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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

	COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	84,376	66,561	70,951	80,767	82,897	84,463	86,587	Continuing	TBD
4519	Communications Technology	21,784	15,855	16,331	15,251	16,581	17,020	17,476	Continuing	TBD
4594	Information Technology	31,601	23,143	24,210	24,492	24,722	25,389	26,071	Continuing	TBD
4600	Electromagnetic Technology	10,247	0	0	0	0	0	0	Continuing	TBD
4917	Collaborative Information Tech	0	9,060	6,044	5,396	5,523	5,632	5,748	Continuing	TBD
5581	Command and Control (C2) Technology	20,744	18,503	24,366	35,628	36,071	36,422	37,292	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2002, portions of efforts in Projects 4519, 4594, and 5581 move into Project 4917 within this PE. In FY 2002, the effort accomplished in Project 4600 moves into PE 0602204F Project 4916 in order to align projects with the Air Force Research Laboratory organizational structure.

(U) A. Mission Description

This program develops the technology base for Air Force Command, Control, and Communications (C3). Advances in C3 are required to increase warfighter readiness by providing the right information, at the right time, anywhere in the world. The program has four projects. The Communication Technology project develops assured, secure communications technology. The Information Technology project develops improved and automated capabilities to generate, process, fuse, exploit, interpret, and disseminate timely and accurate information. The Collaborative Information Technology project develops high payoff emerging technologies for the next generation of distributed, collaborative command and control systems. The Command and Control Technology project investigates and develops planning, assessment, and knowledge base technologies to allow the warfighter to plan, assess, execute, monitor, and re-plan on the compressed time scales required for tomorrow's conflicts. Note: In FY 2002, Congress added $3.9 million for simulation-based acquisition; $1.8 million for Information Hiding, Steganography and Digital Watermarking for Information Protection and Authentication Systems; and $2.3 million for Assured Communications.

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(U) B. Budget Activity Justification

This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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

		FY 2001	FY 2002	FY 2003	Total Cost
(U)	Previous President's Budget	86,448	59,672	67,480	
(U)	Appropriated Value	87,249	66,659		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions		-98		
	b. Small Business Innovative Research	-2,048			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	-24			
	e. Rescissions	-801			
(U)	Adjustments to Budget Years Since FY 2002 PBR			3,471	
(U)	Current Budget Submit/FY 2003 PBR	84,376	66,561	70,951	TBD

(U) Significant Program Changes:

Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4519

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4519 Communications Technology	21,784	15,855	16,331	15,251	16,581	17,020	17,476	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 4519 moves into Project 4917.

(U) A. Mission Description

The Air Force requires technologies that enable assured, worldwide communications for an agile Expeditionary Aerospace Force (EAF). These communication technologies will provide en-route and deployed reachback communications for distributed collaborative command and control (C2). A rapidly deployed EAF requires assured connectivity with reliable, responsive, affordable information exchange via all available communications media. This project provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques; lightweight, phased array antennas; and modular, programmable, low-cost radios. It includes technologies for advanced processors and devices, advanced network protocols and services, intelligent communications management and control, advanced communications algorithms, and enabling communication signal processing techniques.

(U) FY 2001 ($ in Thousands)

(U) $7,224 Developed assured and survivable information and networking technologies enabling the capability for worldwide command, control and communication operations for EAF. Developed information systems and networking technologies for globally distributed information systems. Continued to develop technologies to provide managed, seamless global information exchange for the Air Force, in a joint/coalition environment. Developed technologies to improve quality of service, robustness, security, and survivability of mission-critical information.

(U) $7,307 Developed critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and greatly reduce equipment footprint. Continued to develop and apply critical multiband and wideband wireless communications technologies for assured communications in Joint and Coalition environments. (In FY 2002, a portion of this effort moves into Project 4917.)

(U) $7,253 Developed Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communication and information systems. Continued to develop net visualization tools and attack indicators. Continued to develop automated capability for computer forensics analysis. Developed preemptive indicators, damage assessment, and recovery techniques.

(U) $21,784 Total

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U) $7,561 Develop assured and survivable information and networking technologies enabling the capability for worldwide command, control and communication operations for Expeditionary Aerospace Forces. Continue to develop technologies to improve quality of service for globally distributed information systems. Continue to develop assured networking and information systems technologies to improve survivability to critical infrastructure attacks. Complete development of technologies for assured wireless networking algorithms. Develop assured communication technology that will focus on techniques for tactical wireless networking, wireless information assurance, and the management of these capabilities within the global information enterprise.

