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ISSUE 8RIEF
IB/41/26

AUTOMATION BIAS IN MILITARY DECISION-MAKING: AN EMERGING OPERATIONAL RISK

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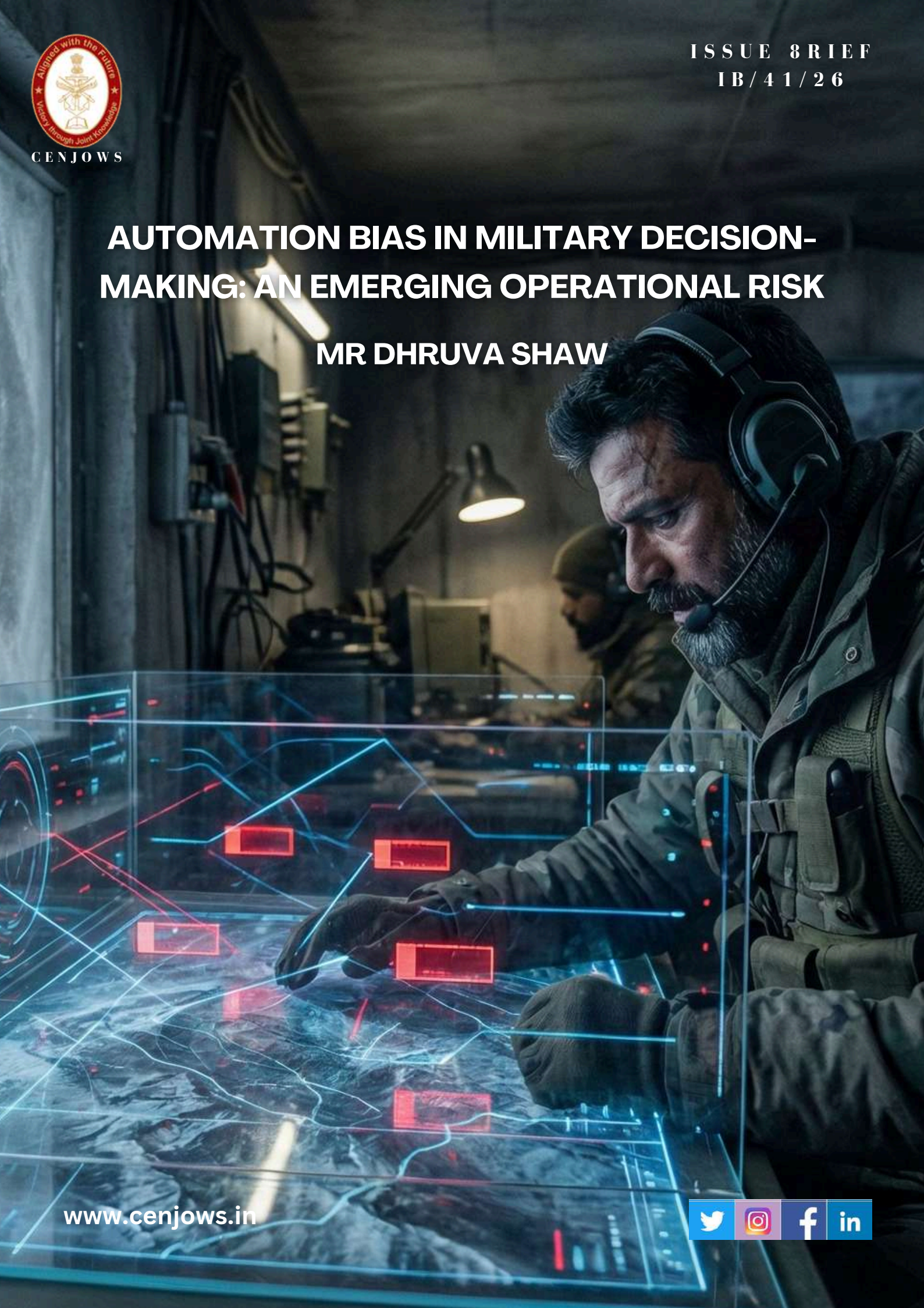

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Automation Bias in Military Decision-Making: An Emerging Operational Risk

