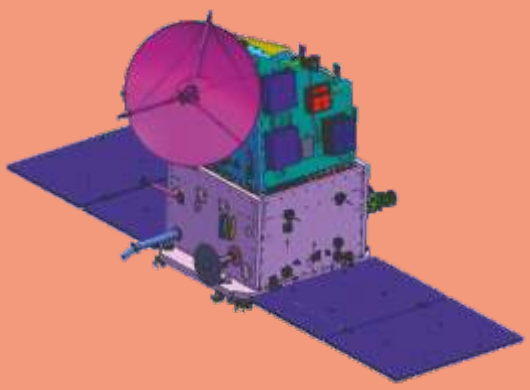


PSLV-C35
SCATSAT-1

PISAT **PRATHAM**

ALSAT-1B (Algeria) **ALSAT-2B** (Algeria) **ALSAT-1N** (Algeria)

NLS-19 (Canada) **Pathfinder-1** (USA)

PSLV-C35

PSLV-C35 at the First Launch Pad

India's Polar Satellite Launch Vehicle in its thirty seventh flight (PSLV-C35), will launch the 371 kg SCATSAT-1 for weather related studies and seven co-passenger satellites together weighing about 304 kg at lift-off. The co-passenger satellites are from Algeria, Canada and the USA as well as two satellites from Indian University/Academic Institute. The total weight of all the eight satellites carried onboard PSLV-C35 is about 675 kg.

Of the eight satellites carried by PSLV-C35, SCATSAT-1 is launched into a 720 km polar Sun Synchronous Orbit (SSO) inclined at an angle of 98.1 degree to the equator whereas the two Indian University/Academic Institute satellites and the five satellites from abroad will be placed in a 689 km polar orbit of 98.21 degree inclination later. This is the first mission of PSLV in which it will be launching its payloads into two different orbits.

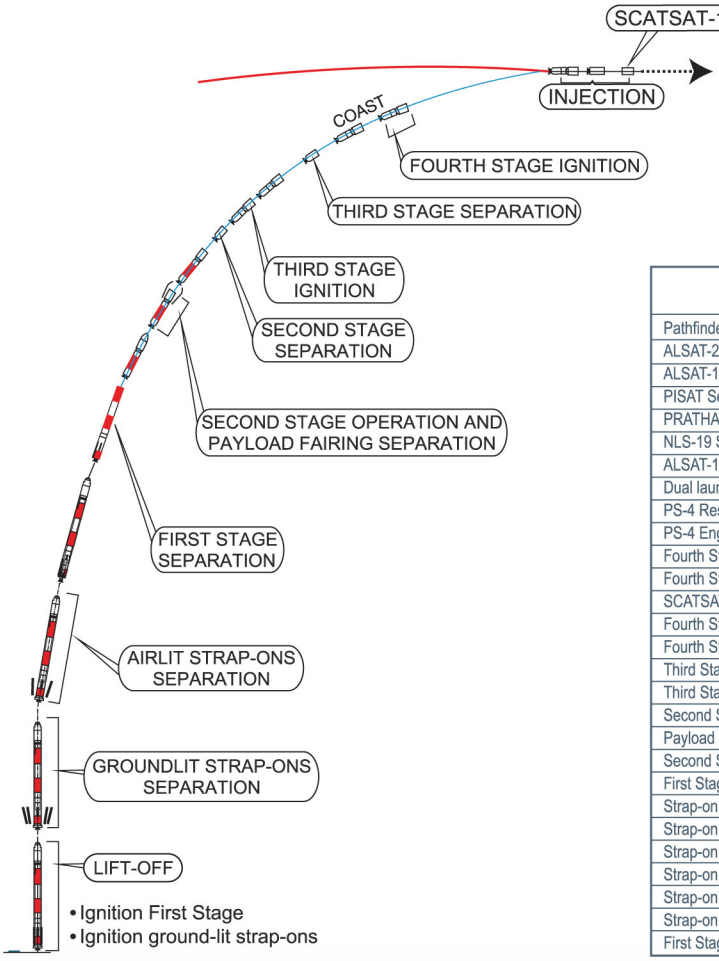
PSLV-C35 will be launched from the First Launch Pad (FLP) of Satish Dhawan Space Centre SHAR, Sriharikota.

