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

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2006

BUDGET ACTIVITY: 04 Advanced Component Development and Prototypes (ACD&P)

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

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	3.819	3.916	4.095	4.234	4.312	4.412	4.486	Continuing	TBD
NATO Nato Coop R&D	3.819	3.916	4.095	4.234	4.312	4.412	4.486	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, Egypt, Bahrain, Israel, Japan, Jordan, and Rep. of Korea (South Korea), Kuwait, Morocco, New Zealand, Pakistan, Taiwan, Thailand, and Phillipines) and friendly foreign countries (Austria, Brazil, Bulgaria, 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)

		FY 2005	FY 2006	FY 2007
(U)	Previous President's Budget	3.895	3.916	3.972
(U)	Current PBR/President's Budget	3.819	3.916	4.095
(U)	Total Adjustments	-0.076	0.000	
(U)	Congressional Program Reductions			
	Congressional Rescissions	-0.076		
	Congressional Increases			
	Reprogrammings			
	SBIR/STTR Transfer			
(U)	Significant Program Changes:			
	Change Summary Explanation: N/A			

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
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 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
NATO Nato Coop R&D	3.819	3.916	4.095	4.234	4.312	4.412	4.486	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, Egypt, Bahrain, Israel, Japan, Jordan, and Rep. of Korea (South Korea), Kuwait, Morocco, New Zealand, Pakistan, Taiwan, Thailand, and Phillipines) and friendly foreign countries (Austria, Brazil, Bulgaria, 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. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) Aero-Engine Component Life Extension (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.	0.700	0.500	0.100
(U) Optical Sensor Protection Development and Evaluation (AFRL / UK) - Planned cooperative project to develop and assess promising electro-optic protection materials, devices, and configurations for laser hazard and threat protection for eyes and sensors. In FY03, development, testing, and analyses will begin.	0.650	0.298	0.000
(U) Strike Warrior (AFRL / UK) - Ongoing cooperative project to develop, demonstrate, and test interface technology and concepts for future advanced strike aircraft. It is a follow-on to the Vista Warrior project. The Strike Warrior project will increase the pilot's tactical capabilities with improvements in two related aspects of interface design. First, the interface hardware will be developed to enable better presentation of a larger variety of mission data. This will include large area cockpit displays linked with advanced interface technologies. Second, new approaches to real-time human engineering will be developed to allow the pilot to manage the new display capabilities and	0.050	0.000	0.000

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
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 2005	FY 2006	FY 2007
	information. In FY03, flight testing and trials will continue.			
(U)	C-2 Warrior (AFRL / Australia) - Planned cooperative project will develop advanced work-centered interface technologies to enhance ISR Collection Management and Air Space Control operations within an Air Operations Center (AOC). The work-centered interface systems will integrate stereoscopic visualization, speech control, head-eye based control, gesture recognition, intelligent interface agents, and face recognition. By combining technical components within a work-centered organizing framework, an interface client system can be developed that will improve information integration, decision making, and operational execution.	0.750	0.100	0.000
(U)	Coalition Mission Training (AFRL / Canada/UK) - Planned cooperative project is being conducted to enable warfighters to train for coalition air operations while remaining at their home stations. Partner nations will develop distributed simulation technologies, implement a multi-national distributed training network, and conduct a series of coalition force training exercises. Warfighters will use real-time virtual simulators to conduct readiness training for combined air operations within a common synthetic environment. The program sill support incorporation of USAF simulators located outside the Continental US into Distributed Mission Training exercises and will provide the foundation for integrating coalition partners' simulation assets into future multi-national training readiness exercises.	0.758	0.345	0.000
(U)	Distributed Mission Training (DMT) Technologies (AFRL / Canada) - Planned cooperative project to develop DMT technologies that will enhance allied simulator based training of fighter aircrews and demonstrate proof of concept. Project will complete research and development of next generation visual systems for DMT to include ultra-high resolution laser projector, image generator, and collimating display screen materials.	0.271	0.200	0.000
(U)	Enhanced C3 Team Training in Sustained Operations (AFRL / The Netherlands) - Planned cooperative project to evaluate team performance in advanced capabilities. This effort will evaluate the effects of fatigue on adaptive team performance in unpredictable, time-critical and long-duration high-ops tempo events. The primary goal will be to enhance a simulated environment for developing operational teamwork under wartime conditions characterized by mental fatigue, uncertainty, unexpected events, high-ops tempo, and/or sustained operations.	0.025	0.000	0.000
(U)	Visual Process Fit & Accommodation Consulting Tools (AFRL / The Netherlands) - Planned cooperative project to develop web based, comprehensive, international data system on 3-D body size, shape, fit, and performance. The new data visualization tools will be used to make information more usable, and additional data on pilot performance will be more dynamic.	0.140	0.240	0.000
(U)	High-Power Microwave Narrowband Effects Investigations (AFRL / UK) - Planned cooperative project will conduct High-Power Microwave (HPM) electronics effects experiments in the UK. There is a need for HPM effects information on electronic systems in a statistically significant format with high confidence values in order to investigate the impact of future HPM systems on the battlefield. There is a need to perform test series in order to build up a library of electronic asset response distributions. This cooperative project will perform these needed	0.175	0.200	0.000