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Executive Summary

The strategic environment of the Indian subcontinent is characterized by a relentless acceleration in the velocity of warfare. Faced with the "intelligentised" military modernization of the People's Liberation Army (PLA) along the India's Northern frontiers and the persistent, hybrid threats emanating from the Western borders, the Indian Armed Forces have embarked upon a profound transformation. This paradigm shift is defined by the aggressive integration of Artificial Intelligence (AI) and autonomous systems into the very core of the national defence architecture. From the high-altitude surveillance grids of the Himalayas to the networked maritime domain awareness systems of the Indian Ocean Region, AI is being positioned not merely as a force multiplier but as the central nervous system of future operations. The establishment of high-level bodies such as the Defence AI Council (DAIC) and the Defence AI Project Agency (DAIPA), coupled with the rollout of comprehensive AI roadmaps for the Army, Navy, and Air Force, underscores a

decisive move towards algorithmic warfare.[1]

This rapid technological assimilation introduces a distinct, insidious, and often overlooked vulnerability that resides not in the silicon chips of the machine but in the neural pathways of the human operators; Automation Bias, defined as the psychological tendency of human operators to over-rely on automated systems, disregarding contradictory information or failing to vigilantly monitor the system for errors, automation bias represents a critical single point of failure in the human-machine team.[2] In the context of India's specific operational realities, which are characterized by extreme environmental conditions that degrade cognitive performance, compressed decision-making timelines imposed by hypersonic threats, and the deployment of complex, opaque missile defence systems like the S-400 Sudarshan, the risks of automation bias are not merely theoretical, they are existential.

This Issue Brief provides an exhaustive analysis of automation bias within the Indian military context. It argues that while the hardware of AI is being procured at a pace, the "software" of human cognition (the training, doctrine, and psychological readiness to manage algorithmic fallibility) lacks commensurate maturity. The report examines the collision between the immutable limits of human cognition and the relentless speed of algorithmic warfare. It posits that without a radical restructuring of training and doctrine to account for these psychological vulnerabilities, the Indian military risks ceding the "moral agency" of lethal decision-making to opaque algorithms. This surrender of judgment could potentially lead to catastrophic fratricide, inadvertent strategic escalation, or operational paralysis during critical moments of conflict.[3]

The analysis draws upon recent developments, including the operational lessons from 2025's Operation Sindoor and the launch of the Evaluating Trustworthy AI (ETAI) Framework, to offer a forward-looking assessment of this emerging risk landscape.[4]

The Strategic Landscape: AI Integration in the Indian Armed Forces

The trajectory of India’s military modernization is increasingly defined by the pursuit of technological sovereignty and decision superiority. The dual pressures of a

technologically advanced adversary along the Northern border and a proxy-warfare dynamic on the Western border have necessitated a shift toward systems that can process vast quantities of intelligence data in real-time. The strategic imperative is clear: to compress the OODA (Observe, Orient, Decide, Act) loop to a speed that the adversary cannot match.

- **The Imperative for Algorithmic Sovereignty**

  The operational logic driving AI adoption in India is rooted in the necessity of managing information saturation. In a potential conflict scenario in the Himalayas or the Indian Ocean, the volume of incoming sensor data from satellites, Unmanned Aerial Vehicles (UAVs), ground radars, and cyber networks exceeds human processing capacity. AI offers the promise of "fusing" this data to present commanders with actionable intelligence, theoretically allowing the Indian military to decide and act faster than the adversary.[5]

  The Indian government has institutionalized this intent through a robust organizational framework. The DAIC (Defence AI Council), chaired by the defence minister, provides the highest level of strategic oversight, ensuring that AI integration is treated as a command priority rather than a niche research interest.[6] Supporting this is the DAIPA (Defence AI Project Agency), which acts as the implementation arm, driving projects across the Defence Public Sector Undertakings (DPSUs) and the services. With an annual budget of ₹100 crore specifically earmarked for AI projects and a mandate to deliver on over 75 specific AI-enabled products, the Indian defence establishment has moved beyond the conceptual phase into active deployment.[7]

Table 1: Different AI bodies set by up Indian Government

Strategic Body	Mandate and Role	Key Achievements & Trajectory
Defence AI Council (DAIC)	Strategic direction and oversight; chaired by Defence Minister. Ensures cross-service coordination.	Institutionalized the AI framework; allocates ₹100 crore annually to drive R&D.[8]
Defence AI Project Agency (DAIPA)	Implementation arm; facilitates collaboration between services, DRDO, and industry.	Identification and execution of 75+ projects; driving AI roadmaps for DPSUs.[9]
Centre for Artificial Intelligence & Robotics (DRDO)	Primary R&D centre for AI, Robotics, and Command Control systems.	Development of "Silent Sentry," AI-based intrusion detection, and networked decision tools.[10]
Service-Specific AI Task Forces	Formulation of service-specific roadmaps (e.g., Army's 2025-27 Roadmap).	Integration of AI into specific operational domains like logistics, ISR, and wargaming.[11]

