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HISTORY

OF THE

SPACE AND MISSILE SYSTEMS CENTER

October 1994 - September 1997

VOLUME I

Assigned to

Headquarters Air Force Space Command

Stationed at

Los Angeles Air Force Base, California

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SPACE AND MISSILE SYSTEMS CENTER

1 October 1993 – 30 September 1997

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CHAPTER 5

SPACE-BASED INFRARED SYSTEMS

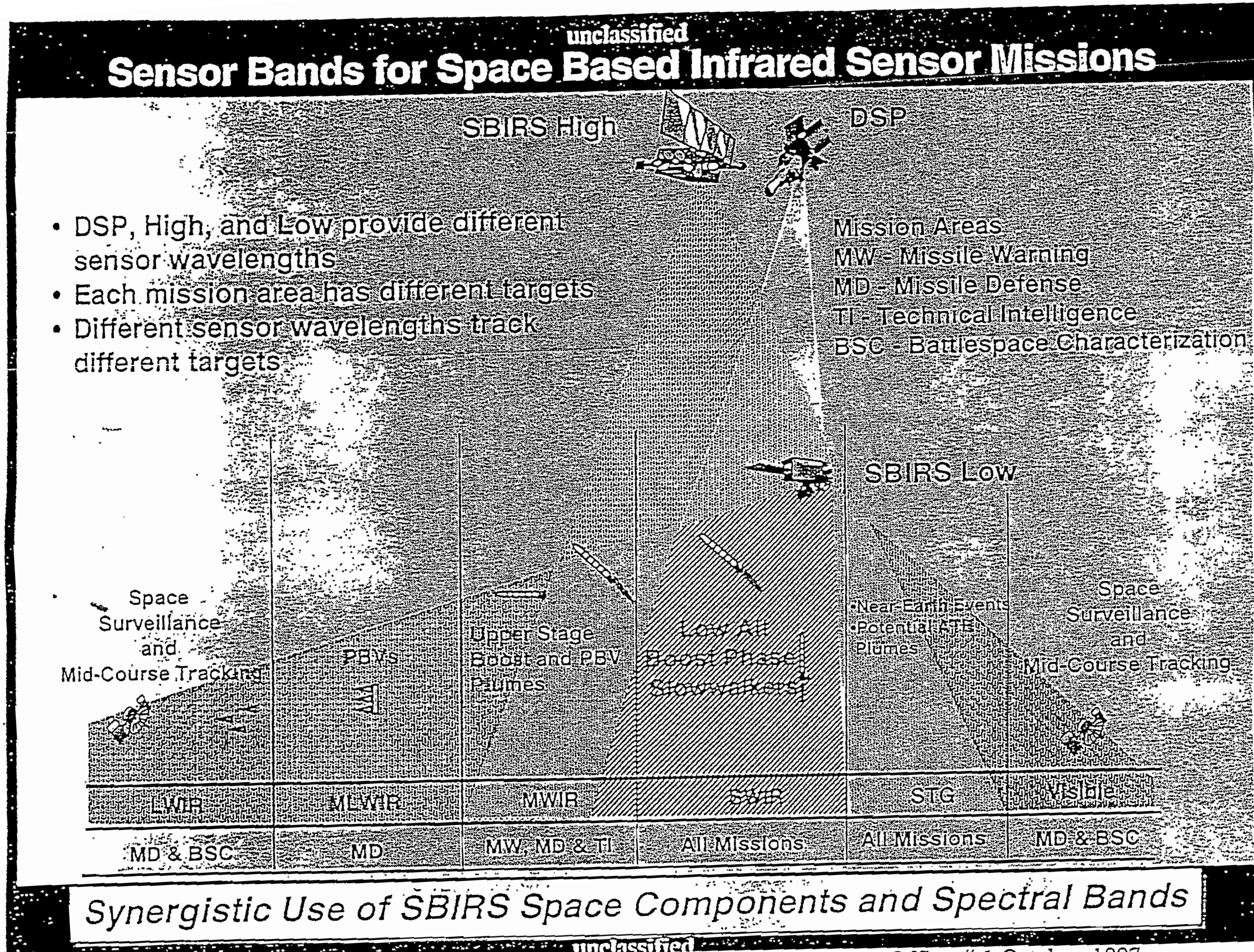
The Air Force had been interested in space-based infrared surveillance since the mid-1950s, and SMC had managed development programs in this area since its original organizational predecessor, the Western Development Division, had assumed responsibility for the first Air Force satellite program in 1956. During the period under consideration, 1994-1997, the operational infrared surveillance program was known as the Defense Support Program (DSP). It had been under development since 1963, and it had been in operation in various evolutionary phases since 1970.

However, SMC was also developing DSP's planned successor, known as the Space-Based Infrared System (SBIRS). The SBIRS concept actually included two planned satellite systems, referred to as SBIRS High and SBIRS Low. Both were heirs of infrared technology developed for the Ballistic Missile Defense Program (earlier known as the Strategic Defense Initiative) during 1983-1995. SBIRS High was focused on the detection and tracking of missiles during the earlier phase of their flight, while their motors were generating heat and infrared signatures in short wave lengths. SBIRS Low would add the capability of tracking and reporting other data about missiles during the middle portions of their flight, when their infrared signatures were at longer wave lengths.[1]

Defense Support Program

[redacted] The current configuration of the DSP satellite was known as DSP-1. It was one of the largest and heaviest military spacecraft in operation, weighing roughly

[1] Program Management Directive (U), SAF/AQS, "PMD 2362(3), PE# 35911F/63441F/64441F/35915F, Program Management Directive for Defense Support Program and Space-Based Infrared Systems (Space-Based Early Warning Systems IWSM Program)," 4 November 1996 (Doc V-1).



Source: Br[illegible]ng Charts (s), SMC/MT, "Space Based Infrared S[illegible]ms (SBIRS) Program Office," 1 October, 1997.
This chart is unclassified.

5,250 pounds and extending 32.8 feet long by 22 feet in diameter when fully deployed in orbit.

Four operational DSP-1 (or earlier model) satellites and one on-orbit spare satellite were supposed to be in orbit to provide full capability and protect against contingencies. Nevertheless, the remaining capabilities of satellites retired from the operational lineup were sometimes used as well. As Table 5-2 indicates, the first DSP-1 satellite had been launched on 14 June 1989, the second on 13 November 1990, and the third on 24 November 1991. During the period under consideration, SMC and Air Force Space Command successfully launched the fourth and fifth DSP-1 satellites on 22 December 1994 and 23 February 1997. All of these launches employed Titan IV boosters with Inertial Upper Stages (IUSs) except for the launch in 1991, which used the Space Shuttle with an IUS. On 5 September 1997, SMC awarded a contract (FO4701-97-C-0004) to Boeing's Defense and Space Group for final assembly of up to four more IUS vehicles and integration with Titan IVB launch vehicles for launch from Cape Canaveral AS. The contract was valued at $152.326 million, and the period of performance was June 1997 through December 2001. (For more details about the launches in 1994 and 1997, see Table 2-1 in Chapter II of this history.)[2]

[2] News Release (U), SMC/PA, "Upgraded Titan IV Launches Surveillance Satellite," 23 February 1997 (Doc V-2); News Release (U), SMC/PA, "Contracts: Defense Logistics Agency, Navy, Air Force," 22 May 95 (Doc V-8); News Release (U), SMC/PA, "Contracts: Army, Navy," 20 Jul 95 (Doc V-9); News Release (U), SMC/PA, "Contracts: Defense Logistics Agency, Army," 28 Sep 95 (Doc V-10); News Release (U), SMC/PA, "Contracts: Air Force, Army," 20 May 96 (Doc V-11; News Release, SMC/PA, "Contracts: Army," 20 Sep 96 (Doc V-12; News Release (U), Aerojet, "Aerojet Awarded Defense Support Program Consolidation Contract," 24 Sep 96 (Doc V-13); News Release (U), SMC/PA, "Contracts: Navy," 30 Sep 96 (Doc V-14); News Release (U), SMC/PA, Contracts: Army, Civil Works – Non Military, Defense Logistics Agency," 5 Sep 97 (Doc V-15); News Release (U), SMC/PA, "Contracts: Navy," 24 Sep 97 (Doc V-16); News Release (U), SMC/PA, "Contracts: Army," 25 Sep 97 (Doc V-17); News Release (U), SMC/PA, "Contracts: Defense Logistics Agency, Army," 26 Sep 97 (Doc V-18); News Release (U), SMC/PA, Contracts: Army, Defense Logistics Agency, Air Force," 1 Oct 97 (Doc V-19); News Release (U), SMC/PA, "Contracts: Army, Civil Works – Non Military, Navy," 1 Oct 98 (Doc V-20); History (U), Maj James J. Rosolanka, Defense Support Program (DSP), A Pictorial Chronology, 1970-1998, 1998 (Doc V-3); WWW Page, OSD/NSSA, "National Security Space Road Map: Defense Support Program (DSP)," 09 Sep 98 http://www.irmspace.tasc.com/irm/nssafouo/surwarn/init/html/dsp_dod.htm (Doc V-21); WWW Page (U), OSD/NSSA, "National Security Space Road Map: Defense Support Program (DSP)/Nuclear Detonation (NUDET) Detection System (NDS)," 25 Mar 99 http://www.irmspace.tasc.com/irm/nssafouo/ surwarn/init/html/dpsnds.htm (Doc V-22); Fact Sheet (U), SMC/PA, "Defense Support Program," Jul 92 (Doc V-23); Fact Sheet (U), SMC/PA, "Defense Support

[redacted] The DSP space segment consisted of four operational satellites in essentially geostationary orbits—24-hour orbits at a radial distance of 23,230 nautical miles from the earth's center. Each satellite rotated about its earth-pointing axis, which allowed its telescope to scan the entire terrestrial hemisphere visible from that point in space on every sweep. The layout of sensors on the telescope's focal plane was designed to distinguish signals both above and below the horizon (meaning inside or outside the circle made by the earth's outer edge).[3]

