



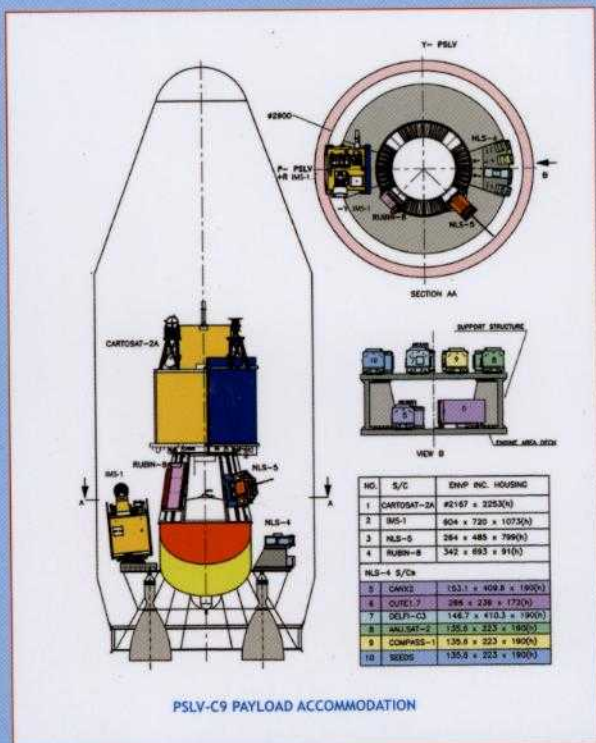
INDIAN SPACE RESEARCH ORGANISATION



PSLV C9/ CARTOSAT 2A/ IMS-1 MISSION

PSLV C9 MISSION

PSLV-C9 is the tenth operational flight of PSLV carrying ten satellites. This will be the first mission to employ a core alone vehicle to launch a satellite in SSPO orbit. The launch will orbit Cartosat-2A, IMS-1, six nos. of NLS-4 satellites, one no. of NLS-5 satellite and Rubin-8 into a circular SSPO orbit. While the Cartosat-2A and IMS-1 use the conventional Band clamp and IBL-298 separation systems respectively, the NLS-4 and NLS-5 satellite use their own separation system (called XPODs & Cute SS) for which the command goes from PSLV EB. Rubin-8 will not separate and will orbit along with the spent PS4 stage.



PSLV-C9 PAYLOAD ACCOMMODATION

Mission Specification

Orbit	:	635 km SSPO
Inclination	:	97.93 deg
Launch Time	:	09:23:51 hrs IST
Launch window	:	-0/+10 min
Launch Pad	:	Second Launch Pad
Launch Azimuth	:	140 deg

VEHICLE

Overall height	-	44.4m
Lift-off mass	-	228 ton
First stage	-	PS1 (S139) HTPB Solid Propellant
Second stage	-	PS2 (PL40) UH25 + N ₂ O ₄ Liquid Propellant
Third stage	-	HPS3 (S7) HTPB Solid Propellant
Fourth stage	-	PS4 (L1.6) MMH+Mon3 Liquid Propellant

The vehicle configuration for PSLV-C9 Mission remains same as PSLV-C10 except for the changes mentioned below