(U) $3,350 Develop critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and greatly reduce equipment footprint. Investigate and develop techniques to improve information assurance capabilities for mobile wireless networks to preclude information attacks aimed at denial of service and quality of service degradation. Continue to develop mobile communication technologies for wide-band data and video services to beyond-line-of-sight airborne command and control, and sensor platforms.

(U) $4,944 Develop Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communication and information systems. Continue to develop automated capability for damage assessment and recovery of information systems. Develop computer and network forensics tools. Develop data mining tools for coordinated information warfare attack assessment. Investigate techniques to perform analysis on detection and eradication of malicious software.

(U) $15,855 Total

(U) FY 2003 ($ in Thousands)

(U) $6,015 Develop assured and survivable information and networking technologies enabling worldwide command, control and communication operations for the Global Strike Task Force. Continue to develop technologies to improve quality of service for globally distributed information systems. Complete development of assured networking and information systems technologies to improve survivability to critical infrastructure attacks. Initiate development of securely managed enterprise network technology to develop assured network services across multiple network security domains. Initiate development of programmable networking algorithms that enable the dynamic creation of advanced information delivery services, independent of the underlying physical infrastructure devices.

(U) $4,734 Develop critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and greatly reduce equipment footprint. Continue to develop techniques to improve information assurance capabilities for mobile wireless networks to preclude information attacks aimed at denial of service and quality of service

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BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602702F Command Control and Communications
PROJECT: 4519	

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

degradation. Develop assured communication technologies that will enable a full spectrum of information superiority capabilities in wireless networks in a joint/coalition environment. Investigate high performance wireless device and waveform technologies for improving affordability of critical Air Force command and control networks.

(U) $5,582 Develop Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communication and information systems. Continue to develop automated capabilities for damage assessment and recovery techniques. Continue to develop computer and network forensics tools and data mining tools to assess coordinated information warfare (IW) attacks. Continue to develop detection and eradication techniques for malicious software. Initiate investigations in active response technologies, detection of hidden data, and early assessment of complex IW attacks.

(U) $16,331 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4594

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4594 Information Technology	31,601	23,143	24,210	24,492	24,722	25,389	26,071	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 4594 moves into Project 4917.

(U) A. Mission Description

The Air Force requires technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project improves global awareness at all levels, enabling warfighters to understand relevant military situations on a consistent basis, with the timeliness and precision needed to accomplish their missions. Global awareness is achieved by exploiting information provided by the Air Force and other government agencies. The information is fused to support the dynamic planning and execution cycle via the global information enterprise. Knowledge, information, and data are archived in the global information base for continued use and historical analysis. The information technologies required to achieve this capability are developed under this project in an affordable manner, and include appropriate access mechanisms for our coalition partners.

(U) FY 2001 ($ in Thousands)

(U) $4,686 Developed information exploitation technologies for imagery and electronic signals to increase global awareness. Continued to develop multisensor, multimedia analytical techniques to automatically detect and track the presence and location of objects (target, non-targets both civilian and military) and extract changes in the information. Investigated advanced information dissemination techniques for seamless integration into the global information base via the global grid.

(U) $7,390 Developed and evaluated innovative multisensor collaborative fusion technologies in a fully distributed aerospace environment. Developed and evaluated collaborative multisensor technologies for near-real-time cueing and retasking of sensors for dynamic fusion of information, addressing surface, airborne, and spaceborne systems in a fully distributed environment.

(U) $4,961 Developed global information base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Developed and investigated technology concepts that employ multiple levels of abstraction to rapidly extract information from globally distributed databases, to provide timely and accurate information to dynamic planning and execution operations. Continued to develop information extraction technology to retrieve data from text and automatically insert into structured formats, enabling the warfighter to process large volumes of text faster and more effectively.

(U) $2,611 Developed embedded, affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation. Developed and evaluated technology for real-time information fusion and exploitation for Expeditionary Aerospace Force situational awareness that is 100 times more affordable than current embedded and radiation hardenable high performance processing systems.

