RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: June 2001

BUDGET ACTIVITY: 04 - Demonstration and Validation

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

PROJECT: NATO

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
NATO	Nato Coop R&D	4,091	5,458	5,616	5,721	5,867	5,912	6,203	6,265	0	0
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

FY03-FY07 budget numbers do not reflect the DoD strategic review results.

(U) A. Mission Description

These funds will be used to help implement international cooperative research, development, and acquisition (ICRD&A) agreements with North Atlantic Treaty Organization (NATO) and major non-NATO allies (Argentina, Australia, Egypt, Israel, Japan, Jordan, and Rep. of Korea (South Korea)). 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. Starting in FY01 these funds have focused on implementing coalition warfare technology and demonstrations that address Air Force space, command, control, communications, intelligence, surveillance, and reconnaissance (C3ISR), modernization and readiness needs in support of the National Military Strategy, Joint Vision 2020, and the Air Force's Strategy of Global Engagement. The planned program is shown below. 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) Demonstration and Validation (5) Engineering and Manufacturing Development and (6) RDT&E Management Support.

(U) FY 2000 ($ in Thousands)

(U) $312 Advanced Combustion Chamber Concepts Program (Air Force Research Laboratory (AFRL)/France) - Ongoing cooperative project to develop and demonstrate a composite combustor structure suitable for use in advanced hypersonic weapon system operation to Mach 8 on liquid hydrocarbon fuels. Engines using this type of composite structure are simpler, easier to cool, lower in weight, and more durable than baseline metallic designs. During FY00, fabrication of a composite panel was completed. During preliminary testing, the panel developed leaks. The panel will be reworked, and testing is to take place in late FY01.

(U) $400 Aging Aircraft Life Prediction/Extension (AFRL/Australia) - Ongoing cooperative project to investigate the damage that can degrade an aircraft's service life, and develop the technology to ensure the structural integrity of aging aircraft with such damage present. This project is focused on composite patch repairs of metallic structures, widespread fatigue damage including multiple-element damage and multiple site damage, techniques for predicting the effects of corrosion and the interaction with fatigue loads, and sensors for structural health monitoring. In FY00,

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(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

the project completed documenting experience with widespread fatigue damage and composite patch repairs, continued developing analysis techniques for corrosion/fatigue, continued evaluating composite patch repair and analysis techniques, and performed in-service evaluation of corrosion sensor. Two AFRL technical reports have been sent to the Australian technical team.

(U) $250 Airworthiness of Aging Aircraft (AFRL/UK) - Ongoing cooperative project to investigate the damage that can degrade an aircraft's service life, and develop the technology to ensure the structural integrity of aging aircraft with such damage present. This project is focused on composite patch repairs for metallic structures, techniques for predicting the effects of corrosion and the interaction with fatigue loads, and structural life extension techniques for metal structures, such as the fastener-hole cold expansion process. In FY00, the project continued analysis techniques for corrosion/fatigue and continued developing analysis techniques for life enhancement and composite patch repairs. Two AFRL technical reports have been sent to the UK technical team.

(U) $300 Anthropometric Accommodation in Crew Systems (AFRL/The Netherlands) - Ongoing cooperative project to establish: (1), a collection of three dimensional (3D) anthropometric data which accurately and consistently describes the variability of men and women in both Europe and the US; (2), high quality methods for accommodation and interoperability assessment of crew systems; and (3), methods for combining the database with the assessment methods to assure accommodation and interoperability are achieved in the design process. In FY00, the project finished the European data collection, the model assessment of the aircraft crew stations, and began accommodation effect assessments using US and European data sets.

(U) $100 Advanced Transmission Language and Allocation of New Technology for International Communication and Proliferation of Allied Waveforms (ATLANTIC PAW) (AFRL/France, Germany, UK) - Ongoing cooperative project to allow joint compliance testing which will be conducted with multinational communication assets to assure interoperability on a functional level. This will be conducted by using the previously designed Future Multiband, Multiwaveform, Modular Tactical Radio (FM3TR) waveform and newly designed multinational radio platforms. In FY00, compliance testing verified the interoperability of the basic equipment that is required for the ATLANTIC PAW effort. Modifications resulting from the compliance testing are being integrated. The initial design and tool characterization of the international waveform interpreter and language development also commenced.

(U) $75 Challenging Mini-Satellite Payload (CHAMP) (formerly Cooperative Space Measurements) (AFRL/Germany) - Ongoing cooperative project to fly a DoD developed Digital Ion Drift Meter (DIDM) (space plasma detector) aboard a German scientific spacecraft beginning in 2000. Joint exchange and analysis of scientific data from this mission will be used to develop better descriptive and predictive models of the space environment, enhancing the reliability of space-based communications and navigation capabilities for the US and its allies. In July 2000, the instrument was launched aboard the CHAMP scientific spacecraft. The instrument is operating as designed, generating valuable data, and cooperative data analysis efforts are continuing.

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(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

(U) $250 Coalition Command, Control and Communications (C3) Demonstration Environment (CC3DE) (AFRL/Australia, Canada, UK) - Ongoing cooperative project to improve the efficiency of future coalition operations capabilities through the development of interoperable C3. This project is exploring the effective management of information system resources in a coalition environment. It is developing a management architecture for the coalition environment, and developing the tools to implement this architecture. In particular, Asynchronous Transfer Mode (ATM) technology is being integrated into a Broadband-Integrated Services Digital network (B-ISDN) in efforts to form a common international standard for networking. In FY00, the test bed setup work started to verify operational compatibility. Integration of network management technologies is proceeding as development progresses.

(U) $450 Distributed Mission Training (DMT) Technologies (AFRL/Canada) - Ongoing cooperative project to develop DMT technologies that will enhance allied simulator based training of US and Canadian fighter aircrews and demonstrate proof of concept. DMT refers to shared training environment comprised of live, virtual, and constructive simulations allowing warfighters to train individually or collectively at all levels of war. In FY00, the project initiated efforts to convert and rehost CF-18 software to multi-task trainer format, and continued visual perception and engineering research efforts to specify design requirements for ultra-high resolution visuals for DMT flight simulators.

