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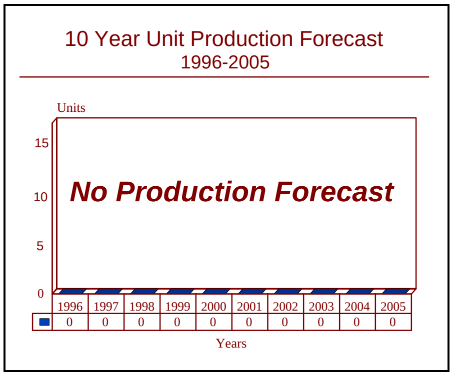
Improved Space-Based Tactical Warning/ Attack Assessment (ISB TW/AA) - Archived 9/97

Outlook

- Program terminated in FY94
- Much of this technology used in the Space-Based Infrared System
- For additional information, see the report **SBIRS**



Orientation

Description. The Improved Space-Based Tactical Warning/Attack Assessment (ISB TW/AA) system (formerly know as the Follow-on Early Warning System or FEWS) was originally intended to be a satellite system developed to replace Defense Support Program (DSP) satellites. The ISB TW/AA satellites were being designed to detect, identify and track intercontinental ballistic missiles (ICBMs), sea-launched ballistic (SLBMs) and tactical surface-to-surface missiles during their initial stages of flight.

Sponsor

US Air Force
  Air Force Space and Missile Systems Center
  Los Angeles, California (CA)
  USA

Prime Contractors. The USAF selected two contractor teams in July 1992. The two teams are headed by Lockheed Corp, Lockheed Martin Missiles & Space Co Inc, Sunnyvale, CA and TRW Inc, Space and Defense Sector, Redondo Beach, CA.

Lockheed Martin Corp
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  1111 Lockheed Way
  PO Box 3504
  Sunnyvale, California (CA) 94088-3504
  USA
  Tel: +1 408 742 4321
  Fax: +1 408 756 8654
  (Prime contractor team leader)

TRW Inc
  Space & Defense Sector
  Defense Systems Division
  One Space Park R5/2089
  Redondo Beach, California (CA) 90278-1001
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  Tel: +1 310 813 0514
  Fax: +1 310 814 6231
  (Prime contractor team leader)

Contractors

E-Systems Inc
ECI Division
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St Petersburg, Florida (FL) 33733-2248
USA
Tel: +1 813 381 2000
Fax: +1 813 343 1295
(Lockheed team member; up/down communications)

Honeywell Inc
Satellite Systems Operation
PO Box 21111
Phoenix, Arizona (AZ) 85036
USA
Tel: +1 602 436 2311
Fax: +1 602436- 252
(Lockheed team member; on-board computing)

Hughes Aircraft Co
Hughes Electronics Corp
Electro-Optical & Data Systems Group
PO Box 902
El Segundo, California (CA) 90245-0902
USA
Tel: +1 213 648 2345
(Lockheed principal team member; primary mission payload)

Loral Federal Systems Co
6600 Rockledge Drive
Bethesda, Maryland (MD) 20817
USA
Tel: +1 301 493 8100
Fax: +1 301 493 1747
(Lockheed team member; ground-support segment)

McDonnell Douglas Corp
McDonnell Douglas Aerospace
5301 Bolsa Avenue
Huntington Beach, California (CA) 92647
USA
Tel: +1 714 896 3311
Fax: +1 714 896 1308
(Lockheed team member; cross-link communications system)

Northrop Grumman Corp
Electronics & Systems Integration Division
1111 Stewart Avenue
Bethpage, New York (NY) 11714-3580
USA
Tel: +1 516 575 5119
Fax: +1 516 575 3691
(TRW principal team member; primary payload including IR focal plane)

Raytheon Co
Research Division
131 Spring Street
Lexington, Massachusetts (MA) 02173
USA
Tel: +1 617 863 5300
Fax: +1 617 642 3936
(TRW team member)

Science Applications International Corp (SAIC)
10260 Campus Point Drive
San Diego, California (CA) 92121-1522
USA
Tel: +1 619 546 6000
Fax: +1 619 546 6777
(Lockheed team member; mission analysis)

Status. Program terminated in early 1994, to be replaced by the ALARM program which in turn was canceled in late 1995 in favor of the SBIRS program, which is scheduled to have initial launch capability in 2002.