PSLV-C35 at a glance (Vehicle lift-off Mass: 320 tonne Height: 44.4 m)

	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_2O_4)	Solid (HTPB based)	Liquid (MMH + MON-3)
Propellant Mass(T)	138.2 (Core), 6 x 8.9 (Strap-on)	42.0	7.6	1.6
Stage Dia (m)	2.8 (Core), 1 (Strap-on)	2.8	2.0	1.3
Stage Length (m)	20 (Core), 8.8 (Strap-on)	12.8	3.6	2.4

HTPB : Hydroxyl Terminated Poly Butadiene
UH25 : Unsymmetrical Dimethyl Hydrazine + 25% Hydrazine Hydrate
N_2O_4 : Nitrogen Tetroxide
MMH : Mono Methyl Hydrazine, MON-3: Mixed Oxides of Nitrogen

PSLV-C35



Height: **720** km (SCATSAT-1)
Inclination: 98.1 deg

Height: **670** km (PRATHAM, PISAT, ALSAT-1B, ALSAT-2B, ALSAT-1N, Pathfinder-1, NLS-19)
Inclination: 98.21 deg

Event Name	Time after lift-off	Altitude (kilometre)	Velocity (metre per second)
Pathfinder-1 Separation	2 hr 15 min 32.96 sec	689.600	7520.90
ALSAT-2B Separation	2 hr 15 min 17.96 sec	689.647	7520.91
ALSAT-1B Separation	2 hr 15 min 2.96 sec	689.690	7520.93
PISAT Separation	2 hr 14 min 52.96 sec	689.715	7520.94
PRATHAM Separation	2 hr 14 min 42.96 sec	689.737	7520.94
NLS-19 Separation	2 hr 13 min 22.96 sec	689.826	7521.02
ALSAT-1N Separation	2 hr 13 min 12.96 sec	689.825	7521.03
Dual launch adapter Separation	2 hr 12 min 42.96 sec	689.807	7521.05
PS-4 Restart-2 cut-off	2 hr 12 min 5.96 sec	689.752	7521.18
PS-4 Engine Restart-2	2 hr 11 min 46.52 sec	689.731	7527.63
Fourth Stage Restart-1 cut-off	1 hr 22 min 58.56 sec	739.306	7475.54
Fourth Stage Engine Restart-1	1 hr 22 min 38.02 sec	739.314	7489.37
SCATSAT-1 Satellite Separation	17 min 32.84 sec	730.758	7490.68
Fourth Stage Cut-off (Injection)	16 min 55.84 sec	730.092	7485.00
Fourth Stage Ignition	12min 26.52 sec	680.576	6184.49
Third Stage Separation	9min 47.80 sec	580.877	6313.34
Third Stage Ignition	4min 25.40 sec	223.638	4141.24
Second Stage Separation	4min 24.20 sec	222.233	4144.35
Payload Fairing Separation	2min 41.14 sec	115.464	2400.74
Second Stage Ignition	1min 52.94 sec	65.491	2027.02
First Stage Separation	1min 52.74 sec	65.276	2027.86
Strap-on 5, 6 (Airlit) Separation	1min 30.0 sec	40.911	1642.71
Strap-on 3, 4 (Groundlit) Separation	1min 8.1 sec	22.894	1147.86
Strap-on 1, 2 (Groundlit) Separation	1min 7.9 sec	22.756	1143.62
Strap-on 5,6 (Airlit) Ignition	25.00 sec	2.392	546.40
Strap-on 3,4 (Groundlit) Ignition	0.62 sec	0.024	451.89
Strap-on 1,2 (Groundlit) Ignition	0.42 sec	0.024	451.89
First Stage Ignition	0.00	0.024	451.89

PSLV-C35 Typical Flight Profile

Cross sectional view of PSLV-C35 payload fairing

Integration of strap-ons to PSLV-C35 core stage at Mobile Service Tower

Primary Satellite

SCATSAT-1 is the primary satellite carried by PSLV-C35. The mission objectives of SCATSAT-1 are to help provide weather forecasting services to the user communities through the generation of wind vector products for weather forecasting, cyclone detection and tracking. SCATSAT-1 is a continuity mission for Scatterometer payload carried by the earlier Oceansat-2 satellite.

The Ku-band scatterometer payload carried by SCATSAT-1 has enhanced features compared to the similar one carried by Oceansat-2 launched in 2009.