(U) $213 Effects of the Ionosphere on Command, Control, Communications, and Intelligence (C3I) Systems (AFRL)/United Kingdom (UK) - Ongoing cooperative project to leverage complementary ionospheric sensors and data to develop capabilities for timely warning of ionospheric disturbances that disrupt C3I systems. In FY00, the concepts underlying a rapidly deployable Space Weather Station, employing real-time data from a variety of ionosphere sensors, integrated with radiowave propagation codes and signal-coverage displays, were demonstrated to a number of potential operational Department of Defense (DoD) users. In addition, an ionosphere scintillation monitoring system was installed in the Middle East, thereby greatly increasing the coverage of the so-called SCINDA technique for real-time specification of equatorial ionosphere disturbance conditions that will impact C3I systems and operations.

(U) $216 Flight Test Demonstration of Miniature Munitions Release from Internal Weapons Bay (AFRL/Australia) - Ongoing cooperative project to validate separation simulation codes for the release of miniature munitions from internal weapons bays at both subsonic and supersonic airspeeds. The Royal Australian Air Force (RAAF) F-111G is the only available operational fighter/bomber, with an internal bay, capable of dropping internally carried munitions at subsonic and supersonic velocities. In FY00, validated trajectory simulation codes that will support the store certification efforts for aircraft such as the F-22, Joint Strike Fighter, and Unmanned Combat Air Vehicles.

(U) $100 Free Piston Shock Tunnel (FPST)/High Enthalpy Goettingen (HEG) Project (Arnold Engineering and Development Center (AEDC)/Germany) - Ongoing cooperative project to significantly reduce the cost of acquiring technologies and ground test capabilities for the development of hypersonic flight systems by combining the complementary efforts of the US FPST and Germany's HEG facilities. In FY00, final evaluation of non-intrusive diagnostics in the laboratory shock tunnel and additional development of the pulsed electron beam system in the laboratory shock

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(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

tunnel was completed. Final data reduction and final report preparation is underway.

(U) $150 Future Multiband, Multiwaveform Modular Tactical Radio (FM3TR) AFRL/France, Germany, United Kingdom) - Just completed cooperative project that defined, tested, and implemented a system to share new communications waveforms and technologies for implementation on the diffferent nations' software-based and reprogrammable radio systems. In FY00, the interoperability of a common test waveform across the various unique radio platfoms, including the US SPEAKeasy system, was demonstrated. SPEAKeasy was a joint program which directly fed into the Joint Tactical Radio System (JTRS) that has provided a multi-functional radio capable of satisfying many communications requirements currently being addressed by separate, non-interoperable systems. The end result will be the fielding of a superior, flexible and interoperable communications asset that will play a critical role in international military coalitions.

(U) $500 Integrated Tactical Aircraft Control (ITAC) Program (AFRL/France) - Ongoing cooperative project to develop, integrate and demonstrate critical flight control and flight management technologies that enable cooperative flight operations of a package comprised of manned and uninhabited combat air vehicles (UCAVs). The cooperative control architecture enables management and control of an integrated strike package by the aircrews in the combat aircraft. The design approach is based on software agents. In FY00, work continued in the development and refinement of the agent/algorithms. Functional descriptions of the agents and their interrelationships was further refined. A draft System/Subsystem Specification (SSS) and Interface Control Document (ICD) were developed. Initial measures of merit and performance were developed.

(U) $375 Scintillation Impacts on Communication and Navigation Systems (AFRL/Australia) - Ongoing cooperative project to exchange data, deploy current sensors, develop improved sensors, and tailor current decision aids, including software, which relate to ionospheric phenomena and their effect on C3I systems. This project will provide the US critical access to data in regions of strategic interest in South East Asia and the South Pacific where large ionospheric disturbances routinely occur. FY00, activities included the deployment of sensors for monitoring scintillation on UHF Satellite Communication links at existing Australian sites. Real-time data retrieval has been implemented at these sites for ready data access and prototype operational support. Routine data collection is ongoing.

(U) $350 Structural Integrity of Aging Aircraft (AFRL/Canada) - Ongoing cooperative project to investigate the damage that can degrade an aircraft's service life, and develop the technology to ensure the structural integrity of aging aircraft with such damage present. This project is focused on composite patch repairs for metallic structures, widespread fatigue damage, life extension techniques for metallic structures, corrosion and its interaction with fatigue, structural dynamics with emphasis on weapon bay acoustics, and structural health monitoring with emphasis on sensor development. In FY00, the project developed analytical models for widespread fatigue damage and corrosion/fatigue, completed evaluation of composite patch repair techniques, and identified in-service dynamic problems. Three AFRL technical reports are being prepared to be sent to the Canadian technical team.

(U) $50 Three Dimensional Multilayer Microwave Integrated Circuit (3DIC) Technology Development (AFRL/Rep. of Korea) - This ongoing cooperative

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(U) A. Mission Description Continued

(U) FY 2000 ($ in Thousands) Continued

project is developing new multi-layer microwave packaging and interconnect sub-assembly technologies applicable to a broad range of critical defense needs. This cooperative effort is focused on multi-layer dielectric interconnect technology--thin multiple dielectric layers with vertical interconnects. During FY00, the US and Korean 3DIC project teams worked jointly on a one to four, 3-D Wilkinson divider/combiner. By designing and building a component used in high performance assemblies using 3-D techniques, the uniqueness and advantages of 3-D technology over the more common planar approaches for select components is being demonstrated.

(U) $4,091 Total

(U) FY 2001 ($ in Thousands)

(U) $350 Air Command, Control, Communications and Intelligence (C3I) Capabilities (Electronic Systems Center (ESC)/NATO Consultation, Command, and Control (C3) Agency) - Planned cooperative project to develop an operationally robust interface between the US Contingency Theater Automated Planning System/Theater Battle Management Core System (CTAPS/TBMCS) and NATO Initial Combined Air Operations Center (CAOC) Capability (ICC) as well as the future NATO Air Command and Control System (ACCS). This cooperative R&D effort will support air campaign planning and execution for joint and combined air operations. In FY01, the scope of work to be accomplished includes advanced R&D into shared data environment, developing a concept of operation for the transfer of control between national and NATO Command, Control, Communications, Computers and Intelligence (C4I) systems without interrupting combat operations; and the extension of a middle-ware/translator product needed for the successful prosecution of a combined/joint air operation.

