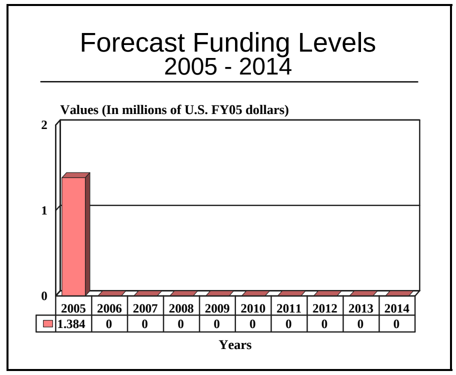
MILSTAR Satellites - Archived 2/2006

Outlook

- Final MILSTAR satellite, MILSTAR II-F6, launched in April 2003
- No further MILSTAR production expected; MILSTAR will phase out as next-generation Advanced EHF constellation begins launch schedule
- This report will be archived in 2006



Orientation

Description. The Military Strategic and Tactical Relay (MILSTAR) system is a U.S. Department of Defense joint service advanced satellite-based military communications (EHF/SHF/UHF) system.

Sponsor

United States Air Force
Joint MILSTAR Program Office
Space & Missile Systems Center
Los Angeles, California (CA)
USA

Status. Final MILSTAR satellite was launched in the first quarter of 2003.

Total Produced. Six MILSTAR satellites were produced and launched. Only five reached their operational orbit.

Application. MILSTAR functions primarily as a tactical system offering jam-resistant, secure, extremely high-frequency (EHF) communications.

Price Range. MILSTAR's original 20-year, $27 billion price tag was reduced to approximately $17 billion in 1993. Initial MILSTAR satellites are estimated to cost about $1 billion each, while MILSTAR II satellites cost $600 million each.

Contractors

Lockheed Martin Space Systems - Sunnyvale, http://lmms.external.lmco.com, 1111 Lockheed Martin Way, Sunnyvale, CA 94088-3504 United States, Tel: 1 (408) 742-7151, Fax: 1 (408) 742-8484, Prime

Technical Data

Specifications

Weight	Approximately 10,000 lb (4,536 kg)
Length	51 ft
Solar array span	116 ft
Solar array power	Almost 5,000 W
Payload	Low-data-rate communications (voice, data, teletype, and facsimile) at 75 bps to 2,400 bps (all satellites)

	Medium data rate communications (voice, data, teletype, facsimile) at 4.8 kbps to 1.544 Mbps (Satellites 4 through 6 only)
Orbit altitude	22,3000 mi; low inclined geosynchronous orbit
Designed life	10 yr
Launch vehicle	Titan IV/Centaur

MILSTAR satellite communications system

Source: U.S. Air Force

Design Features. The MILSTAR satellite communication system meets the minimum essential wartime communication requirements of the United States President and Joint Chiefs of Staff to command and control U.S. strategic and tactical forces through all levels of conflict. Originally, eight MILSTAR satellites were to be placed in orbit; however, the quantity was trimmed to six satellites by congressional mandate in 1990. The satellite constellation was to consist of three spacecraft in highly elliptical polar orbits (22,000 x 350 nautical miles), four spacecraft in geosynchronous positions (22,844 nautical miles), and one spare in a super synchronous orbit (145,890 nautical miles). These orbits cross-link to supply worldwide coverage. Use of EHF renders the system impervious to electromagnetic interference from nuclear radiation or jamming.

MILSTAR's EHF communications package provides encrypted, highly jam-resistant communications to military units worldwide. The first three MILSTAR satellites are hardened to resist the effects of nuclear explosions. Unlike lower frequencies, the EHF package is able to recover quickly from the propagation degradation caused by high-altitude nuclear detonations. The MILSTAR satellites also incorporate a small, ultra-high-frequency (UHF) process package to supply backward compatibility with the current AFSATCOM system and to expedite transition to MILSTAR. Super high frequencies (SHF) are used to broadcast from the satellites to users.

In an effort to protect transmissions from interception, data and command links are encoded from end to end. Beam-hopping antennas, frequency-hopping transmitters, and onboard satellite processing are used to resist jamming.

