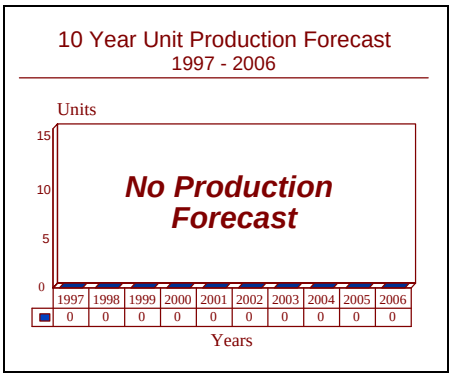
SATCOM Terminals - US Air Force - Archive 12/98

Outlook

- Program completed end of FY1995
- Continuing efforts transferred to MILSTAR and UHF SATCOM programs
- Remaining production contracts for this program were completed by the end of FY1996
- THIS REPORT WILL BE DROPPED NEXT YEAR, 1998



Orientation

Description. Development of US Air Force SATCOM terminals and associated equipment for US Department of Defense interoperability.

Sponsor

US Air Force
Air Force Materiel Command
Electronic Systems Center
Bedford, Massachusetts (MA) USA
(Overall program management)

Contractors

Harris Corp
Government Communications Systems Division
PO Box 91000
Melbourne, Florida (FL) 32902
USA
Tel: +1 407 727 4000
Fax: +1 407 727 4167
(Mach/14 Circuit Card Assemblies)

Lockheed Martin Corp
(formerly Loral Command & Control Systems)
9970 Federal Drive
Colorado Springs, Colorado (CO) 80921-3697
USA
Tel: +1 303 594 1000
Fax: +1 719 594 1158

Raytheon Co
Equipment Division
Communication System Directorate
1001 Boston Post Road
Marlborough, Massachusetts (MA) 01752
USA
Tel: +1 508 490 1000
Telex: 798120
(Software and Subsystems for MILSATCOM)

Raytheon E-Systems Inc
1501 72nd Street N
PO Box 12248
St Petersburg, Florida (FL) 33733-2248
USA
Tel: +1 813 381 2000
Fax: +1 813 343 1295
(UHF Radio and Multimission UHF SATCOM Transceiver)

Rockwell International Corp
Collins Avionics & Communications
Command and Control Systems Division
Richardson, Texas (TX) 75082
USA
Tel: +1 214 705 0000
Fax: +1 214 705 3398
(MILSTAR Command Post Terminals)

Stanford Telecommunications Inc
2421 Mission College Blvd
Santa Clara, California (CA) 95054
USA
Tel: +1 408 748 1010
Fax: +1 408 980 1066
(EHF Satellite Terminal Demonstration)

Unisys Government Systems Inc
8008 Westpark Drive
McLean, Virginia (VA) 22102
USA
Tel: +1 703 556 5656
Fax: +1 703 556 5444
(Ku-band Satellite Air Data Terminal prototypes)

Status. Funding for the Air Force's MILSATCOM terminals development ended in FY95. Further development of various SATCOM terminals was transferred to related programs such as MILSTAR Terminals and UHF Satellite Communications.

Total Produced. Developmental models only for most items, except for the Anti-Jam Control Modems (AJCM). It is estimated that 301 various UHF, EHF, and SHF development model SATCOM terminals will have been built by the end of 1997.

Application. This program developed military SATCOM terminals and associated modulator/demodulator equipment for use by the US Air Force with interoperability among the Army and Navy and other US Department of Defense (DoD) agencies, as well as US allies. Developments addressed strategic and tactical deficiencies of US MILSATCOM systems.

Price Range. Indeterminate due to the developmental nature of this program.

Technical Data

Design Features. This program focused on the following three projects:

Project 3163 UHF Satellite Terminal System (USTS). This project, previously designated as the Military Airlift Command (MAC) UHF Satellite Terminal (MUST) project, centered on developing a small UHF satellite communications terminal which operates in either an airborne or ground mobile mode in support of MAC and other Air Force communications requirements. More effective USAF operations are possible, since USTS results in a flexible, reliable, and secure worldwide C^2 system that functions via a Demand Assigned Multiple Access (DAMA) scheme for 5 kHz UHF satellite channels. The adoption of the USTS DAMA scheme greatly increases the number of users able to access the satellite channel at any one time. The DAMA capability was adopted as the DoD standard for 5 kHz UHF satellite communications and will be implemented in future Army and Navy terminal programs. The USTS DAMA scheme should also provide full USAF terminal interoperability with the Navy's 25 kHz UHF satellite DAMA systems.