(U) $300 Anthropometric Accommodations in Crew Systems (AFRL/The Netherlands) - Ongoing cooperative project to establish: (a), a collection of three-dimensional (3-D) anthropometric data which accurately and consistently describes the variability of men and women in both Europe and the US; (b), high quality methods for accommodation and interoperability assessment of crew systems; and (c), methods to assure accommodation and interoperability are achieved in the design process. In FY01, US and Dutch anthropometric data collection was completed. Data processing is ongoing. The first phase of postural studies have been completed; further postural data collection is ongoing.

(U) $550 ATLANTIC PAW (AFRL/France, Germany, UK) - Ongoing cooperative project to develop a common waveform syntax allowing for joint allied communications that will be demonstrated on programmable radio systems in each of the participating nations. In FY01, the waveform interpreter design has commenced, and initial specifications of the waveform language are being developed. Preliminary testing of portions of the system components is being performed to mitigate integration risks. Activities are beginning to address the shortfalls in tool capability.

(U) $500 Coalition Aerial Surveillance And Reconnaissance (CAESAR) (ESC/Canada, France, Germany, Italy, Norway, UK) - Planned cooperative project to develop and evaluate technologies for the integration of diverse Ground Moving Targeting Indicator (GMTI)/Synthetic Aperture Radar (SAR) platforms to promote interoperability amongst multiple participants to support coalition warfare operations. The project will enable all

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(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

participants to collaboratively develop the architecture and interoperability framework, key interfaces, and formats needed to meet coalition warfare requirements. In FY01, this project will focus on developing interoperability amongst surveillance and reconnaissance assets of participating nations.

(U) $500 CC3DE (AFRL/Australia, Canada) - Ongoing cooperative project to improve the efficiency of future coalition operations capabilities through the development of interoperable C3. This project will initially explore the effective management of information system resources in a coalition environment. It will develop a management architecture for the coalition environment, and develop the tools to implement this architecture. In particular, ATM technology will be integrated into a B-ISDN in efforts to form a common international standard for networking. In FY01, the project is continuing to finalize the testbed setup between nations to verify operational compatibility. Integration of network management technologies is being applied as development progresses.

(U) $100 Cooperative Research and Development Efforts in Imaging Spectrometer Development (Arnold Engineering and Development Center/Canada) - Ongoing cooperative project to pool the spatial and spectral advances of both the US and Canada to produce a hyperspectral infrared (IR) imaging spectrometer. This high-resolution sensor system will be capable of characterizing signatures of missiles and aircraft, and for identifying trace quantities of a broad spectrum of gases in the environment. In FY01, work continued to enhance the data acquisition and viewing software. Components for the brassboard system, including a commercial IR camera and an existing spectrometer, are being assembled and integrated.

(U) $500 DMT Technologies (AFRL/Canada) - Ongoing cooperative project to develop DMT technologies that will enhance allied simulator based training of US and Canadian fighter aircrews and demonstrate proof of concept. DMT refers to a shared training environment comprised of live, virtual, and constructive simulations allowing warfighters to train individually or collectively at all levels of war. In FY01, the project is completing software conversion and rehost efforts, developing a DMT control station, initiating modernization enhancements and aircraft hardware/emulation integration to the CF-18 Multi-Task Training (MTT), and continuing visual research and development activities.

(U) $400 Effects of Ionization on Hydrocarbon-Air Combustion (AFRL/UK) - This ongoing cooperative project is a joint effort in the research and development of high-speed liquid hydrocarbon fueled airbreathing propulsion technology. This will be accomplished by exploiting the benefits of weak ionization in enhancing the reactivity of hydrocarbon fuels. Plasma technology will be examined for its utility in improving ignition and piloting for hydrocarbon combustors. In FY01, laboratory experiments were conducted and results are being analyzed to validate and/or improve the existing kinetic model of ion-enhanced hydrocarbon combustion. Planning is underway for experiments to be conducted in the Air Force Research Lab scramjet test facility within the next two months. These tests will explore the effectiveness of several plasma torch designs and configurations.

(U) $200 Effects of the Ionosphere on C3I Systems (AFRL/UK) - Ongoing cooperative project to leverage complementary ionospheric sensors and data to develop capabilities for timely warning of ionospheric disturbances that disrupt C3I systems. In FY01, a new sensing technique employing High

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Frequency (HF) ionosounding data to provide (advanced) forecasts of ionospheric disturbance conditions that will affect C3I systems and operations is being demonstrated; and HF radio wave propagation data and ionosphere total-electron-content (tomography) data is being used to validate the Space Weather concept for real-time specification of the in-theater battlespace environment affecting C3I systems and operations.

(U) $354 Engine Component Life Extension (AFRL/Australia) - Planned 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 FY01, existing life prediction models will be evaluated to determine specific avenues for improvement, and identify gaps in material databases.

(U) $100 Flight Test Demonstration of Miniature Munitions Release from Internal Weapons Bay (AFRL/Australia) - Ongoing cooperative project to validate separation simulation codes for the release of miniature munitions from internal weapons bays at both subsonic and supersonic airspeeds. The Royal Australian Air Force (RAAF) F-111G is the only available operational fighter/bomber, with an internal bay, capable of dropping internally carried munitions at subsonic and supersonic velocities. In FY01, flight testing was conducted and completed, including release of 16 small smart bomb shapes. Data reduction and analysis in ongoing, and will be compiled for a final report.

(U) $570 High Altitude Endurance Unmanned Aerial Vehicle (HAE UAV) Cooperative Analysis, Development and Operational Demonstration (Aeronautical Systems Center/Australia) - Ongoing cooperative project to demonstrate the Out of Continental United States (OCONUS) deployment capability of the US Global Hawk HAE UAV, advance surveillance technology and interoperability, and enhance operational utility assessments of the US HAE UAV Advanced Concept Technology Demonstration (ACTD). In FY01, the US deployed the Global Hawk to Australia, demonstrated, and is assessing the system's operational effectiveness in a maritime and littoral environment.

