

NORTHROP GRUMMAN

**Ensuring National Security
Through Missile Defense**



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SPACE TRACKING AND SURVEILLANCE SYSTEM

STSS

**Ensuring National Security
Through Missile Defense**

BOOST PHASE
MIDCOURSE PHASE
RE-ENTRY PHASE



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Ensuring National Security Through Missile Defense

The Urgent National Security Need for STSS

- Today's ballistic missile threat is increasingly global in scope.
- Ground-based tracking systems can only provide accurate tracking data when the threats are within their limited coverage area – most only during the boost or terminal phase of the hostile missile's flight.
- Global coverage for tracking missile threats in all phases of flight is available only with a space-based system of sensors – the Space Tracking and Surveillance System (STSS).
- STSS is the only U.S. Missile Defense Agency-developed space-based sensor element to stand watch worldwide 24/7 against ballistic missile threats from boost to midcourse to terminal phases of flight.
- Two STSS demonstration satellites are nearing completion and are on track for launch in 2008.
- It is a national imperative to initiate and expeditiously deploy the operational STSS constellation for defense of our national interests.

"North Korea's nuclear weapons and missile programs threaten to destabilize a region that has known many great power conflicts and comprises some of the world's largest economies. North Korea has already sold ballistic missiles to several Middle Eastern countries and to Iran."

J. Michael McConnell, Director of National Intelligence, in testimony before the U.S. House Permanent Select Committee on Intelligence – Feb. 7, 2008

The security of the U.S., deployed forces, allies and friends is threatened by the proliferation of increasingly sophisticated ballistic missiles. More than 100 foreign ballistic missiles were launched across the globe in 2007. To date, at least 30 nations have deployed this capability. It is in the U.S. national interest to initiate and expeditiously deploy an operational layered missile defense that includes the capability to continuously monitor these missiles in all stages of flight.

The Missile Defense Agency (MDA) is chartered with developing the system of systems necessary to protect against ballistic missile threats. The three elements that comprise the layered missile defense system are sensors, command and control, and shooters, which are analogous to the eyes, brains and muscles of the Ballistic Missile Defense System (BMDS).

- The eyes, or sensor elements, detect the launch of a missile and continue to monitor the trajectory and other aspects of the threat and enable successful target selection and interdiction. This is the role of the STSS constellation.
- The command and control, battle management, and communications (C2BMC) system processes data from sensor assets and communicates with the different shooter elements to allow for optimum selection and launch of interceptor systems assets.
- The "shooter systems" enable interception during all phases of the missile's flight: boost phase, midcourse, and terminal phase. But importantly, these systems must rely on continuous detection and identification. Current systems include the Aegis and Ground Based Interceptor systems, which are operational and continue to evolve. Other systems are well on their way to development and deployment, including the Kinetic Energy Interceptor (KEI), the Airborne Laser (ABL), and the Terminal High-Altitude Area Defense system (THAAD).

STSS not only provides continuous global detection of missiles in all phases of flight but also enables the optimum selection and launch of interceptor systems.



The Problem: Current Sensor Systems Do Not Provide Continuous Global Coverage

“The U.S. doesn’t possess a system for continuously tracking ballistic warheads in midcourse, and that makes effective interception much less likely no matter what defense weapons and sensors await the warheads when they enter their terminal or re-entry phase of their trajectory.”

Loren Thompson, chief operating officer, Lexington Institute
Commentary in Defense News, Sept. 10, 2007

Current sensor systems are limited in their ability to provide continuous global coverage. While the Defense Support Program and Space Based Infrared System are designed to detect a missile launch from any location on earth, they only track missiles through the initial boost phase. Trajectory predictions are passed to the C2BMC, but geometrical distances and lack of continuous midcourse tracking ability necessarily limit the accuracy of predicting missile trajectories, especially in the latter phase of flight.

This increases the nation’s vulnerability.

Radar systems provide accurate tracking data while missiles are in range. Current early warning radars provide limited coverage – about ten percent of the earth’s surface, mainly at the northern latitudes. Plans to deploy additional sea-based and forward deployed radars will help fill gaps, but cannot provide a robust or even an adequate global solution. The expense and logistics of global coverage by radar is prohibitive, due to the sheer number of sites required, many of which would be foreign-based.