Total Produced. None.

Application. ISB TW/AA spacecraft were designed to detect, identify and track intercontinental ballistic missiles (ICBMs), sea-launched ballistic (SLBMs) and tactical surface-to-surface missiles during their initial stages of flight.

Price Range. The Air Force had expected the ISB TW/AA program, including the engineering and manufacturing effort, production and fielding of ground segments and procurement of the first seven satellites, to cost approximately $9.4 billion.

Technical Data

Design Features. ISB TW/AA satellite system design details were difficult to assess. However, the spacecraft plans did follow some basic design guidelines. ISB TW/AA satellites were likely be deployed in geosynchronous orbits in pairs, which provides a stereoscopic capability. Stereo coverage provides better detection of missile launches. ISB TW/AA also featured intersatellite crosslinks, possibly laser-based, to reduce the system's dependence on overseas ground stations.

Like the Boost Surveillance and Tracking System (BSTS) designs before them (see below), the ISB TW/AA satellites may have featured focal plane sensors. This technology is better able to detect the telltale exhaust plumes of solid propellant missiles, especially the type used in tactical surface-to-surface missiles.

At the direction of Congress, the ISB TW/AA satellites were to feature direct downlinks enabled by onboard processors, with the information being sent directly to US tactical commanders facing threats such as those encountered from Iraqi SCUD missiles during the Persian Gulf War. Before the program was terminated, however, there was still some question as to whether this capability would be developed in time to be fielded on the first ISB TW/AA satellite.

BSTS Design. Two primary pieces of equipment on board the canceled BSTS satellites were a large optical telescope and a focal plane array (FPA). The FPA would detect the infrared radiation emitted by a missile's exhaust plume and feed this information to the satellite's onboard processing system. Lockheed and Grumman took two different approaches in developing the FPA.

The Lockheed system had a scanning sensor, in which focal plane assemblies containing clusters of detectors are arranged in a pattern on the array. In this arrangement, the detectors, processors and cooling system are separate. Lockheed believed the scanning system would be easier and less costly to produce.

Grumman opted for a staring array design, a system consisting of about 2,000 clustered modules, each module containing millions of detectors. The staring array would combine detectors, processors and thermal subsystems into one unit. Grumman anticipated that the high volume of parts used along with automation in the manufacturing process, would contribute to a low cost for the staring array, which traditionally is a high-priced system. Grumman claimed that its technology results in a higher fidelity and better reliability. The company also demonstrated that it can produce the staring arrays in high volume at relatively low cost.

Both companies explored the use of mercury-cadmium-telluride for infrared detector material. Mercury-cadmium-telluride has a high sensitivity and inherent radiation hardness, which would provide the BSTS arrays with greater survivability in a radiation environment. Materials under consideration for the radiation-hardened mirrors used in the BSTS satellite one-meter class telescope included glass ceramic, beryllium and silicon carbide.

Nuclear-hardened Very High Speed Integrated Circuits (VHSIC) were being developed to process in real time the large amounts of data from the BSTS focal plane arrays. Small, fault-tolerant, radiation-hardened computers and accompanying software were also being developed.

Variants/Upgrades

No variants or upgrades; at the time of termination this was still a developmental program.

Program Review

Background. The ISB TW/AA program (formerly the Advanced Warning System — AWS program, formerly the BSTS program; then again, formerly the AWS program; and now formerly the FEWS program) was a replacement for the current constellation of DSP satellites. The DSP satellite system has operated in space for over two decades, keeping a watch out for ICBM and SLBM missile launches. During the Persian Gulf War, the system played an important role detecting SCUD surface-to-surface missiles launched from Iraq and warning the governments of Israel and Saudi Arabia of impending attacks. Although the satellites have performed admirably in their two decades of service, the pace of modern warfare is beginning to overtake the system's ability to provide timely and accurate information, primarily of tactical missile launches. In addition, the system is too dependent on labor-intensive ground stations.

