

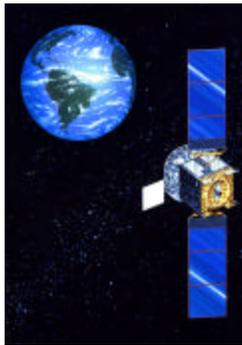


FACT SHEET

Navy Communications Satellite Programs

Program Executive Officer for
Space, Communications and Sensors
4201 Pacific Highway, San Diego CA 92110-3215

Ultra High Frequency Follow-On (UFO) Program



HS 601 Satellite

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Technical Information on the Satellite

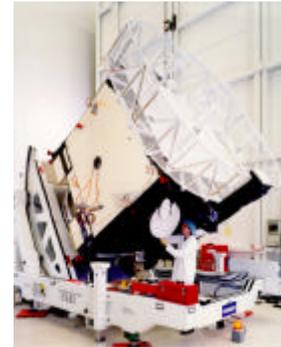
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Program History

The U.S. Navy is replacing and upgrading its ultra-high frequency (UHF) satellite communications network during the 1990s with a constellation of customized Hughes HS 601 spacecraft known as the UHF Follow-On (UFO) series.

The Navy Communications Satellite Program Office (PMW 146) of the Program Executive Office for Space, Communications and Sensors in San Diego has overall responsibility for executing the procurement of the UHF communications satellites for all of DoD. In July 1988, a fixed-price contract based on competition was awarded to [Hughes Space and Communications Company](#) to build the UFO satellite constellation and place it in orbit. The UFO contract is an innovative implementation of acquisition reform. The Navy issued contract performance objectives and goals, which allowed the contractor latitude in choosing commercial off-the-shelf components for the satellite and in selecting the commercial launch vehicle for lift to orbit.

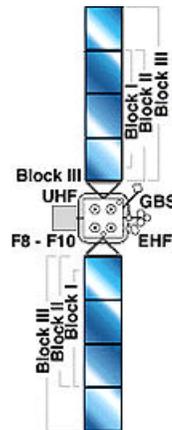
The initial agreement called for Hughes to build and launch one satellite, with options for nine more, for a total value of \$1.9 billion. In March 1996, the Navy ordered a high-power, high-speed Global Broadcast Service (GBS) payload to be incorporated onto the last three satellites. The UFO satellites replace the Hughes-built LEASAT and the TRW built Fleet Satellite (FLTSAT) spacecraft currently supporting the DoD's global communications network. This network serves ships at sea, aircraft and a variety of other U.S. military fixed and mobile terminals used by mobile warriors. The satellites are fully compatible with ground and sea-based terminals already in service. Procurement of an 11th satellite is in progress with a projected launch date in the 2003 timeframe. This satellite will help sustain the UHF constellation into the latter part of the next decade. The Navy has already commenced the planning effort to develop solutions to support the next generation of mobile satellite users.

Technical Information on the Satellite

Hughes is manufacturing the UFO satellites in its El Segundo, California factory. The satellites are body-stabilized, three-axis HS 601 models composed of two main modules. The bus module houses the bus electronics, propulsion subsystem, and battery packs. The payload module contains the communications equipment and antennas. Using a building-block approach, Hughes and the Navy are enhancing the constellation capabilities in stages. Satellites F-1 through 3 carry UHF and SHF (super-high frequency) payloads. In F-4, 5 and 6 there is an additional payload for EHF (extremely high frequency) communications. F-7 introduced an enhancement to the EHF package that doubles capacity. The SHF payload is replaced with the GBS package on F-8 through 10. The first seven satellites measure more than 60 feet long from the tip of one three-panel solar array wing to the tip of the other. Spacecrafts F-8 through F-10 each have four solar panels on a side, making them 75 feet long from wing tip to wing tip. These arrays generate a combined 2500 watts of electrical power on the first three satellites, 2800 watts for F-4 through F-7, and 3800 watts for F-8 through F-10.

Spacecraft	Blk	Weight (lbs)*	Power (w)**	L (ft)	W (ft)	Payload
F1 - F3	I	2,610	2,370	60	23	UHF/SHF
F4 - F7	II	3,050	2,630	60	23	UHF/SHF/EHF
F8 - F10	III	3,371	3,734	75	UHF/EHF/GBS	

