
इसरो isro
PSLV C22
INDIA
PSOM XL-4
PSLV-C22/IRNSS-1A

FULLY INTEGRATED PSLV-C22 WITH IRNSS-1A ON LAUNCHPAD

PSLV-C22

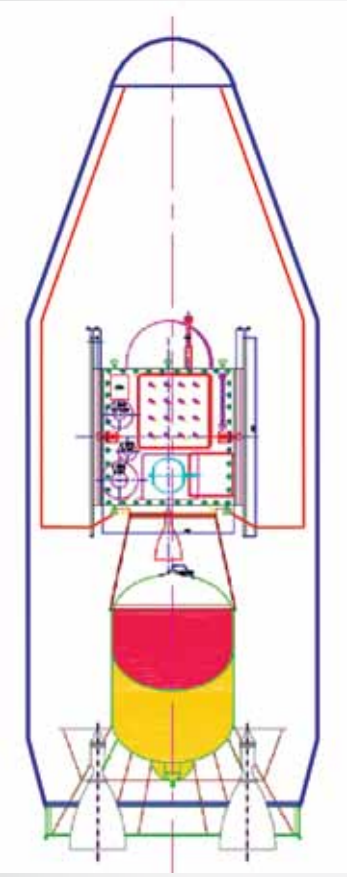
Polar Satellite Launch Vehicle, in its twenty fourth flight (PSLV-C22), will launch India's first dedicated navigational satellite IRNSS-1A. The launch will take place from the First Launch Pad (FLP) of Satish Dhawan Space Centre, (SDSC) SHAR, Sriharikota. PSLV-C22 will use 'XL' version of PSLV. This is the fourth time such a configuration is being flown, earlier three being PSLV-C11/ Chandrayaan-1, PSLV-C17 / GSAT-12 and PSLV-C 19 / RISAT-1 missions.

PSLV-C22 AT A GLANCE

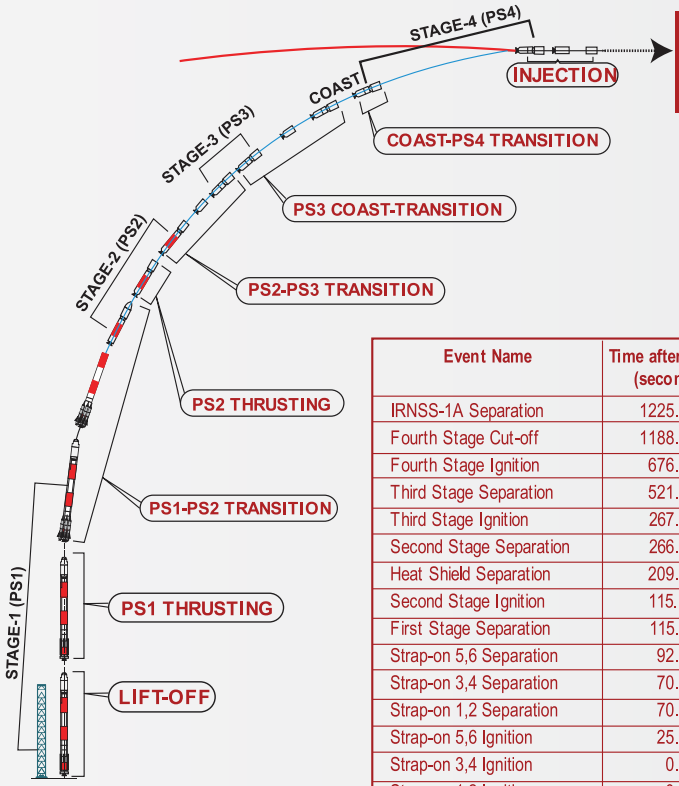
Lift-off Mass: 320 tons Height: 44 metres

	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)
Mass (T)	138 (Core), 6 x 12 (Strap-on)	41.7	7.6	2.5
Max Thrust (kN)	4819 (Core), 6 x 716 (Strap-on)	804	240	7.3 x 2
Burn Time (s)	101.5 (Core), 49.5 (Strap-on)	149	112.1	513
Stage Dia (m)	2.8 (Core), 1 (Strap-on)	2.8	2.0	2.8
Stage Length (m)	20 (Core), 14.7 (Strap-on)	12.5	3.6	2.6

