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Cosmic comeback for military space?
Conversations with Douglas Barrie

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After years of struggle, many of the U.S. military's most troubled satellite acquisition programs are finally putting spacecraft into orbit, delivering much-anticipated new capabilities to the nation's warfighters. But even as the DOD continues to face challenges in developing new constellations, it has taken steps to avoid the kinds of problems that have plagued past programs.

Cosmic comeback for military space?

by Marc Selinger
Contributing writer

In a clean room, a HEO payload is prepared for delivery. HEO 1 and 2 were the first SBIRS satellites to be launched.

Building new satellites has long been a serious headache for the Dept. of Defense. Billions of dollars in cost overruns, years of schedule delays, and a seemingly endless spate of technical glitches have afflicted a host of major programs.

"The developmental systems promised giant single-step leaps in technology, but often overran program budgets and failed to meet requirements in a timely manner," says Air Force Col. David Arnold, a DOD space official.

As one congressional panel observed, "A myriad of reasons has contributed to the decline of space acquisition, not the least of which was the Dept. of Defense turning over space program management to contractors in an effort to reduce cost and improve efficiency."

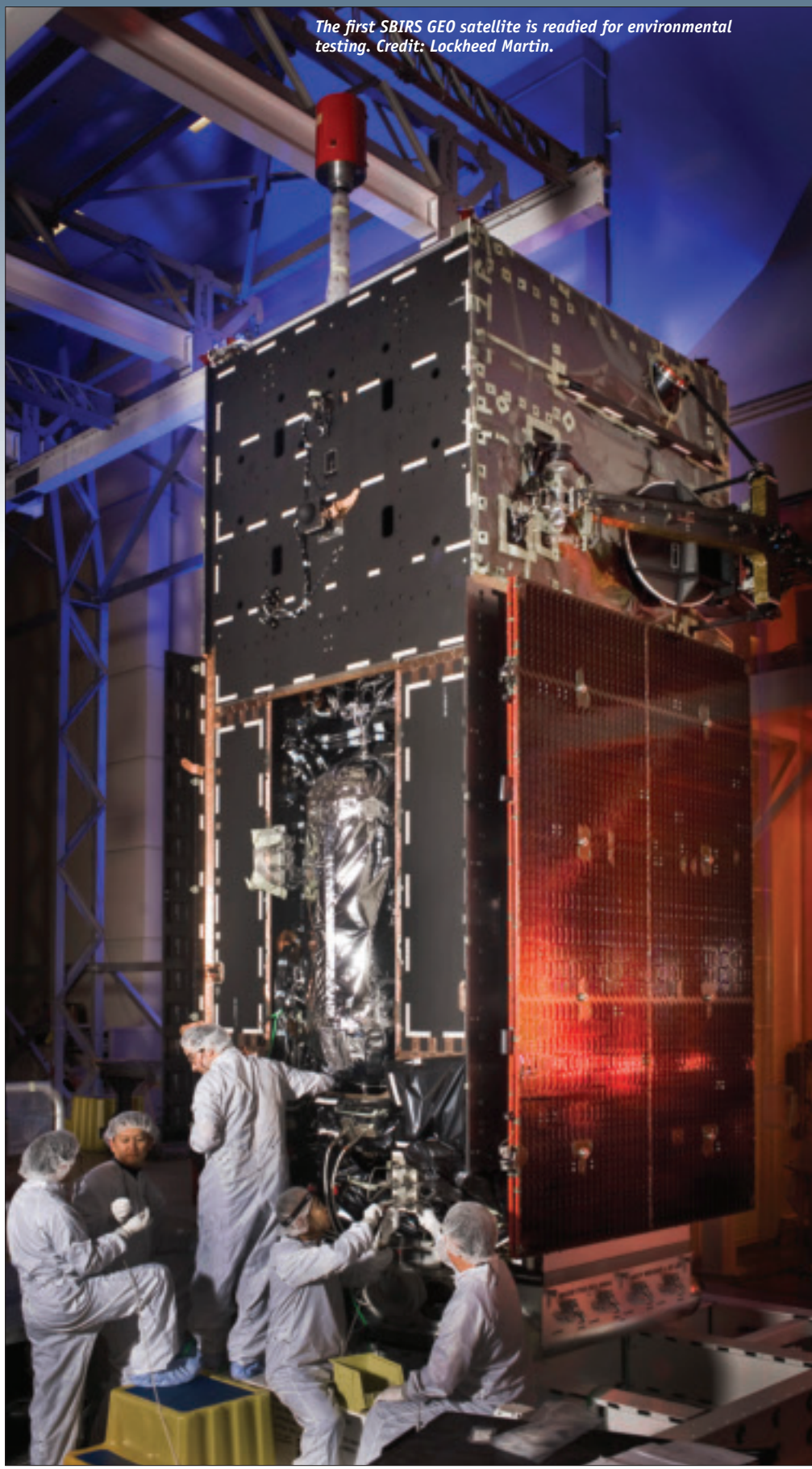
Despite these problems, some of the most troubled systems have begun to show significant, tangible signs of progress. From 2009 to 2012, several programs providing communications, missile tracking, missile warning, and navigation have all launched their first satellites, prompting government and industry officials to suggest that military space may finally be turning a corner.