This push is further catalysed by the "Atmanirbhar Bharat" (Self-Reliant India) initiative, which seeks to reduce dependency on foreign technology. However, the

rush to indigenous development, while strategically sound, introduces its own risks if the developmental focus remains solely on technical capability without addressing the human-factors engineering required to mitigate operator bias. The integration of AI is seen as a key enabler for "Multi-Domain Operations" (MDO), where the seamless flow of data between land, air, sea, cyber, and space domains is managed by algorithmic decision support systems.[12]

- **The Spectrum of Implementation**

  The scope of AI integration in the Indian military is not limited to autonomous weapon systems but permeates the decision-making architecture across all levels of command.

  - **Air Defence and Missile Systems**

    The induction of the S-400 Sudarshan system represents the pinnacle of automated warfare in the Indian inventory.[13] Capable of tracking hundreds of targets and engaging them at ranges up to 400 km, the S-400 utilizes sophisticated algorithms to prioritize threats in a saturated airspace. The reaction times involved in intercepting hypersonic or supersonic missiles are measured in seconds, often necessitating the system to be placed in semi-automatic or fully automatic modes.[14] In this regime, the human operator is pushed "on the loop" rather than "in the loop," monitoring the system's logic rather than executing individual engagements. This operational reality creates a fertile ground for automation complacency, where the operator assumes the system's complex targeting solution is correct because the cognitive cost of verifying it is too high given the extreme time constraints.[15] The indigenous Project Kusha, aimed at developing a long-range air defence system comparable to the S-400.[16]

  - **Logistics and Predictive Maintenance**

    The Indian Navy and Army are increasingly utilising AI for predictive maintenance and logistics management.[17] Projects involving the analysis of

engine health data or supply chain optimization rely on machine learning models to predict failures before they occur. While seemingly benign compared to lethal targeting, automation bias in logistics can lead to strategic vulnerabilities. Over-reliance on algorithmic predictions for supply chain requirements in high-altitude areas could lead to critical shortages if the model fails to account for "black swan" weather events or adversarial disruption of data inputs. If a commander trusts the AI's assessment that "fuel stocks are sufficient" despite contradictory anecdotal reports from the field, the operational consequences could be severe operational paralysis during a mobilization.

The Anatomy of Automation Bias: Cognitive Dimensions

To understand the risk, we must first understand the psychological mechanism. Automation bias is not merely a training issue; it is a fundamental characteristic of human cognition when paired with sophisticated machines.

- **Defining the Phenomenon**

  Automation bias is a psychological phenomenon where human operators place disproportionate trust in the output of automated decision aids, often to the detriment of their own sensory information or judgment.[18] It manifests in two primary forms of error:

  - **Errors of Commission:** This involves following an automated recommendation that is incorrect. For example, an air defence officer might fire on a friendly aircraft because the IFF (Identification Friend or Foe) interrogation failed and the AI classified the track as hostile based on a flight profile anomaly. The operator commits an active error by trusting the machine over other potential indicators.[19]

  - **Errors of Omission:** This involves failing to act because the automated system did not provide an alert. For example, a surveillance operator might

> ignore a visual sighting of an enemy patrol on a monitor because the AI "Silent Sentry" system did not flag it with a red box. The operator assumes that if the machine didn't see it, it isn't there.[20]

This bias is distinct from automation complacency, though they are related. Complacency involves a lack of vigilance (looking away from the screen). Automation bias involves looking at the screen and trusting it *over* other indicators.[21] In the high-stakes environment of military operations, this bias is exacerbated by the "heuristic" nature of human cognition. Under stress, the human brain defaults to "System 1" thinking (fast, intuitive, and low-effort) rather than "System 2" thinking (slow, analytical, and deliberate).[22] An AI decision support system (DSS) provides a convenient heuristic shortcut; trusting the "red box" on the screen is cognitively cheaper than analysing raw radar data.[23]

- **The "Black Box" and Trust**

  A significant driver of automation bias in the Indian context is the opacity of the technology. Much of India's high-end defence hardware, including the S-400 and various avionics suites, are imported or co-developed. The underlying algorithms (the "logic" of the machine) are often proprietary "black boxes".[24] Operators are trained on how to operate the interface, not necessarily on how the algorithm reaches a conclusion.