Launches from within “deep” (or “thick”) countries, where foreign basing is not an option, allow the missiles to reach sufficient altitude to pass above forward deployed radars, denying these systems the ability to track the missiles. Similarly, missile trajectories that fly through the southern latitudes are problematic because of sparse or non-existent radar sites in the southern hemisphere.

Further complicating the issue, missile technology continues to mature.

The Solution: Space-based Systems Offer Ubiquitous Protection

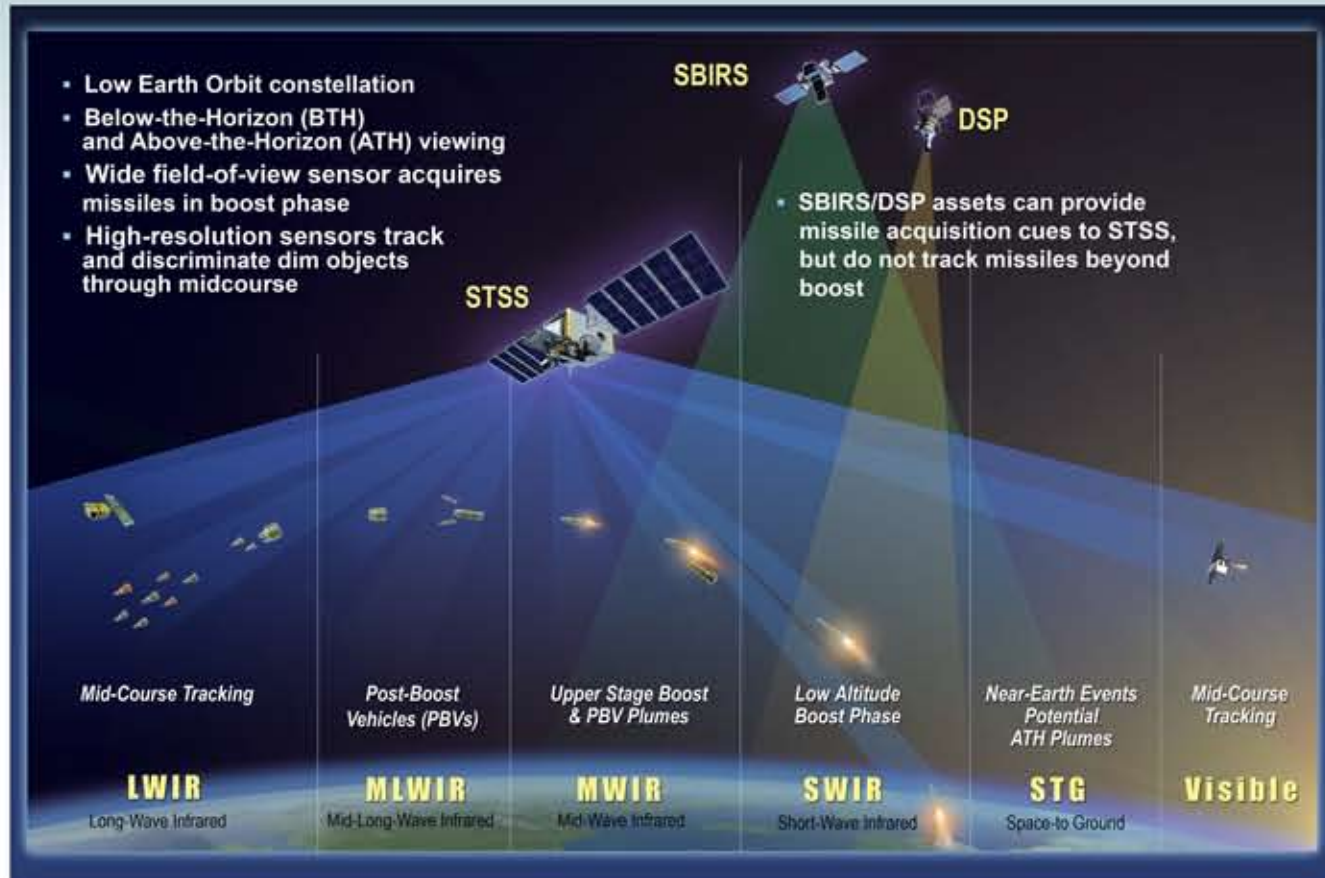
A space-based system of sensors can provide ubiquitous and persistent global tracking of enemy missiles. STSS is a space-based sensor element of the MDA’s layered missile defense system, and consists of a constellation of low-earth orbiting (LEO) satellites, supported by ground-based command, control, communications and processing that will provide critical global missile tracking through *all* phases of flight.

