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Project NATO III-B

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NASA TO LAUNCH NATO III-B COMMUNICATIONS SATELLITE

The second in a new series of communications satellites to serve the North Atlantic Treaty Organization (NATO) is scheduled for launch by NASA's Kennedy Space Center from Cape Canaveral, Fla., Jan. 27. This will be the first launch by NASA in 1977.

Launch window is 7:50 to 8:28 p.m. EST.

The spacecraft, NATO III-B, will be placed by the Delta launch vehicle in an elliptical transfer orbit with an apogee of 35,785 kilometers (22,235 miles) and a perigee of 185 km (115 mi.). It will be inclined 27 degrees to the equator.

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After NATO III-B is in the transfer orbit, the U.S. Air Force Satellite Control Facility (SCF) network will exercise control on NATO's behalf. Approximately two days later, on about the fifth apogee, SCF operators will correctly aim the spacecraft and fire an onboard solid propellant kick motor to circularize the orbit and change its inclination to be above the equator.

In this circular orbit the satellite will drift until an onboard reaction control system stabilizes it at a predetermined location. After this event the spacecraft will be at an altitude of 35,900 km (22,300 mi.) and traveling at a speed of 11,066 km per hour (6,876 mi. an hour). At this height and velocity its movement becomes "synchronized" with that of the Earth below so that it appears to remain stationary in the sky.

NATO III-B is the second of three NATO Phase III spacecraft designed to replace the NATO II satellites in the NATO Integrated Communications Systems (NICS). The three spacecraft are funded entirely by NATO and were built by Ford Aerospace and Communication Corp. at Palo Alto, Calif. They are launched by NASA from Complex 17 at the Cape Canaveral Air Force Station, Fla., on NASA Delta 2914 launch vehicles.

The U.S. Air Force Space and Missile Systems Organization (SAMSO) serves as the satellite contracting agency on behalf of the NATO Integrated Communications System Management Agency.

The third NATO III is scheduled for launch in 1978. NATO reimburses the United States for the cost of the launch vehicles and launch services.

NASA's Goddard Space Flight Center, Greenbelt, Md., provides the Delta rocket to launch NATO III-B. McDonnell Douglas Astronautics Co., Huntington Beach, Calif., manufactures the Delta. Three previous NATO satellites were launched successfully by Delta. These were NATO II -- A and B -- spacecraft in March 1970 and February 1971 and NATO III-A in April 1976.

(END OF GENERAL RELEASE. BACKGROUND INFORMATION FOLLOWS.)

THE NATO III SPACECRAFT

The NATO III spacecraft is a further development in communications satellites, along the same lines as preceding NATO spacecraft. The cylindrical main body is covered with solar cells for power generation; they produce over 500 watts at maximum. The satellite spins at 90 rpm in operation, so that each solar cell is in sunlight and producing electricity about one-third of the time. A NATO III spacecraft is 3.1 meters (10.1 feet) high, including the antennas on top, and 2.2 m (7.2 ft.) in diameter. It weighs about 701 kilograms (1,543 pounds) at launch, and has a mass of 340 kg (748 lb.) in final orbit, after the burnout of the apogee kick motor.

A NATO III spacecraft is well balanced, and the spinning of the main body acts like a gyroscope, providing stability. The antenna system is de-spun, or counter-rotated, at the same speed, so that the antennas remain pointed at the Earth. NATO III-B has three transponder channels, consisting of one narrow-beam channel, transmitting through the larger central antenna horn, and two wide-beam channels, transmitting and receiving through the two smaller horns.

All active spacecraft communications components are 100 per cent redundant; that is, each active component has a backup part on board. These standby components are cross-strapped, so that each could serve more than one transponder. For example, the two critical 23 watt traveling wave tube assemblies that power the three transponders are backed up by two spares, either of which can be switched to any transponder.

The three antennas are circularly polarized, and operate on the multi-mode principle. The receiving communications system operates in the 8 GHz range, and the two transmitters in the 7 GHz range. The entire communications system is compatible with both U.S. and NATO ground stations.

The NATO III spacecraft are comparatively simple in design and based as much as possible on previously flight-proven concepts and hardware. Existing equipment and techniques were used to the maximum extent practicable. New payload equipment was thoroughly tested. Attitude control, antenna pointing and station-keeping are expected to require ground command corrections less than 18 times per year.

