

# ARCHIVED REPORT

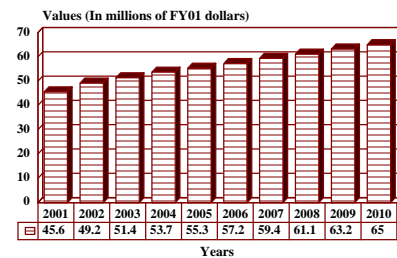
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## Surveillance Technology (US Air Force) - Archived 01/2002

### Outlook

- Project 4506 scheduled to be completed by year-end 2000
- Project 4506 activities to be transferred to PE#0602702F - Project 4594 and PE#0602204F - Project 7622 in 2001

Forecast Funding Levels  
2001 - 2010



### Orientation

**Description.** This project develops advanced ground and airborne system concepts, as well as the technology required for future US Air Force surveillance missions.

#### Sponsor

US Air Force - Rome Air Development Center  
 Griffiss AFB  
 Rome, New York (NY)  
 USA

#### Prime Contractors

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 347 Ferst Drive  
 Atlanta, Georgia (GA) 30332  
 USA  
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 Fax: +1 404 894 9081  
 Web site: [www.gatech.edu](http://www.gatech.edu)

#### Lucent Internetworking Systems

(formally Ascend Communications)  
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 Tel: +1 703 925 4100  
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E-mail: [info@ascend.com](mailto:info@ascend.com)

Northrop Grumman Corp - ES<sup>3</sup>  
 1580-A West Nursery Road  
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#### Sensis Corp

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 E-mail: [info@sensis.com](mailto:info@sensis.com)

#### Contractors

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 Tel: +1 800 448 6505  
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 Web site: [www.partech.com](http://www.partech.com)

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Vanguard Research Inc  
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Fax: +1 408 438 8930  
Web site: www.vrisv.com

**Status.** Ongoing technology base provision for other US Air Force (USAF) programs.

**Total Produced.** Not applicable.

**Application.** This project supports USAF requirements for advanced ground and airborne system concepts and technologies to improve surveillance capabilities.

**Price Range.** Indeterminate

## Technical Data

PE#0602702F-Command, Control, & Communications

Project 4506 - Surveillance Technology. This project was the original project dedicated to surveillance technology research, development, testing and evaluation (RDT&E). It involves the development of performance upgrades to existing systems, advanced line-of-sight radar, surveillance technologies to counter low observable threats, and counter-countermeasure technologies to meet electronic warfare threats directed against surveillance systems.

This project also explores methods for demonstrating radar and electro-optical surveillance systems for detection, tracking and identification of low-cross-section atmospheric targets in a severe jamming environment. Areas of concentration are low-observable surveillance, passive surveillance, and advanced processing technologies. Technologies being developed include advanced passive bistatic radar, spatial coordinate and time processing techniques, sensor and data fusion, signal generation, and advanced array antennas.

This project is expected to completed by year-end 2000. Funding for these efforts are scheduled to be transferred

and continued under Project 4594 - Information Technology (under the same PE number) and Project 7622 - RF Sensors & Countermeasures Technology (under PE#0602204F).

Project 4594 - Information Technology. This project is expected to begin surveillance technology efforts in 2001 when funding is transferred to it from Project 4506. Project 4595 primarily focuses upon the development of technologies that will improve and automate USAF capabilities in the areas of generating, processing, fusing, disseminating, interpreting and exploiting timely and accurate information.

PE#0602204F - Aerospace Sensors

Project 7622 - RF Sensors & Countermeasures Tech.

This project will also have surveillance technology efforts added to it in 2001. This project essentially determines the feasibility of technology for reliable, all-weather, reconnaissance and precision strike radio frequency (RF) sensors and electric combat systems. It also develops RF warning and countermeasure technology for advanced electronic combat applications and exploits emerging technologies to provide increased capability for radar warning, RF electronic combat, and electronic intelligence applications.

## Variants/Upgrades

This program provides the technology base that enables the US Air Force to upgrade existing capabilities.

