GSLV MkIII-D1/GSAT-19 MISSION

GSLV MkIII-D1/GSAT-19 Mission

GSLV MkIII-D1 at Second Launch Pad

The Mission

GSLV MkIII-D1/GSAT-19 Mission is the first developmental flight of GSLV MkIII, a heavy lift launch vehicle, capable of lofting payloads up to 4,000 kg into Geosynchronous Transfer Orbit (GTO) and 10,000 kg into Low Earth Orbit (LEO).

GSAT-19, a high throughput communication satellite is identified as the payload in this mission. This will be the heaviest satellite being launched from India till date.

Launch of GSLV MkIII-D1 is planned from the Second Launch Pad at Satish Dhawan Space Centre, Sriharikota.

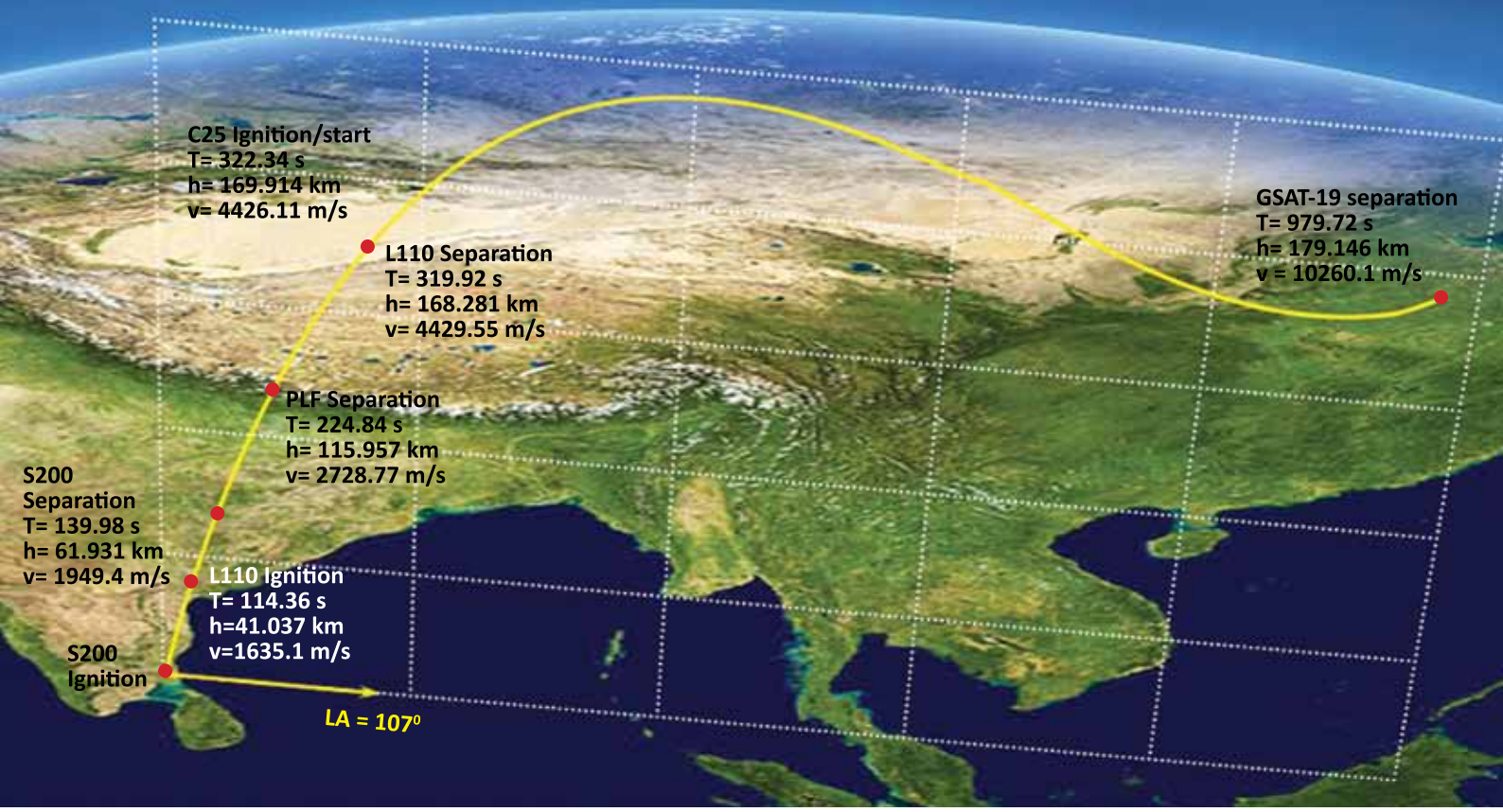
Mission Specifications

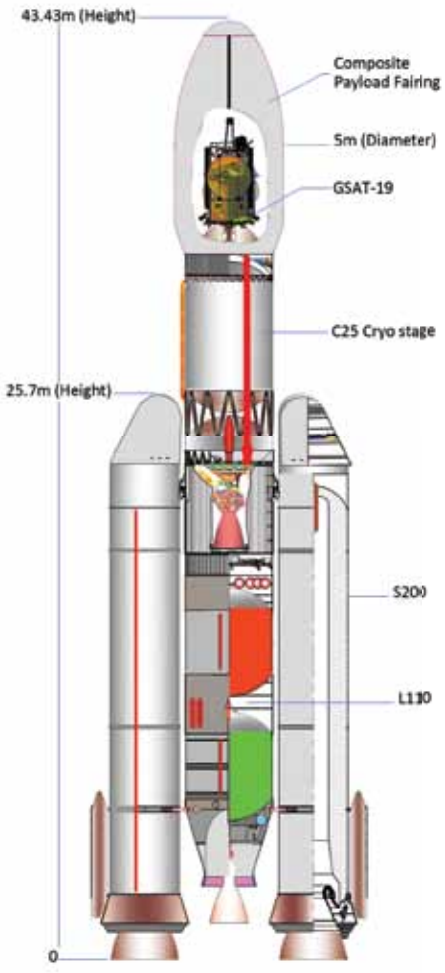
Orbit	**GTO**
Perigee	**170 km**
Apogee	**35975 km**
Inclination	**21.5 degree**
Payload Mass	**3136 kg**

GSLV MkIII-D1 Stage Characteristics

Parameters	Stages		
	Two S 200	L110	C25
Length (m)	26.2	21.39	13.545
Diameter (m)	3.2	4	4
Propellants	Composite solid	Hypergolic liquid	Cryogenic
Propellant Mass (t)	2 x 205	116	28
Stage Mass at Lift-off (t)	472	125	33

GSLV MkIII-D1 Flight Profile





GSLV MkIII-D1 Details

GSLV MkIII-D1 Flight Events

Events	Time		Altitude (km)	Initial Velocity (m/s)
	Min.	s		
GSAT-19 Separation	16	20	179.146	10260.10
C25 Cryo Stage Shutoff	16	05	174.619	10233.27
C25 Cryo Stage Ignition	5	22	169.914	4426.11
L110 Core Stage Separation	5	20	168.281	4429.55
L110 Core Stage Shutoff	5	17	166.361	4397.47
Payload Fairing Separation	3	45	115.957	2728.77
S200 Strap-ons Separation	2	20	61.931	1949.4
L110 Core Stage Ignition	1	54	41.037	1635.1
S200 Strap-ons Ignition	0	0	0.024	451.9

GSLV MkIII-D1/GSAT-19 Mission

S200 strap-ons on Mobile Launch Pedestal

GSLV MkIII Vehicle