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



IRNSS-1A in PSLV-C22 Envelope



Apogee	20,650 ± 675 km
Perigee	284 ± 5 km
Inclination	17.86 ± 0.2 deg

Event Name	Time after lift-off (second)	Altitude (kilometre)	Velocity (metres per second)
IRNSS-1A Separation	1225.4	501.0	9603.4
Fourth Stage Cut-off	1188.4	449.4	9642.8
Fourth Stage Ignition	676.0	189.9	7725.9
Third Stage Separation	521.4	162.8	7758.5
Third Stage Ignition	267.9	128.7	5382.1
Second Stage Separation	266.7	128.5	5382.5
Heat Shield Separation	209.0	112.5	3742.4
Second Stage Ignition	115.2	58.1	2391.0
First Stage Separation	115.0	58.0	2391.4
Strap-on 5,6 Separation	92.0	38.9	1955.1
Strap-on 3,4 Separation	70.1	23.5	1396.2
Strap-on 1,2 Separation	70.0	23.4	1391.7
Strap-on 5,6 Ignition	25.0	2.6	609.7
Strap-on 3,4 Ignition	0.7	0.02	452
Strap-on 1,2 Ignition	0.5	0.02	452
First Stage Ignition	0.0	0.02	452

PSLV-C22 TYPICAL FLIGHT PROFILE

Nozzle End Segment of PSLV-C22 first stage being positioned over the Launch Pedestal

PSLV-C22 first stage with strap-ons inside mobile service tower

PSLV-C22 Second Stage liquid engine being lowered into the interstage

The Satellite

IRNSS-1A undergoing tests in clean room

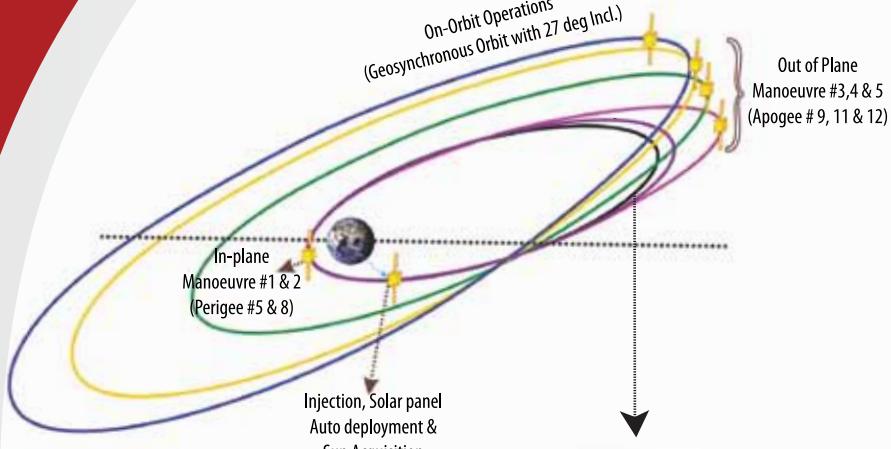
IRNSS-1A is the first satellite in the Indian Regional Navigation Satellite System (IRNSS). It is one of the seven satellites constituting the IRNSS space segment. The satellite has a lift-off mass of 1425 kg. The two solar panels with Ultra Triple Junction solar cells generate about 1660 Watts of electrical power. Sun and Star sensors as well as gyroscopes provide orientation reference for the satellite. Special thermal control schemes have been designed and implemented for some of the critical elements such as atomic clocks. The Attitude and Orbit Control System (AOCS) of IRNSS-1A maintains the satellite's orientation, with the help of reaction wheels, magnetic torquers and thrusters. The propulsion system of IRNSS-1A consists of a Liquid Apogee Motor (LAM) and thrusters.

IRNSS-1A is launched into a sub Geosynchronous Transfer Orbit (sub GTO) with a 284 km perigee (nearest point to Earth) and 20,650 km apogee (farthest point from the Earth) with an inclination of 17.86 deg with respect to the equatorial plane.

