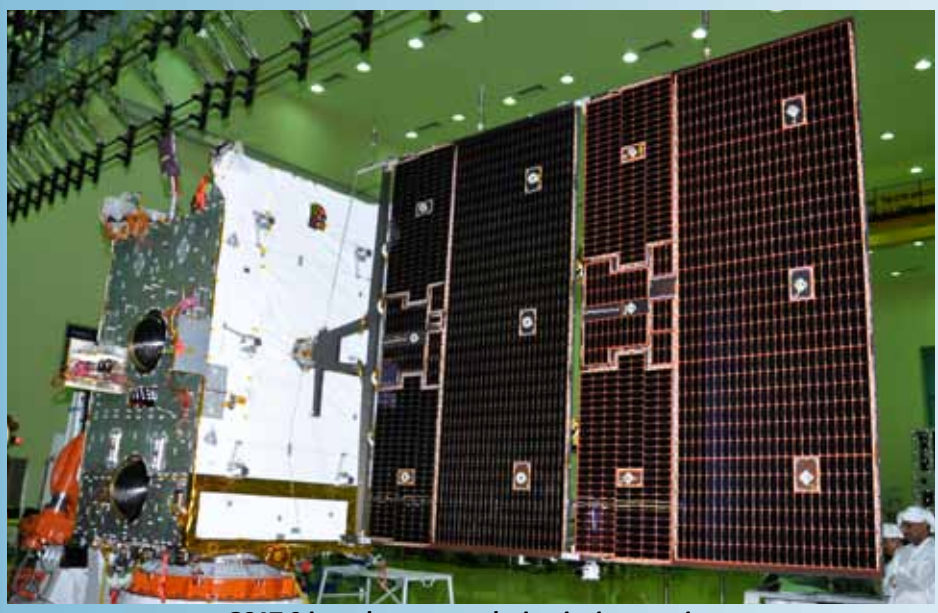
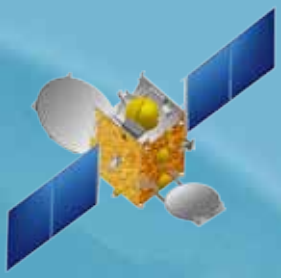

इसरो isro
GSLV-F09 GSAT-9
AFGHANISTAN
NEPAL
BHUTAN
BANGLADESH
INDIA
SRI LANKA
MALDIVES
ISRO
INDIA

THE SATELLITE



GSAT-9 in a clean room during its integration



GSAT-9

GSAT-9 is a Geostationary Communication satellite realised by India. The primary objective of GSAT-9 is to provide various communication applications in Ku-band with coverage over South Asian countries.

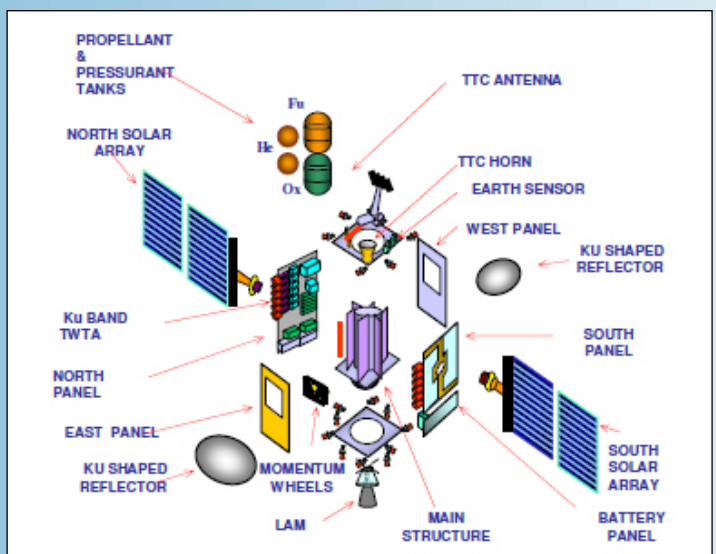
GSAT-9 is configured around the ISRO's standard I-2K bus. With lift off mass of 2230 kg the main structure of the satellite is cuboid in shape built around a central cylinder.

The two solar arrays of GSAT-9 consisting of Ultra Triple Junction solar cells generate about 3500 Watts of electrical power. Sun and Earth sensors as well as gyroscopes provide orientation reference for the satellite. The Attitude and Orbit Control System (AOCS) of the satellite maintains it'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. The satellite also carries plasma thrusters which will assist in station keeping.

