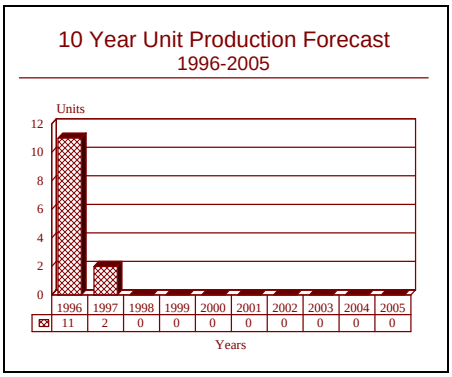
Joint Surveillance System - Archived 8/97

Outlook

- ARSR-4 radar in production
- 42 ARSR-4s are to be produced
- Approximately 10 AICUs are to be produced



Orientation

Description. The Joint Surveillance System (JSS) is an air defense surveillance and C^2 system for North America.

Sponsor

US Air Force
Electronic Systems Center
Hanscom AFB, Massachusetts (MA)
(Management for the Atmospheric Tactical Warning Connectivity)

Materiel Command
Wright-Patterson AFB, Ohio (OH)
(Program management for the JSS Region Operations Control Centers)

Federal Aviation Administration
Washington, DC
(Lead acquisition agency for the FAA/AF Radar Replacement Program)

The Air Force and FAA have established a Joint Program Office at HQ FAA, Washington, DC, for this procurement.

Contractors

Computer Sciences Corp
1200 E. Grand Ave
El Segundo, California (CA) 90245
Tel: +1 310 615 0311
Fax: +1 310 322 9805
(Engineering support)

Continental Page Engineers
Vienna, VA
(Subcontractor to GTE)

Hughes Aircraft Co
7200 Hughes Terrace
PO Box 80028
Tel: +1 310 568 7860
Fax; +1 310 568 6715
Los Angeles, California (CA) 90080-0028
(System design and development; prime contractor for the JSS ROCC/SOCCs)

GTE Government Systems Corp
Systems Operations
100 First Ave.
Waltham, Massachusetts (MA) 02254
Tel: +1 617 466 3510
Fax; +1 617 466 3294
(Communications system)

Input Output Computer Services
Cambridge, Massachusetts (MA)
(SAGE/JSS interface)

Logicon, Inc
Torrance, California (CA)
(Software support service)

TRW Inc
Space & Defense Systems
One Space Park
Redondo Beach, California (CA) 90278
Tel: +1 213 535 4321
(AICU prime contractor)

Westinghouse Electric Corp
Electronic Systems Group
Baltimore-Washington Int'l Airport
PO Box 17319
Baltimore, Maryland (MD) 21203
Tel: +1 410 765 1000
Fax: +1 410 993 8971
(ARSR-4 prime contractor)

Status. ARSR-4 radar in production. Contract awarded in FY91 to TRW for Advanced Interface Control Unit.

Total Produced. ARSR-4 FAA/USAF Final Acceptance of the first implementation site took place at Mt. Laguna, CA, in December 1994. A total of 42 ARSR-4s are scheduled to be produced. The number of AICUs scheduled for production is undisclosed, but is estimated to be approximately 10 units.

Application. JSS has dual application. For the USAF, it provides air surveillance over the North American continent using joint FAA/USAF radar sites and Canadian-based radar sites. In this role it also provides USAF command and control functions for appropriate air defense forces. In civil application, information provided by the common radar net is also provided to FAA facilities to provide en-route monitoring of commercial air traffic.

Price Range. ARSR-4 approximate unit cost is US$6.5 million. AICU unit cost is undisclosed.

Technical Data

Design Features. From the USAF perspective, the Joint Surveillance System (JSS) is an Air Force/FAA program to provide modern command and control of air defense forces by replacing the existing Semi-Automatic Ground Environments (SAGE) Back-Up Interceptor Control (BUIC) and manual air defense systems. The JSS is forecast to be implemented at approximately 1/40th the cost of SAGE, require 5,000 fewer crewmembers, and save about $100 million annually in operating costs.

The Joint Surveillance System (JSS) provides for air surveillance and command and control of air defense forces for airspace sovereignty of North America. A joint use network of FAA and military radar in the Continental US (CONUS), Alaska and Hawaii provides data to six Air Force Region Operations Control Centers (ROCCs) for air defense and to FAA Air Route Traffic Control Centers for air traffic control. The ROCCs are located at the four corners of the continental US, with one more in Hawaii, and another in Alaska.