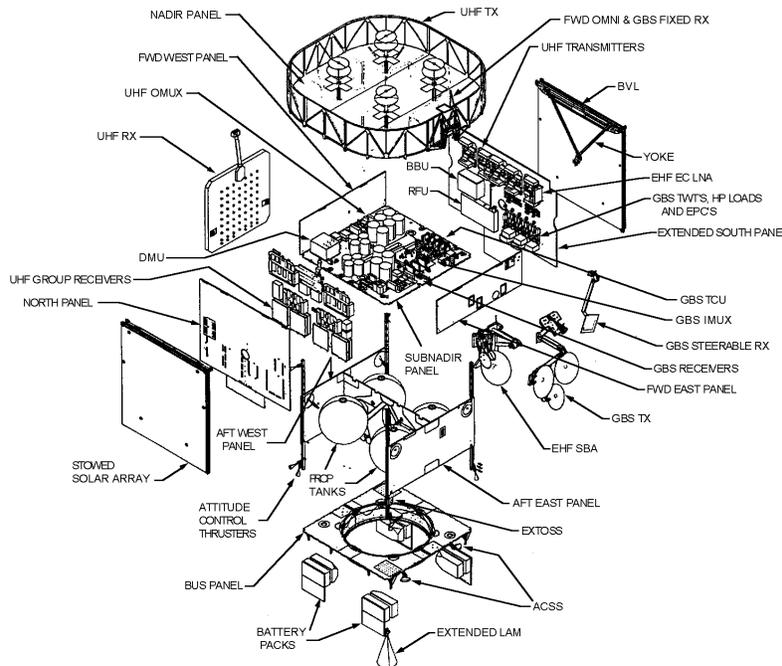
*Beginning of life **End of life



F-8 Prior to Shipment



Height stowed
11Ft
Width stowed
10.5 x 11.1 ft



Graphics courtesy of Hughes Space & Communications

Orbit altitude: Geosynchronous orbit - 32,810 km **Launch Site:** Cape Canaveral, Florida.
Launch Vehicle: Atlas-Centaur space booster **Mean Mission Duration:** Minimum 10-years

The Mission of the Satellite

The UFO satellites offer increased communications channel capacity over the same frequency spectrum as the current systems. Each spacecraft has 11 solid-state UHF amplifiers and 39 UHF channels with a total 555 kHz bandwidth. These frequencies consist of 21 narrowband channels at 5 kHz each and 17 relay channels at 25 kHz plus one fleet broadcast channel. In comparison, FLTSAT offers 22 channels. The F-1 through F-7 spacecraft include a SHF subsystem, which provides redundant command and ranging capabilities when the satellite is on station. In addition, it serves as the secure uplink for Fleet Broadcast Service, which is transmitted to the fleet on UHF.

The Navy added an extremely high frequency communications package beginning with the fourth spacecraft. This addition includes 11 EHF channels distributed between an earth coverage beam and a steerable 5-degree spot beam and is compatible with MILSTAR ground terminals. The EHF subsystem provides enhanced anti-jam telemetry, command, broadcast, and fleet interconnectivity communications, using advanced signal processing techniques. The EHF Fleet Broadcast capability supersedes the need for the SHF fleet uplink. Beginning with UFO F-7, the EHF package has been enhanced to provide 20 channels through the use of advanced digital integrated circuit technology.

Launch of the Satellite

Hughes chose Lockheed Martin International Launch Services and the Atlas-Centaur series of rockets to provide launch service from Cape Canaveral, Florida for the UFO satellites. The Atlas I rocket was used for the UHF-only satellites. The Atlas II rocket was used for satellites with the additional EHF payloads and for those with GBS packages. UFO F-2 was the first in the series to go into service, after its successful launch 3 September 1993. UFO F-3 was launched 24 June 1994. Three UFO spacecraft were orbited in 1995: F-4 28 January, F-5 31 May, and F-6 22 October. F-7 was launched 25 July 1996. F-8 was launched 16 March 1998 and F-9 was launched on 20 October 1998. The present deployment schedule calls for F-10 to be launched in the summer of 1999.



F-8 Launch

ATLAS IIA LAUNCH VEHICLE



Characteristics

Total Liftoff Mass: 187,545-kg (413,470-lb)

Total Length: 47.6-m (156.0-ft) with standard length large payload fairing (LPF)

	Atlas	Centaur
Length:	25.0-m (82.0-ft)	15.0-m (33-ft)
Diameter:	3.05 m (10-ft)	3.05-m (10-ft)
Propulsion:	One MA-5A	Two RL10A-4 (or RL10A-4-1)
Inert Mass:	8,165-kg (18,000-lb)	2,000-kg (4,410-lb)
Flight Expendables:	155,495-kg (342,810-lb)	16,810-kg (37,060-lb)