GSLV MkIII, a three stage vehicle has been designed for catering the need of carrying heavier communication satellite into Geosynchronous Transfer Orbit (GTO). The Vehicle has two solid strap-on motors S200, a core liquid booster L110 and a cryogenic upper stage C25. The strap-on motors are located on either side of the L110 core liquid booster. To accommodate the heavier payloads, 5m dia. "Ogive PayLoad Fairing" (OPLF) is employed. The ignition of both solid strap-on motors results in vehicle lift-off from launch pad. L110 core liquid stage will ignite during S200 thrusting phase itself, at 114s after lift-off to augment the thrust of the vehicle and continue to function beyond the separation of solid strap-ons which occurs at 140s from lift-off.

Hoisting of L110 during vehicle integration

S200 strap-ons integrated with Core L110 liquid Stage

GSLV MkIII-D1/GSAT-19 Mission

C25 Cryogenic Stage with 20 tonne thrust Cryogenic engine at stage Preparation Facility

The C25 cryogenic stage carries about 28 tons of cryogenic propellants stored on-board at very low temperatures. It is integrated on top of the L110 core liquid stage. The ignition of C25 stage takes place 2 s after the separation of the L110 stage about 322 s after lift-off. The functioning duration of C25 is 643 s and this will facilitate the GSAT-19 carried on-board to reach the intended GTO.

All the three propulsion elements of GSLV MkIII – the solid S200 stages, the liquid L110 core stage carrying hypergolic liquid propellants and C25 cryogenic upper stage – are new developments. Besides these systems, the other advanced systems that constitute GSLV MkIII include Navigation, Guidance and Control system and stage separation systems. The vehicle performance and its flight status are closely monitored by S-band telemetry and C-band transponder respectively.