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(U)	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	experiments and tests.			
(U)	Refractive Turbulence and Transient Electronic Disconnectivity (AFRL/VS / Australia) - This Cooperative project falls within 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.	0.125	0.175	0.000
(U)	Trophoseric Refraction and Propogation Modeling For Airborne Surveillance Systems (AFRL/Australia, UK) - Planned cooperative project to combine a low cost aircraft measurement platform for simultaneous measurements of refraction of Airborne Warning and Control System (AWACS) radar signal strength reduction with parabolic equation methods of microwave propogation modeling for evaluation and prediction of refraction conditions. In FY02, testing and validation were conducted to determine the adverse performace of microwave and infrared systems that perform surveillance, communication, signal intelligence, and direct energy functions in electronic battlespace.	0.075	0.000	0.000
(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 contect 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 adaptablity. Cognitive engineering and user-centered design methodologies will be employed to identify the appropriate information and interface requirement for operators working within the domain.	0.000	0.225	0.150
(U)	Operator and State Assessment and Aiding Implementation (AFRL / Sweden) - Planned project provides enhanced mission effectiveness by matching the cognitive demands placed on the operator with the current, momentary, capabilities of the human operator. Existing and future systems can easily overload the cognitive capabilities of the human operator. However, these systems are also capable of controlling the amount and rates of information presented to the operator. Accurate assessment of the operator's cognitive state coupled with intelligent agents will permit the real-time tailoring of system demands placed upon the operator to produce enhanced overall system performance and increase mission effectiveness. The proposed project is a follow-on to the very successful Annex E, "Pilot Performance and Mental Workload", to that MOA. This proposed project will permit continuation of our excellent relationship with the Swedish FMV and FOI organizations. AFRL/HEC and FOI have common goals and	0.000	0.150	0.150

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	complementary personnel and facilities. While the AFRL/HEC interests are primarily with unmanned aircraft operators FOI has excellent cockpit and dynamic simulators. Sweden can adapt and test the operator assessment and adaptive aiding technology in these cockpits while AFRL/HEC will focus on the unmanned operator environment. These parallel efforts will permit lessons learned from these two environments to jointly benefit one another.			
(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.	0.000	0.200	0.400
(U)	Hard Target Defeat (AFRL / Germany) - PA signed April 15th 1998, established the Hard Target Defeat Technology 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.	0.000	0.150	0.200
(U)	Coaltion-Interoperable SATCOM Data Broadcast Protocols (GBS-JPO/HQ ESC/NATO / Australia) - Planned groundwork for a US and coalition interoperable satellite data delivery system that ensure the right data is received by warfighters who need them in real-time to save lives and gain tactical advantage and information dominance. The objective of the proposal is to test, analyze and coordinate technical solutions for interoperable data broadcast protocols among three principle international partners and to set the stage for documenting an interoperable coalition agreement in an Annex to the current Draft NATO STANAG 4622, Interoperability Standard for Satellite Broadcast Services (SBS). These three partners are among the world's leaders in technical maturity of data broadcast capability, USAF GBS JPO, NATO Command, Control and Communications Agency (NC3A) and Australian Theatre Broadcast System (TBS). This assists these players in aggressively pursuing military coalition interoperability based	0.000	0.200	0.215

