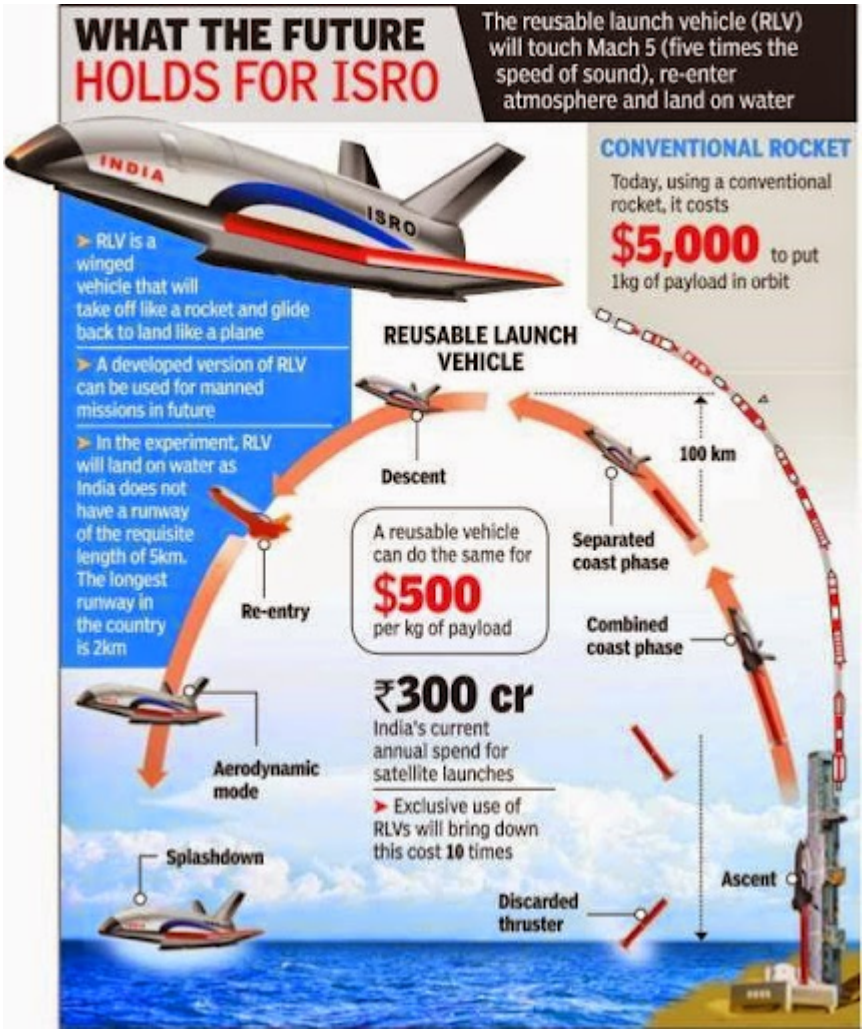
ISRO’s reusable Launch Vehicle

April 3, 2023

In news– The Indian Space Research Organisation and its partners successfully demonstrated a precise landing experiment for a Reusable Launch Vehicle at the Aeronautical Test Range (ATR), Chitradurga, Karnataka.

About Reusable Launch Vehicle(RLV)-

- The RLV Autonomous Landing Mission (RLV LEX) test was the second of five tests that are a part of ISRO’s efforts to develop RLVs, or space planes/shuttles, which can travel to low earth orbits to deliver payloads and return to earth for use again.
- The experiment was carried out nearly seven years after the technology demonstration of an RLV and the first experiment was conducted successfully by ISRO in 2016, on the RLV-TD (HEX) mission.



ISRO's RLV TD project-

- According to ISRO, the series of experiments with the winged RLV-TD are part of efforts at developing essential technologies for a fully reusable launch vehicle to enable low-cost access to space.
- **The RLV-TD will be used to develop technologies like hypersonic flight (HEX),** autonomous landing (LEX), return flight experiment (REX), powered cruise flight, and Scramjet Propulsion Experiment (SPEX).
- In the future, this vehicle will be scaled up to become the first stage of India's reusable two-stage orbital (TSTO) launch vehicle.
- **ISRO's RLV-TD looks like an aircraft.** It consists of a **fuselage, a nose cap, double delta wings,** and twin vertical tails.
- The 2016 experiment involved sending a winged spacecraft

on a rocket powered by a conventional solid booster (HS9) engine used by ISRO into space.

- **The spacecraft traveled at a speed of Mach 5 (five** times the speed of sound) when re-entering the earth's orbit and traveled a distance of 450 km before splashdown in the Bay of Bengal.
- When the first experiment was done in 2016, ISRO officials described it as a "baby step" in the development of an RLV.
- **A rocket carrying the 1.75 tonnes RLV-TD was launched** into space for 91.1 seconds and reached a height of about 56 km, when the RLV-TD separated from the rocket and climbed to a height of about 65 km.
- From this height, **the RLV-TD began its return to earth and entered the atmosphere at a speed of around Mach 5** and was **navigated by the vehicle's own systems to a predetermined landing spot** in the Bay of Bengal, around 450 KM from the launch site at Sriharikota.
- The RLV was tracked during the flight from ground stations at Sriharikota and a terminal on a ship. While the **re-entry into the earth's atmosphere happens at a velocity of 8 km/sec the RLV TD HEX1** was tested at a much lower velocity of 1.7 km/sec to 2 km/sec.

About the second experiment-

- **The RLV LEX recent test involved a Chinook Helicopter of the Indian Air Force lifting the RLV LEX to a height of 4.5 km** and releasing the RLV, based on a command from Mission Management Computer.
- After midair release, the RLV carried out an autonomous landing under the exact conditions of a Space Re-entry vehicle's landing – high speed, unmanned, precise landing from the same return path – as if the vehicle arrived from space.

What was the difference in the two tests?

- According to ISRO, the **first test with RLV-TD (HEX1) involved the vehicle landing on a hypothetical runway** over the Bay of Bengal while the recent LEX experiment involved a precise landing on a runway.
- The LEX mission achieved the final approach phase that coincided with the re-entry return flight path exhibiting an autonomous, high speed (350 km per hour) landing. With LEX, the dream of an Indian Reusable Launch Vehicle arrives one step closer to reality.
- Three more experiments return flight experiment (REX), powered cruise flight, and Scramjet Propulsion Experiment (SPEX) have to be conducted.

Its advantages-

With the costs acting as a major deterrent to space exploration, a reusable launch vehicle is considered a low-cost, reliable, and on-demand mode of accessing space.

By using RLVs the cost of a launch can be reduced by nearly 80 percent of the present cost.

Note:

- Reusable space vehicles have been in existence for a long time with NASA space shuttles carrying out dozens of human space flight missions.
- The use case for reusable space launch vehicles has revived with the private space launch services provider Space X demonstrating partially reusable launch systems with its Falcon 9 and Falcon Heavy rockets since 2017.
- SpaceX is also working on a fully reusable launch vehicle system called Starship.
- Several private launch service providers and government space agencies are working on developing reusable launch systems in the world alongside ISRO.