PE NUMBER: 0602702F
PE TITLE: Command Control and Communications

# Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2004

BUDGET ACTIVITY: 02 Applied Research

PE NUMBER AND TITLE: 0602702F Command Control and Communications

| | Cost ($ in Millions) | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total Program Element (PE) Cost | 77.637 | 79.594 | 82.147 | 82.865 | 90.866 | 88.794 | 90.720 | 0.000 | 0.000 |
| 4519 | Communications Technology | 14.268 | 16.532 | 17.235 | 17.141 | 17.604 | 18.129 | 18.667 | 0.000 | 0.000 |
| 4594 | Information Technology | 23.109 | 28.600 | 25.511 | 25.557 | 28.224 | 28.610 | 28.484 | 0.000 | 0.000 |
| 4917 | Collaborative Information Tech | 15.530 | 7.746 | 5.637 | 5.197 | 5.297 | 5.456 | 5.616 | 0.000 | 0.000 |
| 5581 | Command and Control (C2) Technology | 24.730 | 26.716 | 33.764 | 34.970 | 39.741 | 36.599 | 37.953 | 0.000 | 0.000 |

**(U) A. Mission Description and Budget Item Justification**

This program develops technology 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 2004, Congress added $1.2 million for the Griffiss Institute, $4.0 million for Measures and Signatures Intelligence Warfighter Visualization Tools, $2.4 million for Secure Knowledge Management for Collaborative Enterprise Management, and $1.0 million for Effects Based Planning Execution and Assessment.

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

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

| | | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|---|
| (U) | Previous President's Budget | 78.204 | 71.674 | 82.764 |
| (U) | Current PBR/President's Budget | 77.637 | 79.594 | 82.147 |
| (U) | Total Adjustments | -0.567 | 7.920 | |
| (U) | Congressional Program Reductions | | | |
| | Congressional Rescissions | | -0.680 | |
| | Congressional Increases | | 8.600 | |
| | Reprogrammings | | | |
| | SBIR/STTR Transfer | -0.567 | | |
| (U) | Significant Program Changes: | | | |
| | Not Applicable. | | | |

| Exhibit R-2a, RDT&E Project Justification | | | DATE: February 2004 |
|---|---|---|---|
| BUDGET ACTIVITY: 02 Applied Research | PE NUMBER AND TITLE: 0602702F Command Control and Communications | PROJECT NUMBER AND TITLE: 4519 Communications Technology | |

| Cost ($ in Millions) | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total |
|---|---|---|---|---|---|---|---|---|---|
| 4519 Communications Technology | 14.268 | 16.532 | 17.235 | 17.141 | 17.604 | 18.129 | 18.667 | 0.000 | 0.000 |
| Quantity of RDT&E Articles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

**(U) A. Mission Description and Budget Item Justification**

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) B. Accomplishments/Planned Program ($ in Millions)** | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|
| (U) MAJOR THRUST: Develop assured and survivable information and networking technologies enabling worldwide C3 operations for the Air Force Task Forces. | 5.254 | 5.583 | 6.022 |

(U) In FY 2003: Developed technologies to improve quality of service for globally distributed information systems. Completed development of assured networking and information systems technologies to improve survivability against critical infrastructure attacks. Developed securely managed enterprise network technology to develop assured network services across multiple network security domains. Developed programmable networking algorithms that enable the dynamic creation of advanced information delivery services, independent of the underlying physical infrastructure devices.

(U) In FY 2004: Continue to develop technologies to improve quality of service for globally distributed information systems (e.g., Joint Battlespace Infosphere (JBI)). Continue development of assured networking and information systems technologies to improve survivability against critical infrastructure attacks. Continue development of securely managed enterprise network technology to develop assured network services across multiple network 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) In FY 2005: Continue to develop technologies to improve quality of service and survivability for globally distributed information systems (e.g., JBI). Complete development of assured networking and information systems technologies to improve survivability against critical infrastructure attacks. Complete development of securely managed enterprise network technology to develop assured network services across multiple network security domains. Continue development of programmable networking algorithms that enable wide area dynamic creation of advanced