(U) $400 ITAC Program (AFRL/France) - Ongoing cooperative project to develop, integrate and demonstrate critical flight control and flight management technologies that enable cooperative flight operations of a package comprised of UCAVs. The cooperative control architecture enables management and control of an integrated strike package by the aircrews in the combat aircraft. In FY01, agent integration and development refinement will continue culminating in a world station based on real-time and real-time simulations. The measures of merit and performance metrics will be evaluated and refined. Baseline performance for autonomous, intelligent control will be established. System mechanization for a real-time, operator in the loop simulation will be initiated.

(U) $200 Refraction and Propagation Modeling for Microwave Systems (AFRL/Australia, UK) - Planned cooperative project to combine a low cost aircraft measurement platform for simultaneous measurement of refraction, and Airborne Warning And Control System (AWACS) radar signal strength reduction with parabolic equation methods of microwave propagation modeling for evaluation and prediction of refraction conditions. In FY01, testing and validation will be conducted to determine the adverse performance of microwave and infra-red systems that perform surveillance, communication, signal intelligence, and directed energy functions in electronic battlespace.

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(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$300	Scintillation Impacts on Communication and Navigation Systems (AFRL/Australia) - Ongoing cooperative project will exchange data, deploy current sensors, develop improved sensors, and tailor current decision aids, including software, which relate to ionospheric phenomena and their effect on C3I systems. This project will provide the US critical access to data in regions of strategic interest in South East Asia and the South Pacific where large ionospheric disturbances routinely occur. In FY01, data collection is continuing and additional sites are being brought on-line; characterization of ionospheric disturbances in the region and assessment of their impacts on space-based navigation, communications and surveillance systems is being conducted. An intensive multiple-diagnostic measurement campaign is being performed during active scintillation periods to enhance our understanding of the physical mechanisms leading to the development of severe equatorial disturbances.
(U)	$34	Space Radiation Sensors (AFRL/UK) - Planned cooperative project to validate the performance of a key Air Force spacecraft instrument for the measurement of space environment radiation hazards. The instrument's capability of issuing real-time space hazard warnings will be tested under a variety of conditions encountered in space aboard a joint US/UK satellite mission. In FY01, the project will develop the preliminary space radiation data base using the US and UK instruments. Final verification of the US instrument's calibration will be performed using the preliminary database.
(U)	$100	Management and administrative support and travel.
(U)	$5,458	Total

(U) FY 2002 ($ in Thousands)

(U)	$493	Advanced Hybrid Propulsion Technologies (AHPT) (AFRL/Japan) - This ongoing cooperative project is researching and exploring technologies for an advanced hybrid rocket engine propulsion system to increase the performance, safety and reliability of future tactical missiles. The technologies include liquid oxidizers, gas generator fuels, and flow control systems. This activity will enable the demonstration of a forward injected gas generator hybrid rocket engine with energy management. Sub-systems of the full-scale test hardware are being manufactured and assembled. Test planning for the full-scale tests is ongoing. In FY02, activities will include study of hybrid ignition, completion of test components and their integration, test firings, data collection, data analysis, and final report generation.
(U)	$100	Air C3I Capabilities (ESC/NATO C3 Agency) - Planned cooperative project to develop a fieldable interface between the US CTAPS/TBMCS and NATO Initial CAOC (ICC) and the future NATO ACCS. This cooperative R&D effort will support air campaign planning and execution for joint and combined air operations. In FY02, work will focus on: (a), productizing the C2 interface between the then fielded systems; (b), harmonization of system data base structures as part of the shared data environment; and (c), evaluating and implementing the reuse of appropriate functional module.
(U)	$640	ATLANTIC PAW (AFRL/France, Germany, UK) - Ongoing cooperative project to develop a common waveform syntax allowing for joint allied

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

communications that will be demonstrated on programmable radio systems in each of the participating nations. In FY02, the waveform interpreter design and the initial specifications of the waveform language will be completed, and rehosted on the US development equipment. The development environment will be completed and used for an international demonstration.

(U) $1,500 Coalition Aerial Surveillance And Reconnaissance (CAESAR) (ESC/Canada, France, Germany, Italy, Norway, UK) - Planned cooperative project to develop and evaluate technologies for the integration of diverse Ground Moving Targeting Indicator (GMTI)/Synthetic Aperture Radar (SAR) platforms to promote interoperability amongst multiple participants to support coalition warfare operations. The project will enable all participants to collaboratively develop the architecture and interoperability framework, key interfaces, and formats needed to meet coalition warfare requirements. In FY02, this project will continue to focus on developing interoperability amongst surveillance and reconnaissance assets of participating nations, and develop architecture and interoperability framework, key interfaces, and formats needed to meet coalition warfare requirements.

(U) $50 CC3DE (AFRL/Australia, Canada) - Ongoing cooperative project to improve the efficiency of future coalition operations capabilities through the development of interoperable C3. This project will initially explore the effective management of information system resources in a coalition environment. It will develop a management architecture for the coalition environment, and develop the tools to implement this architecture. In particular, ATM technology will be integrated into a B-ISDN in efforts to form a common international standard for networking. In FY02, the project will continue to network management integration to completion. C3I applications will be tested to demonstrate the effectiveness of the developed network management capability.

(U) $250 Cooperative Research and Development Efforts in Imaging Spectrometer Development (Arnold Engineering and Development Center/Canada) - Ongoing cooperative project to pool the spatial and spectral advances of both the US and Canada to produce a hyperspectral infrared (IR) imaging spectrometer. This high-resolution sensor system will be capable of characterizing signatures of rockets and aircraft for drug interdiction and for identifying trace quantities of a broad spectrum of gases in the environment. In FY02, work will continue to enhance the data acquisition and viewing software. The brassboard system will be assembled and integrated. Portions will be ruggedized in preparation for field testing.

(U) $250 Distributed Mission Training (DMT) and Virtual Air Environment (VAE) Technologies (AFRL/Australia) - Planned cooperative project to develop DMT and VAE technologies that will enhance allied simulator based training of US and Australian fighter aircrews and demonstrate proof of concept. DMT refers to a shared training environment comprised of live, virtual, and constructive simulations allowing warfighters to train individually or collectively at all levels of war. The Australian VAE program will establish a training capability for the Air Defence System using networked simulated and constructive forces. The cooperative project will merge efforts being conducted under these complementary programs. In FY02 the project will initiate efforts to (1) develop Australian F-18 multi-task trainers, (2) conduct visual perception and engineering research efforts to specify design requirements for ultra-high resolution visuals for DMT flight simulators, and (3) initiate

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collaborative long-haul networking and constructive forces development activities.

