

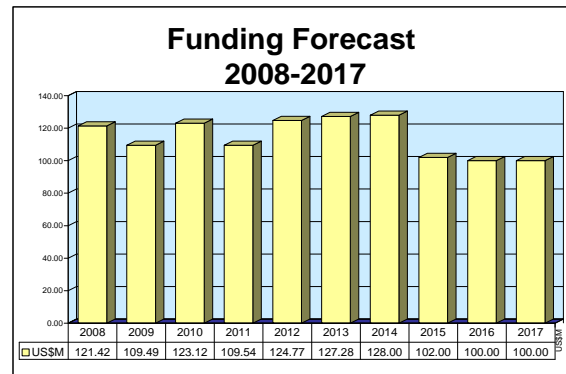
# ARCHIVED REPORT

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## Command, Control and Communications (C3)

### Outlook

- Forecast International forecasts that the U.S. Air Force will invest approximately \$1.15 billion over the next 10 years on its Command, Control and Communications (C<sup>3</sup>) program
- In FY08, look for Project 4594 to begin developing technology demonstration plans for active intelligence, surveillance, and reconnaissance (ISR) defense on wired networks



### Orientation

**Description.** The Command, Control and Communications (C<sup>3</sup>) program is a United States Air Force research and development program that develops the technology base for U.S. Air Force C<sup>3</sup>.

**Status.** Ongoing research and development.

**Application.** The dissemination of information across military force elements.

#### Sponsor

U.S. Air Force  
Rome Air Development Center  
Griffiss AFB, NY  
USA

Rome Air Development Center Division  
Hanscom AFB, MA  
USA

### Contractors

Contractor(s) not selected or not disclosed.

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to [www.forecastinternational.com](http://www.forecastinternational.com) (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

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## Command, Control and Communications (C<sup>3</sup>)

### Technical Data

The U.S. Air Force PE#0602702F – Command, Control and Communications (C<sup>3</sup>) program comprises four projects.

**Project 4519 – Communications Technology.** The U.S. Air Force requires technologies that enable assured, worldwide communications and networking. These technologies are to provide en-route and deployed distributed collaborative command, control, surveillance, reconnaissance and exploitation. This project provides the technologies for the following:

- multilevel, 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.

Project 4519 also develops technologies for advanced processors and devices, advanced network protocols and services, intelligent communications management and control, advanced communications algorithms, and communication signal processing.

**Project 4594 – Information Technology.** The U.S. Air Force requires technologies that improve and automate its capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project seeks to develop the information technologies required to achieve this capability. As such, This project develops high-payoff embedded information systems technologies for the next

generation of distributed information integration architectures.

**Project 5581 – Command and Control (C<sup>2</sup>) Technology.** Project 5581 develops C<sup>2</sup> technologies that will provide the next generation of weapons systems with better methods of processing and displaying information. Specific technology development in this project focuses on assessing knowledge bases, distributed information systems, and information management and distribution services.

**Project 66SP – Space Optical Network Technology.** This project develops the technology base for the next generation of ultra-wide-bandwidth, multi-channeled, air- and space-based communications networks on and between platforms. This project will explore technologies for developing “photonic chip scale optical” Code Division Multiple Access (CDMA) and Wavelength Division Multiplexed (WDM) transceivers and prototype networks. These technologies, in turn, will demonstrate the benefits of advanced fiber-optic, wireless, platform, and satellite networks that can be built based on them. This project will also develop and demonstrate technology that can be used to integrate current radio frequency (RF) with high-data-rate optical laser communications, along with associated network management techniques, tools and software. These technologies have potential applications for military systems at the theater level, and for the multiplexing of U.S. DoD users onto a common networking infrastructure for reduced manning and logistics.

### Program Review

#### **PE#0602702F: Command, Control and Communications**

**Project 4519 – Communications Technology.** In FY01, Project 4519 developed survivable information and networking technologies, as well as networking technologies for globally distributed information systems. In FY02, the project developed technologies to ensure the security of sensitive and encrypted Air Force communications and information systems.

In FY03, Project 4519 developed securely managed enterprise network technology to assure network services across multiple domains. In FY04, the project continued developing technologies to improve the quality of globally distributed information systems (e.g.,

Joint Battlespace Infosphere). This effort was completed in FY06.