USTS terminal main components included a combined single channel receiver/transmitter modem, an operator input/output unit, a transportable SATCOM antenna, a remote control unit, and various carrying cases. The goal was to field a system that could be carried onboard MAC C-5, C-141, and C-130 transport aircraft (probably will also eventually include the new-generation C-17), mounted for use during flight, and upon arrival remaining onboard the aircraft or being removed for fixed or mobile operations. The five man-transportable cases each weighed less than 45 pounds.

Project 3164 Ground Mobile Forces Satellite Communications (GMFSC). The Air Force completed fielding of MultiChannel Super High Frequency (SHF) transportable satellite terminals for the Tactical Air Control System and Combat Communications forces. In turn, these terminals (including MSQ-114s and TSC-85As/93As/94As/100A) were retrofitted with the AJCM that was developed for the Army, and provides full interoperability among all services' tactical SHF SATCOM terminals. The GMFSC terminals possessed certain characteristics such as quick reaction, ability to support a large amount of highly mobile users, ability to handle

changing requirements on link communications, and being reasonably localized regardless of constantly varying scenes of action. The AJCMs were fitted as a follow-on to a baseband improvement modification and testing program that included new multiplexers which set up the terminals and control facilities for follow-on installation of the AJCMs.

The Air Force had been seeking a small, lightweight SHF SATCOM terminal to provide reliable, secure voice and data for highly mobile combat teams such as Forward Air Controllers, Special Operations Forces, and Military Airlift Command (MAC) Combat Control Teams. This project conducted a demonstration/validation effort to assess the feasibility of meeting user requirements with SHF manpack units. The chosen system had to be very compact and lightweight, and able to support flexible networks of many users with minimal impact on satellite resources. Net weight had to be under 25 pounds with the production goal being 20 pounds. The SHF Portable Terminal System was to consist of a Portable Terminal, a Network Controller, and Network Control Processors. The latter two make up the Network Control Appliqué.

Project 3594 (formerly XXX1) Single Channel Transponder System (SCTS). This was a FY92 new-start project for PE#0303605F, with previous programming and funding having come under PE#0303601F MILSTAR. The SCTS effort was part of the overall transition from AFSATCOM to MILSTAR, supplying required jamming and nuclear effects protection for critical National Command Authorities (NCA) communications. Specific work focused on provision of an Emergency Action Message (EAM) and Force Direction Message (FDM) dissemination capability to selected command centers and force elements. Without this research and engineering effort, the SCTS satellite transponders (used on aging DSCS, Polar, and AFSATCOM satellites) would soon have become inoperative for survivable force projection/force execution.

Earlier Project 3594 Universal SHF Satellite Communications Modem. In FY90 this project was transferred to the Army under PE#0303142A. (Please see **SATCOM Ground Environment** report.) This project develops an interoperable, anti-jam, nuclear-capable modem for use in all SHF terminals for the use of the Defense Communications System (DSCS) satellite system. This modem was to provide interoperability among the strategic and tactical elements of all US military services.

Variants/Upgrades

The main upgrade effort in this program was the retrofitting of US Air Force Multi-Channel SHF transportable satellite terminals such as the TSC-94A/100A with the Army's AJCM. The AJCM provides an ECCM capability via the use of spread spectrum methods.

There were three different types of AJCMs fielded. The non-nodal network terminal modem was used with the TSC-85A/100As and consisted of two units, the AJCM (MD-1131) and the Transec Unit (OX-63). The AJCM provided the modulation, demodulation, bit synchronization, error-correction coding, and baseband processing features required to support a user communications channel and a CCC (Critical Control Circuit) channel. The Transec Unit contained KGV-9 transec devices and interface control circuitry. The nodal terminal modem was used with the TSC-93A/94As. The AJCM was also included and provided control communications, one data communications link, and the primary operator. Other components were the AJ/Communications Unit (MD-1132) which provided three additional user data communications links, and a Transec Unit (OX-64), which supplied sufficient KGV-9 transec devices and interface circuitry to support both the MD-1131 and the MD-1132. The network control terminal modem was used with the MSQ-114 control terminals. Components included the Network Control Unit (MD-1131) which provided the necessary circuitry to allow automation of control communications, the exchange of messages with the network terminal operators via the CCC, off-line acquisition of newly deployed terminals, tracking of the appropriate reference signal, and a Transec Unit (OX-63) which provided transmission security.

Program Review

Background

Project 3163 UHF Satellite Terminal System (USTS). The system acquisition strategy for this project was developed in FY84. Evaluation of DAMA technology also took place in FY84 and a draft specification for the terminals was prepared. During FY85, system specifications were finalized. Since FY87, funding under this project provided for the development of the required terminal equipment.

