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NASA TO LAUNCH SECOND BUSINESS COMMUNICATIONS SATELLITE

Satellite Business Systems-B, the second of three synchronous altitude, geostationary spacecraft, that will further expand the use of outer space for business communications, will be launched on board a two-stage Delta 3910 launch vehicle from NASA Launch Complex 17, Pad A, on the Cape Canaveral Air Force Station, Fla, no earlier than Sept. 3, at 7:16 p.m. EDT. The first of two launch opportunity time windows extends to 7:25 p.m. EDT; the second extends from 7:55 p.m. EDT, to 8:08 p.m. EDT.

The Delta will place the SBS-B spacecraft into a transfer orbit having a high point (apogee) of 36,619 kilometers (22,754 miles) and a low point (perigee) of 167 km (104 mi.), at an inclination of 27.7 degrees to Earth's equator. Later in flight, its orbit will be circularized at an altitude of about 35,888 km (22,300 mi.).

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SBS-B, like SBS-1 launched in November 1980, is designed and built by Hughes Aircraft Co., Culver City, Calif., and owned by Satellite Business Systems, McLean, Va. The company is a partnership of the Aetna Life and Casualty Insurance Co., COMSAT General Corp. and International Business Machines Corp. (IBM). Life span of the spacecraft is expected to be seven years.

The Delta 3910, chosen to launch the second SBS spacecraft, is the latest and most powerful in the Delta family of expendable launch vehicles. For 20 years, Deltas have launched communications, weather, military and scientific satellites for United States and foreign customers. Through July 1981, 154 Deltas have been launched, with a mission success rate of about 94 percent.

Designed and manufactured for NASA under the management of the Goddard Space Flight Center, Greenbelt, Md., the Delta has become the agency's "workhorse" launch vehicle.

The Delta family has evolved through many configurations since the initial launch on May 13, 1960. The first mission was for Echo-I, a pioneering communications satellite. The SBS satellites, along with their payload assist module, are the largest geosynchronous payloads to date for a Delta.

The first and second stages of the Delta 3910s to be used for the SBS launches are conventional. However, instead of a conventional third stage, a payload assist module will be used on each vehicle. The payload assist module, for use with either a Delta or the Space Shuttle, will inject the spacecraft into an elliptical transfer orbit. The basic components of the module are a spin table, solid-fuel motor and payload attachment system.

(END OF GENERAL RELEASE; BACKGROUND INFORMATION FOLLOWS.)

DELTA 3910 CHARACTERISTICS

The Delta 3910 is 35 meters (116 feet) long and 2.4 m (8 ft.) in diameter. Its first stage, 22.4 m (73.6 ft.) long, is powered by a Rocketdyne main engine. This liquid-fueled engine (kerosene and liquid oxygen) develops 912 kilonewtons (205,000 pounds) of thrust. Strapped onto the first stage are nine solid-fuel Castor IV motors, made by Thiokol. Each of these boosters is 9.1 m (30 ft.) long, 1 m (3.3 ft.) in diameter and develops 378 kN (85,000 lb.) of thrust.

The nozzles on four of the strap-on motors have a new tilt angle to give the motors more thrust in the direction of motion. In previous launch, all nine booster nozzles were tilted outward 11 degrees from vertical. For the SBS launch, the tilt of four will be reduced to 7 degrees.

Delta's 4.9-m (16-ft.) second stage is powered by a TRW-201 motor, which is also liquid-fueled (Aerozene 50 and nitrogen tetroxide) and develops 43.8 kN (9,850 lb.) of thrust.

The attachment system between the first and second stages consists of four bolts with an ordnance device in each to cut the bolts for separation. Between the second stage and the payload assist module/spacecraft is another attachment system consisting of a clamp band and two bolts, one of which is redundant. An ordnance device severs the bolts, after which the clamp band disengages, allowing four springs to push the payload assist module/ spacecraft away from the second stage. A similar system attaches the payload assist module to the spacecraft.

Firing and Separation Sequence

First-stage burnout occurs three minutes and 43 seconds after liftoff. During the first-stage powered flight, the nine boosters are ignited (57-second burn times) and jettisoned in clusters so that the vehicle maintains trajectory stability and thrust. At first-stage burnout, the vehicle has an altitude of 121 km (75.4 mi.) and a velocity of 20,117 km/hr (12,500 mph).

The burn time for the second-stage engine is four minutes and 35 seconds. Two seconds before second stage separation, the spin table of the payload assist module is activated by eight small rockets to give the module/spacecraft a spinning motion of 50 revolutions per minute, which will stabilize its flight. At separation of the second stage, the payload has an altitude of 216 km (134 mi.) and a velocity of 26,876 km/hr (16,700 mph).

