



AXIA IAS ACADEMY



EDITORIAL ANALYSIS



JULY 19



**CONSISTENT
COMPREHENSIVE
AND CREDIBLE**



**UNIQUE AND BEST IN
QUALITY**

- 1. India's Parliament must not stage its Cadaver Synod (THE HINDU)**
- 2. A trade deal that tests India's competitive confidence (THE HINDU)**
- 3. India now has the funds, the talent and the opening for a research leap (THE INDIAN EXPRESS)**
- 4. New escape velocity? Isro's talent exodus can still be a win for India (THE TIMES OF INDIA)**



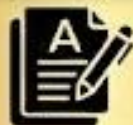
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- **Key Terms and Explanations**

- **The Energy Trilemma:** A governance framework that requires balancing three conflicting objectives: **Energy Security** (securing uninterrupted supply), **Energy Equity** (providing affordable, accessible power to all), and **Environmental Sustainability** (mitigating climate change and reducing emissions).

- *Example:* Relying solely on solar power achieves sustainability but compromises security when the sun sets; relying on coal achieves equity and security but destroys sustainability. Nuclear energy emerges as a potent solution to balance all three.

- **Pressurized Heavy Water Reactor (PHWR):** A nuclear power reactor that uses unenriched natural uranium as its fuel and heavy water (D_2O) as both its coolant and neutron moderator. India's domestic fleet relies heavily on this technology due to its compatibility with indigenous natural uranium resources.

- **Prototype Fast Breeder Reactor (PFBR):** A type of nuclear reactor that generates more fissile material than it consumes. India's flagship 500 MWe PFBR at Kalpakkam utilizes a mix of plutonium-uranium oxide fuel to "breed" more fissile material while simultaneously irradiating thorium to pave the way for future fuel cycles.

- **The SHANTI Act (2025):** The *Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India Act*, enacted in late 2025. This landmark domestic legislation dismantled the historic state monopoly over the civilian nuclear sector, permitting private entities to hold up to a 49% equity stake in nuclear power projects.

- **Small Modular Reactors (SMRs):** Advanced commercial reactors with a power capacity of up to 300 MW per module—roughly one-third of a traditional gigawatt-scale reactor. India's indigenous variant, the *Bharat Small Reactor*, adapts the existing 220 MW PHWR platform into a factory-fabricated, low-upfront-cost solution ideal for industrial decarbonization.

- **Nuclear Suppliers Group (NSG) & Non-Proliferation Treaty (NPT):** The NPT is the global treaty aimed at preventing the spread of nuclear weapons. The NSG is a 48-member export-control body that regulates global civilian nuclear trade. India remains a non-signatory to the NPT due to its discriminatory nature, yet operates under a unique 2008 NSG waiver that allows it to engage in global nuclear commerce.

- **Main Arguments and Substantive Parts**
- The structural transformation of the nuclear energy ecosystem rests on a clear core thesis: **Achieving rapid economic expansion alongside aggressive net-zero decarbonization necessitates an absolute transition away from fossil fuels, which can only be secured via an open, diversified global fuel supply chain integrated with deep domestic regulatory liberalization.**
- **The Core Pillars of Argumentation**
- **The Limits of Domestic Extraction and the Intermittency of Renewables:** While solar and wind capacities have grown rapidly, their inherent intermittency creates severe grid vulnerabilities for a manufacturing-heavy economy. Base-load power must fill this void. However, domestic uranium entities face low-grade reserves, high extraction costs, and systemic supply shortfalls, frequently forcing domestic PHWRs to operate well below peak efficiency.
- **The Geopolitical Zero-Sum Game for Global Uranium Sourcing:** The international uranium market is not a neutral commercial space; it is highly competitive and deeply politicized. Major powers—most notably China—are aggressively expanding their domestic fleets and capturing equity stakes in resource-rich African and Central Asian nations. For India, securing formal, long-term administrative arrangements with major resource holders like Australia and Canada acts as a crucial strategic hedge against being structurally locked out of the global market.
- **The Regulatory Shift from State Monopoly to Private Capital:** A major bottleneck to scaling nuclear capacity from under 9 GW to the target of 100 GW by 2047 has been capital scarcity. By utilizing newly passed legislative frameworks like the SHANTI Act, the state is actively courting private capital. Allowing a 49% private equity stake creates a twin-track strategy: public enterprises can handle core design and operations, while private investment absorbs the massive capital expenditures required for civil construction and equipment supply.
- **Counterarguments and Implementation Risks:** Skeptics frequently point out that heavy reliance on external fuel matrices risks trading an old dependency on oil and gas for a new dependency on imported yellowcake uranium. Furthermore, the commercialization of advanced reactor technologies, such as fast breeders, has historically suffered from extensive technological delays. The counter-response is that international sourcing is merely a transitional bridge; by locking in foreign uranium now, India rapidly feeds its first-stage reactors to build the massive plutonium stocks required to jumpstart its long-term, self-sustaining indigenous thorium cycle.

- **Historical Evolution of the Issue**

- India's journey from a nuclear outlier to a mainstream global nuclear partner is a masterclass in strategic patience, diplomatic finesse, and technological persistence.

- **The Genesis (1950s):** Dr. Homi Bhabha formulates the visionary Three-Stage Nuclear Power Programme. Acknowledging that India possesses limited natural uranium but vast coastal reserves of thorium, the strategy is explicitly designed to maximize natural uranium in Stage 1 (PHWRs), use the byproduct plutonium in Stage 2 (Fast Breeder Reactors), and finally transition to self-sustaining Thorium-Uranium cycles in Stage 3.

- **The Era of Nuclear Isolation (1974–2008):** Following the "Smiling Buddha" peaceful nuclear explosion in 1974 and the Pokhran-II weapon tests in 1998, India was placed under a strict international technology and fuel embargo. Cut off from global markets, the domestic program had to rely exclusively on constrained domestic resources, severely slowing down commercial scaling.

- **The Diplomatic Breakthrough (2008):** The signing of the historic Indo-US Civil Nuclear Deal and the subsequent negotiation of a unique waiver from the Nuclear Suppliers Group (NSG). This fundamentally decoupled India's military program from its civilian sector, allowing the country to import foreign fuel and reactors without signing the NPT.

- **The Diversification Matrix (2014–2024):** India systematically signs civil nuclear cooperation agreements with a wide array of global partners, including Kazakhstan, Uzbekistan, Russia, and Canada. In 2014, an initial pact was signed with Australia, followed by ratification in 2015, beginning a long period of negotiation over administrative arrangements.

- **The Modern Paradigm Shift (Late 2025 – Mid 2026):**

- *December 2025:* The enactment of the SHANTI Act legally ends the absolute monopoly of state-owned enterprises over civilian nuclear assets.
- *April 2026:* The indigenously built 500 MWe Prototype Fast Breeder Reactor (PFBR) at Kalpakkam achieves its historic first criticality, officially bridging the gap between Stage 1 and Stage 2.
- *July 2026:* The finalization of the administrative arrangements under the India-Australia Civil Nuclear Cooperation Agreement in Melbourne, unlocking direct, long-term uranium exports from the world's largest resource holder to Indian ports.

MASTERCLASS ANALYSIS: India's Nuclear Energy Architecture and Global Supply Chain Dynamics

Comprehensive Review for UPSC CSE Aspirants

KEY TERMS & EXPLANATIONS

1 THE ENERGY TRILEMMA



2 PHWR (Pressurized Heavy Water Reactor)

- Unenriched natural uranium fuel
- D2O coolant/moderator



3 PFBR (Prototype Fast Breeder Reactor)

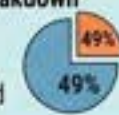
- Kalpakkam 500 MWe
- Breeds fissile
- Breeds fissile
- uses thorium



4 THE SHANTI ACT (2025)

Legislative breakdown

- Private private 49%
- equity allowed



5 SMRs (Small Modular Reactors)

- Up to 300 MW
- Factory-built modules
- Industrial decarbonization



6 NSG & NPT

- NSG 48-member export-control India 2008 Waiver vs. NPT non-signatory status

MULTIDIMENSIONAL ANALYSIS (6 Dimensions)

SOCIAL:
Energy Justice/Equity to rural homes



POLITICAL:
Cooperative Federalism with state alignment lines



LEGAL:
De-monopolization SHANTI ACT 49% Private Equity structure



ETHICAL:
Impeccable Non-Proliferation Stewardship Dove



INTERNATIONAL:
Indo-Pacific Strategic Architecture Map Connecting fuel (Aus/Canada/Kazakhstan)



ECONOMIC:
Mitigating Spot-Market Volatility (Cameco/Aus contract visuals)



STRATEGIC SHIFT & LOGICAL BASE

CORE ARGUMENTS:

Limits of Intermittency & Domestic Extraction



REGULATORY MONOPOLY TO PRIVATE CAPITAL:
Before SHANTI Act After SHANTI Act



GEOPOLITICAL LOGIC:
Strategic Autonomy



HISTORICAL EVOLUTION



WAY FORWARD: 4-PRONGED STRATEGY

1. Streamline Public-Private Joint Ventures



2. Standardize & Mass-Produce SMRs



3. Accelerate Transition to Stages 2 & 3



4. Deepen Commercial Diplomacy



EXAM PERSPECTIVE

KEY UPLOAD
GS PAPER II,
III, IV

PREVIOUS YEARS' UPSC/APSC QUESTIONS

- Trilemma in GS III
- NSG in GS II
- Liability/Ethics in GS III/IV

NCERT FOCUS:

Geography
Minerals, Economics
Infrastructure, Political
Environment

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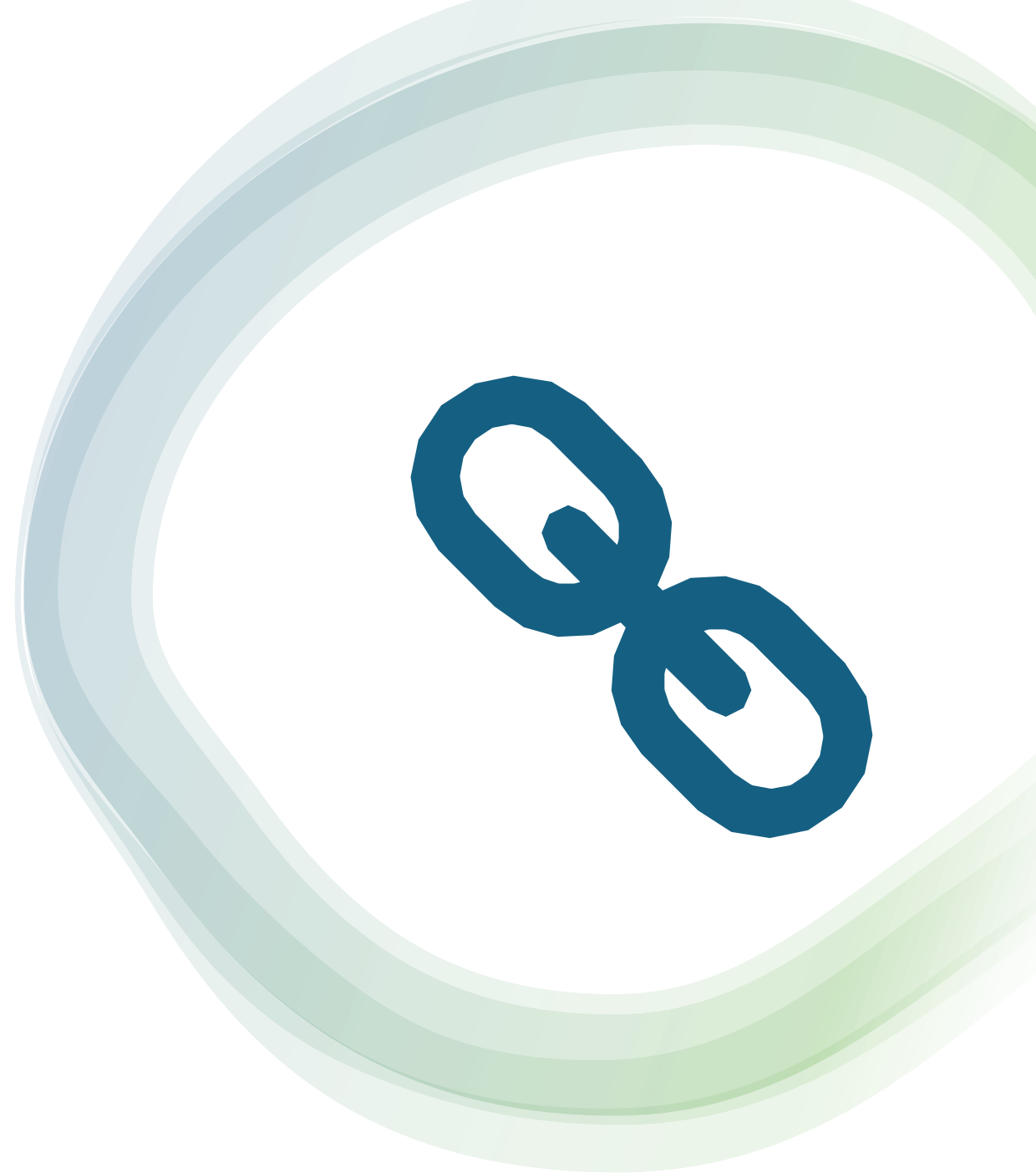
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RISE ABOVE THE REST

