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Centre for Space Science & Technology Education in Asia and the Pacific (CSSTEAP)
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..... on a mission of capacity building, under the initiative of the United Nations, for Asia and the Pacific Region in Space Science and Technology, through Excellence in Education, Training, and Research.

GSLV-D5 AND GSAT-14 LAUNCHED

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GSLV-D5 with Indigenous Cryogenic Stage was successfully launched from the Second Launch Pad (SLP) at Satish Dhawan Space Centre SHAR, Sriharikota on January 05, 2014. GSLV-D5 is the eighth flight of India's Geosynchronous Satellite Launch Vehicle (GSLV). It is also the fourth developmental flight of GSLV. In this successful flight of GSLV-D5, a communication satellite - GSAT-14 was launched very precisely to its intended Geosynchronous Transfer Orbit.

After a smooth countdown of 29 hours, GSLV-D5 lifted off at 1618 hours IST at the opening of the launch window. All the important flight phases, namely, the core stage and strap-on stage propulsion, payload fairing separation, second stage propulsion, cryogenic stage propulsion and spacecraft separation, were executed as planned. After a flight of 17 minutes 5 seconds, GSAT-14 satellite was precisely injected into a Geosynchronous Transfer Orbit with a Perigee (nearest point to Earth) of 175 km and an Apogee (farthest point to Earth) of 35,945 km with an orbital inclination of 19.3 degree with respect to the equator. Immediately after the injection, ISRO's Master Control Facility at Hassan took over the control and commanding of GSAT-14. The solar panels of the satellite were deployed as planned, the satellite health was found normal and the satellite was oriented towards the Sun.

GSLV-D5 Stages at a glance

Parameters	First Stage		Second Stage	Third Stage
	Strap-Ons 4 L40 H	Core Stage S139		
Length (m)	19.7	20.1	11.6	8.7
Diameter (m)	2.1	2.8	2.8	2.8
Propellants	UH25 & N_2O_4	HTPB	UH25 & N_2O_4	LH_2 & LOX
Propellant mass (T)	4 X 42.6	138.2	39.5	12.8
Max. Thrust (kN)	680	4800	720	75
Duration (sec)	148	100	150	720

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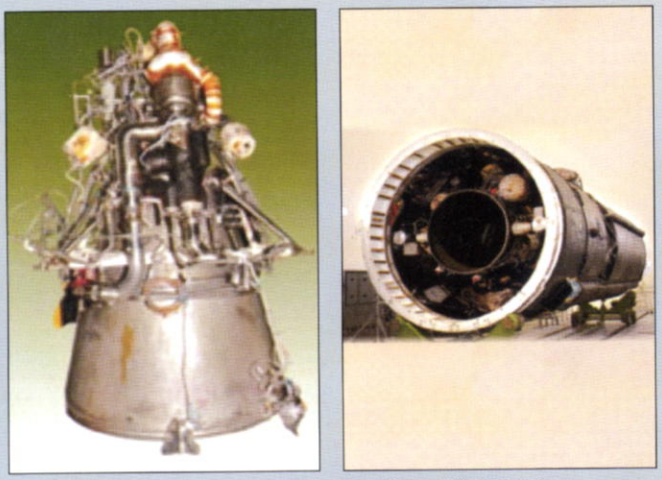
Wishing all the readers a Very Happy & Prosperous 2014



Indigenous Cryogenic Upper Stage of GSLV-D5

Two halves of GSLV-D5 payload fairing surrounding GSAT-14 satellite

The vehicle had three stages with an overall height of 49.13m; lift-off mass of 414.75 Ton and lift-off thrust 6773kN. It is configured with its first and second stages similar to the ones flown during earlier GSLV missions. The metallic payload fairing with a diameter of 3.4 m is adopted for this vehicle. S-band telemetry and C-band transponders enable GSLV-D5 performance monitoring, tracking, range safety/flight safety and Preliminary Orbit Determination (POD).

The third stage is the indigenous cryogenic rocket stage which is more efficient and provides more thrust for every kilogram of propellant it burns compared to solid and earth-storable liquid propellant rocket stages. Specific impulse (a measure of the efficiency) achievable with cryogenic propellants (liquid Hydrogen and liquid Oxygen) is much higher compared to earth storable liquid and solid propellants, giving it a substantial payload advantage. However, cryogenic stage is technically a very complex system compared to solid or earth-storable liquid propellant stages due to its use of propellants at extremely low temperatures and the associated thermal and structural problems. Oxygen liquifies at -183 deg C and Hydrogen at -253 deg C. The propellants, at these low temperatures are to be pumped using turbo pumps running at around 40,000 rpm. It also entails complex ground support systems like propellant storage and filling systems, cryo engine and stage test facilities, transportation and handling of cryo fluids and related safety aspects. ISRO's Cryogenic Upper Stage Project (CUSP) envisaged the design and development of the indigenous Cryogenic Upper Stage to replace the stage procured from Russia and used in GSLV flights. The main engine and two smaller steering engines of CUS together develop a nominal thrust of 73.55 kN in vacuum. During the flight, CUS fires for a nominal duration of 720 seconds. Liquid Oxygen (LOX) and Liquid Hydrogen (LH_2) from the respective tanks are fed by individual booster pumps to the main turbopump to ensure a high flow rate of propellants into the combustion chamber. Two gimbaled steering engines provide for control of the stage during its thrusting phase.

GSAT-14 Launched on 05.01.2014 is the 23rd geostationary communication satellite of India built by ISRO. The main objectives of GSAT-14 mission are to augment the In-orbit capacity of Extended C and Ku-band transponders & to provide a platform for new experiments. The payloads of GSAT-14 are:

- Six extended C-band transponders for Indian mainland and island coverage with 36 dBW Edge Of Coverage-Effective Isotropic Radiated Power (EOC-EIRP).
- Six Ku-band transponders covering the mainland India with 51.5 dBW EOC-EIRP
- Two Ka-band Beacons operating at 20.2 GHz and 30.5 GHz to carry out attenuation studies

Some of the new technologies being tested on GSAT-14 are:

- Fiber Optic Gyro
- Active Pixel Sun Sensor
- Ka band beacon propagation studies
- Thermal control coating experiments