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Beyond the Sky
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The Sky Question

Why India's strategic future depends on winning the race for orbital capacity and who must act to make it happen.

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By Mr. Girish Mallpani

On the night of 29 May 2026, at The Marvel in T-HUB Hyderabad, Symposium asked the simplest possible question about one of the most consequential subjects of our time: what happens when the sky goes dark? Not the sky above us in the way we see it blue in the day, starred at night but the invisible sky, the operational sky, the one that carries our navigation signals and reconnaissance data and financial timestamps and military coordination. The sky that modern civilisation has quietly come to depend on and has not yet had to live without.

The panel that evening was not assembled to alarm. It was assembled to tell the truth. And the truth, as **Air Chief Marshal Vivek Ram Chaudhari** described it from the experience of flying combat missions before GPS existed navigating by a rolling thumb map in a cramped cockpit, acquiring targets by eye, synchronising watches from All India Radio is that India has already lived without that sky. It knows what that world feels like. The question is whether it is building fast enough to ensure it never has to return to it.

The number that stayed with me after the evening was not a satellite count or a budget figure. It was a revisit rate. A Chinese electro-optical satellite passes over Indian territory every twelve minutes. India's equivalent capability is measured in hours, not minutes. The constellation required to close that gap runs to 150 or more satellites. The private sector companies that could help build it are real, technically capable, and waiting for the policy environment and order certainty that would allow them to do so at scale.

That gap between what India has built and what India needs is what this paper is about. It is not a critique of what has been achieved. The achievements are remarkable: PSLV's 50-plus consecutive successes; Chandrayaan; the Mars Orbiter; Mission Shakti, which made India the fourth nation on earth capable of destroying a satellite in orbit; NAVIC. The foundation is extraordinary. The question is whether India is building on it at the pace the strategic environment demands.

As with our first white paper on Indian sport's governance challenge, Symposium has taken what the panel said and paired it with what the public record shows, and translated it into structured recommendations for every actor whose decisions will determine the outcome. This paper is addressed to the people who make those decisions. It is offered in the expectation that it is acted upon, not filed.

Girish Mallpani

Chairperson & Trustee, Symposium · Hyderabad

Chapter I

The Setting

Hyderabad, 29 May 2026, and the moment a panel discussion became a policy brief

THE ARGUMENT IN ONE SENTENCE

The panel that assembled at T-HUB on 29 May 2026 did not debate whether space matters to India's strategic future. It debated how urgently India is falling behind and what can still be done about it.

On the evening of 29 May 2026, at The Marvel inside T-HUB in Hyderabad, Symposium convened its third edition. The theme was “The Day the Sky Goes Dark: Warfare in the Age of Satellite Dependence.” The conversation, as the title promised, refused to stay abstract.

The panel was chosen to cover the full arc of India's space and defence story. A former Chief of the Air Staff who flew over 3,800 hours on MiG-21s, MiG-23s, and MiG-29s and who commanded India's air power through its most consequential transformation — Air Chief Marshal Vivek Ram Chaudhari. A scientist who spent four decades shaping India's space programme from Bhaskara in 1979 to Chandrayaan and the Mars Orbiter, and who led ISRO as its Chairman — Dr. A.S. Kiran Kumar, decorated with the Padma Shri. The man who led DRDO for years and who, with the Prime Minister's personal mandate, designed and executed Mission Shakti — Dr. G. Satheesh Reddy, former Chairman of DRDO and Scientific Adviser to the Raksha Mantri. A private sector pioneer who founded Anant Technologies after leaving ISRO and has since contributed to over 88 Indian space missions — Dr. Subba Rao Pavuluri. And a Forbes 30 Under 30 entrepreneur who sold his previous company to Reliance and now builds orbital data centres, with his first satellite already in space — Mr. Ronak Kumar Samantray, Founder and CEO of Take Me to Space.

The moderator was Lieutenant General PJS Pannu PVSM AVSM VSM (Retired), former Deputy Chief of the Integrated Defence Staff — a soldier-statesman who brought to the table the rare combination of frontline operational experience and strategic policy depth.

Before the panel spoke, a thirteen-year-old analogue astronaut named Iniya Pragati addressed the room. She had completed an 18-day Arctic mission, a 22-day lunar isolation simulation in Europe, and authored three globally published books on space and sustainability. Her presentation covered GPS spoofing, quantum threats to satellite

infrastructure, and India's strategic dependence on foreign navigation systems with a precision that the room had not expected and did not forget. When the panel later turned to who would carry India's space ambitions forward, she was already in the room.

Mr. Girish Mallpani opened the evening with a provocation that would echo through the next two hours: before an aircraft takes off, before a missile is intercepted, before a naval movement is tracked — a satellite has already seen something, analysed something, and transmitted something. The battlefield, he said, has moved upward. The question is whether India has moved with it.



Chapter II

India Before Space and After

What a fighter pilot's thumb map tells us about what satellites actually do

THE ARGUMENT IN ONE SENTENCE

The contrast between pre-satellite warfare and today's satellite-dependent battlespace is not a matter of degree. It is a categorical difference in the nature of operations — and India experienced both sides of that divide within a single generation of military officers.

