

PSLV-C20 / SARAL Mission

25 February, 2013

THE MISSION

PSLV-C20 carrying on-board the joint Indo-French Satellite SARAL, along with 6 other co-passenger Satellites from Canada, Austria, Denmark and United Kingdom, lifted-off from the Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota at 06:01 PM (IST) on February 25, 2013. After a flight of 17 minutes 55 seconds, the main payload SARAL along with 6 commercial payloads were placed into a 785 km polar Sun-synchronous Orbit inclined at an angle of 98.538° to the Equator.

SARAL is an oceanographic satellite jointly developed by ISRO and the French Space Agency CNES. The satellite is built by ISRO, whereas CNES contributed the ARGOS and ALTIKA payloads. Data from SARAL is useful for researchers besides having many practical applications like marine meteorology and sea state forecasting, climate monitoring, continental ice studies, environmental monitoring, protection of biodiversity and improvement in maritime security.

ISRO Telemetry, Tracking and Command Network (ISTRAC) in Bangalore took over the SARAL's monitoring and control operations immediately after its injection. Following the automatic deployment of SARAL's solar panels, shortly after reaching orbit, all the subsequent operations are proceeding normally.

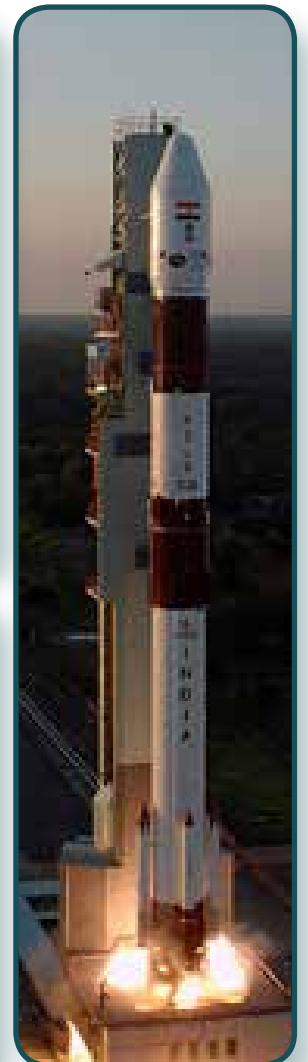
PSLV-C20

THE LAUNCH VEHICLE

PSLV-C20 was in its 23rd flight for this mission and it's the 9th flight of PSLV in 'Core-Along' configuration without the use of solid strap-on motors.

SPECIFICATIONS

Height	44.4 m	
Lift-Off Mass	229.7 t	
No of Stages	4	
Payloads	SARAL – Indo-French Satellite	6 INTERNATIONAL CUSTOMER SATELLITES Canada (2) Austria (2) Denmark (1) and UK (1)
Orbit Height	785 km	
Inclination (deg)	98.536°	
Launch Pad	First Launch Pad (SDSC, SHAR)	



STAGE CHARACTERISTICS				
	Stage-1	Stage-2	Stage-3	Stage-4
Nomenclature	PS1	PS2	PS3	PS4
Propellant	Solid (HTPB based)	Liquid (UH25 + N ₂ O ₄)	Solid (HTPB based)	Liquid (MMH + MON-3)
Mass (t)	138.0	41.0	7.6	2.5
Max Thrust (kN)	4787	804	242	7.3 x 2
Burn Time (sec)	102	148	110	526
Stage Dia (m)	2.8	2.8	2.0	2.8
Stage Length (m)	20	12.8	3.6	2.6
Control	SITVC for Pitch & Yaw, Reaction Control Thrusters for Roll Control	Engine Gimbal for Pitch & Yaw, Hot Gas Reaction Control Motor for Roll Control	Flex Nozzle for Pitch & Yaw, PS4 Reaction Control System (RCS) for Roll Control	Engine Gimbal for Pitch, Yaw & Roll, on-off RCS for Coast Phase Control

SARAL

THE SATELLITE

The satellite with ARGOS and ALTIKA (SARAL) is a joint Indo-French satellite mission for oceanographic studies. SARAL performs altimetry measurements designed to study ocean circulation and sea surface elevation.

