



PSLV-C16



RESOURCESAT-2 / YOUTH SAT / X-SAT

PSLV-C16 is the eighteenth flight of ISRO's Polar Satellite Launch Vehicle, PSLV. In this flight, the standard version of PSLV with six solid strap-on motors is used.

PSLV-C16 will place three satellites with a total payload mass of 1404 kg – RESOURCESAT-2 weighing 1206 kg, the Indo-Russian YOUTHSAT weighing 92 kg and Singapore's X-SAT weighing 106 kg – into an 822 km polar Sun Synchronous Orbit (SSO). PSLV-C16 will be launched from the First Launch Pad (FLP) at Satish Dhawan Space Centre SHAR, Sriharikota.

PSLV was initially designed for launching 900 kg Indian Remote Sensing Satellites into a 900 km polar SSO. Since the first launch in 1993, PSLV has been successively improved to attain its present capability.

The major changes made in PSLV since its first launch include changes in strap-on motors ignition sequence, increase in the propellant loading of

PSLV-

the first stage and strap-on solid propellant motors as well as the second and fourth stage liquid propellant motors, improvement in the performance of the third stage motor by optimising motor case and enhanced propellant loading and employing a carbon composite payload adapter.

PSLV has also become a more versatile vehicle for launching multiple satellites in polar SSOs as well as Low Earth Orbits (LEO) and Geosynchronous Transfer Orbit (GTO). With sixteen successful launches, PSLV has emerged as the workhorse launch vehicle of ISRO and is offered for launching satellites for international customers also. During 1994-2010 period, PSLV has launched a total of 44 satellites, of which 25 satellites are from abroad and 19 are Indian satellites.

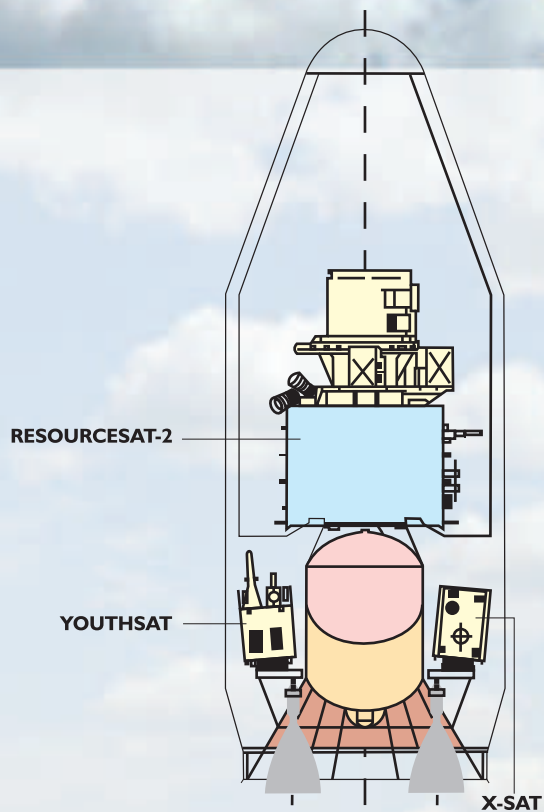
*PSLV-C16 integration in progress
inside the Mobile Service Tower
of the First Launch Pad at Sriharikota*