Four Stationary Plasma Thrusters (SPTs) constituting the electrical propulsion system of the satellite are intended for technology demonstration and as a backup to the satellite's chemical propulsion system.

GSAT-9 Carries communication transponders operating in Ku-band.

GSAT-9 will be launched into a Geosynchronous Transfer Orbit (GTO) with a 170 km perigee (nearest point to Earth) and 35,975 km apogee (farthest point to Earth) with an inclination of 20.61 deg with respect to the equatorial plane.



Disassembled view of GSAT-9

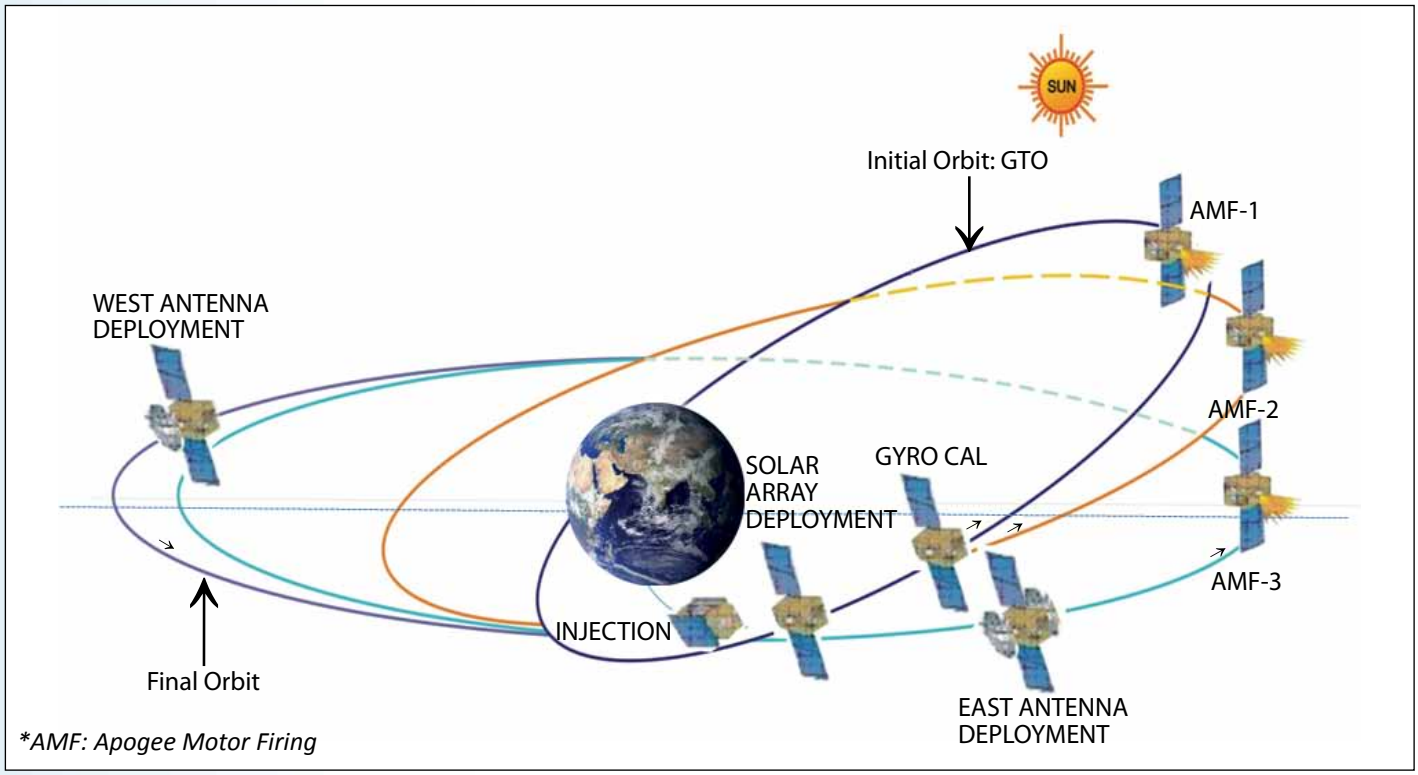
THE SATELLITE

Salient Features

Orbit	Geostationary
Mass	Dry Mass : 976 kg Lift-Off Mass : 2230 kg
Physical Dimensions	1.53 m x 1.65 m x 2.40 m
Power Generation	3500 Watts, two 90 AH Lithium Ion Batteries
Antennas	1.4 m Ku-band reflector on West side (for reception) 2.0 m by 2.2 m Ku-band reflector on East side (for transmission)
Propulsion System	440 N Liquid Apogee Motor Eight 10 N and eight 22 N Chemical thrusters Four Stationary Plasma Thrusters of 18 mN thrust each
Satellite Control	Three axis stabilised Orientation reference from Sun and Earth Sensors and Gyros Momentum Wheels, Magnetic Torquers as well as Chemical and Ion thrusters for orbit and orientation control
Payload	Ku-band Transponders
Satellite Coverage Area	South Asian Countries
Mission Life	12 years

After injection into GTO, the two solar panels of the Satellite are automatically deployed in quick succession for meeting power requirements of the satellite. The Master Control Facility (MCF) at Hassan takes care of the satellite operations including orbit raising manoeuvres. The Liquid Apogee Motor (LAM) of the satellite is fired in three steps to raise the orbit to geostationary height and the satellite will be finally located at its GSO slot.

