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

DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

	COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	63,572	78,204	71,674	82,764	86,338	94,434	92,679	94,359	Continuing	TBD
4519	Communications Technology	15,605	15,380	15,473	17,062	17,508	17,980	18,502	19,031	Continuing	TBD
4594	Information Technology	16,750	24,286	24,845	25,441	26,116	28,793	29,173	29,036	Continuing	TBD
4917	Collaborative Information Tech	8,916	12,620	5,412	5,619	5,728	5,846	6,018	6,191	Continuing	TBD
5581	Command and Control (C2) Technology	22,301	25,918	25,944	34,642	36,986	41,815	38,986	40,101	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2002, portions of efforts in Projects 4519, 4594, and 5581 moved into Project 4917 within this PE.

(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 and 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 2003, Congress added $3.5 million for Agile Research and Development/Science and Technology Center of Excellence; $1.5 million for Information Protection and Authentication; $3.5 million for Secure Knowledge Management; and $3.0 million for Information Management for Crisis Response.

(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.

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

		FY 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	66,561	70,951	80,767	
(U)	Appropriated Value	66,659	82,451		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-98	-4,182		
	b. Small Business Innovative Research	-731			
	c. Omnibus or Other Above Threshold Reprogram		-65		
	d. Below Threshold Reprogram	-1,947			
	e. Rescissions	-311			
(U)	Adjustments to Budget Years Since FY 2003 PBR			-9,093	
(U)	Current Budget Submit/FY 2004 PBR	63,572	78,204	71,674	TBD

(U) Significant Program Changes:

The decrease in FY04 from the previous President's Budget is due to higher Air Force priorities.

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

DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4519

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4519 Communications Technology	15,605	15,380	15,473	17,062	17,508	17,980	18,502	19,031	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 4519 moved 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 software 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 2002 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $7,442 Developed assured and survivable information and networking technologies that enable the capability for worldwide command, control, and communication operations for an EAF. Continued to develop technologies to improve quality of service for globally distributed information systems. Continued to develop assured networking and information systems technologies to improve survivability to critical infrastructure attacks. Completed development of technologies for assured wireless networking algorithms. Developed 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) $3,297 Developed critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and to greatly reduce equipment footprint. Investigated and developed techniques to improve information assurance capabilities for mobile wireless networks that would preclude information attacks aimed at denial of service and quality of service degradation. Continued to develop mobile communication technologies for wide-band data and video services to beyond-line-of-sight airborne C2, and sensor platforms.

(U) $4,866 Developed Defensive Information Warfare tools and technologies to ensure information protection and security of sensitive and encrypted Air Force communications and information systems. Continued to develop automated capability for damage assessment and recovery of information systems. Developed computer and network forensics tools. Developed data mining tools for coordinated information warfare attack assessment. Investigated techniques to perform analysis on detection and eradication of malicious software.

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	PROJECT 4519

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U) $15,605 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $5,664 Develop assured and survivable information and networking technologies that will enable worldwide command, control, and communications (C3) 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 that will improve survivability against 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) $4,458 Develop critical assured communications and signal processing technologies to provide adaptive, covert, anti-jam, and assured global battlespace connectivity to aerospace forces and to greatly reduce equipment footprint. Continue to develop techniques to improve information assurance capabilities for mobile wireless networks by precluding information attacks aimed at denial of service and quality of service 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) $5,258 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) $15,380 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $5,631 Develop assured and survivable information and networking technologies enabling worldwide C3 operations for the Air Force Task Forces. Continue to develop technologies to improve quality of service for globally distributed information systems (e.g., Joint Battlespace Infosphere). Continue development of assured networking and information systems technologies that will improve survivability against critical infrastructure attacks. Continue development of securely managed enterprise network technology to develop assured network services across multiple network

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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 2004 ($ in Thousands) Continued

security domains and coalitions. Continue development of programmable networking algorithms that enable wide area dynamic creation of advanced information delivery services that are independent of the underlying physical infrastructure devices.

(U) $4,465 Develop improved, higher bandwidth communications and signal processing technologies to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity to highly mobile aerospace forces while reducing the equipment footprint. Continue development of information assurance technologies that will improve the robustness of the Global Information Grid in both wired and wireless networks for ground, air, and joint/coalition environments to preclude information systems attacks, such as denial of service and degradation of device quality. Continue to develop high performance, adaptable, and re-configurable wireless devices to implement new waveform technologies for improved robustness, security, and affordability of critical Air Force command and control networks. Initiate development of higher performance video compression and modulation techniques that enable critical objectives for high bandwidth information transmission and exploitation capabilities over wireless channels.