[redacted] Mounted inside each telescope was an array of over 6,000 non-imaging photoelectric cells, called detectors. The telescope picked up infrared radiation from a variety of sources, including the hot exhaust gases given off by missiles during launch. The photoelectric cells absorbed this radiation and produced electrical charges—signals—whose amplitude was proportional to the brightness of the radiation. The system then had to discriminate between signals representing missile launches and signals representing less interesting sources of radiation. This task was initiated by signal processing electronics within the sensor and was later completed by computers at the

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Program," 9 May 95 (Doc V-24); Fact Sheet (U), SMC/PA, "Defense Support Program," Nov 96 (Doc V-25); Fact Sheet (U), Peterson Air Force Base, "Defense Support Program Satellites," May 97 (Doc V-26); WWW Page (U), PAFB, Defense Support Program," [no date] http://www.pafb.af.mil/facts/dsp.htm (Doc V-27); WWW Page (U), "DSP Satellite," [no date] http://www.au.af.mil/au/database/projects/ay1996/acsc/ 96-004/hardware/docs/dsp.htm (Doc V-28); WWW Page (U), PAFB, "Defense Support Program," [no date] http://www.pafb.af.mil/45OG/3sls/ dsp.htm (Doc V-29); WWW Page (U), Maxwell AFB, "Defense Support Program (DSP)," [no date] http://www.cadre.maxwell.af.mil/warfarestudies/iwac/IWCBT/dsp.htm (Doc V-30); WWW Page (U), Air Force Spacve Inventory, "Defense Support Program," [no date] http://134.205.96.217/reo/SpaceOps/ dsp.htm (Doc V-31); WWW Page (U), TRW, "Defense Suppot Program (DSP)," [no date] http://www.trw. com/seg/sats/DSP.html (Doc V-32); WWW Page (U), TRW, "TRW Spacecraft Guide," [no date] http://www.trw.com/seg/space_guide/space_guide.cgi?12 (Doc V-33); Fact Sheet (U), AFSC "US Early Warning Satellites: Vela, DSP, SBIRS-Low," [no date] (Doc V-34); WWW Page (U), Dave's Miliary Space Page, "Military Satellite Data: DSP Block 1 Satellie Launches," [no date] http://users.ox.ac.uk/cgi-bin/safeperl/daveh/satellite (Doc V-35); WWW Page (U), Dave's Military Space Page, "Military Satellitd Data: DSP Block 2 Satellite Launches," [no date] http://users. ox.ac.uk/cgi-bin/safeperl/daveh/satellite (Doc V-36); WWW Page (U), Dave's Military Space Page, "Military Satellite Data: DSP-I Satellite Launches," [no date] http://users.ox.ac.uk/cgi-bin/safeperl/daveh/ satellite (Doc V-37); Document (U), FAS, Space Policy Projeet, "Defense Support Program," 20 Apr 97 (Doc V-38); Document (U), SAF/AQ, "Defense Support Program," [no date] (Doc V-39).

[3] Theodor W. Polk, Aerospace Corporation, comments and corrections made during review of DSP section of this history, 21 November 2001.

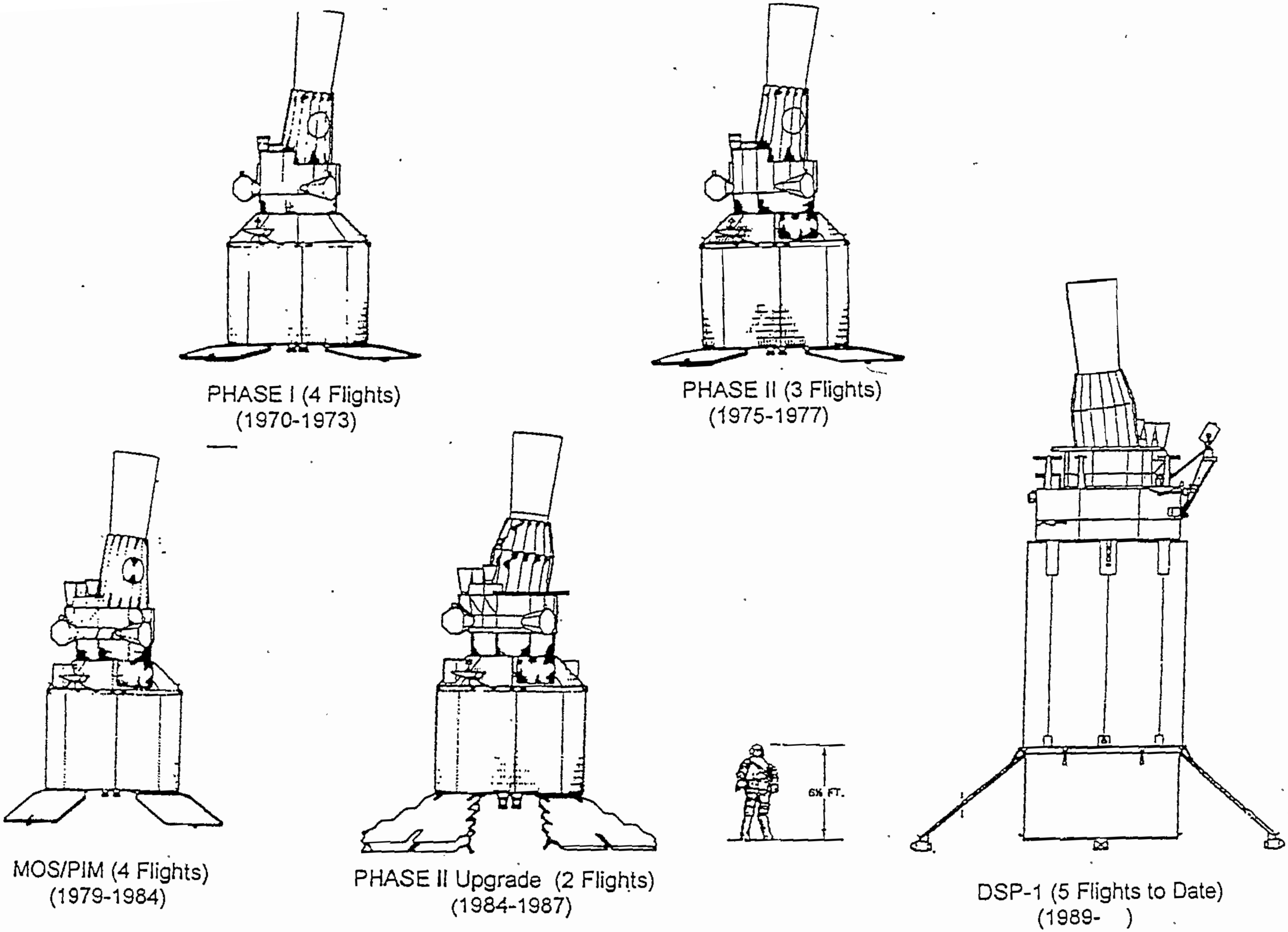
DSP Operational History

Flight #	Block	Spacecraft #	Sensor #	RI # (D1/D2)	RII #	ARI #	ARII #	Launch Date	Launch Site	Launch Vehicle
DSP-1	Phase I	1	R	–/1	–	–	–	11/6/70	ETR/LC-40	Titan IIIC/Transtage
DSP-2	Phase I	3	T	2/3	–	–	–	5/5/71	ETR/LC-40	Titan IIIC/Transtage
DSP-3	Phase I	4	U	1/4	–	–	–	3/1/72	ETR/LC-40	Titan IIIC/Transtage
DSP-4	Phase I	2	S	3/2	–	–	–	6/12/73	ETR/LC-40	Titan IIIC/Transtage
DSP-5	Phase II	8	9	6/9	8	–	–	12/14/75	ETR/LC-40	Titan IIIC/Transtage
DSP-6	Phase II	7	8	8/8	7	–	–	6/26/76	ETR/LC-40	Titan IIIC/Transtage
DSP-7	Phase II	9	5	9/5	9	–	–	2/6/77	ETR/LC-40	Titan IIIC/Transtage
DSP-8	MOS/PIM	11	13	13/13	11	–	–	6/10/79	ETR/LC-40	Titan IIIC/Transtage
DSP-9	MOS/PIM	10	10	12/11	10	–	–	3/16/81	ETR/LC-40	Titan IIIC/Transtage
DSP-10	MOS/PIM	13	12	–	13	2	–	3/6/82	ESMC/LC-40	Titan IIIC/Transtage
DSP-11	MOS/PIM	12	11	–	12	4	–	4/14/84	ESMC/LC-40	Titan 34D/Transtage
DSP-12	Phase II UG	6R	7R	–	6	3	–	12/22/84	ESMC/LC-40	Titan 34D/Transtage
DSP-13	Phase II UG	5R	6R	–	5	1	–	11/29/87	ESMC/LC-40	Titan 34D/Transtage
DSP-14	DSP-1(Blk 14)	14	17	–	–	6	1	6/14/89	ESMC/LC-41	Titan IVA/IUS
DSP-15	DSP-1(Blk 14)	15	15	–	–	8	2	11/13/90	ESMC/LC-41	Titan IVA/IUS
DSP-16	DSP-1(Blk 14)	16	16	–	–	5	3	11/24/91	KSC/LC-39A	STS/IUS
DSP-17	DSP-1(Blk 14)	17	14	–	–	7	4	12/22/94	ER/LC-40	Titan IVA/IUS
DSP-18	DSP-1(Blk 18)	20	21	–	–	9	7	2/23/97	ER/LC-40	Titan IVB/IUS

Flight # - The official designation of a particular launch.
Block - The engineering block or model of the satellite.
Spacecraft - The serial number of the delivered TRW spacecraft; spacecraft were not necessarily launched in sequential order.
Sensor - The serial number of the delivered Aerojet sensor; sensors, like spacecraft, were not necessarily launched in sequential order, usually for technical reasons
RI – RADEC I or RAdiation DEtection Capability I device; serial number of a nuclear detonation detection instrument; D1=Device1, D2=Device 2
ARI – Advanced RADEC I.
RII – RADEC II or RAdiation DEtection Capability II device; serial number of a nuclear detonation detection instrument.
ARII – Advanced RADEC II.
Launch Date - Launch date of the satellite from Cape Canaveral, Florida (Universal Coordinated Time).
Launch Site - Various names for Cape Canaveral, Florida and the NASA launch facilities
- ETR - Eastern Test Range
- ESMC - Eastern Space and Missile Center
- ER - Eastern Range
- KSC - Kennedy Space Center

Launch Vehicle - Launch vehicles used by the DSP satellites, along with their upper stage.