GSAT-9 Mission Profile



**AMF: Apogee Motor Firing*

THE LAUNCH VEHICLE

GSLV-F09 mission is the eleventh flight of India's Geosynchronous Satellite Launch Vehicle (GSLV) and its fourth consecutive flight with the indigenous Cryogenic Upper Stage (CUS). This mission envisages the launch of 2230 kg GSAT-9 into a Geosynchronous Transfer Orbit (GTO). The vehicle is designed to inject 2 - 2.5 ton class of satellites into GTO. The overall length of GSLV-F09 is 49.1 m. GSLV-F09 will be launched from the Second Launch Pad (SLP) at Satish Dhawan Space Centre SHAR (SDSC SHAR), Sriharikota, which is the space port of India.

GSLV-F09 vehicle configuration including the CUS is similar to the ones successfully flown during the previous three missions – GSLV-D5, D6 and F05 – in January 2014, August 2015 and September 2016 respectively. GSLV-D5 and D6 successfully placed two communication satellites — GSAT-14 and GSAT-6, while GSLV-F05 placed India's weather satellite INSAT-3DR, in the intended GTOs.

S-band telemetry and C-band transponders enable GSLV-F09 performance monitoring, tracking, range safety/flight safety and Preliminary Orbit Determination (POD).

Vehicle Configuration

Four liquid Propellant Strap-On Motors (L40Hs) and Solid propellant Core stage (S139) together constituting the first stage (GS1) + Liquid Propellant Second Stage (GS2) + Cryogenic Third Stage (GS3) + Metallic Payload Fairing with a diameter of 3.4 m.

GSLV-F09 at Second Launch Pad

Hoisting of the GSLV-F09 second stage during vehicle integration

Indigenous Cryogenic Upper Stage of GSLV-F09 at Stage Preparation Facility

Mission Specifications

Orbit	GTO
Perigee	170 ± 5 km
Apogee	35975 ± 675 km
Inclination	20.61 ± 0.1 degree
Payload Mass	2230 kg