To enable the MILSTAR system to continue functioning in the event that a spacecraft is lost, each satellite has a sophisticated cross-link communications system. This allows messages to be relayed to other satellites in the system and permit rerouting of message traffic to and from Earth terminals. With cross-link antennas routing between satellites does not require ground station relaying.

If normal ground-based satellite control centers were to become inoperable in the event of a nuclear war, the MILSTARs could still operate for up to six months. The satellites are also equipped to communicate with ground-based and airborne mission control elements (MCE). MCEs allow mobile command terminals, such as the E-4B National Emergency Airborne Command Post (NEACP), to control the MILSTAR satellites and the overall system.

MILSTAR Payload. TRW and Hughes are responsible for the payload, which reportedly has a capacity of 192 low-data-rate (75 to 2,400 bps) EHF channels and four UHF channels, while the MILSTAR spacecraft carries an additional 32 1.5 Mbps EHF channels.

E-Systems (ECI Division) manufactured the UHF transponder group that includes the receiver/processor and frequency generator/power converter. MILSTAR features Electromagnetic Sciences' 20- to 44-GHz beam-hopping antenna switching networks, composed of complex arrays of latching junction circulators, a 4x4 latching ferrite redundancy switch, electro-formed waveguide, remote hybridized electronic drive circuitry, and central electronic control circuitry.

Variants/Upgrades

Variants

MILSTAR I. MILSTAR I satellites feature low-data-rate communications payloads and nuclear hardening.

MILSTAR II. MILSTAR II satellites have low- and medium-data-rate payloads, but they do not have the degree of nuclear hardening as MILSTAR I.

Upgrades

Modem Upgrade. In June 1998, Raytheon increased the performance of the MILSTAR modems from a low-data-rate 2.4 kbps to a medium-data-rate 2.048 Mbps. This upgrade allows USAF satcom terminals to operate with the USN UHF Follow-On Satellite. The modems are installed on USAF E-3 AWACS, E-4 NEACAP, and E-8 Joint-JSTARS aircraft.

Program Review

Background. In 1981, President Ronald Reagan announced a strategic modernization program that included the start of the MILSTAR program. MILSTAR-related technology had earlier been demonstrated in development and evaluation programs. The development of the EHF communications technology was carried out by the Naval Ocean Systems Center. The technology level studies for the STRATSAT (Strategic Satellite) system, an earlier proposed successor to the AFSATCOM system, were the work of the Rome Air Development Center.

The original MILSTAR acquisition strategy called for the total system (electronics payload, satellite bus, mission control) as an integrated package with multiple Phase 1 validation contracts. This was followed by selection of one contractor for the Phase 2 full-scale development/production contract. Problems arose because TRW Space & Technology Group and Hughes Aircraft teamed up and became the prime contenders for MILSTAR. Another competitor, Lockheed Missiles & Space, complained, arguing that TRW and Hughes had already carried out the majority of EHF-related work and that teaming gave them an unfavorable advantage over other contractors. The same sentiment expressed by other contractors jeopardized the competition; no one wanted to participate.

As a result, the MILSTAR program office developed an alternative acquisition scheme based on an associate contractor plan, with the government contracting components out to different contractors rather than contracting the whole system out to one prime contractor. A validation phase, Phase 1, generated all specifications, the statement of work, plans, and conceptual studies. The full-scale engineering development phase, Phase 2, had three teams competing for the electronics payload and three teams competing for the satellite bus and systems integration (including mission control).

In February 1982, the satellite bus and integration validation contracts were awarded to Lockheed, TRW, and Ford Aerospace. In May 1982, contracts for the electronics payload validation were awarded to the Hughes/TRW team, General Electric, and Ford Aerospace. Ford and GE subsequently withdrew, citing the Hughes/TRW team's technological lead as the reason.

After awarding the validation contracts, the MILSTAR program office commenced preparation of the full-scale engineering development and initial production phase Request for Proposal. In November 1982, proposals were received from Lockheed and TRW, the two remaining potential systems integration contractors.