(U) $250 DMT Technologies (AFRL/Canada) - Ongoing cooperative project to develop DMT technologies that will enhance allied simulator based training of US and Canadian fighter aircrews and demonstrate proof of concept. DMT refers to a shared training environment comprised of live, virtual, and constructive simulations allowing warfighters to train individually or collectively at all levels of war. In FY02, the project will complete development of a DMT control station, select and integrate a visual system to the CF-18 MTT, continue modernization enhancements and aircraft hardware/emulation integration to the CF-18 MTT, finalize joint operability test procedures, and continue visual research and development activities.

(U) $400 Engine Component Life Extension (AFRL/Australia) - Planned 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 FY02, full-life engine parts will be examined using nondestructive evaluation (NDE) tools and destructive analysis to identify typical populations of crack-like damage; appropriate time-temperature-stress profiles will be developed to best simulate engine operating conditions; mechanical testing will be performed for use in developing improved fatigue crack growth algorithms; development of NDE techniques for characterization of residual stress profiles will begin; activities to address the shortfalls in life prediction capabilities will begin.

(U) $700 ITAC Program (AFRL/France) - Cooperative project to develop, integrate and demonstrate critical flight control and flight management technologies that enable cooperative flight operations of a package comprised of UCAVs. The cooperative control architecture enables management and control of an integrated strike package by the aircrews in the combat aircraft. In FY02, real-time operator in the loop simulations will be conducted. Evaluation of a flight operations package will be performed to evaluate the robustness of ITAC. Interface control documents and software will be delivered. A joint, interactive demonstration, in which an operator can select levels of autonomy, performance and coordination, will be developed for demonstration in an international forum.

(U) $50 Refraction and Propagation Modeling for Microwave Systems (AFRL/Australia, UK) - Planned cooperative project to combine a low cost aircraft measurement platform for simultaneous measurement of refraction, and Airborne Warning And Control System (AWACS) radar signal strength reduction with parabolic equation methods of microwave propagation modeling for evaluation and prediction of refraction conditions. In FY02, testing and validation will continue to be conducted to determine the adverse performance of microwave and infra-red systems that perform surveillance, communication, signal intelligence, and directed energy functions in electronic battlespace.

(U) $300 Scintillation Impacts on Communication and Navigation Systems (AFRL/Australia) - Ongoing cooperative project will exchange data, deploy current sensors, develop improved sensors, and tailor current decision aids, including software, which relate to ionospheric phenomena and their effect on C3I systems. This project will provide the US critical access to data in regions of strategic interest in South East Asia and the South

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(U) FY 2002 ($ in Thousands) Continued

Pacific where large ionospheric disturbances routinely occur. In FY02, data collection will be completed, and characterization of ionospheric disturbances in the region and assessment of their impacts on space-based navigation, communications and surveillance systems will be concluded.

(U) $100 Space Radiation Sensors (AFRL/UK) - Planned cooperative project to validate the performance of a key Air Force spacecraft instrument for the measurement of space environment radiation hazards. The instrument's capability of issuing real-time space hazard warnings will be tested under a variety of conditions encountered in space aboard a joint US/UK satellite mission. In FY02, the project will begin the development of the final radiation database.

(U) $433 Strike Warrior (AFRL/UK) - This planned cooperative project is 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 information. In FY02, the project will begin with an evaluation of an unmanned combat air vehicle operator's station.

(U) $100 Management and administrative support and travel.

(U) $5,616 Total

(U) B. Budget Activity Justification

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 relistic 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) C. Program Change Summary ($ in Thousands)

		FY 2000	FY 2001	FY 2002	Total Cost
(U)	Previous President's Budget (FY 2001 PBR)	4,222	5,509	5,616	0
(U)	Appropriated Value	4,283	5,509		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-27	-39		
	b. Small Business Innovative Research	-131			
	c. Omnibus or Other Above Threshold Reprogram				

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DATE: June 2001

BUDGET ACTIVITY: 04 - Demonstration and Validation

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PROJECT: NATO

(U) C. Program Change Summary ($ in Thousands) Continued

		FY 2000	FY 2001	FY 2002	Total Cost
	d. Below Threshold Reprogram	-34	-12		
	e. Rescissions				
(U)	Adjustments to Budget Years Since FY 2001 PBR				
(U)	Current Budget Submit/FY 2002 PBR	4,091	5,458	5,616	TBD

(U) Significant Program Changes:
Change Summary Explanation: N/A

(U) D. Other Program Funding Summary ($ in Thousands)

	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
(U) Program Management										

(U) E. 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(A&T). 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.

(U) F. Schedule Profile

		FY 2000				FY 2001				FY 2002			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	Effects of the Ionosphere on C3I Systems Project												
(U)	- Expand C3I outage alert coverage to include Middle East sector			X									
(U)	- Develop HF sounding technique to forecast scintillation conditions				X								
(U)	- Field demonstration of HF scintillation forecasting technique						X	X					

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

PROJECT: NATO

(U) F. Schedule Profile Continued

		FY 2000				FY 2001				FY 2002			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	- Employ ionosphere sensor data to validate/expand support concept								X				
(U)	Strike Warrior Project												
(U)	- Project Agreement signed								X				
(U)	- Begin strike system simulations								X	X	X	X	X
(U)	- Flight tests and trials									X	X	X	X
(U)	FM3TR Project												
(U)	- Conducted international demonstration with Germany	X											
(U)	- Development and transition of FM3TR platform	X	X	X	X								
(U)	3DIC Project												
(U)	- Process development	X	X										
(U)	- Passive component development	X	X										
(U)	- Modeling	X											
(U)	- Transmitter development (US)					X							
(U)	- Receiver development (Korea)					X							
(U)	- Integration of transmitter/receiver								X				
(U)	HAE UAV (Global Hawk) Coop Analysis, Dev and Op Demo Project												
(U)	- Preliminary design	X											
(U)	- System design review		X	X									
(U)	- System modification		X	X	X	X							
(U)	- Global Hawk deployment						X						
(U)	- Operational exercise							X					
(U)	- Project report								X				
(U)	Structural Integrity of Aging Aircraft Project												
(U)	- Develop widespread fatigue damage analytical models		X	X	X								
(U)	- Eval composite patch analysis techniques for metallic structures	X	X										
(U)	- Identify candidate solutions for dynamic control	X											
(U)	- Develop corrosion/fatigue analysis techniques	X	X	X	X	X							

