

Reusable Launch Vehicle

India launched its first-ever indigenous space shuttle Reusable Launch Vehicle -Technology Demonstrator (RLV – TD) successfully in 2016.

The major hurdle in the exploration of space and its utilisation is the cost factor. The challenges imposed due to very high cost can be addressed through the development of Reusable Launch Vehicle (RLV) which would help in drastically reducing the costs incurred in space exploration in addition to providing a reliable option for a nation's pursuits in space.

This topic would be of importance in the [IAS Exam](#) from the Prelims and Mains perspective, in understanding India's advances, in the domain of Space technology.

What is RLV-TD?

It is a prototype vehicle developed to achieve the Two-Stage To Orbit (TSTO) Reusable Launch Vehicle (RLV).

Which organisation handles the RLV-TD Programme?

[Indian Space Research Organisation](#) (ISRO) handles the RLV-TD programme. The Technology Demonstration Programme consists of the development of a hypersonic rocket with air-breathing engines and the reusable launch vehicle

When did the first RLV-TD test flight take place?

The first test-flight took place on 23rd May 2016 from Satish Dhawan Space Centre in Sriharikota, Andhra Pradesh

What will be the main function of the fully developed Reusable Launch Vehicle (RLV)?

The main function of a fully developed Reusable Launch Vehicle is to deploy a satellite in Orbit, return to earth by landing on a runway.

What are the technologies that will be evaluated in the test flight of RLV-TD?

The technologies that will be evaluated in this test flight are

1. Powered cruise flight
2. Hypersonic flight
3. Autonomous landing using air-breathing propulsion.

The development of the final version of RLV-TD is expected to take between 10 to 15 years.

Which are the organisations involved in the design and development of RLV-TD?

As it involves complex engineering, multiple organisations were involved in developing this state of the art machine.

The below table gives the organisations and their respective work

Organisation	Work done in Design and Development
National Aerospace Laboratories (NAL)	Aerodynamics characterisation on the RLV-TD prototype
CIM Technologies, Hyderabad	Built RLV-TD
Vikram Sarabhai Space Centre (VSSC)	Installation of thermal tiles on the outer surface for protection against intense heat

RLV – TD Specifications & Features

1. Constructed using special alloys, composites, and insulation materials
2. Launch Mass – 1.75 tonnes
3. Length – 6.5 metres.
4. Wingspan – 3.6 metres
5. 600 heat resistant tiles on its undercarriage

RLV – TD Mission programme

The main 2 objectives of the RLV-TD mission are

1. To assist the Coast Guard for mid-sea wind measurement.
2. To assist the [National Institute of Ocean Technology](#) (NIOT) for shipborne telemetry.

The other objectives of RLV-TD are:

- Hypersonic aero thermodynamic characterisation of wing body
- Evaluation of autonomous Navigation, Guidance and Control (NGC) schemes
- Integrated flight management
- Thermal Protection System Evaluation

The RLV-TD mission consists of 4 major steps before the development of the final Reusable Launch Vehicle (RLV).

1. Hypersonic Flight Experiment (HEX) – it was conducted in May 2016.

2. Landing Experiment (LEX)
3. Return Flight Experiment (REX)
4. Scramjet Propulsion Experiment (SPEX)

From where was the RLV-TD launched and how was it launched?

RLV-TD was launched from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota, located in Nellore District of Andhra Pradesh.

RLV-TD was launched using an HS9 solid rocket booster, which had a diameter of 1 metre and weighing 9 tonnes.

The lift-off lasted from 91.1 seconds; RLV-TD and the HS9 solid rocket booster separated at an altitude of 56 Km. RLV-TD further climbed to an altitude of around 65 km. The Thermal Protection System of RLV-TD helped it to withstand the high temperatures while it was re-entering [Earth's atmosphere](#) at Hypersonic Velocity of Mach 5. The total flight duration from launching to landing took 770 seconds.

Where did the RLV-TD land?

RLV-TD landed at a pre-determined spot in the Bay of Bengal, at a distance of 450 Km from Sriharikota.

How is the ISRO approach to reusable launch vehicles different from that of SpaceX and Blue Origin?

The objective of the above organisations is the same i.e. reducing the highly exorbitant launch costs.

The below table gives the difference in approach between ISRO and other organisations in reducing costs

The methodology of Launch Vehicle Reusability between ISRO, SpaceX, and Blue Origin

ISRO	SpaceX and Blue Origin
Using Winged Body Space Plane as a reusable launch vehicle	Recovering and reusing stages of their existing rockets.

What is the next mission of RLV-TD?

The next mission is the Landing Experiment (LEX). The objective of this mission is to test the landing capability of RLV-TD on a runway.

Will this Reusable Launch Vehicle (RLV) be used for the upcoming Gaganyaan Mission?

No, RLV will not be used in the Gaganyaan mission. A Space Capsule will be used in Gaganyaan Mission.