"The capabilities being delivered are the best in the world," says Arnold, Program Assessment Division chief for the DOD Executive Agent for Space Staff. "The current state of space acquisition is reaping the benefits of those years of development by having the ability to field mature systems now."

Even some of the DOD's harshest critics have been impressed by the improvement.

"The worst of the Defense Dept.'s space acquisition problems may be behind the department, as programs long plagued by serious cost and schedule overruns are finally being launched," says Cristina Chaplain, the GAO's director of acquisition and sourcing management. "Though acquisition challenges persist, they are not as widespread and significant as they were several years ago, and to its credit, DOD has taken an array of actions to reduce risks."

The House Appropriations Committee also sees improvement: "After two decades of troubled space acquisition, the national security space portfolio seems to be emerging from a period of programmatic excuses based on flawed acquisition strategies, poor cost estimating, and reliance on immature technologies," the



The first SBIRS GEO satellite is readied for environmental testing. Credit: Lockheed Martin.

panel wrote in its FY12 defense report. "Additionally, when new systems have actually become operational they have, for the most part, been successful on orbit despite problems that may have occurred in the development phase."

However, none of these accomplishments came easily, and difficulties still lie ahead.

Missile warning

For three decades, DOD has struggled to replace the aging Defense Support Program (DSP) satellites that detect launches of hostile ballistic missiles across the globe. Several potential DSP successors in the 1980s and early 1990s all foundered because of immature technology and high costs.

Military brass hoped the Space Based Infrared System (SBIRS) would finally be the charm. But the program, begun in 1996, seemed cursed instead. Problems mounted, and the price tag soared to $18.3 billion, up from an initial estimate of $4.6 billion.

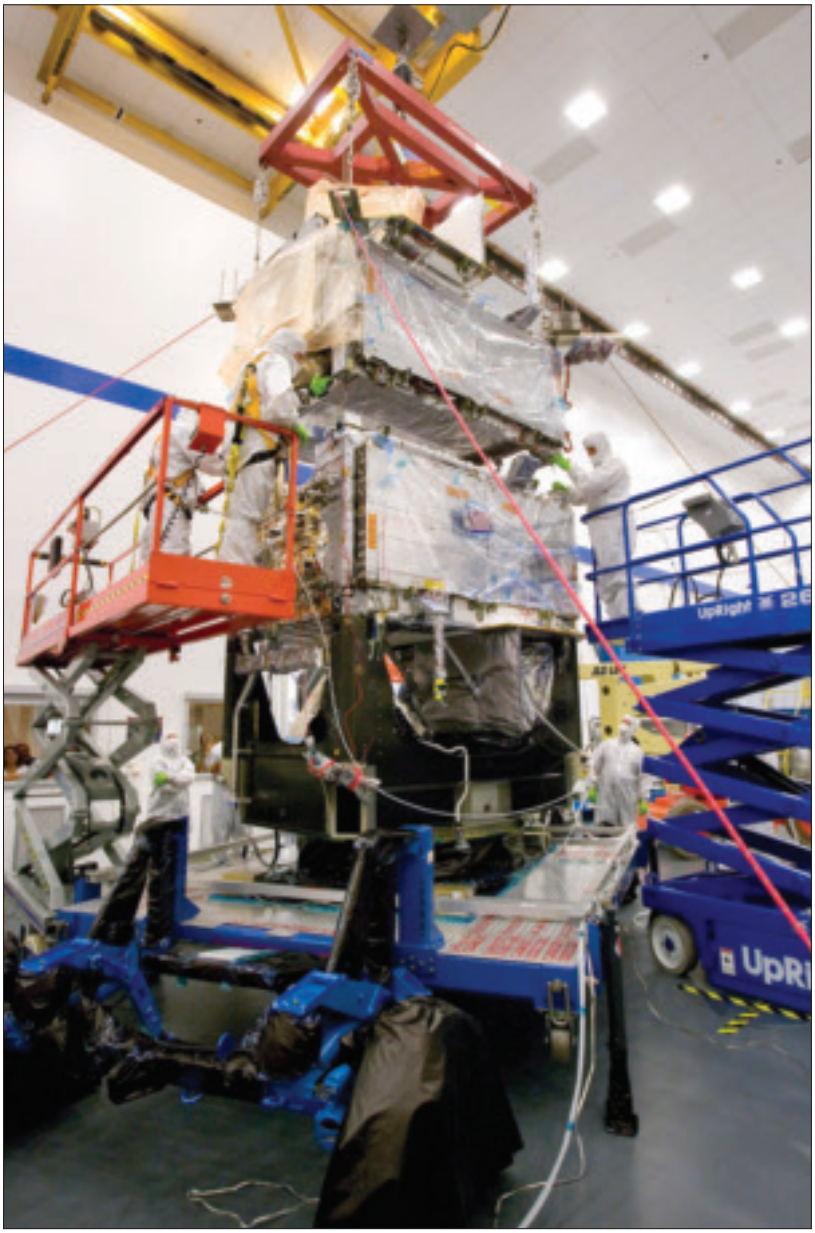
"Since its inception, SBIRS has been burdened by immature technologies, unclear requirements, unstable funding, underestimated software