Source: History (u), Maj James Rosolanka (SMC/MT), "Defense Support Program (DSP): A Pictorial Chronology 1970-1998," 1998.



DSP Block Change Configurations

Source: History (u), Maj James Rosolanka (SMC/MT), "Defense Support Program (DSP): A Pictorial Chronology 1970-1998," 1[illegible].

ground stations. Detectors with two different compositions operated in two wavebands. Lead sulfide detectors worked in the shortwave infrared spectrum, and mercury cadmium teluride detectors worked in the mediumwave infrared.[4]

TRW, Incorporated, was responsible for developing and supporting the spacecraft, and Aerojet Electronic Systems Division was responsible for the sensors. Each of these contractors performed its work under three separate contracts, the purposes of which were development engineering, operations and maintenance, and spacecraft or sensor support. Early in the period under consideration, the program office decided to consolidate their work into only one contract each. On 23 September 1996, SMC awarded a consolidated contract (FO4701-96-C-0031, known as the DSP Sensor Post-Production Support Contract) to Aerojet for its work with DSP sensors during FY 1997. On 1 October 1996, SMC awarded a consolidated contract (FO4701-96-C-0030) to TRW for its work with the spacecraft during FY 1997. The contracts were extended for FY 1998, and they would be extended again in subsequent years.[5]

[redacted] The DSP system performed the strategic function of detecting and reporting on launches of both land-based ICBMs and Submarine-Launched Ballistic Missiles (SLBMs). However, it could also carry out the tactical mission of detecting and reporting on theater ballistic missiles such as the SCUDs that had been launched by Iraq during Operation Desert Storm. DSP used the same sensors for the tactical mission, but it employed a Centralized Tactical Processing Element to fuse data from multiple

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[4] History (S), History of SMC, Sep 1991-Oct 1992, pp. 331-332; History (U), Maj James J. Rosolanka, Defense Support Program (DSP), A Pictorial Chronology, 1970-1998, 1998 (Doc V-3).

[5] See note 2 above, Doc V-8 to Doc V-20; Document (U), HQ AFSPC/DOOO, "Initial Operational Capability (IOC) Declaration for the DSP Satellite Readout Station Upgrade (SRSU)," 8 Jun 98 (Doc V-40); News Release (U), Defense & Security Electronics, "Loral Awarded Services and Software Contract," Sep 95 (Doc V-41); News Release (U), Aviation Week, "First Phase of DSP-SIBRS Transition Underway," 29 Sep 97 (Doc V-42); Document (U), SMC/PK, "Thr Defense Support Program (DSP) Sensor Post-Production Support," 8 Oct 96 (Doc V-43).

(U) TABLE 5-1[6]

DSP Engineering History

{PRIVATE}	PHASE I	PHASE II	MOS/PIM	PHASE II UG	DSP-1
FLIGHT #	1,2,3,4	5,6,7	8,9,10,11	12,13	14-23
LAUNCH YEARS	1970-1973	1975-1977	1979-1984	1984-1987	1989-
WEIGHT (lbs)	2000	2300	2580	3690	5250
POWER (Watts)	400	480	500	680	1275
DESIGN LIFE (Years)	1.25	2.0	3.0	3.0	3.0
DETECTORS					
2000 (PbS) (SWIR)	X	X	X		
6000 (PbS) (SWIR)				X	X
2nd Color (HgCdTe) (MWIR)				Demo	X
CAPABILITY					
Below the Horizon (BTH)	X	X	X	X	X
Above the Horizon (ATH)		Demo		X	X
RADEC	X	X	X		
Advanced RADEC				X	X

Abbreviations: HgCdTe=Mercury Cadmium Teluride; MOS/PIM=Multi-Orbit Satellite/Performance Improvement Modification; MWIR=Medium Wave Infrared; PbS=Lead Sulfide; RADEC=Radiation Detection Capability; SWIR=Short Wave Infrared; UG=Upgrade.

[6] Source: This table is copied from History (U), Maj James J. Rosolanka, "Defense Support Program (DSP), A Pictorial Chronology, 1970-1998," 1998 (Doc V-3).

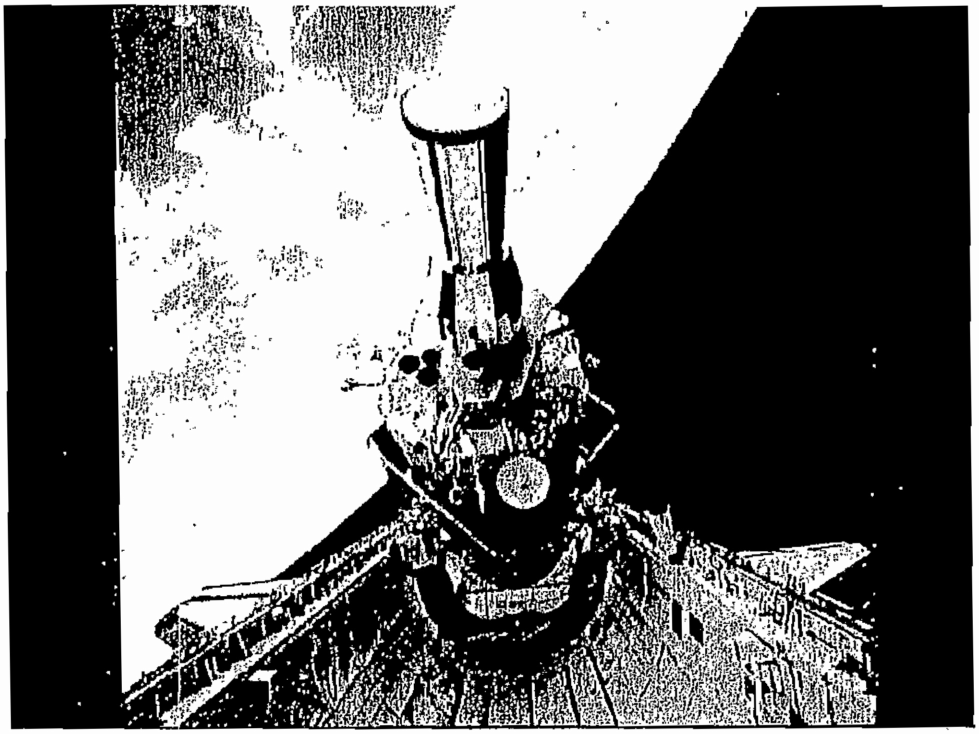

Illustration 5-4: DSP-13 and IUS being deployed from the Space Shuttle on 24 November 1991

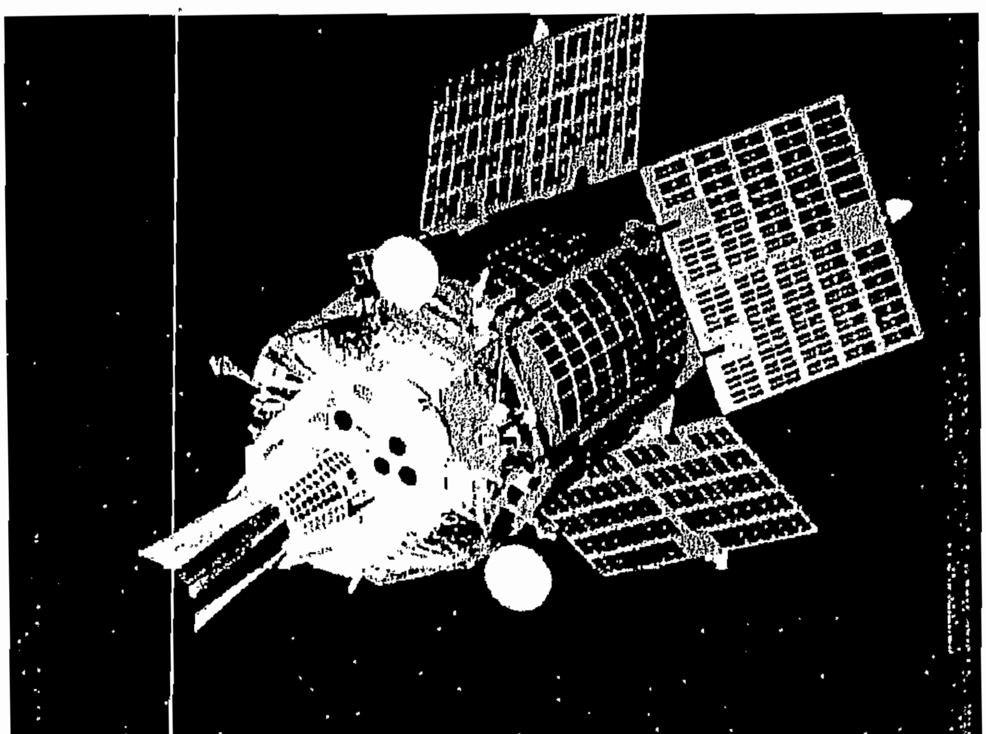

Illustration 5-5: Defense Support Program (DSP) satellite of the DSP-1 configuration as deployed in orbit (model)