Major changes from PSLV C10

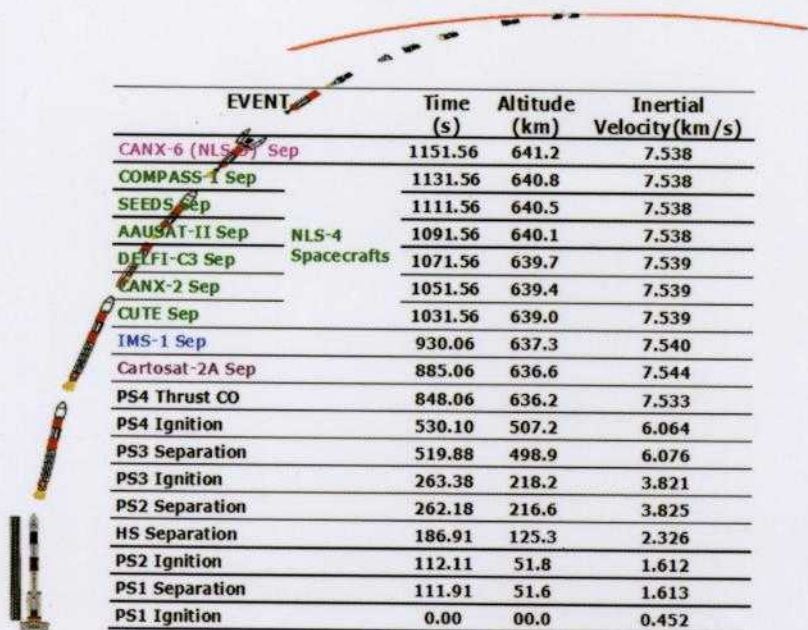
- ▶ Euler angle based guidance computation as in PSLV-C7
- ▶ Vehicle anchoring system as in C8
- ▶ Introduction of RCV in PS2 N₂O₄ MEV command line to prevent N depletion
- ▶ Use of 1040mm height PLA for the first time
- ▶ 10 satellites in a single mission
- ▶ Two tier mounting configuration for NLS-4 satellites on EB deck
- ▶ Mounting of Rubin-8 and NLS-5 on PLA
- ▶ Introduction of sequencer for separating NLS-4/5 satellites
- ▶ Use of the 110mm thick PPL deck for mounting IMS-1
- ▶ Flight qualification of IAMA and MEMS based acoustic sensors (IMAS)



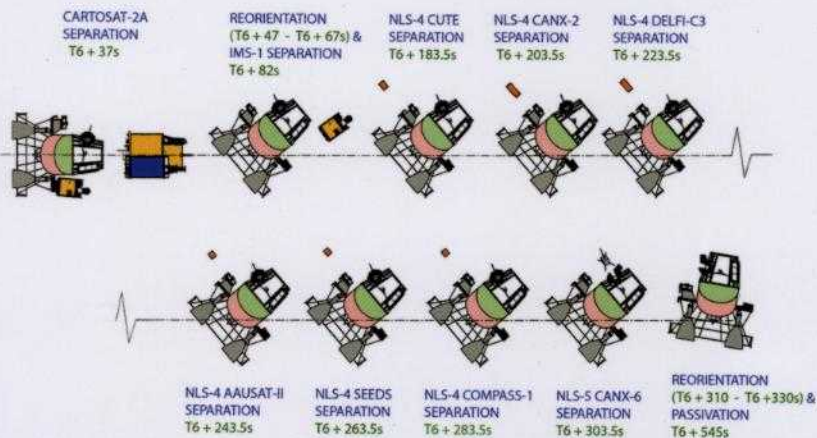
Operational Flights

PSLV-C1	29 September 1997	IRS-1D
PSLV-C2	26 May 1999	IRS-P4, KITSAT, TUBSAT
PSLV-C3	22 October 2001	TES, PROBA, BIRD
PSLV-C4	12 September 2002	KALPANA-1
PSLV-C5	17 October 2003	IRS-P6
PSLV-C6	5 May 2005	IRS-P5, HAMSAT
PSLV-C7	10 January 2007	CARTOSAT-2, SRE, LAPAN TUBSAT, NANO PEHUENSAT
PSLV-C8	23 April 2007	AGILE
PSLV-C10	21 January 2008	POLARIS

Flight Profile



Spacecraft Separation Sequence



Cartosat-2A (Mass: 686 kg)



Cartosat-2A mission is identical to that of Cartosat-2 mission. The main objective of the spacecraft is remote sensing for obtaining high resolution scene specific spot imageries from a highly agile platform carrying a single panchromatic camera operated in step & stare mode. The data products are used for cartographic applications at cadastral level.

The spacecraft is 3 axes stabilized for 2 nominal modes of operations namely sun pointing mode and imaging mode. The spacecraft is put in 635 km SSPO with 09.30 hrs ECT for 4 days revisit. Also it has capability for one time special orbit at 560 km for daily revisit. The spacecraft can be steered ± 26 deg cross-track nominally for different modes of imaging.

