technical Development		1Q
(U) - Testing and Analysis		2Q
(U) Development of Electro-Optic & Infrared Countermeasures and Protection Measures	4Q	
(U) - Technical Development		1Q
(U) - Testing and Analysis		1Q
(U) Engagement-level Modeling for HPM Weapons Applications	4Q	
(U) - Technical Development		1Q
(U) - Testing and Analysis		4Q
(U) Hypersonic Flight Research and Development	2Q	
(U) - Technical Development		1Q
(U) - Testing and Analysis		4Q
(U) US Theater Battle Management Core Systems (TBMCS)		1Q
(U) - Signed Agreement		2Q
(U) Coalition Airspace Information Sharing (CAIS)		1Q
(U) - Signed Agreement		2Q
(U) Mission Planning and NATO Tasking Interoperability		1Q
(U) - Signed Agreement		2Q
(U) Study of Insensitive Explosives for High-Speed Penetrators		1Q
(U) - Signed Agreement		2Q
(U) Integrally Bladed Rotor Report Validation		1Q
(U) - Signed Agreement		2Q
(U) Toxicity of Nano-Engineered Materials		1Q
(U) - Signed Agreement		2Q
(U) Distributed Collaboration for Network Centric C2		1Q
(U) - Signed Agreement		2Q
(U) Development of Animal Models to Assess the Inhalation Exposure of Engineered Nanomaterials		1Q
(U) - Signed Agreement		2Q
(U) Modulation of Immune Response by Inhaled Engineered Nanoparticles		1Q
(U) - Signed Agreement		2Q
(U) Image Gyro		1Q
(U) - Signed Agreement		2Q
(U) Durability Assessment and Probabilistic Life Prediction of Titanium Alloys		1Q
(U) - Signed Agreement		2Q

UNCLASSIFIED

Exhibit R-4a, RDT&E Schedule Detail		DATE February 2008
BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603790F NATO Cooperative R&D	PROJECT NUMBER AND TITLE NATO Nato Coop R&D
(U) Next Generation Advanced Composites Processing Science		1Q
(U) - Signed Agreement		2Q
(U) Development of Fuel Cell Power Systems		1Q
(U) - Signed Agreement		2Q
(U) Aging Systems Materials and Process Technologies		1Q
(U) - Signed Agreement		2Q
(U) Team Based Metric Development		1Q
(U) - Signed Agreement		2Q
(U) Performance Effects of "Microwave Hearing"		1Q
(U) - Signed Agreement		2Q
(U) Military Aircraft Survivability Through Improved Composite Structures		1Q
(U) - Signed Agreement		2Q
(U) Use of combined Geospatial Intelligence with Social Network Analysis techniques to increase the effectiveness of Counter IED information and operations		1Q
(U) - Signed Agreement		2Q
(U) Testing of a Hypersonic Airbreathing Propulsion System		1Q
(U) - Signed Agreement		2Q