

GSLV-D6/GSAT-6



Indian Space Research Organisation



GSLV-D6 is the ninth flight of India's Geosynchronous Satellite Launch Vehicle (GSLV). It is also the fifth developmental flight of GSLV. This is the third time the indigenously developed Cryogenic Upper Stage (CUS) is being carried on-board during a GSLV flight. GSLV-D6 flight is significant since it intends to continue the testing of CUS. GSLV is designed to inject 2 ton class of communication satellites into Geosynchronous Transfer Orbit (GTO).

GSLV-D6 will be launched from the Second Launch Pad at Satish Dhawan Space Centre SHAR (SDSC SHAR), Sriharikota.

GSLV-D6 will launch 2117 kg GSAT-6, an advanced communication satellite, into a GTO. GSAT-6 will provide S-band communication services in the country. After reaching GTO, GSAT-6 will use its own propulsion system to reach its final geostationary orbital home and will be stationed at 83° East longitude.

GSLV-D6 vehicle is configured with all its three stages including the CUS similar to the ones successfully flown during the previous GSLV-D5 mission in January 2014. GSLV-D5 successfully placed GSAT-14 satellite carried on-board in the intended GTO very accurately.

Targeted GTO of GSLV-D6

Perigee	170 km
Apogee	35975 km
Inclination	19.95 deg

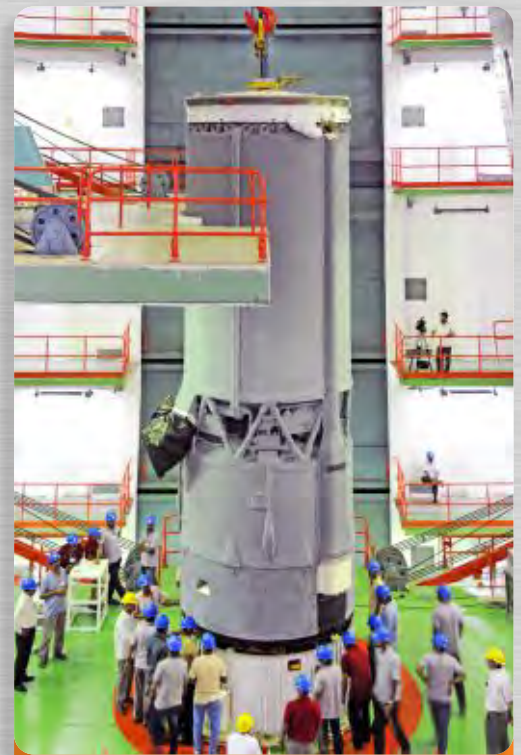
The metallic payload fairing of GSLV-D6 has a diameter of 3.4 m. The overall length of GSLV-D6 is 49.1 m with a lift-off mass of 416 t.

The Cryogenic Upper Stage (CUS) being flown in GSLV-D6 is designated as CUS-06. A Cryogenic rocket stage is more efficient and provides more thrust for every kilogram of propellant it burns compared to solid and earth-storable liquid propellant rocket stages.

The 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 challenges. Oxygen liquefies 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.

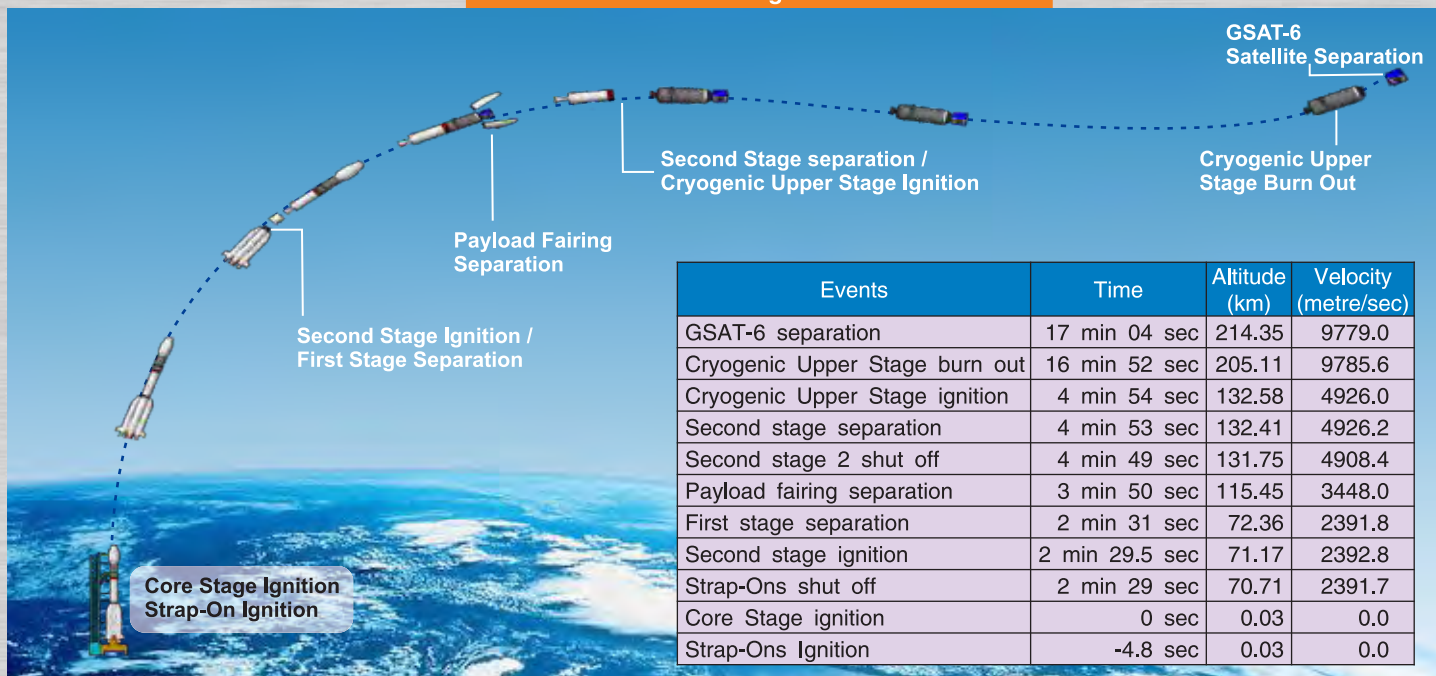
The main engine and two smaller steering engines of CUS together develop a nominal thrust of 73.55 kN in vacuum. During the flight, CUS fires for a nominal duration of 720 seconds.