complexity, poor oversight, and other problems that have resulted in billions of dollars in cost overruns and years in schedule delays," the GAO told Congress in 2007. "In addition, the program has been restructured several times to account for cost and schedule problems."

In 2006, the program finally lofted hardware into space—the first highly elliptical orbit payload (HEO-1) on a host satellite. HEO-2 followed two years later. And in May 2011, the first geosynchronous Earth orbit satellite (GEO-1) lifted off on an Atlas V rocket—nine years late but a major milestone nonetheless.

Air Force officials say SBIRS now meets or exceeds expectations. For example, GEO-1's pointing accuracy is almost 10 times better than expected, and it is seeing targets 25% dimmer than what is required. GEO-2 is on track to be launched in March 2013, and two more GEO satellites and two more HEO payloads are in production.

STSS-D satellites are meant to track ballistic missiles during the midcourse phase of flight. Credit: MDA.



"I think we have positive momentum," says Col. James Planeaux, who oversees SBIRS as head of the Air Force's Infrared Space Systems Directorate. "We have a lot of confidence that SBIRS as a constellation capability will have a very enduring performance and will last for decades to come."

Not everyone is convinced the program is out of the woods. The GAO's Chaplain warns that GEO-3 and -4 could experience a one-year production delay and a $438-million cost overrun "due in part to technical challenges, parts obsolescence, and test failures." Prime contractor Lockheed Martin disputes that assessment, however.

"Production of GEO-3 and GEO-4 is proceeding well, and we are confident we will deliver these critical satellites on the baseline schedule and well under the cost figures reflected in the GAO report," says Jeff Smith, vice president of the overhead persistent infrared mission area for Lockheed Martin. DOD's plan to procure long-lead items for GEO-5 and GEO-6 is "a reflection of this increased confidence in the SBIRS team's ability to deliver the assets on budget and on schedule," he says.

What's next for SBIRS is unclear. DOD is studying what SBIRS-like capabilities it might pursue after GEO-6.

"If the country decides to procure more SBIRS, we'll be ready to do that," Planeaux says. "If the country decides to go in a different direction and pursue alternate technologies or an alternate acquisition approach, then we'll support that as well."

Missile tracking

Attempts to field missile-tracking satellites have also hit their share of snags. According to the GAO, DOD has spent billions of dollars since 1984 on a series of programs that were derailed by cost, schedule, and technical problems.

The latest effort, the Missile Defense Agency's Space Tracking and Surveillance System Demonstrators (STSS-D) program, launched its two satellites in September 2009—17 months late. MDA attributes the delay to defective electronic parts in the space/ground-link subsystem.

"By the time the problem was discovered, the manufacturer no longer produced the part," MDA says. "The delay was a re-

sult of [the need for] identifying an alternate contractor to manufacture and test the replacement parts."