In FY05, Project 4519 completed the development of securely managed enterprise network technology to assure network services across multiple security domains.

In FY07, Project 4519 completed development of capabilities for self-organizing, self-healing, autonomous networking. Also in FY07, the project developed, tested, and assessed exploratory radio frequency and optical information transfer technologies.

In FY08, Project 4519 continues to develop airborne content-based delivery networking (CBDN), synergistic

Command, Control and Communications (C<sup>3</sup>)

with the Joint Tactical Radio System Wideband Networking Waveform's Network Service Layer.

**Project 4594 – Information Technology.** In FY01, Project 4594 developed information exploitation technologies for imagery and electronic signals to increase global awareness. In FY02, the project investigated information extraction techniques to populate automatically very large knowledge-base systems. In FY03, Project 4594 continued developing multi-source fusion techniques for continuous tracking of militarily significant vehicles in the battlespace – an effort that continued into FY05.

In FY04, Project 4594 developed techniques that can be used to quantitatively evaluate fusion algorithms that support the analysis of information. In FY06, Project 4594 tested and analyzed vehicle motion models in an effort to “associate the current location of vehicles with a future state.”

In FY07, Project 4594 evaluated fusion management and advanced the state-of-the-art in track-to-track fusion techniques. Also in FY07, the project worked on developing intelligence, surveillance, and reconnaissance management techniques that optimize the fusion process for identification and continuous tracking of military significant threats. This work continued into FY08.

Among other efforts in FY08, Project 4594 is initiating the development of technology demonstration plans for active intelligence, surveillance, and reconnaissance (ISR) defense on wired networks for an adaptive response to multiple, coordinated, sustained attacks.

**Project 5581 – Command and Control (C<sup>2</sup>) Technology.** In FY01, Project 5581 developed and evaluated advanced display and human-computer interface technologies for current and next-generation C<sup>2</sup> systems. In FY02, the project 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.” In FY03, Project 5581 developed advanced interactive displays suitable for deployment with C<sup>2</sup> applications and command centers.

In FY04, Project 5581 continued developing tools that will automate the intelligent extraction, correlation, and classification of link patterns for use in determining relevant linkages between entities. In FY05, the project developed technologies for the rapid development and application of next-generation knowledge bases for aerospace C<sup>2</sup> systems.

In FY06, Project 5581 completed an investigation of technologies that could be used to dynamically filter and fuse information and produce customized coalition information products.

In FY07, Project 5581 completed the development of techniques and tools that will ensure the availability, integrity, and survivability of information within a coalition net-centric environment. Also in FY07, the project completed development of technologies for the rapid development and application of next-generation knowledge bases for aerospace C<sup>2</sup> systems.

In FY08, Project 5581 continues to develop technologies to improve the fidelity, accuracy, and interconnection of computer-based wargames used to prepare contingency plans and response strategies.

**Project 66SP – Space Optical Network Technology.** In FY07, Project 66SP designed and developed waveform, coding, management, and atmospheric mitigation technologies for use in a combined RF/laser communications terminal. Also, the project completed demonstration of a highly integrated multi-gigabit optical network with a 4 x 4 optical data router and optical backbone interface chips.

In FY08, Project 66SP is initiating the design and development of a 40-channel multi-wavelength optical network for onboard air and space applications. In other efforts, the project is designing and developing higher throughput RF waveform datalink technology for application in adverse weather conditions.

## Funding

### U.S. FUNDING

	FY07 (Actual) QTY	FY07 (Actual) AMT	FY08 (Req) QTY	FY08 (Req) AMT	FY09 (Req) QTY	FY09 (Req) AMT	FY10 (Req) QTY	FY10 (Req) AMT
<b>RDT&amp;E (U.S. Air Force)</b>								
PE#0602702F	-	125.79	-	121.42	-	109.49	-	123.12

## Command, Control and Communications (C<sup>3</sup>)

	FY11 (Req) <u>QTY</u>	FY11 (Req) <u>AMT</u>	FY12 (Req) <u>QTY</u>	FY12 (Req) <u>AMT</u>	FY13 (Req) <u>QTY</u>	FY13 (Req) <u>AMT</u>
<b>RDT&amp;E (U.S. Air Force)</b>						
PE#0602702F	-	109.54	-	124.77	-	127.28

All \$ are in millions.