S-band telemetry and C-band transponders enable GSLV-D6 performance monitoring, tracking, range safety/flight safety and Preliminary Orbit Determination (POD).



Integration of the Cryogenic Upper Stage at Vehicle Assembly Building, SDSC SHAR, Sriharikota

GSLV-D6 Flight Profile



GSLV-D6 at a Glance

Parameters	Stages			
	FIRST STAGE		SECOND STAGE	THIRD STAGE
	Strap-Ons	Core Stage		
	(4 L40 H)	(S139)		
Length (m)	19.7	20.1	11.6	8.7
Diameter (m)	2.1	2.8	2.8	2.8
Propellants	UH25 & N ₂ O ₄	HTPB	UH25 & N ₂ O ₄	LH ₂ & LOX
Propellant mass (T)	4 x 42.6	138.1	39.5	12.8
Max. Thrust (kN)	759.3	4815	799	73.55
Duration (sec)	148.9	106	150	720

HTPB: Hydroxyl Terminated Poly Butadiene, LH₂: Liquid Hydrogen, LOX: Liquid Oxygen
 N₂O₄: Nitrogen Tetroxide, UH25: Unsymmetrical Dimethyl Hydrazine + 25% Hydrazine Hydrate

GSAT-6

GSAT-6 is the twenty fifth geostationary communication satellite of India built by ISRO and twelfth in the GSAT series. Five of GSAT-6's predecessors were launched by GSLV during 2001, 2003, 2004, 2007 and 2014 respectively. After its commissioning, GSAT-6 will join the group of India's other operational geostationary satellites.

GSAT-6 satellite provides communication through five spot beams in S-band and a national beam in C-band for strategic users.

The cuboid shaped GSAT-6 has a lift-off mass of 2117 kg. Of this, propellants weigh 1132 kg and the dry mass of the satellite is 985 kg.

One of the advanced features of GSAT-6 satellite is its S-Band Unfurlable Antenna of 6 m diameter. This is the largest satellite antenna realised by ISRO. This antenna is utilised for five spot beams over the Indian main land. The spot beams exploit the frequency reuse scheme to increase frequency spectrum utilisation efficiency. The other advanced feature of the satellite is the 70 V bus, which is flying first time in an Indian communication satellite.

GSAT-6 at a glance

Physical Properties	Lift off Mass : 2117 kg Main Structure : I-2K Overall size(m) : 2.1 x 2.5 x 4.1
Power	Generated power 3100 W
AOCS	Momentum biased 3-axis stabilised
Propulsion System	Bi propellant – MMH and MON-3
Antennas	One 0.8 m (fixed) and one 6 m unfurlable antenna (transmit and receive)
Communication payloads	<ul style="list-style-type: none"> S-band payload with five spot beams covering India for user links C-band payload with one beam covering India for hub links <p>S-band payload uses 6 m unfurlable antenna and C-band uses 0.8 m antenna.</p>
Mission life	9 years



GSAT-6 in clean room before its launch

After its injection into GTO by GSLV-D6, ISRO's Master Control Facility (MCF) at Hassan takes control of GSAT-6 and performs the initial orbit raising manoeuvres by repeatedly firing the Liquid Apogee Motor (LAM) on-board the satellite, finally placing it in the circular Geostationary Orbit. After this, deployment of the antenna and three axis stabilisation of the satellite will be performed. GSAT-6 will be positioned at 83 deg East longitude.

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