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(U)	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	on direct broadcast and very small aperture terminal (VSAT) internet capability in the rapidly advancing worldwide satellite broadcast industry.			
(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 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.	0.000	0.200	0.215
(U)	International Mission Training Research (AFRL / Sweden) - The objective of this project is to collaboratively conduct research and development activities that will enhance the technologies, processes, and strategies for training based on Distributed Simulation. To achieve these objectives, the participants will cooperatively conduct research efforts to enhance the capabilities of national Distributed Mission Operations (DMO) systems and accelerate collection of research data. Participants will also develop a secure data link between the US and Sweden to support DMO exercises and to develop and evaluate application of DMO for training coalition operations in Peacekeeping Support Operations	0.000	0.200	0.100
(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.	0.000	0.150	0.150

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	Policy Enabled Coaltion 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 nework degradation/failture impacts mission accomplishment.	0.000	0.083	0.200
(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 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.	0.000	0.100	0.125
(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.	0.000	0.100	0.200

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(U)	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(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 required to manipulate multiple command and control and message standards to plan and execute the air war.	0.000	0.000	0.150
(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	0.000	0.000	0.100

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(U)	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	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.			
(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	0.000	0.000	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 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.	0.000	0.000	0.100
(U)	High-Cycle Fatigue Reduction (AFRL / UK) - The objective of this project is to demonstrate to TRL-6 UK-developed HCF/durability technologies in the US-provided XTE78/LF1 demonstrator engine. The main objective of the High Cycle Fatigue (HCF) Reduction project is to increase engine reliability, enhancing safety to users of gas turbine propulsion systems. This project will enhance the existing US National HCF Program and UK	0.000	0.000	0.200

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	MOD efforts in HCF. The Project will increase the safety and cost effectiveness of airbreathing aircraft engines in both the US and UK by providing additional HCF-related data sources and validations of HCF-related methodologies, all aimed at reducing HCF-caused mishaps, and the costs and maintenance burdens associated with HCF-related corrective and preventive measures.			
(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.	0.000	0.000	0.690
(U)	US Theater Battle Management Core Systems (TBMCS) and NATO Air Command and Control System (ACCS) Interoperability analysis and demonstrations (AFRL / NATO) - The overarching objective of this proposed effort 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 required to manipulate multiple command and control and message standards to plan and execute the air war.	0.000	0.000	0.250
(U)	Management and administrative support and travel	0.100	0.100	0.100
(U)	Total Cost	3.819	3.916	4.095

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
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) C. Other Program Funding Summary ($ in Millions)

FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost

(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.

Exhibit R-3, RDT&E Project Cost Analysis

DATE: **February 2006**

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) Cost Categories (Tailor to WBS, or System/Item Requirements) ($ in Millions)	Contract Method & Type	Performing Activity & Location	Total Prior to FY 2005 Cost	FY 2005 Cost	FY 2005 Award Date	FY 2006 Cost	FY 2006 Award Date	FY 2007 Cost	FY 2007 Award Date	Cost to Complete	Total Cost	Target Value of Contract
(U) Product Development												
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			3.019	Nov-05	3.266	Nov-06	3.395	Nov-07	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	3.019		3.266		3.395		Continuing	TBD	TBD
Remarks:												
(U) Support												
AFRL Hanscom AFB, MA						0.550		0.600		Continuing	TBD	
AFRL WPAFB, OH										Continuing	TBD	
45th Space Wing Patrick AFB, FL	AF 185									Continuing	TBD	
AFRL Eglin AFB, FL										Continuing	TBD	
Pender Technology, TN	CR									Continuing	TBD	
Veridian Dayton, OH										Continuing	TBD	
None											0.000	
Subtotal Support			0.000	0.000		0.550		0.600		Continuing	TBD	0.000
Remarks:												