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**4519 Communications Technology** |

| | | | | |
|---|---|---|---|---|
| | information delivery services, independent of the underlying physical infrastructure devices. Initiate development of capabilities for self-organizing, self-healing, autonomous networking. | | | |
| (U) | | | | |
| (U) | MAJOR THRUST: 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. | 4.136 | 4.427 | 4.510 |
| (U) | In FY 2003: Developed techniques to improve information assurance capabilities for mobile wireless networks by precluding information attacks aimed at denial of service and quality of service degradation. Developed assured communication technologies that enable a full spectrum of information superiority capabilities in wireless networks in a joint/coalition environment. Investigated high performance wireless device and waveform technologies for improving affordability of critical Air Force command and control networks. | | | |
| (U) | In FY 2004: 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) | In FY 2005: Continue development of information assurance technologies that improve the robustness of the Global Information Grid in both wireline and wireless networks for air, space, ground, and joint/coalition environments to preclude information systems attacks such as distributed denial of service and degradation of device quality. Continue to develop high performance, adaptable, and reconfigurable wireless devices to implement new waveform technologies for improved robustness, security, and affordability of critical Air Force command and control networks. Continue development of higher performance video compression and modulation techniques that enable critical objectives for high bandwidth information transmission and exploitation capabilities over wireless channels. Explore the feasibility of implementation of above technologies, where applicable, to Joint Tactical Radio System or compatible software radios. | | | |
| (U) | | | | |
| (U) | MAJOR THRUST/CONGESSIONAL ADD: Develop cyber operations technologies for enabling worldwide command, control, communications and intelligence. Note: This effort includes $1.2 million in FY 2004 Congressional Add funding for the Griffiss Institute. | 4.878 | 6.522 | 6.703 |
| (U) | In FY 2003: Developed automated capabilities for damage assessment and recovery techniques. Developed computer and network forensics tools and data mining tools to assess coordinated information warfare attacks. Developed detection and eradication techniques for malicious software. Investigated active response technologies, | | | |

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**4519 Communications Technology** |

detection of hidden data, and early assessment of complex information warfare attacks.

(U) In FY 2004: 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. Complete work in detection of hidden data. Initiate the development of advanced correlation fusion techniques for defensive course of action analysis. Initiate development of intrusion detection techniques for wireless networks. Initiate the development of new tools and techniques to protect command, control, communications, intelligence, and information systems, and allow for integration of coalition information elements.

(U) In FY 2005: Continue to develop automated capabilities for damage assessment and recovery techniques. Complete development of network forensics. Continue development of data mining tools for detecting adversary information warfare attacks and provide early warning notification. Continue to develop detection and eradication techniques for malicious code. Continue development of active response technologies. Continue development of advanced correlation fusion techniques for defensive course of action analysis. Continue development of intrusion detection techniques for wireless networks. Continue the development of tools and techniques to protect C4I and information systems and allow for integration of coalition information elements.

| | | | |
|---|---|---|---|
| (U) Total Cost | 14.268 | 16.532 | 17.235 |

**(U) C. Other Program Funding Summary ($ in Millions)**

| | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| (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.

| Exhibit R-2a, RDT&E Project Justification | | | DATE: February 2004 |
|---|---|---|---|
| BUDGET ACTIVITY: 02 Applied Research | PE NUMBER AND TITLE: 0602702F Command Control and Communications | PROJECT NUMBER AND TITLE: 4594 Information Technology | |

| Cost ($ in Millions) | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total |
|---|---|---|---|---|---|---|---|---|---|
| 4594 Information Technology | 23.109 | 28.600 | 25.511 | 25.557 | 28.224 | 28.610 | 28.484 | 0.000 | 0.000 |
| Quantity of RDT&E Articles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