Satellites and to report detections it in near real time to theater commanders. In times of conflict, additional uses were found for DSP's fused multisatellite observations, which led to the definition of new tactical missions for the ground system that produced this information.[7]

[redacted]DSP satellites carried additional sensors to perform the mission of detecting, locating, and reporting on nuclear detonations and background radiation. These sensors were called the NUDET (Nuclear Detonation) Detection System (NDS). They were contained in two packages known as Advanced Radiation Detection Capability (RADEC) I and Advanced RADEC II. The packages consisted of optical, x-ray, neutron, and gamma-ray sensors. They could detect nuclear detonations both inside the earth's atmosphere and in space, and they could monitor background radiation in space. (Global Positioning System (GPS) satellites also carried NDS secondary payloads during this period. See Chapter 3 of this history.)[8]

[redacted]The ground segment consisted of fixed and mobile ground stations and a ground communications network controlled by a Data Distribution Center. The ground stations included an Overseas Ground Station (OGS) in Australia, a European Ground Station (EGS), a CONUS (Continental United States) Ground Station (CGS), and Mobile Ground Terminals (MGTs). Before the period covered by this history, data from each satellite was processed at the ground station where the downlink from that satellite was read out. During this period, however, the ground system received two important upgrades in tactical capability—upgrades that involved additional routing of the data. The first upgrade was called the Attack and Launch Early Reporting to Theater (ALERT)

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[7] See note 2 above Doc V-21 to Doc V-39; Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); Theodor W. Polk, Aerospace Corporation, comments and corrections made during review of DSP section of this history, 21 November 2001.

[8] See note 2 above Doc V-21 to Doc V-39; Document (U), RDT&E Budget Item Justification Sheet (R-2 Exhibit), "0305911F Defense Support Program (Space)," Feb 97 (Doc V-44); Document (U), RDT&E Budget Item Justification Sheet (R-2 Exhibit), 0305913F NUDET Detection System (Space)," Feb 97 (Doc V-45).

system. It became operational in 1995. The second was called the Joint Tactical Ground Station (JTAGS), and it became operational in 1997.[9]

The ALERT system began as an R&D effort under an effort then called the Talon Shield Project. It was intended to exploit DSP's potential for warning of missile attacks within local theaters of war such as the Persian Gulf region during Operation Desert Storm. It also intended to improve the dissemination of tactical information to other users. To do so, the program office drew together the data from the complete DSP constellation as well as data and communications lines from other resources into a single location housed in the National Test Facility at Falcon AFB (later renamed Schriever AFB), Colorado. The data was integrated by a system of data processors, displays, and software collectively known as a Central Tactical Processing Element (CTPE). The resulting warning and cueing reports were transmitted to theater commanders to provide extremely rapid warning information by means of existing tactical communications networks. The CTPE was developed by Aerojet Electronic Systems Division under contract FO4701-92-C-0054. The program achieved dramatic improvements in the accuracy, description, and timeliness of warning data. The improved warning information contained estimates of missile launch point location, time, and heading, as well as post-boost trajectory data including the predicted impact area.[10]

The commander of Air Force Space Command, General Charles Horner, directed on 22 November 1993 that the CTPE system developed by the Talon Shield Project

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[9] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4).

[10] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); WWW Page (U), OSD/NSSA, "National Security Space Road Map: Attack and Launch Early Report to Theater (ALERT)," 25 Mar 99 http://www.irmspace.tasc.com/irm/nssafouo/surwarn/init/html/alert.htm (Doc V-46); Document (U), Aerojet, "ALERT Space-Based Theater Warning System," 20 Mar 98 (Doc V-47); Document (U), FAS, "ALERT Space-Based Theater Warning System," 24 Mar 98 (Doc V-48); Document (U), HQ AFSPC, "Initial Operational Capability (IOC) Decleration," 14 Mar 95 (Doc V-49); Memorandum (U), DSP Program Manager to AFPEO/SP & SAF/AQ, "Space-Based Infrared Systems Monthly Acquisition Report," Jun 97 (Doc V-50); News Release (U), Aviation Week, "An Aerojet-Led Team," 20 Nov 95 (Doc V-51).

become an operational system to be operated by Air Force Space Command. It became the Attack and Launch Early Report to Theater (ALERT) system, operated by the 11th Space Warning Squadron of Air Force Space Command's 21st Space Wing on 30 September 1994. After the initial operational testing and training, ALERT operations officially began on 10 March 1995. On 28 September 1995, SMC awarded a contract (FO4701-96-C-0004) to Aerojet Electronic Systems Division for maintaining and upgrading the CTPE portion of the ALERT system. A first version of upgraded CTPE software became operational on 4 April 1996, and a second version of software became operational on 11 July 1996. Plans called for continuing tactical improvements for DSP until Increment 1 of the SBIRS Ground Segment achieved initial operational capability. The Talon Shield Project, now renamed simply "Shield," continued to be run by Space Command's Space Warfare Center to provide R&D and test support to the operational Alert system.[11]

The Army and Navy Joint Tactical Ground Station (JTAGS) provided in-theater warning of a missile attack to theater commanders. This system could receive and use data directly from DSP satellites as well as processed warning information from communications networks. The data would be applied by units in the war zone to aim radars and antimissile weapons at incoming missiles. In the field, the JTAGS units would be equipped with three eight-foot antennas to receive telemetry directly fom the DSP satellites, a processing and communications unit housed in a shelter measuring 8x8x20 feet, a 60-kilowatt generator, and a HMMWV (High Mobility Multipurpose Wheeled Vehicle). The system became operational early in 1997.[12]

[11] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); Theodor W. Polk, Aerospace Corporation, comments and corrections made during review of DSP section of this history, 21 November 2001. See also note 8 above, Doc V-46 to Doc V-51.

[12] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS,"1998, pp. 14-16 (Doc V-4); Theodor W. Polk, Aerospace Corporation, comments and corrections made during review of DSP section of this history, 21 November 2001.

Space-Based Infrared System (SBIRS)

During FY 1992 and FY 1993, SMC had pursued concepts and technologies for follow-on systems to replace the Defense Support Program (DSP). By 1994, the concept for a system to succeed DSP was known as the Space-Based Infrared System (SBIRS). The overall SBIRS architecture was to be an integrated missile warning system that would support several missions--missile warning, missile defense, battlespace characterization, and technical intelligence. It would consolidate various infrared systems into a single architecture and employ constellations of different satellites in different orbits—geosynchronous, elliptical, and low earth—a complex of segments that the program office called "a system of systems."[13]

SBIRS High

The technological basis for the high-altitude follow-on system to detect missile launches was an earlier Strategic Defense Initiative (SDI) program known as the Boost Surveillance and Tracking System (BSTS). It had been transferred to the Air Force in FY 1992 and renamed the Advanced Warning System (AWS). In FY 1993, it had been renamed again as the Follow-on Early Warning System (FEWS). In November 1993, the FEWS program was canceled and replaced with a cheaper alternative called the Alert Locate and Report Missiles (ALARM) program. Before the ALARM program could really get started, however, it was replaced by the Space-Based Infrared System (SBIRS) concept for geosynchronous orbit, known as SBIRS High. The major development contracts for the programmatic predecessors of SBIRS High were these:[14]

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[13] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS,"1998, pp. 14-16 (Doc V-4).

[14] E-mail (U), Waldron to Mendoza, "BSTS, etc. History," 10 February 1999 (Doc V-5); Briefing Charts (U), PEO and Program Directors, "Space Based Early Warning System, "6 Oct 93 (Doc V-52); Briefing Charts (U), PEO and Progam Director's Review, "Space Based Early Warning System," 7 Dec 94 (Doc V-53).

Boost Surveillance and Tracking System (BSTS)
Phase IIIA: Demonstration and Validation
FO4701-87-C-0023 Lockheed Missiles and Space Company 17 Mar 87 - 30 Jun 91
FO4701-87-C-0024 Grumman Aerospace Company 17 Mar 87 - 30 Jun 91

Advanced Warning System (AWS)
Studies for AWS were conducted during FY 1991 under the 2 BSTS contracts and TRW's DSP contract (FO4701-86-C-0022). There were no separate contracts awarded for AWS.

Follow-on Early Warning System (FEWS): Demonstration and Validation
FO4701-92-C-0041 Lockheed Missiles and Space Company 21 Jul 92 - 30 Mar 94
FO4701-92-C-0042 TRW Space and Technology Group 21 Jul 92 - 30 Mar 94

OSD approved the plan for SBIRS in November 1994 and soon approved the program's entry into the early phase of development. The program's rapid first steps occurred through one of the earliest and most thorough applications of the Air Force's initiatives in streamlined acquisition reform. On 4 August 1995, SMC awarded two 15-month contracts for SBIRS Architecture Definition and Technology Demonstration (pre-EMD): one (FO4701-95-C-0017) to the team led by Lockheed Missiles and Space Company as the prime contractor, with Loral and Aerojet as subcontractors, and the other (FO4701-95-C-0018) to the team of Hughes Aircraft Co. and TRW. The efforts included the entire system architecture, the ground system for all mission processing, the space element for geosynchronous orbit, and satellite ground control. Each contract was valued at $80 million, and each was scheduled to end on 4 November 1996.[15]

