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DEFENSE

Does JSTARS Demise Spell End for Airborne ISR?

by Chris Pocock
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A graphic from Lockheed Martin suggests an environment for the Advanced Battle Management System (ABMS) that the U.S. Air Force is seeking.

Are airborne ISR platforms becoming too vulnerable to air defense systems? Last year's decision by the U.S. Air Force (USAF) to cancel its JSTARS replacement was partly driven by this fear. But it was also because of the amazing capabilities now available from reconnaissance satellites, and an ambitious aim to intelligently network a variety of sensors from all domains.

The 17 E-8C Joint Surveillance and Target Attack Radar System (JSTARS) airframes are based on the Boeing 707 and are now more than 50 years old. They perform onboard battle management as well as radar imaging. But their availability is down to 40 percent.

In 2014 the USAF solicited suggestions for a JSTARS replacement and issued pre-development contracts. They went to Boeing, proposing the 737-700 airframe; Lockheed Martin (Bombardier Global 6000 business jet, with Raytheon); and Northrop Grumman (Gulfstream G550 business jet). Northrop Grumman and Raytheon also got risk-reduction contracts for the radar.

But in February last year, the USAF said it was not proceeding. The service said it would keep the existing JSTARS until the mid-2020s. Meanwhile, it would investigate how to "network current and new sensors from air, space, land, and sea and fuse the information to create a more comprehensive battle management picture…coupled with an agile, resilient communications architecture."

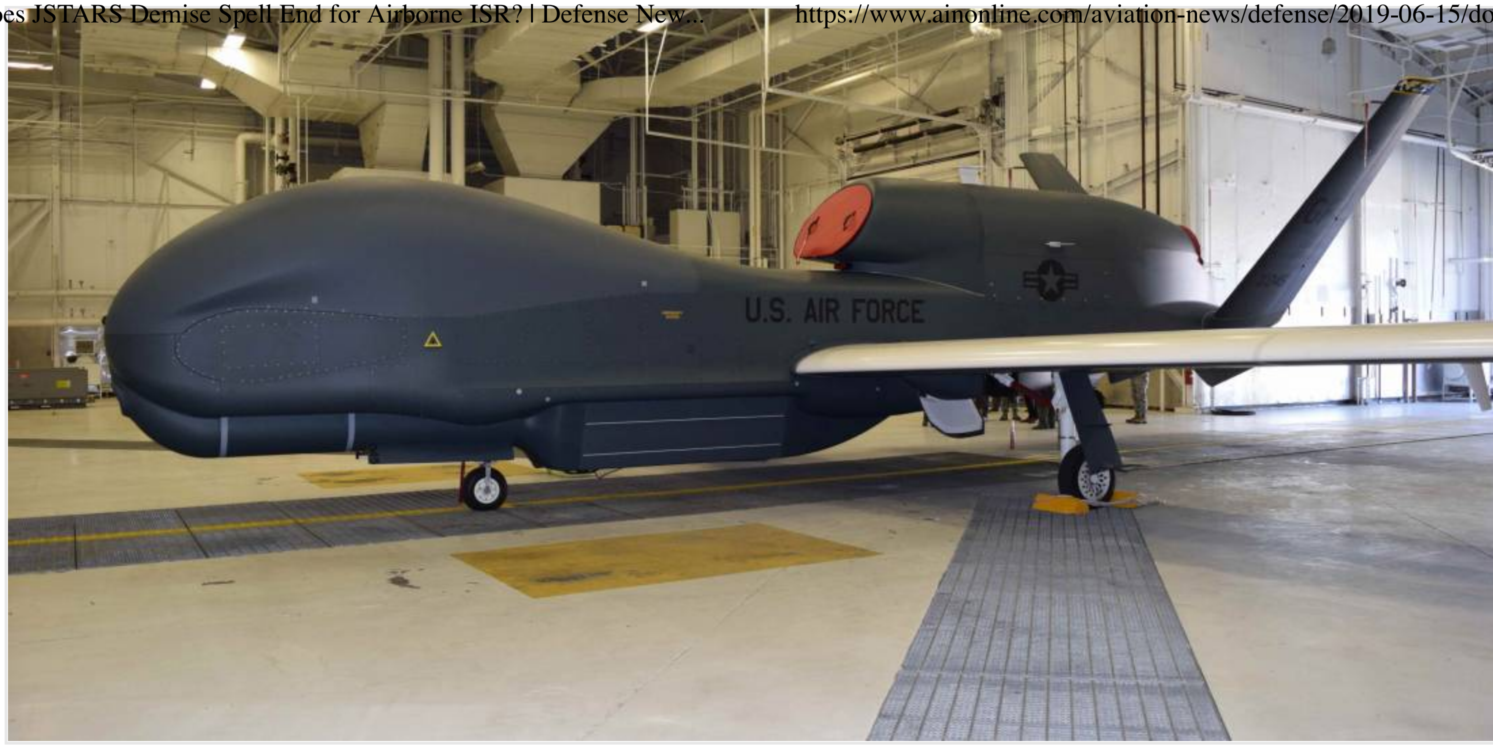
Flying below 40,000 feet, the JSTARS radar horizon is about 230 miles. That is within the reported range of the Russian S-400 SAM system—and a Boeing 707 has a large radar return. The USAF told Congress that JSTARS was already "being forced outside its effective range." And in addition to the air defense threat, there are concerns about the vulnerability of its datalink.