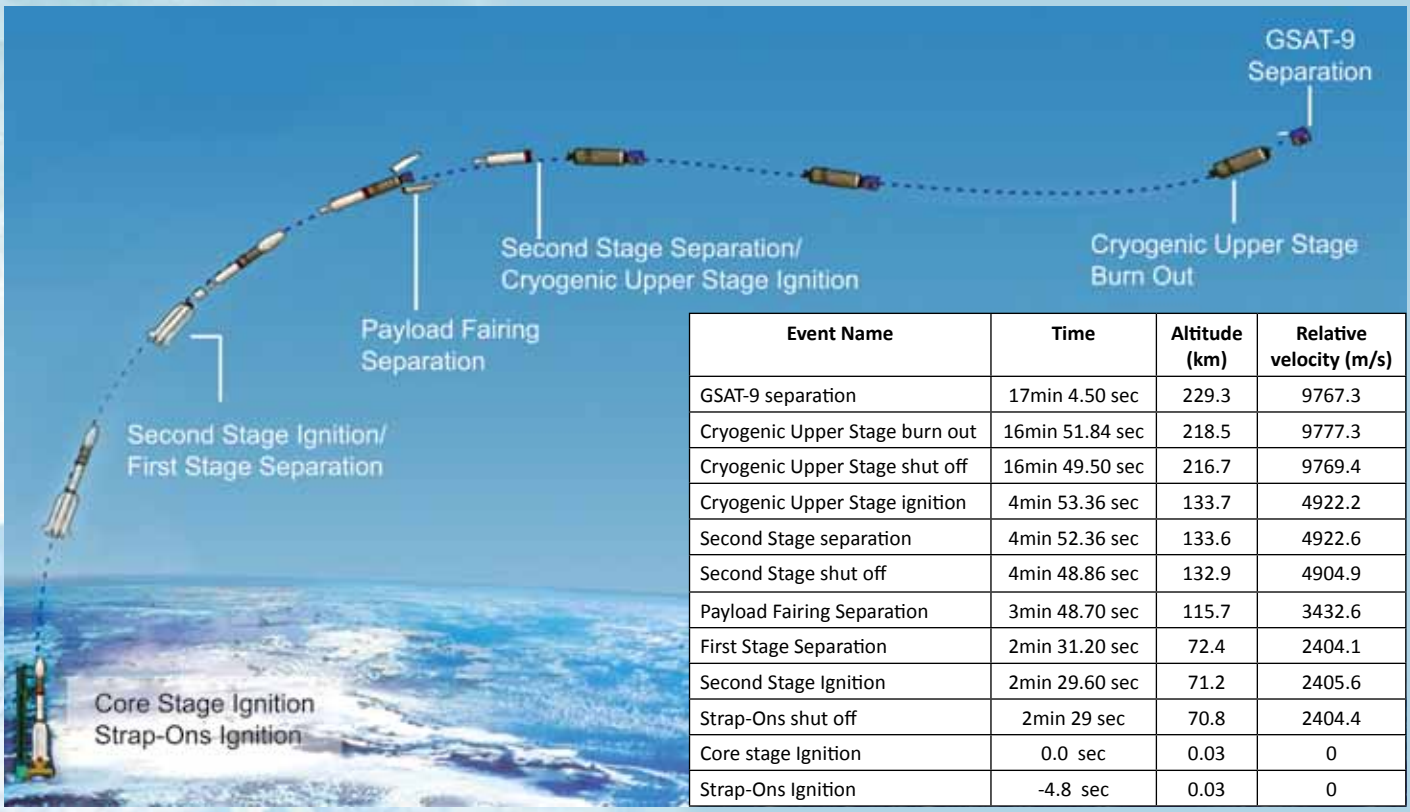
THE LAUNCH VEHICLE

GSLV-F09 at a Glance

Parameters	Stages			
	First Stage (GS1)		Second Stage (GS2)	Third Stage (GS3)
	Strap-Ons	Core Stage		
	(4 L40 Hs)	(S139)		
Length (m)	19.7	20.2	11.6	8.7
Diameter (m)	2.1	2.8	2.8	2.8
Propellants	Earth Storable Liquid Propellants	Composite Solid Propellant	Earth Storable Liquid Propellants	Cryogenic Propellants
Propellant mass (T)	4 x 42.7	138.2	39.5	12.8