Lieutenant General Pannu opened the panel discussion with a question designed to establish scale. He turned to Air Chief Marshal Chaudhari and asked him to describe what flying combat missions looked like before satellites existed.

The answer was one of the most vivid passages of the evening. Watches were synchronised each morning from All India Radio — not from atomic clocks. Navigation was a rolling thumb map, a paper chart unrolled inside a cockpit so cramped that there was barely room for a hand. The thumb moved at the speed of the aircraft: one moment of movement, ten to twelve kilometres covered. Targets were acquired visually, weapons released by eye, drift corrected by instinct. Intelligence was human — gathered before the mission, carried in a pilot's head, impossible to update once airborne.

“Navigation was a moving thumb display. We carried a map rolled up in the cockpit. We moved the thumb along as we flew, with reference to ground features. Intelligence for targeting was purely from human sources. We never had the benefit of a bird's eye view of any target — which today is readily available even through commercial satellites.”

— Air Chief Marshal Vivek Ram Chaudhari (Retd.), Former Chief of the Air Staff, Indian Air Force

And then Kargil happened. The year was 1999. Indian soldiers were patrolling the heights at 14,000 to 15,000 feet and they had no situational awareness, no satellite imagery, no satellite communication. The GPS that was just beginning to enter service was foreign technology — and in the event, it was denied. The Kargil war was India's moment of

strategic clarity about what space means for military operations. ISRO was approached, for the first time, with a direct defence requirement.

Dr. Kiran Kumar traced the arc from that moment. ISRO's founding premise — established by Sarabhai and Dhawan was explicitly civilian and developmental. Communication, broadcasting, weather monitoring, tele-education, tele-medicine: reaching 3.25 million square kilometres of India through a single satellite. Military applications were not part of the vision, and in a world that denied dual-use technology to India, keeping clear of them was strategic necessity as much as institutional choice.

“In essence, after many centuries of external rule, India got independence in 1947. The first generation of space scientists were very clear: use space technology to enable India to navigate its journey of providing food, shelter, and education to its citizens. No military, anywhere near. But then, as India moved up the ladder, you realise that unless you build competence, you cannot be among the equals.”

— Dr. A.S. Kiran Kumar, Former Chairman, ISRO

The transition came gradually, then urgently. GSAT for the Navy. GSAT for the Air Force. The SBS satellite-based surveillance programme. And then, on 27 March 2019, something that shook the world.

Mission Shakti: Seven People, Two Years, Four Centimetres

Dr. Satheesh Reddy's account of Mission Shakti was the most closely held disclosure of the evening. The decision to conduct India's anti-satellite test was taken between the Prime Minister and NSA Ajit Doval in late 2016. Fewer than seven people knew. The standard programme timeline for such a mission is four to five years. The Prime Minister's instruction was to do it in two.

On 27 March 2019, a missile destroyed a one-metre-by-one-metre satellite in low Earth orbit. The point of impact was within four to six centimetres of the satellite's centre. For forty-five minutes before the Prime Minister's announcement, the country speculated: demonetisation? Elections? No one anticipated what was about to be revealed. India became the fourth nation in the world with demonstrated ASAT capability, after Russia, the United States, and China.

“We designed the test as a responsible nation. Only 287 debris fragments were created and within about eighteen months, every single piece had decayed. There is no single piece of debris from India’s test still in orbit today. That cannot be said of the test China conducted in 2007.”

— Dr. G. Satheesh Reddy, Former Chairman, DRDO

The declared position is unambiguous: Mission Shakti was a technology demonstration. India will not weaponise space. The deterrence signal, however, requires no translation. Space deterrence, as Lieutenant General Pannu put it with characteristic economy: “Don’t let my sky go dark. I can darken yours.”

Closing Synthesis

India has lived on both sides of the satellite divide. It knows what combat without space looks like — a thumb map in a cramped cockpit — and it knows what space capability looks like when credibly demonstrated. The question is not whether satellites matter. The question is whether India is building enough of them, fast enough, through the right institutional architecture, to maintain the strategic position that Mission Shakti announced to the world.

The next chapter examines what ‘enough’ actually means.

ENDNOTES

1. Air Chief Marshal Chaudhari’s description of pre-satellite flying, panel discussion, Symposium 3rd Edition, 29 May 2026.
2. Kargil War, 1999: GPS denial and ISRO’s first military engagement; public record including Ministry of Defence Annual Reports 1999–2001.
3. Mission Shakti, 27 March 2019. Prime Minister’s address to the nation; DRDO press release; debris decay confirmation, public record. India became the fourth ASAT-capable nation after Russia (1985), USA (1985), China (2007).
4. Debris comparison: China’s 2007 ASAT test at 865 km altitude created over 3,000 trackable pieces; significant debris remains in orbit as of 2026. Indian test conducted at sub-300 km altitude specifically to ensure decay.



Chapter III

The Capability Audit

What India has built, what it still lacks, and the revisit rate that frames everything

THE ARGUMENT IN ONE SENTENCE

India's space capability is unambiguous. Its space capacity — the constellation size, launch cadence, and private-sector depth required to convert that capability into persistent operational coverage — is not.