**(U) A. Mission Description and Budget Item Justification**

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) B. Accomplishments/Planned Program ($ in Millions)** | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|
| (U) MAJOR THRUST: Develop innovative multi-sensor collaborative fusion technologies in a fully distributed air and space environment. | 5.538 | 6.637 | 6.813 |
| (U) In FY 2003: Developed techniques to quantitatively evaluate fusion algorithms. Developed multi-source fusion techniques for continuous tracking of militarily significant vehicles in the battlespace. Developed and evaluated fusion technologies for enemy threat prediction based on multi-source fusion. | | | |
| (U) In FY 2004: 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) In FY 2005: Evaluate fusion techniques to determine optimal algorithms based upon data available that support the analysis of a new emerging information era. Continue to develop optimized multi-source fusion techniques for positive identification and continuous tracking of militarily significant vehicles in the battlespace. Continue development and evaluation of fusion technologies for enemy threat prediction based on the use of multi-source fusion. | | | |
| (U) | | | |
| (U) MAJOR THRUST: Develop higher level fusion and the enabling information/knowledge base technologies to achieve situational awareness at all command levels for the dynamic planning and execution process. | 4.612 | 5.531 | 5.694 |
| (U) In FY 2003: Developed intermediate information extraction techniques that will reduce data overload and increase time allocated to analysis and decision-making, enabling the ability to populate knowledge base systems. Developed techniques for a self-organizing, data repository, and content-based extraction. Developed advanced web-based | | | |

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**4594 Information Technology** |

search techniques and information aggregation methods required for rapid situational understanding.

(U) In FY 2004: 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) In FY 2005: Continue development of intermediate information extraction techniques to decrease analysis time for decision-making and enabling the ability to populate knowledge base systems. Continue development of data mining techniques for self-organizing data repositories and content-based extraction to support identification of potential events in the world. Continue development of web-based search techniques, data filtering techniques, and information aggregation methods to take advantage of the explosion of available data on the Web required for rapid situational understanding.

(U)

| | | | |
|---|---|---|---|
| (U) MAJOR THRUST: Develop automatic and dynamically reconfigurable, affordable, scalable, distributed petaflop processing technologies for real-time command and control (C2) global information systems. | 2.886 | 3.606 | 3.948 |

(U) In FY 2003: Completed the processor-in-memory, content-addressable architecture for rapid extraction of information from globally distributed knowledge bases. Evaluated architecture to support real-time requirements for dominant battlespace awareness.

(U) In FY 2004: 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) In FY 2005: Demonstrate architecture for rapid extraction of information from globally distributed knowledge bases. Demonstrate architecture to support real-time requirements for dominant battlespace awareness. Continue study of next generation information technologies (e.g., quantum computing and bio-molecular computing) for C2 systems.

(U)

| | | | |
|---|---|---|---|
| (U) MAJOR THRUST: Develop modeling and simulation technologies for the next generation of planning, execution, and assessment environments. | 2.908 | 1.916 | 2.006 |

(U) In FY 2003: Evaluated, exploited, and developed 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) In FY 2004: 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 foundation, to support

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**4594 Information Technology** |

| | | | | |
|---|---|---|---|---|
| | high-profile system concepts, such as the Joint Synthetic Battlespace and the Global Strike Task Force. | | | |
| (U) | In FY 2005: Continue to develop modeling and simulation technologies to support next generation planning execution and assessment environments. Develop adversarial behavior models and modeling techniques for course of action assessment and prediction. Prototype and demonstrate decision support technologies and the theoretical foundation to support high-profile system concepts; such as the Joint Synthetic Battlespace and Air Force Concepts of Operations. | | | |
| (U) | | | | |
| (U) | MAJOR THRUST/CONGRESSIONAL ADD: Develop digital information exploitation technologies for electronic communications and special signals intelligence, imagery and measurement signatures to increase accuracy, correlation and timeliness of the information value to the decision maker. Note: This effort includes $4.0 million in FY 2004 Congressional Add funding for Measurement and Signature Intelligence Warfighter Visualization Tools. | 5.766 | 10.910 | 7.050 |
| (U) | In FY 2003: Developed 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) | In FY 2004: 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) | In FY 2005: Continue development of advanced multi-sensor and automated analyst tools for exploiting measurement and signature intelligence, commercial sources and hyperspectral imagery, on-board video processing, new digital electronic signals, moving target indicator, and speech intelligence products to feed an information fusion process in support of the decision maker. Continue development of techniques in steganography, steganalysis, watermarking and digital data forensics for imagery, video and speech information protection and authentication, intelligence exploitation, and analysts' tool aids. Initiate investigation of new techniques to improve open systems techniques for multi-sensor exploitation for enhanced indications and warning and situational awareness. | | | |
| (U) | | | | |
| (U) | CONGRESSIONAL ADD: Information Protection and Authentication. | 1.399 | 0.000 | 0.000 |
| (U) | In FY 2003: Developed information hiding, steganography, and digital watermarking to protect and authenticate data within Air Force and DoD information systems. Developed and evaluated steganographic detection, decoding, and countermeasure techniques for data embedding, tamper detection and proofing, image and video content authentication, and secure information dissemination. | | | |
| (U) | In FY 2004: Not Applicable. | | | |