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BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602702F Command Control and Communications
	PROJECT: 4594

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$5,939	Developed information technologies that significantly reduce the development cost of complex electronic systems. Completed the development of a requirements modeling representation concisely capturing the engineering requirements for computer-aided simulation, verification, and analysis. Completed the research for making digital hardware models more reusable. Develop an interface between digital hardware models and battlespace models, enabling more of a system to be verified by simulation. (In FY 2002, this effort moves to Project 4917.)
(U)	$6,014	Developed modeling and simulation technologies to support next generation distributed collaborative environments. Evaluated, exploited, and developed techniques to expand the capability while reducing the complexity of existing high-resolution models and simulations for the National Air and Space Warfare Model. Developed simulation techniques to provide accurate, real-time decision support for the next generation distributed collaborative environments.
(U)	$31,601	Total

(U) FY 2002 ($ in Thousands)

(U)	$5,485	Develop information exploitation technologies for imagery and electronic signals to increase global awareness. Develop advanced multi-sensor open systems techniques and tools for production of imagery (including hyperspectral), electronic signals, and speech intelligence products to achieve situation awareness. Develop advanced information dissemination techniques for seamless integration into global information databases.
(U)	$5,585	Develop and evaluate innovative multi-sensor collaborative fusion technologies in a fully distributed aerospace environment. Develop techniques to quantitatively evaluate fusion algorithms. Develop and evaluate fusion technologies for multi-platform cross-cueing of sensors for the location and identification of military targets, addressing surface, airborne, and spaceborne systems in a fully distributed environment.
(U)	$6,047	Develop global information base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Investigate information extraction techniques to automatically populate very large knowledge base systems. Develop approaches for synthesizing a common data representation from multiple sources for improved situational awareness. Investigate methods of content-based retrieval techniques for improved sensor data exploitation and faster data base access.
(U)	$2,688	Develop affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation. Develop processor-in-memory, content-addressable architecture for rapid extraction of information from globally distributed knowledge bases. Develop architectures to support real-time requirements for dominant battlespace awareness.
(U)	$1,538	Develop modeling and simulation technologies to support next generation planning, execution, and assessment environments. Evaluate,

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	PROJECT: 4594

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

exploit, and develop model abstraction and multi-resolution modeling techniques to reduce the complexity of existing high-resolution models and simulations, supporting the National Air and Space Model.

(U) $1,800 Develop information hiding, steganography and digital watermarking techniques to protect and authenticate data within Air Force and DoD information systems. Develop and evaluate steganography detecting and decoding techniques for data embedding, tamper detection and proofing, image and video content authentication, and secure information dissemination.

(U) $23,143 Total

(U) FY 2003 ($ in Thousands)

(U) $6,848 Develop information exploitation technologies for imagery and electronic signals to increase global awareness. Continue to develop advanced multi-sensor open systems techniques and automated analyst tools for exploiting hyperspectral imagery, on-board video processing, new electronic signals, and speech intelligence products to achieve improved situational awareness.

(U) $6,578 Develop and evaluate innovative multi-sensor collaborative fusion technologies in a fully distributed aerospace environment. Continue to develop techniques to quantitatively evaluate fusion algorithms. Develop multi-source fusion techniques for continuous tracking of militarily significant vehicles in the battlespace. Develop and evaluate fusion technologies for enemy threat prediction based on multi-source fusion.

(U) $5,478 Develop global information base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Develop intermediate information extraction techniques to reduce data overload and increase time allocated to analysis and decision-making, enabling the ability to populate knowledge base systems. Continue to develop techniques for a self-organizing, data repository, and content-based extraction. Develop advanced web-based search techniques and information aggregation methods required for rapid situational understanding.

(U) $3,429 Develop affordable, scalable, petaflop processing technologies for real-time information fusion and exploitation. Complete processor in memory content addressable architecture for rapid extraction of information from globally distributed knowledge bases. Evaluate architecture to support real-time requirements for dominant battlespace awareness.

(U) $1,877 Develop modeling and simulation technologies to support next generation planning, execution, and assessment environments. Continue to evaluate, exploit, and develop model abstraction and multi-resolution modeling techniques to reduce the complexity of existing high-resolution models and simulations for next generation distributed collaborative decision support environments, exemplified by the Joint Synthetic Battlespace.

(U) $24,210 Total

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602702F Command Control and Communications	4594

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4600

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4600 Electromagnetic Technology	10,247	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2002, Project 4600 efforts transferred to PE 0602204F Project 4916, in order to align projects with the Air Force Research Laboratory organizational structure.