- **Logical and Philosophical Base**
- **Strategic Autonomy and Resource Realism:** At its core, the policy reflects classical *Realpolitik*. In a fractured, multipolar world order, relying on a single geographic hub for critical inputs invites economic coercion. The underlying logic here is "strategic diversification"—by weaving a supply web across Eurasia (Russia, Kazakhstan), North America (Canada), and the Indo-Pacific (Australia), India ensures that no single geopolitical shock can paralyze its domestic energy grid.
- **Intergenerational Equity and Environmental Ethics:** The philosophy of sustainable development dictates that the current generation must not fulfill its growth needs by permanently destroying the biosphere for future generations. Because gigawatt-scale nuclear energy offers zero-carbon base-load power, it satisfies the ethical imperative of leaving behind a stable climate while ensuring the economic upliftment of millions out of poverty.
- **Techno-Nationalism Coupled with Pragmatic Internationalism:** There is a fascinating philosophical balance between self-reliance (*Atmanirbhar Bharat*) and global integration. The logical flow assumes that pure isolationism leads to technological stagnation, while total dependence leads to strategic vulnerability. The synthesis is pragmatic: import raw fuel matrix materials from trusted global partners to rapidly scale up domestic, proprietary technology like the Prototype Fast Breeder Reactor and Bharat Small Reactors.

- **Multidimensional Analysis**
- **Social Dimension**
 - **Energy Justice vs. Displacement Discontent:** Nuclear expansion provides high-quality, continuous electricity to marginalized rural and urban areas, promoting social equity. However, the land acquisition required for large-scale reactors often triggers sharp local resistance and concerns over displacement, livelihood rehabilitation, and public safety perceptions.
 - **Skill Demands and High-Tech Employment:** Unlike traditional resource extraction, the nuclear supply chain demands a highly skilled workforce. Investing in this sector sparks a social upgrade in educational standards and creates long-term, specialized engineering and technical jobs across the country.
- **Political Dimension**
 - **Cooperative Federalism and Local Consensus:** Nuclear policy is a central subject, but executing projects requires deep alignment with state governments regarding land, water infrastructure, and law and order. Building a stable political consensus across state lines is vital to prevent local protests from stalling nationally important projects.
 - **Bipartisan Foreign Policy Continuity:** The successful transition from the 2008 NSG waiver to the modern administrative arrangements with resource superpowers highlights a rare, stable foreign policy consensus in New Delhi that spans across changes in political leadership.
- **Legal Dimension**
 - **De-monopolization via the SHANTI Act:** This legislation fundamentally redefines the legal boundaries of civilian atomic energy by creating a structured framework for private equity (up to 49%). It creates a complex legal task: maintaining strict state oversight over fissile material tracking while offering private investors predictable, commercially viable corporate governance.
 - **Civil Nuclear Liability Complexities:** Operating a nuclear supply chain involves navigating the Civil Liability for Nuclear Damage Act. Aligning domestic liability clauses with international conventions remains a delicate legal balancing act to ensure foreign equipment suppliers feel legally insulated while protecting domestic citizens' right to compensation.
- **Ethical Dimension**
 - **The Morality of Non-Proliferation Stewardship:** Despite operating outside the NPT framework, India has maintained an impeccable, self-imposed non-proliferation record. This ethical stewardship is the primary reason global democracies are willing to supply sensitive energy resources without demanding complete strategic submission.
 - **Nuclear Waste and Intergenerational Risk:** A deep ethical dilemma centers on the management of high-level radioactive waste. While the fast breeder program minimizes waste by recycling spent fuel, the long-term storage of nuclear byproducts presents an ethical challenge regarding the safety of generations yet unborn.
- **International Dimension**
 - **Securing the Indo-Pacific Strategic Architecture:** The operationalization of supply lines with Australia deeply strengthens the broader bilateral Comprehensive Strategic Partnership. It transforms a shared maritime security vision into a concrete, material economic interdependence.
 - **Countering the China-Centric Resource Monopolization:** As China aggressively locks up global mining assets, India's proactive partnerships with alternative resource providers like Canada and Kazakhstan prevent the emergence of a unipolar energy landscape in Asia. It also secures vocal diplomatic backing from major suppliers for India's eventual full integration into the NSG.
- **Economic Dimension**
 - **Mitigating Spot-Market Volatility:** By pivoting away from short-term spot markets toward long-term, fixed-price administrative supply contracts (such as the multi-billion dollar Cameco pact), India insulates its macro-economy from sudden price shocks in the global energy market.
 - **Unlocking Private Capital for Low-Upfront SMRs:** Traditional gigawatt reactors carry massive upfront financial risks and long construction periods. By utilizing private investment via the SHANTI Act to manufacture factory-built, modular Bharat Small Reactors, the state helps capital-intensive heavy industries (like steel and cement) decarbonize cost-effectively.

- **Linkages with NCERTs**
- **Class XII Political Science (Contemporary World Politics):** *Chapter on Environment and Natural Resources.* This chapter covers the geopolitics of resource allocation, global commons, and the intense competition for energy security. It provides the essential background for understanding why India must aggressively diversify its global uranium matrix to counter resource monopolization.
- **Class X & XII Geography (Contemporary India-II & India: People and Economy):** *Chapters on Mineral and Energy Resources.* These sections provide the exact geographical distribution of India's domestic atomic minerals—detailing the limited, low-grade uranium deposits in Jharkhand (Jaduguda) and the extensive monazite sand reserves (thorium) along the coasts of Kerala and Odisha. This highlights the geographic necessity behind the Three-Stage Nuclear Programme.
- **Class XII Economics (Indian Economic Development):** *Chapter on Infrastructure.* This text outlines how critical infrastructure acts as a primary catalyst for GDP growth. It directly links to the concept of base-load power requirements and explains why sustainable economic development is impossible without solving the core bottlenecks of the national energy grid.



- **Linkages with UPSC CSE Syllabus**
- **General Studies Paper II (Governance, Constitution, Polity, and IR)**
- **Bilateral, Regional, and Global Groupings involving India:** Deeply relevant for analyzing the India-Australia Comprehensive Strategic Partnership, civil nuclear deals, and India's long-term diplomatic strategy to navigate the Nuclear Suppliers Group (NSG) architecture.
- **General Studies Paper III (Technology, Economic Development, Environment)**
- **Infrastructure: Energy:** Directly maps to India's target of scaling nuclear capacity to 100 GW by 2047, alongside domestic energy security strategies.
- **Science and Technology - Developments and their Applications:** Perfect for technical analyses of the Three-Stage Nuclear Programme, the milestone achievement of PFBR criticality at Kalpakkam, and the engineering behind Bharat Small Reactors (SMRs).
- **Conservation, Environmental Pollution, and Degradation:** Highly relevant for discussions on achieving net-zero emissions by 2070 and resolving the Energy Trilemma.
- **General Studies Paper IV (Ethics, Integrity, and Aptitude)**
- **Environmental Ethics:** Provides a rich case study for evaluating the ethical trade-offs between rapid economic growth (poverty alleviation) and the management of long-term radioactive hazards and waste stewardship.
- **Essay Paper & Optional Subjects**
- **Essay Themes:** Ideal for essays touching upon *"Strategic Self-Reliance vs. Global Interdependence"*, *"The Geopolitics of Climate Change"*, or *"Technology as the Engine of Modern Diplomacy"*.
- **Optional Subjects:** Highly lucrative for students with **Political Science & International Relations (PSIR)** (Paper 2: India's Foreign Policy and Global Nuclear Governance) and **Geography Optional** (Paper 2: Economic Geography and Energy Resources of India).



- **Way Forward**

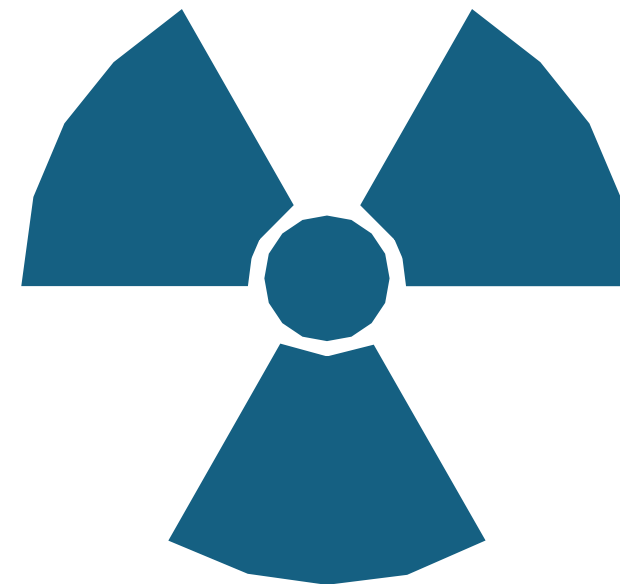
- To successfully scale its nuclear capacity to 100 GW by 2047, India should pursue a balanced, actionable, four-pronged strategy going forward.

- **Streamline Public-Private Joint Ventures:** Following the regulatory opening created by the SHANTI Act, the government must rapidly draft clear, transparent model concession agreements. These frameworks should clearly assign financial risks—allocating civil construction and capital sourcing to private consortia while leaving core nuclear operations, fuel management, and safety protocols under the strict control of public entities like NPCIL.

- **Standardize and Mass-Produce Bharat Small Reactors (SMRs):** Instead of treating every nuclear installation as a unique, mega-scale engineering project, India should treat its 220 MW SMR platform as a factory-fabricated product. Standardizing components will allow for rapid replication, dramatically shortening construction times and helping heavy industries establish captive nuclear units near major manufacturing hubs.

- **Accelerate Commercial Transition to Stage 2 and Stage 3:** With the Prototype Fast Breeder Reactor at Kalpakkam having achieved first criticality, the immediate priority must be compiling operational data to build a standardized fleet of fast breeders. Simultaneously, R&D funding for Advanced Heavy Water Reactors (AHWRs) must be expanded to accelerate the ultimate transition into the thorium-based third stage.

- **Deepen Commercial Diplomacy and Establish Strategic Fuel Reserves:** India should capitalize on its excellent non-proliferation reputation to secure long-term equity stakes in overseas uranium mines, particularly in friendly nations like Kazakhstan, Australia, and Canada. Building a robust domestic strategic uranium reserve—similar to our strategic petroleum reserves—will safeguard the national grid against sudden maritime chokepoint disruptions or geopolitical realignments.



UPSC CSE Prelims Questions

1. With reference to the Nuclear Suppliers Group (NSG), consider the following statements: (Conceptual Template)

- 1.It is a group of nuclear supplier countries that seeks to contribute to the non-proliferation of nuclear weapons through the implementation of Guidelines for nuclear exports.
- 2.Its members are automatically signatories to the Non-Proliferation Treaty (NPT).

Which of the statements given above is/are correct?

- A) 1 only
- B) 2 only
- C) Both 1 and 2
- D) Neither 1 nor 2

2. In India, why are some nuclear reactors kept under IAEA safeguards while others are not? (2020) A) Some use uranium and others use thorium

- B) Some use imported uranium and others use domestic supplies
- C) Some are operated by foreign enterprises and others by domestic enterprises
- D) Some are State-owned and others are privately-owned

3. What is "Yellowcake", the item which is smuggled across borders? (2012) A) Crude heroin

- B) Unrefined gold
- C) Uranium oxide
- D) Crude cocaine

UPSC CSE Mains Questions

- GS Paper III (2018):** "With growing energy needs, should India keep on expanding its nuclear energy programme? Discuss the facts and fears associated with nuclear energy."
- GS Paper III (2017):** "Give an account of the growth and development of nuclear science and technology in India. What is the advantage of a fast breeder reactor programme in India?"
- GS Paper II (2016):** "Analyze the strategic significance of India's civil nuclear cooperation agreements with resource-rich nations like Australia and Canada. How does it help India bypass historic technological apartheid?"