## Program Review

This program effort is a multifaceted continuing project covering the development of a broad spectrum of technologies to enhance the surveillance capabilities of the US Air Force (USAF). Highlights or key activities conducted since the mid-1980s are indicated below.

PE#0602702F

Project 4506 - Surveillance Technology. In 1984, 200 phase-shift-only modules were delivered and tested,

breadboard Monolithic Microwave Integrated Circuit (MMIC) transmit/receive modules tested and transition programs were initiated. In 1985, a lightweight, phased array, space-based radar antenna design was successfully demonstrated with a sub-scale 6x6 ft array. Other project activities involved the design completion of a conformal (flush-mounted) array antenna for an advanced airborne surveillance radar; the design completion and manufacture of a passive, lightweight,

surveillance radar decoy; the completion of a VHSIC-based signal processor; and demonstrations of a G/H-band traveling wave tube for tactical radar.

In 1986, a dual-polarized E/F-band tracking radar was developed for the Rome Air Development Center Surveillance Lab. Additional 1986 activities included the development of a Phased Array Lens Demonstration space-based radar antenna; development of a monolithic chip; development of rule-based data processing techniques; and verification of simulation models for low observable threats.

Efforts continued in 1987 in support of space-based radar technologies. In addition, testing of a 2x3 ft active phased array was completed; beam-forming alternatives, radar control techniques, processing techniques, and dual-band T/R modules were developed; and efficient, low-cost traveling wave tubes were fabricated and tested. Regarding MMIC modules, development proceeded in the areas of power conditioning, chip yield improvement, and chip level integration of analog-to-digital conversion (required for digital beam forming).

1989 accomplishments included a demonstration of the space-based radar adaptive nulling capabilities to counter the high-speed adaptive jammer threat; the completion of an evaluation of a multi-domain signal processing algorithm for radar systems; the delivery of high-power D-band T/R modules for ground phased array radar applications; and the development of the multispectral system testbed to assess fusion algorithm performance.

The transition of the pulse power module tester to industry was completed in 1990, as was the instrumentation of the D, E/F, and G/H-band radar in a multispectral testbed. Also completed was a fusion capability demonstration and the development of a G/H-band, digital beamforming, phased-array testbed.

Improving current simulation/analysis tools for space radar was the major project focus during 1991. Other efforts included a prototype multiband T/R demonstration; real-time adaptive multispectral sensor fusion and cueing techniques development; multispectral T/R modules for passive or active sensors development and demonstration of for low-observable surveillance; signal processing algorithms; and a super angular resolution target detection capability through the application of digital beam forming techniques.

In 1992, an airborne, multichannel, phased array, high-fidelity, data collection system was implemented. This system provides the data necessary to more fully validate methods of detecting small targets within clutter and jamming environments. Meanwhile, various

multimode, multispectral, airborne sensor suite designs and technologies were validated. These all serve to provide flexible surveillance of atmospheric, round, and tactical missile targets.

Efforts were made in 1993 to develop and demonstrate sensor technology algorithms through analysis of real-time multichannel airborne measurements. This was done in order to provide small target detection in a complex electromagnetic background. Additionally, technologies were developed to enable electronic support measures (ESM)/bistatic detection, tracking, and classification in severe clutter and jamming environments and the integration of off-board and on-board sensor requirements into high-confidence target detection, fusion, and classification technologies.

1995 efforts to improve bistatic target detection and tracking of low-cross section targets resulted in a remarkable suppression of background clutter. Additional project achievements included the fabrication of a breadboard wafer scale signal processor multichip module; the demonstration of adaptive threshold control for enhanced detection of low-cross section targets; and the development of wideband receiver modules for employment in a bistatic radar system testbed. Phase 1 development of the multichip module wafer scale signal processor was completed during 1996. Phase 2 was completed in 1997.

During 1996, technologies and concepts for passive surveillance were developed, with an emphasis on ESM and bistatics, for enhanced detection, tracking, and classification in severe clutter and jamming environments. Studies were initiated in support of the advanced airborne radar and bistatic fusion processing technology demonstrations.