(U) A. Mission Description

This project conducts research in electromagnetics and photonics technologies for application to Intelligence, Surveillance, and Reconnaissance (ISR) Systems. Future surveillance, communications, and imagery/information processing systems will require improved technology for the generation, control, processing, and radiation of electromagnetic and optical energy to reduce system cost, improve system sensitivity, and increase processing rates. Promising technologies for improving ISR systems are electromagnetic propagation and scattering (from targets and clutter) and antennas. This project develops technology and control techniques for large phased array antennas, infrared focal plane array technology, and characterizes phenomena for low-observable surveillance.

(U) FY 2001 ($ in Thousands)

(U) $3,313 Designed and developed electromagnetic technologies for advanced surveillance and reconnaissance systems applications. Continued to develop and evaluate algorithms for a digital beam-formed multibeam antenna.

(U) $3,093 Designed and developed antenna concepts for aerospace surveillance and reconnaissance applications. Continued to develop and evaluate advanced concepts for large, lightweight arrays. Continued to develop and evaluate a three-dimensional optically excited antenna array.

(U) $3,841 Designed and developed electro-optical technology to enable passive or active targeting of difficult targets. Investigated ways of mitigating atmospheric phenomenology effects on extended range aerospace sensors. Continued to develop turbulence compensation techniques for precision targeting, target signatures, and phenomenology models, and selected multifunction sensor target characteristics. Continued to design and develop infrared focal plane array technology.

(U) $10,247 Total

(U) FY 2002 ($ in Thousands)

(U) $0 In FY 2002, the effort moves into PE 0602204F, Project 4916.

(U) $0 Total

(U) FY 2003 ($ in Thousands)

(U) $0 In FY 2002, the effort moves into PE 0602204F, Project 4916.

(U) $0 Total

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
02 - Applied Research	0602702F Command Control and Communications	4600

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:
(U) PE 0602204F, Aerospace Sensors.
(U) PE 0603203F, Advanced Aerospace Sensors.
(U) PE 0603789F, C3I Advanced Development.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4917

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4917 Collaborative Information Tech	0	9,060	6,044	5,396	5,523	5,632	5,748	Continuing	TBD

Note: In FY 2001, the effort in this project was accomplished in Projects 4519, 4594, and 5581 in this PE.

(U) A. Mission Description

To implement the Expeditionary Aerospace Force concept, the Air Force requires a distributed, collaborative command and control (C2) system, allowing the majority of the C2 center to remain in CONUS, while only a small command element is deployed forward. This project accomplishes the initial exploration of high payoff emerging technologies for the next generation of distributed collaborative C2 systems. This program develops technologies for platform connectivity, collaboration and embedded information systems. Platform connectivity technologies focus on advanced modulation waveforms for bandwidth efficiency, assured aerospace platform connectivity for C2, and conceptual design approaches for seamless integration of aerospace weapon systems into the information grid. Collaboration technologies advance collaboration science, virtual environments, and predictive simulation tools to facilitate the development and fielding of next generation operational collaborative enterprises. Embedded information systems technologies explore high payoff technologies for the next generation of distributed information integration architectures, which will provide cross disciplinary products/capability to a decision maker when, where, and how it is needed. It also provides embedded information system technologies for affordable and adaptable design and development of complex C2 systems, facilitated by an open system architecture approach.

(U) FY 2001 ($ in Thousands)

(U) $0 The effort was accomplished in Projects 4519, 4594, and 5581 in this PE.

(U) $0 Total

(U) FY 2002 ($ in Thousands)

(U) $1,248 Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems command and control, intelligence, surveillance, and reconnaissance data/information. Continue to develop assured, secure communications technology, leveraging the commercial infrastructure, for positive command and control of aerospace assets in civilian airspace. Continue to develop secure, wide-band wireless information transfer technology for assured communications by multiple weapon systems. (Prior to FY 2002, this effort was accomplished in Project 4519.)

(U) $2,235 Develop advanced information technologies for collaborative decision support, knowledge management, and rapid adaptation/re-allocation of assets in response to the continuing changing threat environment. Develop technologies to support distributed decision making and collaborative planning for Expeditionary Aerospace Forces in a battlespace information environment. Develop technology to support a

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	PROJECT: 4917

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

sensor-to-shooter scenario stressing the time-critical-target requirement, resulting in denying the enemy the sanctuary of time. (Prior to FY 2002, this effort was accomplished in Projects 5581 and 4594.)