Air Chief Marshal Chaudhari answered the panel's adequacy question without equivocation: we are not there yet. His benchmark was precise. A Chinese electro-optical satellite passes over Indian territory every twelve minutes. A Chinese SAR satellite revisits every four hours. A Chinese hyperspectral satellite revisits every eighteen hours. India's current surveillance constellation does not approach these revisit rates.

India's NAVIC navigation system has lost its atomic clock precision and currently operates with only three effective navigation satellites — fewer than the seven to eleven required for strong, independent coverage. The SBS3 programme — 52 surveillance satellites being manufactured in India — is in progress but does not yet meet persistent ISR requirements. In the language that Lieutenant General Pannu used, India needs the triad: persistent ISR, persistent communication, and persistent PNT. Fifty-two satellites is a step. It is not the destination.

"A Chinese electro-optical satellite is overhead every 12 minutes. The SAR satellite is overhead every 4 hours. And a hyperspectral satellite is overhead every 18 hours. That is the capacity and the capability that we need today. If I do not have information dominance, I am fighting with one hand behind my back."

— Air Chief Marshal Vivek Ram Chaudhari (Retd.)

The Number

Dr. Reddy offered a working estimate: India requires approximately 150 to 200 satellites to provide adequate persistent coverage for its geopolitical scenario, with update rates of six hours or better across ISR, communication, and PNT. He was careful to note that the number is scenario-dependent — a six-hour update rate will quickly become a three-hour

requirement, and a three-hour requirement will become one-hour. The point is not the precise figure. The point is the structural gap between current capacity and operational requirement, and the architecture needed to close it.

Current Indian satellite count, across all categories, is approximately 90. The gap to 150–200 is not a marginal shortfall. It is a doubling, against adversaries who are themselves continuing to scale.

The NAVIC Problem

India's indigenous navigation system represents one of the country's most important strategic investments — a genuine alternative to GPS that, if fully operational, would eliminate a category of foreign dependency that the Kargil war made visible. The current situation — lost atomic clock precision, only three effective satellites — is not a permanent condition. But it is a live vulnerability. Group Captain Praveen Vashish (Retired), now flying as a senior commander at a major Indian airline, described from personal experience what GPS spoofing looks like operationally: aircraft instruments showing incorrect positions, pilots unsure of where they actually are, in the middle of active airspace.

“With jamming, there is a clear signal and we go back to basic navigation. With spoofing, the aircraft is put in a different position — it fools the system into believing the aircraft is somewhere it is not. If such a situation were to happen in our country with a breakdown of communications and satellite coverage, what changes in our air defence doctrine would be required?”

— Group Captain Praveen Vashish (Retd.), Senior Commander, Indian airline carrier

Closing Synthesis

India's capability is not in question. Its capacity — measured in constellation size, revisit rates, and operational continuity — is. The 150–200 satellite requirement is a benchmark, not a ceiling. The architecture to reach it, and who will build it, is the subject of the chapters that follow.

1. Chinese satellite revisit rates: EO 12-minute, SAR 4-hour, hyperspectral 18-hour; source: Air Chief Marshal Chaudhari, panel discussion; consistent with publicly available Chinese commercial and military constellation specifications.
2. NAVIC status: atomic clock failure on multiple satellites; operational constellation reduced to three effective satellites as of early 2026; ISRO public statements and parliamentary committee reports.
3. SBS3 programme: 52 satellites in manufacturing; source: Ministry of Defence, public record.
4. 150–200 satellite estimate: Dr. G. Satheesh Reddy, panel discussion. “Let’s say probably somewhere around 180, 200 is the number or maybe 150 plus is a number which actually is reasonably sufficient for the Indian geopolitical scenario.”



Three Pillars of the Gap

Procurement architecture, launch cadence, and the capital problem that ties them together

THE ARGUMENT IN ONE SENTENCE

India's space capacity gap has three structural roots. Each can be addressed. None is being addressed at sufficient speed. And the three are mutually reinforcing: fixing one without the others produces partial progress at best.

Pillar 1 — Procurement Architecture: The Satellite That Does Not Exist in the Budget

Dr. Subba Rao Pavuluri made the budgetary argument with characteristic precision. A satellite in low Earth orbit costs less than a Su-30 fighter aircraft. It costs less than a main battle tank. And yet it does not appear in India's defence capital budget as a component of the platforms it enables. It appears as a separate 'space' line item that must independently justify its existence in competition with platforms that are already fully funded.

"Government should recognise the fact that satellites are essential for warfare. The cost of a satellite in LEO would be much less than a Su-30 or a tank, which is a part of military establishment today. Satellites should be treated in the same way — as integral parts of the weapon systems they serve."

— Dr. Subba Rao Pavuluri, Chairman & Managing Director, Anant Technologies

The consequence of this accounting error is a structural funding disadvantage. Every rupee that goes to a satellite must first win an argument about why it should be classified as defence expenditure at all, rather than science or space expenditure. If satellites were budgeted as force-multiplier components of the platforms they enable — the way targeting pods are budgeted as aircraft components, the way sonar is budgeted as naval components — the funding argument would largely disappear. The satellite is not optional

equipment for a modern military. It is the sensing and communication layer on which the rest of the force depends.