The SCATSAT-1 structure has IMS-2 satellite bus heritage. The satellite's thermal control is achieved with the use of passive thermal elements like Optical Solar Reflectors, Multi Layer Insulation blanket, paints and heat pipe embedded panels. The two solar arrays of SCATSAT-1 generate about 750 Watts of electrical power. Sun and Star sensors as well as magnetometers and miniaturised Inertial Reference Unit (IRU) provide precise orientation reference to the satellite. The Attitude and Orbit Control System (AOCS) of SCATSAT-1 maintains the satellite's orientation with the help of reaction wheels, magnetic torquers and thrusters.

After its injection into the 720 km polar Sun Synchronous Orbit (SSO) by PSLV-C35, the satellite will be brought to the final operational configuration following which it will begin providing regular weather forecasting related inputs.

SCATSAT-1undergoing a prelaunch test

Salient Features

Satellite mass	377 Kg
Orbit type	Circular polar Sun Synchronous
Orbit height	720 km
Orbit inclination	98.1 degree
Local time of Equator crossing	9:20 am
Power	Solar arrays generating 750 Watts; 28 Ah Li- Ion battery
Attitude control	Reaction wheels, Magnetic torquers and Hydrazine thrusters
Design life	5 years
Data Transmission	X-band
On-board data storage	Solid State Recorder with 32 GB capacity

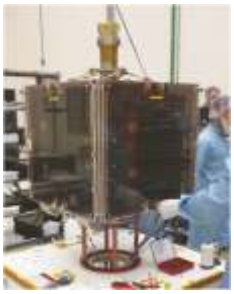
Co-passenger Satellites

International Customer Satellites

ALSAT-1B (Algeria)

Mass: 103 kg

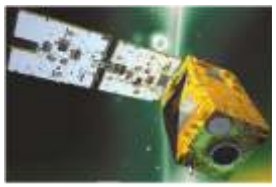
ALSAT-1B is an Algerian earth orbservation satellite based on SSTL-100 platform for monitoring agriculture, environment and disasters



ALSAT-2B (Algeria)

Mass: 117 kg

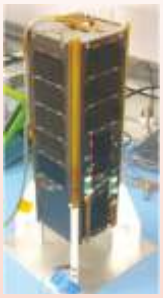
ALSAT-2B is a high resolution remote sensing satellite with panchromatic and multispectral imaging capability



ALSAT-1N (Algeria)

Mass: 7 kg

ALSAT-1N is a technology demonstration nanosatellite built as part of the programme for Algerian students



Pathfinder-1 (USA)

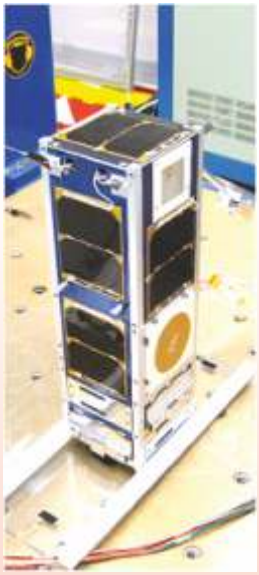
Mass: 44 kg

Pathfinder-1 is a commercial high resolution imaging microsatellite

NLS-19 (Canada)

Mass: 8 kg

NLS-19 (CAN X-7) is a technology demonstration nanosatellite built to perform experiments to help reduce space debris and for tracking commercial aircraft



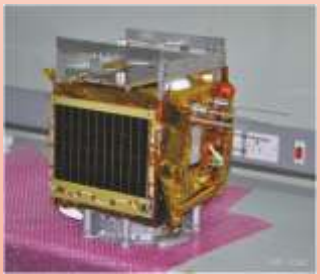
University/Academic Institute Satellites from India

PRATHAM

Mass: 10 kg

(from IIT, Bombay)

Mission Objectives: To estimate the Total Electron Count (TEC) with a resolution of 1km x 1km location grid

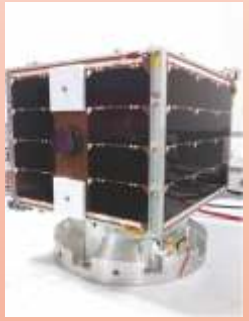


PISAT

Mass: 5.25 kg

(from PES University, Bangalore and its consortium)

Mission Objectives: Design and develop a Nanosatellite for remote sensing applications



From Oscat to Scatsat-1

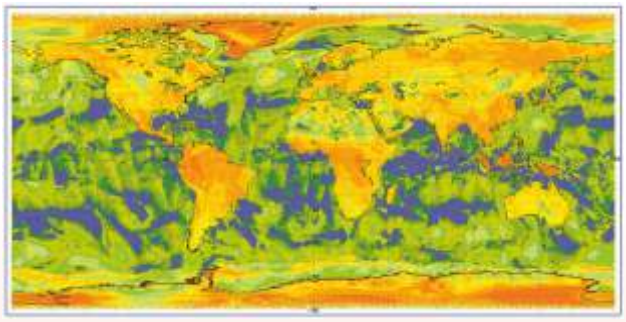
The Oceansat-II Scatterometer (popularly known as 'Oscat') is the Indian Space Research Organization's (ISRO's) first microwave remote-sensing sensor launched on 23rd September 2009.

