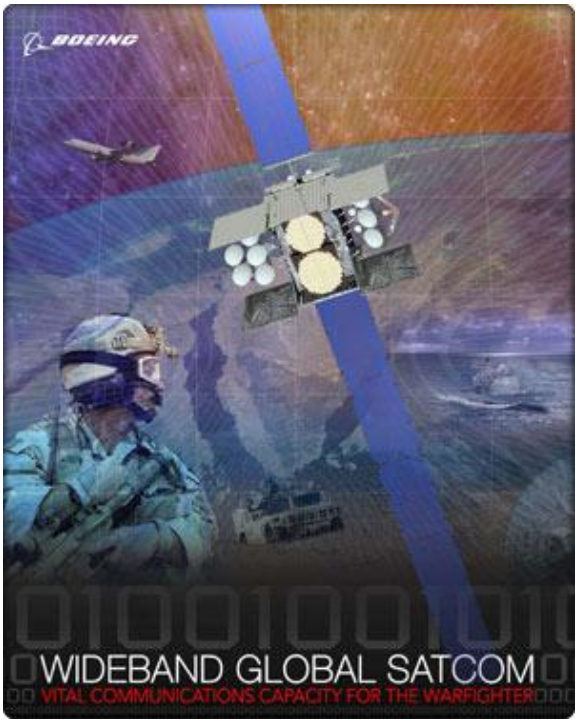
Defense, Space & Security

Boeing Satellites

Transformational Wideband Communication Capabilities for the Warfighter

WGS Mission



The Wideband Global SATCOM (WGS) satellites are the key elements of a high-capacity system that provide a quantum leap in communications capabilities for the warfighter.

WGS supports the Department of Defense's warfighting information exchange requirements, enabling execution of tactical command and control, communications, and computers; intelligence, surveillance, and reconnaissance (C4ISR); battle management; and combat support information. WGS also augments the current Ka-band Global Broadcast Service (on UHF F/O satellites) by providing additional information broadcast capabilities.

WGS is the DoD's highest-capacity satellite communications system. Each WGS satellite can route 2.1 to 3.6 Gbps of data -- providing more than 10 times the communications capacity of the predecessor DSCS III satellite. Using reconfigurable antennas and a digital channelizer, WGS also offers added flexibility to tailor coverage areas and to connect X-band and Ka-band users anywhere within the satellite field of view. The system provides tremendous operational flexibility and delivers the needed capacity, coverage, connectivity and control in support of demanding operational scenarios.

Boeing was awarded the WGS initial contract in January 2001 for the first three satellites plus the associated ground-based command and control elements. Integrated logistics, training, and sustaining engineering support are also provided by Boeing.

The U.S. Air Force MILSATCOM Systems Directorate at Los Angeles Air Force Base (AFB) is the WGS customer. The first WGS three satellites, which constitute Block I, are all on-orbit and are meeting or exceeding all operational requirements. WGS-1 was placed into service over the Pacific Ocean region in April 2008. WGS-2 was placed into service over the Middle East in August 2009. WGS-3 went into operations over Europe and Africa in June 2010.

In October 2006 the Air Force awarded a Block II contract that provides three more satellites, WGS-4, -5, and -6, to meet the warfighter's evolving SATCOM bandwidth requirements. The Block II satellites add a radio frequency bypass capability designed to support airborne intelligence, surveillance and reconnaissance platforms requiring ultra-high bandwidth and data rates demanded

by unmanned aerial vehicles.

As is common with DOD satellite contracts, the Government has incrementally increased the size of the constellation through the exercise of contract options for procurement of additional satellites. To that end, the Block II Follow-On (B2FO) contract was awarded in August 2010 with the initial order for satellite 7. Satellites 8, 9 and 10 were awarded in December 2011, January 2012 and July 2012, respectively. The Wideband Digital Channelizer upgrade, which was awarded in June 2012, will be included on satellites WGS-8 and beyond.

The first Wideband Global SATCOM satellite was launched Oct. 7, 2007 aboard an Atlas V launch vehicle. The second was launched April 3, 2009, also on an Atlas. The third satellite, the last of the Block I spacecraft, was launched on Dec. 5, 2009, aboard a Delta IV launch vehicle. The fourth satellite, the first in the Block II spacecraft, was launched on Jan. 19, 2012, also aboard a Delta. All four operational satellites are meeting or exceeding their mission requirements.

Capacity:

WGS supports communications links within the government's allocated 500 MHz of X-band and 1 GHz of Ka-band spectrum. The WGS payload can filter and route 4.875 GHz of instantaneous bandwidth. Depending on the mix of ground terminals, data rates and modulation schemes employed, each satellite can support data transmission rates ranging from 2.1 Gbps to more than 3.6 Gbps. By comparison, a DSCS III satellite will support up to 0.25 Gbps.

Coverage:

The WGS design includes 19 independent coverage areas that can be positioned throughout the field of view of each satellite. This includes eight steerable and shapeable X-band beams formed by separate transmit and receive phased arrays; 10 Ka-band beams served by independently steerable, diplexed antennas, including three with selectable RF polarization; and transmit/receive X-band Earth coverage beams.

Connectivity:

The enhanced connectivity capabilities of WGS enable any user to communicate with any other user with very efficient use of satellite bandwidth. A digital channelizer divides the uplink bandwidth into nearly 1,900 independently routable 2.6 MHz subchannels, providing connectivity from any uplink coverage area to any downlink coverage area (including the ability to cross-band between X and Ka frequencies). In addition, the channelizer supports multicast and broadcast services and provides an effective and flexible uplink spectrum monitoring capability to support network control.