Since the Hughes/TRW team was the only remaining competitor for the electronics payload contract, the MILSTAR program office concluded that the electronics payload developer should be a contractor to the satellite bus and integration contractor.

At the end of the concept validation phase in February 1983, the U.S. Air Force selected Lockheed for the MILSTAR full-scale engineering development and initial production phase. The Hughes/TRW electronics payload contracting team became Lockheed subcontractors instead of associate contractors. The MILSTAR program office rewrote the program plan a second time, adding requirements that arose as a result of user input and concerns. The Air Force and Lockheed subsequently negotiated a contract based on the final MILSTAR configuration. On March 1, 1983, Lockheed was issued a letter of contract. On June 30, 1983, Lockheed received a cost-plus-incentive-fee contract for program full-scale engineering development.

Satellite Segment. Under a five-year, $1.05 billion contract, Lockheed designed and built three developmental satellites as part of Block I of the MILSTAR program. After numerous delays, including a six-month stall in 1991 alone, the first satellite delivery was made in early 1993.

Block II was to be made up of seven satellites, MILSTAR vehicles 4 through 10. Spacecraft 4 and 5, slated for launch sometime in the mid-1990s, were developmental models. The U.S. DoD hoped that building five developmental spacecraft with less survivability and capacity than production models would reduce the technological risks. According to congressional testimony by U.S. Air Force Secretary Edward Aldridge, building the first few MILSTAR satellites as production models would have been too complicated and too risky. The Air Force's acquisition strategy was to use a less ambitious program for the first three satellites and incorporate the required improvements in a block change, basically as a pre-planned product improvement plan.

When the constellation was trimmed to six satellites overall, some changes were made in the acquisition strategy, although these changes could not be incorporated until the third satellite.

MILSTAR Launch Schedule and Delays. The original target date for launch and operation of the first MILSTAR satellite was late 1987 to early 1988. The network was scheduled to be in position by the early 1990s; however, it did not become fully operational until the late 1990s. Part of the blame for MILSTAR delays can be traced to the enormous technological hurdles Lockheed faced in designing and building this next-generation satellite. Never before had a satellite been designed to operate at such high power levels and frequencies as MILSTAR. The satellite's electronic miniaturization and complexity also added to development delays. The satellite's survivability, nuclear hardening, and planned ability to operate autonomously for up to six months at a time were additional technological obstacles to surmount. And on top of it all, the satellite, which is one of the heaviest communications satellites ever built, had to fit the weight restrictions of the Titan IV.

Delays were caused by developmental problems encountered with the sophisticated computer processor (being provided by Teledyne) used to control the satellites' routine operations. The biggest hurdle was the requirement for the computers to operate in very high radiation conditions that would disable ordinary computers. The first computer was finally delivered in October 1991, followed by another in November 1991. With the two computers delivered, the U.S. Air Force was able to proceed with testing of the first complete satellite.

In remarks accompanying the FY88 appropriations bill, Congress expressed concern over the MILSTAR program's pervasive problems, specifically the cost overruns due to repeated changes to acquisition schedules, inadequate funding, poor contracting procedures, and a lack of management attention at the senior levels of the DoD and Air Force. Congress was also worried that as much as one billion dollars might be wasted over the following 10 years because of MILSTAR production inefficiencies.

MILSTAR will go down as one of the costliest military projects of the 1980s and 1990s. An article in the trade journal *Aviation Week & Space Technology* quoted U.S. Air Force Secretary Aldridge as saying that the cost of each MILSTAR/Titan IV-Centaur combination has reached $1 billion. Aldridge told the magazine that MILSTAR was pushing the state-of-the-art right to the limit of communications satellites.