POROUS BORDERS, SHADOW OPERATIVES: A RIFT IN U.S.-INDIA INTELLIGENCE RELATIONS

US national Jordan Brown's arrest is the latest in a concentrated operational pattern along India's critical security corridors. When analysed along with its historical antecedents and contextual correlations, the evaluation of this incident changes from isolated immigration fraud to institutionalised grey-zone infiltration.



SARAJIT AGARWAL
NEW DELHI

SONAULI INTERCEPT AS A STRATEGIC SYMPTOM

On 11 July 2026, personnel from the Sashastra Seema Bal (SSB) and local police apprehended US national Jordan Brown near border Pillar 316 at the Sonauli crossing in Maharajganj, Uttar Pradesh. He was on an unauthorised foot trail. When signalled to halt, Brown attempted to break free and flee into Nepal, but was cornered by local villagers and border patrols. Two mobile phones and Rs 31,460 in cash were recovered—but zero identification documents, passports, or valid visas.

Under multi-agency interrogation, Brown claimed to be a retired US Navy and Special Forces operative (Green Beret). He offered inconsistent accounts of his

travel history, first claiming he lost his passport in Thailand for Vietnam, then asserting he entered India illegally via a maritime route from Sri Lanka in November 2025 before hiding out in Goa. He is currently jailed under Sections 26 and 23 of the Foreigners Act.

When analysed along with its historical antecedents and contextual correlations, the evaluation of this incident changes from isolated immigration fraud to institutionalised grey-zone infiltration.

A SYSTEMIC PATTERN OF INFILTRATION

Brown's arrest is the latest in a concentrated operational pattern along India's critical security corridors. On 30 May 2026, US national Phelan Travis Anthony was arrested at the Chitauri Bridge in Maharajganj while attempting to slip into Nepal after an extensive visa-overstay. Earlier, on 24 April 2026, US national Binod Baraily was intercepted by the SSB at Puri Tank in the Silguri corridor, carrying USD 21,500 in undeclared foreign currency.

On 13 March 2026, the National Investigation Agency (NIA) synchronously arrested US national Matthew Aaron Van Dyke at Kolkata Airport, and six Ukrainians at Delhi and Lucknow

airports, under the Unlawful Activities Prevention Act (UAPA), for operating an illegal, cross-border weapons pipeline. Significantly, a long time gap was allowed between their activities and detention. The rift was not caught at the physical border but was intercepted at domestic travel hubs as they attempted standard exit flights. This was after they had successfully crossed back from Myanmar—where they allegedly trained the Kuki-Chin Army in drone warfare and operations—and had traversed through multiple Indian states. Indian agencies had kept a track. In its public stance, the US embassy sidestepped the NIA's specific charges.

HISTORICAL BASELINES OF DEEP-STATE DISTRUST

For New Delhi, uncoordinated Western military veterans navigating international borders evokes deep historical friction. The distrust dates back to the 1995 Parasit Arms Drop Case, when an *Autonne* An-26 aircraft illegally entered Indian airspace and dropped four tonnes of military-grade weapons (including hundreds of AK-47 rifles and rocket launchers) over West Bengal. The primary operative, Kim Dwyer (aka Christian Nielsen),



An American citizen, identified as Jordan Brown, was arrested by the Sashastra Seema Bal near the Sonauli India-Nepal border on July 11, in Maharajganj on 13 July. ANI

was widely suspected of having deep-state backing from Western intelligence channels to orchestrate regional destabilisation.

The pattern of public bilateral diplomacy evokes deep-state distrust. While public channels focus on cooperation through various platforms and agreements, and lately also focus on trade and tariffs, the shadow realm is actively engaged in counter-espionage on sensitive borders, hard vetting of ex-US military assets, and the deliberate hardening of the Nepal corridor. The legacy of Dhaka hotel in Bangladesh, Jackson had spent months travelling through sensitive Bangladesh military instal-

lations under the cover of a civilian business trip. Jackson's death directly coincided with Indian Prime Minister Narendra Modi attending the Shanghai Cooperation Organisation (SCO) Summit in Tianjin, China. The sinister correlation of the timeline of the two concurrent events raises a stark geopolitical implication.

THE DHAKA MYSTERY AND THE INDIA-RUSSIA INTELLIGENCE FIREWALL

Beyond the tariff frost, the strategic friction between Washington and New Delhi peaked with the geopolitical crisis of 31 August 2025, when Inspector General Terrence Arville Jackson of US Special Forces Command was found dead in Room 606 of The Westin Dhaka hotel in Bangladesh. Jackson had spent months travelling through sensitive Bangladesh military instal-

lations under the cover of a civilian business trip.

Jackson's death directly coincided with Indian Prime Minister Narendra Modi attending the Shanghai Cooperation Organisation (SCO) Summit in Tianjin, China. The sinister correlation of the timeline of the two concurrent events raises a stark geopolitical implication. Some media platforms and geo-analysts alleged that a joint India-Russia intelligence sharing network had successfully intercepted and foiled a sophisticated CIA/ISI assassination plot targeting Boko, resulting in the rapid neutralisation of the asset.

The diplomatic fallout was heavily managed, the US

Embassy immediately intervened to accept Jackson's body from local authorities, strongly bypassing standard operational protocols, avoiding a post-mortem. The rushed repatriation without forensic transparency deepened regional intelligence suspicions.

The happenings indicate that New Delhi maintains deep strategic contingencies separate from its Western alignments.

THE EVOLVING COUNTER-INTELLIGENCE LANDSCAPE

The context of this shadow play is shaped by the Gaurang Singh Pannun case, which underwent a monumental legal shift in February 2026, when Indian national Nikhil Gupta pleaded guilty to a New York federal court to murder-for-hire charges. This plea dramatically altered the bilateral equation, allowing the US Department of Justice to quietly de-escalate the public, state-level "murder-for-hire" allegations against top Indian officials by shifting the legal focus entirely onto a concluded criminal proceeding.

The Pannun case in the US, the preceding Nijjar row in Canada, the unyielding diplomatic stances of their respective governments, and the coordinated, adversarial

statements issued by the Five Eyes alliance, collectively triggered a quiet but intense counter-intelligence pivot by New Delhi.

The 1750 km India-Nepal border, historically treated as an open frontier under the 1950 Treaty of Peace and Friendship, is being rapidly hardened into an active intelligence firewall. The repeated detention of unmonitored Western nationals with elite tactical training near these boundaries changes the evaluation, from isolated immigration fraud to institutionalised grey-zone infiltration.

STRATEGIC LENS

The strategic convergence between Washington and New Delhi is bound by a hard geopolitical reality: public defence partnerships do not equal shadow-war immunity. As global intelligence networks unravel, India's security apparatus has made it clear that no amount of diplomatic goodwill can buy a free pass for uncoordinated foreign assets operating in its strategic periphery.

"The author, an Indian Army veteran and a strategic analyst, is former Security Adviser, Ministry of Home Affairs, Government of India and former Advisor, Government of Seychelles. The views expressed are personal."

- **Key Terms and Explanations**
- **Grey-Zone Infiltration/Warfare:** Operations that fall in the ambiguous space between standard peacetime diplomacy and open, declared military warfare. These activities are intentionally designed to remain below the threshold of triggering a formal military response, often utilizing covert operatives, cyber disruptions, or asymmetric proxies.
 - *Example:* The presence of unmonitored foreign military veterans navigating sensitive border corridors under the guise of tourists or civilian businessmen.
- **Deep-State:** A covert, self-perpetuating network embedded within a nation's military, intelligence, and administrative bureaucracies. Operating independently of the elected political leadership, these elements pursue long-term, subterranean strategic agendas that often contradict public foreign policy.
- **Sashastra Seema Bal (SSB):** One of India's premier Central Armed Police Forces (CAPFs), functioning under the Ministry of Home Affairs. Established in 1963 following the Sino-Indian War, it is specifically mandated to guard India's borders with Nepal and Bhutan, managing open frontiers that require specialized intelligence-led policing.
- **Siliguri Corridor ("Chicken's Neck"):** A highly sensitive, narrow stretch of land in West Bengal, measuring approximately 20 to 22 kilometers at its narrowest point. It connects the northeastern states to the rest of mainland India and is closely bordered by Nepal, Bhutan, and Bangladesh, making it a primary focus for counter-intelligence infrastructure.
- **Unlawful Activities Prevention Act (UAPA):** India's primary anti-terror legislation, designed to prevent unlawful activities of individuals and associations and to effectively counter direct threats to the sovereignty and integrity of the nation. It grants specialized investigative bodies broad powers of detention and asset freezing.
- **Five Eyes Alliance:** An elite intelligence-sharing network comprising Australia, Canada, New Zealand, the United Kingdom, and the United States. Bound by the multilateral UKUSA Agreement, it enables the seamless sharing of signals and human intelligence across member states, often creating unified diplomatic positions on security matters.
- **1950 Treaty of Peace and Friendship:** A foundational bilateral agreement between New Delhi and Kathmandu that established an open border policy, allowing citizens of both nations to move, work, and reside across the frontier without passports or visas.

- **Main Arguments and Substantive Parts**

- The contemporary intelligence landscape reveals a distinct structural duality: public defense partnerships do not equal shadow-war immunity.

- **The Myth of Isolated Immigration Fraud**

- A critical analysis of security corridors reveals that the detention of highly trained foreign nationals near international borders cannot be dismissed as routine administrative lapses. The repeated interception of individuals possessing specialized military or tactical backgrounds indicates a systematic, institutionalized pattern of grey-zone infiltration. These actors leverage the historically open nature of peripheral corridors to establish shadow footprints within the region.

- **Cross-Border Asymmetric Nodes**

- Covert networks are increasingly operating across multi-state transit routes, engaging in the proliferation of unconventional warfare techniques. The coordination between foreign assets and regional insurgent groups—specifically involving advanced drone warfare training and the orchestration of illegal weapons pipelines—demonstrates that porous borders are being actively utilized to spark domestic ethnic conflicts and destabilize critical security sectors.

- **Judicial Mechanisms as Diplomatic De-escalation Tools**

- Transnational friction points, such as high-profile extraterritorial legal disputes, frequently undergo a process of judicial management. By steering complex state-level allegations into concluded federal court proceedings (such as a structured guilty plea), global powers can quietly de-escalate public diplomatic standoffs. This legal insulation allows formal bilateral trade and defense agreements to continue while keeping the underlying counter-intelligence friction firmly out of the public eye.

- **Strategic Autonomy and Intelligence Firewalls**

- Despite extensive public alignment on global trade and regional security frameworks, nations like India maintain independent counter-intelligence doctrines. This manifests as an unyielding protective firewall, which includes parallel intelligence-sharing agreements with non-Western powers (such as Russia) to insulate domestic leadership from sophisticated external threats. For the security apparatus, no amount of diplomatic goodwill grants a free pass to uncoordinated foreign entities operating within its strategic periphery.

- **Historical Evolution of the Issue**

- The trajectory of India's peripheral security and counter-intelligence doctrine has evolved through distinct historical phases, shifting from an era of open-frontier trust to an era of institutionalized vigilance.

- **The Post-Independence Matrix (1947–1990s)**

- Following independence, India's approach to its immediate neighbors was characterized by geopolitical neighborhood warmth, best exemplified by the 1950 Treaty of Peace and Friendship with Nepal. Borders were viewed as bridges for socio-economic integration rather than militarized firewalls. During the Cold War, while India championed non-alignment, the intelligence community remained deeply suspicious of Western deep-state maneuvers in South Asia, though these anxieties rarely altered physical border management architectures.

- **The Structural Shock of 1995**

- The watershed moment occurred on December 17, 1995, with the Purulia Arms Drop Case. An Antonov An-26 aircraft flew deep into Indian airspace and dropped over four tonnes of military-grade weapons—including hundreds of AK-47 rifles, anti-tank grenades, and rocket launchers—over West Bengal. The primary operative, Kim Davy, escaped amidst suspicious circumstances pointing toward Western intelligence facilitation. This incident shattered New Delhi's operational assumptions, permanently embedding a doctrine that unauthorized foreign tactical footprints on sovereign soil pose an existential national security threat.

- **The Era of Public Convergence (Post-2000)**

- The turn of the century brought a major realignment. Faced with the rise of an assertive China in the Indo-Pacific, New Delhi and Washington forged a tight strategic partnership. This period saw the signing of foundational defense pacts (such as LEMOA and COMCASA) and elevated joint military exercises. Public diplomacy focused on shared democratic values and commercial integration, which largely masked the underlying friction within their respective intelligence agencies.