FUTURE OF NON-JSTARS AIRCRAFT

What does this mean for other aircraft that currently perform the intelligence, surveillance, and reconnaissance (ISR) mission? The USAF has a fleet of RC-135s also based on the Boeing 707. But they mainly collect SIGINT and therefore don't have to fly as close to defended areas. Israel also uses Boeing 707s, and some other countries use converted turboprop transports or maritime patrol aircraft.

Bombardier and Gulfstream would argue that their jets fly higher and can therefore "collect" ISR data from greater stand-off distances. They are also more maneuverable: when the UK Royal Air Force was evaluating business jets for its Airborne Stand-Off Radar Requirement (ASTOR), it tested their ability to make a steep evasive dive from 50,000 feet upon warning of a SAM attack. But that was 20 years ago, when the long-range SAM threat was still the SA-5 and similar.

The Northrop Grumman Global Hawk UAV can theoretically reach 60,000 feet, but only toward the end of a mission. However, it offers very long endurance, and in the USAF's Block 40 version, a very capable AESA surveillance radar designated MP-RTIP, that was originally planned for retrofit to JSTARS as well. The same airframe/radar combination is entering service with NATO as the Alliance Ground Surveillance (AGS) system. The Global Hawk has also been sold to Japan and Korea. The U.S. Navy is introducing the MQ-4C Triton version for maritime surveillance, and Australia is another customer.



The Northrop Grumman Global Hawk Block 40 carries the MP-RTIP radar that could replace JSTARS, but it is not stealthy and can therefore not get close to defended ISR targets. (Photo: Bill Carey)

But the Global Hawk is not stealthy and can therefore also not get close to defended ISR targets. What about the U-2, which flies up to 15,000 feet higher than the UAV and carries similar sensors? Lockheed Martin says that "an enhanced defensive suite…enables the U-2 to operate in and around contested airspace." That is one reason why the Pentagon decided to retain the U-2 until at least 2024. The Dragon Lady's Advanced Synthetic Aperture Radar System (ASARS) is being upgraded with an AESA. The maker, Raytheon, says that this doubles the radar's range and improves moving target tracking (a JSTARS specialty) while retaining the very high mapping resolution of the current system.

So the U.S. has at least two current airborne alternatives to JSTARS. But can these high-altitude platforms, or ASTOR and the other business jet conversions for ISR that some countries have bought, remain viable ISR collectors against tomorrow's air defense threat? With that in mind, the USAF has been developing a classified low-observable high-altitude ISR platform. It may recently have become operational in small numbers.

Some analysts think that stealthy, fifth-generation platforms such as the F-35 can take over the airborne ISR mission. They certainly have state-of-the-art EO, IR, and radar sensors. But as a study by two officers with over 4,000 hours experience on JSTARS and AWACS noted recently, "their air pictures continue to be local by design. Their bubbles of awareness are short-range. Networked fifth-gen surveillance solves the access problem, but can't provide a comprehensive, persistent picture."

SENSOR AND COMMUNICATIONS ADVANCES

However, the positive news for those worried about the future of ISR collection is the rapid advances in sensor and communications satellites. And whereas in years gone by, the state-of-the-art was found in classified U.S. programs, commercial satellite providers can now provide huge capability in the defense realm.