Two JSS ROCCs were acquired by Canada as a Foreign Military Sale. US and Canadian JSS assets provide warning and threat assessment information to Headquarters, North American Air Defense Command (NORAD).

One ROCC can display coverage for a geographical area of approximately one million square miles and accepts inputs from up to 20 radar sites. Information from the JSS civilian and military radar feed into a combined total of eight ROCCs in which data processing, display, and command and control functions are carried out. The JSS attention is focused on approximately 1,500 of the more than 200,000 flights made each day over the US and Canada. If identification cannot be established by means of correlation with flight plans or communications checks, interceptors are scrambled, with the JSS providing updated flight path information for the intercepting aircraft.

During time of crisis and attack, the ROCCs serve as primary command and control centers. If put out of commission, the command and control function is transitioned to E-3B AWACS aircraft.

The USAF elements of the JSS program are funded under two projects defined under Program Element 0102325F. These projects are described briefly below.

Project 2976 - Joint Surveillance System Connectivity (formerly Atmospheric Tactical Warning Connectivity or ATWC): This project addresses the necessity for providing Over the Horizon - Backscatter (OTH-B), North Warning System (NWS) and US Navy Relocatable Over the Horizon Radar (ROTHR) data to Regional and Sector Operations Control Centers (ROCC/SOCCs) to provide improved airspace control, and to allow selected target information to be forwarded to HQ NORAD for incorporation into raid recognition assessments. The original ARWC effort was to integrate OTH-B, NWS and ROTHR information into the ROCC/SOCCs. The retitled project provides for improvements to strategic air defense command, control and communications by integrating new sensor data and enhancing command center crosstell capabilities. Currently the major focus is on the development of an Advanced Interface Control Unit (AICU) to provide connectivity with OTH-B and ROTHR sensor data.

Project 2996 - FAA/AF Radar: The FAA/AF Radar Replacement (FARR) program will replace existing JSS search, beacon and height finding radar with solid state, three dimensional radar to improve mission performance and reduce operation and maintenance costs. The new radar (ARSR-4s) will be incorporated into the FAA's National Airspace System (since renamed the Aviation System Capital Investment Plan). The FAA will assume ownership and maintenance responsibility, resulting in a savings to the Air Force of approximately $48 million a year in support costs, and over 1,000 critical manpower authorizations.

The locations identified for installation of the ARSR-4 radar are as follows: Maine - Buck's Harbor; Massachusetts - North Truro; New York - Riverhead (LI) and Utica; New Jersey - Gibbsboro; Virginia - Oceana; North Carolina - Fort Fisher; South Carolina - Jedburg; Georgia - Whitehouse; Florida - Patrick AFB, Richmond, Fort Lonesome, Cross City, Tyndall AFB; Louisiana - Slidell, Lake Charles; Texas - Ellington, Oilton, Sonora, Odessa, El Paso; Oklahoma - Oklahoma City; New Mexico - Silver City; Arizona - Phoenix; California - Mount Laguna, San Clemente, Paso Robles, Mill Valley, Crescent City; Guam - Mount Santa Rosa; Hawaii - Mount Kaala; Oregon - Salem; Washington - Makah, Mica Peak; Montana - Lakeside, Malmstorm AFB; North Dakota - Watford City, Finley; Minnesota - Naswauk; Michigan - Empire.

Variants/Upgrades

The initial objective of the JSS program was to upgrade the existing aging system to improve reliability, reduce operating costs and incorporate enhancements to allow connectivity with OTH-B and ROTHR radar sensor data. The subsequent replacement of the existing aging radar with ARSR-4s will result in improved coverage, accuracy, reliability and clutter penetration.

Program Review

Background. The Air Force initially invited industry proposals for the JSS in 1974, with nine companies submitting proposals at that time. A formal RFP was issued in 1976, with only Hughes Aircraft responding. Hughes was eventually awarded the JSS development contract in 1979. In 1980, GTE was also awarded a 10-year communications management contract for JSS. Sensor integration and IOC were completed in FY83.

The first ROCC was tested in 1982 and was formally approved by the Air Force in FY83. All other ROCCs have since reached IOC, the Hawaiian site being the most recent in July 1984. This date also marked the first full year of JSS operation. The overall mission availability at the March AFB ROCC for the year exceeded 99.9 percent, and the same rate would have applied for the entire network had not externally caused power outages occurred at two sites.