- **The Modern Frontier Hardening (2025–2026)**

- The current era is defined by an intense counter-intelligence pivot driven by transnational legal standoffs, including high-profile diplomatic disputes with Five Eyes nations over extraterritorial plots. Concurrently, the discovery of elite-trained Western military veterans attempting to exploit the open 1,750 km India-Nepal border has forced a fundamental recalculation. The open frontier is being rapidly transformed into a hardened intelligence firewall, proving that public geopolitical partnerships no longer guarantee immunity from shadow-state friction.

ANALYSIS OF U.S.-INDIA INTELLIGENCE FRICTION, POROUS BORDERS & SHADOW OPERATIVES

UNDERSTANDING "INSTITUTIONALIZED GREY-ZONE INFILTRATION" & THE HARDENING FRONTIER

OPERATIONAL PATTERN (INCIDENTS)



NEPAL

- Jul 2026:** Jordan Brown (Maharajganj) - US Navy/Special Forces, Fled border, No ID
- May 2026:** Travis Anthony (Maharajganj) - US National, Visa overstay
- Apr 2026:** Binod Baraily (Pani Tanki) - US National, \$21,500 cash

Mar 2026: Matthew Aaron VanDyke & Six Ukrainians (Kolkata/Delhi/Lucknow) - Illegal Cross-Border Weapons Pipeline from Myanmar. Drones & warfare training.

Locations: Chhatra Bridge, Pani Tanki, Siliguri Corridor

PATTERN OF INFILTRATION - GREY-ZONE.

GEOPOLITICAL FRICTION (AUG 2025)

Death of US IG Terrence A. Jackson (Dhaka Westin, Rm 808)

VS

Indian PM Narendra Modi at SCO Summit (Tianjin)

CORRELATION: Alleged joint India-Russia interception of CIA assassination plot.

Managed fallout, rushed repatriation, no post-mortem. Strategic contingency separate from Western alignments.

INDIA-RUSSIA INTELLIGENCE FIREWALL

HARDENING THE FRONTIER INTO AN ACTIVE INTELLIGENCE FIREWALL

DEEPER HARD VETTING OF EX-US MILITARY ASSETS

Strategic context: Unmonitored tactical training at borders = Institutionalized Infiltration.

HISTORICAL ROOTS OF DISTRUST

1995 PURULIA ARMS DROP CASE - Four tonnes of military-grade weapons (AK-47s) dropped. Suspected Deep-State backing for regional destabilization.



LEGACY: Institutional prerequisite for existential threat perception of unauthorized footprints.

LEGAL SHIFT & COUNTER-INTELLIGENCE PIVOT



US DOJ Quiet De-escalation.

Feb 2026: Gupta Plea (NY Federal Court) - shifts legal focus from state-level allegations to criminal proceeding.



TRIGGER FOR INDIA COUNTER-INTELLIGENCE PIVOT

Coordinated Adversarial Statements (Five Eyes alliance)



- **Logical and Philosophical Base**

- **The Paradigm of Structural Realism:** At its core, this dynamic validates the realist school of international relations (pioneered by thinkers like Hans Morgenthau and John Mearsheimer). Realism dictates that the international system is anarchic, and states are driven entirely by self-preservation and national interest. Overt alliances and public defense partnerships are merely transactional instruments; they do not erase the fundamental systemic distrust that exists between the shadow intelligence architectures of sovereign nations.

- **The Supremacy of Strategic Autonomy:** The underlying logic of hardening border firewalls while simultaneously engaging in global trade blocks highlights India's absolute commitment to strategic autonomy. Philosophically, this rejects the concept of total alignment. It assumes that relying on a foreign superpower for security creates an inherent vulnerability. True sovereignty demands that a state maintain the capability to neutralize threats originating from friendly and adversarial nations alike.

- **Securitization Theory:** This phenomenon is a textbook application of Securitization Theory (developed by the Copenhagen School of security studies). By reclassifying unauthorized border crossings by foreign veterans from simple "immigration fraud" (a bureaucratic/administrative issue) to "grey-zone infiltration" (an existential security threat), the state justifies the deployment of extraordinary intelligence assets, multi-agency interrogations, and the rapid hardening of a historically open border corridor.

- **Multidimensional Analysis**

- **Social Dimension**

- Porous borders directly influence the delicate demographic and social fabric of frontier regions. When foreign assets infiltrate these corridors, they frequently exploit local ethnic anxieties, as seen in the volatile Siliguri corridor and northeastern border states. The weaponization of local populations via advanced technological training (such as drone operations) turns agrarian border communities into active intelligence buffers, disrupting local communal harmony and placing innocent villagers on the front lines of global shadow conflicts.

- **Political Dimension**

- This issue exposes a distinct dual-track political reality. The executive branch must navigate the complex internal challenge of celebrating robust global partnerships on the world stage while managing domestic security concerns behind closed doors. When foreign military operatives are detained under anti-terror frameworks, it places immense pressure on the political leadership to maintain national sovereignty without derailing key international trade relationships or defense procurement agreements.

- **Legal Dimension**

- The legal landscape is defined by the sharp friction between domestic emergency legislation and international jurisprudence. Processing covert foreign actors requires deploying strict statutes like the Foreigners Act and the Unlawful Activities Prevention Act (UAPA).

- The challenge lies in managing transnational extradition complexities and navigating how foreign federal courts use criminal pleas to defuse state-level espionage liabilities, often restricting the transparency of vital security investigations.

- **Ethical Dimension**

- The primary ethical dilemma revolves around the core principles of statecraft versus international norms of transparency. It pits the state's fundamental obligation to protect its citizens through covert counter-espionage against the requirement to follow standard diplomatic protocols, such as granting transparent consular access and conducting public forensic post-mortems. Additionally, using civilian corporate covers for clandestine military reconnaissance raises serious ethical concerns regarding the safety of legitimate global travelers and businessmen.

- **International Dimension**

- This dynamic tests the limits of mini-lateralism and defense groupings like the Quad. The coordinated intelligence positioning of the Five Eyes alliance against unilateral counter-espionage maneuvers demonstrates that deep-seated intelligence loyalties frequently override public bilateral treaties. It forces a complete reassessment of regional security dynamics, proving that strategic partnerships do not mean a country can let down its guard along its sovereign borders.

- **Economic Dimension**

- Hardening a historically open 1,750 km frontier brings substantial fiscal and economic implications. Transitioning from basic physical checkpoints to a comprehensive intelligence firewall requires large-scale capital investments in smart border technologies, electronic sensors, and dedicated surveillance centers.

- Furthermore, these strict security protocols can slow down legitimate border trade and disrupt local informal economic networks that have sustained border communities for generations, highlighting the difficult balance between national security and local economic health.

-
- **Linkages with NCERTs**
 - **Class XII Political Science: Contemporary World Politics (Chapter: Security in the Contemporary World):** This chapter provides the theoretical framework for understanding non-traditional security threats. It differentiates between traditional military threats and contemporary grey-zone challenges, including transnational networks, state-backed terrorism, and the limits of global alliances, offering direct theoretical grounding for modern border hardening.
 - **Class XII Political Science: Politics in India Since Independence (Chapter: India's External Relations):** This section charts the historical evolution of India's foreign policy, detailing the core principles of Non-Alignment and Strategic Autonomy. It explains the historical shifts in India's interactions with Western powers and immediate neighbors like Nepal, illuminating the shift from historical trust to modern intelligence-led border defense.
 - **Class XI Political Science: Indian Constitution at Work (Chapters: Executive and Fundamental Rights):** Provides crucial structural knowledge on how national security decisions are executed under the constitutional framework. It illustrates the balance between executive authority during security crises, the application of special preventive detention laws (like UAPA), and the constitutional protections extended to foreign nationals under Indian jurisdiction.



- **Linkages with UPSC CSE Syllabus**
- **GS Paper II: Governance, Constitution, Polity, Social Justice, and International Relations**
- **India and its Neighborhood-Relations:** Analyzes how the shifting management of the 1950 India-Nepal Treaty impacts bilateral trust, cross-border mobility, and regional stability.
- **Bilateral, Regional, and Global Groupings and Agreements involving India:** Examines the structural friction between public defense frameworks (such as the Quad) and covert counter-intelligence standoffs with Western networks.
- **Effect of Policies and Politics of Developed and Developing Countries on India's Interests:** Investigates how deep-state intelligence architectures and coordinated pressure from groups like the Five Eyes alliance affect India's strategic autonomy.
- **GS Paper III: Technology, Economic Development, Bio-diversity, Environment, Security and Disaster Management**
- **Linkages between Development and Spread of Extremism:** Looks at how the infiltration of foreign assets into sensitive border zones can exacerbate localized ethnic insurgencies.
- **Role of External State and Non-State Actors in Creating Challenges to Internal Security:** Covers the deployment of covert operatives and tactical veterans to conduct grey-zone warfare along vital corridors.
- **Security Challenges and their Management in Border Areas; Linkages of Organized Crime with Terrorism:** Analyzes the transition toward Integrated Border Management Systems along porous frontiers like the Siliguri corridor and the India-Myanmar-Nepal transit networks.
- **GS Paper IV: Ethics, Integrity, and Aptitude**
- **Ethical Dilemmas in International Relations and Strategic Statecraft:** Evaluates the moral choices involved in bypassing diplomatic protocols to neutralize immediate national security threats, balanced against long-term global accountability.
- **Essay & Optional Subjects**
- **Polity & International Relations Optional (PSIR - Paper II):** Directly applicable to sections analyzing India's Foreign Policy, Strategic Autonomy, and the dynamics of South Asian geopolitics.
- **Geography Optional (Paper II - Political Aspects):** Relevant to topics concerning geopolitical boundaries, the strategic vulnerability of corridors like the "Chicken's Neck," and regional security mapping.



- **Way Forward**
- **Implementation of Comprehensive Smart Border Technology**
 - India must transition from traditional, human-dependent border policing to an advanced, tech-driven architecture along the 1,750 km Indo-Nepal border. Deploying a Comprehensive Integrated Border Management System (CIBMS)—incorporating thermal imagers, infrasonic underground sensors, fiber-optic communication firewalls, and real-time satellite surveillance—will allow security forces to spot unauthorized movements on foot trails without disrupting legitimate trade at designated Integrated Check Posts (ICPs).
- **Establishment of a Central Foreign Tactical Asset Database**
 - The Ministry of Home Affairs, in coordination with the Bureau of Immigration and domestic intelligence branches, should build a specialized database to track arriving foreign nationals with documented histories in elite military, intelligence, or private defense organizations. Implementing rigorous visa vetting and mandatory biometric registration for individuals with advanced tactical profiles will prevent the exploitation of standard tourist or commercial entry visas for covert reconnaissance.
- **Strengthening Multi-Agency Counter-Intelligence Integration**
 - To eliminate the operational delays that allow covert networks to move across multiple domestic transit hubs, India must improve real-time data sharing between Central Armed Police Forces (like the SSB), central investigative bodies (such as the NIA), and state-level police intelligence cells. Creating dedicated Joint Counter-Intelligence Command Centers will ensure immediate communication from initial border interception to comprehensive inter-agency questioning.
- **Upgrading Border Diplomacy and Regional Intelligence Protocols**
 - New Delhi should establish clear, structured communication channels with key regional and international partners specifically focused on the movements of ex-military personnel. Bilateral protocols must mandate that foreign embassies provide prompt, transparent verifications of their nationals' military credentials when requested. Concurrently, intelligence cooperation with immediate neighbors like Nepal and Bangladesh should be upgraded to dismantle cross-border proxy operations before they reach domestic soil.