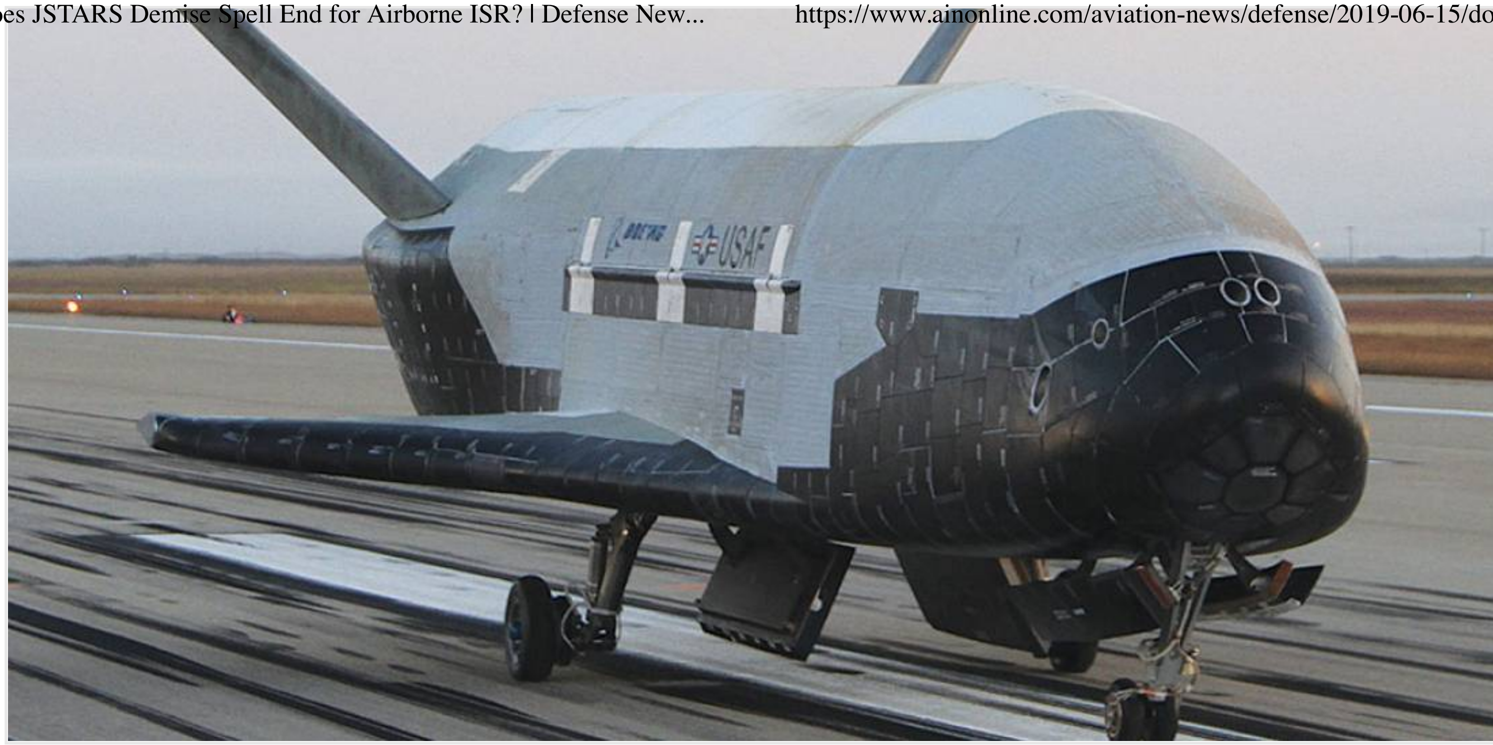
Of course, commercial satellite imagery (CSI) has been available since 1985, when the first SPOT satellite with 10-meter resolution was launched. Now CSI offers panchromatic, color, and infrared still and video imagery at resolutions to 0.3 meters. Everyone can view composites of CSI on Google Earth. Meanwhile, hyperspectral and radar coverage continues to expand. Geospatial Intelligence (GEOINT) is a multi-billion dollar industry of providers, analyzers, and exploiters. One company alone, Esri, boasts more than 350,000 defense and commercial users of its mapping, analytic, and visualization software.

An American CSI provider, Tyvak, has launched multiple microsatellites that it claims provide the “first affordable” visible and radar imaging. It also offers radio frequency and mapping (eg, ELINT) that is particularly suited to the maritime domain.

A similar claim for low-cost provision is made by British company Surrey Satellite Technology Ltd (SSTL). Last year it launched a smallsat named Carbonite 2 that provides 1-meter color imagery and video in a wide (5-sq-km) swathe. The UK Ministry of Defence is a partner in this program. High-resolution video from space could potentially substitute for airborne radar-based ground moving target indication (GMTI).

As the CSI constellations have grown, "revisit rates" to many points on earth are now measured in hours, not days. That clearly has operational defense utility. “High refresh rates could make near-real-time change detection a reality,” a manager from American GEOINT provider Hexagon told the Defense Geospatial Intelligence (DGI) conference in London last year. Capella Space, a Silicon Valley start-up backed by venture capitalists, is planning a constellation of 36 satellites that will offer hourly synthetic aperture radar coverage with one-meter resolution in spotlight mode.

A senior USAF officer with management experience of both classified and unclassified satellite imagery analysis told **AIN** last year he did not think that space collection could replace airborne collection. “Space, too, is vulnerable to countermeasures,” he said. However, constellations of small satellites are inherently less vulnerable than the few large and expensive reconnaissance satellites that have been the specialty of the U.S. classified world. Another option is reusable space planes, like the Boeing X-37B. They are also more difficult to counter. The X-37B has completed five successful missions, whose purpose remains clouded.