GSLV-F09

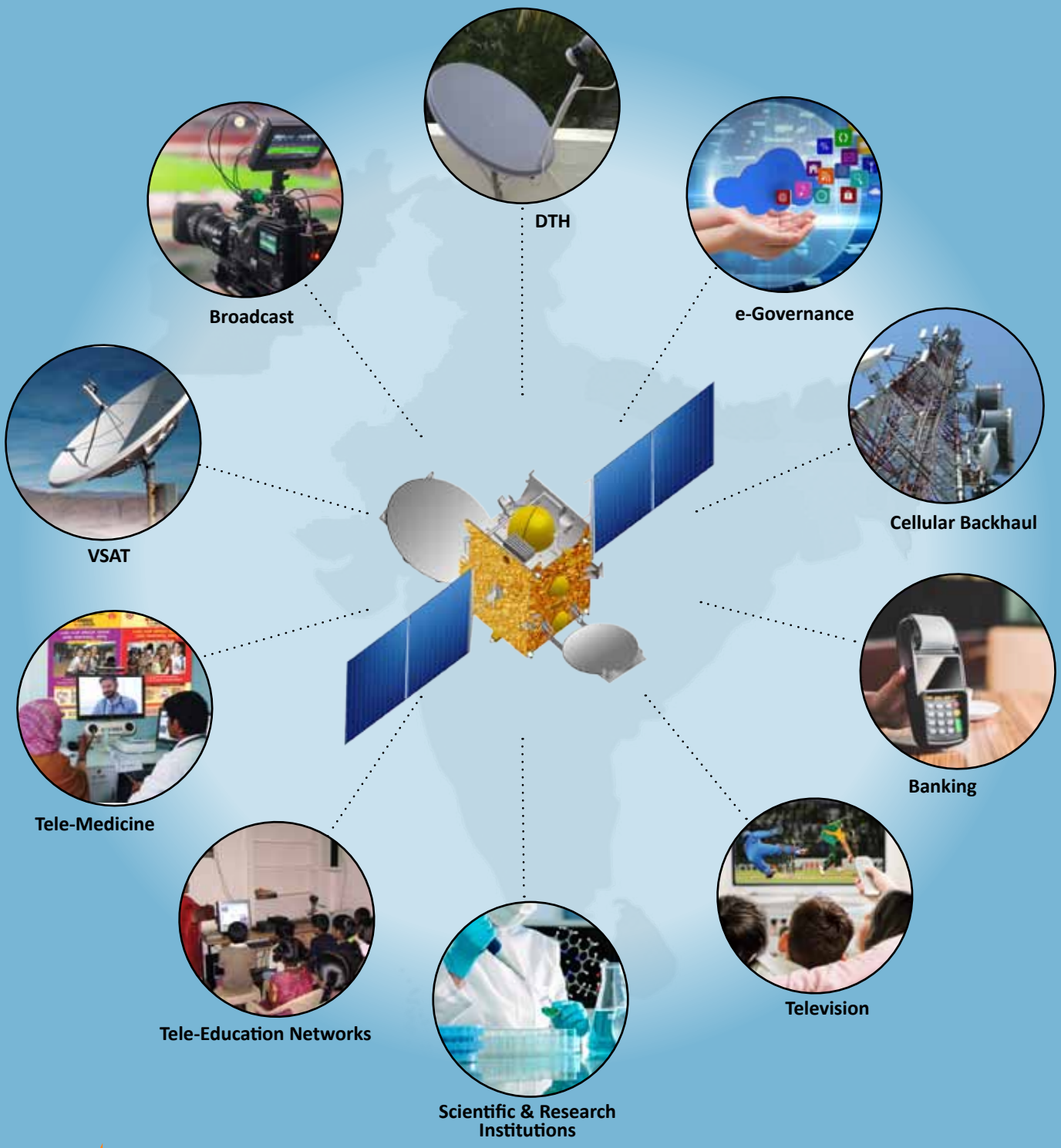
GSLV-F09 Flight Profile



Event Name	Time	Altitude (km)	Relative velocity (m/s)
GSAT-9 separation	17min 4.50 sec	229.3	9767.3
Cryogenic Upper Stage burn out	16min 51.84 sec	218.5	9777.3
Cryogenic Upper Stage shut off	16min 49.50 sec	216.7	9769.4
Cryogenic Upper Stage ignition	4min 53.36 sec	133.7	4922.2
Second Stage separation	4min 52.36 sec	133.6	4922.6
Second Stage shut off	4min 48.86 sec	132.9	4904.9
Payload Fairing Separation	3min 48.70 sec	115.7	3432.6
First Stage Separation	2min 31.20 sec	72.4	2404.1
Second Stage Ignition	2min 29.60 sec	71.2	2405.6
Strap-Ons shut off	2min 29 sec	70.8	2404.4
Core stage Ignition	0.0 sec	0.03	0
Strap-Ons Ignition	-4.8 sec	0.03	0

APPLICATIONS

The GSAT-9 has the potential to be utilised for various broadcasting and interactive telecommunication applications. These applications would benefit the member countries to address their specific needs. In addition, the satellite will also be used for supporting applications that include Disaster Management Support, Broadcast of Meteorological Data, Networking of academic, scientific and research institutions. The intended applications of GSAT-9 would strengthen the regional cooperation among the member countries.



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