ISRO – Achievements and Challenges

Mains: *GS-III – Science & Technology | Space Technology*

Why in News?

Over the past decade, ISRO has built an impressive record despite its modest size and budget, but its next major challenge lies in transforming landmark missions into a scalable industrial system.

What are the recent achievements of ISRO?

- **PSLV –** ISRO's rockets, particularly the Polar Satellite Launch Vehicle (PSLV), have consistently provided dependable access to orbit, making the launch of diverse satellite classes nearly routine.
- **Chandrayaan-3** (2023) – It has achieved a successful soft landing on the Moon (Aug 23, 2023), made India the 4th country to demonstrate lunar landing capability.
- **Aditya-L1** (2024) – India's first solar observatory mission, placed in halo orbit around L1 on Jan 6, 2024, adding a dedicated solar observatory mission to ISRO's portfolio.
- **NISAR Mission** (2025) – It is a prominent international collaboration between NASA and ISRO, launched in July 2025, an earth-observation platform for climate and hazard monitoring.
- **SpaDeX Mission** (2025) – India's first space docking experiment (Jan 2025), two small satellites (SDX01 "Chaser" and SDX02 "Target") successfully demonstrated autonomous docking technology.

What are the challenges ISRO needs to overcome?

ISRO's structural prioritisation problem

- **Parallel priorities –** ISRO has multiple priorities in parallel - the human spaceflight mission, complex science missions, satellite replenishment, and the development of Next-Generation Launch Vehicle (NGLV).
- **Private sector dependence –** At the same time private launch providers still depend heavily on ISRO facilities and infrastructure, meaning the system can't yet offload work at scale.
- **Vehicle limitation –** GSLV Mk III (Bahubali) is reliable but only medium-lift, not sufficient for heavier missions.
- **Low launch statistics (2025) –** In 2025, ISRO carried out only five launches, falling short of Chairman V. Somanath's already modest projection of eight.
- **Current bottleneck –** ISRO's low annual launch rate and extended project timelines

have become increasingly evident, reflecting delays and a shift towards big-ticket programmes.
- Also, include inadequate test stands, restricted integration capacity, and weak industrial supply chains.

Governance & Legal Framework

- **Post 2020 reforms –** India has liberalised its space sector, but in reality Roles are defined but not fully operational in practice.
- **Lack of comprehensive law –** ISRO's role in India's liberalised space and spaceflight ecosystem is constrained by the absence of a comprehensive national space law.
- **Third Party Liability Gap** – The absence of clear responsibility for third-party liabilities often results in ISRO being drawn in by default as the most capable state actor.
- **Statutory Authority for ISRO** – Without statutory authority, ISRO continues to act as the fallback regulator.

Competitiveness & Industrial Depth

- **Global Trends vs India's Response** – As the world advances toward frequent launches, reusable launch vehicles, and rapid satellite production, India must respond with more than just expanded engineering ambitions.
- **Framing the NGLV –** The Indian government presents the NGLV as a high-capacity (up to 30 tonnes to LEO), partially reusable system.
- It acknowledges that economic launches and agility are now central, rather than optional, features of enterprises that operate launch vehicles.
- **Requirements for competitiveness** – For building such systems and operating them in turn requires more production depth, advanced manufacturing capabilities, higher qualification capacity, and much more capital.
- **Declining Investment trends** – In 2024, investment in India's space sector declined significantly, driven by global headwinds and the challenges of financing long horizon hardware projects.

What are the measures to overcome these challenges?

- **Ultimate Aim –** ISRO should not be forced to act as the designer and the integrator, and the bottleneck for all missions simultaneously.
- **Need for a National Space Law** – A national space law would help startups and protect ISRO by reducing the ad hoc demands on ISRO as fallback regulator/certifier.
- To ensure continuity beyond political and administrative changes.
- **Policy response –** IN-SPACe has launched a technology adoption fund aimed at helping firms bridge prototypes with scalable products and at reducing import dependence, among other funding instruments.
- **Better operational improvements** – ISRO needs
    - More integration capacity,
    - Better access to test stands, industrial supply chains for structures and avionics, and
    - A workflow that can absorb setbacks without freezing unrelated programmes or

limiting their timelines.

- **Internal Management Measures –** The first step is to create an internal system that lets scientists decide which mission timelines can be delayed and why, with separate resources for R&D and operational vehicles, and more industrial capacity.
- **Institutional Roles & Legal Authority**
  - **IN-SPACe** – If it is to be the authorising body, it needs to have legal authority.
  - **NSIL** – If it is to be the commercial arm, should not face unclear liability in case of commercial mission failures.
  - **ISRO** – Focus on frontier capabilities; insulated from routine tasks (test stands, spectrum allocation).
- **Legal & Statutory Needs –** ISRO and related bodies require statutory authority to function efficiently.
- Clear legal allocations are needed for authorization, liability, insurance, dispute resolution, defined responsibilities must ensure ISRO is insulated from routine regulatory tasks, allowing it to focus on core missions.
- **Resource & Industrial Strengthening** – Separate resource allocations for R&D vs operational vehicles, stronger industrial base, and workflows resilient to anomalies.

What lies ahead?

- **ISRO's Past & Present** – ISRO's past accomplishments have earned it political capital and public trust but the next phase depends on sustained institutional performance, not just individual feats.
- **Capacity to Execute** – India's ability to deliver ambitious missions in a routine way will hinge on its execution capacity.
- **Governance & Law** – It will decide whether the government's efforts to liberalise the sector will reduce ISRO's burden or, counterintuitively, expand it.
- **Transition to Industrial System** – To compete, ISRO must evolve from individual missions into an industrial ecosystem, with engineering, regulation, manufacturing, and finance advancing together.

References

1. The Hindu | Why ISRO's next big challenge is to succeed on an industrial scale
2. Times of India | Major achievements of ISRO

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