Defense, Space &
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Wideband Global SATCOM

Description and Purpose:
The mission of the Wideband Global SATCOM (WGS) system is to provide broadband communications connectivity for U.S. and allied warfighters around the world. WGS is the highest-capacity military communications system in the U.S. Department of Defense arsenal, providing a quantum leap in communications capability for the U.S. military.

Boeing's investments in phased array antennas and digital signal processing, combined with innovations in the commercial satellite market, have resulted in a flexible WGS system that delivers the capacity, coverage, connectivity and control required by the most demanding operational scenarios.

Customer:
The U.S. Air Force MILSATCOM Systems Directorate at Los Angeles Air Force Base (AFB) is the WGS customer.

General Characteristics:
WGS is designed for coverage, capacity and connectivity, with each satellite designed for high-data-rate communications providing full-motion video and sensor data gathered from remote piloted aircraft; video teleconferencing among military leaders around the world; and critical communications for humanitarian efforts and deployed forces.

Through frequency reuse and digital channelization, each WGS payload provides bandwidth-efficient communications to respond to evolving mission demands. Operating at both X-band and Ka-band, the system enables networks for tactical Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR). The dual-band system allows tens of thousands of users with military wideband terminals to operate seamlessly, anytime, anywhere. WGS is the backbone of U.S. Department of Defense satellite communications, providing more than 75% of tactical wideband communications.

The WGS design includes 19 independent coverage areas. Ten Ka-band and 8 X-band beams can be positioned anywhere in the field of view of each satellite. Full-Earth coverage in X-band is also provided. Use of phased array technology allows the eight X-band beams to be steered and shaped to apply gain and power exactly where it's needed.

Communications between users are enhanced using the digital channelizer, which allows for very efficient use of a satellite's bandwidth. It divides the uplink bandwidth into nearly 1,900 independently routable sub-channels, providing the connection from any uplink coverage area to any downlink coverage area.

WGS satellites have features to operate in contested environments and soon will receive updates to provide the fleet with anti-jamming capabilities through two programs currently under development at Boeing in partnership with the U.S. Air Force: the Mitigation and Anti-Jam Enhancement (MAJE) program and the Protected Tactical Enterprise Service (PTES) program.

The MAJE program is a ground-based anti-jam upgrade that will use the existing capabilities of the WGS satellites to geolocate from where interference is coming and shape beams to mitigate the interference. The PTES program, a new global military satellite communications ground system, will use the wide bandwidth available per beam on WGS satellites to transmit the Protected Tactical Waveform, one of the U.S. Department of Defense's secure, anti-jam waveforms. In later phases of the program, PTES also will manage Protected Tactical Waveform transmissions over commercial communication satellites and terminals.

Background:
The first three WGS satellites, which constitute Block I, are all on-orbit and are meeting or exceeding all operational requirements. WGS-1 was originally placed into service over the Pacific Ocean Region in April 2008. WGS-2 was placed into service in August 2009, and WGS-3 went into operations in June 2010.

WGS-4, the first in the Block II series, was placed into service over the Indian Ocean Region in August 2012. WGS-5 was placed into service in October 2013, and WGS-6 was placed into service in December 2013.The Block II satellites include a Radio Frequency Bypass enhancement to allow broadband routing of data to bypass the digital channelizer for additional support to high-data-rate airborne intelligence, surveillance and reconnaissance (AISR) missions.

WGS-7, the first of the Block II Follow-On series, was launched in July 2015. WGS-8 was launched in December 2016, and WGS-9 was launched in March 2017. The tenth WGS satellite is scheduled to launch in Q1 2019. WGS-8, -9 and -10 feature an upgraded digital channelizer that nearly doubles the available bandwidth of each satellite. In total, nine WGS satellites are now on orbit and are meeting or exceeding all operational requirements. Since the original contract start in 2001, the U.S. Air Force and Boeing developed and launched nine satellites in 16 years, an average launch rate of more than once every two years.

Backgrounder

Miscellaneous:
The WGS communications payload is controlled from four Wideband Satellite Operations Centers, using ground-based control elements provided by Boeing. Platform control is conducted from Schriever Air Force Base using mission-unique software designed specifically for this program by Boeing in concert with the U.S. Air Force Command and Control System-Consolidated (CCS-C).

WGS leverages a wealth of government and commercial experience and technology, including the proven Boeing 702 satellite platform – the industry leader in capacity, performance and cost-efficiency. Enabling technologies of the 702 platform include autonomous operations, xenon-ion propulsion system (XIPS), highly efficient triple-junction gallium arsenide solar cells and deployable radiators with flexible heat pipes.

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February 2019

Backgrounder

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Wideband Global SATCOM

Providing affordable global MILSATCOM access to international partners

The U.S. Air Force's Wideband Global SATCOM (WGS) is the Department of Defense's (DOD) highest capacity communications satellite. The system provides a global footprint of critical wideband communications for warfighters as well as an unparalleled ability to interconnect users that are geographically dispersed or using different frequency bands.

Australia became the first international participant in the WGS system under a cooperative agreement with the United States Air Force in 2007. In 2012, five additional partner nations – Canada, Netherlands, Luxembourg, Denmark and New Zealand – executed a similar agreement to gain global access to the WGS system.

Benefits:
WGS provides modern MILSATCOM wideband services to meet a variety of civilian and military missions, minimizing cost by leveraging the existing infrastructure of compatible wideband ground and user terminals. Existing international partners have demonstrated how quickly existing equipment can be used to access the WGS system.

The WGS constellation continues to expand, with the tenth satellite anticipated to launch in Q1 2019. WGS-9, the most recent of the system's satellites to be placed on-orbit, expanded the advanced secure communications network that supports the U.S. DOD and its international partners. The on-board digital channelizer, the heart of the WGS payload, has been upgraded starting with the eighth spacecraft to nearly double the payload bandwidth and further improve connectivity of future spacecraft. The new channelizer also enhances anti-jam (AJ) performance for advanced protected MILSATCOM terminals using next-generation waveforms. In addition, there are affordable ground modifications that can provide adaptive nulling and geolocation capabilities to address the evolving threat environment. The increased bandwidth

provided by the new Wideband Digital Channelizer, combined with the available AJ features described above, provide allied partners assured access to a globally robust and secure constellation to support military or disaster relief activities worldwide.

Affordability:
The DOD's program to bring partner nations into the WGS system provides a highly affordable way to gain modern wideband MILSATCOM access globally for a much lower cost than developing a dedicated satellite system. Compatible with existing X- and Ka-band user equipment, WGS can provide high performance, global access, and interoperability with NATO forces and other international partners. The international program has allowed member nations to invest proportional to their specific level of MILSATCOM needs. This arrangement provides the benefits of immediate access through an existing worldwide infrastructure, including multiple gateways, terrestrial networking, and mission planning capabilities. In addition, international partners are able to leverage existing user terminals and telecom equipment.

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February 2019