After injection into this preliminary orbit, solar panels of IRNSS-1A are automatically deployed and the Master Control Facility (MCF) at Hassan takes control of the satellite and performs the initial orbit raising manoeuvres using the Liquid Apogee Motor (LAM) onboard the satellite, finally placing it in the circular geosynchronous orbit at 55 deg East location with an inclination of 29 deg with respect to the equator.

IRNSS-1A: Sequence of Events

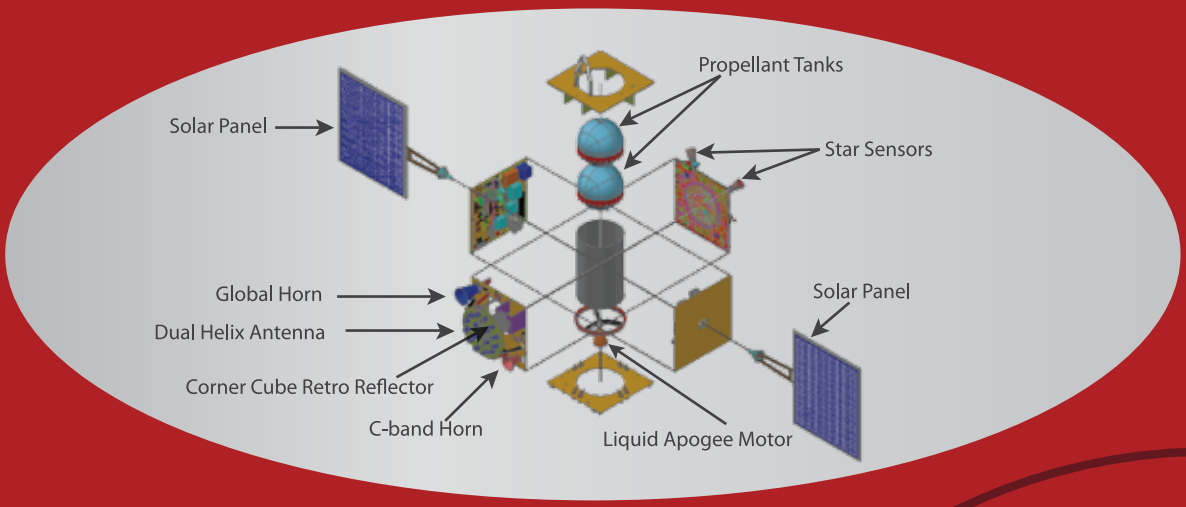
(Nominal Orbit Raising Strategy)



Apogee	20,650 ± 675 km
Perigee	284 ± 5 km
Inclination	17.86 ± 0.2 deg

IRNSS-1A salient features:

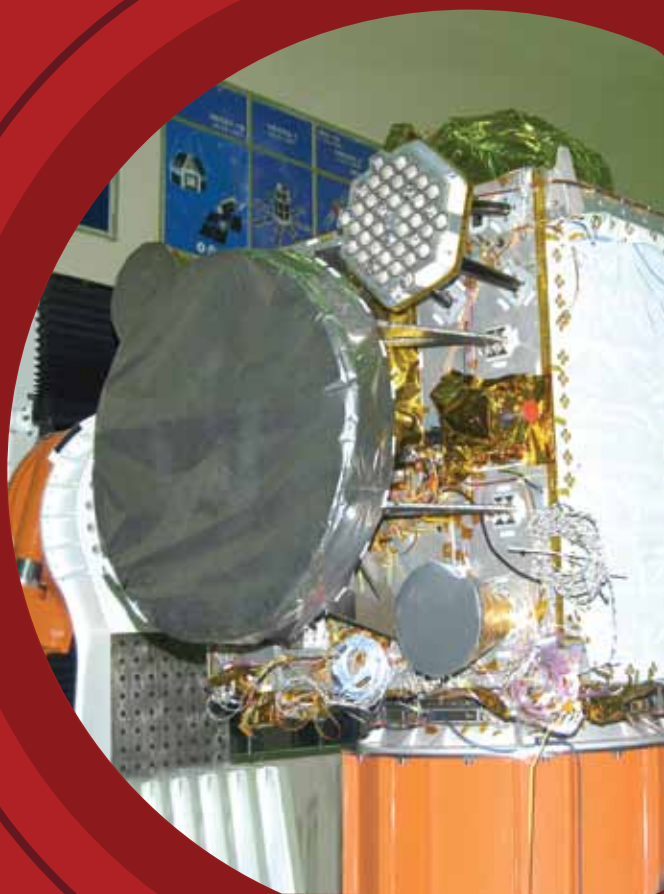
ORBIT	:	Geosynchronous, at 55 deg East longitude with 29 deg inclination
LIFT-OFF MASS	:	1425 kg
DRY MASS	:	614 kg
PHYSICAL DIMENSIONS	:	1.58 metre x 1.50 metre x 1.50 metre
POWER	:	Two solar panels generating 1660 W, one Lithium-ion battery of 90 Ampere-Hour capacity
PROPULSION	:	440 Newton Liquid Apogee Motor, twelve 22 Newton Thrusters
CONTROL SYSTEM	:	Zero momentum system, orientation input from Sun & Star Sensors and Gyroscopes; Reaction Wheels, Magnetic Torquers and 22 Newton thrusters as actuators
MISSION LIFE	:	Ten years