Exhibit R-3, RDT&E Project Cost Analysis

DATE: February 2006

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) Test & Evaluation										
Air Force Development Test Center, FL	PO							Continuing	TBD	
Sverdrup Technology, Inc TN	CPAF							Continuing	TBD	
Naval Air Warfare CenterPoint Mugu, CA	MIPR							Continuing	TBD	
Fora Laser System	PO							Continuing	TBD	
Arnold Engineering Development Center, TN	TBD		0.700	Nov-05				Continuing	TBD	
Fora laser system	PO							0.000	0.000	
Subtotal Test & Evaluation		0.000	0.700		0.000	0.000		Continuing	TBD	0.000
Remarks:										
(U) Management										
			0.100		0.100	0.100			0.300	
Subtotal Management		0.000	0.100		0.100	0.100		0.000	0.300	0.000
Remarks:										
(U) Total Cost		0.000	3.819		3.916	4.095		Continuing	TBD	TBD

Exhibit R-4, RDT&E Schedule Profile		DATE February 2006
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 & Int'l Agreement Schedule	Start Date	END IA	PE
Optical Sensor Protection Development	FY 04	FY 07	63790
C-2 Warrior	FY 04	FY 08	63790
Coalition Mission Training	FY 04	FY 08	63790
DMT Technologies	FY 04	FY 06	63790
Enhanced C3 Team Training in Operations	FY 04	FY 06	63790
Visual Fit and Accommodation Consulting Tools	FY 04	FY 06	63790
High-Power Microwave Narrowband Effects	FY 04	FY 07	63790
Aero-Engine Component Life Enhancement, Phase II	FY 05	FY 07	63790
HPM Effects Testing & Analysis	FY 05	FY 07	63790
Refractive Turbulence & Transient Electronic Disconnectivity	FY 05	FY 07	63790
Strike Information Displays	FY 06	FY 08	63790
Resilient Structural and Blast Suppression Systems....	FY 06	FY 08	63790
Policy Enabled Coalition Comm. Environment	FY 06	FY 09	63790
Network-Centric Strike Controller	FY 06	FY 09	63790
Material & Technology for Laser Protection	FY 06	FY 09	63790
Hard Target Defeat	FY 06	FY 08	63790
Operator and State Assessment and Aiding Implementation	FY 06	FY 08	63890
Coalition Interoperable SATCOM Data Broadcast Protocols	FY 06	FY 08	63790
Multimodal Situational Awareness Displays....	FY 06	FY 08	63790
International Mission Training Research	FY 06	FY 08	63790
3-Dimensional laser Radar Technology and Phen....	FY 06	FY 08	63790
Theater Battle Mangement Core Systems	FY 07	FY 09	63790
Coalition/Joint Force Air Component Commander Battle Bd.	FY 07	FY 09	63790
Engagement-level Modeling for HPM Weapons Applications	FY 07	FY 09	63790
High-Cycle Fatigue Reduction	FY 07	FY 09	63790
Hypersonic Flight Research and Development	FY 07	FY 09	63790
US Theater Battle Management Core Systems and NATO...	FY 07	FY 09	63790
Development of Electro-Optic and Infrared Countermeasures	FY 07	FY 09	63790

Exhibit R-4a, RDT&E Schedule Detail		DATE February 2006
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

