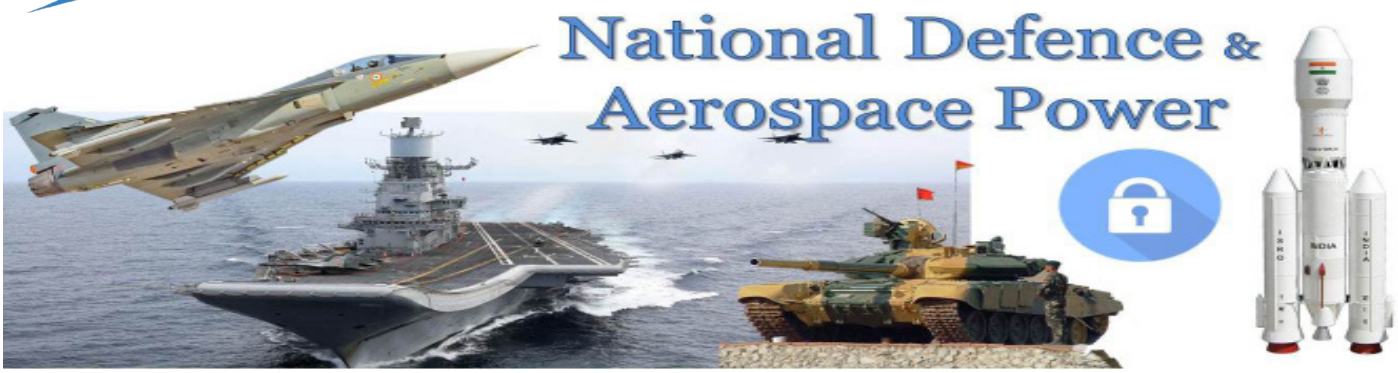
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SILICON DETERRENCE: WHY SEMICONDUCTORS HAVE BECOME AN 'ENABLING' STRATEGIC MILITARY CAPABILITY

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The Invisible Foundation of Military Power

An Indian Air Force fighter locks onto multiple targets through its Active electronically scanned array (AESA) radar. A BrahMos missile, mid-flight, recalculates its trajectory in milliseconds. A Reconnaissance satellite supporting Indian forces compresses and downlinks imagery through a radiation-hardened processor that no technician will ever touch again once it reaches orbit. Three very different systems, one shared dependency—none of them function without an advanced semiconductor.

Strip away the chip and the fighter is an inert airframe, the missile a tube of fuel and explosive with no sense of where it is going, the satellite a silent piece of metal. Semiconductors are a component of modern military power and are its substrate, invisible in ordinary discussions of strategy, yet indispensable to everything strategy depends on. This brief goes a step beyond the now-familiar observation that 'chips matter'. Industrial success in semiconductors does not automatically translate into military assurance, and this brief sets out how India can close that gap. The central claim is that India should pursue semiconductor assurance rather

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Why Semiconductor Security Matters 'Now'?

For most of India's post-Independence industrial history, semiconductor self-sufficiency was not treated as an essential strategic question. That was not because chips did not matter to the electronics of the day; it was because three assumptions, each reasonable at the time, made import dependence look like an acceptable cost of doing business rather than a vulnerability. First, post-1991 liberalisation built India's technology brand on software and services, not hardware. India exported code, not silicon, and industrial policy followed that comparative advantage. Second, for most of the 1990s and 2000s, global chip supply behaved like ordinary commercial infrastructure: foundries across several continents competed on price, and no single geography looked indispensable. Third, India's defence electronics demand, in volume terms, was a rounding error against global semiconductor output not large enough on its own to justify the capital cost of a dedicated fabrication base. These shifts, in barely half a decade, have overturned each of these assumptions.

The strategic importance of semiconductors is now also reflected in India’s highest-level policy discourse. In his August 15, 2026 Independence Day address, Prime Minister Narendra Modi highlighted the development of India’s domestic semiconductor ecosystem, noting the initiation of three semiconductor plants and the beginning of chip exports.[1] He situated this progress within the broader objective of building an *Aatmanirbhar Bharat*, alongside efforts to secure critical minerals and energy.

Shifts Reshaping the Strategic Landscape

Five converging shifts, taken together, have turned semiconductor access into an immediate national-security question for India rather than a distant industrial one. Semiconductor assurance requires a harder test than domestic production alone. The relevant national security question is whether India can maintain trusted access to the materials, equipment, design tools, fabrication capacity, and specialised components on which its defence systems depend when commercial supply is disrupted, denied or weaponised.