In 1997, a design evaluation of the advanced airborne radar technology demonstration was conducted; data collection, hardware integration, and software development for the static wing testbed was completed; a ground-based field test of the static wing testbed was conducted; and special-purpose artificial intelligence machines for both expert and blackboard systems were developed.

In 1998, Project 4506 activities included development, testing, and demonstration of high-speed signal processor processing technologies and algorithms. These technologies and algorithms were focused on enhancing small target detection in a complex electromagnetic background. Also in 1998, technologies and concepts for passive surveillance were developed and tested.

Efforts in 1999 included an analysis of sensor performance, and the development and demonstration

of the software of the synthetic aperture radar (SAR) and the moving target indicator (MTI). Technologies and concepts for passive surveillance, with an emphasis on ESM and airborne bistatics, were developed for UAV platform applications. Modernized real-time, multispectral, and multisensor fusion techniques for enhanced air and space situational awareness were developed, tested and demonstrated. Architecture for an affordable, scaleable, teraflop information processor was designed and augmented to support rapid fusion processing.

In 2000, the development of technologies and concepts for passive surveillance were scheduled to continue. Space-based radar subsystem technologies and concepts were developed and evaluated. Operational algorithms processing massive global databases were demonstrated and assessed.

Beginning in 2001 this program is expected to undergo a large alteration. Funding for surveillance technologies is scheduled to be transferred and continued under Project 4594 - Information Technology (under the same PE number) and Project 7622 - RF Sensors & Countermeasures Technology (under PE#0602204F).

Project 4594 - Information Technology. This project is expected to begin surveillance technology efforts in 2001 when funding is transferred to it from Project 4506. Project 4595 primarily focuses upon the development of technologies that will improve and automate USAF capabilities in the areas of generating, processing, fusing, exploiting, interpreting, and disseminating timely and accurate information.

Scheduled activity under this program in 2001 is expected to include development of information

exploitation technologies; development of multisensor, multimedia analytical techniques to automatically detect and track the presence and location of objects; investigation of advanced information dissemination techniques; development and evaluation of innovative multisensor collaborative fusion technologies and multisensor technologies for near-real-time cueing and retasking of sensors; development of global information base technologies to achieve situational awareness at all command levels; and development of embedded, affordable, scalable, teraflop processing technologies for real-time information fusion and exploitation.

**PE#0602204F - Aerospace Sensors**

Project 7622 - RF Sensors & Countermeasures Tech.

This project will also have surveillance technology efforts added to it in 2001. This project essentially determines the feasibility of technology for reliable, all-weather, reconnaissance and precision strike radio frequency (RF) sensors and electric combat systems. It also develops RF warning and countermeasure technology for advanced electronic combat applications and exploits emerging technologies to provide increased capability for radar warning, RF electronic combat, and electronic intelligence applications.

Planned 2001 activity under this project includes the development of aerospace microwave sensor technologies, of high fidelity analytical tools, of aerospace microwave processing algorithms, of adaptive processing techniques that incorporate knowledge-based approaches, and of technology used to detect and attack concealed targets. This project is also expected to conduct airborne radar data collection and perform laboratory analysis for application of advanced surveillance techniques.

## Funding

	<b>US FUNDING</b>					
	<b>FY99</b>		<b>FY00 (Req)</b>		<b>FY01 (Req)</b>	
	<b>QTY</b>	<b>AMT</b>	<b>QTY</b>	<b>AMT</b>	<b>QTY</b>	<b>AMT</b>
<b><u>RDT&amp;E (US Air Force)</u></b>						
PE#0602702F - C <sup>3</sup>						
Project 4506						
Surveillance						
Technology <sup>(a)</sup>	-	11.1	-	5.1	-	0
Project 4594						
Information						
Technology*	-	0	-	0	-	22.5
PE#0602204F						
Project 7622						
RF Sensors &						
Countermeasures						

	FY02 (Req)		FY03 (Req)		FY04 (Req)		FY05 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
	<b>RDT&amp;E (US Air Force)</b>							
Technology*	-	0	-	0	-	0	-	23.1
PE#0602702F - C <sup>3</sup>								
Project 4506 <sup>(a)</sup>	-	0	-	0	-	0	-	0
Project 4594*	-	24.7	-	25.0	-	25.4	-	25.8
PE#0602204F								
Project 7622*	-	24.5	-	26.4	-	28.3	-	29.5

All US\$ are in millions.