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**4594 Information Technology** |

(U) In FY 2005: Not Applicable.

| | | | |
|---|---|---|---|
| (U) Total Cost | 23.109 | 28.600 | 25.511 |

**(U) C. Other Program Funding Summary ($ in Millions)**

| | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| (U) Related Activities: | | | | | | | | | |
| (U) PE 0603789F, C3I Advanced Development. This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication. | | | | | | | | | |

**(U) D. Acquisition Strategy**

Not Applicable.

| Exhibit R-2a, RDT&E Project Justification | | | DATE: February 2004 |
|---|---|---|---|
| BUDGET ACTIVITY: 02 Applied Research | PE NUMBER AND TITLE: 0602702F Command Control and Communications | PROJECT NUMBER AND TITLE: 4917 Collaborative Information Tech | |

| Cost ($ in Millions) | | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 4917 | Collaborative Information Tech | 15.530 | 7.746 | 5.637 | 5.197 | 5.297 | 5.456 | 5.616 | 0.000 | 0.000 |
| | Quantity of RDT&E Articles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

**(U) A. Mission Description and Budget Item Justification**

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 continental 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) B. Accomplishments/Planned Program ($ in Millions)** | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|
| (U) MAJOR THRUST: Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems' C2, intelligence, surveillance, and reconnaissance data/information. | 1.808 | 1.989 | 2.012 |
| (U) In FY 2003: Developed assured secure communications technology, leveraging the commercial infrastructure, for positive C2 of aerospace assets in civilian airspace. Developed secure, wide-band wireless information transfer technology for assured communications between munitions and aircraft. | | | |
| (U) In FY 2004: 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) In FY 2005: Continue the development of assured communications technology, leveraging commercial infrastructure, for positive command and control of aerospace assets in commercial airspace. Complete the design and development of secure, wide-band wireless miniaturized transceiver information transfer technology for assured communications between munitions and aircraft. Develop, test, and assess exploratory information transfer technologies. | | | |
| (U) | | | |
| (U) MAJOR THRUST: Develop processes, methods, and techniques to provide assured performance, integrity, and security of real-time embedded information systems. | 2.533 | 1.388 | 1.505 |
| (U) In FY 2003: Developed dynamically reconfigurable aerospace systems using adaptive computing techniques. | | | |

Developed concepts, designs, and models for the next generation C2 global information systems, which will allow affordable design and development of highly complex aerospace systems. Developed 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) In FY 2004: 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) In FY 2005: Continue development of dynamically reconfigurable aerospace systems using adaptive computing techniques. Continue to develop algorithms, methods, and processes to support real-time, adaptive resource management of system resources across multiple tactical platforms. Develop methods and processes for implementation of Java and Real-Time Java Virtual Machines using adaptive computing techniques.