First, China's Made in China 2025 programme set explicit, state-backed targets for domestic semiconductor self-sufficiency. A decade on, the United States (US)-China Economic and Security Review Commission's (USCC) 2025 assessment finds that China has met or exceeded many of those targets, particularly in mature-node production, packaging, and certain equipment segments. China nevertheless remains constrained at the most advanced nodes.[2] A rival power investing this heavily in ending its own chip dependence changes the terms of the argument for everyone else in the region.

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Second, Washington's own conduct confirms the same lesson from the other direction. Since October 2022, the US Bureau of Industry and Security has used export licensing on advanced computing chips and semiconductor manufacturing equipment as a direct instrument of state power against China, tightened further in October 2023.[3] If the world's largest chip economy treats semiconductor access as a lever of statecraft to be switched on and off, no country building a military on imported chips can treat that access as guaranteed, including India.

Third, the rise of Artificial Intelligence (AI) has turned raw computing power into a strategic resource: training and running the models behind modern intelligence analysis, autonomous targeting, and cyber operations depend on advanced processors. Only a handful of firms can design these, and only a handful of foundries can build them. This makes compute capacity a new axis of military-relevant power in its own right. The AI race is increasingly determined not only by algorithms but by specialised AI accelerators. Companies such as NVIDIA, AMD, and Google dominate the advanced Graphics Processing Units (GPUs) and AI processors required to train frontier models, while Chinese firms including Huawei (Ascend), Biren, and Cambricon have accelerated indigenous AI-chip development under tightening US export controls. Much of China's recent AI progress has nevertheless depended upon hardware ecosystems originally built around US-designed architectures and fabrication networks. As military applications of AI expand—from intelligence analysis and autonomous systems to cyber operations and decision support—control over AI-chip supply chains is becoming as strategically important as access to energy or critical minerals.

Fourth, the war in Ukraine has offered two lessons that cut in different directions and both matter for India. At scale, drone and missile production consumes enormous volumes of comparatively unglamorous, mature-node chips, not exotic cutting-edge silicon—a

demand pattern much closer to India's likely wartime needs than the AI-chip headlines suggest. And even a sweeping, well-resourced sanctions regime has struggled to stop Western-made microelectronics from reaching Russian weapons through third-country intermediaries.[4] A sobering data point on how leaky even the most determined export-control regime can be.

Fifth, and underlying all four shifts above, is the sheer concentration of the chokepoints that make denial possible in the first place. As Chris Miller documents in *Chip War*, the industrial ecosystem needed to design and manufacture cutting-edge chips is defined by severe technological and geographic bottlenecks.[5] Extreme-ultraviolet lithography, advanced chip-design software, and leading-edge fabrication are each concentrated among a handful of firms and one geography. Taiwan's TSMC alone accounts for roughly 70 per cent of the global foundry market.[6] This concentration cuts both ways. China has already shown, through its own export controls on critical minerals, that it is willing to use chokepoints as leverage. A further legal wrinkle sharpens the point for India specifically. Electronic Design Automation (EDA) software is used to design a chip before a single wafer is fabricated. It typically embeds US-origin intellectual property and remains subject to the US Export Administration Regulations regardless of where it is licensed or used.[7] An Indian design house working on defence-relevant silicon can therefore fall within US export-control jurisdiction through its tools alone, independent of where the finished chip is fabricated or who buys it. Any Indian legal or procurement framework for semiconductors has to be built with this extraterritorial reach in mind, not as an afterthought. The race is increasingly driven by private capital too. Elon Musk has recently announced plans for a "Terafab", envisioned as one of the world's largest AI-oriented semiconductor manufacturing facilities. This illustrates that semiconductor capacity is becoming a strategic asset not only for states but also for globally integrated technology firms supporting AI infrastructure. Together, these five shifts explain why a question India no longer can defer.

Existing Semiconductor Models and India’s Choice

China: State-Directed Self-Reliance

China's approach rests on state direction of strategic sectors, patient capital absorbing losses no private market would tolerate, civil-military fusion that erases the line between commercial and military production, and procurement-led demand—sustained across decades rather than funding cycles. The 2025 USCC assessment finds this combination has let China meet or exceed most of its Made in China 2025 targets despite tightening Western export controls.[8] India can borrow the transferable half—patient capital, coordinated institutions, procurement-led demand—without the coercive half: civil-military

fusion depends on a one-party state's ability to direct private firms and override the transparency norms a democracy owes its citizens. ISM 2.0's extension of programme lifecycles from five to twelve years already reaches for the first, without the second.