(U) $1,677 Develop processes, methods, and techniques to provide assured performance, integrity, and security of real-time embedded information systems. Develop dynamically reconfigurable aerospace systems using adaptive computing techniques. Continue to develop concepts, designs, and models for the next generation command and control global information systems, which will allow affordable design and development of highly complex aerospace systems, and autonomous unmanned airborne/spaceborne platforms for deployment against time-critical targets. (Prior to FY 2002, this effort was accomplished in Project 5881.)

(U) $3,900 Develop and assess Simulation Based Acquisition (SBA) technologies for application to integrated aerospace systems design and analysis. Conduct experiments with challenge problems to define the boundaries of SBA capabilities. Develop an enhanced collaborative technology architecture that supports the tenants of SBA.

(U) $9,060 Total

(U) FY 2003 ($ in Thousands)

(U) $1,443 Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems' command and control, intelligence, surveillance, and reconnaissance data/information. Complete the development of assured secure communications technology, leveraging the commercial infrastructure, for positive command and control (C2) of aerospace assets in civilian airspace. Continue the development of secure, wide-band wireless information transfer technology for assured communications between munitions and aircraft.

(U) $2,570 Develop advanced information technologies for collaborative decision support, knowledge management, and rapid adaptation/re-allocation of assets in response to the continuing changing threat environment. Investigate techniques to perform the collaborative planning for the Global Strike Task Force. Continue development of distributed decision making technology for joint battlespace information environment. Continue to develop technology to support a sensor-to-shooter scenario stressing the time-critical-target requirement, which will result in denying the enemy the sanctuary of time.

(U) $2,031 Develop processes, methods, and techniques to provide assured performance, integrity, and security of real-time embedded information systems. Continue to develop dynamically reconfigurable aerospace systems using adaptive computing techniques. Continue to develop concepts, designs, and models for the next generation C2 global information systems, which will allow affordable design and development of highly complex aerospace systems. Develop methods and processes for determining the suitability of Java and Real-Time Java to support open system architectures for real-time, embedded information systems.

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued
(U) $6,044 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:
(U) PE 0603789F, C3I Advanced Development.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 5581

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
5581 Command and Control (C2) Technology	20,744	18,503	24,366	35,628	36,071	36,422	37,292	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 5581 moves into Project 4917.

(U) A. Mission Description

The Air Force requires Command and Control (C2) technologies which provide the next generation of weapon systems with improved processing and presentation of information for real-time, distributed battle management. Technologies being developed in this project will increase capability and quality, while reducing the cost of C2 systems and infrastructure. Technology development in this project focuses on planning and assessing techniques, knowledge bases, and distributed information systems. Advances in planning and assessment technologies will vastly improve the military decision making process within C2 systems. Advances in development of very large comprehensive knowledge bases to rapidly formulate and create new knowledge are needed by the Expeditionary Aerospace Force. Advances in distributed intelligent information systems will allow automatic rapid reconfiguration to varying crisis levels required by the Expeditionary Aerospace Force.

(U) FY 2001 ($ in Thousands)

(U) $6,158 Developed the next generation of planning and assessment technologies and tools enabling aerospace commanders to determine and create the desired operational effects at the right place at the right time. Developed technologies to dynamically assess the battlespace, determine measures to create the desired effects, and provide near-real-time command of forces to execute those measures. Developed technologies to provide alternative courses of action and feasibility assessment in uncertain environments.

(U) $1,963 Investigated and developed technologies for the rapid development and application of next generation knowledge-bases for aerospace C2 systems. Developed tools and techniques needed by an Expeditionary Aerospace Force for building very large comprehensive knowledge bases by rapidly formulating and creating new knowledge, along with capabilities to re-use, augment, and repair existing knowledge-bases. Continued the development of techniques for knowledge-base theory slicing and merging, conflict resolution, and context management. Investigated new techniques to allow users to enter, validate, and manipulate knowledge using natural language, sketching, and templating approaches.

(U) $5,908 Investigated, analyzed, and developed technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Expeditionary Aerospace Forces. Developed and evaluated advanced display and human-computer interface technologies for current and next generation C2 systems.