Source: FY2000/2001 US DoD Biennial RDT&E Descriptive Summary (R-1)

<sup>(a)</sup> Beginning in 2001 Project 4506 - Surveillance Technology funding will be transferred to PE#0602702F - Project 4594 - Information Technology and to PE0602204F - Project 7622 - RF Sensors and Countermeasures Technology.

\*Funding under Project 4594 and Project 7622 is not anticipated to be allocated solely for Surveillance Technology activities. However, it is impossible to break out the exact amount of funding that these activities will receive; thus the drastic increase in annual funding allotments.

## Recent Contracts

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Specific contracts related to this program have always been difficult to identify. Funding is typically provided by another program dealing with a specific system that uses the new technology developed under this program element to enhance or modify that system.

## Timetable

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<u>Year</u>	<u>Major Development</u>
FY84	200 phase-shift-only modules tested; testing on breadboard MMIC transmit/receive modules
FY85	Completion of a conformal array antenna using MMIC; digital beam-forming technology initiated
FY86	Development of dual-polarized S-band tracking radar begun; validation of simulation models
FY87	Active phased array tested
FY90	Development of C-band digital beamforming phased array testbed
FY91	Demonstration of prototype multiband T/R module for space system
FY92	Airborne multichannel phased array system for detecting small targets implemented
FY93	Integrated transmit and receive module demonstrated
FY94	Digital beamformer receiver developed
FY95	Breadboard wafer scale signal processor multichip module fabricated
FY96	Studies initiated on advanced airborne radar and bistatic fusion processing technology
FY97	Tests and demonstrations of bistatic passive surveillance and imaging technology
FY98	Initial advanced airborne surveillance program demonstration tests conducted
FY99	Enhanced target detection capabilities through adaptive and jamming environments developed
FY01	Project 2504 funds transferred to two different projects under PE#0602702F and PE#0602204F

## Worldwide Distribution

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This is a **US Air Force** program only.

## Forecast Rationale

The US Air Force project dedicated to developing advanced ground and airborne system concepts and technology required for future USAF surveillance missions is still receiving a fair amount of funding and support. However, as of 2001, some drastic changes are expected to be taken with the program itself.

According to the US Department of Defense (DoD) FY2000/2001 Biennial Descriptive Summary (R-1), the original project used for surveillance technology efforts, PE#0602702F - Project 4506, will be completed by year-end 2000. However, this does not mean that any and all surveillance technology applications will be completed as well. In fact, the activities previously performed under this project are to be transferred to PE#0602702F - Project 4594 - Information Technology and PE#0602204F - Project 7622 - RF Sensors & Countermeasures Technology, beginning in 2001.

The transfer of Surveillance Technology activities and funding is reportedly taking place so that the USAF will be able to align its projects with the Air Force Research Laboratory organizational structure.

While the change in where these activities receive their funding isn't expected to alter the actual activities, the amount of funding is expected to rise dramatically. It is not known if this funding increase will specifically affect surveillance technology activities. However, it is believed that a good portion of this funding will be used for activities other than the ones for surveillance technology.

All in all, the surveillance technology program is expected to continue much as it has in the past. Now, however, the program will take place under two PE numbers instead of one.

## Ten-Year Outlook

ESTIMATED CALENDAR YEAR FUNDING (\$ in millions)													
Designation	Application	Thru 00	High Confidence Level				Good Confidence Level			Speculative			Total 01-10
			01	02	03	04	05	06	07	08	09	10	
SURVEILLANCE TECHNOLOGY (USAF)	TECHNOLOGY BASE (US AIR FORCE)	141.900	45.600	49.200	51.400	53.700	55.300	57.200	59.400	61.100	63.200	65.000	561.100

NOTE: Funding specifically for Surveillance Technology efforts is impossible to break out of total funding. Please see **Funding** section for full explanation.