Efforts to integrate AWACS, OTH-B radar and NWS began in FY83. Hughes received at least US$150 million in contracts for the JSS from 1979 through the late 1980s. GTE's contract, awarded in FY80, was for US$118 million over a 10-year period to develop and manage the communications portion of the JSS. In FY83, GTE awarded an US$8 million subcontract to Continental Page Engineers to install and maintain a portion of the communications system.

In FY86, studies were conducted of the data processing and display requirements for the Phase II program (see below). Development of alternate architectures to meet these requirements began that year.

In September 1987 GTE Telecommunications Inc received a follow-on five and one-half year award to be the single system manager to enhance the currently installed JSS Contingency Communications System.

Contract value was US$45 million. JSS-FCS provides increased system security, efficiency and capacity; enhanced network trouble-shooting and restoration; and improved information presentation. The company is also handling system design, engineering, installation, testing, training, operation, and maintenance. GTE's subcontractors include Intellect, Novacom, Tellabs, and Telex Federal Systems.

The following sections provide a more detailed description of program activities within each of the two project areas.

Project 2976 - Joint Surveillance System Connectivity (formerly ATWC): As originally configured, the Joint Surveillance System Connectivity (JSSC) project (formerly Atmospheric Tactical Warning Connectivity) developed ROCC hardware/software modifications that allowed OTH-B radar systems and the NWS to be integrated into the JSS ROCCs. This effort also provided for data exchange between Air Force and Navy OTH radar systems and permitted integration of advanced sensor systems. The ATWC RDT&E effort also funded supporting program office activities.

The program consisted of two phases. Phase I accomplished the integration of the OTH-B, ROTHR and NWS into the ROCCs. Phase II provided for the integration of the remaining sensor systems. Hardware modifications expanded the memory capability of the ROCC computers and display processors in order that OTH-B tracks could be displayed to the ROCC operators. The ROCC software modifications made it possible to display OTH-B, ROTHR and NWS data and pass the information to the NORAD Cheyenne Mountain Complex.

The initial ROCC/SOCC computer memory and port expansion was accomplished in FY88 and the initial development prototyping of the ROCC/SOCC OTH-B and ROTHR interface control was completed. In FY89 the initial ROCC/SOCC computer upgrades and integration were completed, OTH-B/ROTHR integration and evaluation continued, procurement documentation and specifications were prepared, and the competitive procurement for the integration hardware and software was initiated.

In FY90 the ATWC program was modified by the addition of the ATWC/Limited Version Advanced Interface Control Unit (LV-AICU). According to a *Commerce Business Daily* notice issued May 10, 1990, the AICU served as an interface between various OTH sensors, ROCCs, SOCCs, and Command Centers. The basic contract awarded to TRW in FY91 included the acquisition of six units. An interim capability, to be completed three to nine months after the award of the contract, was included to support West Coast Radar System (FPS-118 OTH-B) testing. The interim capability system was mechanized by rehosting the Region Operations Control Unit software on two of the six fully capable LV-AICU hardware systems.

The Full Operational Capability (FOC) of the six units delivered under the basic contract was specified to be 12 to 20 months after contract award. The contract also included options for Contractor Logistics Support and hardware options for four units (exercisable six months after contract award), and up to seven additional units (exercisable 18 months after contract award). All hardware options were specified to use LV-AICU developed software and included contractor logistics support requirements.

In FY92, Project 2976 was renamed "Joint Surveillance System Connectivity." Accomplishments during this time period included initiation of AICU testing, installation of Block A upgrades at two CONUS Sector Operation Control Centers (SOCCs), conducting of studies and planned-for improvements in atmospheric warning connectivity, and preparation of the Tethered Aerostat Radar System (TARS) Engineering Change Proposal and the Automated Air Movement Data System (AAMDS) Advanced Change Study Notice (ACSN).

Scheduled activity during FY93 consisted of the following: activation of Block A upgrades of the AICU at five additional SOCCs, including the NORAD System Support Facility (NSSF); achievement of Initial Operational Capability (IOC) and Full Operational Capability (FOC) for the AICU core program; initiation of work on the Engineering Change Proposal to implement the AAMDS; completion of the study on flight plan correlation methods, AICU testing, and the installation of the three remaining AICUs following delivery of the Engineering Change Proposal 5 software modification; and initiation of Contractor Logistics Support for AICUs and permanent hardware/software configuration management procedures.