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[15] WWW Page, OSD/NSSA, "National Security Space Road Map: Space Based Infrared system (SBIRS) High," 25 Mar 99 http://www.irmspace.tasc.com/irm/nssafouo/signit/html/sbirsh.htm (Doc V-54); Document (U), SAF/AQ, "SBIRS Architecture Baseline," [no date] (Doc V-55); Fact Sheet (U), SMC/PA, "Space-Based Infrared System," Sep 98 (Doc V-56); Document (U), RDT&E Budget Item Justification Sheet (R-2 Exhibit), "0604441F Space Based IR Arch (EMD) (Space)," Feb 97 (Doc V-57); News Release (U), Jane's Defense, "SBIRS to take over in space," 19 Aug 95 (Doc V-58); News Release (U), Defense & Security Electronics, "Hughes/TRW Team Wins SBIRS Contract," Oct 95 (Doc V-59); Document (U), SMC/PK, "Research and Development," 28 May 96 (Doc V-60); News Release (U), Aviation Week & Space Technology, "Pentagon Readiness SBIRS Award," 13 Nov 96 (Doc V-61); News Release (U), Space News, "Lockheed Martin Team Wins SBIRS," 13 Nov 96 (Doc V-62); Memorandum (U), Program Manager of SBIR High to AFPEO/SP & SAF/AQ, "Space Based Infrared Systems Monthly Acquisition Report," Jun 97 (Doc V-63); Staff Summary Sheet (U), SMC/AXD to SMC/AX, SMC/MT, SMC/FM, SMC/PK, SMC/JA, SMC/CCX, SMC/CV, SMC/CD, SMC/CC, AFPEO/SP, "Cost Credibility Implementation Memo to SMC SPDs," 1 Aug 97 (Doc V-64); Briefing Charts (U), SMC/TEI, "Space Based Infrared Systems (SBIRS) Program Office," 15 Aug 96 (Doc V-65); Briefing Charts (U), "Space

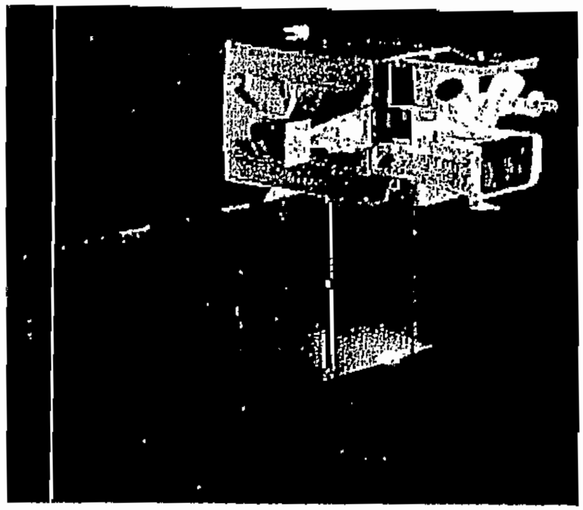

Illustration 5-6: An Early Model of a SBIRS High Geosynchronous Satellite

These efforts and plans underwent a Milestone II review by the Defense Acquisition Executive, Under Secretary of Defense for Acquisition and Technology Paul Kaminski, on 3 October 1996. As a result, he approved the SBIRS High program for entry into the Engineering and Manufacturing Development (EMD) phase.[16]

After evaluation of the contractors' efforts, SMC selected Lockheed Martin and its subcontractors for continuation into the EMD phase on 8 November 1996. The subcontractors were Aerojet Electro Systems to provide payload integration and mission data processing; Lockheed Martin Federal Systems to provide satellite and ground system control as well as telemetry and tracking operations; Northrop Grumman to provide the primary infrared sensor payload and focal plane assembly; and Honeywell to provide on-

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Jun 97 (Doc V-68); Briefing Chart (U), SMC/MT, "Space Based Infrared Systems (SBIRS)," 1 Oct 97 (Doc V-69).

[16] Management Plan (U), SMC/MT, "Space Based Infrared System Single Acquisition and Management Plan," 1 October 1996 (Doc V-6); see also note 13 above, Doc V-54 to Doc V-57.

board data processing. The new work on the contract (FO4701-95-C-0017) was valued at $2.1 billion for efforts over the next ten years.[17]

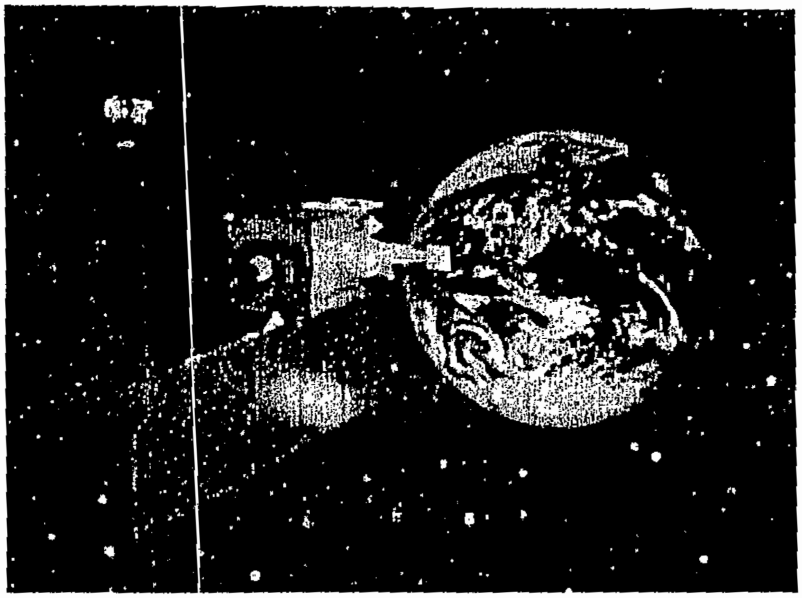

Illustration 5-7: An Artist's Concept of SBIRS High Satellites in Geosynchronous Orbit

[redacted] The planned system to be developed for SBIRS High consisted of the following major elements. The EMD contractors would provide five satellites and their suites of sensors for geosynchronous orbit. The sensors would include a scanning infrared sensor for rapid global coverage and a staring infrared sensor to detect and track missiles in theaters of conflict. The satellite bus into which the payload of sensors would be integrated was Lockheed Martin's A2100 spacecraft—already in commercial production—adapted for military requirements. The first of these geosynchronous satellites would be launched in the third quarter of FY 2002, and the following satellites would be launched a year apart. They would be launched using medium-lift EELVs or Atlas IIA launch vehicles. The SBIRS High contractors would also deliver two suites of sensors to be launched into highly eccentric, elliptical orbits. These sensors would share a

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[17] See note 13 above, Doc V-54 to Doc V-64. Value of contract from review comments by Col Daniel A. Cvelbar on 3 December 2001: "value of EMD contract (not including the pre-EMD) over the ten years including all options and award fee was $2.1 billion, not $1.8."

common design and common components with the geosynchronous sensors, creating economies of scale for sensor production. However, they would be integrated into the spacecraft for a different, classified system that also used an elliptical orbit. The first set of sensors for elliptical orbit would be delivered in the first quarter of FY 2001, and the second in 2002.[18]

[redacted] Like DSP satellites, the SBIRS High satellites might be a host platform for a set of sensors to detect, locate, and report on nuclear detonations inside and outside of the atmosphere. They would be able to locate nuclear detonations anywhere in the world and report them almost instantly. The proposed detection package under consideration was called the Space and Atmospheric Burst Reporting System (SABRS). It would be essential especially for detection and identification of nuclear bursts in the upper atmosphere as well as relatively low-energy bursts, such as those that might be detonated by countries only beginning to develop nuclear capabilities. SABRS would measure and report five types of nuclear data: neutron energy measured by time of flight, prompt (that is, bursts) of gamma rays from a detonation, delayed gamma rays from a cloud of nuclear debris, background environment of energetic ions and electrons, and spacecraft charging levels by low-energy particles. The SABRS package would occupy only a single square foot of volume and weigh only 35 pounds. The earliest SBIRS flight on which it could be carried would be the third launch of the SBIRS geosynchronous satellites, scheduled during 1997 for the third quarter of FY 2004.[19]

[redacted] The ground segment to be developed under the SBIRS High EMD contract would consist of the following facilities and capabilities: Mission Control

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[18] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); Ibid (Doc V-54 to V-57); World Wide Web pages (U), SMC/MT, "Space Based Infrared Systems (SBIRS)," no date, accessible at http://www. losangeles.af.mil/SMC/MT/sbirs.htm (Doc V-7).

[19] WWW Page (U), OSD/NSSA, "National Security Space Road Map: Space and Atmospheric Burst Reporting System (SABRS),""25 Mar 99 http://www.irmspace.tasc.com/irm/nssafouo/emonitor/init/html/sabrs.htm (Doc V-70); WWW Page (U), OSD/NSSA, "National Security Space Road Map: Space Based Infrared system (SBIRS) (HIGH) Nuclear Detonation (NUDET) Package," 25 Mar 99 http://www.irmspace. tasc.com/irm/nssafouo/surwarn/init/html/sbirsnp.htm (Doc V-71).