STSS-D, which has the "unique capability" to track ballistic missiles for long periods during their midcourse phase of flight, now provides valuable information, according to the agency. The two satellites, which marked their 1,000th day on orbit in June, have successfully tracked targets in 12 MDA tests, "demonstrating the viability of space-based remote networked sensors to deliver fire control quality tracks" to antimissile weapons systems, the agency says.

Despite being pleased with STSS-D's recent progress, MDA may not have an operational version anytime soon. The Precision Tracking Space System (PTSS) program, which is supposed to provide an STSS-like operational capability, is not scheduled to start launching satellites until FY17, and the first two spacecraft will be considered developmental. The GAO has warned that even that schedule is at risk because PTSS does not fully meet any of the nine 'best practices' for schedule development. But MDA insists STSS has laid a strong foundation for PTSS.

"STSS-D has shown a satellite can observe postboost threat objects, form a high-quality track for fire control solution purposes, and report this information to the [Ballistic Missile Defense System] battle manager within operationally realistic timelines," the agency says. "This success informs the PTSS program today."

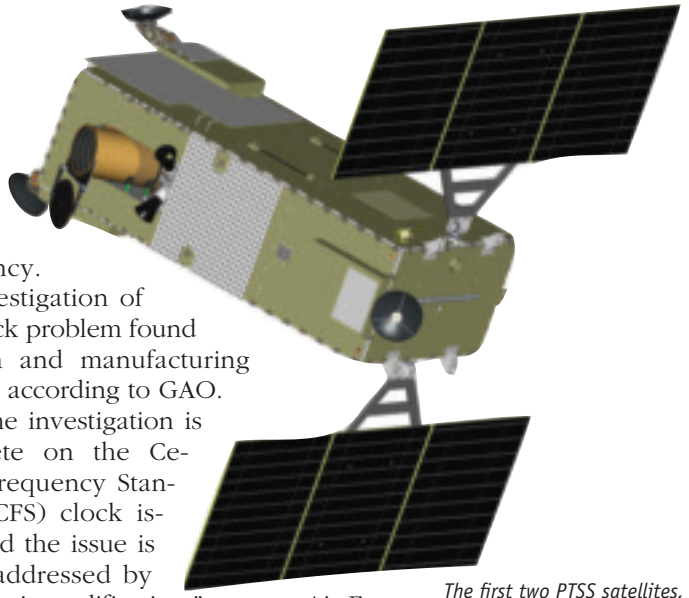
PTSS is also expected to benefit from the NFIRE (Near Field InfraRed Experiment) satellite, which MDA launched in 2007 to improve its understanding of how rockets perform in flight.

"NFIRE is being used as a risk reduction strategy to predict what PTSS will see," the agency says. "That will influence design improvements to PTSS sensors."

Navigation

The Global Positioning System IIF (GPS IIF), the latest generation of GPS navigation satellites to be fielded, has had difficulties, too. Development challenges delayed the launch of the first satellite by four and a half years, to May 2010, and the Air Force program's cost more than tripled, from $729 million to $2.6 billion, the GAO reports.

The second IIF satellite, launched in July 2011, experienced a failure of its cesium clock, one of three clocks that ensure the accuracy of the spacecraft through redundancy. An investigation of the clock problem found "design and manufacturing issues," according to GAO.



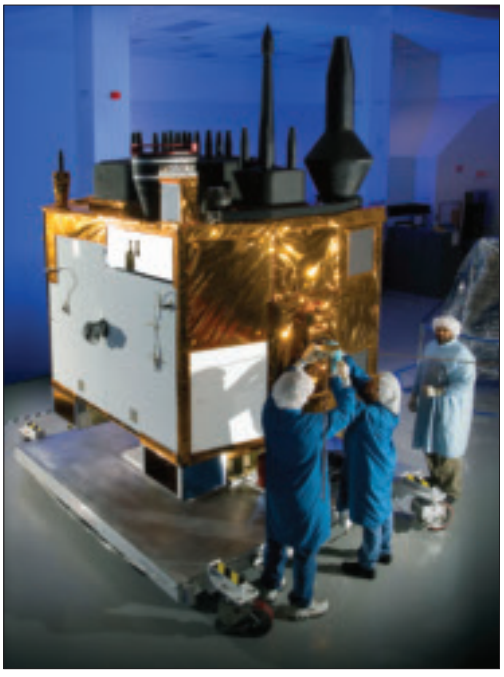
The first two PTSS satellites, not expected before 2017, will be considered experimental.