(U) $5,377 Develop information assurance technologies for enabling worldwide command, control, communications, and intelligence (C4I). Continue to develop automated capabilities for damage assessment and recovery techniques. Continue development of network forensics and data mining tools for detecting adversary information warfare attacks and to provide early warning notification. Continue to develop detection and eradication techniques for malicious code. Continue development of active response technologies and detection of hidden data. Initiate the development of new tools and techniques to protect C4I and information systems, and allow for integration of coalition information elements. Initiate investigation of effects-based information operations.

(U) $15,473 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

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

(U) E. Schedule Profile Continued

(U) Not Applicable.

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

DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 4594

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4594 Information Technology	16,750	24,286	24,845	25,441	26,116	28,793	29,173	29,036	Continuing	TBD

Note: In FY 2002, a portion of the effort accomplished in Project 4594 moved 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 all 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 2002 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $3,969 Developed information exploitation technologies for imagery and electronic signals to increase global awareness. Developed advanced multi-sensor open systems techniques and tools for production of imagery (including hyperspectral), electronic signals, and speech intelligence products to achieve situational awareness. Developed advanced information dissemination techniques for seamless integration into global information databases.

(U) $4,042 Developed and evaluated innovative multi-sensor collaborative fusion technologies in a fully distributed aerospace environment. Developed techniques to quantitatively evaluate fusion algorithms. Developed and evaluated 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) $4,375 Developed global information base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Investigated information extraction techniques to automatically populate very large knowledge base systems. Developed approaches for synthesizing a common data representation from multiple sources for improved situational awareness. Investigated methods of content-based retrieval techniques for improved sensor data exploitation and faster data base access.

(U) $1,945 Developed affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation. Developed processor-in-memory, content-addressable architecture for rapid extraction of information from globally distributed knowledge bases. Developed architectures to support real-time requirements for dominant battlespace awareness.

(U) $1,114 Developed modeling and simulation technologies to support next generation planning, execution, and assessment environments. Evaluated,

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	PROJECT 4594

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

exploited, and developed 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) $1,305 Developed information hiding, steganography, and digital watermarking techniques to protect and authenticate data within Air Force and DoD information systems. Developed and evaluated steganography detecting and decoding techniques for data embedding, tamper detection and proofing, image and video content authentication, and secure information dissemination.

(U) $16,750 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $6,078 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) $5,838 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) $4,862 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 that will reduce data overload and increase time allocated to analysis and decision-making, that will enable 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) $3,043 Develop affordable, scalable, petaflop processing technologies for real-time information fusion and exploitation. Complete the 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) $3,066 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 such as the Joint Synthetic Battlespace.

(U) $1,399 Continue development of information hiding, steganography, and digital watermarking to protect and authenticate data within Air Force and DoD information systems. Continue development and evaluation of steganographic detection, decoding, and countermeasure techniques for data

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	PROJECT: 4594

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

embedding, tamper detection and proofing, image and video content authentication, and secure information dissemination.

(U) $24,286 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $7,003 Develop information exploitation technologies for imagery and electronic signals to increase the information value to the decision maker. Continue development of advanced multi-sensor open systems techniques and automated analyst tools for exploiting measurement and signature intelligence, hyperspectral imagery, on-board video processing, new electronic signals, moving target indicator, and speech intelligence products for improved situational awareness, indication and warning, and reporting capabilities. Research techniques in steganography, steganalysis, and watermarking of imagery, video and speech for information protection and authentication, intelligence exploitation, and analysis tool aids.

(U) $6,694 Develop innovative multi-sensor collaborative fusion technologies in a fully distributed air and space environment. Continue to develop techniques to quantitatively evaluate fusion algorithms that support the analysis of a new emerging information era. Continue development of optimized multi-source fusion techniques for continuous tracking of militarily significant vehicles in the battlespace. Continue development and evaluation of fusion technologies for enemy threat prediction through the use of multi-source fusion.

(U) $5,578 Develop higher-level fusion technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. Continue development of 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 development of data mining techniques for a self-organizing data repository and content-based extraction to support prediction of potential events in the world. Continue development of advanced web-based search techniques, data filtering techniques, and information aggregation methods required for rapid situational understanding.