THE PAYLOADS OF SARAL:

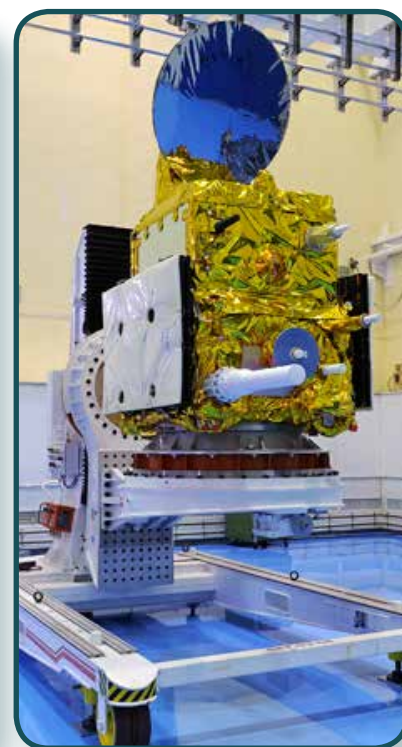
- **Ka-band Altimeter, ALTIKA** built by the French National Space Agency CNES. The payload is intended for oceanographic applications that operates at 35.75 Giga Hertz.
- **ARGOS Data Collection System** built by the French National Space Agency CNES. ARGOS contributes to the development and operational implementation of the global ARGOS Data Collection System. It will collect a variety of data from ocean buoys to transmit the same to the ARGOS Ground Segment for subsequent processing and distribution.
- **Solid State C-band Transponder (SCBT)** is from ISRO and intended for ground RADAR calibration. It is a continuation of such support provided by C-Band Transponders flown in the earlier IRS-P3 and IRS-P5 missions.

The payloads of SARAL are accommodated in the Indian Mini Satellite-2 bus, which is built by ISRO.

SARAL Applications

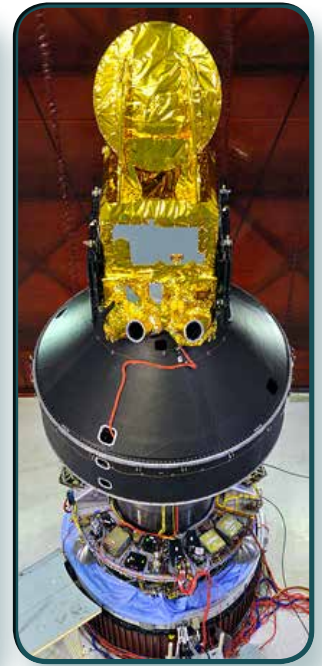
SARAL data products will be useful for operational as well as research user communities in many fields like

- Marine Meteorology and Sea State Forecasting
- Operational Oceanography
- Seasonal Forecasting
- Climate Monitoring
- Ocean, Earth System and Climate Research
- Continental Ice Studies
- Protection of Biodiversity
- Management and Protection of Marine Ecosystem
- Environmental Monitoring
- Improvement of Maritime Security



SPECIFICATIONS

Weight	407 kg
Power	906 W, 46.8 Ampere-hour Li-Ion Battery
Stabilisation	Three axis stabilization with reaction wheels, Hydrazine Control System based thrusters 4, PI Sun sensors, magnetometer, star sensors and miniaturized gyro based Inertial Reference Unit
Type of Satellite	Earth Observation
Payloads	<ul style="list-style-type: none"> • Ka-band Altimeter, ALTIKA • ARGOS Data Collection System • Solid State C-band Transponder (SCBT)
Mission Life	5 Years



THE INTERNATIONAL CUSTOMER SATELLITES

Satellite	No. of Satellite	Country	Mission Objectives
SAPPHIRE	1	Canada	The primary objective is to deploy an operationally acceptable space based surveillance to contribute to the US Space Surveillance Network (SSN). It is a space based optical sensor system to perform surveillance of orbit in deep space and to deliver Resident Space Objects (RSOs) tracking information in the orbit range of 6000 to 40000 km. ISRO's Ball Lock separation system IBL-298 is being used for separating satellite.
NEOSSat	1	Canada	The Satellite has a space telescope dedicated for detecting and tracking asteroids and satellites in Geo-stationary orbit. NEOSSat also uses IBL-298 separation system.
NLS 8.1 (UniBRITE) NLS 8.2 (BRITE)	1 (each)	Austria	The Objective of UniBRITE mission is to measure the photometrical low-level oscillations and temperature variations in stars brighter than visual magnitude (4.0), with unprecedented precision and temporal coverage not achievable through terrestrial based methods. BRITE, similar to UniBRITE spacecraft, with the exception of the optical filter within the payload, which is used to observe the blue region of the light spectrum. Both the satellites use XPOD GNB separation system provided by the UTIAS, Canada.
NLS 8.3 (AAUSAT3)	1	Denmark	The payloads area dual-band AIS receiver for feasibility study of receiving AIS signals from ships in Arctic regions and a Phoenix GPS receiver from DLR, Germany. XPOD single separation system is being used for separation of the satellite.
STRaND-1	1	UK	The mission objective is to fly state-of-the art technologies and new developments in Low Earth Orbit. Payloads are Smart Phone, Resistojet Propulsion System and Pulsed Plasma Electrical Propulsion System. ISIPOD separation system 3U is being used for separation of the satellite.