  When a system performs reliably in training (often under controlled conditions), operators develop a "trust capability" that may not hold up in the chaos of actual combat.[25]

  When an algorithm presents a solution, such as a target classification, without an "explainability" layer (XAI), the operator cannot effectively critique the recommendation. In the absence of understanding why the AI thinks a target is hostile, the operator is left with a binary choice: blind trust or blind rejection. Given the penalties for missing a hostile target (e.g., an incoming missile striking a city), the psychological pressure heavily favours blind trust.[26] This "black box" nature

effectively strips the human operator of the ability to audit the machine's reasoning in real time, reducing them to a rubber stamp for the algorithm's decisions.

- **Physiological Stressors in Indian Operational Theatres**

  The Indian military operates in some of the most physiologically punishing environments on earth, most notably the high-altitude sectors of Siachen, Ladakh, and Sikkim. Research indicates that hypoxia and extreme cold significantly impair cognitive function, specifically executive processing and attention.[27] This creates a unique "Indian" dimension to the problem of automation bias.

  - **Hypoxia and Decision Making:** At altitudes above 14,000 feet, oxygen deprivation reduces the brain's capacity for complex system reasoning. Soldiers and commanders become more reliant on external cues and simplified decision rules. The "cognitive reserve" required to doubt a machine is simply unavailable.[28]

  - **The Technology Trap:** In such a state, an AI decision aid offering a clear, unambiguous recommendation becomes a cognitive crutch. The fatigued, hypoxic brain is physiologically primed to succumb to automation bias, viewing the AI not as a tool but as an authority. The effort required to cross-check an AI alert against a paper map or a raw data feed is significantly higher in a hypoxic state, leading to a dangerous dependency on the automated output.

  This intersection of environmental severity and algorithmic reliance is a uniquely critical risk factor for the Indian Army, distinguishing its automation challenges from those of Western militaries operating primarily in non-alpine environments.

Emerging Operational Risks: Scenarios and Analysis

The theoretical risks of automation bias manifest in specific, high-stakes scenarios relevant to India's current security posture. These scenarios highlight how the interaction between human psychology and machine logic can lead to operational failure.

- **The Air Defence Dilemma: Speed vs. Sovereignty**

  The induction of the S-400 and the development of the indigenous Project Kusha have created a layered air defence network capable of engaging targets hundreds of kilometres away.[29] However, the efficacy of these systems relies on their ability to distinguish friend from foe in a saturated airspace.

  - **The Fratricide Risk**

    Historical precedents, such as the 2003 Patriot missile fratricides (where US systems shot down a British Tornado and a US Navy F/A-18), demonstrate that even highly trained crews can be led astray by automation errors.[30] In those instances, the system falsely classified friendly aircraft as anti-radiation missiles. The operators, conditioned to trust the system's speed, failed to override the automated engagement sequence in time.

    In the Indian context, the 2019 Budgam incident, where an Indian Mi-17 helicopter was shot down by its own SPYDER air defence system during a period of heightened alert, serves as a grim warning.[31] While not strictly an AI failure, it was a failure of the IFF procedures and confirmation bias, which is a human cognitive failure. Introducing AI targeting assistants into this mix raises the stakes exponentially. If an AI system, processing data from a radar feed compromised by electronic warfare or cyber intrusion[32], confidently misidentifies a returning IAF Rafale as a hostile drone swarm, the operator has seconds to intervene. If the doctrine emphasizes "zero leakage" (letting nothing through), the cognitive bias will be to shoot.

  - **Hypersonic Compression**

    The advent of hypersonic missiles by adversaries like China further compresses the reaction window to under a minute for terminal defence. In this regime, the "Human-in-the-Loop" becomes a liability due to latency. The system must likely operate in "Human-on-the-Loop" mode, where the AI engages automatically unless vetoed. This shifts the psychological burden:

the operator must actively disbelieve the machine to stop a launch. Automation bias makes this veto unlikely, creating a high risk of accidental escalation during tense standoffs if the system registers a false positive.[33]

- **The Swarm Drone and Algorithmic Fratricide**

  The proliferation of swarm drone technology, as envisioned in India's technology roadmap, introduces the risk of "algorithmic fratricide".[34] Swarms operate on decentralized logic where individual drones make decisions based on neighbour behaviour.