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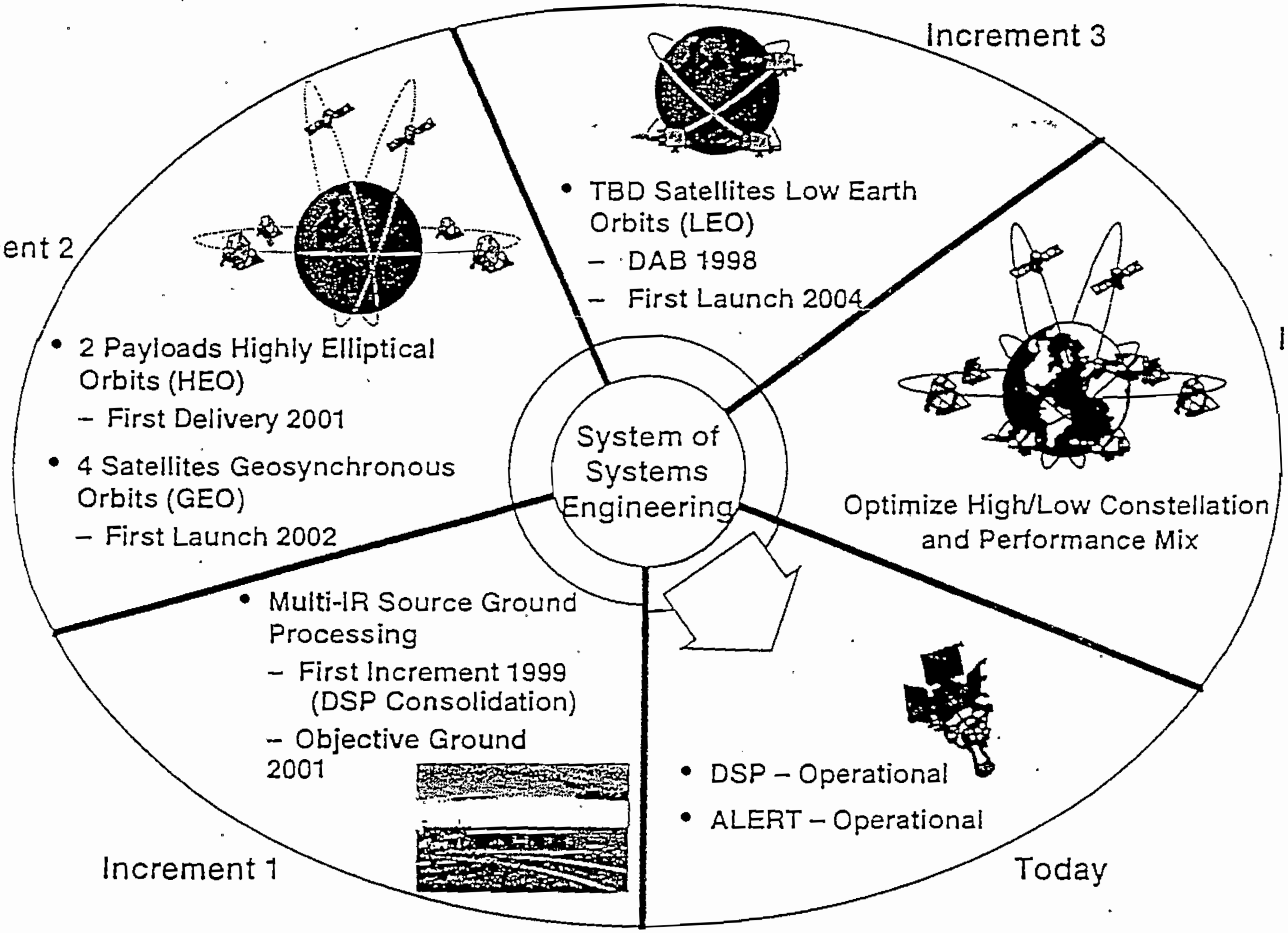
Integrated Architecture Approach



Integrated architecture to meet SBIR System ORD

Source: Brie-ng Charts (s), SMC/MT, "Space Based Infrared Sys- ms (SBIRS) Program Office," 1 October, 1997.
This chart is .classified.

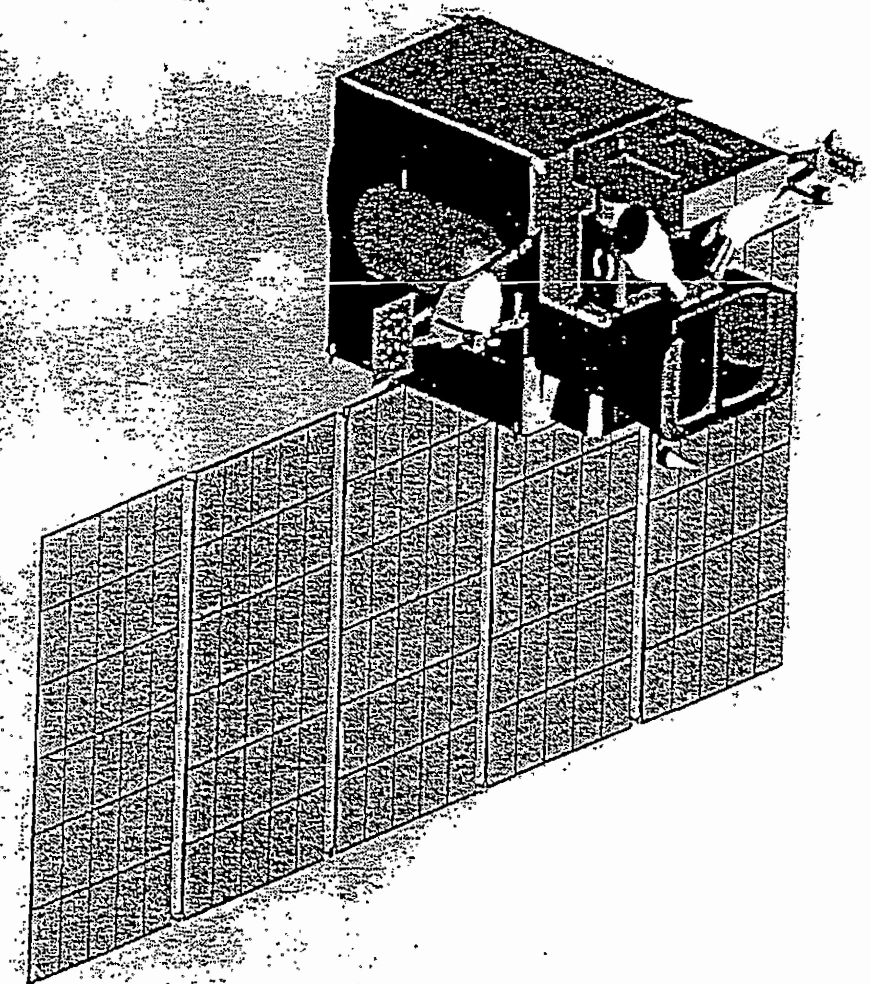
unclassified

SBIRS GEO Spacecraft Overview

On Orbit Configuration

Major Components

- A2100M Equipment Bus Section
- Payload Reference Bench
  - Common IR Sensors
  - Star Trackers
- Fixed Sunshade
- Deployable Communications Suite
  - K-band Antennas
  - S-band Antenna
  - GPS Receive Antenna
  - SGLS Antennas
- Five Panel Rigid Solar Array
  - GaAs Solar Cells
  - Single axis array drive



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Source: Briefing Charts (s), SMC/MT, "Space Based Infrared Systems (SBIRS) Program Office, " 1 October, 1997.
This chart is unclassified.

Stations (MCSs) including a primary MCS located in the continental United States, a backup MCS, and a survivable MCS; Relay Ground Stations (RGSs) located overseas; Relocatable Terminals; and the necessary communications links. The ground segment for SBIRS High would build on the existing ground segment for DSP, first consolidating and updating the DSP capabilities. The first step would be to consolidate three DSP operational sites located in the United States and overseas—along with their associated comunications networks—into an integrated site at Buckley Air National Guard Base in Aurora, Colorado. The integrated ground segment centered at Buckley would be able to fuse all data from infrared sensors and other sources into a product of the greatest utility to national and theater command authorities. The hardware and software at the consolidated site would be designed into modular components so that it could be updated or replaced relatively easily. The consolidation was scheduled for completion in the third quarter of FY 1999. The operations at Buckley would then be upgraded to accommodate SBIRS High by the second quarter of FY 2001.[20]

[redacted] Both the SBIRS High and the SBIRS Low programs were supported during this period by a series of on-orbit demonstrations of sensor technologies called the Miniature Sensor Technology Integration (MSTI) program. Three MSTI satellites were launched: MSTI-1 on 21 November 1991 using a Scout booster launched from Vandenberg AFB; MSTI-2 on 8 May 1994 using a Scout booster launched from Vandenberg; and MSTI-3 on 16 May 1996 using a Pegasus launch vehicle launched from an L-1011 aircraft near Edwards AFB. MSTI-2 successfully demonstrated acquisition and tracking of a simulated theater ballistic missile, a Minuteman III missile launched from Vandenberg AFB. MSTI-3 gathered extensive mediumwave infrared data on backgrounds in the shortwave and mediumwave spectra using a sensor payload developed

[20] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); Ibid (Doc V-54 to V-57); World Wide Web pages (U), SMC/MT, "Space Based Infrared Systems (SBIRS)," no date, accessible at http://www. losangeles.af.mil/SMC/MT/sbirs.htm (Doc V-7).

by Science Applications International Corporation (SAIC). The SBIRS contractors used the data in simulations and passband refinement.[21]

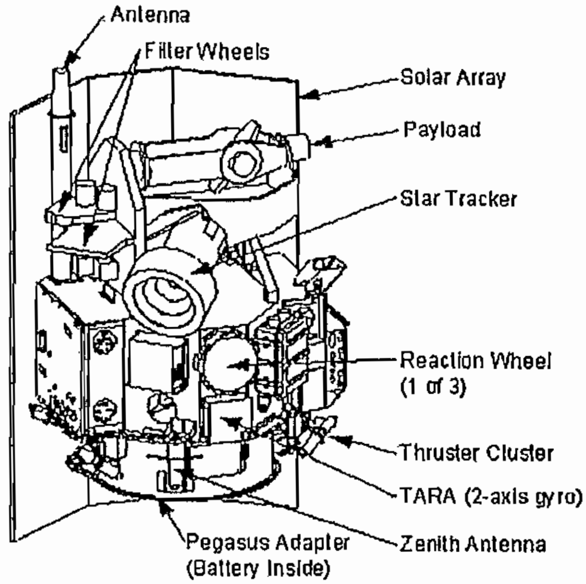

Illustration 5-10: Schematic of MSTI-3 satellite

SBIRS Low

The technological basis for the low-altitude follow-on system to provide tracking and discrimination data for missiles in the middle portion of their trajectories had also been an SDI program. It had been known as the Space Surveillance and Tracking System (SSTS) during the mid and late 1980s. After that, it went through several restructurings