(U)

| | | | |
|---|---|---|---|
| (U) MAJOR THRUST/CONGRESSIONAL ADD: 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. Note: This effort includes $3.5 million in FY 2003 Congressional Add funding for Secure Knowledge Management and $2.4 million in FY 2004 Congressional Add funding for Secure Knowledge Management for Collaborative Enterprise Management. | 7.728 | 4.369 | 2.120 |

(U) In FY 2003: Investigated techniques to perform the collaborative planning for the seven Air Force Concepts of Operations (AF CONOPS). Developed distributed decision-making technology for joint battlespace information environment. Developed 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) In FY 2004: Develop techniques to assist in performing the collaborative planning for the seven AF CONOPS. 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) In FY 2005: Continue development of techniques to perform collaborative, capability based planning required by the seven AF CONOPS. Continue development of distributed collaborative environment technology for effects based operations and predictive battlespace awareness. Complete work to develop technology to support a sensor-to-shooter scenario stressing time-critical target requirement, which will deny the enemy sanctuary of time.

(U)

| | | | |
|---|---|---|---|
| (U) CONGRESSIONAL ADD: Agile Research and Development/Science and Technology Center of Excellence. | 3.461 | 0.000 | 0.000 |

(U) In FY 2003: Developed simulation-based acquisition (SBA) technologies for application to integrated aerospace systems design and analysis. Developed an enhanced collaborative technology architecture supporting the tenets of SBA. Demonstrated the enhanced architecture in an experiment for collaborative spiral requirements and capability

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**4917 Collaborative Information Tech** |

based planning.

(U) In FY 2004: Not Applicable.

(U) In FY 2005: Not Applicable.

| | | | |
|---|---|---|---|
| (U) Total Cost | 15.530 | 7.746 | 5.637 |

**(U) C. Other Program Funding Summary ($ in Millions)**

| | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| (U) Related Activities: | | | | | | | | | |
| (U) PE 0603789F, C3I Advanced Development. This project has been coordinated through the | | | | | | | | | |
| (U) Reliance process to harmonize efforts and eliminate duplication. | | | | | | | | | |

**(U) D. Acquisition Strategy**

Not Applicable.

| Exhibit R-2a, RDT&E Project Justification | | | DATE: February 2004 |
|---|---|---|---|
| BUDGET ACTIVITY: 02 Applied Research | PE NUMBER AND TITLE: 0602702F Command Control and Communications | PROJECT NUMBER AND TITLE: 5581 Command and Control (C2) Technology | |

| Cost ($ in Millions) | | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 5581 | Command and Control (C2) Technology | 24.730 | 26.716 | 33.764 | 34.970 | 39.741 | 36.599 | 37.953 | 0.000 | 0.000 |
| | Quantity of RDT&E Articles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

**(U) A. Mission Description and Budget Item Justification**

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) B. Accomplishments/Planned Program ($ in Millions)** | FY 2003 | FY 2004 | FY 2005 |
|---|---|---|---|
| (U) MAJOR THRUST: Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems. | 4.930 | 6.576 | 7.393 |
| (U) In FY 2003: Developed tools that will automate intelligent extraction, correlation, and classification of link patterns for discovering relevant linkages between entities. Developed enhanced reasoning techniques for complex inferencing and performance of C2 systems. | | | |
| (U) In FY 2004: 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) In FY 2005: 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. Continue development of ultra-large all-source information repositories and associated privacy protection technologies. | | | |
| (U) | | | |
| (U) MAJOR THRUST: Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels faced by the Expeditionary Aerospace Force. | 7.031 | 7.385 | 8.228 |

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**5581 Command and Control (C2) Technology** |

(U) In FY 2003: Developed 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 (AOC) 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.

(U) In FY 2004: 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 AOC 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) In FY 2005: 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 AOC C2 process. Continue to develop advanced interactive displays suitable for deployment with C2 applications and command centers. Initiate development of advanced techniques and AOC-based applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Continue to develop technologies to improve the fidelity, accuracy, and interconnection of computer-based wargames used to prepare contingency plans and response strategies.