Subsequent firing of the payload assist module motor -- also known as the perigee motor -- injects the spacecraft into an elliptical transfer orbit with a perigee of about 166 km (103 mi.), an apogee of about 36,595 km (22,739 mi.) and an orbital period of about 11 hours.

Transfer orbit velocity ranges from 37,015 km/hr (23,000 mph) at perigee to less than 5,633 km/hr (3,500 mph) at apogee.

Following velocity and attitude corrections, the on-board apogee motor is fired to circularize the orbit at an altitude of about 35,888 km (22,300 mi.). Further orbital touchups, accomplished with on-board thrusters and a controlled drift to its intended station where the spacecraft is halted, are performed to complete the spacecraft's injection into geosynchronous orbit. In geosynchronous orbit, the spacecraft has a velocity of 11,066 km/hr (6,876 mph) and a period of almost precisely 24 hours so that, with occasional orbital touchups, it remains in a fixed position relative to Earth.

Inertial Guidance System

The Delta Inertial Guidance System, mounted in the second-stage guidance compartment, incorporates an inertial sensor package and digital guidance computer. It guides the Delta vehicle and controls the launch sequence from liftoff to second stage/payload assist module separation. The sensor package provides vehicle attitude and acceleration information to the on-board guidance computer, which in turn generates steering commands for each stage. The computer constantly checks for trajectory deviation by comparing actual positions and velocities against preprogrammed data. It also provides timing and staging functions as well as critical-event commands.

MAJOR DELTA SBS-B EVENTS

Event	Time (min:sec)	Altitude (km)	Altitude (mi.)	Velocity (km/hr)	Velocity (mph)
Liftoff	0:00	0	0	0	0
5 Solid Motors Burnout	0:57	9.9	6.1	2,725	1,693
3 Solid Drop/4 Solid Ign.	1:04	12.2	7.6	2,722	1,692
2 Solid Motors Drop	1:05	12.6	7.8	2,760	1,715
4 Solid Motors Burnout	2:01	41.9	26.0	8,313	5,166
4 Solid Motors Drop	2:07	46.2	28.7	8,645	5,372
Main Engine Cutoff (MECO)	3:43	114.4	71.1	20,167	12,531
Vernier Engine Cutoff (VECO)	3:50	120.1	74.7	20,189	12,545
Stage II Ignition	3:57	126.6	78.6	20,150	12,521
Fairing Drop	4:01	130.1	80.8	20,199	12,551
Second Stage Cutoff (SECO)	9:03	263.1	163.5	26,748	16,620
Stage II Separation	20:14	215.0	133.6	26,952	16,747
Stage III Ignition	20:52	202.3	125.7	27,008	16,781
Stage III Cutoff (TECO)	22:18	171.1	106.3	37,011	22,998
Spacecraft Separation	24:26	195.0	121.1	36,933	22,950

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TRACKING AND CONTROL

For precise tracking of SBS-B throughout launch phases and afterward, facilities and services of several organizations will be used. These include NASA, COMSAT, Intelsat and SBS.

NASA has responsibility for the launch mission until spacecraft injection into an elliptical transfer orbit 24 minutes after liftoff. For this purpose, NASA uses a combination of its own antennas and U.S. Air Force missile range antennas. These are supplemented by airborne antennas downrange from Cape Canaveral and over Ascension Island.

Intelsat tracking stations will provide precise orbital parameters computed on the basis of acquisition by Intelsat tracking facilities.

Spacecraft flight controllers at the COMSAT Launch Control Center in Washington, D.C., will assume control of SBS-B in the elliptical orbit. At apogee of the fourth orbit they will fire an on-board solid propellant apogee kick motor. This final burn will place the spacecraft into a near-geosynchronous orbit.

Using the Intelsat ground stations, the COMSAT controllers will track and control the spacecraft until it reaches its final position at 97 degrees west longitude at an altitude of 35,808 km (22,250 mi.) and a speed of 11,066 km/hr (6,876 mph).

After the satellite has arrived at its permanent location at 97 degrees west longitude, the SBS tracking, telemetry and command facilities, consisting of a beacon station at Castle Rock, Colo., and a control station at Clarksburg, Md., will assume control of the tracking, telemetry and command functions.

All of the tracking data is fed in real time to the COMSAT Launch Control Center which processes the data and generates the critical commands for orbital touchups and apogee motor firing.

NASA tracking services are provided under the basic launch agreement. SBS contracts separately for the COMSAT and Intelsat services.

Because the Intelsat system and the SBS system operate at different frequencies, the SBS spacecraft carries two telemetry and control systems -- one operating in the 4 and 6 GHz bands for Intelsat and one in the 12 and 14 GHz bands for SBS.

Soon after apogee motor firing, deployments and verification of the initial near-geosynchronous orbit, COMSAT duties are fulfilled and SBS assumes control of the satellite.

During the drift, an in-orbit test team of SBS and COMSAT engineers working under contract will conduct a comprehensive series of spacecraft subsystem and radio frequency tests in preparation for commercial service.