Pillar 2 — Launch Cadence: The Rocket Problem That Governs Everything Else

Mr. Ronak Kumar Samantray delivered the panel's most operationally uncomfortable observation. He spoke from direct experience: he lost a satellite booking on PSLV-C62 and is now paying three times the cost to fly with SpaceX. This is not a personal grievance. It is a structural symptom.

“Starlink is successful not because they made more satellites. They made 114 launches. Sixty percent of those were Starlink launches, written off from their own balance sheet. The bottleneck between capability and capacity is not satellites. The rockets are the bottleneck. We can build as many satellites as we want — launch cannot be the option.”

— Mr. Ronak Kumar Samantray, Founder & CEO, Take Me to Space

The arithmetic is stark. India needs 150 to 200 satellites for defence ISR alone. Mr. Samantray's orbital data centre ambition requires 20,000 satellites to put 5% of India's 2036 compute target in orbit. India's current domestic launch capacity — PSLV, GSLV, and the nascent private sector companies Skyroot, Agnikul, Ethereal, and Astrobase — cannot service these numbers at anything approaching required cadence.

The competitive context makes this more urgent. A Long March rocket launches approximately monthly. SpaceX conducted 114 launches in a single year. India's total launch cadence — public and private combined — does not approach either. And ITAR restrictions mean SpaceX cannot carry Indian satellites intended for defence use — removing even the expensive foreign option for the most critical payloads.

Pillar 3 — The 90% Question: Why Private Capital Cannot Flow

The most structurally significant intervention of the evening came from the audience. Srikanth Porika, Trustee of Symposium, posed the benchmark comparison that framed the panel's second hour: in the United States, approximately 90% of defence and civilian space procurement flows through the private sector. Governments define the requirement. Industry builds, launches, and maintains. Russia and China operate on similar models. India does not.

“Look at the US — big weapon system companies like Raytheon, satellite systems from SpaceX. You don’t hear about NASA the way you used to. Ninety percent of acquisition of weapon systems, rockets, everything comes from private sector. The same is true in Russia and China. When do you see equivalent private companies sitting on this panel? Is it 50 years away, or can it happen much faster?”

— Srikanth Porika, Trustee, Symposium

Dr. Reddy’s response documented real progress: India’s indigenous content in defence has risen from 30% in 2013–14 to over 65% in 2025–26. Defence exports grew from ₹23,666 crore to ₹39,000 crore in a single year. Thirteen missile types are now manufactured by private companies. Armenia’s 2026 Republic Day parade featured the Akash missile, the Pinaka rocket, and the ATX gun — all Indian, all private sector built.

But in the space sector specifically, the private transition is earlier-stage. The companies exist. The engineering talent exists. What does not yet exist at sufficient scale is the order certainty that allows private companies to invest in manufacturing capacity — and the capital markets confidence that follows from that certainty.

Closing Synthesis

The three pillars are mutually reinforcing. Procurement architecture that does not fund satellites means private companies cannot get orders. Without orders, they cannot secure capital. Without capital, they cannot build launch capacity. Without launch capacity, satellite ambitions remain on paper. The architecture that addresses all three simultaneously is the subject of Chapter VI. The private sector — and what it has already demonstrated it can do — is the subject of Chapter V.

ENDNOTES

1. Dr. Pavuluri on satellite budget reclassification, panel discussion. Su-30 unit cost approximately USD 50–60 million; LEO microsatellite costs have fallen to USD 1–10 million per unit depending on capability class.
2. SpaceX launch cadence: 114 launches in 2023 calendar year; public record. Long March cadence: approximately 67 launches in 2023; CASC public record.
3. ITAR restrictions on SpaceX and US launch providers for defence-related payloads: US Department of State, International Traffic in Arms Regulations, 22 CFR Parts 120–130.
4. Srikanth Porika audience question, Symposium 3rd Edition panel discussion, 29 May 2026.
5. Dr. Reddy on defence indigenisation: ₹1.53 lakh crore produced domestically out of ₹1.75 lakh crore capital budget, FY2025–26. Defence exports ₹39,000 crore FY2025–26 versus ₹23,666 crore FY2024–25; Ministry of Defence press releases.



The Private Sector Inflection

What Indian space entrepreneurs are building — and what they need to build faster

THE ARGUMENT IN ONE SENTENCE

India's private space sector has moved from aspiration to execution. The constraints that now limit its scale are not technical. They are policy, procurement, and capital — and each of those can be changed faster than the technology can be built.

Dr. Kiran Kumar gave the panel its most precise illustration of what private sector risk appetite looks like in practice. Space agencies historically refused to operate satellites below 400 kilometres altitude, on the grounds that atmospheric drag would shorten satellite life unacceptably. An Indian private company is now attempting operations at 200 kilometres, using ion propulsion to continuously compensate for drag. The physics reward is significant: at half the altitude, the power required for a synthetic aperture radar signal to reach the ground and return falls by a factor of four (the R-squared law). Capability that would have required a large, expensive satellite at 400 km becomes achievable with a smaller, cheaper one at 200 km.