When the first DSP satellite was launched in 1970, the main threat against the United States was strategic, that is, a nuclear attack from the then-Soviet Union. DSPs were designed to monitor the Soviet Union and China for the infrared signature given off by an ICBM launch. Once a DSP satellite detected a launch, it alerted Air Force Space Command authorities in Colorado Springs, who identified it and plotted its course and expected area of impact. The satellites revealed their capability to detect smaller rockets during the course of the Iraq-Iran conflict in the 1980s. DSP satellites reportedly monitored the launches of Soviet SCUD surface-to-surface missiles from Iran.

The Air Force began a program called the Advanced Warning System (AWS) in 1979 to replace the current DSP satellite system. In 1984, the program became part of the Strategic Defense Initiative (SDI) and was renamed the Boost Surveillance and Tracking System

(BSTS), but in 1990 the program was canceled and the effort moved back to the Air Force and called once again the AWS program. AWS was canceled in the Pentagon's FY92 budget request, but resurrected in the amended FY92 request as the Follow-on Early Warning System (FEWS). In FY93, FEWS was renamed and moved to PE #0305905F Improved Space-Based Tactical Warning/Attack Assessment program.

What the BSTS Program Would Have Been. The SDI's BSTS system would have been, in effect, the first line of defense of the Strategic Defense System (SDS). Separately from SDS, the system was also needed as a follow-on for the DSP satellite system. The BSTS would detect and track ballistic missile launches and relay the data to the battle management/ command, control and communications (BM/C^3) network. From there the targeting information would be relayed to an orbiting weapon system called Brilliant Pebbles, and to ground-based interceptors.

In a report to Congress in April 1990, SDIO Director Monahan said that the addition of Brilliant Pebbles to the SDI architecture would lower the overall cost of Phase I from $69.1 billion, as reported in October 1988, to $55.3 billion. Monahan also said that because of Brilliant Pebbles, the BSTS satellites wouldn't be essential. Brilliant Pebbles would feature a surveillance capability, at much lower orbits than the BSTS satellites, and consequently would be able to view the same areas of Earth's surface slated for BSTS coverage.

BSTS satellites would still be required, according to Monahan, because they would be cheaper to operate and maintain than the DSP surveillance satellites they were to eventually replace. Besides, Monahan said, "there's been about a $1 billion investment in BSTS so far. There are two contractors and their progress has been excellent."

With the BSTS no longer necessary for SDI, that left only the tactical warning/attack assessment (TT/AA) portion of the program active, the Air Force said. The service also renamed the DSP follow-on to the Advanced Warning System (AWS). In September 1990 the Space Systems Division released a request for proposals for the DEMVAL phase of AWS, expecting to award a full-scale development (FSD) contract in FY92.

AWS and Brilliant Eyes. Congress entered the picture in the fall of 1990. Meeting to iron out differences in the budget, House-Senate conferees chopped AWS funding from $402 million to $210 million. In passing the defense spending bill for FY91, Congress also ordered the Air Force to conduct a new competition among the AWS and other concepts, such as Brilliant Eyes. A large constellation of small satellites, Brilliant Eyes would be less complex than AWS satellites, cost less, and be less vulnerable to enemy attack than larger satellites.

The Air Force later said that development of the Brilliant Eyes program was not far enough along to compete in the AWS program. Specifically, officials believed that Brilliant Eyes would not be ready to go into full-scale development by November 1992, the time the AWS program was slated to enter FSD.

Funding a New System. In early 1991, the Air Force’s chief concern was where to find the money to fund the AWS program. By some estimates the program would cost nearly $3 billion or more, money which apparently had not been completely budgeted by the service. The USAF adopted a plan that called for redirecting $116 million in DSP long-lead funding in FY92 to AWS. But this still would have left the service looking for AWS funds for FY93 through FY97.

In a move to cut costs, the Air Force began mulling over "austere" versions of the AWS, a system initially lacking a full capability but which could be upgraded further down the road. Such a satellite might be lighter and thus could be launched aboard cheaper Atlas II rockets instead of the costlier Titan IV.

