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NASA TO LAUNCH JAPANESE COMMUNICATIONS SATELLITE

A Japanese medium capacity communications satellite is being readied for launch by NASA no earlier than Dec. 14 from the Kennedy Space Center, Fla. It is one of the largest spacecraft ever to be launched by the Delta 2914 vehicle. Called CS (Communications Satellite for experimental purposes) its mission is to relay communications and television signals between the Japanese Islands.

CS is more than 351 centimeters (138 inches) and is 218 cm (86 in.) in diameter. The satellite weighs approximately 676 kilograms (1,490 pounds) at lift-off and 340 kg (748 lbs.) at the time of injection into geosynchronous orbit.

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The satellite carries its own apogee kick motor which is used to circularize the highly elliptical transfer orbit provided by the Delta booster. The final station at 135 degrees E. longitude will be achieved using the onboard monopropellant (hydrazine) reaction control system.

CS is a spin stabilized satellite with a mechanical despin motor used to despin only the communications reflector which is specially shaped to provide coverage of the Japanese Islands effectively. The satellite is equipped with 6 K-Band and 2 C-Band communications transponders for relay of communication and television signals. The satellite is primarily powered by solar cells which cover the cylindrical main body and augmented by a battery for eclipse mode operation. The solar array provides more than 500 watts of electrical power absorbed from the Sun's energy by over 20,000 solar cells.

The satellite is equipped with Earth sensors which are used as a reference for maintaining pointing of the communications antenna. The main body of the satellite spins at 90 r.p.m. and acts as a gyroscope to provide satellite stability. Thrusters, using monopropellant hydrazine provide attitude and station keeping capability. The satellite is designed for an estimated operating life in excess of three years.

The satellite will be used for telephone and television distribution service and will be the first to operate in the 30/20 GHz (K-Band). Experiments will be conducted in this band to determine its suitability for operational communications systems.

The Delta launch vehicle is managed for NASA's Office of Space Flight by the Goddard Space Flight Center, Greenbelt, Md. The Expendable Launch Vehicles Division NASA's Kennedy Space Center, Fla., is responsible for management of launch operations. The CS is a communications satellite program of the National Space Development Agency of Japan (NASDA). NASDA is responsible for the satellite's procurement, launch and initial checkout.

The CS has been designed, developed and manufactured by Mitsubishi Electric Corp. (MELCO) and Ford Aerospace and Communications Corp. The satellite will be used by the Ministry of Post and Telecommunications (MOPT) and by NASDA for experimental uses.

Prime contractor for the Delta launch vehicle is McDonnell Douglas Astronautics Co., Huntington Beach, Calif.

The U.S. is reimbursed by the Japanese Government for costs associated with providing Delta launch support.

(END OF GENERAL RELEASE: BACKGROUND INFORMATION FOLLOWS)

PROGRAM MISSION

The mission of the CS spacecraft is to provide C-Band (3.7 to 6.5 GHz) and K-Band (17.2 to 31.0 GHz) communications coverage of the Japanese Islands with both telephone and color television transmissions. In addition, experimental operations will be conducted utilizing the CS to relay communications between the remote and main islands from fixed and mobile ground stations.

The experimental phase will explore high-speed digital transmission characteristics and establish satellite control techniques to include signal quality and propagation measurements, together with tests of ground operational switching of modulation and access and of the temporary establishment of emergency links.

Telemetry, tracking and command (TT&C) functions will be accomplished during ascent and station carrier acquisition phases by a unified S-Band (USB), 2.3 GHz nominal, that is compatible with the NASA ground station Spaceflight Tracking and Data Network (STDN). TT&C operations will be transferred to the C-Band links with the Japanese ground stations after the satellite is in orbit.

The mission has four distinct phases:

- Launch Trajectory. The CS will be launched from ETR on the Thor/Delta 2914 with the main engine, and first stage two burn placing the satellite into a low altitude parking orbit. After the second burn of stage two, the satellite and third stage are spun up, then separated from stage two and ignited to provide the final velocity increment for transfer orbit injection. The launch time and the trajectory are determined by the amount of node rotation needed, which, in turn, is specified by launch window requirements.

- Transfer Orbit. Transfer orbit begins at separation from the Thor-Delta third stage and ends at the apogee kick motor (AKM) burn. Apogee radius and AKM burn point are determined by the requirement to achieve the desired drift orbit and minimize use of reaction control equipment (RCE) fuel. The AKM burn point is determined by the amount of node rotation needed.

- Drift Orbit. This phase starts after AKM burn and ends when the satellite is on station. Several orbit shaping maneuvers (velocity changes) are used to achieve a circular synchronous orbit at a specified longitude.

- Final Orbit. Station keeping will be performed in final orbit to cause the spacecraft to stay within plus or minus 0.1 degrees of the planned longitude of 135 degrees E. The initial orbit inclination will be zero plus or minus 0.1 degree.