MILSTAR Program Development. In the summer of 1989, the MILSTAR program came under heavy criticism from Congress. In July of that year, the House Armed Services Committee voted to withhold $103 million in MILSTAR funding until the U.S. DoD provided clarification regarding MILSTAR procurement. The Senate Armed Services Committee issued a budget report critical of the U.S. Air Force management of MILSTAR and said it wanted a new launch schedule. Also in July, the House Appropriations subcommittee blasted the MILSTAR program for billions of dollars of cost overruns and voted to kill the program after construction of three satellites. Congress eventually approved a scheme in which the program would not proceed past the three satellites until the DoD complied with a classified annex to the FY90 appropriations bill.

In 1990, activity surrounding MILSTAR was no less intense, and in July, the Senate Armed Services committee voted to kill the program. Although the program survived, receiving $600 million in the final appropriations package, Congress forced a number of changes. The U.S. DoD finally revealed the very high total costs of the MILSTAR program (between $35 billion and $40 billion), and Congress mandated that the total satellite constellation be reduced from eight to six satellites. Furthermore, Congress directed the Secretary of Defense to either restructure MILSTAR or develop an advanced communications satellite relay system. The associated congressional report laid out three objectives: a substantial reduction in program cost, an increase in the utility of the program for tactical forces, and a reduction of unnecessary capabilities for protracted nuclear war missions and operations.

In 1991, following a directive by Congress, the MILSTAR program was restructured to place greater emphasis on aiding tactical users. The end result of the restructuring was the MILSTAR II satellite, which was designed to have both the low-data-rate (LDR) broadcast system from the MILSTAR I satellite and a new medium-data-rate (MDR) broadcast system attuned to the needs of tactical users. Teledyne encountered developmental difficulties with the computer processor it was designing and with the installation of improper capacitors in the first satellite, requiring replacement and forcing delays in the program. Teledyne delivered the first of the two computers in October and the second unit in November 1991.

Another development involved the number of satellites. The U.S. Air Force disclosed that it wanted to terminate Lockheed's MILSTAR satellite contract after the first three were completed. In turn, the service proposed that the company be awarded a contract for building five of the medium-data-rate spacecraft.

In October 1992, the U.S. DoD issued an Acquisition Decision Memorandum resulting from the Defense Acquisition Board's program review of the MILSTAR program. The DoD approved the U.S. Air Force's MILSTAR II program with a new MDR communications payload. Under the plan drawn up by the Air Force, the third MILSTAR satellite would be fitted with the new MDR payload. At the same time, the DoD directed the Air Force to study a small MILSTAR-compatible adjunct satellite. Also, the Air Force awarded Lockheed a $1.659 billion contract to develop one MILSTAR satellite equipped with both LDR and MDR payloads.

MILSTAR's 1992 plans called for a minimum of four MILSTAR II satellites, in addition to the three existing MILSTAR I satellites, to make it functionally a MILSTAR II model program. On October 30, 1992, the U.S. Air Force awarded a $1.7 billion contract to a team of companies headed by (then) Lockheed Missiles & Space Co. This team was to build the first satellite in the restructured program that aimed to provide unprecedented flexible communications for United States troops around the world. Under this contract, the companies would build a communications spacecraft that could instantly link a tactical commander to forces anywhere in the world. The plans also included engineering and design services that would form the groundwork for future MILSTAR II satellites, as well as modifications to ground control systems.

Additional program accomplishments for FY92 included the start of Satellite 1 launch support preparations and Satellite 2 integration, continued development of Satellite 3 and the MILSTAR Mobile Constellation Control Station (MMCCS), continued installation of the engineering development model (EDM) command post terminal, completion of the MDR design review, and awarding of a contract for the low-cost terminal Phase 1 terminal processing unit and risk-reduction efforts.

In an uncharacteristic display of openness in November 1992, the U.S. Air Force unveiled the second MILSTAR payload. That occasion marked the first time the public was allowed to view and photograph the formerly top-secret communications system. On display at TRW was the LDR payload consisting of antenna fixtures and five subsystems. In December, the unit was transferred to Lockheed for integration onboard the second MILSTAR I satellite.

Program accomplishments during FY93 included delivery of Satellite 1, completion of assembly and commencement of testing of Satellite 2, the continued building of Satellite 3, beginning of contractor support for the mission control segment (MCS) software sustainment for mission planning and satellite operations, continuing contractor software/hardware support for MCS equipment, and awarding of the contract for the MILSTAR MDR EDM and Satellite 4 with LDR and MDR payloads.