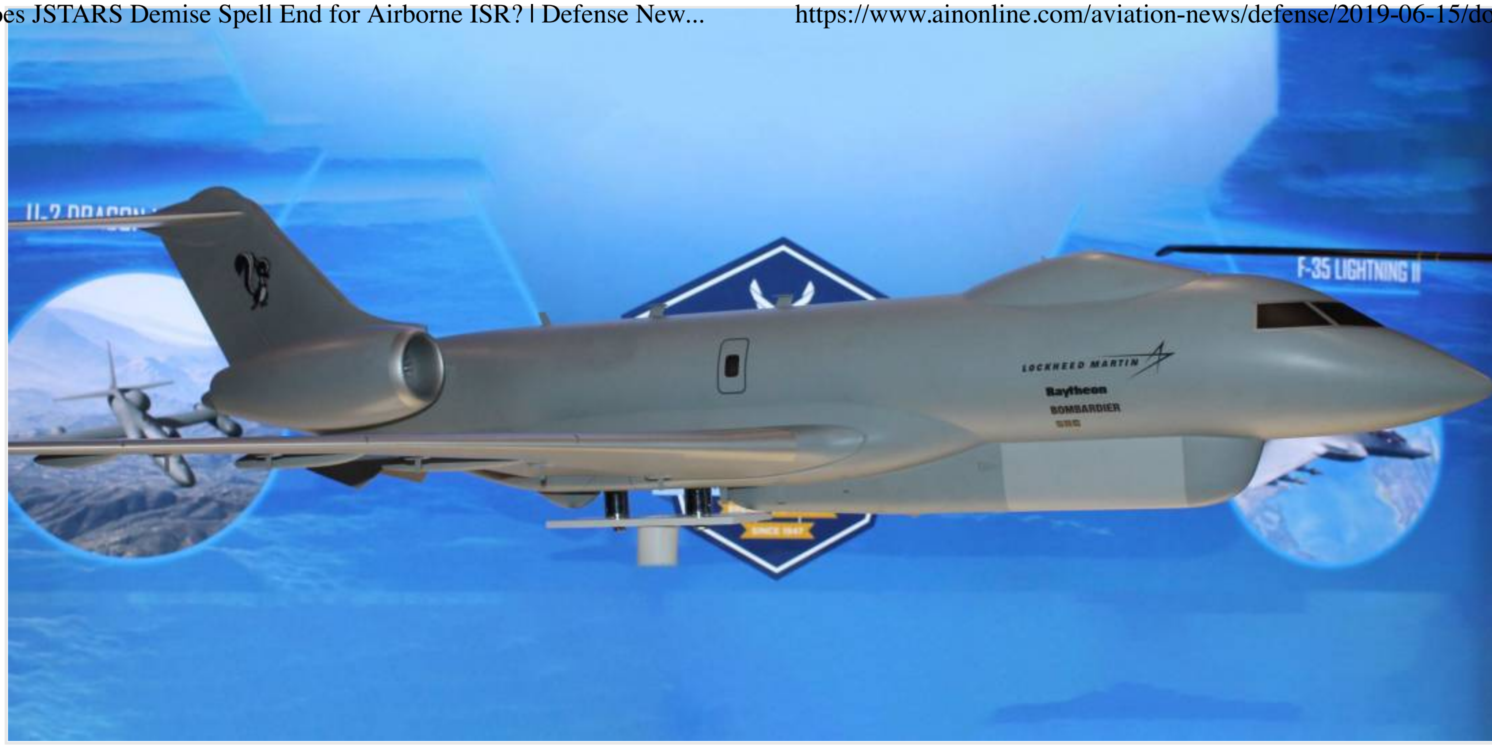


The Boeing X-37B has demonstrated unmanned reusable spaceplane techniques. (Photo: Boeing)

An official from one of the prime contractors for the JSTARS replacement admitted to **AIN** that the surveillance mission might be performed from space "provided that robust networking is in place."

Networking is the key to the ground-based Advanced Battle Management System (ABMS) that the USAF claims can replace the other key JSTARS mission. The service plans to spend $3.4 billion on developing ABMS and the associated Multi-Domain Command and Control (MDC2) network over the next five years.

The buzzwords being used in descriptions of ABMS include "trusted networks," "disaggregation," and "intelligent algorithms." A Lockheed Martin video claims that the company's investment in artificial intelligence, pattern recognition, and adaptive learning is already mature enough to support MDC2. "A constellation of people working together with a common picture" is the aim.



The JSTARS replacement proposal from Lockheed Martin would have used a Bombardier Global 6000 carrying a Raytheon radar. (Photo: Chris Pocock)

Lockheed Martin also says that its Open Architecture Processor can replace the multiple proprietary processors that compete for space, weight, and power on ground, air, maritime, and space applications. The payoff could be the level of integration that allows "any sensor to talk to any shooter" that is called for in the ABMS.

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