

Integrated Defense Systems
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Global Positioning System (GPS) IIF

Description and Purpose:

GPS is a space-based, world-wide navigation system providing users with highly accurate, three-dimensional position, velocity and timing information 24 hours a day in all weather conditions. Boeing has been the prime contractor for most GPS satellites and is under contract to build 12 next-generation GPS Block IIF satellites.

Customer: U.S. Air Force

General Characteristics:

Created by the U.S. Department of Defense to enhance US military warfighting capability, GPS is available for use, free of charge, to anyone with a GPS receiver. Since its development, the system has seen a proliferation of use by the civilian community and new applications are continuously being developed.

This increased civil and commercial use of GPS, coupled with lessons learned from years of military operations and specific experiences during Operation Desert Storm, Kosovo, Desert Shield and Iraqi Freedom, drove a desire to modernize the system – augment its capabilities while sustaining the current GPS mission. In response to new civil demands and the emerging doctrines of navigation warfare, the U.S. Air Force was charged with directing and procuring improvements to the GPS constellation. Boeing was selected to support the Air Force in architecting the future of GPS, guiding the introduction of new capabilities and technologies into the Block IIF to create a modernized satellite.

The GPS IIF system brings next-generation performance to the constellation. The GPS IIF vehicle is critical to U.S. national security and sustaining GPS constellation availability for global civil, commercial and defense applications. Besides sustaining the GPS constellation, IIF features more capability and improved mission performance.

Each satellite delivers:

- Two times greater predicted signal accuracy than heritage satellites
- New L5 signals for more robust civil, commercial aviation



- Military signal “M-code” and variable power for better resistance to jamming in hostile environments, meeting the needs of emerging doctrines of navigation warfare
- A 12-year design life providing long-term service and reduced operating costs
- An on-orbit, reprogrammable processor, receiving software uploads for improved system operation

Boeing’s innovative pulse-line manufacturing approach will deliver the IIF fleet on schedule. Similar to a traditional airplane assembly line, the IIF pulse line efficiently moves a satellite from one work area to the next in a steady rhythm, like a pulse.

In May 2009, Boeing shipped GPS IIF Space Vehicle 2 (SV-2) from its El Segundo, Calif., satellite factory to Cape Canaveral Air Force Station, Fla., for ground tests to prepare for the 2010 launch of SV-1, the first of 12 IIF satellites. SV-2 supported the execution of a consolidated system test (CST), which is a set of one-time, system-level design validation tests involving the space vehicle, the ground-based control segment, and user equipment. SV-2 was also used as a "pathfinder" to validate satellite transportation processes and equipment, and to validate the launch site test program, procedures and equipment. After successful completion of the CST and pathfinder activities, SV-2 returned to El Segundo in September to prepare for its own launch from the Cape.

In 2007, Boeing successfully assisted the Air Force in seamlessly deploying two new major ground control segment elements: Launch and Early Orbit, Anomaly Resolution, and Disposal Operations (LADO) and the Architecture Evolution Plan (AEP) Operational Control System (OCS). These systems have enhanced the performance of the current on-orbit GPS fleet while preparing to also operate the new GPS IIF satellites. Boeing recently completed OCS system testing for the addition of a critical new security capability designed to protect GPS receivers against fake satellite signals sent by adversaries.

Background:

GPS IIF is the product of Boeing’s heritage with 39 successful satellites from the GPS Block I and Block II/IIA missions and over 30 years of teamwork with the Air Force, sharing an architecture that ensures sustainment while augmenting mission performance.

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