	Schedule Profile	FY 2005	FY 2006	FY 2007
(U)	Strike Warrior Project	4Q		
(U)	Aero-Engine Component Life Extension		3Q	
(U)	- Field testing		2Q	
(U)	- Test report		1Q	
(U)	Optical Sensor Protection Development and Evaluation	4Q		
(U)	- Development, testing, and analyses		2Q	
(U)	C-2 Warrior	4Q		
(U)	- Development, testing, and analyses	4Q		
(U)	- Test ISR Collection Manager against new requirements and situation	4Q		
(U)	Coalition Mission Training	4Q		
(U)	- Conduct and document coalition exercises in real-time simulators	4Q		
(U)	Distributed Mission Training (DMT) Technologies	4Q		
(U)	- Technology Development	4Q		
(U)	Visual Process Fit and Accommodation Consulting Tools	3Q		
(U)	- Dynamic and performance data gathering	4Q		
(U)	- Digital pilot profiles and injury potential	4Q		
(U)	- Signed international agreement	3Q		
(U)	- Technology development	4Q		
(U)	Enhanced C3 Team Training in Sustained Operations	4Q		
(U)	- Technology development	2Q		
(U)	- Experimental studies and data analysis	4Q		
(U)	High-Power Microwave Narrowband Effects Investigations	4Q		
(U)	- Develop detailed design baseline	2Q		
(U)	- Test high fidelity model and performance analysis	4Q		
(U)	- Report system performance results	4Q		
(U)	Policy Enabled Coalition Communication Environment	3Q		
(U)	- Technology development	1Q		
(U)	- Testing & Analysis	2Q		
(U)	Network-Centric Strike Controller			4Q
(U)	- Testing & Analysis			3Q
(U)	Operator and State Assessment Aiding Implementation		2-3Q	
(U)	- Technology Development	2-3Q		

Exhibit R-4a, RDT&E Schedule Detail		DATE February 2006
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)	- Testing & Analysis	4Q		
(U)	US Theater Battle Mmgt Core System and NATO ACCS signed		2Q	
(U)	- Pre-study coordination activities	1Q		
(U)	- Study contract award		1Q	
(U)	Material and Technologies for Laser Protection			2Q
(U)	- Technology Development			3Q
(U)	Resilient Structural and Blast Suppression Systems for Blast Protection Research			2Q
(U)	- Technical report preparation	3Q		
(U)	- Design methodology development	4Q		
(U)	- Full-scale blast experiments		1Q	
(U)	Refractive Turbulence and Transient Electronic Disconnectivity	4Q		
(U)	- Technical Development	3Q		
(U)	- Testing and analysis	2Q		
(U)	Tropospheric Refraction signed	4Q		
(U)	Hard Target Defeat		3Q	
(U)	- Technical report preparation	3Q		
(U)	- Testing and analysis	4Q		
(U)	Coalition-Interoperable SATCOM Data Broadcast Protocols		2Q	
(U)	- Technical Development	3Q		
(U)	- Testing and Analysis	4Q		
(U)	International Mission Training Research		1Q	
(U)	- Technical report preparation	3Q		
(U)	- Testing and Analysis	4Q		
(U)	Multi-modal Situational Awareness Displays for Maneuvering Aircraft		2Q	
(U)	- Technical Development	3Q		
(U)	- Testing and Analysis	4Q		
(U)	3-Dimensional Laser Radar Technology and Phenomenology		2Q	
(U)	- Technical Development	3Q		
(U)	- Testing and Analysis	4Q		
(U)	Strike Information Displays		2Q	
(U)	- Technical Development	3Q		
(U)	- Testing and Analysis	4Q		
(U)	Coalition/Joingt Force Air Component Commander (C/JFACC) Battle Board			2Q
(U)	- Technical Development		3-4Q	

Exhibit R-4a, RDT&E Schedule Detail		DATE February 2006
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) - Testing and Analysis	4Q	
(U) Development of Electro-Optic & Infrared Countermeasures and Protection Mesaures		2Q
(U) - Technical Development	3Q	
(U) - Testing and Analysis	4Q	
(U) Engagement-level Modeling for HPM Weapons Applications		2Q
(U) - Technical Development	3-4Q	
(U) - Testing and Analysis	4Q	
(U) High-Cycle Fatigue Reduction		2-3Q
(U) - Technical Development	3Q	
(U) - Testing and Analysis	4Q	
(U) Hypersonic Flight Research and Development		2Q
(U) - Technical Development	2-3Q	
(U) - Testing and Analysis	4Q	
(U) US Theater Battle Management Core Systems (TBMCS)		2Q
(U) - Technical Development	3-4Q	
(U) - Testing and Analysis	4Q	