India should pursue a hybrid, private sector-led model of strategic semiconductor assurance. Private industry should remain the manufacturing and scaling engine, since cost competitiveness comes from market discipline rather than administrative direction.

Taiwan and the United States: Democratic Alternatives

China is not the only alternative. Taiwan's model is state-enabled but private-sector-led: public investment-built research infrastructure and talent, while private firms—TSMC foremost—compete under market discipline. The United States runs it the other way: a private-sector ecosystem into which the state intervenes strategically, through funding, incentives, and trusted-supplier certification, rather than directing production. Both show that democratic semiconductor power comes from combining public intervention with private capability in different proportions, not from choosing between state ownership and unmanaged market dependence—the space India's own model has to occupy.

The Indian Model: Strategic Assurance, Not Autarky

India should pursue a hybrid, private-sector-led model of strategic semiconductor assurance. Private industry should remain the manufacturing and scaling engine, since cost competitiveness comes from market discipline rather than administrative direction. Government should act as a patient-capital provider, R&D enabler, and demand anchor, supplying long-horizon financing and predictable procurement without displacing private firms as producers. The Defence Research and Development Organisation (DRDO) and academia should focus on technology development and validation rather than becoming permanent production monopolies. Their advantage lies in derisking frontier capability, not owning fabrication at scale. Allied partnerships should provide redundancy. They should supplement indigenous capacity against disruption, not substitute for it. Together, these four roles avoid both extremes: state direction without private dynamism reproduces China's rigidities without its capital depth; private dynamism without state anchoring reproduces the import dependence India already has. This model shifts the objective from semiconductor self-sufficiency to semiconductor assurance—the ability to maintain trusted access to critical components during disruption, denial, or conflict. What follows applies it: first to what military readiness requires, then to the four domestic gaps standing in the way, then to the partnerships and procurement that make it credible to private capital.

Building India's Semiconductor Strategic Assurance

1. From Production to Military Readiness

Military systems depend on an industrial layer few militaries own: AESA radars need specialised modules to track targets while resisting jamming; precision munitions need compact guidance chips; satellites need radiation-hardened processors with no possibility of repair. India's 2016 Rafale experience shows both the risk and the remedy. When France declined to transfer gallium nitride (GaN) technology despite offset commitments, DRDO's Solid State Physics Laboratory developed indigenous GaN transistors instead. This made India only the seventh country to master the technology.[9] Semiconductor Laboratory, Mohali, India's only government-owned fab, proves the institutional foundation already exists—even if it cannot compete with commercial leading-edge foundries.

Yet defence demand is a small fraction of national chip consumption, and skews toward mature, high-reliability parts. Defence therefore does not need to own fabs; it needs the ability to certify, trace, and ring-fence civilian and allied capacity for defence-grade parts—a governance problem, not a capital one. Readiness depends on certified access to supply, not gross production volume. That access has to be built before a crisis, not during one: the chips flowing reliably through peacetime markets are precisely the ones a determined adversary, or an anxious supplier state, can withhold when they are needed most.

2. The Four Domestic Constraints

Four internal constraints stand between India and defence assurance—materials, fabrication, workforce, and institutional coordination; External reliability constitutes a fifth constraint.

The raw materials including polysilicon, rare gases, and photoresist chemicals remain concentrated outside India, and concentration is leveraged in the hands of whoever holds it. China's gallium and germanium controls, in force since 2023 and hardened into a US-specific export ban by 2024, show that Beijing is willing to restrict critical semiconductor inputs. These include the compound-semiconductor materials on which India's Gallium nitride (GaN)/silicon carbide (SiC) programmes depend.[10] ISM 2.0 now extends incentives to raw-material suppliers and speciality gases.[11] But certified, redundant supply is a multi-year project, not a line item. The immediate priority should therefore be to diversify sourcing, including by deepening ties with Japan and the Netherlands. India should also

negotiate explicitly, in treaty text, the extraterritorial reach of the US Export Administration Regulations over Indian design work.[12] The same arrangements should address liability for defence- and space-grade components that fail.