(U) $3,637 Develop automatic and dynamically reconfigurable, affordable, scalable, distributed petaflop processing technologies that adapt/reallocate resources to changes in environment and application requirements, for real-time command and control (C2) global information systems. Develop and demonstrate architectures for rapid extraction of information from globally distributed knowledge bases. Continue evaluation of architectures to support real-time requirements for dominant battlespace awareness. Initiate study of next generation information technologies (e.g., quantum computing and bio-molecular computing) for C2 systems.

(U) $1,933 Develop modeling and simulation technologies for the next generation of planning, execution, and assessment environments. Complete 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. Initiate development of decision support technologies, and their theoretical

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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 2004 ($ in Thousands) Continued

foundation, to support high-profile system concepts such as the Joint Synthetic Battlespace and the Global Strike Task Force.

(U) $24,845 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: 4917

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
4917 Collaborative Information Tech	8,916	12,620	5,412	5,619	5,728	5,846	6,018	6,191	Continuing	TBD

Note: In FY 2002, a portion of efforts in Projects 4519, 4594, and 5581 moved into this project.

(U) A. Mission Description

To implement the Global Strike Task Force and other task force concepts, the Air Force requires a distributed, collaborative command and control (C2) system, allowing the majority of the C2 center to remain in the continential United States, 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, distributed 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. Distributed collaboration technologies advance collaboration science, virtual environments, and predictive simulation tools to facilitate the development and fielding of next generation operational collaborative decision support systems. 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 2002 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $1,238 Developed critical information transmission technologies to permit the seamless integration of aerospace weapon systems C2, intelligence, surveillance, and reconnaissance data/information. Continued to develop assured, secure communications technology, leveraging the commercial infrastructure, for positive C2 of aerospace assets in civilian airspace. Continued to develop secure, wide-band wireless information transfer technology for assured communications by multiple weapon systems.

(U) $2,235 Developed advanced information technologies for collaborative decision support, knowledge management, and rapid adaptation/re-allocation of assets in response to the continually changing threat environment. Developed technologies to support distributed decision making and collaborative planning for Expeditionary Aerospace Forces in a battlespace information environment. Developed technology to support a sensor-to-shooter scenario stressing the time-critical target requirement, resulting in denying the enemy the sanctuary of time.

(U) $1,667 Developed processes, methods, and techniques to provide assured performance, integrity, and security of real-time embedded information systems. Developed dynamically reconfigurable aerospace systems using adaptive computing techniques. Continued to develop concepts, designs, and models for the next generation C2 global information systems, which will allow affordable design and development of highly

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

complex aerospace systems, and autonomous unmanned airborne/spaceborne platforms for deployment against time-critical targets.

(U) $3,776 Developed and assessed Simulation-Based Acquisition (SBA) technologies for application to integrated aerospace systems design and analysis. Conducted experiments using challenge problems to define the boundaries of SBA capabilities. Developed an enhanced collaborative technology architecture that supports the tenants of SBA.

(U) $8,916 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $1,372 Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems' command and control (C2), intelligence, surveillance, and reconnaissance data/information. Complete the development of assured secure communications technology, leveraging the commercial infrastructure, for positive 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) $5,865 Develop advanced information technologies for collaborative decision support, knowledge management, and rapid adaptation/re-allocation of assets in response to the continually 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) $1,922 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.

(U) $3,461 Continue to develop SBA technologies for application to integrated aerospace systems design and analysis. Continue development of an enhanced collaborative technology architecture supporting the tenets of SBA. Demonstrate the enhanced architecture in an experiment for collaborative spiral requirements and capability based planning.

(U) $12,620 Total

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PROJECT: 4917	

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/ Planned Program
(U)	$2,006	Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems command, control (C2), intelligence, surveillance and reconnaissance data/information. Continue the development of assured communications technology, leveraging commercial infrastructure, for positive C2 of aerospace assets in commercial airspace. Continue the development of secure, wide-band wireless miniaturized transceiver information transfer technology for assured communications between munitions and aircraft.
(U)	$2,006	Develop advanced information technologies for collaborative decision support, knowledge management, and rapid adaptation/re-allocation of assets in response to the continually changing threat environment. Develop techniques to assist in performing the collaborative planning for the Global Strike Task Force. Initiate development of distributed collaborative environment technology for effects-based operations and predictive battlespace awareness. Continue to develop technology to support a sensor-to-shooter scenario stressing time-critical target requirement, which will deny the enemy sanctuary of time.
(U)	$1,400	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. Define and develop algorithms, methods, and processes to support real-time, adaptive resource management of system resources across multiple tactical platforms.
(U)	$5,412	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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DATE: February 2003