The study of Type I COMSEC for the USTS, completing portions of the DT&E, and preparing the 5 kHz DAMA Technical Interface Specification were completed during

FY90. FY91 work included the initiation of development of the USTS terminal and network control system with NSA approved new Type I COMSEC and interoperable 5 kHz and 25 kHz DAMA schemes, the completion of DT&E, and the preparation of interface cable design change. FY92 scheduled work focused on the development of the USTS terminal and network control system, IOT&E, and a production decision.

Originally, the USTS program was established to provide the then Military Airlift Command (now Air Mobility Command) with a satellite communications terminal that incorporated Demand Assigned Multiple Access (DAMA) and Automatic Narrowband Digital Secure Voice Terminal (ANDVT) capabilities. The Air Force was also designated lead agency in the development of the 5 kHz DAMA waveform for the DoD. However, the Air Force had not been able to obtain terminals under this project and negotiated with the contractor for acceptable terms for contract termination.

Project 3164 Ground Mobile Forces Satellite Communications (GMFSC). This project included an advanced-design study in FY85 that evaluated requirements and the available technology. Since FY87 this project funded the integration of the Army's AJCM into the Air Force's SHF satellite terminals, the formulation of SHF manpack satellite terminal standards, and the evaluation of communications protocols for operating and controlling satellite networks. The Army's SCOTT program was terminated at the beginning of FY93.

Integration engineering for installing the AJCMs into the multichannel SHF terminals worldwide, the initiation of the acquisition specification for SHF lightweight manpack terminals, and the development of the Multi-Command Required Operational Capability and associated Technical Analysis/Cost Estimate (TA/CE) for the SHF DAMA networks were completed in FY90. The demonstration/validation program for the SHF lightweight manpack terminals was started in FY91. FY92 work tackled the completion of the DEM/VAL program for the SHF lightweight manpack terminals and the initiation of the study for the UHF DAMA controller. The demonstration/validation program for SHF lightweight manpack terminals was completed in FY93. Upon successful evaluation, limited terminal production began in the FY94-FY95 time-frame.

Project 3594 Single Channel Transponder System (SCTS). Started in FY92, this project conducted the research and engineering on the space segment of the SCTS program required on a continuing/yearly basis in order to keep the aging DSCS, Polar, AFSATCOM (package on FLTSATCOM) satellite systems healthy and their transponders technically intact until the MILSTAR program was fully operational. The SCTS project was part of the overall transition from AFSATCOM to MILSTAR, providing required jamming and nuclear effects protection for critical National Command Authorities (NCA) communications. More specifically, SCTS provided an Emergency Action Message (EAM) and Force Direction Message (FDM) dissemination capability to selected command centers and force elements.

An analysis of UHF and SHF resources on AFSATCOM SCTS, the UHF Follow-On and the MILSTAR Host was conducted in FY92. Other efforts consisted of conducting studies and analysis of the Polar Host satellite system.

The analysis, on-orbit integrity of SCTS on Polar Host satellites maintenance, system timing upgrades to the SCTS, and NEACP and SCTS flight test support efforts all continued through FY92. These last two activities were the reason for the funding increase over FY92. FY94 and FY95 scheduled activity consisted of much the same as FY93: continuing analysis of UHF and SHF resources, monitoring Polar Host development and production, and participating in the development and testing of SCTS operational software.

Research and development, as well as procurement were stopped by the Air Force at the end of FY95. SATCOM terminal development was restructured for specific terminals to be developed under their respective specific satellite communications systems such as MILSTAR and UHF Satellite Communications.

An Earlier Project 3594 — Since FY87 this project funded the development of a brassboard prototype of the universal SHF satellite communications modem. Lack of funds forced the Air Force to limit this project to the completion of the brassboard waveform. In FY90 this project was transferred to the Army.

International Military SATCOM Terminals. Increased world conflicts have placed great emphasis on satellite communications, as reduced sized troop forces must now contend with jumping from regional hot spot to regional hot spot. It was during Operation Desert Storm that the US-led Coalition Forces discovered their tactical reconnaissance ranged from bad to nonexistent. In some instances, the military didn't know where the targets were; in others, the battle damage assessment was too poor to know what was hit. These actions demonstrated the need for real-time satellite data to be directly available to tactical users.

Internationally, Matra Marconi Space and Thomson-CSF teamed up to supply the MANPACK lightweight military satellite communications to the French Armed Forces. Matra is supplying 15 terminals while Thomson is integrating them into the French military Syracuse II satellite communications network. MANPACK is a self-contained terminal weighing about 12 kg with a

deployment time of a few minutes. It can operate with any satellite equipped to handle SHF frequencies, such at the French Syracuse, NATO 4, and the Spanish Hispasat series. In the summer of 1993 it was also announced that the Thomson-Matra team was selling 20 Spartacus portable satellite communications stations to the French army to carry tactical secure voice and data traffic when terrestrial links are insufficient or difficult to establish. The joint development team sees this award as the basis for further collaborations, and they are predicting a substantial export market.