"The investigation is complete on the Cesium Frequency Standard (CFS) clock issue, and the issue is being addressed by a CFS unit modification," says an Air Force statement. "All future IIF space vehicles will undergo this modification prior to shipping to the launch location. The CFS investigation and repair process has not affected the GPS IIF production schedule, and the cost to modify [the clock] was paid for by the contractor, not the government."

Despite this glitch, Arnold says the Boeing-built IIF satellites are giving warfighters improved accuracy and security.

The newest GPS program, GPS III, is taking steps to avoid the kinds of snafus that have plagued GPS IIF. Among these steps is building the GPS III Non-Flight Satellite Testbed (GNST), a full-sized, flight-equivalent prototype of a GPS III satellite.

"Using the GNST, we have identified and solved many issues early on that would have cost more and presented more risk if they had been discovered later in program



The GPS IIF was plagued by snafus. Credit: Boeing.

production," says Michael Friedman, spokesman for GPS III prime contractor Lockheed Martin. "These investments early in the GPS III program will prevent the types of engineering issues discovered on other programs late in the manufacturing process or even on orbit. This approach will ensure mission success and save expensive rework and retest of built-up space vehicles in the production flow."

But cost remains a topic of debate. GAO says the price tag for the first two GPS III satellites has risen at least 18% above initial estimates. Friedman counters, "While we have encountered challenges associated with higher standards for parts testing and first-time technical issues, the program is on firm footing, and our cost estimate at completion remains within the original Air Force program office budget."

The first MUOS lifts off from Cape Canaveral AFS, Fla. Credit: United Launch Alliance.

Communications

When the Navy launched its first Mobile User Objective System (MUOS) satellite in February, it may have helped fill a potential capability gap created by the unexpected failure of two legacy satellites. Prime contractor Lockheed Martin boasts that a single MUOS spacecraft will provide four times the capacity of the entire legacy Ultra High Frequency Follow-On system constellation.

But the program, which is designed to improve ground communications for U.S. forces on the move, is not out of the woods. The first satellite was expected to begin on-orbit operations in May of this year, over two years later than planned, according to GAO. Moreover, the MUOS spacecraft might initially be "significantly underutilized," because most of its capabilities will be enabled by Joint Tactical Radio System terminals, whose operational testing has been delayed until 2014.

Another communications program, the USAF Advanced Extremely High Frequency system, launched its first satellite in 2010, but the spacecraft was about 13 months late in reaching its orbit because of a glitch in one of its three propulsion systems. The Air Force and prime contractor Lockheed Martin insist the satellite's 14-year operational life expectancy will be preserved.

Weather

One long-troubled effort that has yet to find its footing is a replacement for polar-orbiting environmental satellites. The National Polar-orbiting Operational Environmental Satellite System program spent $5 billion over 16 years but never launched a satellite and was killed in 2010. A successor program, the Defense Weather Satellite System, failed to win over Congress and was axed in FY12, creating what the GAO calls "a potential capability gap for weather and environmental monitoring."

A new program, the Weather Satellite Follow-on, is in its early stages. Current activities include "preacquisition studies to reduce risk," according to an Air Force statement. DOD has incorporated the lessons learned from prior programs and is considering a variety of options," the statement says. "The requirements focus on continuing current on-orbit capabilities rather than enhancing performance with immature new sensors."

Future prospects

Military space efforts continue to face tough scrutiny. The GAO found parts quality problems in all 21 of the DOD and NASA space programs it recently reviewed, and discovered that "significant barriers" still exist, including "fragmented leadership," high launch costs, proposed funding cuts in space-related science and technology, and delays in standing up ground systems that process information from the new satellites.

"All of the barriers…require action from the Air Force and the Office of the Secretary of Defense as well as the participation and cooperation of all the military services, the intelligence community, and other agencies such as NASA and NOAA," Chaplain says. "Moreover, though successful launches are being experienced, problems within ongoing development efforts, such as GPS III, indicate that space acquisitions are still at risk of significant cost and schedule problems, and attention to reforms must be sustained."

DOD has taken a host of steps to avoid future problems in space programs. It is making greater use of fixed-price contracts and "evolutionary upgrades," and is telling contractors to "place as much emphasis on engineering for cost control and affordability as [they have] historically placed on engineering for performance," Arnold says. DOD also streamlined its space leadership structure and is working with NASA to improve parts quality.

"The department," he says, "has taken important steps to improve our acquisition practices to deliver better capabilities to the warfighter while achieving better value for the taxpayer."