(U)

| | | | |
|---|---|---|---|
| (U) MAJOR THRUST: Investigate and develop technologies to securely share information via publish, subscribe, and query within a coalition environment. Note: Broken out from the next major thrust below due to the increased emphasis on C2 in a coalition environment. | 0.000 | 0.000 | 5.276 |

(U) In FY 2003: Not Applicable.

(U) In FY 2004: Not Applicable.

(U) In FY 2005: Initiate investigation and development of technologies to dynamically filter and fuse information and produce customized coalition information products. Start development of techniques and tools that will ensure availability, integrity, and survivability of information within a coalition Joint Battlespace Infosphere (JBI). Initiate development of technology approaches that will rapidly incorporate coalition force structure units into an operational infosphere.

(U)

| | | | |
|---|---|---|---|
| (U) MAJOR THRUST/CONGRESSIONAL ADD: Investigate and develop technologies to implement flexible, secure, and survivable information management and distribution services to enable a JBI. Note: This effort includes $3.0 million in FY 2003 Congressional Add funding for Information Management for Crisis Response. | 6.238 | 2.671 | 2.904 |

(U) In FY 2003: Developed techniques for integrating legacy client-server C2 systems into the next generation of agile, web-enabled information management environments. Investigated approaches to enable a JBI to service thousands of

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**5581 Command and Control (C2) Technology** |

participating C2 and intelligence, surveillance, and reconnaissance clients exchanging millions of information objects. Investigated and developed technologies that will ensure availability, integrity, and survivability of information within a Joint Battlespace Infosphere.

(U) In FY 2004: Continue to develop techniques and tools for integrating legacy client-server command and control (C2) systems into a publish, subscribe, and query infosphere.

(U) In FY 2005: Complete development of techniques and tools for integrating legacy client-server C2 systems into a publish-subscribe and query infosphere. Continue to investigate and develop publish, subscribe, and query technologies enabling a secure infosphere that can support thousands of C2 and intelligence, surveillance, and reconnaissance clients, and can operate within a coalition warfighting environment. Investigate techniques to optimize publish, subscribe, and query mechanisms within bandwidth limited environments.

(U)

| | | | |
|---|---|---|---|
| (U) MAJOR THRUST/CONGRESSIONAL ADD: Develop next generation monitoring, planning, execution, and assessment technologies and tools enabling distributed aerospace commanders to efficiently and collaboratively develop effects based campaigns. Note: This effort includes $1.0 million of FY 2004 Congressional Add funding for Effects-Based Planning Execution Assessment. | 6.531 | 10.084 | 9.963 |

(U) In FY 2003: 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 and 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 tools to visualize the probability of success of qualitatively different courses of action. Developed intelligent agent technologies capable of supporting joint/coalition C2 systems for various missions. Developed and assessed active template technologies for use in dynamic mobile C2 applications. Developed tools to increase situational awareness through intelligent information push and pull in dynamic environments.

(U) In FY 2004: 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 command and control (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) In FY 2005: 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 incorporating

| Exhibit R-2a, RDT&E Project Justification | | DATE February 2004 |
|---|---|---|
| BUDGET ACTIVITY<br>**02 Applied Research** | PE NUMBER AND TITLE<br>**0602702F Command Control and Communications** | PROJECT NUMBER AND TITLE<br>**5581 Command and Control (C2) Technology** |

developments in decision support science. Complete development of tools to visualize the probability of success of qualitatively different courses of action. Continue to develop intelligent information systems capable of supporting joint/coalition command and control (C2) for various missions. Continue to develop and assess active template and semantic ontology technologies for use in C2 applications. Continue to develop tools to increase situational awareness through intelligent information push and pull in dynamic environments. Initiate investigation of intelligent information processing techniques to enhance the C2 decision making process.

| | | | | |
|---|---|---|---|---|
| (U) | Total Cost | 24.730 | 26.716 | 33.764 |

**(U) C. Other Program Funding Summary ($ in Millions)**

| | FY 2003 Actual | FY 2004 Estimate | FY 2005 Estimate | FY 2006 Estimate | FY 2007 Estimate | FY 2008 Estimate | FY 2009 Estimate | Cost to Complete | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| (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.