- Oscat was also the only wind-sensing Ku-band scanning pencil-beam Scatterometer in operation during its lifetime (Sep 2009 to Mar 2014). It turned out to be a globally significant and useful mission in the areas of wind-retrieval, weather-forecasting, cyclone-tracking and prediction. As an example, the landfall of Phailin Cyclone in the Odisha coast was accurately predicted well in advance based upon Oscat observations and thus, loss of human life could be avoided.

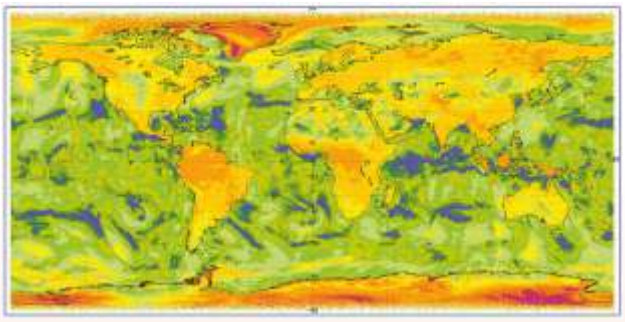
- Oscat data were routinely disseminated to international agencies like EUMETSAT, KNMI NASA, NOAA and ECMWF apart from Indian users. The instrument has been appreciated by all these users for the quality and stability of data it provided.

- Scatsat-1 is a quick replacement mission of Oscat. Although a follow-on mission, significant improvements have been incorporated in the hardware configuration based upon lessons learnt from Oscat. Also, the payload has been characterized with the objective of achieving data quality for Climate Data Records, apart from facilitating routine meteorological applications.

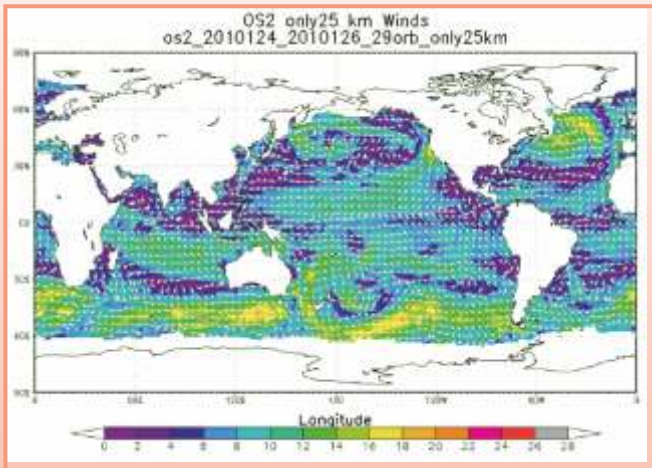
Global Radar Backscatter Images from OSCAT



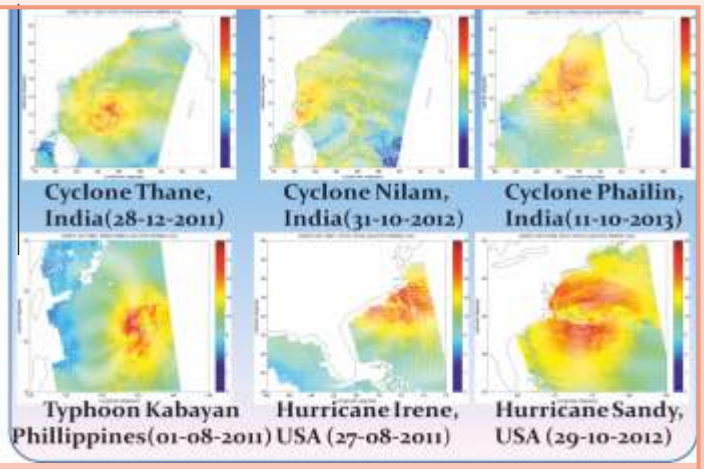
HH Polarization



VV Polarization



Global Wind Retrievals



Major Cyclones Captured by OSCAT

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