Source: U.S. Department of the Air Force FY09 RDT&E Descriptive Summary

## Contracts/Orders & Options

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No specific contract awards have been identified.

## Timetable

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<u>Year</u>	<u>Major Development</u>
FY82	Laser photoscanning technique developed
FY84	Laser multiplexer developed
FY85	Low probability of exploitation modem developed and tested
FY86	Dual-polarized S-band tracking radar system developed
FY87	TWT for millimeter-wave space communications developed
FY89	Design of radomes completed; design of digital optical computers completed
FY90	VHSIC speech enhancement unit developed
FY91	Effectiveness of EW manipulative deception techniques demonstrated
FY92	Development of innovative antenna and electronics technologies initiated
FY93	Integration of neural networks into the Imagery Exploitation 2000 testbed
FY94	Development of real-time technologies to increase C <sup>2</sup> capabilities
FY96	Initiation of development of multimedia analyzing techniques
FY97	Development of Phase 1 ultra-high-speed multiple access testbed for switching architecture
FY98	Intelligent information C <sup>2</sup> technologies developed for use in time-critical air operations
FY99	Development and demonstration of brassboard reconfiguration of multiple distributed sets of nodes for C <sup>2</sup> systems
FY01	Project 4519 develops survivable information and networking technologies
FY02	Project 4594 develops approaches for synthesizing a common data representation from multiple sources for improved situational awareness
FY03	Project 4519 develops securely managed enterprise network technology to assure network services across multiple domains
FY04	Project 4917 develops dynamically reconfigurable aerospace systems using adaptive computing techniques
FY05	Project 4594 develops and evaluates fusion technologies for enemy threat prediction based on the use of multi-source fusion
FY06	Project 5581 completes investigation of technologies for use in dynamically filtering and fusing information and producing customized coalition information products
FY07	Project 66SP completes demonstration of highly integrated multi-gigabit optical network with a 4 x 4 optical data router and optical backbone interface chips
FY08	Project 4519 continues development of airborne CBDN, synergistic with the JTRS Wideband Networking Waveform's Network Service Layer

## Worldwide Distribution/Inventories

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This is a **U.S. Air Force** program.

Command, Control and Communications (C<sup>3</sup>)

## Forecast Rationale

The U.S. Air Force's Command, Control and Communications (C<sup>3</sup>) program develops the technology base for U.S. Air Force C<sup>3</sup>.

### *\$1.15 Billion to be Invested in C<sup>3</sup> Program*

As indicated by the **Ten-Year Outlook** chart, Forecast International projects that the U.S. Air Force will spend some \$1.15 billion over the next 10 years on its Command, Control and Communications (C<sup>3</sup>) program. The U.S. Air Force's strong investment in this program reflects its belief that advances in command, control and communications are required to increase warfighter readiness by providing the right information, at the right time, anywhere in the world.

The C<sup>3</sup> program comprises four projects: Communications Technology, Information Technology, Command and Control Technology, and Space Optical Network Technology.

The Communication Technology project develops assured and secure communications technology, and the capability to attack and exploit adversarial information and information systems. The Information Technology project develops improved and automated capabilities to generate, process, fuse, exploit, interpret, and disseminate timely and accurate information. The Command and Control Technology project investigates and develops planning, assessment, and knowledge base technologies to allow the warfighter to prepare for tomorrow's conflicts. Finally, the Space Optical Network Technology project develops the technology base for the next generation of ultra-wide- bandwidth, multi-channeled, air- and space-based communications networks on and between platforms.

In spite of the current budget tightening in Washington, the U.S. Congress appears prepared to solidly fund the U.S. Air Force's Command, Control and Communications (C<sup>3</sup>) program over the next decade.

## Ten-Year Outlook

ESTIMATED CALENDAR YEAR RDT&E FUNDING (in millions \$)												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
MFR Varies												
<b>Command, Control and Communications (C3) Military &lt;-&gt; United States &lt;-&gt; Air Force</b>												
	2213.85	121.42	109.49	123.12	109.54	124.77	127.28	128.00	102.00	100.00	100.00	1,145.62
<b>Total</b>	2,213.85	121.42	109.49	123.12	109.54	124.77	127.28	128.00	102.00	100.00	100.00	1,145.62