(U) $1,979 Developed tools and techniques to promote assured performance and affordability of complex air and space platforms. Continued to develop new techniques for rapidly incorporating new functions into scaleable, open architecture systems. Developed dynamically reconfigurable

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(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

aerospace systems using field programmable gate arrays. Developed concepts and preliminary designs for the next generation global C2 information systems which will allow the seamless insertion of highly autonomous unmanned airborne and spaceborne platforms for deployment against time-critical targets. (In FY 2002, this effort moves to Project 4917.)

(U) $4,736 Developed the technologies, tools, and techniques required to ensure protection of critical command, control, and communications (C3) infrastructure. Developed the technologies which will allow a robust implementation of an overarching, integrated capability for protection of the global C3 infrastructure. Developed protection techniques with emphasis on integrity of information and availability of networks required for distributed, collaborative command and control (C2) systems.

(U) $20,744 Total

(U) FY 2002 ($ in Thousands)

(U) $5,734 Develop the next generation of planning and assessment technologies and tools enabling aerospace commanders to determine and create the desired operational effects at the right place at the right time. Continue to develop technologies to dynamically assess the battlespace, determine measures to create the desired effects, and provide near-real-time command of forces to execute those measures. Develop tools to visualize the probability of success of qualitatively different courses of action. Continue to develop technologies to provide alternative courses of action and feasibility assessment in uncertain environments. Investigate intelligent agent technologies capable of supporting C2 systems for various missions, from humanitarian relief to major theater warfare. Develop techniques to enable the rapid insertion of new forces and their C2 information management systems into a battlespace infosphere.

(U) $4,835 Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. Develop tools that allow users to enter, validate, and manipulate knowledge using natural language, sketching, and templating approaches. Develop knowledge representation techniques to enable the structured common representation (SCR) required for a battlespace infosphere. Develop capabilities that learn to extract, correlate, and classify link patterns. Investigate enhanced reasoning techniques and algorithms for more complex inferencing and performance.

(U) $7,934 Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Expeditionary Aerospace Forces. Develop dynamic and adaptable interface technologies that allow commanders to create a mission-tailored view of the configuration and status of the currently executing Air Operations Center C2 process. Develop advanced interactive displays suitable for deployment with C2 applications and command centers. Develop techniques and applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Develop techniques for integrating legacy client-server C2 systems

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

into the next generation of agile, web-enabled information management environments. Investigate approaches to enable C2 systems to smoothly scale to over 1,000 clients exchanging information using a publish-subscribe paradigm as required for a battlespace infosphere.

(U) $18,503 Total

(U) FY 2003 ($ in Thousands)

(U) $7,267 Develop the next generation of planning and assessment technologies and tools enabling aerospace commanders to determine and create the desired operational effects at the right place at the right time. Continue to develop technologies to dynamically assess the battlespace, determine measures to create the desired effects, and provide near-real-time command of forces to execute those measures. Continue to develop tools to visualize the probability of success of qualitatively different courses of action. Continue to develop intelligent agent technologies capable of supporting joint/coalition command and control (C2) systems for various missions. Develop and assess active template technologies for use in dynamic mobile C2 applications. Develop tools to increase situational awareness through intelligent information push and pull in dynamic environments.

(U) $5,485 Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. Continue to develop tools that will automate intelligent extraction, correlation, and classification of link patterns for discovering relevant linkages between entities. Develop enhanced reasoning techniques for complex inferencing and performance of C2 systems.

(U) $7,823 Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Aerospace Expeditionary Forces. Continue to develop dynamic and adaptable interface technology that allows commanders to create a mission-tailored view of the configuration and status of the currently executing Air Operation Center C2 process. Continue to develop advanced interactive displays suitable for deployment with C2 applications and command centers. Continue to develop techniques and applications for information visualization for use in conjunction with multiple, heterogeneous data sets.

(U) $3,791 Investigate and develop technologies to implement flexible, secure and survivable information management and distribution services to enable a Joint Battlespace Infosphere (JBI). Continue to develop techniques for integrating legacy client-server C2 systems into the next generation of agile, web-enabled information management environments. Continue to investigate approaches to enable JBI to service thousands of participating C2 and intelligence, surveillance, and reconnaissance clients exchanging millions of information objects. Investigate and develop technologies that will ensure availability, integrity, and survivability of information within a JBI.

(U) $24,366 Total

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(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0603617F, C3 Applications.

(U) PE 0303401F, Communications-Computer Systems (C-CS) Security RDT&E.

(U) PE 0603789F, C3I Advanced Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.