<u>MILSTAR Options Detailed</u>. In June 1993, the Pentagon reviewed four MILSTAR options outlined in a study conducted by a group of independent experts. Among the options submitted to the U.S. DoD was a plan that would continue production of the four MILSTAR II satellites but replace them with an advanced system in 2006. Option 2 would do the same, but would move the date for replacement to 2004. It was stated that this would save nearly $8 billion. Under Option 3, an advanced EHF satellite system would be deployed beginning in 2003 at the expense of canceling

MILSTAR II. A fourth option called for a lighter MILSTAR II satellite that would be launched onboard an Atlas-class booster at the end of the decade.

In October 1993, (then) Secretary of Defense Les Aspin's "Bottom-Up Review" opted for Option 1, calling for an advanced EHF satellite to replace the MILSTAR II satellites. Under the plan, the satellites would feature LDR and MDR payloads but would be light enough for launch onboard the less expensive Atlas Centaur rocket. The plan also limited the total acquisition of MILSTAR satellites to six: the first two with the LDR and the next four with both the LDR and MDR systems.

First MILSTAR Launched. In February 1994, the U.S. Air Force launched the first MILSTAR satellite from Cape Canaveral Air Force Station (AFS), Florida, onboard a Titan IV/Centaur vehicle. It marked the return to service of the Titan, which had been grounded in August 1993, following the explosion of a vehicle launched from Vandenberg AFB, California.

In addition to launching Satellite 1 and conducting Operational Test and Evaluation, scheduled activity in FY94 consisted of delivering Satellite 2, developing and implementing modifications to the mission control element to enhance mission control operations, continuing contractor support for MCS software sustainment for mission planning and satellite operations, awarding the Satellite 3M Supplemental Agreement on the MILSTAR II contract, storing bus and LDR payload components for Satellite 3M pending MDR modifications, continuing engineering and manufacturing development (EMD) of the MDR payload, and starting integration and test of the Satellite 3M bus LDR payload and LDR modifications.

In June 1994, the U.S. Army, Navy, and Air Force announced they had successfully communicated over a 20-terminal network using the MILSTAR satellite as the processing hub and demonstrated mutual accessibility among all terminals in the tri-service network. Each terminal successfully transmitted and received signals at speeds ranging from 75 to 2,400 bps using the satellite's 44 GHz EHF uplink and 20 GHz UHF downlink.

September 1994 marked MILSTAR's operational debut. The system was used in the Haiti operation. The U.S. DoD reported that while the circumstances of the operation, especially at the threat level, did not represent a true test of MILSTAR's ability to operate in battlefield conditions (such as resisting jamming), its availability and the lack of previous testing in an actual contingency made this a good opportunity to do so. The DoD further reported that MILSTAR performed flawlessly, establishing connectivity between nodes such as USACOM, the Combined Joint Task Force, the command ship USS *Mt. Whitney*, and manpack radios located at the United States Embassy in Port-au-Prince.

The second MILSTAR satellite was launched in November 1995, and underwent in-orbit checkout and completion of MILSTAR I on-orbit Phase I IOT&E. Other program activity during FY95 included implementing engineering change proposals as needed based on operational requirements, developing and implementing modifications to MCEs to enhance mission control operations, continuing contractor support for MCS software sustainment for mission planning and satellite operations, developing and fielding operator training equipment, continuing MDR payload manufacturing for Satellites 3M and 4, continuing bus integration and testing for Satellite 3M, starting bus component integration manufacturing for Satellite 4, completing LDR integration and test for Satellite 3M, completing LDR manufacturing and starting LDR integration and test for Satellite 4, initiating parts procurement for Satellites 5 and 6, and starting the MILSTAR II upgrade of MCS software for mission planning.