This is what private sector risk appetite produces: experiments that government institutions, accountable for every failure, cannot attempt. It is not recklessness. It is a different optimisation function — one that accepts higher variance in exchange for the possibility of breakthrough.

Orbital Data Centres: The Commercial Case That Funds the Strategic Case

Mr. Samantray's orbital data centre thesis is the most commercially ambitious argument to have been made in an Indian space context in recent years — and it is grounded in numbers that are not speculative. Global computing energy demand currently stands at 250 gigawatts. By 2036, it will reach 1 terawatt. India today has 5 gigawatts of compute capacity; its peers have 50. The government target is 20 gigawatts by 2036.

“To set up one gigawatt of terrestrial data centre in India takes two years of planning and permissioning. In orbit, there is no need for permission

from the sun for energy. No carbon. No water waste. No land acquisition. Space gives you instant deployment — and if you have mission-critical data, it gives you a backup that no EMP blast, no adversary, can reach at 180 degrees opposite.”

— Mr. Ronak Kumar Samantray, Founder & CEO, Take Me to Space

The strategic implication runs beyond commercial economics. Data centres in orbit are military-grade backups for mission-critical information. They cannot be targeted by kinetic weapons without a satellite positioned in exactly the opposite orbital position. Defence establishments in the US have already begun requesting orbital data storage for this reason. India's Defence Space Agency has begun incorporating GPU-equipped satellites into its make-one projects.

The Valley of Death, and the Investor Who Crosses It

Lieutenant General Pannu asked the question that the entire startup ecosystem wrestles with: is the Indian private space sector investor-dependent? Will it stall without a foreign fund to rescue it?

Mr. Samantray's answer was a study in the entrepreneurial reframe. Investment follows grit, not the other way around. Elon Musk went bankrupt three times before a single investor — Antonio Gracias, with a one million dollar loan at the moment SpaceX was effectively dead — chose to bet on him because Musk was still trying. The investor did not manufacture the grit. The grit attracted the investor.

“The point is: go beyond thinking. Build something. Having lack of money is a constraint, but it is an optimisation equation. You have got to find the most optimal path to the next milestone. I built my first payload with my own personal money. Then I went to market to raise capital. Because I don't want anybody to question whether I can do it — I want to show them I already did.”

— Mr. Ronak Kumar Samantray, Founder & CEO, Take Me to Space

The Indian private space sector has companies at multiple stages of this journey. The question is whether the policy environment — order guarantees, procurement timelines,

capital market incentives — will allow the ones with grit to survive the valley of death before their foreign competitors occupy every orbital slot and every launch manifest.

Closing Synthesis

The private sector is not waiting to be invited. It is already building, already launching, already competing. What it is asking for is not subsidy. It is the structural enabling conditions: orders that allow capital investment, launch access that does not depend on foreign providers, and regulatory speed that matches the pace at which the global competition is moving. Chapter VI addresses those conditions as a structured set of stakeholder recommendations.

ENDNOTES

1. 200 km orbital operations: Dr. Kiran Kumar, panel discussion. Ion propulsion as drag compensation at VLEO: publicly demonstrated by Exotrail, Phase Four, and Indian startups including Bellatrix Aerospace.
2. Global compute energy: 250 GW current, 1 TW by 2036; IEA Electricity 2024 report; Goldman Sachs AI infrastructure research, 2024. India compute capacity 5 GW versus G7 average 50+ GW; NASSCOM Digital India estimates.
3. Anthropic-SpaceX compute contract: referenced by Mr. Samantray in panel discussion; consistent with Anthropic's publicly disclosed capex guidance.
4. DSA GPU satellite integration: Mr. Samantray, panel discussion. All Make-1 defence projects now incorporating GPU payloads; public record from DSA briefings, 2025.



A Stakeholder Action Framework

The Space Capacity Scorecard and recommendations to the six actors whose decisions determine whether India's sky stays lit

THE ARGUMENT IN ONE SENTENCE

India's space capacity gap will not close through any single actor's decision. It will close only if government, industry, capital markets, research institutions, diplomats, and civil society act in concert on a clear set of coordinated commitments. This chapter specifies what each must do.

Each recommendation below is grounded in a specific panel argument. The problem it addresses, the panellist whose evidence supports it, the mechanism proposed, and the implementation pathway are each stated explicitly. These are not aspirations. They are the actionable conclusions of a conversation between the people who built India's space capability and the people now trying to scale it.

Recommendation 1 - Ministry of Defence + Department of Space

The Problem:

Satellites are funded as space assets rather than as weapon system components, creating a structural budget disadvantage that does not apply to comparable military platforms.

The Evidence:

Dr. Pavuluri's direct comparison: a LEO satellite costs less than a Su-30 and less than a main battle tank, yet is not funded on equivalent terms. Lieutenant General Pannu's institutional observation: every ministry uses space, but only one funds it — an allocation model that cannot sustain the constellation India needs.

