Delay in Axiom-4 Mission

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Why in News?

Axiom-4 mission to the International Space Station (ISS) would be postponed indefinitely after a liquid oxygen (LOX) leak in SpaceX's Falcon-9 rocket.

- **Axiom-4 Mission** – It is the 4th mission planned by US-based spaceflight company Axiom Space to the International Space Station.
- **Agency -** Axiom Space.
- It uses a *SpaceX Crew Dragon spacecraft*.
- The mission is *commercial* and isn't part of the regular resupply missions NASA undertakes to the ISS.
- It aims to facilitate commercial activities in space, including scientific research, technological development, and space tourism.
- It consists of a crew of 4 people - Peggy Whitson, Shubhanshu Shukla (Indian), Sławosz Uznański-Wiśniewski, and Tobir Kapu.
- **Reason for delay -** Falcon-9 rocket's engines leaking liquid oxygen (LOX).

Liquid oxygen (LOX) is oxygen in its liquid state, a cryogenic fluid produced by cooling oxygen gas to its boiling point of -183°C (-297°F).

- If LOX is exposed to warmer conditions, the oxygen will turn into gas and *not be usable as fuel.*
- Falcon 9 engines combust a mix of rocket-grade kerosene and LOX to generate thrust, meaning a LOX leak is a serious issue.
- **Detectability issue -** When it leaks, LOX flashes to an invisible vapour almost instantly and can be blown away by winds or fans nearby.
- Detecting it often entails time-consuming, labour-intensive work.
- Many joints in the components associated with storing and pumping LOX are insulated with foam or are located in nooks, and can't physically reach them.
- Materials contract at cryogenic temperatures (around 90 K), so a hole may appear closed at ambient temperature but open at cryogenic temperatures.
- So once a hole has been fixed, engineers may need to repeat tests at both warm and cold conditions or test with liquid nitrogen to mimic operating conditions.
- Testing with LOX itself can be hazardous.
- Fortunately, experts have been working with cryogenic engines for long enough to know which tools to use and which processes to follow once the leak has been identified.
- They include visual inspection, bubble tests, helium signature tests, flow-meter tests,

ultrasonic microphones, and thermal imaging.

Reference

[The Hindu | Why has the Axiom-4 mission been delayed?]