UPSC CSE Mains Questions

- "Analyze the internal security threats faced by India due to porous borders with its neighbors. Suggest practical measures to counter these threats effectively." (*GS Paper III, 2016*)
- "Cross-border movement of insurgents is only one of the several security challenges facing the policing of the border in North-East India. Examine the various challenges currently faced by border policing forces and suggest remedies." (*GS Paper III, 2019*)
- "Collaborative networks between external state and non-state actors have increasingly weaponized grey-zone vulnerabilities along sub-continental frontiers. Critically evaluate this statement in light of recent border management initiatives." (*GS Paper III, Thematic Reflection*)
- "Evaluate the concept of strategic autonomy in India’s foreign policy in the context of changing global alignments and intelligence challenges." (*GS Paper II, 2021*)

UPSC CSE Prelims Conceptual Pointers

1. Which of the following Central Armed Police Forces (CAPFs) is explicitly mandated with the primary responsibility of guarding the open international border between India and Nepal? A) Border Security Force (BSF)
B) Indo-Tibetan Border Police (ITBP)
C) Sashastra Seema Bal (SSB)
D) Central Industrial Security Force (CISF)

Answer: C

2. The strategically sensitive "Siliguri Corridor," frequently referred to as the "Chicken's Neck," provides a vital land link between mainland India and the northeastern states. Which of the following combinations of countries directly borders this narrow corridor? A) Bhutan, Bangladesh, and Myanmar
B) Nepal, Bhutan, and Bangladesh
C) China, Nepal, and Bhutan
D) Bangladesh, Myanmar, and China

Answer: B

3. With reference to the Unlawful Activities Prevention Act (UAPA) in India, consider the following statements:

- 1.The Act empowers the central government to designate individual citizens as terrorists without initial institutional association.
- 2.The investigative agency must obtain prior written approval from the Director General of Police of the concerned state to seize properties linked to suspected terrorism. Which of the statements given above is/are correct? A) 1 only
- 3.B) 2 only
- 4.C) Both 1 and 2
- 5.D) Neither 1 nor 2

6.Answer: C

How India's space programme became a foreign policy instrument

Private firms are beginning to carry weight the state cannot. In May, Skyroot became India's first space unicorn, valued at \$1.1 billion. The ecosystem counts over 300 startups and more than \$600 million in cumulative venture funding. Agnikul Cosmos has flown the world's first fully 3D-printed rocket engine.



BRJESH SINGH
COLUMNIST

On Saturday, Sriharikota had its small midnight reckoning, and the rocket answered it. A 20-metre vehicle built wholly by a private Indian company rose cleanly into orbit, making Skyroot Aerospace's Vikram-I not merely a machine but a marker in the country's political imagination. Among its payloads was a German technology demonstrator, a detail easy to pass over and impossible, once noticed, to shrink back into trivia. Before India's first private orbital rocket had fully entered the historical record, foreign customers had already bought seats on it; after its successful flight, that small fact has become a signal. Thus the satellite slips out of the laboratory and into the chancery. India's space programme is no longer only science, nor only commerce, but foreign policy in one ascending flame.

The popular story runs through Chandrayaan-3, the Rs 615-crore mission

that made India first to land near the lunar south pole; the glory was deserved, but it was advertisement, not product. The product is quieter: 434 satellites for 36 foreign countries, roughly 390 since 2014; more than 300 cooperation agreements with 61 countries and five multilateral bodies. The customer list is a telescope with two ends. The United States accounts for over 230 satellites, including last December's 6,300-kg Bharat-1 Block-2 for AST SpaceMobile, India's heaviest foreign-commercial payload. At the other end stand Nepal, Brazil, Algeria and Malaysia, for whom an affordable Indian rocket may be the difference between a space programme and a brochure. Selling reliability to the rich, gifting capability to the poor, no other space power runs this double helix so calmly.

The gift has never been innocent, which does not make it false. In 2017 India launched the South Asia Satellite, offering communications and disaster-management services to six neighbours. Pakistan offered money, Delhi refused, because the thing had to remain a gift: a Rs 280-crore spacecraft anchoring a programme projected at Rs 9600 crore over twelve years, paid by India, neighbours buying only ground stations. Pakistan declined,

citing security concerns; Bangladesh and Sri Lanka have treated it as one option among several, and its operational footprint has been modest. Yet the method survived: absorb cost, own infrastructure, let goodwill sediment. It now works through training rooms and open data, less ceremonial than a launch, more adhesive than a communiqué.

ISRO's UNNATI programme has taken roughly 90 officials from 48 countries into residential nano-satellite-assembly courses in Bengaluru; the UN-affiliated CSSTAP centre has trained over 1,500 professionals from more than 50 countries since 1995. This is the old grammar of influence. Men and women taught in your institutions carry away standards, habits, methods, and telephone numbers; the engineer who learns integration at ISRO today may direct a space agency tomorrow. India is planting instruments inside future bureaucracies, with a twenty-year maturity period, and compounding the interest annually.

The newer diplomacy is data, colder in appearance, warmer in consequence. NISAR, the \$1.5-billion NASA-India radar satellite launched on an Indian rocket last July, measures shifting land and ice to centimetre precision, making data freely available within



India's first privately developed orbital-class rocket, Vikram-1, launched from the Satish Dhawan Space Centre, in Sriharikota on Saturday. ANI

a day or two, faster in emergencies. For a climate-vulnerable country unable to buy such capacity, this is not largesse; it is infrastructure, a new eye grafted upon the state. India's proposed G20 climate-observation satellite, targeted for 2027, puts the same logic on a multilateral frame. Launches, training, data: together they whisper to the Global South of a frugal alternative to American commercial dominance and China's Space Silk Road; partnership without loans, capacity without dependency.

Orbit has started mirroring earth. By signing the US-led Artemis Accords in June 2023, India moved away from its half-century preference for binding UN-made space treaties, within

months Pakistan joined China's rival lunar coalition. Still Delhi hedged, as it usually does: signing with Washington, abstaining from American-sponsored resolutions on anti-satellite testing, sending Group Captain Shubhanshu Shukla to the International Space Station on a commercial mission last year, and announcing Bharatiya Antariksh Station, whose first module is targeted for 2028. The sentence remains Indian in structure: cooperate with all, depend on none; touch the alliance, but do not be swallowed.

What is new is that private firms are beginning to carry weight the state cannot. In May, Skyroot became India's first space unicorn, valued at \$1.1 billion after

a \$60-million round led by Singapore's sovereign fund GIC and Sherpa Ventures. The ecosystem counts over 300 startups and more than \$600 million in cumulative venture funding. Agnikul Cosmos has flown the world's first fully 3D-printed rocket engine. Pixxel has deployed India's first private satellite constellation and been chosen for a 12-satellite national imaging programme. NewSpace India Limited, ISRO's commercial arm, reported Rs 3,026 crore revenue in FY25, up 43 per cent in a year. The rides are small, but a terrain is becoming visible through the haze.

The arithmetic is unforgiving. The Department of Space budget is roughly Rs 13,400 crore a year; the target is a \$44-billion space economy by 2033, holding 6 per cent of the global market, up from \$6.4 billion and 2 per cent. No public outlay, plausibly imagined, closes that gulf. Private capital must flow in; hence every gifted satellite and trained engineer also becomes market development for Indian industry. The Rs 27,000-crore military surveillance constellation being fast-tracked, with 52 satellites substantially built by private firms, is the anchor order that makes the sector inevitable. Soft power and hard power, once filed in separate ministries of the

mind, now share the same industrial bone.

The constraints are real: capacity, capital, reliability, three demons walking beside the procession. India can build its heaviest rocket only once every six to eight months, so it won OneWeb at \$60 million a launch, undercutting SpaceX, yet cannot win such business at scale, and Pixxel still used Falcon 9. Indian space startups together have raised less than one mid-sized American space company. Then came the PSLV failure early this year, destroying eight foreign satellites, including Nepal's first student-built spacecraft and a Brazilian payload; the first loss of a foreign customer's satellite, a clean diplomatic mirror scratched by a third-stage anomaly. Pakistani think tanks advertised the fall within weeks. In space also, failure has witnesses.

India is not really racing the United States or China to the Moon; the stranger and more consequential race is for the middle earth of nations, those countries that need orbit but cannot mortgage sovereignty to reach it. India wants to become indispensable to them, not by thunder alone, though Vikram-I has now supplied its share of thunder, but by being cheaper, trustworthy, available, almost familiar. The wager has therefore shifted from pos-

sibility to proof. A private Indian rocket has flown; now private Indian firms must turn a decade of diplomatic goodwill into cadence, contracts, factories, failures absorbed, and second flights made ordinary. Vikram-I's manifest was a small horoscope of that future: one German customer, three Indian startups, a robotic arm meant to catch space debris, all tied to a first private ascent. Its success gives the symbolism an easy brightness, but the test remains larger than the launch. Can a state-built reputation for frugal reliability pass into the market without evaporating? Can goodwill become an order book, training become demand, data become dependence without the shame of dependency? The answer did not blaze once above Sriharikota, however cleanly the rocket rose. It will accumulate, as all real statecraft does, through repetitions; not one launch, but the next fifty, each a small vote in the dark. Between flame and ledger, gift and sale, the satellite has become India's most patient envoy circling, measuring, remembering, returning.

* Brjesh Singh is a senior IPS officer and an author (@brjeshsingh on X). His latest book on ancient India, "The Cloud Chariot" (Penguin) is out on stands. Fictionary personae.

- **Key Terms and Explanations**
- **Space Diplomacy:** The strategic deployment of a nation's space capabilities—ranging from satellite launches to data sharing—to advance its foreign policy objectives, build bilateral alliances, and cultivate goodwill.
 - *Example:* India's launch of the South Asia Satellite (GSAT-9) to provide free communication and disaster management tools to its neighboring nations.
- **The "Double Helix" Model of Space Commerce:** A dual-track strategy where a nation operates simultaneously in two distinct economic spheres. On one strand, it sells high-reliability, competitive commercial launch services to wealthy, developed nations. On the other strand, it gifts or subsidizes space capabilities, infrastructure, and training for developing nations.
- **Strategic Autonomy in Orbit:** The space-faring equivalent of non-alignment. It involves participating in major plurilateral international frameworks without locking the nation into rigid geopolitical blocs, thereby preserving independent long-term strategic choices.
 - *Example:* Concurrently signing the US-led Artemis Accords while maintaining an independent path by building the indigenous Bharatiya Antariksh Station and abstaining from certain Western-backed space resolutions.
- **Space Silk Road:** China's strategic initiative to integrate space infrastructure, satellite navigation networks (Beidou), and data centers into its broader Belt and Road Initiative (BRI), offering developing nations space access tied to Chinese capital and long-term infrastructure dependency.
- **Anchor Orders:** Large-scale, long-term procurement contracts guaranteed by a government to a private industry. These orders reduce financial risk for startups, signaling stability to venture capitalists and making an entire sector investable.
 - *Example:* India's fast-tracked military surveillance constellation project, which utilizes private aerospace firms to build out its hardware architecture.
- **Nanosatellite Integration:** The process of assembling and testing miniaturized satellites (typically weighing between 1 to 10 kilograms). This field serves as a prime training ground for developing nations to cultivate basic space access.

- **Main Arguments and Substantive Parts**
- The intersection of space technology and international relations reveals how technological self-reliance transitions into geopolitical leverage. The following core arguments outline this structural evolution:
- **The Paradigm Shift from Laboratory to Chancery**
- Space programs are no longer confined to scientific curiosity or insular commercial transactions; they have transformed into an ascending flame of foreign policy. The successful orbital flight of privately developed vehicles—such as Skyroot Aerospace’s Vikram-1—carrying foreign payloads like German technology demonstrators, signals that the private sector is now an active participant in international statecraft. When foreign clients purchase slots on indigenous private launchers before they are fully historicized, the satellite officially moves from a scientific laboratory into the halls of global diplomacy.
- **The Asymmetric Logic of the Global South**
- India has constructed a unique space-diplomatic niche by positioning itself as the premier alternative to Western commercial dominance and China’s Space Silk Road. This strategy targets the "middle earth of nations"—countries that require orbital assets for governance, agriculture, and climate mitigation but cannot afford to mortgage their national sovereignty to obtain them. By offering partnership without crippling debt and capacity building without structural dependency, India converts its state-built reputation for frugal reliability into long-term diplomatic capital.
- **Institutional Seeding and Data-Driven Influence**
- The true depth of space diplomacy lies in quiet, long-term institutional alignment rather than loud, celebratory launches.
- **Human Capital Seeding:** Through institutional mechanisms like the UNNATI and CSSTEAP programs, foreign engineers and bureaucrats are trained in domestic facilities. These professionals return to their home countries carrying standards, methods, and personal relationships established here, essentially embedding pro-India nodes within future foreign bureaucracies.
- **Data As Infrastructure:** High-precision environmental and radar data, such as that generated by the NISAR satellite or the proposed G20 climate-observation satellite, is made freely available to climate-vulnerable nations. For countries unable to afford standalone constellations, this data serves as an essential eye grafted onto their administrative infrastructure, fostering a soft dependency rooted in goodwill.
- **The Rise of the Private-Industrial Complex**
- The ambitious target of scaling the space economy from its historical base of \$8.4 billion to a projected \$44 billion by 2033 cannot be sustained by public outlays alone. The Department of Space’s annual budget faces systemic limitations that can only be bridged by private capital. Private firms are now carrying strategic weight that the state cannot support by itself, drawing international venture capital to fund technological breakthroughs like 3D-printed engines and private imaging constellations. Consequently, soft power and hard defense needs have converged onto a singular industrial baseline.
- **Systemic Contradictions and Vulnerabilities**
- Despite these advances, the strategy must constantly manage three interconnected vulnerabilities: capital, capacity, and reliability. Heavy launch vehicles are restricted by slow production intervals, forcing domestic innovators to rely on foreign providers like SpaceX's Falcon 9 for rapid deployment. Furthermore, any mechanical failure—such as the recent PSLV anomaly that destroyed payloads belonging to key partners like Nepal and Brazil—is instantly amplified by regional competitors to challenge the narrative of flawless, low-cost reliability. In the high-stakes domain of space diplomacy, technical errors carry immediate geopolitical consequences.