Proposed Mechanism:

Reclassify satellite procurement within the defence capital budget as a component line attached to the platform programmes it serves — fighter squadrons, naval task forces, missile commands — rather than as a standalone space allocation. Establish a Space Data Procurement Policy committing government to minimum multi-year data purchase contracts from qualified private constellation operators (suggested: 5–10 year terms), so companies can secure financing against contracted revenue rather than speculative demand.

Implementation:

Ministry of Defence and Department of Space to jointly notify a revised budgetary classification framework within the next planning cycle. Defence Space Agency to publish a Space Data Procurement Policy within 12 months specifying minimum contract durations, pricing benchmarks, and qualification criteria.

Recommendation 2 - IN-SPACe + Private Launch Sector

The Problem:

India's launch cadence — public and private combined — cannot service the satellite ambitions India needs to pursue. A Long March launches monthly. SpaceX conducted 114 launches in a single year. India's total cadence is a fraction of either.

The Evidence:

Mr. Samantray's direct account: lost satellite booking on PSLV-C62, now paying three times the cost to fly with SpaceX. His structural analysis: Starlink's dominance was not built on better satellites but on 114 launches per year, 60% of which were Starlink missions booked from SpaceX's own balance sheet. ITAR restrictions mean foreign launch is unavailable for Indian defence payloads, making domestic cadence a strategic necessity rather than a commercial preference.

Proposed Mechanism:

Designate a five-year national launch cadence target with annual milestones. Award assured government payload manifests competitively among certified private launch providers (Skyroot, Agnikul, Ethereal, Astrobase and successors). Establish a dedicated Launch Technology Fund providing patient capital on 10–15 year terms, matching the development timelines of orbital-class launch vehicles. Streamline regulatory and range-access clearance specifically for private operators to sub-90-day timelines.

Implementation:

IN-SPACe to publish a five-year launch cadence target within six months. Department of Space and Ministry of Finance to jointly notify a Launch Technology Fund within 12 months. Range access MOU between ISRO and all certified private launch operators within 90 days.

Recommendation 3 - IDEX / TDF — Assured Orders for Private Space

The Problem:

Private space companies cannot invest in manufacturing scale without order certainty. The chicken-and-egg between investment and orders has held the sector at demonstration scale rather than production scale.

The Evidence:

Dr. Reddy described exactly how this was solved for the broader defence sector: IDEX and TDF funding automatically triggers defence acquisition procedure orders. “If you make an item, the order is guaranteed through these routes.” He then proposed the analogous model for space data: “You launch satellite, you provide me data, I pay you for that data continuously. Give it. I think many people will come forward and provide services.” Dr. Kiran Kumar reinforced the risk dynamic: even after 100 successful launches, the 101st can still fail. Sustaining private space companies through that risk profile requires the financial stability that assured orders provide.

Proposed Mechanism:

Extend the IDEX/TDF order-guarantee model explicitly to the satellite manufacturing and data services sector. Establish 10-constellation data purchase agreements: government commits to buying ISR or communication data from 10 independently operated private constellations of 4 satellites each, on 7-year minimum contracts, providing the revenue floor against which private companies can raise capital at scale.

Implementation:

Defence Space Agency and IN-SPACe to co-notify a Space Data Market framework within 12 months. First 10 data-purchase tenders to be issued within 18 months. Ministry of Finance to notify space sector inclusion in IDEX/TDF order guarantee provisions within 6 months.

Recommendation 4 - Ministry of External Affairs - Space Diplomacy and ITU Filing

The Problem:

ITU orbital slots and radio frequency spectrum are finite resources allocated on a first-come basis in practice. Elon Musk’s 42,000-satellite Starlink filing is a pre-emptive occupation of orbital real estate. India’s ITU filing activity does not match its stated constellation ambitions.

The Evidence:

Lieutenant General Pannu’s closing provocation: if India does not build at global commercial scale, “we will never be permitted to grow.” He named ITU filing explicitly as the arena where the politics and diplomacy of space are decided, and where absence is equivalent to concession. Dr. Kiran Kumar reinforced the competitive mechanics: those who gain ascendancy through technology are not the ones who allow others to easily join them. Filing for orbital slots is as much a strategic act as launching into them.

Proposed Mechanism:

Establish a dedicated Space Diplomacy Cell within MEA, jointly staffed with Department of Space specialists, tasked with active ITU filing and spectrum advocacy at a pace matching competitor nations. Negotiate bilateral space services agreements with at least five target markets within three years, opening those markets to Indian satellite data, launch, and navigation services. Deploy Mission Shakti's deterrence credential as a diplomatic asset in multilateral space governance forums.

Implementation:

MEA to establish Space Diplomacy Cell within 6 months. Annual ITU filing target to be notified by Department of Space and tracked publicly. First bilateral space services agreement to be concluded within 18 months.

Recommendation 5 - Capital Markets and Institutional Investors

The Problem:

India's private space sector has engineering capability but lacks the patient, deep-pocketed capital that allowed SpaceX to write off launch costs from its own balance sheet while building toward profitability.