An STSS constellation easily provides coverage that is difficult to achieve with radars alone. A reasonable number of STSS satellites in a LEO constellation provide global coverage against long range, intermediate range, medium range and short range ballistic missiles.

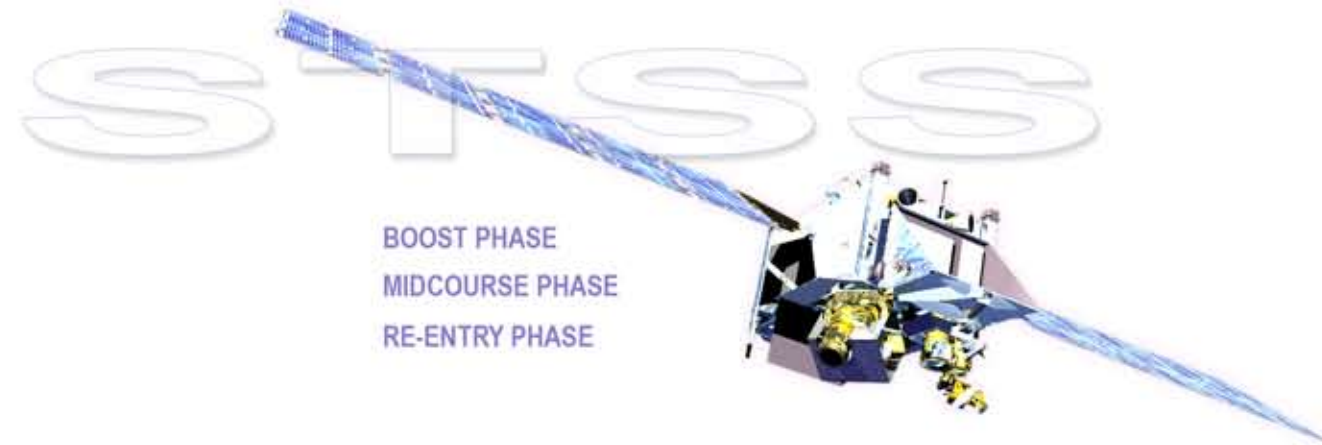
From this orbit, these sensors look both below-the-horizon (earth in the background behind the tracked target) and above-the-horizon (space in the background behind the target) to provide a close-up view of ballistic missiles through all phases of flight – boost, post-boost, midcourse and terminal phases.

STSS satellites carry an infrared (IR) payload with multiple sensors which provide the capability to see even very cold missile bodies after boost phase. These IR sensors are analogous to night vision goggles.

The STSS sensors span a wide range of the IR spectrum, allowing the system to see the missiles throughout their entire flight regime—from hot missiles in boost phase, to cold missiles and re-entry vehicles (RVs) in midcourse flight, to hot RVs re-entering the atmosphere.



Full Coverage. STSS works in concert with both SBIRS and DSP for full spectrum coverage.



Space-Based Midcourse Tracking Enhances the Accuracy of Interceptors

Just as a baseball outfielder continually tracks a baseball with his eyes and makes adjustments in his position to be at the right location at the right time to catch the ball, midcourse tracking allows the C2BMC system to update missile trajectory predictions and increases the ability of missile interceptors to be at the right place at the right time.

Now imagine a baseball hit into a low cloud. Although the outfielder sees the ball leave the bat, he must now guess where the ball will re-emerge from the cloud. He will have very little time to make adjustments once the ball is visible. The chances of the outfielder catching the ball are much lower than when he continually tracks the ball through its entire flight.

