

# PSLV-C4 / KALPANA-1 Mission

12 September, 2002

## THE MISSION

PSLV-C4 carrying on-board the KALPANA-1 Satellite lifted-off from the Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota at 3.55 PM (IST) on September 12, 2002. Initially, PSLV was designed for launching 900 kg Indian Remote Sensing Satellites (IRS) into a 900 km Polar Sun-synchronous Orbit. Since its first launch in 1993 from Sriharikota, the four stage PSLV has been successively improved to enhance its capability. PSLV was used for the first time for launching a Communication Satellite.

Compared to the earlier PSLV launches, the flight path of PSLV-C4 has been modified to inject the KALPANA-1 into a Geosynchronous Transfer Orbit of 250 km perigee (nearest point to Earth) and 36,000 km apogee (farthest point to Earth).

METSAT (renamed as KALPANA-1 on February 5, 2003 after the Indian born American Astronaut Dr. Kalpana Chawla, who passed away on February 1, 2003 in the US Space Shuttle Columbia disaster) is the first exclusive Meteorological Satellite built by ISRO.

## PSLV - C4

### THE LAUNCH VEHICLE

PSLV-C4 is the 7<sup>th</sup> flight of Polar Satellite Launch Vehicle. The PSLV is provided with instrumentation to monitor the vehicle performance during the flight. S-band PCM telemetry and C-band transponders cater to this requirement. The tracking system provides real-time information for flight safety and for preliminary orbit determination once the satellite is injected into orbit.

In its present configuration, the 44.4 m tall, 295 tonne PSLV has four stages using solid and liquid propulsion systems alternately. The 3.2 m diameter metallic bulbous heat-shield of PSLV, which is made of isogrid construction, protects the spacecraft during the PSLV's passage through the dense atmosphere.

### PSLV Flight Control System:

- First stage:** Secondary Injection Thrust Vector Control (SITVC) for pitch and yaw, reaction control thrusters for roll and SITVC in two strap-on motors for roll control augmentation.
- Second stage:** Engine gimbal for pitch and yaw and, hot gas reaction control for roll.
- Third stage:** Flex nozzle for pitch and yaw and PS-4 RCS for roll.
- Fourth stage:** Engine gimbal for pitch, yaw & roll and on-off RCS for control during the coast phase.



### SPECIFICATIONS

<b>Height</b>	44.4 m
<b>Lift-Off Mass</b>	295 t
<b>No of Stages</b>	4
<b>Payloads</b>	KALPANA-1 (METSAT)
<b>Orbit Height</b>	250 km x 36,000 km
<b>Inclination (deg)</b>	18°
<b>Apogee</b>	36,000 km
<b>Perigee</b>	250 km

# KALPANA-1

## THE SATELLITE

KALPANA-1 was a precursor for a future INSAT system that was to have separate satellites for meteorology and telecommunications. KALPANA-1 carries a Very High Resolution Radiometer (VHRR) capable of imaging the Earth in the visible, thermal infrared and water vapour bands. It also carries weather Data Relay Transponder (DRT) for collecting data from unattended meteorological platforms. KALPANA-1 relays the data sent by these platforms to the Meteorological Data Utilisation Centre (MDUC) at New Delhi. It thus, supports the India Meteorological Department by providing meteorological services from Geostationary Orbit, including cyclone warning dissemination services, meteorological data collection and weather imagery on a continuous basis.

KALPANA-1 was a new generation spacecraft designed as a 1000 kg class bus that can be launched using PSLV into GTO, thus, providing cost-effective solution to small spacecraft needs in Geosynchronous Orbit. The spacecraft was configured around a new CFRP cylindrical structural platform with no sail / boom, indigenously developed propellant tanks, optimized RCS thrusters, bus subsystems with proven flight heritage and metrological payload derived from earlier INSAT mission inclusive of modifications for reliable operation.

## SPECIFICATIONS

<b>Weight</b>	1060 kg
<b>Power</b>	640 W
<b>Stabilization</b>	3-axis body stabilized using Momentum / Reaction Wheels, Magnetic Torquers, Sensors and Thrusters
<b>Type of Satellite</b>	Meteorological & Communication
<b>Payloads</b>	<ul style="list-style-type: none"><li>• Very High Resolution Radiometer (VHRR)</li><li>• Data Relay Transponder (DRT)</li></ul>
<b>Mission Life</b>	7 Years