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PROJECT: NATO

(U) F. Schedule Profile Continued

		FY 2000				FY 2001				FY 2002			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	- Identify fatigue life enhancement techniques				X								
(U)	Airworthiness of Aging Aircraft Project												
(U)	- Document corrosion/fatigue service	X	X	X									
(U)	- Develop life enhancement analysis techniques				X	X	X						
(U)	- Conduct experiments					X	X						
(U)	Aging Aircraft Life Prediction/Extension Project												
(U)	- Eval composite patch analysis techniques for metallic structures	X	X										
(U)	- Flight tests			X									
(U)	- Develop corrosion/fatigue analysis techniques	X	X	X	X	X							
(U)	Cooperative R&D Efforts in Imaging Spectrometer Development Project												
(U)	- Brassboard development		X	X	X	X	X	X					
(U)	- Brassboard checkout				X	X	X	X	X				
(U)	- Instrument design				X	X	X						
(U)	- Instrument fabrication					X	X	X	X				
(U)	- Lab instrument checkout								X	X			
(U)	- Prototype checkout											X	X
(U)	- Instrument ruggedization												X
(U)	FPST/HEG Project												
(U)	- Data analysis	X	X	X	X								
(U)	- Exchange consultations		X										
(U)	- Exchange instrumentation and diagnostic articles		X										
(U)	- Produce final report					X	X	X	X				
(U)	Effects of Ionization on Hydrocarbon Combustion Project												
(U)	- Complete reaction rate measurements						X						
(U)	- Design plasma generator							X					
(U)	- Begin updating computational tools							X	X				

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: June 2001
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(U) F. Schedule Profile Continued

		FY 2000				FY 2001				FY 2002			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	- Complete computational tools									X			
(U)	- Begin combustion experiments									X	X	X	
(U)	- Complete combustion experiments												X
(U)	- Data analysis and model validation												X
(U)	- Final report												X
(U)	CHAMP (formerly Cooperative Space Measurements) Project												
(U)	- Spacecraft integration and test	X											
(U)	- Launch			X									
(U)	- Data collection				X	X	X	X	X				
(U)	Advanced Combustor Chamber Concepts Project												
(U)	- Material/fabrication sample tests	X	X										
(U)	- Combustor cooled panel design and fabrication			X									
(U)	- Cooled panel tests				X	X							
(U)	- Combustor chamber design and fabrication						X	X	X				
(U)	- Combustor chamber test								X	X			
(U)	Integrated Tactical Aircraft Control Program												
(U)	- System design	X	X	X	X	X	X	X					
(U)	- System mechanization						X	X	X				
(U)	- Simulation and evaluation								X	X	X	X	X
(U)	- Joint demonstration preparation											X	X
(U)	Distributed Mission Training Technologies Project												
(U)	- Project Agreement signed	X											
(U)	- Program start		X	X									
(U)	- CF-18 software design			X	X	X	X						
(U)	- Software rehost			X	X	X	X	X	X				
(U)	- Instructor operator control station						X	X	X				
(U)	- CF-18 modernization enhancements					X	X	X	X	X	X	X	X

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)		DATE: June 2001
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(U) F. Schedule Profile Continued

		FY 2000				FY 2001				FY 2002			
	1	2	3	4	1	2	3	4	1	2	3	4
(U) - Visual display system/DMT control station									X	X	X	X
(U) Anthropometric Accommodation in Crew Systems Project												
(U) - Conduct anthropometric survey	X	X	X	X	X	X	X	X				
(U) - Assess subjects in actual cockpits	X	X										
(U) - Assess one model in the US and one model in The Netherlands	X	X	X	X								
(U) - Augmented reality assessments					X	X	X	X	X	X		
(U) - 3-D data reduction			X	X	X	X	X	X	X	X		
(U) - Compare live subject, computer model, and augmented reality result						X	X	X	X	X		
(U) - Comparison of data from The Netherlands with the US			X	X	X	X	X	X	X			
(U) - Complete final project documentation							X	X	X	X		
(U) Space Radiation Sensors Project												
(U) - Project Agreement signed								X				
(U) - Calibration Review								X	X	X		
(U) - Preliminary data base										X	X	X
(U) - Verification of calibration												X
(U) Air C3I Project												
(U) - Project Agreement signed								X				
(U) - Scope work effort to achieve shared data environment									X			
(U) - Develop translator extensions									X			
(U) - US/NATO battle lab verification and development test										X		
(U) - Examine US/NATO Concept of operations in coalition environment											X	
(U) Coalition C3 Demonstration Environment Project												
(U) - Project Agreement signed	X											
(U) - Testbed setup & evaluation	X	X	X									
(U) - Network management integration	X	X	X	X	X	X	X	X				
(U) - C3I application and integration demonstrations					X				X	X		
(U) ATLANTIC PAW Project												

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PROJECT: NATO

(U) F. Schedule Profile Continued

		FY 2000				FY 2001				FY 2002			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	- Supplement signed				X								
(U)	- Joint compliance testing					X							
(U)	- Tool characterization					X	X	X					
(U)	- Interpreter characterization/design							X	X	X	X		
(U)	- Allied waveform coding										X		
(U)	- Interop demo											X	
(U)	Scintillation Impacts on Communication and Navigation Systems Project												
(U)	- Project Agreement signed			X									
(U)	- Implement real-time data collection at existing sites				X	X							
(U)	- Deploy scintillation monitors				X	X	X						
(U)	- Campaign/complete data collection start						X						
(U)	- Correlate and calibrate data sets							X					
(U)	- Characterize local disturbance climatology									X			
(U)	- Develop regional forecast algorithms											X	
(U)	- Report regional scintillation & tailored products for C3I sys												X
(U)	Refraction & Propagation Modeling for Microwave Systems Project												
(U)	- Test parabolic propagation model with real refraction data								X	X	X	X	
(U)	- Aircraft measurements: validate extreme refraction cases								X	X	X	X	
(U)	- Aircraft data reduction and analyses								X	X	X	X	
(U)	- Validation propagation model for extreme cases										X	X	X
(U)	- Demonstrate model use with AWACS operation											X	X
(U)	- Final report												X
(U)	Engine Component Life Extension Project												
(U)	- Project Agreement signed								X				
(U)	- Engine Rotor Life Extension (ERLE) technical/economic studies								X				
(U)	- Advanced life prediction methodologies for ERLE									X	X	X	X