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The NATO III spacecraft antenna horns are fixed in place, and no spacecraft components need to be deployed in orbit. The reaction control system decomposes hydrazine, generating five pounds of thrust in various small nozzles for attitude and velocity control.

The structure of a NATO III spacecraft consists of a central cone and six struts which support a five-centimeter (two-inch) thick aluminum honeycomb horizontal equipment panel located near the center of the main body. The apogee kick motor is mounted inside the cone, with its nozzle at the bottom. The cylindrical framework on which the solar cells are mounted attaches to the equipment panel. Thermal control is primarily passive in nature, except for a few localized heaters. Excess heat is conducted to the covers and dissipated into space.

Four Earth sensors and two Sun sensors enable a NATO III satellite to position itself properly in space. Any two of the four Earth sensors will provide enough data to determine the spacecraft's attitude, and just one will provide enough steering data for antenna pointing.

The Telemetry, Tracking and Command (TT&C) subsystem, as in the case of the three communications channels, has redundant components and cross strap connections. The command units are protected from harm by any potential faults in other subsystems. The NATO III satellite system provides vital transmission links for the NATO Communications System, and significantly improves the effectiveness of free world communications.

DELTA 2914 LAUNCH VEHICLE

The spacecraft will be launched by a 2914 three-stage Delta launch vehicle, which has an overall length of approximately 35 m (116 ft.), and a body diameter of 2.4 m (8 ft.). The Delta launch vehicle has been successful in 93 per cent of its 120 launches during the past 15 years.

First Stage

The first stage is a McDonnell Douglas extended long-tank Thor booster with nine strap-on Thiokol Castor II solid-fuel rocket motors. The booster is powered by a Rocketdyne RS-27 engine using liquid oxygen (LOX) and liquid hydrocarbon propellants.

The main engine is gimbal-mounted to provide pitch and yaw control from liftoff to main engine cutoff (MECO). Two liquid propellant vernier engines provide roll control throughout first stage operation and pitch and yaw control from MECO to separation of the first and second stages.

Second Stage

The second stage is powered by a TRW TR-201 liquid-fuel pressure-fed engine that uses Aerozene 50 fuel and N_2O_4 oxidizer and is gimbal-mounted to provide pitch and yaw control through second stage burn. A nitrogen gas system using eight fixed nozzles provides roll control during powered and coast flight as well as pitch and yaw control during coast and after second-stage cutoff (SECO). Two fixed nozzles, fed by the propellant-tank helium-pressurization system, provide retrothrust after third stage separation.

Third Stage

The third stage is the Thiokol TE-364-4 spin-stabilized solid-propellant motor. The third stage motor is secured in a spin table mounted on the second stage. The firing of eight small propellant rockets fixed to the spin table accomplishes spinup of the third stage assembly.

Injection Into Synchronous Orbit

The Delta vehicle places the spacecraft in an elliptical transfer orbit. The spacecraft apogee motor will be fired at the fifth apogee of the orbit about 48 hours after launch. This maneuver will circularize the orbit at synchronous altitude above the equator. The spacecraft hydrazine attitude control system is used to drift the satellite to its final station. About a month after launch, following checkout of the onboard communications systems, the spacecraft will become operational.

STRAIGHT EIGHT DELTA FACTS AND FIGURES

Height: 35.4 m (116 ft.) including shroud

Maximum diameter: 2.4 m (8 ft.) without attached solids

Liftoff weight: 131,895 kg (293,100 lb.)

Liftoff thrust: 1,765,315 newtons (396,700 lb.) including strap-on solids

First Stage

(Liquid only) consists of an extended long-tank Thor, produced by McDonnell Douglas. The RS-27 engines are produced by the Rocketdyne Division of Rockwell International. The stage has the following characteristics:

Diameter: 2.4 m (8 ft.)

Height: 21.3 m (70 ft.)

Propellants: RJ-1 kerosene as the fuel and liquid oxygen (LOX) as the oxidizer

Thrust: 912,000 N (205,000 lb.)

Burning time: About 3.48 minutes

Weight: About 84,600 kg (186,000 lb.) excluding strap-on solids

Strap-on solids consist of nine solid-propellant rockets produced by the Thiokol Chemical Corp., with the following features:

Diameter: 0.8 m (31 in.)