The STSS system will increase our capability to play ball without a cloud over our heads.



Keeping your eye on the ball through its entire flight.

Space-Based Midcourse Tracking Extends the Range of Interceptors

As a space-based sensor system, STSS provides both global coverage and earlier tracking of missiles in flight, maximizing the defended area of the interceptor systems. STSS track data provided to the Aegis weapons system would allow it to focus energy in the direction of the incoming missile and pick up the threat earlier, providing earlier interceptor launch and expanded area defense. Ground Based Interceptor bases in Alaska and California would also benefit from the earlier cues, allowing earlier launches, time to assess effectiveness of the intercept, and time for a second shot if necessary (shoot-look-shoot). For both systems, the STSS constellation increases effectiveness and "probability of kill."

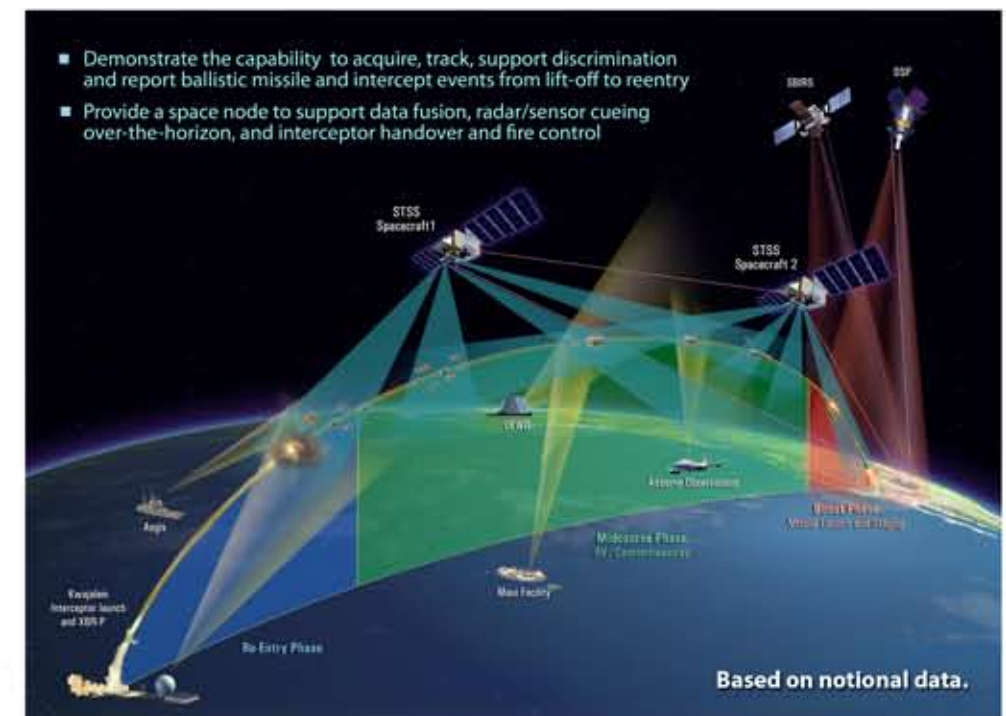


STSS extended coverage multiplies the capabilities of the missile defense interceptor systems, enabling a greater defended area for the same assets to protect deployed forces, allies and friends.



The STSS Demonstrator Program

The STSS Demonstrator program, formerly referred to as Block 06, was authorized in April 2002. Both STSS Demonstrator space vehicles have successfully completed integration, and recently completed thermal vacuum testing. Thermal vacuum testing is conducted to confirm that the satellite will operate according to specifications in its space environment. Once on orbit, these satellites will undergo a series of tests to validate the system's ability to meet key mission objectives, including acquisition-to-track handover; satellite-to-satellite handover; midcourse tracking and successful integration with C2BMC.



STSS Demonstrator satellites reduce procurement risk by validating technology maturity and system capabilities, paving the way to deployment of a fully operational constellation.

The ground station is operational and the two demonstrator satellites are on track for launch in 2008.

A National Imperative

"Our real problem, then, is not our strength today; it is rather the vital necessity of action today to ensure our strength tomorrow."