- **Historical Evolution of the Issue**

- **Phase 1: The Foundations of Frugal Utility (1960s–1980s)**

- Born out of the vision of Vikram Sarabhai, the early space program deliberately bypassed geopolitical posturing or military races. Instead, it focused entirely on structural socio-economic development—using satellite technology for mass education (Satellite Instructional Television Experiment - SITE) and resource mapping. While early satellites like Aryabhata (1975) required Soviet launch assistance, the underlying philosophy remained rooted in developing indigenous, cost-effective capabilities to solve domestic developmental challenges.

- **Phase 2: Commercialization and Structural Reliability (1990s–2010s)**

- The operationalization of the Polar Satellite Launch Vehicle (PSLV) in the 1990s transformed the country into a highly reliable global launch hub. The creation of Antrix Corporation in 1992 marked the formal entry into global space commerce. Over these two decades, the state established an international reputation for executing complex missions—such as the Mars Orbiter Mission (Mangalyaan) and Chandrayaan-1—at a fraction of Western costs, laying the foundation of trust required for future diplomatic use.

- **Phase 3: The Transition into Strategic Space Diplomacy (2014–2020)**

- The space program shifted intentionally from a scientific asset to an explicit tool of foreign policy. The pivotal moment arrived in 2017 with the launch of the South Asia Satellite (GSAT-9). By absorbing the entire financial burden and offering its services as a clean, non-monetary gift to regional neighbors, India established a new style of regional statecraft designed to counter rival checkbook diplomacy in the subcontinent.

- **Phase 4: The Plurilateral and Privatized Era (2020–2026)**

- The current phase is defined by systemic deregulation and a shift away from exclusive alignment with UN-binding treaties toward flexible, plurilateral partnerships, exemplified by the signing of the Artemis Accords in 2023. Domestically, the opening of the sector to private enterprises through IN-SPACe and NewSpace India Limited (NSIL) has catalysed a venture-backed startup ecosystem, transitioning the nation's space diplomacy from a purely state-driven initiative into a dynamic, market-led foreign policy instrument.



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**TO:
THE SATELLITE
SLIPS INTO THE
CHANCERY.**



THE 'DOUBLE HELIX' MODEL.



SELLING RELIABILITY (RICH NATIONS):

e.g., US BlueBird Satellite,
390+ foreign satellites
launched.



GIFTING CAPABILITY (POOR/DEVELOPING):

e.g., South Asia Satellite
(GSAT-9) to 6 neighbors.



THE DIPLOMACY OF DATA & PLURILATERALISM.



DATA

NISAR Satellite:
NASA-India Radar
Data (centimeter
precision).

G20 climate
observation
satellite proposed.

PLURILATERALISM

Indian in structure:
Cooperate with all,
depend on none.

**Artemis
Accords**
(US-led)



**Bharatiya
Antariksh
Station**
(2028 module)



PRIVATE SECTOR AS NEW WEIGHT



Skyroot Aerospace:
Vikram-1 (1st private
private orbital flight),
\$1.1bn Unicorn.



Agnikul Cosmos:
World's 1st fully
3D-printed rocket
engine.



Pixxel: India's 1st
private satellite
constellation.

DIPLOMACY OF TRAINING & INSTITUTIONAL SEEDING



ISRO's UNNATI: Nanosatellite assembly
assembly for 90 officials + 48 countries.
from 48 countries.



CSSTEAP (UN-Affiliated):
Trained 1,500+ professionals
from 50+ countries.
"Planting instruments inside
future bureaucracies."

CHALLENGES & LIMITS



Launch Cadence

• Public Budget Limits

• Reliance on Foreign Vehicles
(e.g., Pixxel used Falcon 9)

• Past Failures (e.g., PSLV)

STRATEGIC GOAL



Indispensability to the
'Middle Earth of Nations'
(cheaper, teachable,
available, familiar)

- **Logical and Philosophical Base**
- **Enlightened Self-Interest over Bare Transactionalism:** The strategy operates on the understanding that providing free infrastructure (like satellite data and training) yields deeper, more enduring geopolitical influence than short-term commercial contracts. The logic is structural: it permits goodwill to sediment within foreign institutions, converting initial economic costs into long-term diplomatic capital.
- **The Philosophy of Asymmetric Non-Coercion:** In contrast to traditional great-power models that use technology transfers to lock smaller states into security pacts or debt-driven agreements, this approach prioritizes capacity building without creating structural dependency. It treats space as a shared global common, aligning closely with the classical civilizational ethos of *Vasudhaiva Kutumbakam* (The World is One Family).
- **Frugality as a Democratic Standard:** The operational logic relies heavily on cost-efficiency. By demonstrating that deep-space exploration and precise orbital imaging can be achieved at a fraction of standard historical budgets, the system democratizes space access. It offers developing nations a realistic model of technological progression that does not demand unmanageable capital expenditures.
- **Strategic Hedging and Autonomy:** The underlying philosophical framework rejects rigid binary alliances. The logic dictates that a state can cooperate extensively with Western frameworks (such as the Artemis Accords) while simultaneously preserving its sovereign freedom by investing in its own space stations and maintaining distinct voting alignments on international forums. It aims to touch alliances without being swallowed by them.

- **Multidimensional Analysis**
- **Social Dimension**
- **Democratic Capacity Building:** By opening technical training programs to administrators across Asia, Africa, and Latin America, India helps democratize specialized scientific knowledge across the Global South.
- **Inspiration of Domestic Human Capital:** The rapid transition from public monopoly to an ecosystem hosting over 300 private startups acts as a powerful catalyst for local scientific talent, mitigating brain drain and fostering an organic culture of high-tech entrepreneurship.
- **Political Dimension**
- **Geopolitical Brand Elevation:** Major accomplishments, such as landing near the lunar south pole, function as powerful tools for international prestige. They project an image of an rising, technologically advanced power capable of offering alternative global leadership.
- **Internal Political Cohesion:** The space program serves as an important anchor for the domestic political imagination, transforming technical engineering feats into symbols of collective national confidence and pride.
- **Legal Dimension**
- **Reorientation of Space Governance:** Moving toward plurilateral, non-binding partnerships like the Artemis Accords reflects a pragmatic shift away from the traditional insistence on rigid, UN-administered legal regimes, allowing the state to navigate the contemporary, fast-evolving space race more flexibly.
- **Regulatory Evolution for Private Players:** Creating domestic bodies like IN-SPACe demands a continuous evolution of national space laws, intellectual property protections, and liability management frameworks to support commercial private launches without compromising state security.
- **Ethical Dimension**
- **Space as a Global Common Good:** Providing real-time, high-precision environmental data to climate-vulnerable nations through joint initiatives like NISAR fulfills a vital global ethical responsibility, assisting states that lack the financial means to purchase such critical infrastructure independently.
- **The Morality of Gifting vs. Selling:** Resisting the financial monetization of regional platforms (like the South Asia Satellite) preserves the ethical purity of these technological assets, ensuring they function as true diplomatic gifts rather than tools of economic leverage.
- **International Dimension**
- **Countering the Space Silk Road:** Offering clean, low-cost launch options and transparent data sharing provides the Global South with a viable alternative to China's expanding space infrastructure network, directly challenging regional hegemony.
- **Managing Subcontinental Rivalries:** The geopolitical push-and-pull over space assets—such as Pakistan declining integration into regional satellite projects to join rival lunar coalitions—highlights how orbital systems have become central to the geopolitical polarization of South Asia.
- **Economic Dimension**
- **Targeting the \$44-Dollar Economy:** Bridging the gap between the public budget and the projected \$44 billion target by 2033 requires leveraging foreign venture capital to scale private launch providers like Skyroot and Agnikul Cosmos.
- **The Military-Industrial Catalyst:** Deploying massive dual-use projects, such as the Rs 27,000-crore military surveillance constellation built substantially by private firms, generates the steady anchor orders necessary to make the broader commercial aerospace sector financially sustainable.

- **Linkages with NCERT Textbooks**
- **Class 12 Political Science (*Politics in India Since Independence*):** Review the chapter on *India's External Relations*. Pay close attention to the foundational principles of Indian foreign policy, the historical commitment to strategic autonomy, and how early scientific self-reliance has matured into modern technological diplomacy.
- **Class 12 Political Science (*Contemporary World Politics*):** Study the sections covering *South Asia and the Contemporary World*. This helps contextualize regional dynamics, understand the geopolitical friction between India and its neighbors, and analyze how soft power assets are used to counter rival checkbook diplomacy.
- **Class 11 Indian Economic Development:** Read the chapters detailing *Economic Reforms Since 1991* and *Industrial Growth*. These provide the necessary background to evaluate how deregulating state monopolies, encouraging foreign direct investment (FDI), and supporting private venture capital have catalyzed the modern startup ecosystem.
- **Class 11 Fundamentals of Physical Geography:** Examine the practical applications of remote sensing, GIS mapping, and satellite imagery for resource conservation, weather forecasting, and disaster management—underscoring why high-precision satellite data is a highly valued diplomatic asset for climate-vulnerable nations.

- **Linkages with the UPSC CSE Syllabus**
- **GS Paper 2: Governance, Constitution, Polity, Social Justice, and International Relations**
- **India and its Neighborhood- Relations:** Analyzing how tools like the South Asia Satellite help manage regional ties and preserve diplomatic goodwill within the subcontinent.
- **Bilateral, Regional, and Global Groupings/Agreements involving India:** Evaluating the strategic implications of joining plurilateral frameworks like the Artemis Accords while maintaining independent national targets.
- **Effect of Policies of Developed and Developing Countries on India's Interests:** Assessing the geopolitical competition between Western commercial launch dominance, China's Space Silk Road, and India's emerging role as a leader of the Global South.
- **GS Paper 3: Technology, Economic Development, Bio-diversity, Environment, Security, and Disaster Management**
- **Science and Technology- Developments and their Applications:** Examining the real-world impact of cutting-edge innovations like 3D-printed rocket engines, private imaging constellations, and radar-based climate monitoring.
- **Achievements of Indians in Science & Technology; Indigenization:** Tracking the transition from state-led engineering successes (ISRO) to world-class private aerospace startups (Skyroot, Agnikul).
- **Investment Models & Growth:** Analyzing how public defense contracts (such as the surveillance constellation project) function as anchor orders to draw private capital into high-tech manufacturing.
- **GS Paper 4 & Essay**
- **Ethics in International Relations:** Evaluating the ethical framework of treating advanced technology as a global public good rather than a tool for commercial exploitation or political coercion.
- **Essay Themes:** Highly relevant for essays focusing on *Technology as an Instrument of Statecraft*, *The Rise of the Global South*, or *Balancing Self-Reliance with Global Integration*.



- **Way Forward**
- **Accelerating Launch Cadence and Infrastructure Capacity:** The systemic delay in heavy-lift launch options (currently restricted to one flight every six to eight months) must be resolved. The state should expedite the operationalization of new spaceports, such as Kulasekarapattinam, and actively hand over proven platforms like the Small Satellite Launch Vehicle (SSLV) to private consortia to handle high-frequency commercial requests efficiently.
- **Implementing Robust Quality Assurance Architectures:** To preserve the hard-earned reputation for cost-effective reliability, IN-SPACe must deploy rigorous, standardized quality-control protocols across the private sector. This will help insulate international client payloads from technical failures like recent third-stage orbital anomalies, protecting the country's reputation from geopolitical criticism.
- **Formalizing a Combined Diplomatic-Industrial Strategy:** The Ministry of External Affairs (MEA) should collaborate systematically with the Department of Space and private industry bodies. By actively incorporating private launch services and satellite capacities into foreign aid packages, the state can match the specific technological needs of partner nations in Africa and Asia with the commercial capacity of domestic startups.
- **Upgrading from Raw Data Provision to Actionable Intelligence:** Instead of merely distributing raw satellite data from networks like NISAR, the country should invest in building dedicated analytical centers for partner states. By providing finished, AI-processed insights for predictive disaster management and crop-yield optimization, India can deepen its strategic value to climate-vulnerable nations without creating an uncomfortable sense of dependency.