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PROJECT: NATO

(U) F. Schedule Profile Continued

		FY 2000				FY 2001				FY 2002			
		1	2	3	4	1	2	3	4	1	2	3	4
(U)	- Advanced nondestructive inspection/evaluation technology										X	X	
(U)	- Advance manufacture concepts/technical development for ERLE												X
(U)	Flight Test Demo of Mini Munitions Release from Internal Weapons Bay												
(U)	- Project Agreement signed		X										
(U)	- Logistics preparations		X										
(U)	- Weapons hardware integration			X									
(U)	- Operational hardware installation				X								
(U)	- Flight test					X							
(U)	- Final reporting						X						
(U)	Distributed Mission Training & Virtual Air Environment Technologies												
(U)	- Project Agreement signed										X		
(U)	- Program start										X		
(U)	- F-18 software conversion										X	X	X
(U)	- Software rehost										X	X	X
(U)	CAESAR Project												
(U)	- Project Agreement signed							X					
(U)	- Technical and operational coordination							X	X	X	X	X	X
(U)	- Survey and assessments, Concepts of Operations							X	X	X	X	X	X
(U)	- Tactics, techniques, procedures, measures of effectiveness/ perf								X	X	X	X	X
(U)	- Identify info for CAESAR ground picture								X	X	X	X	X
(U)	- Architecture development								X	X	X	X	X
(U)	Advanced Hybrid Propulsion Technologies												
(U)	- Hybrid ignition study										X		
(U)	- Testing											X	
(U)	- Data analysis and final report											X	

RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)

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BUDGET ACTIVITY: 04 - Demonstration and Validation

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

PROJECT: NATO

(U) A. Project Cost Breakdown ($ in Thousands)

		FY 2000	FY 2001	FY 2002
(U)	Advanced Combustor Chamber Concepts Program (ACCCP)	312	0	0
(U)	Advanced Hybrid Propulsion Technologies (AHPT)	0	0	493
(U)	Aging Aircraft Life Prediction/Extension	400	0	0
(U)	Air Command, Control, Communications, and Intelligence (C3I) Capabilities	0	350	100
(U)	Airworthiness of Aging Aircraft	250	0	0
(U)	Anthropometric Accommodation in Crew Systems	300	300	0
(U)	Advanced Transmission Language and Allocation of New Technology for International Communication and Proliferation of Allied Waveforms (ATLANTIC PAW)	100	550	640
(U)	Challenging Mini-Satellite Payload (CHAMP) (formerly Cooperative Space Measurements)	75	0	0
(U)	Coalition Aerial Surveillance And Reconnaissance (CAESAR)	0	500	1,500
(U)	Coalition Command, Control, and Communications (C3) Demo Environment (CC3DE)	250	500	50
(U)	Cooperative Research and Development (R&D) Efforts in Imaging Spectrometer Development	0	100	250
(U)	Distributed Mission Training (DMT) and Virtual Air Environment (VAE) Technologies	0	0	250
(U)	Distributed Mission Training (DMT) Technologies	450	500	250
(U)	Effects of Ionization on Hydrocarbon-Air Combustion	0	400	0
(U)	Effects of the Ionosphere on Command, Control, Communications, and Intelligence (C3I) Systems	213	200	0
(U)	Engine Component Life Extension	0	354	400
(U)	Flight Test Demonstration of Miniature Munitions Release from Internal Bay	216	100	0
(U)	Free Piston Shock Tunnel (FPST)/ High Enthalpy Goettingen (HEG) Project	100	0	0
(U)	Future Multiband Multiwaveform Modular Tactical Radio (FM3TR)	150	0	0
(U)	High Altitude Endurance Unmanned Aerial Vehicle (HAE UAV) (Global Hawk) Cooperative Analysis, Development, and Operational Demonstration	0	570	0
(U)	Integrated Tactical Aircraft Control (ITAC) Program	500	400	700
(U)	Refraction and Propagation Modeling for Microwave Systems	0	200	50
(U)	Scintillation Impacts on Communication and Navigation Systems	375	300	300
(U)	Space Radiation Sensors	0	34	100
(U)	Strike Warrior	0	0	433
(U)	Structural Integrity of Aging Aircraft	350	0	0

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(U) A. Project Cost Breakdown ($ in Thousands) Continued

		FY 2000	FY 2001	FY 2002
(U)	Three Dimensional Multilayer Microwave Integrated Circuit (3DIC)	50	0	0
(U)	Management and administrative support and travel		100	100
(U)	Total	4,091	5,458	5,616

Complete information regarding the use of NATO Cooperative R&D funds is not available for all proposed agreements, since some are still being negotiated or were recently signed. In addition, information on the use of future funding for continuing agreements is not available in all instances because the funds are used as needed to supplement a project office's related 6.1 through 6.5 RDT&E appropriations.