Integration of C25 stage in progress at Vehicle Assembly Building

GSLV MkIII – THE HERITAGE

GSLV MkIII is the next version to the presently operational launch vehicles PSLV & GSLV MkII.

Satellite Launch Vehicle-3 (SLV-3) was the first launch vehicle developed indigenously by India. It was a four stage vehicle and all the stages used solid propellants. The successful launch of Rohini RS-1 satellite by SLV-3 on July 18, 1980 enabled India to join the select club of six countries – United States, former USSR, France, Japan, China and Britain – with the capability to launch satellites on their own.

SLV-3 was followed by the Augmented Satellite Launch Vehicle (ASLV), which facilitated the development and testing of various advanced technologies essential for large launch vehicles. All the four stages of ASLV as well as its two strap-ons used solid propellants.

Polar Satellite Launch Vehicle (PSLV) is the third generation launch vehicle of India. It is the first Indian launch vehicle to be equipped with liquid stages. The first and third stages as well as the strap-ons of PSLV are solid whereas its second and fourth stages are liquid. After its first successful launch in October 1994, PSLV emerged as the reliable and versatile workhorse launch vehicle of India with 38 consecutively successful missions by February 2017. During 1994-2017 period, the vehicle has launched 46 Indian satellites and 180 satellites for customers from abroad.

Besides, the vehicle successfully launched two spacecraft – Chandrayaan-1 in 2008 and Mars Orbiter Spacecraft in 2013 – that later travelled to Moon and Mars respectively.

Geosynchronous Satellite Launch Vehicle Mark II (GSLV MkII) is the largest launch vehicle developed by India which is currently in operation. This fourth generation launch vehicle is a three stage vehicle with four liquid strap-ons. The indigenously developed Cryogenic Upper Stage (CUS), which is flight proven, forms the third stage of GSLV MkII. From January 2014, the vehicle has achieved four consecutive successes.

The design and development of GSLV MkIII is based on ISRO's rich experience in handling solid, liquid and cryogenic rocket propulsion technologies. The S200 strap-on motor of GSLV MkIII is an uprated version of S139 solid core motor of PSLV and GSLV MkII. Similarly, the L110 core liquid booster of the vehicle consists of two clustered Vikas engines used in PSLV and GSLV MkII. The first suborbital test flight of GSLV MkIII was successfully conducted on December 18, 2014.

SLV-3

Height : 22.7m
Lift-off weight : 17 t
Propulsion : All Solid
Payload mass : 40 kg
Orbit : Low Earth Orbit

ASLV

Height : 23.5m
Lift-off weight : 39 t
Propulsion : All Solid
Payload mass : 150 kg
Orbit : Low Earth Orbit

PSLV-XL

Height : 44m
Lift-off weight : 320 t
Propulsion : Solid & Liquid
Payload mass : 1860 kg
Orbit : 475 km Sun Synchronous Polar Orbit (1300 kg in Geosynchronous Transfer Orbit)

GSLV MkII

Height : 49m
Lift-off weight : 414 t
Propulsion : Solid, Liquid & Cryogenic
Payload mass : 2200 kg
Orbit : Geosynchronous Transfer Orbit

GSLV MkIII

Height : 43.43 m
Lift-off weight : 640 t
Propulsion : Solid, Liquid & Cryogenic
Payload mass : 4000 kg
Orbit : Geosynchronous Transfer Orbit

GSLV MkIII-D1/GSAT-19 Mission

GSAT-19

GSAT-19 is a Geostationary Communication satellite of India, configured around the ISRO's standard I-3K bus. With a lift-off mass of 3136 kg, the main structure of the satellite is cuboid in shape built around a CFRP central cylinder.

