



India to Launch European Union's Solar Observatory Satellite Proba-3 in December

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Summary:

Union Minister of State (Independent Charge) for Science and Technology, Dr. Jitendra Singh, announced that India will launch the **European Union's Proba-3 satellite** in early December, marking a **significant milestone in Indo-EU space collaboration**.

- Speaking at the 3rd Indian Space Conclave, he highlighted the satellite's mission to observe the Sun, underscoring both nations' commitment to advancing scientific knowledge.

Key Developments in Indo-EU Space Collaboration

1. Announcement of Proba-3 Satellite Launch:

- **Dr. Jitendra Singh**, Union Minister of State for Science and Technology, announced that **India will launch the European Union's Proba-3 satellite** in **early December 2024**.
- This marks a significant milestone in the **Indo-EU space collaboration**.
- The **Proba-3 mission** will focus on **solar research**, specifically observing the Sun, and will further strengthen India-EU space cooperation.

1. Context of Collaboration:

- The launch builds on previous **EU-ISRO collaborations** but stands out due to its emphasis on **solar observation**, adding to **ISRO's** growing portfolio of space missions.
- This development follows on the heels of **ISRO's successful Chandrayaan-3 mission**, continuing India's momentum in space exploration.

1. Launch of SPADE and ISpA Awards:

- During the **3rd Indian Space Conclave**, Dr. Singh also unveiled **SPADE**, a product by **Suhora Technologies**, showcasing India's growing **space tech capabilities**.
- He presented the **ISpA Awards**, celebrating achievements in the Indian space sector and underscoring India's **vision for an advanced space industry** contributing to both national and global scientific progress.

PROBA-3: FORMATION FLYING DOUBLE SATELLITES

Proba-3 is ESA's – and the world's – first precision formation flying mission. A pair of satellites will adopt a fixed configuration in space, 144 m apart while lined up with the Sun so that one satellite blocks out the brilliant solar disk for the other. This will open up continuous views of the Sun's faint corona, or surrounding atmosphere, for scientific observation.

The cost in fuel would be too high to maintain formation continuously, so each orbit will be divided between six hours of actively controlled formation flying manoeuvres at apogee and the rest of the orbit in a passive safe trajectory.

Proba-3 will function as an orbital laboratory, demonstrating acquisition, rendezvous, proximity operations, formation flying, separation from 25 m to 250 m apart, while validating innovative metrology sensors and control algorithms, opening up novel methods of mission control.



The Coronagraph satellite hosts an instrument pointing directly at the Sun, equipped with comparable navigation and control systems and mono-propellant thrusters.

The Occulter satellite's main task is simply to block the Sun for the coronagraph instrument, using a 140 cm diameter occulting disk pointed away from the Sun. It steers using reaction wheels, gyroscopes, a star tracker, Sun sensors and GPS receivers, while also hosting optical metrology sensors, with cold gas thrusters for fine control of the formation.

Proba-3 Mission Overview

The **Proba-3 mission** is a pioneering space project designed to demonstrate **highly precise satellite formation flying** techniques. It will involve **two small satellites** that will launch together, then separate and fly in tandem to perform a variety of tasks, setting the stage for future **multi-satellite missions**. This mission represents a major leap forward in space science, providing essential technology for a range of applications, including Earth observation and in-orbit satellite servicing.

Mission Details:

1. Objective:

- The primary goal of Proba-3 is to demonstrate **formation flying**—a technology that will enable multiple satellites to operate as a single **virtual structure**. This allows for greater accuracy in tasks that require large apertures, long focal lengths, and baselines that a single satellite cannot achieve alone. Proba-3's precision will advance our ability to detect very faint signals and capture smaller features in space.

3. Satellites:

- Coronagraph spacecraft and Occulter spacecraft** are the two satellites that will fly in formation.
- The two will maintain **millimeter-level precision and arc-second accuracy** while maintaining a distance of **144 meters or more for up to six hours at a time**.
- The satellites will form a **virtual giant satellite** through their highly synchronized movements.

1. Key Features of Formation Flying:

- Formation flying** is crucial for missions requiring a large scale, like **Earth observation** and **in-orbit satellite servicing**.
- Precision in formation flying will also enable future missions to **assemble large-scale structures** in space, such as **space telescopes and space stations**.

1. Mission Orbit and Operations:

- The Proba-3 satellites will be launched into a **highly elliptical orbit** (600 x 60,530 km with a 59-degree inclination).
- Preparatory Phase:** The two satellites will begin in a **stack configuration**, and after a brief setup, they will be separated and placed into a **relative tandem orbit**.
- Collision Avoidance:** The mission will demonstrate a **Collision Avoidance Manoeuvre** during its commissioning phase to ensure the satellites remain safe from each other and avoid any risks of collision.

1. Scientific and Operational Goals:

- The Proba-3 mission will use the **solar coronagraph** to block the bright light of the Sun and capture continuous observations of the Sun's **corona** (the Sun's outer atmosphere).
- Formation Flying Operations:** The mission will alternate between **formation flying** at apogee (the highest point of the orbit) for **six hours**, and passive drifting during the rest of the orbit. This will involve **maneuvers, rendezvous, proximity operations, and coronagraph observations**.
- Proba-3 will repeatedly demonstrate the acquisition, rendezvous, and **convoy flying** techniques during each orbit.

1. Technological Demonstrations:

- Satellite Technologies:** Proba-3 will validate key technologies, including **relative GPS navigation, guidance, and navigation control** systems. These technologies will be instrumental in future space missions.
- Rendezvous Experiment:** The mission will test **sensors and algorithms** for cooperative and uncooperative rendezvous operations in **elliptical orbits**. This is particularly relevant for **future Mars missions**, like the

Mars Sample Return mission, and for the **de-orbiting of satellites** from low-Earth orbit.

1. Fuel Efficiency and Operational Cycle:

- Due to fuel constraints, the satellites cannot maintain their precise formation throughout the orbit. Therefore, the orbit will be divided into:
- **Six hours of formation flying at apogee** (the highest point in the orbit).
- **Passive drifting** during the rest of the orbit.

1. Proba-3 as a Space Laboratory:

2. Proba-3 will act as a **space laboratory** to validate strategies and algorithms related to formation flying. The data and technologies developed will have wide applications for **future missions**, particularly those involving multi-satellite systems or precise space operations.

Mission Timeline and Launch:

- **Launch Date: 2024.**
- **Mission Phases:** The mission's implementation phase (Phase C/D/E1) began in **July 2014**, and it is now nearing launch.

Significance:

- **Proba-3** represents a **world-first in precise formation flying**, setting the stage for more ambitious space missions in the future.
- The **technologies** demonstrated by Proba-3 will be critical for future space exploration and scientific missions, especially those involving multiple spacecraft working together as one unit.

Broader Impact:

- **Proba-3** is expected to **revolutionize satellite-based scientific observations**, especially in **solar research and space exploration**, and could enable more advanced, large-scale space infrastructure.