Fabrication tells a similar story of capability outrunning capacity. DRDO's GaN win is defence-specific and low-volume; it proves process mastery, not industrial-scale fabrication[13], and India did not commit state capital at fabrication scale at all until India Semiconductor Mission (ISM) 1.0 in December 2021.[14] Leading-edge fabrication, moreover, is a moving target—competing at the frontier means matching a decade of continuous reinvestment by Taiwan, South Korea, and the United States, not staging a one-time catch-up. India's first commercial fab at Dholera targets mature nodes (28–110 nm) instead,[15] which is not cutting-edge but is precisely the range aerospace and defence need, where reliability matters more than transistor density. The task now is to commercialise DRDO's breakthroughs through the Civil-Military Semiconductor Council proposed above, whose first job should be moving them into production with private foundries, including via the Tata-ASML partnership signed in May 2026.[16]

Workforce looks like strength until you look closer. India holds roughly 20 per cent of the world's chip-design workforce[17]—real, but the wrong kind, since design and fab-ready skills are different pipelines and most engineering programmes teach only the former. Skill-development efforts through the India Semiconductor Mission, sector Centres of Excellence, and grassroots projects like the Indian Institute of Technology (IIT) Bombay's HackerFab are early-stage but real[18], and what they need to become durable is a dedicated fab-and-design bridging initiative. This should provide clean-room and Assembly, Testing, Marking, and Packaging (ATMP) training through industry-academia partnerships, with bodies like the India Electronics and Semiconductor Association (IESA) as a starting point. The objective is to ensure that India's chip-design strength translates into fab-ready skills.[19]

Institutionally, the two halves of this problem don't even speak to each other. ISM 2.0 sits with the Ministry of Electronics and Information Technology (MeitY), while defence production sits with the Ministry of Defence and DRDO. No shared roadmap connects the two. Civilian policy answers to industrial objectives, while defence policy is shaped by procurement law and security classification. They will not converge on their own. The same Civil-Military Semiconductor Council proposed above is the obvious place to close this gap too, forcing civilian and defence semiconductor policy onto one roadmap rather than two uncoordinated tracks.

3. Trusted Partners, Not Trusted Dependence

No version of this model eliminates external dependence—no semiconductor power, however advanced, is self-sufficient across the full value chain. The India-US TRUST (Transforming the Relationship Utilizing Strategic Technology) framework and the Quad Critical Minerals Initiative put supply-chain cooperation and verified vendors at the centre of the relationship[20], and that is genuinely useful, but history counsels' realism over faith. After India's 1998 Pokhran-II tests, the United States imposed export-control listings on Indian nuclear, space, and defence entities. These restrictions were not fully unwound until January 2025.[21] France also refused to transfer GaN radar technology during the 2016 Rafale deal, despite a formal 50-per-cent offset commitment worth roughly INR 30,000 crore.[22] Close partners withhold critical technology when it suits them. That is why partnerships must remain a source of redundancy rather than a substitute for indigenous capability, as discussed below.

The right instrument is therefore an India Trusted Microelectronics Programme, modelled on the US Department of Defense's Trusted Foundry programme.[23] It would certify design houses and foundries for defence-grade provenance, making risk diversification a verifiable mechanism rather than a rhetorical objective.

4. Defence Procurement as Anchor Demand

Private industry will not commit capital to defence-grade fabrication on the strength of policy documents alone; it needs a buyer. India should extend ISM-style incentives to defence-grade compound semiconductors. Bharat Electronics Limited (BEL) and Hindustan Aeronautics Limited (HAL) procurement can also signal early, credible demand, as the Ministry of Defence's expanding Positive Indigenisation Lists already do for other categories. This gives industry the buyer it needs: the same mechanism China used to absorb early domestic output, minus the coercion. This is what turns the proposed model into something private capital will actually bet on.

Conclusion

None of the five gaps—materials, fabrication, workforce, institutional coordination, and external reliability is fatal on its own. Left unaddressed, together, they turn industrial success into strategic exposure. Oil sustained military power in the twentieth century. Deterrence shaped strategy in the nuclear age. Semiconductor ecosystems will decide who holds technological superiority in this one, not because chips are weapons, but because nearly every weapon now depends on one.

Silicon deterrence means that assured access to trusted semiconductors sustains military operations. Sustained operations strengthen denial and punishment capabilities, while credible capability reduces an adversary's confidence in coercive escalation. Conversely, semiconductor vulnerability may invite coercion if an adversary believes military readiness can be degraded without kinetic attack. India's task is not just to manufacture chips, it is to close the gap between civilian industrial policy and defence procurement, by building redundant supply chains for materials needed for its own defence research. Also, to train the technicians its fabs will require, and treat every partnership, however trusted, as something to be verified, not assumed. Assured access to trusted semiconductors is becoming, for every domain, what air superiority once was for modern warfare.

India's task is not just to manufacture chips, it is to close the gap between civilian industrial policy and defence procurement, by building redundant supply chains for materials needed for its own defence research. Also, to train the technicians its fabs will require, and treat every partnership, however trusted, as something to be verified, not assumed.

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