MILSTAR Developments. On-orbit support operations for Satellites 1 and 2 continued through FY98. Work on the MILSTAR II satellites concentrated on the MDR payload manufacturing on Satellite 3, which was completed in FY96. The MDR payload for Satellite 4 was finished by the end of FY97. Construction of Satellites 5 and 6 was also under way by this time.

In June 1998, the Communications Management Branch of Space & Naval Warfare Systems Command (SPAWAR) delivered MILSTAR satellite-terminal management software to the various services. This software allows the generation of imagery between the U.S. Army, Air Force, and Marine Corps. This terminal-imagery generation software is a part of a deliverable increment, designated Increment 2, of an Automated Communication Management System (ACMS) software package that was also delivered in June. ACMS is expected to provide encrypted voice, data, teletype, and facsimile broadcasts between land, sea, and air platforms.

June also saw the delivery of a lighter and more capable payload from TRW to Lockheed Martin. The payload included a new digital signal processor, enhanced memory management capabilities, and new lightweight antenna steering assembly. This payload was incorporated into the last three MILSTAR satellites.

Program Setbacks. In a November 1998 GAO report, titled "Military Satellite Communications: Concerns With MILSTAR's Support to Strategic and Tactical Forces," several problems surrounding the MILSTAR program were exposed. Some of these stated problems included low quality of voice conference transmissions and the need for a future modification to ensure proper redundancy. The report advocated that the U.S. Secretary of Defense compose an evaluation of the DoD's efforts to address the operational shortcomings of MILSTAR I and the development problems of MILSTAR II.

A serious setback occurred in April 1999 when a MILSTAR II EHF satellite did not reach operational orbit. According to the Accident Investigation Board, there was a software failure in the Titan IV/Centaur upper-stage booster. The upper-stage booster, which held the MILSTAR satellite, failed to boost the satellite into its geosynchronous orbit.

The loss of the MILSTAR II satellite was a big loss to the MILSTAR satellite constellation. Prior to the loss, the scheduled time frame for MILSTAR included the launch of the last satellite in 2002, bringing the constellation to full service. In order for the constellation to achieve full operational capability, four satellites with medium- and low-data-rate payloads are needed. Several options were discussed: the first called for procurement of a seventh MILSTAR satellite, a second called for installation of MILSTAR's EHF MDR payload on a U.S. Navy's UFO-11 satellite (scheduled for launch in 2003), and the third called for expediting the Advanced EHF satellite program.

After weeks of research and discussion, the most likely consequence of the satellite loss appeared to be the purchase of a seventh MILSTAR II satellite. In August 1999, it was announced that the Joint Requirements Oversight Council (JROC) had approved the procurement of the seventh MILSTAR II satellite. However, the problems did not end. It was not known who would pay for the satellite, which was worth approximately $800 million or more. The U.S. Air Force carries most of the MILSTAR funding burden, but it did not have the funds needed for an additional satellite. Cost sharing did not appear viable either. An emergency supplement in FY00 was the largest hope for funding the expensive satellite.

The House Appropriations Committee dealt another blow to the program when it announced a recommendation to cut $147 million from the FY00 RDT&E budget. The Joint Staff also reportedly began looking into alternatives to increased MILSTAR funding.

In September 1999, the allocation of supplemental MILSTAR funding was still up in the air. The Pentagon was reportedly waiting for formal notification from the Office of Management and Budget (OMB) on FY00 funding for replacement of the lost satellite. It was also reported that the OMB had informally refused the supplemental funding request in August 1999.

U.S. Air Force officials began considering the possibility of expediting the development and launch schedule of the Advanced EHF satellite constellation in April 1999. After some consideration, the Pentagon decided to accelerate the program schedule by 18 months. With this decision, the purchase of a seventh MILSTAR II satellite was no longer necessary. In an effort to accelerate the Advanced EHF satellite program, in April 2000, the Pentagon approved collaboration between three companies, Raytheon, Lockheed Martin, and TRW. However, the acceleration of this program was short-lived due to added requirements and revised cost estimates. (For more information, see the "Advanced EHF Satellites" report.)