[21] A technical expert made the following comment about MSTI while reviewing this portion of this history: "...MISTI-3 collected clutter background data that was used in background scene model development/verification and supported spectral band optimization studies. The MISTI data has applicability to the SWIR and MWIR band selection for both SBIRS High and Low" (e-mail, James E. Slattery, Aerospace Corporation, "RE: Review of Portion of SMC History," 10 December 2001 (Doc V-72A)). See also WWW Page (U), OSD/NSSA, "National Security Space Road Map: Miniature Sensor Technology Integration (MSTI)," 25 Mar 99 (Doc V-72B); WWW Page (U), OSD/NSSA, "National Security Space Road Map: Miniature Sensor Technology Integration (MSTI) Program Satellites (MSTI-1 and MSTI-2)," 25 Mar 99 http://www.irmspace.tasc.com/irm/ nssafouo/dod/photos/mstichip.htm (Doc V-73); Fact Sheet (U), SMC/PA, "Miniature Sensor Technology Integration-3," May 96 (Doc V-74); Staff Summary Sheet (U), MTAX to MT, CCX, CD, CV, CC, "MSTI-3 MRR Minutes, SMC/CC Action Item #6703," 9 May 96 (Doc V-75); Document (U), SMC/MT, "Miniature Sensor Technology Integration-3 (MSTI-3) Mission Readiness Review (MRR), Pegasus-14," Apr 96 (Doc V-76); Staff Summary Sheet (U), SMC/MTASE to SMC/MT, CCX, CD, CV,CC, "MSTI-3 Spacecraft Loss of Attitude Control on 29 Oct 96," 30 Oct 96 (Doc V-77); Fact Sheet (U), AFMC, "Miniature Sensor Technology Integration-3," May 96 (Doc V-78).

and changes in concept as its planned constellation of satellites became smaller and cheaper. In July 1990, the SDIO had renamed the program Brilliant Eyes. Brilliant Eyes became a simpler system as interest shifted from protection against Soviet strategic missiles toward protection against shorter range, third-world missiles. By FY 1995, the concept for a SBIRS system using low-altitude infrared sensors to track missiles in the middle portion of their trajectories was known as SBIRS Low. The major development contracts for the programmatic predecessors of SBIRS Low were these: [22]

Space Surveillance and Tracking System (SSTS) Phase II: System Concept Definition
FO4701-87-C-0093 Lockheed Missiles and Space Company 30 Jul 87 – 24 Jan 91
FO4701-87-C-0094 TRW Space and Technology Group 30 Jul 87 – 24 Jan 91

Brilliant Eyes Step 01: Concept Design and Test Requirements
FO4701-91-C-0049 Martin Marietta 5 Jun 91 – 30 Sep 92
FO4701-91-C-0050 Rockwell International Corporation 5 Jun 91 – 30 Sep 92
FO4701-91-C-0051 TRW Space and Technology Group 6 Jun 91 – 30 Sep 92
FO4701-91-C-0052 Lockheed Missiles and Space Company 6 Jun 91 – 30 Sep 92

Brilliant Eyes Step 02: Demonstration and Validation
FO4701-92-C-0062 TRW Space and Technology Group 11 Dec 92 -
FO4701-92-C-0063 Rockwell International Corporation 11 Dec 92 -

The concept for SBIRS Low continued to evolve, driven by the work of TRW and Rockwell under the Brilliant Eyes contracts and the work of the program office to shape the acquisition and schedule. By 1997, the concept for an operational system included four segments: a launch segment, a space segment, a ground segment, and a support segment. The launch segment would employ Delta II launch vehicles, which would launch three satellites at a time into low earth orbit.[23]

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[22] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS,"1998, pp. 14-16 (Doc V-4).

[23] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); WWW Pae (U), OSD/NSSA, "National Security Space Road Map: Space Based Infrared System – Low Earth Orbit (SBIRS-Low)," 25 Mar 99 http://www.irmspace.tasc.com/irm/nssafouo/sigint/html/sbirlowd.htm (Doc V-79); Fact Sheet (U), SMC/PA, "Space-Based Infrared System," Sep 98 (Doc V-80); Document (U), TRW, "Space-Based Infrared System Low," [no date] (Doc V-81); Document (U), Boeing, "SBIRS-Low/LADS," [no date] (Doc V-82); Fact Sheet (U), FAS, "Space Based Infrared System – Low Space and Missile Tracking System Brilliant Eyes," 9 Feb 99 (Doc V-83); WWW Page (U), DSP, "Space-Based Infrared System (SBIRS)."

The ground segment would build on the overall SBIRS ground segment that had been under development for the SBIRS High portion of the architecture since 8 November 1996. The unique software and equipment for SBIRS Low would be developed during its EMD Phase as a discrete addition (referred to as a "plug") to the basic Master Control Station (MCS) developed under SBIRS High. The result would be a consolidated SBIRS ground processing station.[24]

The space segment—the SBIRS Low satellites and their exact orbital placement—was the object of more strenuous planning. The constellation would consist of perhaps 20 to 30 satellites in low earth orbits. Although their low altitude would require a greater number of satellites in orbit to provide adequate coverage of the earth, their proximity to potential targets would make it easier for their sensors to acquire longwave infrared radiation from missiles in mid flight and to provide surveillance of theaters of conflict at higher resolutions.[25]

Each satellite would have two primary infrared sensors. They would cover a wide part of the electromagnetic spectrum, enabling them to observe targets of different temperatures. They would also be able to carry out surveillance of space objects and

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FY96 http://www.dote.osd.mil/reports/FY96/96SBIRS.html (Doc V-84); Document (U), Ballistic Missile Defense Organization, "National Missile Defense Program Space and Missile Tracking System (SMTS)," [no date] (Doc V-85); WWW Page (U), OSD/NSSA, "National SecuritySpace Road Map: Cobra Brass," 25 Mar 99 http://www.irmspace.tasc.com/irm/nssafouo/surwarn/init/html/cobrabra.htm (Doc V-86); WWW Page (U), OSD/NSSA, "National Security Space Road Map: Mid-Course Space Experiment (MSX)," 25 Mar 99 http://www.irmspace/tasc/com/irm/nssafouo/surwarn/init/html/midsex.htm (Doc V-87).

[24] Document (U), SMC/MT, "Statement of Objectives Space Based Infrared Systems (SBIRS) Low Program Definition and Risk Reduction (PDRR) Program," 16 Sep 97 (Doc V-88); Document (U), SMC/MT, "Statement of Objectives Space Based Infrared Systems (SIBRS) Low Program Defintion and Risk Reduction (PDRR) Program, Section M," 22 Sep 97 (Doc V-89); Document (U), SMC/MT, "Statement of Objectives Space Based Infrared Systems (SBIRS) Low Program Definition and Risk Reduction (PDRR) Program, Section L," [no date] 97 (Doc V-90); Briefing Charts (U), SMC/MT, "Industry Forum # 1: SBIR Low Acquisition Strategy," 26 Jun 97 (Doc V-91); see also note 21 above, Doc V-79 to Doc V-87.

[25] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); see also note 21 above, Doc V-79 to Doc V-87.

battlefields. The first sensor, the Acquisition Sensor, would be a scanning infrared sensor operating in the shorter wavelengths. It would cover the visible area in a fast scan mode from horizon to horizon, using a wide field of view and a small aperture to acquire missile targets during their boost phase. The Acquisition Sensor, after initiating a two-dimensional track of the target, would then pass information about the target to the Tracking Sensor.[26]

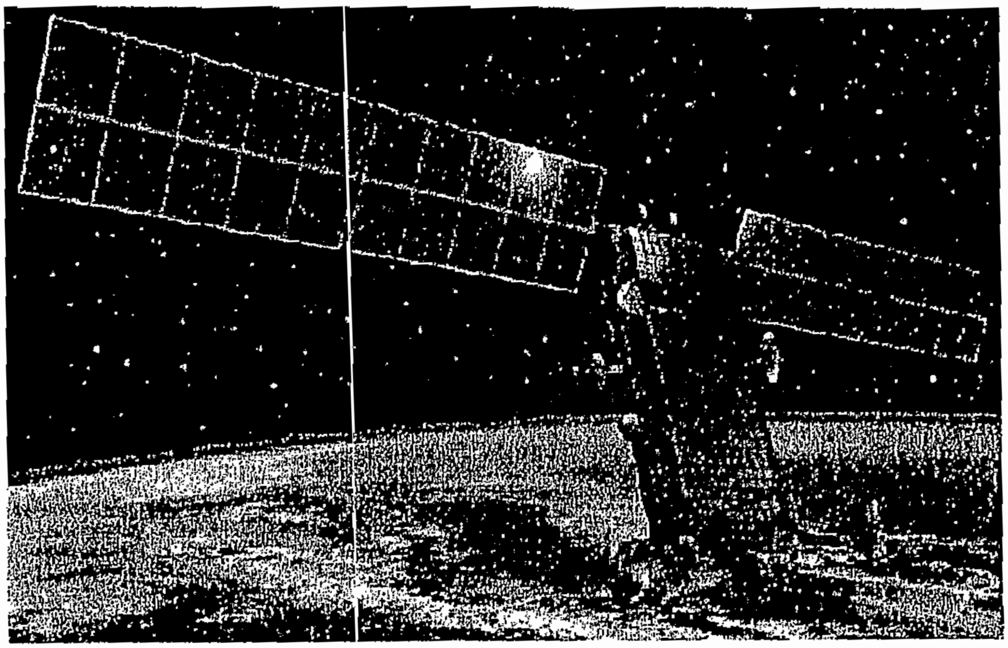

Illustration 5-11: An Artist's Concept of An Operational SBIRS Low Satellite

The Tracking Sensor would be a staring infrared sensor with a narrow field of view and large aperture, and it would be mounted on a two-axis gimbal. After receiving the target from the Acquisition Sensor, it would verify the target, lock on to it, and track it through midcourse trajectory into re-entry. If a target were to leave a given satellite's field of view, that satellite would use an inter-satellite crosslink to hand off the target to