Height: 7 m (23.6 ft.)

Total weight: 40,300 kg (88,650 lb.) for nine
4,475 kg (9,850 lb.) for each

Thrust: 2,083,000 N (468,000 lb.) for nine
231,400 N (52,000 lb.) for each

Burning time: 38 seconds

Second Stage

Produced by McDonnell Douglas Astronautics Co., using a TRW TR-201 rocket engine; major contractors for the vehicle inertial guidance system located on the second stage are Hamilton Standard, Teledyne and Delco.

Propellants: Liquid, consists of Aerozene 50 for the fuel and Nitrogen Tetroxide (N_2O_4) for the oxidizer.

Diameter: 1.5 m (5 ft.) plus 2.4 m (8 ft.) attached ring

Height: 6.4 m (21 ft.)

Weight: 6,118 kg (13,596 lb.)

Thrust: About 42,943 N (9,650 lb.)

Total burning time: 335 seconds

Third Stage

Thiokol Chemical Co. TE-364-4 motor.

Propellant: Solid

Height: 1.4 m (4.5 ft.)

Diameter: 1 m (3 ft.)

Weight: 1,152 kg (2,560 lb.)

Thrust: 61,855 N (13,900 lb.)

Burning time: 44 seconds

LAUNCH OPERATIONS

The Kennedy Space Center's Expendable Vehicles Directorate prepares and launches the thrust-augmented Delta rocket carrying NATO III-B.

Delta first stage and interstage were erected on Pad B on Nov. 3. The nine strap-on rocket motors were mounted in place around the base of the first stage on Nov. 4 and 5 and the second stage was erected on Nov. 8.

The NATO III-B spacecraft was received Dec. 15, checked out and mated with the Delta third stage. The third stage spacecraft assembly is to be mated with Delta on Jan. 20, and the payload fairing which will protect the spacecraft during its flight through the atmosphere is to be erected atop the vehicle on Jan. 25.

NATO III-B SEQUENCE OF EVENTS

Event	Time	Altitude Kilometers	Altitude Miles	Velocity Km/hr	Velocity Mph
Liftoff	0 sec	0	0	0	0
Six solid motor burnout	38 sec	5.9	3.7	1,398	869
Three solid motor ignition	39 sec	6.2	3.8	1,392	865
Three solid motor burnout	1 min 17 sec	21.4	13.3	2,949	1,832
Nine solid motor jettison	1 min 27 sec	25.9	16	3,239	2,012
Main engine cutoff (MECO)	3 min 44 sec	92.6	57.5	17,928	11,140
First/second stage separation	3 min 53 sec	98.4	61.2	17,953	11,155
Second stage ignition	3 min 58 sec	102	63	17,928	11,140
Fairing jettison	4 min 39 sec	125.4	78	18,621	11,571
Second stage first cutoff (SECO-1)	8 min 53 sec	160	100	26,752	16,623
Second stage restart	24 min 22 sec	178	110	26,677	16,576
Second stage second cutoff (SECO-2)	24 min 32 sec	178	111	27,166	16,880

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Event	Time	Altitude Kilometers	Altitude Miles	Velocity Km/hr	Velocity Mph
Third stage spin up	25 min 22 sec	181	112	27,155	16,874
Second/third stage separation	25 min 24 sec	181	112	27,155	16,874
Third stage ignition	26 min 6 sec	183	114	27,143	16,866
Third stage burnout	26 min 49 sec	188	117	35,383	21,985
Third stage/spacecraft separation	28 min 2 sec	219	136	35,276	21,920
Transfer orbit apogee	5 hours 42 min	35,796	22,237	6,487	4,031

DELTA MANAGEMENT

The Expendable Launch Vehicles Program Office in the Office of Space Flight at NASA Headquarters is responsible for program management of the Delta program. The Delta Project Office, Project Directorate at Goddard Space Flight Center is responsible for overall technical direction and management of the Delta Project.

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CONTRACTORS

Aeronutronic-Ford Corp. Palo Alto, Calif.	Spacecraft
McDonnell Douglas Astronautics Co. Huntington Beach, Calif.	Delta Launch Vehicle

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