  - **Scenario:** An Indian swarm is deployed to counter an adversary's armoured column. An adversarial electronic warfare attack spoofs the GPS or communication links. The swarm's collision avoidance and targeting algorithms, attempting to reorient, might misinterpret the signatures of friendly mechanized units as hostile.

  - **The Bias Connection:** The operator controlling the swarm does not fly individual drones but manages "intent." If the swarm signals "Target Acquired," the operator's bias is to assume the swarm has found the enemy. The complexity of the swarm's collective behaviour makes it a "black box" even to its designer, making human intervention nearly impossible once the attack logic initiates. The operator, trusting the collective intelligence of the swarm, may authorize a strike that targets friendly forces.

- **Intelligence Analysis and Confirmation Bias**

  DAIPA and military intelligence units are investing in AI for Open-Source Intelligence (OSINT) and satellite imagery analysis.[35] These tools use Large Language Models (LLMs) and computer vision to summarize threats. An intelligence analyst uses an AI tool to scan thousands of hours of drone footage. The AI misses a subtle indicator of a buildup (error of omission). Because the AI reported "No Activity," the analyst reports "No Activity," engaging in automation

bias by proxy. The analyst's vigilance is outsourced to the algorithm. Conversely, if the AI hallucinates a threat buildup based on patterned data (e.g., misinterpreting construction equipment as missile launchers), the analyst may build a threat assessment on a hallucination, creating an intelligence failure echo chamber.[36]

Structural Vulnerabilities in the Indian Defence Ecosystem

The propensity for automation bias is not just a function of individual psychology; it is exacerbated by structural and systemic factors within the Indian defence establishment.

- **Data Silos and the Integration Challenge**

  A robust AI model requires diverse, high-quality data. However, the Indian armed forces have historically operated in silos, with limited interoperability between Army, Navy, and Air Force data networks.[37] The Indian Navy's maritime domain awareness systems do not seamlessly talk to the IAF's IACCS (Integrated Air Command and Control System).

  - **Impact on Bias:** When an AI system is trained on fragmented or incomplete data (e.g., Army data only), its outputs will be skewed. However, the operator, unaware of the data limitations, perceives the AI's output as "comprehensive." This "illusion of completeness" fosters unwarranted trust. A commander might rely on an AI logistics planner that fails to account for Air Force transport availability because the datasets were never merged.[38]

- **The "Make in India" vs. Import Hybridity**

  India's defence ecosystem is a hybrid of legacy Russian platforms, modern Western systems, and emerging indigenous (DRDO/private sector) technology.[39] Integrating AI across this heterogeneous mix is fraught with difficulty. Operators often have to switch between different interfaces, such as a Russian radar screen, an Israeli UAV feed, and an Indian AI dashboard. This cognitive switching increases mental load. When a user is overwhelmed by disparate inputs, the tendency to latch onto the simplest, most authoritative source (usually the AI

dashboard) increases significantly. The lack of a standardized Human-Machine Interface (HMI) standard across the Indian military exacerbates cognitive fatigue, a precursor to automation bias.[40]

- **Training Deficits**

  Current military training emphasizes procedural competence: how to turn the knob and how to read the display. There is a distinct lack of training on algorithmic limitations. While the Military College of Electronics and Mechanical Engineers (MCEME) and the College of Defence Management (CDM) are introducing AI modules[41], these often focus on what AI is (technology) rather than how it fails (psychology). There is little evidence of training modules specifically designed to induce and mitigate automation bias, such as "red teaming" exercises where the AI is programmed to lie to the trainee to test their scepticism.[42] Without exposure to AI failure in a safe training environment, operators will likely encounter their first AI hallucination in a live operational setting, with potentially lethal consequences.

Legal, Ethical, and Doctrinal Vacuums

The technological adoption has outpaced the legal and doctrinal frameworks required to govern it, creating a "grey zone" of accountability that feeds into automation bias.