- **UPSC Civil Services Mains**
- **GS Paper 3 (2023)**
- **Question:** What is India's Christmas gift to the world in terms of space exploration? Discuss the main objectives of the Chandrayaan-3 mission and its significance for India's future space endeavors.
- **GS Paper 3 (2016)**
- **Question:** Discuss India's achievements in the field of space science and technology. How has the application of this technology helped India in its socio-economic development?
- **GS Paper 3 (2015)**
- **Question:** What are the areas of diplomatic and strategic advantages that India can derive from its space program, particularly with respect to its immediate neighbors?
- **UPSC Civil Services Prelims Core Themes**
- To excel in the Preliminary examination, focus closely on the operational details of the following recurring themes:
- **Space Agency Institutional Frameworks:** Differentiating clearly between the mandates of **IN-SPACE** (the autonomous interface and regulatory body for private space entities) and **NSIL** (NewSpace India Limited, the commercial arm responsible for scaling manufacturing and commercializing ISRO's research outputs).
- **International Frameworks:** Reviewing the precise operational details, member commitments, and legal boundaries of the **Artemis Accords**, along with historical United Nations space treaties.
- **Launch Vehicle Configurations:** Mastering the structural differences, payload limits, and stage fuel compositions between standard workhorses like the **PSLV**, **GSLV Mark III (LVM3)**, and emerging private orbital platforms like the **Vikram** and **Agnibaan** series.



New escape velocity? Isro's talent exodus can still be a win for India

BY INVITATION

V RAMGOPAL RAO



The reported departure of several senior scientists from the Indian Space Research Organisation (Isro) has understandably caused concern. Some are associated with important national missions and possess knowledge that cannot be replaced overnight. But we should not view every departure as a national loss. India's private space and deep technology ecosystem has finally matured enough to attract experienced scientists, offer them challenging work, and make careers outside govt professionally and financially rewarding.

This is something we should celebrate. For decades, India worried that its best scientists would leave the country because meaningful opportunities were available only abroad. Today, some of our most experienced professionals are leaving one Indian institution to build another. They are not abandon-

ing the nation's space ambitions; they are helping expand them. A strong national space ecosystem cannot consist of Isro alone. It must include startups, established companies, universities, investors, suppliers, testing facilities and trained talent.

There has been a similar transition in higher education with many senior IIT professors, and increasingly mid-career faculty members, joining private academic institutions. This is often described as a loss for the IITs. We must see it differently. When good private institutions can attract accomplished faculty and provide the freedom, resources, and leadership opportunities they seek, the higher education system benefits. The IITs were never meant to monopolise talent. Their larger contribution is also in producing academic leaders who can strengthen institutions across the country.

Isro must be viewed similarly. It is one of India's finest institutions, with a remarkable culture of mission orientation, teamwork, frugality and engineering excellence. Rather than merely retaining every person it recruits, it should continuously attract young talent, train it, entrust it with responsi-

bility and produce more leaders than it needs. Some will rise within. Others will join private companies, advise startups or create enterprises of their own. That is how national capability grows.

But if a few departures can seriously affect major programmes, it indicates that succession planning and talent renewal have not received adequate attention. That is an institutional failure, not a reason to restrict mobility by tightening exit rules.

India has an enormous reservoir of young talent coming out of higher education institutions, many of whom leave for careers abroad for lack of sufficient opportunities at home. Thousands of bright engineers and scientists would consider a career in the space programme if recruitment were regular, transparent, and timely. The answer is to widen the entry pipeline, not block the exit door.

Govt institutions often suffer because recruitment is treated as an administrative event rather than a strategic necessity. Approvals take time, sanctioned posts remain vacant, and lateral entry is difficult even when specialised expertise is urgently required in institutions working in global-

ly competitive areas. The Department of Personnel and Training and other agencies responsible for these systems must examine how such controls are choking institutions at both the early-career and lateral-entry stages.

At the same time, Isro should embrace its role as the mother institution of India's private space industry. It should encourage mobility, create structured fellowship programmes, enable scientists to work with startups for limited periods, welcome experienced professionals back, and build stronger pathways between govt laboratories, universities, and industry. People moving across institutions carry knowledge, standards, and professional culture with them. This circulation of talent is essential for innovation.

The emergence of attractive private opportunities is also evidence that years of public investment in deep technology, Startup India, space reforms, and entrepreneurial support are yielding results. A decade ago, an experienced space scientist had few serious options outside Isro. Today, Indian startups are attempting to launch vehicles, satellites,

propulsion systems, earth observation platforms, and space-based services. They need people who understand technology reliability, systems integration, and mission discipline. Isro scientists bring precisely this capability.

We must certainly protect critical missions and ensure responsible transitions. Scientists handling sensitive responsibilities cannot leave without proper notice, documentation, and transfer of knowledge. But retention cannot be achieved through tighter controls alone. Talented people stay when they find purpose, recognition, autonomy, growth, and fair compensation. Govt institutions too must compete for talent.

Isro's success must ultimately be measured not only by the missions it completes, but also by the leaders, companies and capabilities it creates for the country. When a govt scientist joins an Indian startup and helps it succeed globally, India has not lost a scientist; it has multiplied the impact of one. ■

Rao is vice-chancellor for BITS Pilani group of institutions and former director of IIT Delhi. Views expressed are personal.

- **Key Terms and Explanations**

- **Deep Technology (Deep Tech)**

- Deep Tech refers to disruptions and innovations founded on profound scientific discoveries or tangible engineering breakthroughs rather than incremental tweaks to existing software or business models. These ventures require prolonged research and development cycles, high capital intensity, and carry substantial technological risk.

- *Example:* A private aerospace startup developing an indigenous 3D-printed semi-cryogenic rocket engine, as opposed to a company building a standard e-commerce delivery application.

- **Talent Circulation vs. Brain Drain**

- **Brain Drain:** The linear, unidirectional loss of highly skilled human capital from a developing nation to developed economies, leaving the home country depleted of intellectual resources.

- **Talent Circulation:** A dynamic, multi-directional flow of skilled professionals between different sectors—such as public laboratories, private enterprises, and academic institutions—within the domestic economy. This process prevents total loss of talent and creates cross-industry innovation networks.

- **Succession Planning**

- A proactive, strategic human resource process within an organization designed to identify, nurture, and train high-potential employees to seamlessly step into critical leadership and specialized technical roles when current incumbents leave. It eliminates operational dependencies on specific individuals.

- **Lateral Entry**

- The process of inducting domain experts and professionals from outside the traditional government bureaucratic cadres directly into mid-level or senior positions within public institutions. This is aimed at injecting fresh specialized expertise, market agility, and cutting-edge technical knowledge into legacy systems.

- **Institutional Monopoly on Talent**

- A systemic condition where the state or a singular public entity controls all resources, infrastructure, and funding within a particular sector, effectively making it the sole employer for professionals in that field.

- *Example:* For decades, an aerospace engineer in India could only practice their core trade within the confines of the Indian Space Research Organisation (ISRO).

- **Main Arguments and Substantive Parts**
- **Core Thesis**
 - The migration of seasoned scientists and academicians from premier state-funded bodies to the domestic private sector should be viewed as a milestone of a maturing innovation ecosystem rather than a structural loss. This movement shifts the national paradigm from single-institution reliance to an expansive, self-sustaining national capacity.
- **The Transition from Monolith to Ecosystem**
- **Expansion of National Ambition:** The space sector and higher education are outgrowing the capacity of solitary institutions. A resilient national ecosystem requires an interdependent web of startups, testing facilities, venture capital, and academic hubs.
- **Capitalizing on Public Investment:** The emergence of viable private alternatives proves that decades of state spending on initiatives like space reforms, Startup India, and deep-tech grants are bearing fruit by generating high-value private-sector employment.
- **Structural Vulnerabilities Exposed**
- **Flaws in Administrative HR:** The anxiety surrounding the exit of key personnel exposes a deep-seated institutional failure in succession planning. When the departure of a few individuals jeopardizes vital national programs, it reflects a brittle leadership pipeline.
- **The Trap of Tighter Controls:** Attempting to enforce talent retention through rigid exit clauses, extended notice periods, or administrative barriers is counterproductive. True retention is cultivated through autonomy, intellectual purpose, structural recognition, and fair compensation.
- **Bottlenecks in Recruitment:** Public institutions frequently treat talent acquisition as an infrequent administrative task rather than a continuous strategic necessity. Delays in filling sanctioned posts and resistance to lateral entry choke the talent inflow.



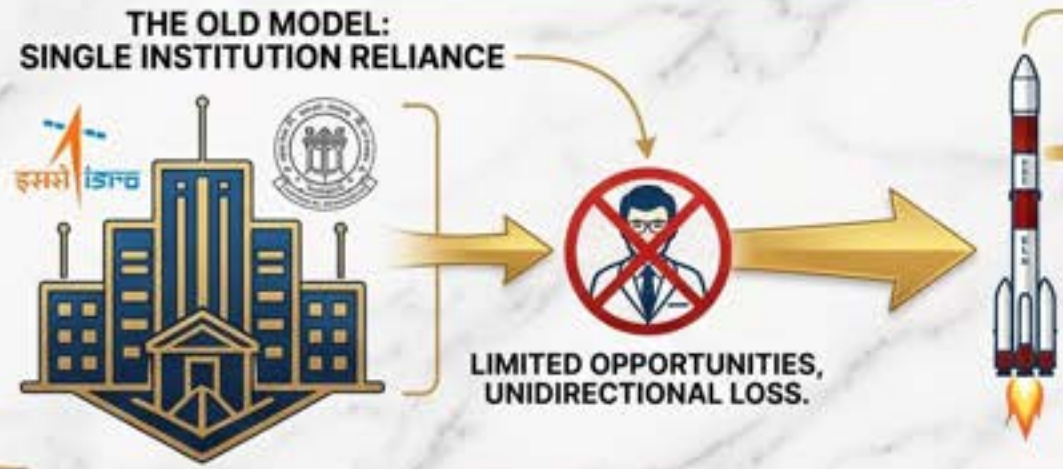
- **Historical Evolution of the Issue**
- **Phase 1: Post-Independence to the 1980s (The Era of State Monoliths)**
- **Strategic Isolation:** Faced with global denial regimes (such as the MTCR and technology sanctions), India had to build its technological base entirely within the public domain. This saw the birth of ISRO (1969) and the early IITs.
- **Unidirectional Brain Drain:** Because the domestic private sector was constrained by the License Raj and lacked capital for high-risk research, India's top scientific minds faced a binary choice: work for the government or migrate to Western nations.
- **Phase 2: 1990s to the 2010s (Liberalization and the IT Boom)**
- **Selective Openness:** The 1991 economic reforms unlocked the services sector, triggering a massive software and IT services boom. However, core strategic sectors like space, defense, and atomic energy remained strictly under state custody due to security protocols and high capital barriers.
- **Academic Multiplicity:** Private higher education began to expand, but it was largely confined to undergraduate teaching institutions. The IITs maintained an absolute monopoly on high-end research and postgraduate engineering talent.
- **Phase 3: 2020 to the Present (The Deep-Tech and Space Renaissance)**
- **Policy Deregulation:** The implementation of Space Reforms in 2020, the creation of IN-SPACe (Indian National Space Promotion and Authorization Centre), and the notification of the Indian Space Policy 2023 structurally dismantled the state monopoly.
- **Capital Infusion:** Liberalized Foreign Direct Investment (FDI) norms introduced in 2024 allowed global and domestic venture capital to flow directly into private space ventures. This gave startups the financial capacity to offer competitive salaries and research environments, attracting talent away from public institutions.