IRNSS-1A Disassembled View

PAYLOADS

IRNSS-1A carries two types of payloads - navigation payload and ranging payload. The navigation payload of IRNSS-1A will transmit navigation service signals to the users. This payload will be operating in L5 band (1176.45 MHz) and S band (2492.028 MHz). A highly accurate Rubidium atomic clock is part of the navigation payload of the satellite. The ranging payload of IRNSS-1A consists of a C-band transponder which facilitates accurate determination of the range of the satellite. IRNSS-1A also carries Corner Cube Retro Reflectors for laser ranging.



IRNSS Overview:

IRNSS is an independent regional navigation satellite system being developed by India. It is designed to provide accurate position information service to users in India as well as the region extending up to 1500 km from its boundary, which is its primary service area. The Extended Service Area lies between primary service area and area enclosed by the rectangle from Latitude 30 deg South to 50 deg North, Longitude 30 deg East to 130 deg East.

IRNSS will provide two types of services, namely, Standard Positioning Service (SPS) which is provided to all the users and Restricted Service (RS), which is an encrypted service provided only to the authorised users. The IRNSS System is expected to provide a position accuracy of better than 20 m in the primary service area.

IRNSS consists of a space segment and a ground segment. The IRNSS space segment consists of seven satellites, with three satellites in geostationary orbit and four satellites in inclined geosynchronous orbit. IRNSS ground segment is responsible for navigation parameter generation and transmission, satellite control, ranging and integrity monitoring and time keeping.

ISRO Navigation Centre (INC) at Byalalu, is the nerve center of the IRNSS Ground Segment. INC primarily generates navigation parameters

IRNSS Range and Integrity Monitoring Stations (IRIMS) perform continuous one way ranging of the IRNSS satellites and are also used for integrity determination of the IRNSS constellation.

IRNSS CDMA Ranging Stations(IRCDR) carry out precise two way ranging of IRNSS satellites.

IRNSS Network Timing Centre(IRNWT) at Byalalu generates, maintains and distributes IRNSS Network Time.

Spacecraft Control Facility (SCF) controls the space segment through Telemetry Tracking & Command networks. In addition to the regular TT&C operations, IRSCF also uplinks the navigation parameters generated by the INC.

IRNSS Data Communication Network(IRDCN) provides the required digital communication backbone to IRNSS network.

Laser Ranging Stations (ILRS) is planned to be used periodically to calibrate the IRNSS orbit determined by the other techniques

Applications of IRNSS:

- Terrestrial, Aerial and Marine Navigation
- Disaster Management
- Vehicle tracking and fleet management
- Integration with mobile phones
- Precise Timing
- Mapping and Geodetic data capture
- Terrestrial navigation aid for hikers and travellers
- Visual and voice navigation for drivers

Indian Space Research Organisation
Publications and Public Relations, ISRO Headquarters, Antariksh Bhavan
New BEL Road, Bangalore - 560 0231, India www.isro.gov.in

Design: Ideaworks.in
Printed by: M/s. Brilliant Printers Pvt. Ltd., B'lore-94