Work during FY94 through FY95 focused on the provision of system integration support for the AAMDS. Beginning in FY96 and continuing into FY97, support goes specifically to an Enhanced Traffic Management System (ETMS) for the AAMDS. Additionally, support of the program office and of system engineering for this project is ongoing

Project 2996 - FAA/AF Radar Replacement: The FAA/AF Radar Replacement Program (FARR) replaces existing JSS search, beacon and height finding radar with solid state, three-dimensional radar to improve mission performance and reduce operation and maintenance costs. The new radar are incorporated into the FAA Aviation System Capital Investment Plan, and the FAA will assume ownership and maintenance responsibility for

these radar. This will result in an Air Force saving of approximately US$48 million per year. FARR is covered by a November 19, 1984, sub-agreement to the FAA/AF National Agreement (NAT) 711, amended by Amendment #1, dated September 1, 1988.

In mid-1988 IBM Federal Systems Division was selected as the contractor for a US$3.6 billion contract to modernize the computer equipment in the National Air System Upgrade program. The Advanced Automation System (AAS) was, according to an early announcement, to be available in the late 1990s and was to give air traffic controllers more modern computer capacity and flexibility to handle increased air traffic loads. The operation of the upgraded radar being developed under FARR and associated en-route system improvements are closely tied to the performance of this updated computer equipment needed to process the increased information flow from the modernized radar system. Unfortunately, the FAA AAS program has experienced a series of extensive delays and over-runs which make the achievement of previously published availability dates highly unlikely.

FARR project accomplishments in FY88 consisted of the preparation of a joint USAF/FAA specification and the competitive ward of a multiyear contract to Westinghouse in July 1988 for the development of the ARSR-4 radar.

According to Westinghouse, the Westinghouse ARSR-4 is an innovative new approach using a phased array antenna with circular polarization, a proven system for aircraft detection in all weather. A weather channel provides calibrated weather to the controller. A centralized solid-state modular transmitter is located below the antenna platform, enabling maintenance activity while the radar is in operation. The ARSR-4 contains a powerful distributed architecture processor which automatically provides an even computational loading of all its constituent microprocessors.

Please refer to Forecast International's separately prepared **ARSR-4** report for a detailed description of the functional and performance characteristics of this new-generation radar.

During FY89, post-award engineering support to the Joint Program Office continued and site-specific implementation issues were resolved. During FY90 and FY91 further contractor system engineering support for the FARR Joint Program Office (JPO) was provided.

Accomplishments during FY92 included the purchase of eight FARR radar, support for contractor system engineering for the FARR JPO, engineering support for site preparations and radar production, and continued interoperability evaluations and commissioning preparation support.

Activity during FY93 included the purchase of the final six FARR radar (out of a total of 39 operational and one training site radar); delivery of two of the radar; continued contractor system engineering support for the FARR JPO; and continued site support, environmental impact studies, and the development of site design and interoperability evaluations.

After a series of program delays, FY94 saw the joint final acceptance by the USAF/FAA of the ARSR-4 first implementation site at Mt. Laguna, California. First site acceptance paved the way for the beginning of full-scale production of the remaining ARSR-4s currently on order from Westinghouse.

Radar production, installation, test and system checkout has been ongoing and will continue through FY97. Test support for FARR JPO was continued in FY95 and is ongoing through FY97. Interoperability evaluations and commissioning support were continued in FY96 and are ongoing through FY97.

Funding

	US FUNDING							
	FY94		FY95		FY96		FY97 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USAF)								
PE0102325F								
Project 2976								
JSS Connectivity	-	0.7	-	0.6	-	0.6	-	0.6
Project 2996								
FAA/AF Radar								
Replacement	-	2.3	-	2.0	-	4.1	-	3.8
Total RDT&E	-	3.0	-	2.6	-	4.7	-	4.4

	FY98 (Req)		FY99 (Req)		FY00 (Req)		FY01 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USAF)								
PE01102325F								
Project 2976								
JSS Connectivity	-	0.7	-	0.7	-	0.7	-	0.7
Project 2996								
FAA/USAR Radar								
Replacement	-	2.0	-	2.0	-	1.6	-	1.7
Total RDT&E	-	2.7	-	2.7	-	2.3	-	2.4