CS EXPERIMENTS

- Satellite communications
  - Communication system
  - Transmission quality
  - Terrestrial microwave link interference
  - Rainfall attenuation

- Operations technology
  - Multiple access and switching technique
  - Emergency link operations
  - Remote island link operations

- Tracking and control technology
  - Antenna pointing and control
  - Tracking
  - Synchronous orbit control
  - Housekeeping command and telemetry
  - Transponder switching technology
  - Data processing

SPACECRAFT PERFORMANCE PARAMETERS

Satellite Location	135 degrees E. longitude
Station Keeping	±0.1 degrees N/S and ±0.1 degrees E/W
Antenna Pointing Accuracy	±0.3 degrees
System Life	Three Years
Launch Vehicle	Delta 2914
Command and Control	S-Band and C-Band from control stations in Japan

DELTA LAUNCH VEHICLE

First Stage

The first stage is a McDonnell Douglas modified Thor booster incorporating nine Castor II strap-on Thiokol solid fuel rocket motors. The booster is powered by a Rocketdyne engine using liquid oxygen and liquid hydrocarbon propellants. The main engine is gimbal-mounted to provide pitch and yaw control from liftoff to main engine cutoff (MECO).

Second Stage

The second stage is powered by a TRW liquid-fuel, pressure-fed engine that also is gimbal-mounted to provide pitch and yaw control through the second stage burn. A nitrogen gas system uses eight fixed nozzles for roll control during powered and coast flight, as well as pitch and yaw control during coast and after second stage cutoffs. Two fixed nozzles fed by the propellant tank, helium pressurization system, provide retrothrust after third stage separation. Fifty-four minutes after spacecraft separation, the second stage will be reignited for a 12-second burn. Data on this burn will be collected for studies related to future Delta missions.

Third Stage

The third stage is the TE-3 64-4 spin-stabilized, solid propellant Thiokol motor. It is secured in the spin table mounted to the second stage. The firing of eight solid propellant rockets fixed to the spin table accomplishes spinup of the third stage spacecraft assembly.

Injection Into Synchronous Orbit

The Delta vehicle will inject CS into a transfer orbit having an apogee of 35,934 km (22,328 mi.), a perigee of 167 km (104 mi.) and inclination of 28.7 degrees. NASA's Spaceflight Tracking and Data Network will provide telemetry, tracking and ranging support until the spacecraft is placed in its final synchronous orbit at 135 degrees E. longitude. Command, control, tracking and data analysis are the responsibilities of NASDA and Ford Aerospace and Communications Corp.

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 TMX-354-5/Castor II solid propellant rockets produced by the Thiokol Chemical Corp. with the following features:

Diameter: 0.8 m (31 in.)

Height: 7 m (23.5 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 Corp. 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 plays a key role in the preparation and launch of the thrust-augmented Delta rocket carrying CS.

Delta 137 will be launched from Pad B, southernmost of the two launch pads at Complex 17, Cape Canaveral Air Force Station, Fla.

The Delta first stage and interstage were erected on Pad B Oct. 28. The nine solid strap-on rocket motors were mounted in place around the base of the first stage Oct. 31. The second stage was erected Nov. 2.

The CS spacecraft was received by Kennedy Center Oct. 14 and underwent initial processing in Building AO. Later it was moved to Explosive Safe Area 60 and mated with the Delta third stage Nov. 29. The third stage/spacecraft assembly was moved to Pad B and mated with Delta 137 Dec. 1. The payload fairing, to protect the spacecraft on its flight through the atmosphere, is to be put in place Dec. 6.

TYPICAL LAUNCH SEQUENCE FOR CS/DELTA 137

Event	Time	Altitude Kilometers/Miles		Velocity Km/Hr	Mph
Liftoff	0 sec.	0	0	0	0
Six Solid Motor Burnout	38 sec.	6	4	1,395	867
Three Solid Motor Ignition	39 sec.	6	4	1,389	863
Three Solid Motor Burnout	1 min. 17 sec.	21	13	2,933	1,825
Nine Solid Motor Jettison	1 min. 27 sec.	26	16	3,220	2,001
Main Engine Cutoff (MECO)	3 min. 45 sec.	93	58	17,894	11,119
First/Second Stage Separation	3 min. 53 sec.	99	62	17,918	11,134
Second Stage Ignition	3 min. 59 sec.	102	63	17,893	11,119
Fairing Jettison	4 min. 37 sec.	126	78	18,527	11,513
Second Stage Cutoff (SECO-1)	8 min. 53 sec.	167	104	26,619	16,541
Restart Second Stage	21 min. 6 sec.	166	103	26,625	16,545
Second Stage Cutoff (SECO-2)	21 min. 15 sec.	166	103	27,017	16,788
Third Stage Spinup	22 min. 13 sec.	166	103	27,035	16,800
Second/Third Stage Separation	22 min. 15 sec.	166	103	27,035	16,800
Third Stage Ignition	22 min. 57 sec.	166	103	27,032	16,798
Third Stage Burnout	23 min. 41 sec.	169	105	35,473	22,043
Third Stage/Spacecraft Separation	24 min. 44 sec.	194	121	35,390	21,991

DELTA 137/CS TEAM

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Joseph B. Mahon	Director, Expendable Launch Vehicle Programs
Peter T. Eaton	Manager, Delta Program

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Robert E. Smylie	Deputy Director
Robert Lindley	Director of Projects
Robert Baumann	Associate Director Space Transportation Systems
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Robert Goss	Chief, Mission Analysis and Integration Branch, Delta Project Office -- NASA Manager for CS
Philip B. Frustace	Delta Mission Integration Manager
Edward Lowe	Network Support Manager
John Walker	Network Operations Manager

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CONTRACTORS

McDonnell Douglas Astronautics Co. Huntington Beach, Calif.	Delta launch vehicle
Mitsubishi International Corp. Tokyo, Japan	Spacecraft
Ford Aerospace and Communications Corp. Palo Alto, Calif.	Spacecraft

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