PAYLOAD ASSIST MODULE

The payload assist module is a privately developed rocket vehicle that can operate either as the third stage of a NASA/ McDonnell Douglas Delta booster or from the cargo bay of a Space Shuttle Orbiter to lift unmanned spacecraft to high altitude orbits.

The expendable Delta booster, in service for more than 20 years, requires a powerful third stage to help loft its payloads to maximum altitude. The reusable Space Shuttle will orbit the Earth about 185 to 1,110 km (115 to 690 mi.) high, carrying a variety of payloads on each mission. Communications satellites aimed toward geosynchronous orbits at 35,888 km (22,300 mi.) and others intended for orbits above the Shuttle's limits must be transferred upward with a boost from another rocket. The payload assist module -- also called a spinning solid upper stage when used in the Shuttle -- provides that boost.

Two versions of the payload assist module have been developed by McDonnell Douglas Astronautics Co., Huntington Beach, Calif. The PAM-D is for payloads in the weight class until now served by the Delta; it is designed for operation either on the Delta or from the Shuttle. The larger PAM-A will carry heavier payloads of the type now flown on the Atlas-Centaur expendable launch vehicle; it will operate only from the Shuttle.

PAM-D will be able to place up to 1,084 kilograms (2,390 lb.) of payload on a geosynchronous transfer track with either a Delta or a Shuttle launch. Options are available on Shuttle launches to raise this capability to 1,245 kg (2,750 lb.).

A growth version of Delta available in 1982 will use an improved second stage with the payload assist module to increase geosynchronous payload capability to 1,270 kg (2,800 lb.).

A new Thiokol Corp. solid propellant motor, designated STAR 48, has been developed for PAM-D. The motor is 121.9 centimeters (48 inches) in diameter and approximately 1.81 m (6 ft.) long. Variations in propellant loading and in the rocket nozzle length are available to tailor the system for specific mission requirements.

The PAM-A will be able to lift a satellite weighing as much as 1,996 kg (4,400 lb.) out of the Shuttle into a geosynchronous transfer orbit. It will be powered by a solid propellant rocket motor developed by Thiokol as a commercial derivative of the third stage for the Air Force Minuteman missile. PAM-A will be approximately 2.29 m (7.5 ft.) long and 1.5 m (4.9 ft.) in diameter.

A payload attach fitting at the top of the rocket motor joins the payload assist module to its spacecraft. At the base of the motor are a spin table and a separation system similar to those previously used on Delta vehicles.

For Delta launches, the PAM-D and the payload are installed atop the boost vehicle's second stage in the same way Delta's earlier third stages and spacecraft have been installed. For Shuttle flights, the payload assist module and its spacecraft will be mounted on a special cradle developed by McDonnell Douglas Astronautics Corp. for installation in the Orbiter cargo bay.

Moments before the payload assist module's launch from low orbit, the spin table is activated to give both module and payload a rotating motion which stabilizes their flight. The spring-loaded separation system releases the vehicle on command, pushing it gently away from the Delta (or out of the cargo bay) before the rocket motor is fired to send the satellite toward its final destination.

McDonnell Douglas developed the payload assist module with private funding, as a commercial venture. The company has received firm orders for both models. Customers to date include NASA, Hughes Aircraft Co.'s Space and Communications Group, the Ford Aerospace and Communications Corp., RCA and Western Union. The first Delta-PAM-D launch was Nov. 15, 1980, with a Satellite Business Systems spacecraft (SBS-1) as the payload. The first Shuttle-PAM missions are scheduled in 1982.

LAUNCH OPERATIONS

NASA's John F. Kennedy Space Center is responsible for the preparation and launch of Delta 156 which will carry SBS-B into orbit.

The first and second stages of the Delta rocket arrived by truck convoy at Cape Canaveral Air Force Station Nov. 13, 1980, and were temporarily stored. The first stage was erected at Complex 17 on June 4, 1981, and the nine Castor IV solid rocket boosters were attached on June 8. The second stage was inserted into the tubelike interstage adapter on June 11.

The SBS-B spacecraft arrived on June 28 and was taken to Building AM for prelaunch checkout of all systems. It was moved to the Delta Spin Test Facility on Aug. 4 and was mated to its apogee kick motor the following day. On Aug. 11, the spacecraft was mated to its Delta payload assist module. Because both the spacecraft and its payload assist module were separately spin tested and balanced by their respective manufacturers, that operation did not have to be repeated in the Delta Spin Test Facility before launch.

On Aug. 12, the spacecraft/payload assist module combination was taken to the pad and mated with the Delta booster and payload fairing.

All launch vehicle and pad operations during the launch countdown are conducted from the blockhouse at Complex 17 by a joint industry-government team.

THE NASA/SBS TEAM

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