All US$ are in millions.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
GTE Telecom	45.0	Sep 1987 - Follow-on JSS Full Communications Service (FCS) upgrade contract. (DCA200-85-H-0140)
Westinghouse	271.6	Jul 1988 - Contract for 40 ARSR-4 radar, with an option for 12 more (Contract number not available)
Westinghouse	13.0	Jul 1991 - Contract option picked up by the US Navy for two ARSR-4s (Contract number not available)
TRW Inc	Unavailable	FY91 - Contract for undetermined number of AICUs (Contract number not available)

Timetable

	1974	Request issued for letters of intent for JSS concept
	FY74	First JSS procured funding
	1975	RFP released for engineering support
	FY76	First JSS RDT&E funding procured
	1977	Joint US/Canadian SPO established
	1977	Design contract awarded to Hughes
	FY77	First two ROCCs became operational
	FY78	Last two continental US ROCCs became operational
	FY79	BUIC phased out
	1979	Production contract awarded to Hughes
	FY80	GTE awarded contract to manage the communications portion of JSS
	1980	First radar site became operational
	1981	First ROCC became operational
	1982	First ROCC tested. Hawaiian ROCC contracted
	1983	Sensor integration completed and IOC for JSS
	1984	Hawaiian ROCC IOC. FAA became lead acquisition agency, FAA/AF Radar Replacement Program
	FY85	OTH-B radar and NWS integrated into the ROCCs
	FY86	Data processing and display requirements studied Phase II
	FY87	Phase I hardware procured. Alternate architectures for Phase II evaluated, one chosen.
Jul	1988	ARSR-4 contract awarded to Westinghouse
	FY89	Completed initial ROCC/SOCC computer upgrades/integration
	FY91	US Navy optioned two ARSR-4s
	FY91	Contract for AICU equipment awarded

	1993	First delivery of ARSR-4s scheduled
Dec	1994	ARSR-4 first site implementation accepted
	1996	ARSR-4 last site implementation to be completed
	FY96	Full Operational Capability to be achieved

Worldwide Distribution

The JSS program upgrades of the ROCCs/SOCCs are shared with **Canada** on a reimbursable basis as part of the 1985 North American Air Defense Modernization MoU signed by the US Secretary of Defense and the Canadian Minister of Defense. Participation by Canada in the MoU allows the Canadians to implement cost effective and operationally consistent changes to their ROCCs. At present there are no other international commitments or cost sharing initiatives in place pertaining directly to the JSS upgrade program.

In the fall of 1994, however, Westinghouse announced the sale of at least two W-2100 radar, a derivative of the ARSR-4, to **Thailand** as an element of the Royal Thai Air Defense System Phase III (RTADS III) program.

Forecast Rationale

The remaining USAF-specific elements of the JSS program are essentially limited to providing continuing support of JSS integration activities, in addition to providing general engineering and joint program office support. The future course of the program is at the mercy of the progress made on those elements of the program for which the FAA has prime responsibility, most specifically the installation and operational acceptance of the remaining ARSR-4 radar sites. Unfortunately, the FAA's track record in this regard is not unblemished. The ARSR-4 program has been beset by an extensive series of delays and overruns with the first site implementation acceptance at Mt. Laguna, California, finally taking place in December 1994.

As a result of these delays, Westinghouse must work aggressively to meet currently contracted installation/ initial operational date schedules. Based on past program experience our forecast predicts a continued slippage of the ARSR-4 production schedule into 1997.

We are not projecting additional JSS or related product sales at this time due to several considerations. First, the JSS as implemented is a single US-specific application system which is not liable to be expanded in the near future. Secondly, the major element of the system, the ARSR-4 radar, is a mature technology device which is being increasingly challenged by European suppliers. (However, the Thai sale of the W-2100 radar could eventually spur foreign sales, notably in the former USSR, Eastern Europe and China where ATC equipment is woefully inadequate.) Thirdly, the future of radar systems as the primary means of tracking cooperative aircraft is being challenged by rapidly developing Global Positioning System (GPS) technology. This latter factor is underscored by the fact that the FAA abandoned its beleaguered microwave landing system (MLS) in favor of a to-be-fully-demonstrated alternate GPS approach for automated approach and landing operations, including Category III instrument landings. It should be noted that a GPS solution to en-route tracking is more easily accomplished technically.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level				Speculative		
Designation	System	thru 95	96	97	98	99	00	01	02	03	04	05	Total 96-05
JSS	ARSR-4	29	11	2	0	0	0	0	0	0	0	0	13