The FEWS Program Surfaces. In early May 1991, the Air Force submitted the FEWS plan for a new satellite system to the House Armed Services Committee. Initially, FEWS was not be a fully capable system, primarily due to funding constraints. Under the USAF plan, advances in sensor and microelectronic technology will emerge in later years, and be incorporated on board successive satellites. In its FY92 defense bill markup, the House Appropriations Committee was critical of the FEWS plan.

The committee took issue with the USAF plan to develop FEWS, arguing that the service would have to play "requirements catch-up" to meet the full range of requirements expected when the first FEWS is launched in 2001. "If that same FEWS satellite could be launched today," the Committee said, "it would not even meet existing strategic, tactical and intelligence requirements." The Committee also questioned the USAF idea that FEWS could grow to meet future requirements. "It is not clear what would compel the Department of Defense to include sufficient funding to grow the program in the out years if it is not willing to adequately fund a program that will meet the requirements to begin with," the Committee said.

In May 1991, the Air Force Space Systems Division released an RFP for the FEWS DEM/VAL phase. The effort would to an engineering and manufacturing phase the Air Force said, with only those contractors taking part in the DEM/VAL portion likely to be eligible.

"Based on availability of funds and quality of proposals, the Government intends to award two contracts for DEM/VAL," the Air Force said. Contractors wishing to take part in the FEWS DEM/VAL program must have experience in all the following areas:

- Development, design, analysis and integration of payload concepts to form an integrated system complement with defined and derived requirements
- Fixed and mobile ground systems
- Critical surveillance technologies including their development and integration of future space systems
- Conduct of spacecraft system integrated tests
- Launch vehicle operations requiring spacecraft-to-launch vehicle integration and test
- Production capability on large scale satellite systems
- Systems engineering for complex satellite systems

The FEWS program marked a milestone in January 1992, when defense acquisition chief Donald Yockey approved a revised acquisition strategy for the program, clearing the way for the DEM/VAL phase. The Air Force revised the acquisition strategy at Secretary Yockey's request. In a December 19, 1991 memorandum to the Secretary of the Air Force, Mr. Yockey stressed that in the initial stages of the DEM/VAL phase, the FEWS contractors should "provide a plan to prove the producibility of the higher risk critical technology components (e.g., focal plane arrays and other critical devices) through technology demonstrations before we enter into a higher spending rate for the remainder" of the DEM/VAL phase.

A revised RFP for the DEM/VAL phase was approved on March 13, 1992. Technical issues were considered the most important, the RFP said, followed by management and cost considerations. The RFP called for the contractors to outline a component/subsystem maturity plan before the DEM/VAL contracts were awarded. Technology demonstrations are slated to take place during the first part of the phase, followed by system design and validation in the second part. In July 1992, two DEM/VAL contracts were awarded for the design and demonstration of capabilities, and development of the required technology and production facilities for FEWS. One contract, worth $240.0 million, went to Lockheed; the other contract, also worth $240.0 million, went to TRW. The Air Force had planned to choose one contractor in early 1994 for the EMD portion of the program before the program was halted.

FEWS was retitled ISB TW/AA and funded in PE #0305905F at the beginning of FY93. The ISB TW/AA program consisted of three parts: a Space Segment (SS), a Fixed Ground Segment (FGS), and a Survivable Ground Segment (SGS). Scheduled work for FY93 included the following: continuation of DEM/VAL phase, intensive development of flight-like software code, fabrication and test of critical optics components using state-of-the-art null lens techniques, definition of integration and testing requirements for the on-board data processor, and ground-based testing of the telescope system.

Program Terminated. On December 31, 1993, a stop-work order was implemented that virtually brought to a halt all activity on the ISB TW/AA (FEWS) program. In March 1994, the DoD moved again in asking Congress for permission to speed up the official termination of the program. The reasons for the program cancellation have been cited as overwhelming costs, program necessity, and program efficiency. The Air Force, it seems, was in a hurry to finish with ISB TW/AA so it could begin work on the new Alert, Locate, and Report Missiles (ALARM) program, which is designed to replace the aging DSP more efficiently than ISB TW/AA.

ALARM. Although ISB TW/AA was canceled, the DSP itself is considered a continuing program until it is replaced by a new early warning system. However, DSP has been heavily criticized for its failure to see theater missile launches. ALARM was supposed to replace the IBS TW/AA (FEWS) program before its own termination. Unfortunately, it did not meet Air Force goals to provide an enhanced theater capability. ALARM was canceled in late 1994 before it even had a chance to get off the ground.