Technical problems with Titan launch vehicles and the satellite's thrust heaters led to delays in the launch of the fourth MILSTAR satellite, postponing the original launch date from April 2000 to February 2001. Thrown into this mix was the failure of the sixth MILSTAR satellite to go into safe mode. This resulted in a five-week delay as a fix was installed in satellites 4, 5, and 6. The delays in the launch of the fourth satellite had a ripple effect that set the launches of both satellites 5 and 6 back until January and November 2002. The delays also resulted in the need for about $186 million to keep the Titan program operating for an extended period.

Shortly after a successful launch in late February 2001, the fourth satellite deployed its antennas and solar arrays as it began a three-month test period in which its maneuverability and LDR and MDR payloads were checked. By early March 2001, the first point-to-point transmissions utilizing the MDR payload were performed. Included in these transmissions was the first-ever video teleconference (VTC) using two U.S. Army SMART-T terminals.

The fifth MILSTAR satellite was shipped to Cape Canaveral in November 2001 and was launched in January 2002. The sixth and final MILSTAR satellite was scheduled to be launched in January 2003. However, analysis of the Centaur upper stage booster detected similar problems that inhibited an earlier MILSTAR satellite from reaching its proper orbit. In order to correct this error, the U.S. Air Force rescheduled the launch for early February 2003. Insufficient time to obtain an acceptable analysis of the booster and schedule maintenance of the launch area shoved the launch date back until April 2003. On April 8, 2003 the final MILSTAR satellite was successfully launched. Shortly thereafter, in June 2003, it was reported that the U.S. Air Force and Lockheed Martin had completed the on-orbit checkout of the final MILSTAR satellite.

Funding

U.S. FUNDING

	FY98 QTY	FY98 AMT	FY99 QTY	FY99 AMT	FY00 QTY	FY00 AMT	FY01 QTY	FY01 AMT
RDT&E (US Air Force)								
PE#0604479F MILSTAR LDR/MDR Sat. Comm. (Space) Project 5010 MILSTAR Satcom SYSTEM	-	610.0	-	514.0	-	345.6	-	224.6

	FY02 QTY	FY02 AMT	FY03 QTY	FY03 AMT	FY04(Req) QTY	FY04(Req) AMT	FY05(Req) QTY	FY05(Req) AMT
PE#0604479F MILSTAR LDR/MDR Sat. Comm. (Space) Project 5010 MILSTAR Satcom SYSTEM	-	226.4	-	147.8	-	1.4	-	1.4

All $ are in millions.

Source: US Air Force 2004/05 RDT&E Descriptive Summary

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Lockheed Martin	9.8	Apr 2001 – Modification to a cost-plus-award fee contract to provide for the award fee for Period 17 for production and launch of the MILSTAR 4 satellite. Space & Missile Systems Center, Los Angeles, CA, is the contracting agency. (F04701-92-C-0049-P00295)
Lockheed Martin	59.74	Jul 2001 – Cost-plus-award-fee contract modification to provide for adjustment of the launch schedule for the MILSTAR communication satellite program. This included a two-month delay in the launch of Space Vehicle 3 (launched in April 1999) resulting from the launch failure of Titan IV mission A-20. It also includes changes in the launch dates of MILSTAR Space Vehicles 4 (from January 2000 to October 2000), 5 (from November 2000 to July 2001), and 6 (from October 2001 to June 2002) in order to perform further technical/processing effort. At the time of contract, zero funds have been obligated. This work was expected to be completed August 2003. The Space & Missile Systems Center, Los Angeles, CA, is the contracting agency. (F33657-01-C-2083)
Lockheed Martin	7.7	Nov 2001 – Cost-plus-award-fee contract modification that provides for award-fee earned for Evaluation Period 18 (March 1, 2001 – October 31, 2001) for performance of MILSTAR Block II satellite production efforts. The Space & Missile Center, El Segundo, CA, is the contracting agency. (F04701-92-C-0049, P00308)