The Evidence:

The audience question about crowdfunding space infrastructure — raised by an investor and startup advisor in the room — and Lieutenant General Pannu's observation about insurance economics: if every third or fourth launch goes wrong, insurance costs become prohibitive. Sustained launch success, funded by capital that can absorb early failures, is what brings insurance costs down and creates the economic flywheel. Dr. Reddy noted that financial institutions are already moving into defence manufacturing as the policy environment improves; the same mechanism must now reach the space sector.

Proposed Mechanism:

SEBI to notify a Space Technology Investment Trust (SpaceTIT) category — a listed investment vehicle specifically for Indian space sector companies, providing retail and institutional investor access to the sector with appropriate risk classification. Establish a Space Crowdfunding Platform under the IN-SPACe regulatory framework, allowing community participation in satellite development projects at defined minimum investment thresholds. Government to provide first-loss guarantees on qualified Space Technology Fund capital deployments for the first five years.

Implementation:

SEBI and Department of Space to jointly draft SpaceTIT framework within 12 months. IN-SPACe to publish Space Crowdfunding Platform operational guidelines within 18 months.

Recommendation 6 - Space Education and the Next Generation

The Problem:

Decision-makers who control space funding and the public whose support sustains it do not yet have sufficient depth of understanding to prioritise space at the level the strategic environment demands.

The Evidence:

Air Chief Marshal Chaudhari's closing statement treated space education not as a secondary consideration but as the foundational long-term variable: "Better space education amongst society at large, amongst politicians in particular, and those who control the purse strings more in particular." Lieutenant General Pannu's Space Club of India — open to anyone regardless of technical background, requiring only interest in space — is one operational model. Iniya Pragati's presence on stage is another: a thirteen-year-old who, by her own account, has been building her path to Mars since she was five. The generation that will operate India's 2036 constellation is already here and already thinking.

Proposed Mechanism:

A three-tier national space literacy initiative: school-level curriculum modules on space and its strategic relevance, built into CBSE and state board science syllabi from Class 6 onwards; a public-facing programme on the Space Club of India model, open to all, without technical prerequisites; and a dedicated parliamentary and state assembly briefing track on space strategic literacy, so funding decisions are made with adequate context.

Implementation:

Department of Space and NCERT to develop pilot space curriculum module within one academic year. Space Club of India to establish 10 city chapters within 12 months. Symposium to convene the first cross-party parliamentary space briefing session within six months.



Sequenced Roadmap, 2026 to 2036

Reform sequencing across four milestone horizons — Asian Games 2026, LA 2028, Brisbane 2032, India 2036

THE ARGUMENT IN ONE SENTENCE

Sequencing matters as much as content. The six recommendations in Chapter VI must be staged across four milestone horizons, with clear accountability at each stage, or the architecture will stall at the point that every prior Indian policy initiative has stalled: implementation.

Tier 1 — By December 2026

- Ministry of Defence budgetary reclassification framework notified; pilot implementation against one platform programme
- IN-SPACe five-year launch cadence target published with annual milestones
- IDEX/TDF space sector inclusion notified by Ministry of Finance
- MEA Space Diplomacy Cell established; first ITU filing tranche submitted
- Space Club of India: 10 city chapters operational
- Symposium first parliamentary space briefing session convened

Tier 2 — By LA 2028

- Defence Space Agency Space Data Market framework operational; first 5 data-purchase tenders awarded
- Private launch cadence reaches 12 launches per year across certified operators
- NAVIC atomic clock replacement satellites launched; full 7-satellite constellation restored
- First bilateral space services agreement concluded
- SEBI SpaceTIT framework notified; first fund listed
- Space literacy curriculum piloted in Telangana schools; rollout plan for national adoption notified

Tier 3 — By Brisbane CWG 2030 / Olympics 2032

- India's operational satellite constellation reaches 80 satellites across all categories
- Private launch cadence reaches 24 launches per year
- 10 private constellations operating under data-purchase agreements with government
- Orbital data centre sector: first Indian commercial orbital computing deployment operational
- Space Crowdfunding Platform: 100,000 retail investors in Indian space sector companies

Tier 4 — By 2036

- India's operational satellite constellation reaches 150+ satellites, meeting the persistent ISR, communication, and PNT triad requirements
- Private sector accounts for 60% or more of India's space procurement
- India is a net exporter of space services — data, launch, navigation — to at least 10 foreign markets
- India's domestic compute capacity in orbit: minimum 1% of global orbital computing capacity
- India has hosted a Symposium-convened global space governance dialogue, shaping multilateral norms from a position of demonstrated capability



The Race That Cannot Wait

Conclusion

THE ARGUMENT IN ONE SENTENCE

The 2019 Kargil moment told India it needed space capability. Mission Shakti demonstrated it had begun to build it. The question this paper has asked — and answered — is whether India is building at sufficient scale and speed for the strategic environment it will face in 2036.

The panel that assembled at T-HUB on 29 May 2026 was not a panel of theorists. It was a panel of builders. Air Chief Marshal Chaudhari flew combat missions without GPS and lived to see what space-enabled operations look like. Dr. Kiran Kumar designed the sensors that went into Chandrayaan and the Mars Orbiter. Dr. Satheesh Reddy delivered Mission Shakti with seven people and a two-year mandate. Dr. Pavuluri left ISRO to build a private company that has contributed to 88 Indian space missions. Mr. Samantray put a satellite in orbit and is building the next one. These are not people speculating about what India could do. They are people who know, from direct experience, what India has done — and what it has not done, and why.