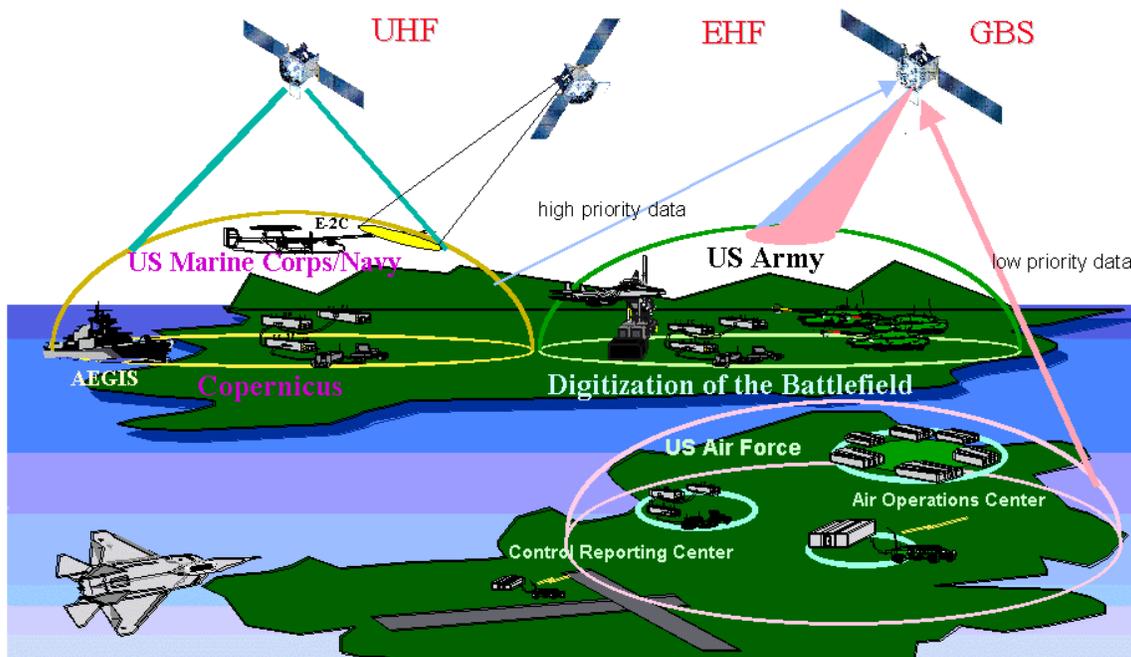
For launch, the arrays are folded against the spacecraft bus forming a cube roughly 11 feet per side. Without fuel, the satellites weigh an average of 2600 pounds with the UHF payload, 3000 pounds with the additional EHF payload, and 3400 pounds with the GBS payload.

Operation of the Satellite

The 3rd Space Operations Squadron at Schriever Air Force Base, Colorado, performs launch, early orbit, and on-orbit operations. The Air Force Satellite Control Network (AFSCN) and the Navy Satellite Control Stations (NSCS) provide telemetry, tracking, and commanding (TT&C) coverage. The satellite is designed to operate for 30 days without ground contact if necessary. Satellite operations will transition to the Naval Space Operations Center after the launch of F-10.

Global Broadcast Service (GBS)

The GBS payload replaces the SHF payload on spacecraft F-8, 9, and 10. This new package includes four 130-watt, 24 megabits-per-second (Mbps) military Ka-band (30/20 GHz) transponders with three steerable downlink spot beam antennas (two at 500 nmi and one at 2000 nmi) as well as one steerable and one fixed uplink antenna. This modification results in a 96 Mbps capability per satellite. Three spacecraft give the DOD near-global coverage. The systems will transmit to small, mobile, tactical terminals.



This GBS package will revolutionize communications for the full range of the Defense Department's high-capacity requirements, from intelligence dissemination to quality-of-life programming. The payloads have been successfully integrated under a tight production schedule meeting the deadline to launch UFO F-8 in March of 1998. Full, three-satellite operational capability is planned by the summer of 1999.

Related Information and Web Sites

Space & Naval Warfare Systems Command / Program Executive Office for Space, Communications & Sensors, Office of Congressional & Public Affairs: Richard Williamson at (619) 524-3432
<http://www.spawar.navy.mil/corporate/spawarpao/newsreleases/>

Hughes Space And Communications Company: Communications and Customer Relations: (310) 364-6363 <http://www.hughespace.com/home.html>

Lockheed Martin: Julie Andrews at International Launch Services: (619) 645-6400 (San Diego Headquarters) or (407) 730-5300/5305 (Cape Canaveral)
<http://www.lmco.com/ILS/index.htm>

U.S. Air Force Space Command's 45th Space Wing Office of Public Affairs: Ken Warren at (407) 494-5933 <http://www.pafb.af.mil/>