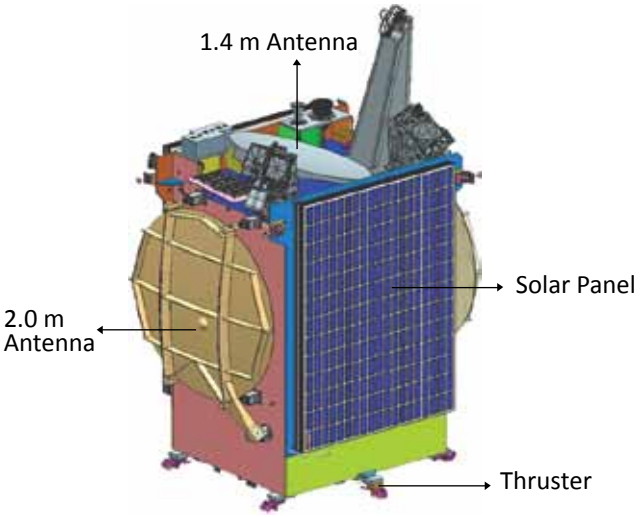
GSAT-19 in clean room

The two solar arrays of GSAT-19 consisting of Ultra Triple Junction solar cells generate about 4500 Watts of electrical power. Sun, Earth and Star sensors as well as gyroscopes provide orientation reference for the satellite. The Attitude and Orbit Control System (AOCS) of GSAT-19 maintains the satellite's orientation with the help of momentum wheels, magnetic torquers and thrusters. The satellite's propulsion system consists of a Liquid Apogee Motor (LAM) and chemical thrusters using liquid propellants for initial orbit raising and station keeping.

GSAT-19 carries Ka/Ku-band high throughput communication transponders. Besides, it carries a Geostationary Radiation Spectrometer (GRASP) payload to monitor and study the nature of charged particles and the influence of space radiation on satellites and their electronic components.

GSAT-19 also features certain advanced spacecraft technologies including miniaturised heat pipe, fibre optic gyro, Micro Electro-Mechanical Systems (MEMS) accelerometer, Ku-band TTC transponder, as well an indigenous Lithium-ion Battery.

After its separation from the GSLV MkIII in GTO, GSAT-19 will use its own propulsion system to reach its geostationary orbital home.



GSAT-19 with solar panel and antennas in folded position

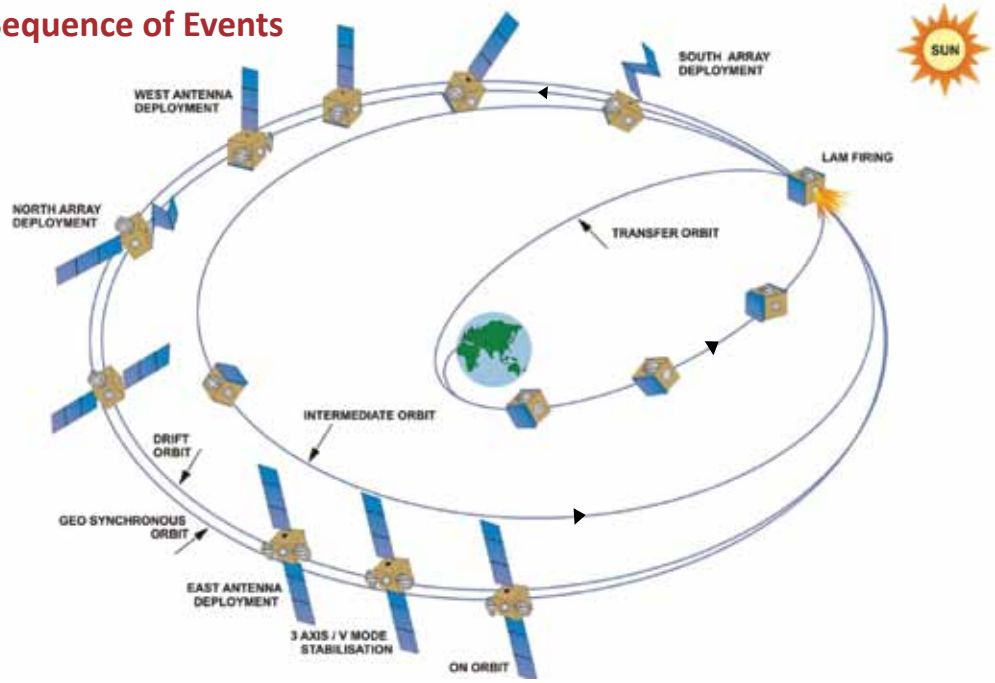
GSAT-19

Salient Features

Orbit	Geostationary
Mass	Dry Mass : 1394 kg Lift-Off Mass : 3136 kg
Physical Dimensions	2.0 m x 1.77 m x 3.1 m
Power Generation	Solar array generating 4500 Watts, one 100 Ah Lithium Ion Battery
Antennas	1.4 m reflector on Earth viewing face Two 2.0 m deployable reflectors
Propulsion System	440 N Liquid Apogee Motor Eight 10 N and eight 22 N Chemical thrusters
Satellite Control	Three axis stabilised Orientation reference from Sun, Earth and Star Sensors and Gyros Orbit and orientation control through Momentum Wheels, Magnetic Torquers and Chemical thrusters
Payload	Ka/Ku-band high throughput Transponders Geostationary Radiation Spectrometer (GRASP)
Mission Life	10 years

GSAT-19 Mission Profile

Sequence of Events



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