Voyager 1 – reached a Light-Day Distance

Mains: *GSIII – Science and Technology*

Why in News?

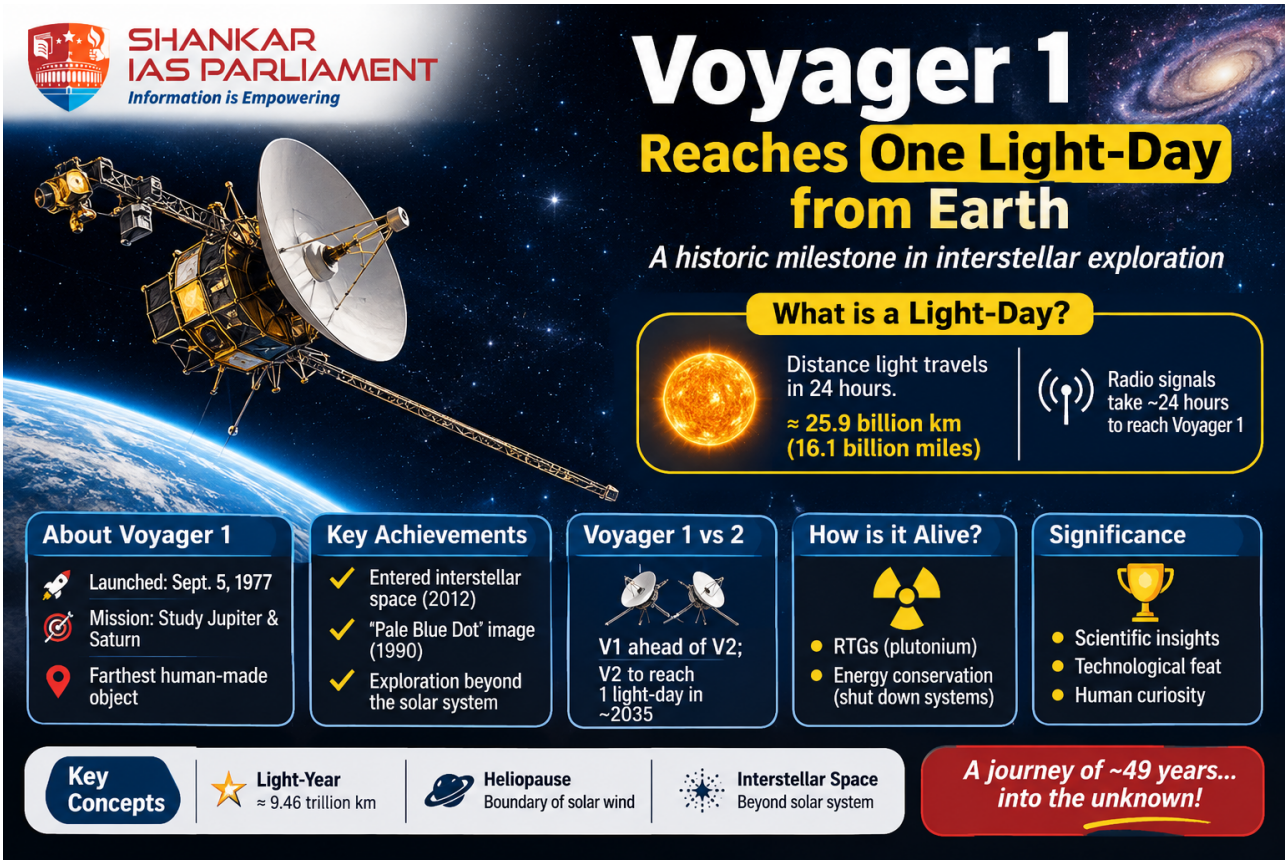
Recently the NASA's Voyager 1 became the first human-made object to reach a distance of one light-day from Earth on November 18, 2026.

What is One Light-Day?

- **A light-day** – It is a unit of distance representing the distance travelled by light in 24 hours.
- *Light travels at approximately 300,000 km per second.*
- At this distance, radio signals between Earth and Voyager 1 take approximately 24 hours one way and 48 hours for a round trip.

What is Voyager 1 mission?

- **Launch** – September 5, 1977.
- **Organisation** – NASA (National Aeronautics and Space Administration).
- **Original Mission** – Designed for a four-year mission to study Jupiter and Saturn.
- **Current Status** – Farthest human-made object from Earth.
- **Speed** – Approximately 38,000 miles per hour.
- **Trajectory** – Travelling in the direction of Gliese 445 (AC +79 3888), a star located over 17 light-years away in the constellation Ursa Minor.



What are the Major Achievements of Voyager 1?

- **Exploration of Outer Planets** – Conducted close-up studies of Jupiter and Saturn, providing valuable information about their moons, rings and atmospheres.
- **Entry into Interstellar Space** – Became the first spacecraft to enter interstellar space in August 2012, crossing the heliopause.
- **Pale Blue Dot** – Captured the iconic image of Earth from approximately 6 billion kilometres away in 1990.
- **Interstellar Exploration** – Continues transmitting scientific data about the environment beyond the heliosphere.

Voyager 1 and Voyager 2
• Both spacecraft were launched in 1977 to explore the outer planets. • Voyager 2 was launched 16 days before Voyager 1. • Voyager 1 eventually overtook its twin due to its different trajectory. • Voyager 2 is expected to reach the one-light-day distance from Earth in November 2035.

How is NASA Keeping Voyager 1 Operational?

- **Power Source** – Uses Radioisotope Thermoelectric Generators (RTGs), which convert heat from decaying plutonium-238 into electricity.
- **Power Decline** – Both Voyager spacecraft lose approximately 4 watts of electrical power annually.
- **Energy Conservation** – NASA has gradually switched off non-essential heaters and scientific instruments to conserve electricity.
- **Ground Support** – Engineers at NASA's Jet Propulsion Laboratory continue sending commands and managing spacecraft operations.

What is the Significance of the Voyager Mission?

- **Scientific Knowledge** – Expanded understanding of Jupiter, Saturn and the interstellar environment.
- **Technological Achievement** – Demonstrates the durability of spacecraft engineering and long-distance communication.
- **Human Exploration** – Represents humanity's ability to explore regions far beyond the solar system.
- **Future Research** – Provides valuable information about cosmic radiation, magnetic fields and interstellar plasma.

What are the Challenges of Deep-Space Exploration?

- **Communication Delay** – Increasing distances create significant delays in transmitting commands and receiving scientific data.
- **Limited Power** – Radioactive decay gradually reduces the electricity available for spacecraft operations.
- **Ageing Equipment** – Nearly five decades of operation have increased the risk of technical failures.
- **Operational Limitations** – Limited power requires NASA to progressively shut down scientific instruments.

What lies ahead?

- The Voyager 1 mission represents an extraordinary achievement in space exploration, demonstrating scientific curiosity, technological innovation.
- It further showcases the humanity's determination to explore the unknown.

Quick facts

Important Concepts	
Concept	**Explanation**
Light-year	Distance travelled by light in one year.
Light-day	Distance travelled by light in 24 hours.
Heliopause	Boundary where the solar wind's influence becomes weaker than the surrounding interstellar medium.
Interstellar Space	Region beyond the heliosphere between stars.
RTG	Device converting heat from radioactive decay into electrical energy.

Reference

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