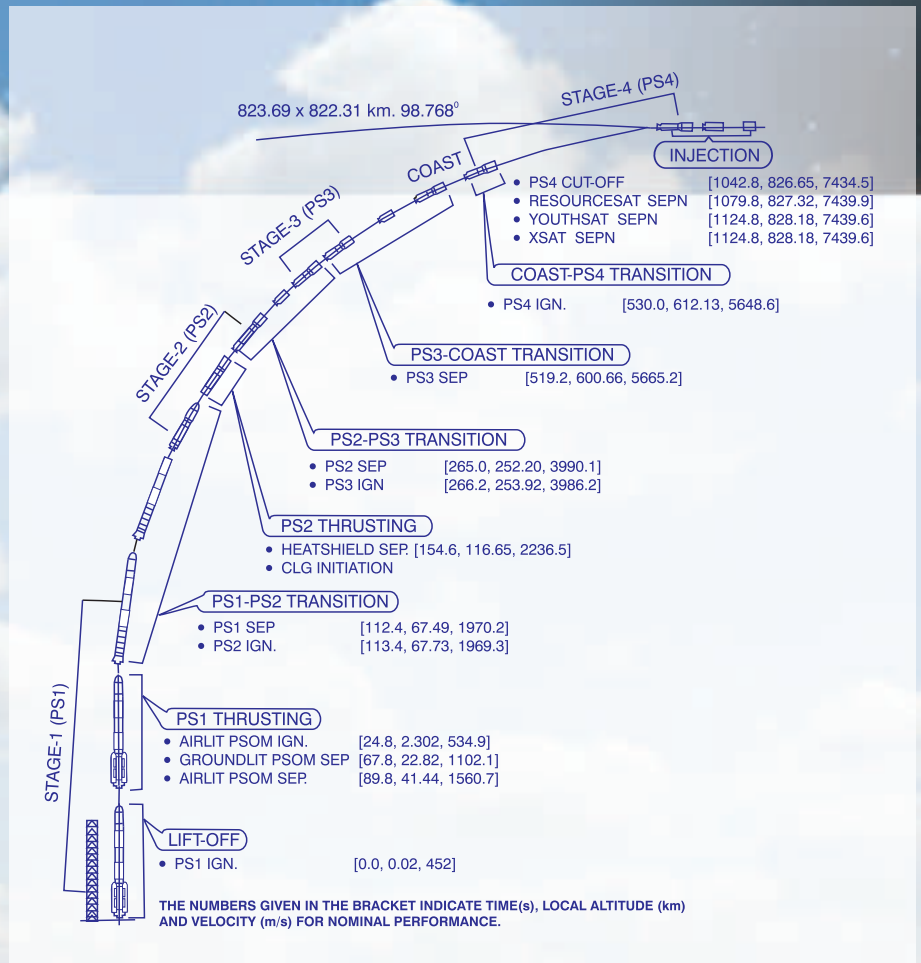
PSLV-C16 Details

	STAGE-1	STAGE-2	STAGE-3	STAGE-4
Nomenclature	Core Stage (PS1) + 6 Strap-on Motors	PS2	PS3	PS4
Propellant	Solid (HTPB Based)	Liquid (UH25 + N ₂ O ₄)	Solid (HTPB Based)	Liquid (MMH+MON-3)
Mass (Tonne)	138.0 (Core) + 6 x 9.0 (Strap-on)	41.0	7.6	2.5
Max Thrust (kN)	4703 (Core) + 6 x 635 (Strap-on)	804	244	7.3X2
Burn Time (Sec)	107 (Core) 50 (Strap-on)	151	116	510
Stage Dia (m)	2.8 (Core) 1.0 (Strap-on)	2.8	2.0	2.8
Stage Length (m)	20 (Core) 11.3 (Strap-on)	12.8	3.6	2.6

C16



Cross Sectional view of PSLV-C16 Payload Fairing



PSLV-C16 Flight Profile

RESOURCESAT-2 is the eighteenth Remote Sensing satellite built by ISRO. RESOURCESAT-2 is a follow on mission to RESOURCESAT-1, launched in 2003. RESOURCESAT-2 is intended to continue the remote sensing data services to global users provided by RESOURCESAT-1 that has far outlived its designed mission life. Also, it provides data with enhanced multispectral and spatial coverage as well.

RESOURCESAT-2 carries three cameras which are similar to those of RESOURCESAT-1. They are: a high resolution Linear Imaging Self Scanner (LISS-4) operating in three spectral bands in the Visible and Near Infrared Region (VNIR) with 5.8 m spatial resolution and steerable up to ± 26 deg across track to achieve a five day revisit capability; a medium resolution LISS-3 operating in three-spectral bands in VNIR and one in Short Wave Infrared (SWIR) band with 23.5 metre spatial resolution; and a coarse resolution Advanced Wide Field Sensor (AWiFS) operating in three spectral bands in VNIR and one band in SWIR with 56 metre spatial resolution.



LISS-4

RESOURCESAT-2



LISS-3

Important changes in RESOURCESAT-2 compared to RESOURCESAT-1 are: Enhancement of LISS-4 multispectral swath from 23 km to 70 km and improved Radiometric accuracy from 7 bits to 10 bits for LISS-3 and LISS-4 and 10 bits to 12 bits for AWiFS. Besides, suitable changes, including miniaturisation in payload electronics, have been made in RESOURCESAT-2.



AWiFS



AWiFS B

RESOURCESAT-2 also carries an additional payload known as AIS (Automatic Identification System) from COMDEV, Canada as an experimental payload for ship surveillance in VHF band to derive position, speed and other information about ships.

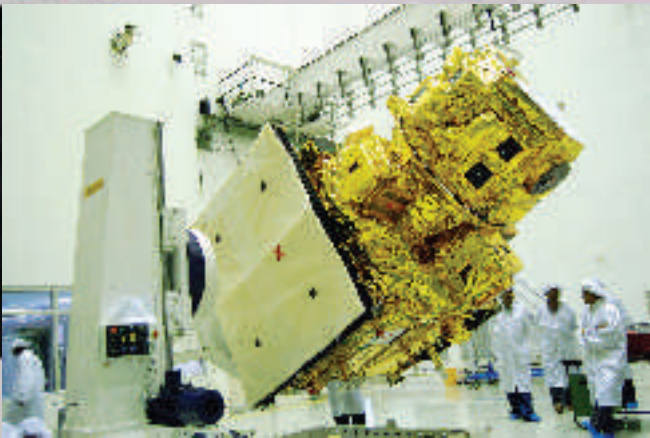
RESOURCESAT-2 carries two Solid State Recorders with a capacity of 200 Giga Bytes each to store the images taken by its cameras which can be read out later to ground stations.