Contractor	Award ($ millions)	Date/Description
Lockheed Martin	6.7	Feb 2003 – A cost-plus award-fee contract modification. This effort exercises an option, Flight 6 launch delay options, that funds continued contractor support for the launch of MILSTAR Flight 6. Coverage is needed as a result of launch slide resulting from a problem with Titan IVB and Centaur Booster. Work was completed by April 2004. The Headquarters Space and Missile Systems Center, Los Angeles Air Force Base, CA, is the contracting agency. (F04701-92-C-0049, P00338).
Lockheed Martin	7.7	Apr 2003 – A cost-plus-award-fee contract modification to provide Award Fee Earned for Evaluation Period 20, MILSTAR Block II. Period of performance was July 2002 to February 2003. The Space and Missile Systems Center, Los Angeles Air Force Base, CA, is the contracting agency. (F04701-92-C-0049/P00340).

Timetable

Month	Year	Major Development
Apr	1981	MILSTAR program begun
Jan	1982	Joint MILSTAR program office established
Feb	1982	Satellite bus and integration validation contracts awarded
May	1982	Payload validation contracts awarded
Jun	1983	Full-scale engineering development begun
Sep	1983	U.S. Air Force MILSTAR terminal full-scale development
Nov	1985	Satellite system Preliminary Design Review
Aug	1986	Start of EHF terminal qualification model integration
Nov	1987	MILSTAR terminal prototype test
Oct	1990	Congress directed the Secretary of Defense to restructure MILSTAR or develop an advanced communications satellite relay system to replace it; delivery of satellite No. 1 payload to the prime contractor
	1991	MOC and MCC activated at CSOC; MDR system architecture development begun
	1992	FSD of MDR system payload begun, and fabrication of fourth satellite's payload and bus begun
Jan	1993	First MILSTAR satellite delivered
Dec	1993	First MILSTAR satellite launch originally scheduled
	1994	Installation of airborne modular control elements begun
Feb	1994	Launch of first MILSTAR
	1994	Narrowband secure voice terminal compatibility implementation begun
	1994	Delivery of second MILSTAR satellite
Nov	1995	Launch of second MILSTAR
	1995	Delivery of third MILSTAR satellite
	1995	Multiservice IOT&E Phase II of Mission Control System
	1996	MILSTAR I Phase II IOT&E begun; development and fielding of operator training equipment begun
	1997	Delivery of fourth, revised MILSTAR satellite; continued support for on-orbit operations on satellites 1 and 2
	1998	Milestone III satellite production decision
	1998	Launch of first MDR satellite
	1999	Launch of third MILSTAR
Apr	1999	Third MILSTAR failed to reach orbit, left useless
	2000	Multi-service IOT&E Phase III of Mission Control System
Aug	2000	Last MDR communications payload for the F-6 MILSTAR satellites delivered to Lockheed Martin

Month	**Year**	**Major Development**
Feb	2001	Launch of fourth MILSTAR
Nov	2001	Fifth MILSTAR satellite shipped to Cape Canaveral
Jan	2002	Fifth MILSTAR launched
Sep	2002	Lockheed Martin wraps up production of MILSTAR satellites
Jan	2003	Launch of sixth MILSTAR delayed
Apr	2003	Sixth and final MILSTAR satellite launched
Jun	2003	Lockheed Martin completes on-orbit checkout of the final MILSTAR satellite

Worldwide Distribution

MILSTAR was developed strictly for the **United States Department of Defense**.

Forecast Rationale

The Air Force has budgeted $1.38 million for MILSTAR operational costs in FY05. MILSTAR's follow-on system, the Advanced EHF satellite, is currently under development. Although there have been some delays in the Advanced EHF program, no further MILSTAR satellites are planned to be constructed to fulfill the U.S. Department of Defense needs. The first of the next-generation Advanced EHF satellites is to launch in April 2007, followed by the second in 2008 and the third in 2009. This report will be archived in 2006.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR FUNDING ($ in millions)

			High Confidence Level			Good Confidence Level			Speculative			
Designation	**Application**	**Thru 04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**Total 05-14**
MILSTAR SATELLITES	MILSTAR SATELLITES (U.S. AIR FORCE)	9702.443	1.384	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.384