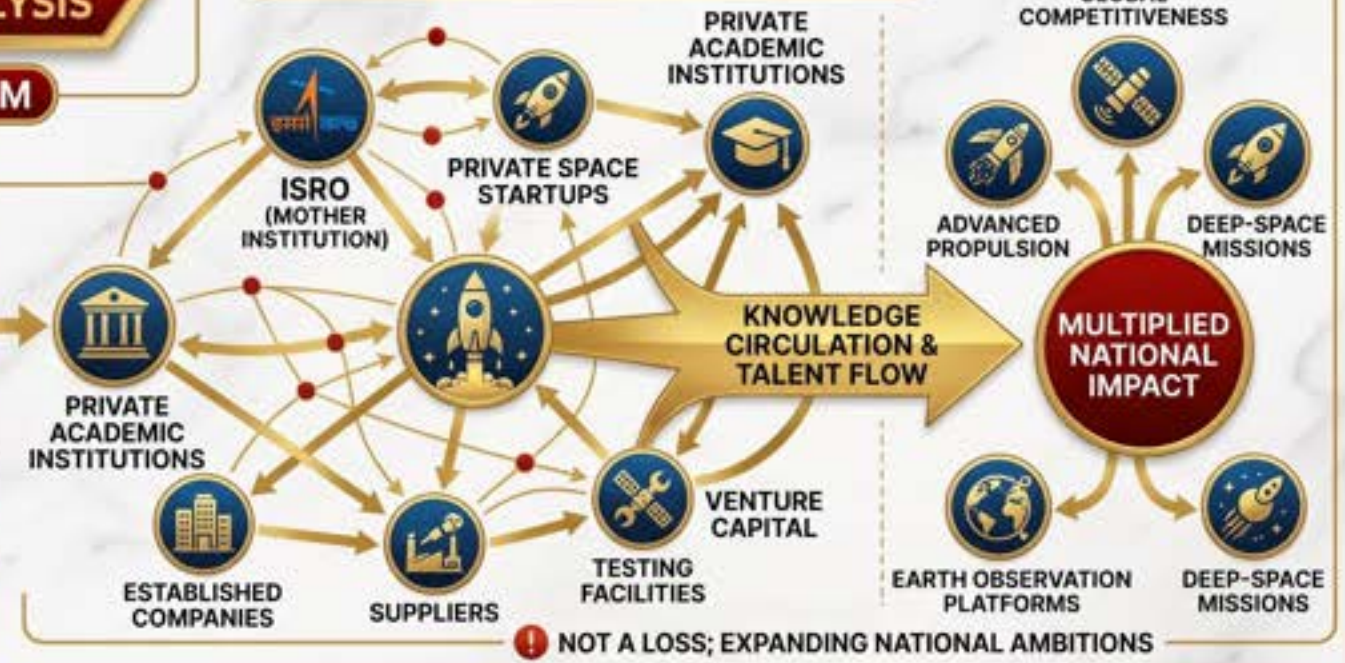


DEEP-DIVE ANALYSIS

INDIA'S EVOLVING SPACE & TECH TALENT ECOSYSTEM (FROM MONOLITH TO ECOLOGICAL EXPANSION)



THE NEW MODEL: A THRIVING ECOLOGY



KEY STRATEGIC SHIFTS: PUBLIC VS PRIVATE ROLE

FEATURE	PUBLIC INSTITUTIONS (ISRO/IITs)	PRIVATE DEEP-TECH & ACADEMIA
MANDATE	TRAIN & PRODUCE ACADEMIC & MISSION LEADERS.	BUILD NATIONAL CAPABILITY. ADVANCE SPACE ECONOMY.
RECRUITMENT	FROM ADMINISTRATIVE EVENT TO STRATEGIC NECESSITY. WIDEN ENTRY PIPELINE.	MATURING TO OFFER PROFITABLE & CHALLENGING CAREERS.
TALENT MANAGEMENT	EMBRACE CIRCULATION. SABBATICALS, JOINT APPOINTMENTS.	ATTRACT EXPERIENCED PROFESSIONALS FOR RELIABILITY & INNOVATION.
IMPACT	MEASURED BY COMPLETED MISSIONS & CREATED LEADERS.	MULTIPLIED IMPACT OF A SINGLE SCIENTIST ON THE NATION.

WAY FORWARD: STRENGTHENING THE NATIONAL SPACE ECOSYSTEM



Logical and Philosophical Base

Shift from Zero-Sum to Positive-Sum Logic

The traditional bureaucratic view operates on zero-sum logic: if a scientist leaves a public laboratory, the state loses that asset. Modern economic philosophy, however, applies positive-sum logic: a public scientist moving to a domestic private firm acts as a capability multiplier. The knowledge, safety benchmarks, and mission discipline they inject into the private firm elevate the entire domestic market's global competitiveness.

The Evolution of the Social Contract of Public Institutions

This philosophy redefines the ultimate mandate of premier public institutions:

Autonomy as an Intellectual Prerequisite

High-caliber scientific and academic productivity cannot thrive under rigid administrative hierarchies. The core argument rests on the principle that intellectual capital naturally migrates toward environments that offer the highest degree of operational autonomy and institutional flexibility.

Legacy Metric	Modern Ecosystem Metric
Retaining 100% of internal recruits for life	Serving as a talent nursery for the broader economy
Guarding intellectual property behind state walls	Seeding capability across startups and private universities
Completing insular, state-directed missions	Spurring economic growth and national technological self-reliance

- **Multidimensional Analysis**
- **Social Dimension**
- **Changing Aspirations:** The traditional middle-class preference for secure, lifelong government employment is shifting toward high-risk, high-reward entrepreneurial careers in deep tech.
- **Reversing External Brain Drain:** By providing world-class, well-funded research opportunities within private domestic entities, India can retain bright minds who would otherwise migrate to Silicon Valley or European research hubs.
- **Economic Dimension**
- **Value-Added Capital Multiplication:** When public scientists join private startups, they help convert public research into commercial products. This attracts global venture capital, generates high-skill manufacturing jobs, and expands India's share in the global space economy.
- **Public Exchequer Relief:** As the private sector takes over commercial launches and routine satellite operations, the state can optimize its budget, redirecting public funds toward high-risk, non-commercial deep-space exploration and fundamental science.
- **Political and Governance Dimension**
- **Reimagining the Bureaucratic Framework:** This trend forces organizations like the Department of Personnel and Training (DoPT) to re-evaluate outdated recruitment manuals, civil service structures, and lateral entry roadblocks.
- **Policy Implementation Success:** The migration of talent serves as tangible proof that policies like Startup India and the production-linked incentive (PLI) schemes are successfully transitioning from paperwork to real-world industrial capacity.
- **Legal Dimension**
- **Intellectual Property (IP) Dynamics:** The movement of personnel creates a pressing need for clear legal frameworks governing IP sharing, technology transfers, and spin-off patents between state labs and private entities.
- **Evolving Labor Jurisprudence:** The legal challenge lies in balancing national security considerations (via non-disclosure agreements and gardening leaves) with the constitutional right of an individual to practice any profession (Article 19(1)(g)).
- **Ethical Dimension**
- **The Return-on-Investment Dilemma:** Is it ethical for individuals whose education or specialized training was heavily subsidized by the public exchequer to exit state services for private gain?
- **Institutional Accountability:** The counter-ethical perspective highlights the state's failure to provide regular, transparent, and merit-based career progression, which can stymie a scientist's productive years within rigid administrative systems.
- **International and Geopolitical Dimension**
- **Enhancing Strategic Autonomy:** A diverse domestic ecosystem comprised of both public and private champions makes India's supply chains resilient against global geopolitical shocks or targeted sanctions.
- **Soft Power and Global Competitiveness:** Private space entities can aggressively bid for international commercial contracts, helping position India as a cost-effective, reliable hub for global high-tech engineering.



- **Linkages with NCERT Textbooks**
- **Class XI NCERT: Indian Economic Development**
- **Chapter 4: Human Capital Formation in India:** Directly addresses how investments in specialized education and technical training create economic value. The shift toward private-sector deep tech illustrates how human capital dynamically creates secondary and tertiary market opportunities.
- **Chapter 6: Economic Reforms Since 1991:** Provides the baseline for understanding the transformation from state-directed monopolies to market-driven ecosystems, illustrating the long-term effects of deregulation on high-skill employment.
- **Class XII NCERT: Sociology – Social Change and Development in India**
- **Chapter 5: Industrial Society in India:** Explores the evolution of work, the decline of absolute reliance on public sector undertakings (PSUs), and the growth of private enterprise. This grounds the structural shifts occurring within the IIT and ISRO talent pools in a clear sociological context.

- **Linkages with the UPSC CSE Syllabus**
- **General Studies Paper II (Governance and Public Policy)**
- **Syllabus Topic:** *Development processes and the development industry — the role of NGOs, SHGs, various groups and associations, donors, charities, institutional and other stakeholders.*
- **Syllabus Topic:** *Statutory, regulatory and various quasi-judicial bodies; Government policies and interventions for development in various sectors and issues arising out of their design and implementation.*
- **Application:** Analysis of civil service reforms, administrative vs. strategic human resource management, and the deregulation of strategic sectors like space and defense.
- **General Studies Paper III (Science, Technology, and Economic Development)**
- **Syllabus Topic:** *Science and Technology- developments and their applications and effects in everyday life; Achievements of Indians in science & technology; indigenization of technology and developing new technology.*
- **Syllabus Topic:** *Effects of liberalization on the economy, changes in industrial policy and their effects on industrial growth.*
- **Application:** Evaluation of the Indian Space Policy, the role of IN-SPACe, deep-tech startup funding, and transforming the space economy from a government monopoly into an integrated commercial ecosystem.
- **General Studies Paper IV (Ethics and Integrity)**
- **Syllabus Topic:** *Public/Civil service values and Ethics in Public administration: Status and problems; ethical concerns and dilemmas in government and private institutions.*
- **Application:** Evaluating the conflict between individual professional growth and institutional/national loyalty, alongside the ethical obligation of the state to practice efficient succession planning.
- **Essay Paper and Optional Subjects**
- **Essay Themes:** "Atmanirbharta (Self-Reliance) through Ecosystems, Not Isolation"; "The Changing Paradigm of Public Institutions in 21st Century India."
- **Public Administration/Political Science Optionals:** Useful for analyzing structural human resource management, delegation of authority, dismantling the License Raj in strategic spheres, and network governance models.



- **Way Forward**

- **1. Introduce Flexible Sabbatical and Joint-Appointment Frameworks**

- Public institutions should formulate structured policies allowing senior scientists and professors to take a two- to three-year sabbatical to work within domestic startups or private universities.
- *Benefit:* This enables a two-way circulation of knowledge. Veterans inject mission discipline into startups, while bringing back market agility, commercial awareness, and fresh research perspectives to state laboratories without severing their institutional ties.

- **2. Modernize Public HR from Administrative to Strategic Recruitment**

- The Department of Personnel and Training (DoPT) needs to decouple scientific recruitment from standard administrative bureaucratic processes.
 - *Action Plan:* Implement rolling recruitment platforms, automate entry-level pipelines via standardized national talent searches, and simplify lateral entry channels for specialized, time-sensitive fields like quantum computing, materials science, and propulsion systems.
- **3. Implement Institutional Succession Planning Matrices**
 - State-funded strategic organizations must institutionalize a "Dual-Command" and mentorship framework for all critical national missions.
 - *Action Plan:* Every primary mission director or principal investigator must have a designated, actively trained mid-career deputy. Knowledge management systems must be upgraded to digitize and store tacit technical processes, simulation data, and decision-logs, ensuring that no project has a single point of failure.

- **4. Build Collaborative Joint Infrastructure Corridors**

- Rather than forcing private players to replicate capital-intensive testing setups, the state should expand the role of IN-SPACe to turn ISRO's advanced testing labs, wind tunnels, and launch pads into shared, fee-for-service national infrastructure. This grounds private talent within the domestic ecosystem by reducing their capital constraints.

- **Civil Services Mains Questions**

- **GS Paper III (2023):** "What is the main task of India's Third Moon Mission which could not be achieved in its earlier mission? List the subsystems of the spacecraft launched and explain the role of the Virtual Launch Control Centre at the Vikram Sarabhai Space Centre which contributed to the successful launch." *(Relevance: Technical and institutional depth of ISRO missions).*

- **GS Paper III (2019):** "Discuss India's achievements in the field of Space Science and Technology. How has the application of this technology helped India in its socio-economic development?" *(Relevance: Evolution of public space investments).*

- **GS Paper II (2020):** "Institutional quality is a crucial driver of economic performance. In this context, suggest reforms in the Civil Services for strengthening democracy and development." *(Relevance: Reforming rigid personnel management systems).*

- **GS Paper III (2016):** "India has achieved remarkable successes in unmanned space missions including Chandrayaan and Mars Orbiter Mission, but has not ventured into manned space missions. Discuss the main technological and logistic challenges faced by India in this regard." *(Relevance: Complex project management and reliance on specialized team structures).*

- **Civil Services Prelims Reference Themes**

- **Theme: Space Sector Regulators & PSUs (2021/2022-style):** Consider the following statements regarding the Indian space ecosystem:

- NewSpace India Limited (NSIL) functions as the commercial arm of ISRO, responsible for production and marketing of space capabilities.
- IN-SPACe acts as a single-window, autonomous nodal agency to promote and authorize space activities of non-government private entities. *Which of the statements given above is/are correct?* (Answer: Both 1 and 2).

- **Theme: Technology Frameworks:** Questions tracking deep-tech definitions, including application fields of Gaganyaan, cryogenic fuels, IRNSS NavIC constellations, and public-private tech transfers.



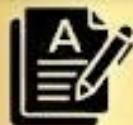
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