In the meantime, DSP efforts will proceed on developing new software and replacing outdated computers. Emphasis is being directed toward eliminating and minimizing operational deficiencies and vulnerabilities, maintaining the satellite constellation through satellite procurements and launches, ensuring accurate system performance, and ensuring the supportability of the DSP ground system.

SBIRS. The Space Based Infrared System (SBIRS) program is reported not to be a continuation of previous efforts to develop a follow-on to DSP, but rather is envisioned as a new effort that is considerably broader than previous work. The program is slated to have a ten-year Engineering Model Development (EMD) phase with an initial launch capability scheduled for 2002. The program is estimated to have a total lifecycle cost of $22.6 billion. SBIRS was created by a DoD senior steering group who reviewed space-based infrared satellite solutions. Earlier systems, such as ALARM, Brilliant Eyes, and Gapfiller were all rejected due to their inability to meet some critical requirements; namely, saving time and money.

NOTE: *For additional information see the report* ***Space-Based Infrared System (SBIRS).***

Funding

No funding has been allocated since FY94. All project efforts have been transferred to the SBIRS program.

Recent Contracts

No recent contracts have been identified.

Timetable

	1979	Air Force initiated AWS program
Mar	1983	President Reagan announced plan for SDI
Jan	1984	Formation of SDIO
	1984	AWS incorporated into SDI and renamed BSTS
Mar	1987	Lockheed and Grumman awarded follow-on BSTS contracts
Oct	1988	SDIO reduced BSTS Phase I cost estimates
Apr	1990	SDI Phase I costs reduced to $55.3 billion; less dependency predicted on BSTS
Nov	1990	RFP for BSTS Phase IV full-scale development
	1990	BSTS dropped from SDI, moved to Air Force and called AWS
	1991	AWS dropped in FY92 budget, later resurrected as FEWS
May	1991	Air Force released RFP for FEWS DEM/VAL
Jul	1992	FEWS DEM/VAL contracts awarded
	FY93	FEWS renamed IBS TW/AA
	1993	Selection of IBS TW/AA contractor for full-scale development
Dec	1993	ISB TW/AA Stop Work Order issued
Mar	1994	ISB TW/AA terminated, ALARM program initiated
late	1994	ALARM program canceled, SBIRS program initiated

Worldwide Distribution

ISB TW/AA was a **US** program through to the point of termination.

Forecast Rationale

The history leading up to the demise of the IBS TW/AA program and the birth of SBIRS reads like a page from Old Testament: the need for a DSP replacement begot AWS; AWS begot BSTS; BSTS begot AWS; AWS begot FEWS; FEWS begot IBS TW/AA; ISB TW/AA begot ALARM; and ALARM begot SBIRS. On the surface, the requirement to field an advanced orbiting surveillance system was what directed Pentagon planners over the years; however, as with most DoD programs, the primary factor influencing the entire affair was money

Congress balked at the amount and successive fiscal years have seen the program evolve to ever less expensive designs. In 1990 the SDI Organization decided money could be saved by eliminating BSTS satellites, a job now earmarked for cheaper Brilliant Eyes spacecraft. The SDIO turned BSTS back over to the Air Force where it was renamed AWS. But, AWS had its price, too, presumably too high to fit into the ever shrinking Air Force budget.

IBS TW/AA, the replacement for the canceled AWS, was supposed to be an austere system that would save money by being less capable, at least initially, than a full-blown DSP replacement. The plan was to add capability downstream when money would be available to buy emerging technology.

The end of the ISB TW/AA program puts a lot of strain on the aging DSP and its satellites until SBIRS is up and running. Given the historical facts that new systems such as SBIRS always seem to take longer to go into service than originally planned and that two of the five DSP satellites in orbit are beginning to show signs of failure, DSP will have to be maintained.

Forecast International will keep this report active until SBIRS is up and running as much of the technology developed in this program will be incorporated into SBIRS.

Ten-Year Outlook

No Forecast Chart is being presented due to program termination.

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