The Australian Department of Defence awarded Raytheon E-Systems a contract worth US$12.3 million in May 1997 for the supply of an undisclosed number of military SATCOM terminals which are understood to be for the Royal Australian Air Force's P-3C maritime patrol aircraft.

Funding

With the Air Force's termination of this program at the end of FY1995, those efforts deemed worth continuing were transferred to various other US Department of Defense SATCOM programs. (See **Rationale** section of this report.) Procurement will continue until existing contracts reach completion.

Recent Contracts

Contractors	Award ($ millions)	Date/Description
Loral	5.6	Mar 1993 – FFP for Mach/14 circuit card assemblies for the Air Force MILSTAR terminal (N00019-93-C-0048)
Raytheon	9.6	Mar 1993 – FFP FVI for initial provisioning spares in support of MILSTAR Ground Command Terminals (F19628-89-89-C-0131, PP0055)
Raytheon	73.9	May 1993 – FFP for 20 MILSTAR Command Post Terminals in support of the MILSTAR command Post Production Program (F19628-93-C-0032)
Rockwell	111.3	May 1993 – FFP for 24 MILSTAR Command Post Terminals in support of the MILSTAR Command Post Production Program (F19628-93-C-0033)
Raytheon	8.2	Aug 1993 – CPFF FVI for 22 time distribution subsystem preprocessors, associated data and software for use with USAF MILSATCOM terminals (F19628-85-C-0004, P00183)
Raytheon	10.7	Oct 1993 – FVI to a FPIF contract for an equitable adjustment for increased effort in hardware/software development, system engineering, and management in support of the MILSATCOM program (F19628-85-C-0004, P00172)
E-Systems	11.7	Oct 1993 – Production contract for newest UHF radio and Multimission UHF SATCOM Transceiver (MUST) (Contract Number not available)
Unisys	10.6	Jan 1994 – CPFF contract for 10 Ku Band Satellite Air Data Terminals, two Ku-band Satellite Ground Data Terminals, spares and technical support. Contract Completed December 1996 (N00019-94-C-0069)
Raytheon	19.3	Feb 1994 – FVI to a CPIF contract for FY94 time and material labor categories, analysis tasks, and continuation of FY93 repair of engineering development model and full-scale engineering development terminals line and subassembly repairable units in support of the MILSTAR Program (F19628-85-C-0004, P00187)
Satellite Systems	1.5	Apr 1994 – Contract for two C, X, Ku-band lightweight, multiband satellite terminals (Contract Number not available)

Timetable

FY89	Completed DT&E TEMPEST testing of USTS. Scheduled completion date for integration engineering of AJCM modules into the multichannel SHF terminals worldwide.
FY91	Completed USTS DT&E. Initiated DEMVAL for the SHF lightweight manpack terminals.
FY92	USTS IOT&E.
FY93	SCOTT program terminated.
FY93	Initiated FSD of the lightweight manpack terminals. Develop UHF DAMA controller.
FY95	Program terminated at end of fiscal year. Continuing efforts transferred to various other US SATCOM programs.

Worldwide Distribution

Development efforts were primarily for **US** applications, although systems in use by US allies were supported.

Forecast Rationale

The US Air Force Satellite Communications (MILSATCOM) Terminals program focused on the USTS, the AJCM upgrade, and the SHF and EHF terminal requirements. The USTS finished development of the 5 kHz DAMA waveform and Network Control Stations in 1992. The AJCM upgrade of the multichannel SHF SATCOM terminals was originally scheduled to be completed by the end of 1990; however, it wasn't until 1993/1994 that the SHF PTS lightweight manpack satellites (with AJCM) completed the Demonstration/ Validation for access user requirements. GE Aerospace and Harris Corporation were awarded the demonstration and validation contracts in FY91. Upon completion of existing contracts, no further terminal production under this specific program is expected.

NOTE: *Various stages of SATCOM terminal development still continues in numerous US DoD programs spread among the services. For additional and related information on SATCOM terminals, please refer to the following specific reports in this* **C^{3}I** *binder:* **ELF Submarine Communications**, **Joint Service Image Processing System (JSIP), MILSTAR Airborne Terminals, MILSTAR Satellites, Navy EHF SATCOM Program (NESP),** *and* **SATCOM Ground Environment.**

Ten-Year Outlook

Production related to this particular program has been completed. However, it should be noted that US SATCOM terminals are still being developed under various programs and efforts described in the preceding section. This is particularly true of the US SATCOM Ground Environment program. THIS REPORT WILL BE DROPPED NEXT YEAR, DECEMBER 1998.