(U) B. Budget Acquisition History and Planning Information ($ in Thousands)

(U) Performing Organizations:

Contractor or Government Performing Activity	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Performing Activity EAC	Project Office EAC	Total Prior to FY 2000	Budget FY 2000	Budget FY 2001	Budget FY 2002	Budget to Complete	Total Program
Product Development Organizations										
Lockheed Martin Colorado Springs, CO	CPAF	Oct 95			0	0	350	0	Continuing	TBD
Sytronics Dayton, OH	CPFF	Apr 98			600	85	300	0	Continuing	TBD
Boston College Boston, MA	CFSR	Mar 97			155	0	0	0	Continuing	TBD
RADEX Bedford, MA	CPFF	Mar 97			920	40	50	0	Continuing	TBD
Pacific Sierra Research Santa Monica, CA	CPFF	Mar 97			60	0	0	0	Continuing	TBD
CPI Fairfax, VA	CPFF	Mar 97			180	0	0	0	Continuing	TBD
U of Massachusetts Lowell, MA	CR	Apr 97			170	125	100	0	Continuing	TBD
KEO Consultants Brookline, MA	CPFF	Mar 97			220	0	0	0	Continuing	TBD
NW Research Associates Bellevue, WA	CPFF	Apr 97			110	75	50	0	Continuing	TBD

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(U) Performing Organizations Continued:									
Product Development Organizations									
Visdyne Inc.	CPFF	Sep 00	400	0	0	0	Continuing	TBD
Innovative Scientific Solutions Inc.	CPFF	Sep 00	0	0	400	0	Continuing	TBD
U of Texas Austin, TX	CPFF	May 97	25	0	0	0	Continuing	TBD
Applied Research Lab, U of Texas Austin, TX	CPFF	May 97	105	0	0	0	Continuing	TBD
Lockheed Martin Orlando, FL	CPFF	Sep 96	913	0	0	0	Continuing	TBD
Raytheon TI Systems	CPFF	Dec 97	683	0	0	0	Continuing	TBD
Boeing Seattle, WA	CPFF	Sep 98	260	400	300	600	Continuing	TBD
UES, Inc Dayton, OH	CPFF	Oct 97	100	0	0	0	Continuing	TBD
NOAA/ATDD Oak Ridge, TN	MIPR	Oct 97	0	0	0	0	Continuing	TBD
Pratt & Whitney West Palm Beach, FL	CPFF	Jun 98	1,000	312	0	0	Continuing	TBD
AFRL WPAFB, OH	TBD	TBD	0	0	388	816	Continuing	TBD
Boeing Long Beach, CA	CPFF	Jul 98	265	0	0	0	Continuing	TBD
Boeing Seattle, WA	CPFF	Mar 98	200	0	0	0	Continuing	TBD
Lockheed Marietta, GA	CPFF	Oct 98	325	200	0	0	Continuing	TBD
Northrop Hawthorne, CA	CPFF	Oct 98	50	0	0	0	Continuing	TBD
Selectech Dayton, OH	CPFF	Feb 98	50	300	0	0	Continuing	TBD
Boeing St Louis, MO	CPFF	Mar 00	0	250	0	0	Continuing	TBD
University of South Carolina	CPFF	Apr 00	0	250	0	0	Continuing	TBD
Boeing St Louis, MO	CPIF	Apr 99	0	0	0	0	Continuing	TBD
Thiokol Corp Elkton, MD	CPFF	Nov 97	0	0	0	0	Continuing	TBD
Raytheon Mesa, AZ	CPFF	Jul 97	0	250	500	1,000	Continuing	TBD
CPI Annandale, VA	CPFF	TBD	0	0	200	0	Continuing	TBD
U of Colorado Boulder, CO	CPFF	TBD	0	0	100	0	Continuing	TBD
Boston College Newton, MA	CPFF	TBD	0	0	50	0	Continuing	TBD
Radex	CPFF	Feb 01	0	0	135	0	Continuing	TBD

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(U) Performing Organizations Continued:								
Product Development Organizations								
Applied Physics Lab Laurel, MD	MIPR	May 00	0	0	0	0	Continuing	TBD
Boston College Boston, MA	CPFF	TBD	0	0	40	0	Continuing	TBD
Radex Bedford, MA	CPFF	TBD	0	25	0	0	Continuing	TBD
U of Mass Lowell, MA	CR	TBD	0	0	45	0	Continuing	TBD
Scion Associates Seattle, WA	CPFF	TBD	0	0	65	0	Continuing	TBD
SRI, Int'l Menlo Park, CA	CPFF	TBD	0	0	40	200	Continuing	TBD
AFRL Rome, NY	TBD	TBD	1,250	500	1,050	0	Continuing	TBD
AFRL Hanscom, MA	TBD	TBD	0	25	300	100	Continuing	TBD
Navigation Warfare					170	250	Continuing	TBD
Global Hawk					400	0	Continuing	TBD
0								
Support and Management Organizations								
AFRL Hanscom, MA			135	688	75	1,850	Continuing	TBD
AFRL WPAFB, OH			5	75	25	220	Continuing	TBD
45th Space Wing Patrick AFB, FL	AF 185	May 95	5	0	0	0	Continuing	TBD
AFRL Eglin AFB, FL			50	216	0	0	Continuing	TBD
Pender Technology, TN	CR	Oct 97	90	25	45	0	Continuing	TBD
Veridian Dayton, OH			145	75	75	75	Continuing	TBD
Test and Evaluation Organizations								
Air Force Development Test Center, FL	PO	Jan 98	54	0	0	0	Continuing	TBD
Sverdrup Technology, Inc TN	CPAF	Sep 95	1,443	175	205	205	Continuing	TBD
Naval Air Warfare CenterPoint Mugu, CA	MIPR	Jan 99	40	0	0	0	Continuing	TBD
Aeronautical Systems Center WPAFB			0	0	0	300	Continuing	TBD

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(U) Performing Organizations Continued:

Test and Evaluation Organizations								
Fora Laser System	PO	Nov 97	100	0	0	0	Continuing	TBD
Arnold Engineering Development Center, TN	TBD	TBD	0	0	0	0	Continuing	TBD

(U) Government Furnished Property:

Item Description	Contract Method/Type or Funding Vehicle	Award or Obligation Date	Delivery Date	Total Prior to FY 2000	Budget FY 2000	Budget FY 2001	Budget FY 2002	Budget to Complete	Total Program
Product Development Property									
None									
Support and Management Property									
None									
Test and Evaluation Property									
Fora laser system	PO	Nov 97	Jan 98	147	0	0		0	147

Subtotals	Total Prior to FY 2000	Budget FY 2000	Budget FY 2001	Budget FY 2002	Budget to Complete	Total Program
Subtotal Product Development	8,041	2,837	5,033	2,966	TBD	TBD
Subtotal Support and Management	430	1,079	220	2,145	TBD	TBD
Subtotal Test and Evaluation	1,784	175	205	505	TBD	TBD
Total Project	10,255	4,091	5,458	5,616	TBD	TBD