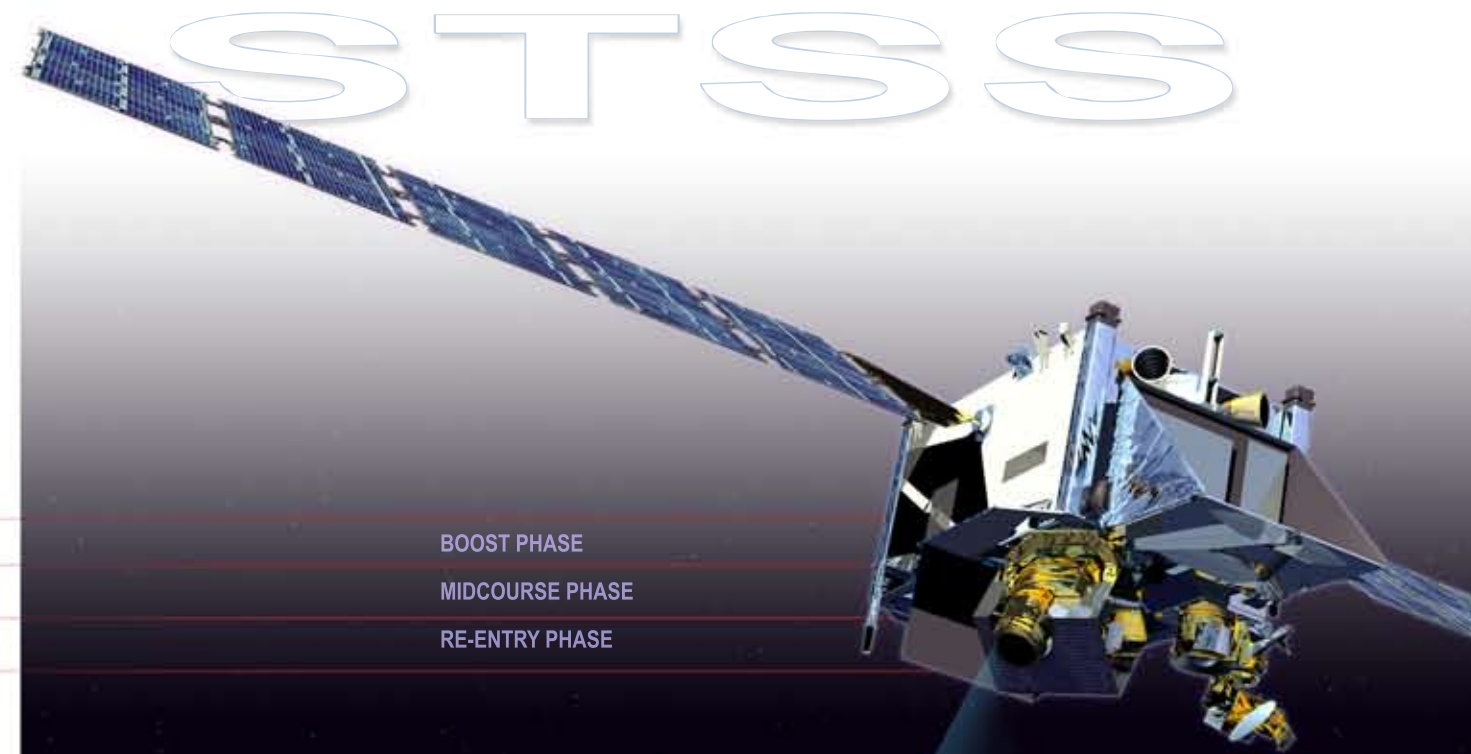
Former U.S. President Dwight D. Eisenhower
State of the Union Address – 1958

The threat is global and unpredictable. The global sensor capability of STSS provides the unique tracking solution through all phases of a ballistic missile trajectory. Fielding all three segments of the missile defense architecture (the eyes, the brains, and the muscles) will increase our missile defense capability as the threat continues to grow.

It is a national imperative to initiate and expeditiously deploy the operational STSS constellation which is vital to defending our nation.

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