Close up view of RESOURCESAT-2 during one of its prelaunch tests at ISRO Satellite Centre



Salient Features

Orbit	: Circular Polar Sun Synchronous
Orbit altitude at injection	: 822 ± 20 km (3 Sigma)
Orbit inclination	: 98.731 deg. ± 0.2 deg.
Orbit Period	: 101.35 min
Number of Orbits per day	: 14
Local Time of Equator crossing	: 10.30 AM
Repetivity	: 24 days
Lift-off Mass	: 1206 kg
Attitude and Orbit Control	: 3-axis body stabilised using Reaction Wheels, Magnetic Torquers and Hydrazine Thrusters
Power	: Solar Array generating 1250 W at End of Life, two 24 AH Ni-Cd batteries
Mission Life	: 5 years

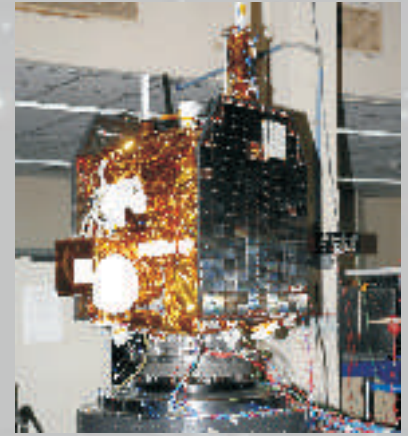


RESOURCESAT-2 in Clean Room at Sriharikota prior to its launch



Payload	LISS-4	LISS-3	AWiFS
Spatial Resolution (m)	5.8	23.5	56
Swath (km)	70.0 in MX mode and Mono mode	141	740
Spectral Band (microns)	0.52-0.59 0.62-0.68 0.77-0.86	0.52-0.59 0.62-0.68 0.77-0.86 1.55-1.70	0.52-0.59 0.62-0.68 0.77-0.86 1.55-1.70
Quantisation (bits)	10	10	12
Data Rate (MBPS)	105	105	

YOUTHSAT, is a joint Indo-Russian satellite for stellar and atmospheric studies with the participation of students from Universities at graduate and post graduate level. With a lift-off mass of 92 kg, Youthsat intends to investigate the relationship between solar variability and thermosphere-ionosphere changes. The satellite carries three payloads, of which two are Indian and one Russian. Together, they form a unique and comprehensive package of experiments for the investigation of the composition, energetics and dynamics of earth's upper atmosphere. The Indian payloads are:



Youthsat undergoing vibration test at ISRO Satellite Centre

1. **RaBIT (Radio Beacon for Ionospheric Tomography)**, which is a dual frequency beacon payload for mapping the Total Electron Content (TEC) of the Ionosphere.

2. **LiVHySI (Limb Viewing Hyper Spectral Imager)** is designed to perform airglow measurements of the Earth's upper atmosphere (100 to 1100 km)

The Russian payload **SOLRAD** monitors the solar X- and γ ray fluxes and helps to study solar cosmic ray flux parameters and conditions of their penetration in the Earth's magnetosphere.

YOUTHSAT X-SAT

Salient Features

Orbit altitude at injection	: Circular Polar Sun Synchronous 822 ± 20 km (3 Sigma)
Orbit inclination	: $98.731 \text{ deg.} \pm 0.2 \text{ deg.}$
Orbit Period	: 101.35 min
Number of Orbits per day	: 14
Lift-off Mass	: 92 kg
Dimension	: $1020 \text{ (Pitch)} \times 604 \text{ (Roll)} \times 1340 \text{ (Yaw)} \text{ mm}^3$
Attitude and Orbit Control	: 3-axis body stabilised using Sun and Star Sensors, Miniature Magnetometer, Miniature Gyros, Micro Reaction Wheels and Magnetic Torquers
Power	: Solar Array generating 230 W, one 10.5 AH Li-ion battery
Mechanisms	: Paraffin Actuator based Solar Panel Hold Down and Release Mechanism
Mission Life	: 2 years

X-SAT, the third payload of PSLV-C16, is Singapore's first satellite. Weighing 106 kg at lift-off, X-SAT is a Mini Satellite with a multispectral camera IRIS as its primary payload. X-SAT mission mainly intends to demonstrate technologies related to satellite based remote sensing and onboard image processing.