[26] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); Ibid (Doc V-79 to V-87); Document (U), SMC/PK, "Letter RFP Rev 3.7," 6 May 94 (Doc V-92); Document (U), SMC/PK, "Consolidated Requirements: Letter RFP Rev 3.7 Requirements with Modifications from 9 Dec LRFP Change Package Rev 4.2," 9 Dec 94 (Doc V-93).

another satellite in a better viewing position. This crosslink would enable any satellite to communicate with all other satellites in the constellation.[27]

The satellites' on-board data processors would work out the target missile's trajectory, predict its impact point, and relay the information to anti-missile batteries that would intercept and destroy the target. SBIRS Low sensors would cover a wider area than the ground-based radars used to aim any particular battery of anti-missile weapons. They would allow such batteries to take several shots at any given hostile missile, and to do so at a safer range.[28]

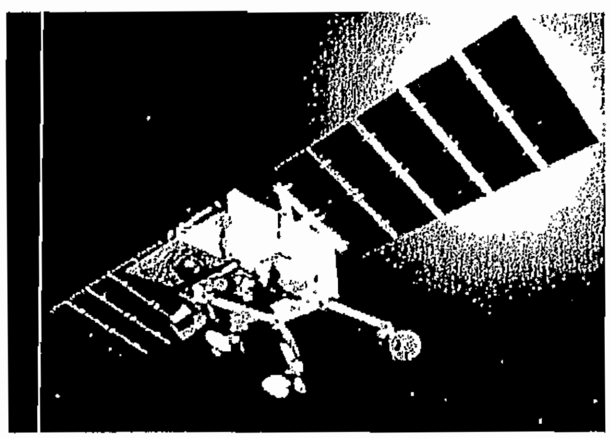

Illustration 5-12: A Concept for a SBIRS Low Flight Demonstration System (FDS) Satellite

The first part of Phase I of the SBIRS Low acquisition was known as Program Definition and Risk Reduction. The program office at first planned to award two contracts for this phase, and each contractor was to build and fly two demonstration satellites to resolve some technical problems and demonstrate that the systems could detect, track, and discriminate missiles and perform kill assessments. The product of

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[27] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); see also note 21 above, Doc V-79 to Doc V-87.

[28] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); see also note 21 above, Doc V-79 to Doc V-87.

these efforts was known as the SBIRS Low Flight Demonstration System (FDS). OSD approved an acquisition plan for it in August 1992.[29]

Unfortunately, after the initial source selection and system design was completed, the program's budget was not large enough to support two prime contractors developing two demonstration satellites each. Congress had cut the President's budget for Brilliant Eyes from $250 million to $140 million in FY 1994, and it limited spending in FY 1995 to $80 million until OSD submitted a statement of compliance with the 1972 Anti-Ballistic Missile Treaty. OSD submitted the statement of compliance on 2 May 1995. The program office decided in 1994 to award only one contract—known as the "flyer contract"—for the satellites and another, lower cost, supporting contract to develop algorithms and simulations.[30]

On 2 May 1995, SMC awarded the FDS flyer contract to TRW to design and build two FDS satellites to be launched in FY 1999. The actual contractual mechanism was a restructuring of the Brilliant Eyes Demonstration and Validation Contract (FO4701-92-C-0062). The additional work was valued at $15.314 million. On 8 March

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[29] See note 21 above, Doc V-79 to Doc V-87; see also note 22 above, Doc V-88 to Doc V-90; Document (U), RDT&E Budget Item Justification Sheet (R-2 Exhibit), "0603441F Space Based IR Archive (Demonstration/Validation) (Space)," Feb 97 (Doc V-94); News Release (U), Aviation Week, "TRW Wins Brilliant Eyes," 8 Apr 95 (Doc V-95); News Release (U), Defense News, "Rockwell Keeps Integral Role in Brilliant Eyes Successor," 29 May – 4 Jun 95 (Doc V-96); Document (U), Inside Missile Defense, "Air Force Prepares for Accelerated Space and Missile Tracking System," 27 Sep 95 (Doc V-97); Memorandum (U), SMC/MTKA to U.S. Department of Commeree Business Daily, "Synopsis Number 75 – Presolicitation Notice/Procurement," 15 May 96 (Doc V-98); Document (U), Douglas Berenson, "Space Architect Considers Having SBIRS Low Perform Double-Duty," 19 Jun 97 (Doc V-99); Memorandum (U), SBIR Low Program Manager to AFPEO/SP & SAF/AQ, "SBIR Low Monthly Activity Report, "15 Jul 97 (Doc V-100); News Release (U), Astro News, "AF restructures Space Based Infrared System," 12 Feb 99 (Doc V-101); News Release (U), SMC/PA, "Contract Announcements: Defense Logistics Agency, Navy, Army & Air Force," 2 May 95 (Doc V-102); News Release (U), SMC/PA, "Contract Announcements: Army, Air Force & Navy," 8 Mar 96 (Doc V-103); News Release (U), SMC/PA, "Contract Announcements: Air Force," 3 sep 96 (Doc V-104); News Release (U), SMC/PA, "Contract Announcements: Air Force, Navy," 2 Oct 96 (Doc V-105); Document (U), SMC/MT, "Sources Sought Synopsis for SBIRS Low Strategy," 3 Mar 97 (Doc V-106); Memorandum (U), SMC/MTKA to U.S. Department of Commerce Business Daily, "Sources Sought Synopsis Number 21," 21 Apr 97 (Doc V-107).

[30] Descriptive Pamphlet (U), SMC/MT, "Space Based Infrared System, SBIRS," 1998, pp. 14-16 (Doc V-4); see also note 21 above, Doc V-79 to Doc V-87; see also note 27 above, Doc V-95 to Doc V-107.

1996, SMC added another $214.1 million to the contract to cover the remaining provisions for fabrication, test, and operation of two FDS satellites for validation of the Space and Missile Tracking System (SMTS), as SBIRS Low was sometimes called. TRW was to launch both FDS satellites into the same orbit using a Delta II launch vehicle in the second quarter of FY 2000. Boeing North America (formerly Rockwell International Space Systems Division) was awarded the FDS "non-flyer" contract—actually a restructuring of its existing contract (FO4701-92-C-0063) for Brilliant Eyes.[31]

Nevertheless, after obtaining adequate funding, the program office decided to issue another flyer contract for SBIRS Low Demonstration and Validation to make Phase I more competitive. SMC therefore issued another request for proposals in June 1996. On 2 September 1996, it awarded the contract (FO4701-96-C-0044) to Boeing North America. This was to be a risk reduction effort for a cost-effective alternate design concept for SBIRS Low (also known as the Space and Missile Tracking System). The product of Boeing North America's efforts was known as the Low Altitude Demonstration System (LADS). Boeing would launch one LADS satellite on a Lockheed Martin booster, and it would also operate a ground demonstration payload. The satellite would use a spacecraft bus and a launch vehicle built by Lockheed Martin. The FDS non-flyer contract with Boeing was terminated in December 1996 in favor of the competitive Demonstration and Validation contract.[32]

The two FDS satellites and the LADS satellite were scheduled for launch in the third quarter of FY 1999. They were to operate in orbit for two years, conducting tests and experiments to verify the concept. A deployment decision for the operational constellation could then be made in the year 2001. If the decision were favorable, the first operational SBIRS Low satellite could be delivered in 2004. (SMC had announced

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[31] See note 21 above, Doc V-79 to Doc V-87; see also note 24 above, Doc V-92 to Doc V-93.

[32] See note 21 above, Doc V-79 to Doc V-87; see also note 27 above, Doc V-94.

plans in 1994 for a first satellite and launch in 2006, but Congress had directed that the schedule be accelerated.)[33]

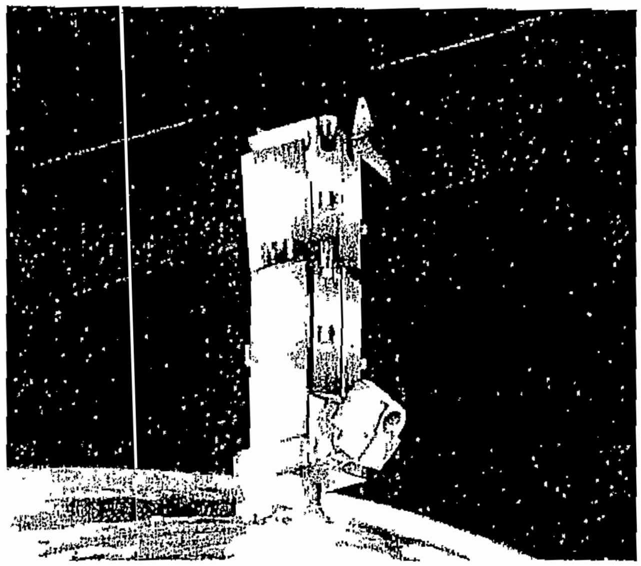

Illustration 5-13: An Artist's Concept of a Low Altitude Demonstration (LADS) Satellite

The next part of Phase I, known as Program Definition, would proceed at the same time. It would involve selecting two contractors in about the first quarter of FY 1999 to produce initial system designs for SBIRS Low. This would be followed by the start of Phase II (Engineering and Manufacturing Development) in 2001. During this phase, a single contractor would develop the operational SBIRS Low system, launching the first satellite, as mentioned above, in 2004.[34]

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[33] See note 21 above, Doc V-79 to Doc V-87; see also note 22 above, Doc V-88 to Doc V-91.

[34] See note 21 above, Doc V-79 to Doc V-87; see also note 22 above, Doc V-91.