The figure below shows how the X-band and Ka-band antenna suites are interconnected via the digital channelizer to provide the unique flexibility and connectivity of WGS.

Command and Control: Control of the WGS communications payloads is accomplished from four Army Wideband Satellite Operations Centers (WSOCs), using ground equipment hardware and software developed by Boeing, ITT Industries, and Raytheon Corp.

Spacecraft platform control is performed by the 3rd Space Operations Squadron (3 SOPS) at Schriever AFB in Colorado Springs,Colo., using WGS mission unique software and databases provided by Boeing, hosted on the Command and Control Segment Consolidated (CCS-C) systems that are being fielded by Integral Systems, Inc.

Boeing 702HP Platform :

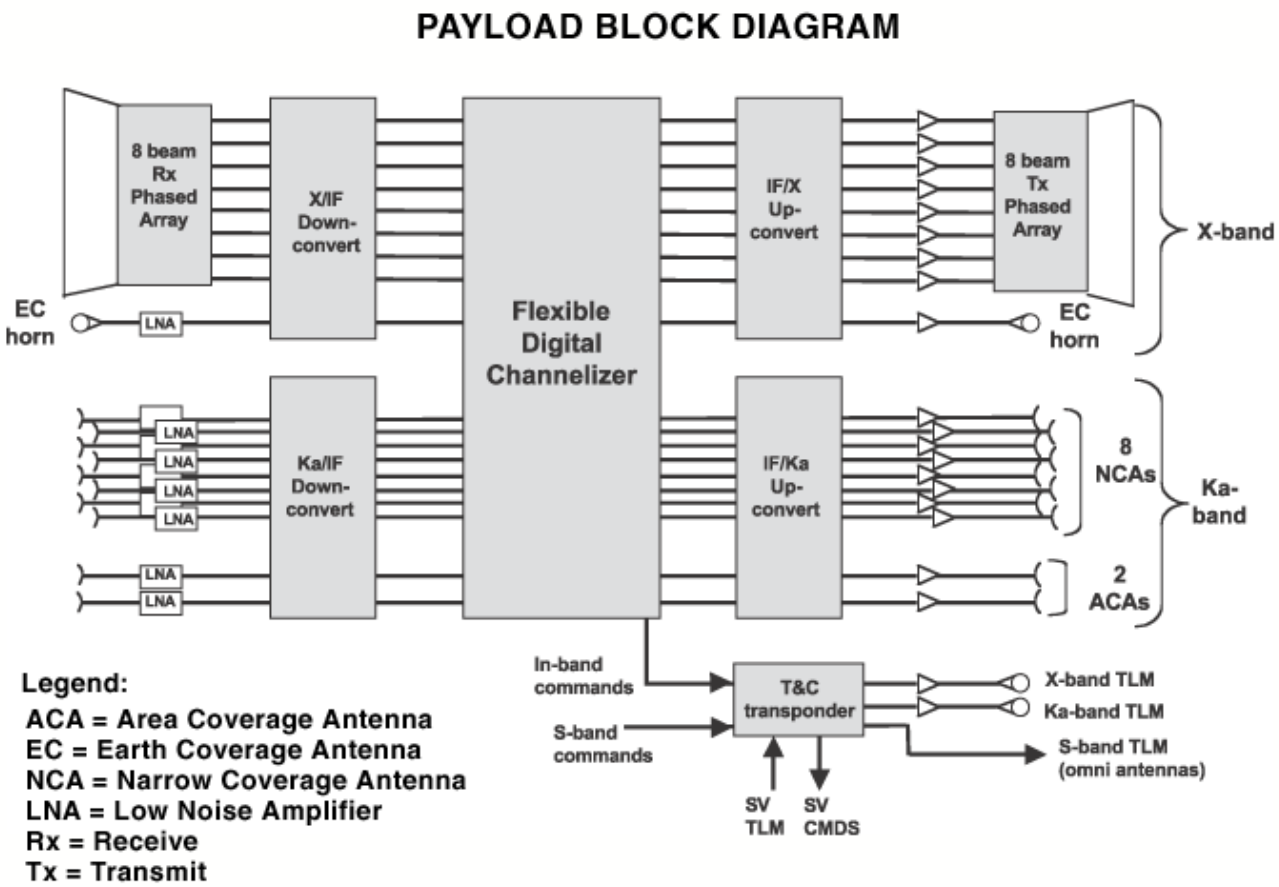
The Boeing 702HP satellite is the industry leader in capacity, performance and cost-efficiency. Enabling technologies for the advanced 702HP design are the xenon-ion propulsion system (XIPS), highly efficient triple-junction gallium arsenide solar cells, and deployable radiators with flexible heat pipes.

XIPS is 10 times more efficient than conventional bipropellant systems. Four 25-cm thrusters remove orbit eccentricity during transfer orbit operations and are used for orbit maintenance and to perform station change maneuvers as required throughout the mission life. Deployable radiators with flexible heat pipes provide substantially more radiator area, resulting in a cooler, more stable thermal environment for both bus and payload. This increases component reliability and reduces performance variations over life.

Summary

As the leading provider of advanced satellite communications systems for broadcast and packet-switched satellite communications, Boeing has leveraged a wealth of government and commercial experience and technology for WGS. This includes the company's extensive investments to develop the Boeing 702HP, as well as prior work on phased array antennas and digital signal processors. Together these technologies enabled the tremendous capacity and operational flexibility sought for the WGS space segment. Additionally, these core capabilities can support WGS evolution to satisfy additional transformational requirements of the warfighter, such as improved connectivity for intelligence, surveillance and reconnaissance platforms and network-centric communications architectures.

For more information, read the Wideband Global SATCOM overview (PDF).



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