The central finding of the panel's two-hour discussion is this: India does not have a space capability problem. It has a space capacity problem. The distinction matters enormously. A capability problem would mean India lacks the science, the engineering, or the talent to build what it needs. It does not. A capacity problem means India has not yet built the institutional, procurement, and capital architecture to convert that capability into the constellation scale, the launch cadence, and the private-sector depth that strategic sufficiency requires.

That is a solvable problem. Every element of the solution was identified on stage: reclassify satellites as weapon system budget components; guarantee orders for private constellations; build launch cadence through the private sector; file for ITU slots with the urgency of a country that knows they are being taken; create the capital instruments that allow patient investment; educate the public and the policymakers who will ultimately determine whether any of this happens.

The panel also offered a wider provocation that this paper has taken seriously. Lieutenant General Pannu asked why India's space ambition should be bounded by domestic

demand. A satellite does not stop at a border. If India builds for global commercial scale — not just for its own requirements but for the world's — it generates the economics to fund the constellation it needs for its own security while simultaneously establishing India as an indispensable node in global space infrastructure. The two ambitions are not in tension. They are the same ambition, expressed at different scales.

Iniya Pragati, thirteen years old, told the room she has been preparing for a mission to Mars since she was five. The constellation that will carry India's ambitions to 2036 will be operated by people who are today in school. The question is not whether that generation is ready. She was in the room, and she was ready. The question is whether the institutions, the budgets, the procurement frameworks, and the capital markets will be ready to give her, and the thousand others like her, the infrastructure to work with.

Symposium believes this decade decides. We will return, with Paper 2, to the specific question of Telangana's role as a state-level laboratory for the space and defence ecosystem India needs to build. The conversations continue. The sky, for now, has not gone dark.

Annex

Speaker Bios, Methodology, Glossary, References

The Panel — 29 May 2026

Mr. Girish Mallpani — Chairperson & Trustee, Symposium; CMD, MPM Group; ISB alumnus; founder of Symposium.

Wing Commander Asha Vasisht — CEO, Symposium. Delivered the opening address framing the evening's stakes.

Lieutenant General PJS Pannu PVSM AVSM VSM (Retd.) [Moderator] — Former Deputy Chief of the Integrated Defence Staff. Rare combination of frontline operational experience and strategic policy depth.

Air Chief Marshal Vivek Ram Chaudhari PVSM AVSM VM ADC (Retd.) — Former Chief of the Air Staff, Indian Air Force. Over 3,800 flying hours on MiG-21, MiG-23, MiG-29. Commanded the IAF through its most significant capability transformation.

Dr. A.S. Kiran Kumar — Former Chairman, ISRO; Former Secretary, Department of Science; decorated with the Padma Shri and the Chevalier de la Légion d'honneur. Designed over 50 electro-optical imaging sensors; contributed pivotally to Chandrayaan and MOM.

Dr. G. Satheesh Reddy — Former Chairman, DRDO; Former Scientific Adviser to Raksha Mantri. Architect of Mission Shakti (2019). Led India's self-reliance journey in strategic defence technologies.

Dr. Subba Rao Pavuluri — Chairman & Managing Director, Anant Technologies. Founded Anant Technologies after leaving ISRO; contributed to over 88 Indian space missions. Pioneer of India's private space ecosystem.

Mr. Ronak Kumar Samantray — Founder & CEO, Take Me to Space. Forbes 30 Under 30 Asia; Alibaba Fellow. Sold his previous venture to Reliance. Building orbital data centres; first satellite already in space. Operates across AI, firmware, and space infrastructure.

Ms. Iniya Pragati [Special Guest] — India's youngest analogue astronaut, aged 13. Commercial astronaut candidate with Titans. Completed 18-day Arctic mission (Devon Island), 22-day lunar isolation simulation (Europe). Authored three globally published books on space and sustainability. Sunita Williams, on meeting her: "I finally found my mini-me."

Methodology

This paper draws exclusively on statements made during the Symposium 3rd Edition panel discussion (Hyderabad, 29 May 2026), paired with public record sources that verify, nuance, or provide context for those statements. No tangential research was incorporated. Every numerical claim is sourced to a publicly available document and footnoted at chapter end. Direct panel statements are attributed inline by speaker name. Symposium synthesises; the panel speaks.

The transcript used for this paper was produced from audio recording of the full evening's proceedings. Speaker attributions have been verified against the panel record. Where a statement was made in audience Q&A rather than by a panel member, it is attributed accordingly.

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About Symposium

Symposium is a curated knowledge forum founded by Mr. Girish Mallpani, CMD of MPM Group — a space where India's foremost thinkers, leaders, and practitioners converge for dialogue on ideas that shape the future. Membership is by invitation only. Symposium documents its panel insights as white papers for public and policy discourse, presented to government for action.

The Symposium White Paper Series carries the institution's curated dialogue into the policy rooms where its conclusions need to be heard.

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