IMS-1 (Mass: 83.4 kg)

IMS-1 is a Remote sensing mini satellite. The data from this satellite is planned to be used for Natural resources monitoring/management like agriculture, forest coverage and deforestation, urban infrastructure development, land use and waste land mapping, coastal features mapping, coral reef mapping and land slide studies. This project has been approved with the intention of providing access to remote sensing data to scientists and students of developing countries.



NLS-4

The NLS-4 is the designation of six satellites that will be mounted on the PPL deck at P+ side of EB. These satellites will be separated at an interval of every 20s using the separation system supplied along with the satellites. PSLV will issue the separation commands through a sequencer. All these satellites will be OFF during launch.

1. CanX-2 (Mass: 3.3 kg)

The CanX-2 is an experimental spacecraft built by the University of Toronto Institute of Aerospace Studies, Canada. The technologies to be tested include a novel cold gas propulsion system, custom radios, innovative attitude sensors and actuators and a commercial GPS receiver. The spacecraft will also perform GPS radio occultation experiment, network communication experiment and space materials experiment.



2. AAUSat-II (Mass: 1 kg)



The AAUSat-II is built by Aalborg University at Denmark. Two scientific payloads are supported by the platform. An attitude control system with magnetorquers and momentum wheels which will be used to de-tumble and stabilize the spacecraft in three axes. The second payload is a Gamma-Ray Burst Detector.

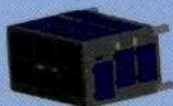
3. COMPASS-1 (Mass: 1 kg)



COMPASS-1 is an experimental spacecraft built by the Aachen University of Applied Sciences in Germany. The mission of the spacecraft is to capture images from the earth and to validate the newly developed miniaturized spacecraft bus. The spacecraft includes 2 payloads namely a GPS receiver and a CMOS VGA camera system

4. CUTE 1.7 + APD II (Mass: 3.1 kg)

The CUTE 1.7+APD II is an experimental spacecraft built by the Tokyo Institute of Technology, Japan. The mission of the spacecraft is to demonstrate the use of a PDA (Personal Digital Assistant) based bus system for nano satellites and APD (Avalanche Photo-diode) sensor for astronomy observation.



5. Delfi-C3 (Mass: 3.1 kg)



The Delfi-C3 is an experimental spacecraft built by the Technical University Delft, The Netherlands. Delfi -C3 is a technology test-bed for 3 payloads viz. thin film solar cells, an autonomous wireless sun sensor, and an advanced transceiver. This spacecraft is without any battery as it is not operational in eclipse.

6. SEEDS (Mass: 1 kg)

SEEDS (Space Engineering Education Satellite) has been developed by the Nihon University, Japan. The main objective is to receive house keeping data from the spacecraft by CW signal. The other objectives are to receive the sensor data using FM packet downlink and to receive the sound data from SEEDS that is recorded in the digi-talker.



CanX-6 (NLS-5) (Mass: 6.8 kg)



CanX-6 is a technology demonstration spacecraft built by the Spaceflight Laboratory at the University of Toronto Institute for Aerospace Studies. The mission of the spacecraft is to perform a survey of VHF band centered on 162 MHz to be used as Maritime Identification System.

RUBIN-8 (Mass: 7 kg)

RUBIN-8 spacecraft is designed as non-separable attached payload, mounted on the Payload Adapter. The main purpose of the RUBIN-8 spacecraft is to test and develop a new space based receiver and data upload system for the maritime Automatic Identification System (AIS). This is a joint project of University of Applied Sciences and OHB system, Bremen, Germany.



Glimpses of PSLV C9 Launch Campaign



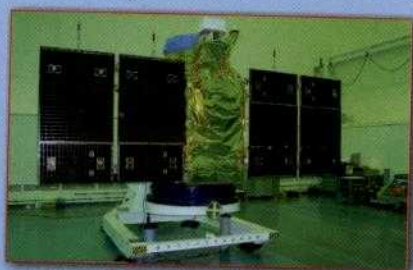
First Stage



PS2 Stacking



PS3-PS4 Module integration



Cartosat-2A testing at SP 1A



Satellite Assembly



Heat Shield Closure



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