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

PROJECT: 5581

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
5581	Command and Control (C2) Technology	22,301	25,918	25,944	34,642	36,986	41,815	38,986	40,101	Continuing	TBD

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

(U) A. Mission Description

The Air Force requires command and control (C2) technologies, that will 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, distributed information systems, and information management and distribution services. Advances in planning and assessment technologies will vastly improve the military decision making process within C2 systems. Advances in the ability to detect, classify, identify, and track objects and events will improve the understanding and prediction of enemy intentions, allowing the development of various courses of action to counter their intentions. Advances in the 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 of C2 centers to respond to varying crisis levels, as required, by the Expeditionary Aerospace Force. Advances in robust information management and distribution technologies will ensure the delivery of high quality, timely, secure information to the warfighter.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $6,911 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. Continued 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. Developed tools to visualize the probability of success of qualitatively different courses of action. Continued to develop technologies to provide alternative courses of action and feasibility assessment in uncertain environments. Investigated intelligent agent technologies capable of supporting C2 systems for various missions, from humanitarian relief to major theater warfare. Developed techniques to enable the rapid insertion of new forces and their C2 information management systems into a battlespace infosphere.

(U) $5,828 Investigated and developed technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. Developed tools that allow users to enter, validate, and manipulate knowledge using natural language, sketching, and templating approaches. Developed knowledge representation techniques to enable the structured common representation required for a battlespace infosphere. Developed capabilities that learn to extract, correlate, and classify link patterns. Investigated enhanced reasoning techniques and algorithms for more complex inferencing and performance.

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	PROJECT: 5581

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U) $9,562 Investigated, analyzed, and developed technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Expeditionary Aerospace Forces. Developed 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 command and control (C2) process. Developed advanced interactive displays suitable for deployment with C2 applications and command centers. Developed techniques and applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Developed techniques for integrating legacy client-server C2 systems into the next generation of agile, web-enabled information management environments. Investigated 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) $22,301 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $6,845 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 and 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 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) $5,167 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) $7,369 Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by Expeditionary Aerospace Forces. Continue to develop a 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) $6,537 Investigate and develop technologies to implement flexible, secure, and survivable information management and distribution services to enable a Joint Battlespace Infosphere. Continue to develop techniques for integrating legacy client-server C2 systems into the next generation of agile,

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

web-enabled information management environments. Continue to investigate approaches to enable a Joint Battlespace Infosphere to service thousands of participating command and control (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) $25,918 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/ Planned Program

(U) $9,170 Develop the next generation of monitoring, planning, execution, and assessment technologies and tools enabling aerospace commanders to efficiently and collaboratively develop effects-based campaigns. Continue to develop technologies to dynamically and rapidly assess the battlespace, and provide near-real-time command of manned and unmanned forces to execute the required missions. Investigate developments in decision support science for incorporation into C2 tools. Continue to develop tools to visualize the probability of success of qualitatively different courses of action. Continue to develop intelligent information systems capable of supporting joint/coalition C2 for various missions. Develop and assess active template and semantic ontology technologies for use in mobile C2 applications. Continue to develop tools to increase situational awareness through intelligent information push and pull in dynamic environments.

(U) $6,632 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 the intelligent extraction, correlation, and classification of link patterns for discovering relevant linkages between entities. Investigate and develop ultra-large, all-source information repositories and associated privacy protection technologies. Complete development of enhanced reasoning techniques for complex inferencing and performance of C2 systems.

(U) $7,448 Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to respond to varying crisis levels faced by Expeditionary Aerospace Forces. Continue to develop a 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. Complete the development of techniques and applications for visualization of multiple, heterogeneous data sets. Develop technologies to improve the fidelity, accuracy, and interconnection of computer-based wargames used to prepare contingency plans and response strategies.

(U) $2,694 Investigate and develop technologies to implement flexible, secure, and survivable information management and distribution services to enable a JBI. Continue to develop techniques and tools for integrating legacy client-server C2 systems into a publish, subscribe, and query infosphere.

(U) $25,944 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.