- **The Accountability Gap**

  Indian military law and the broader legal framework (such as the IT Act) do not clearly define liability for AI errors in a military context.[43]

  - **The Commander's Dilemma:** If a commander overrides an AI recommendation and the mission fails, they are liable for "ignoring intelligence." If they follow the AI recommendation and it leads to a war crime (e.g., bombing a hospital misidentified as a command post), they are liable for "failure of command."

  - **Impact on Bias:** Faced with this asymmetry, the "safe" bureaucratic choice

is often to follow the system. If the AI made the mistake, the commander can plausibly argue, "The system indicated a valid target." This legal ambiguity acts as a perverse incentive, encouraging automation bias as a form of liability shielding.[44]

- **The Evaluating Trustworthy Artificial Intelligence (ETAI) Framework: A Step Forward?**

  In October 2024, the Indian government launched the "Evaluating Trustworthy Artificial Intelligence" (ETAI) Framework.[45] This framework outlines five principles: Reliability, Safety, Transparency, Fairness, and Privacy.

  - **Analysis:** While a positive step, the ETAI framework is primarily technical, focusing on evaluating the *software*. It does not sufficiently address the human component of the interaction. A system can be rated "Reliable" (technically) but still induce bias if its user interface is poorly designed or if the operator is over-trusting. The framework lacks specific protocols for "cognitive ergonomics," which means designing systems that actively prevent complacency.[46]

- **Doctrine and the "Human-in-the-Loop"**

  India's official stance at the UN Convention on Certain Conventional Weapons (CCW) supports the retention of human control over lethal autonomous weapons.[47] However, "control" is a fluid concept. The Joint Doctrine of the Indian Armed Forces (2017) and the Land Warfare Doctrine (2018) predate the massive influx of AI.[48] They do not explicitly articulate protocols for when a commander should trust an algorithm over their intuition. In the absence of clear doctrine, decision-making defaults to the path of least resistance: automation bias.

Learning from History: The Cost of Blind Trust

To understand the stakes for India, one must look at global precedents where automation bias led to disaster.

- **USS Vincennes (1988)**

  The Aegis combat system on the USS Vincennes correctly detected an Iranian civilian airliner (Flight 655) as ascending. However, the crew, under stress and expecting an attack, misinterpreted the data and believed the system was indicating a descending attack profile. They trusted their expectation of what the system was doing rather than the raw data, combined with a bias toward the system's threat classification. Result: 290 civilians dead. For India, operating similar high-tech air defence assets in the crowded airspace of the subcontinent, this is a terrifying precedent.[49]

- **The Patriot Fratricides (2003)**

  US Patriot batteries shot down friendly aircraft because the system classified them as ballistic missiles. The operators had seconds to decide. In one case, the operator watched the system engage and did nothing, paralyzed by the assumption that "the machine knows best." This is the quintessential manifestation of automation bias in high-intensity conflict.[50]

- **Stanislav Petrov (1983) – The Counter-Example**

  Petrov, a Soviet officer, ignored a satellite warning of a US nuclear launch. He relied on intuition and context (Why only five missiles?) to identify it as a false alarm.[51] Petrov represents the antidote to automation bias: scepticism and contextual reasoning. The Indian military must ask: Are we training Petrovs, or are we training button-pushers? Current trends suggest the latter.

Strategic Recommendations for the Indian Armed Forces

To mitigate the operational risk of automation bias, the Indian military must move beyond "AI adoption" to "AI adaptation." The focus must shift from acquiring technology to evolving the human cognition that wields it.

- **Doctrinal Reforms: The "Cognitive Firewall"**
  - **Redefine "Control":** Doctrines must explicitly define "Meaningful Human

Control" not just as the ability to press a button but as the cognitive capacity to understand the situation. If a system operates faster than human cognition (e.g., hypersonic defence), the doctrine must acknowledge that the human is a failsafe, not a decision-maker, and design safeguards accordingly.[52]

- **Mandatory Disconfirmation Protocols:** Standard Operating Procedures (SOPs) for high-stakes AI decisions (e.g., engaging a target beyond visual range) must require a "disconfirmation check." The operator must actively seek one piece of evidence that contradicts the AI before engaging.

- **Training and Wargaming**
  - **Adversarial AI Training:** Training simulations must include scenarios where the AI fails, lies, or is spoofed. Operators must be graded not on how well they use the system, but on how effectively they detect system errors. "Trust" should be earned, not assumed.[53]
  - **Cognitive Wargaming:** Wargames should explicitly stress-test the command chain's reliance on automation. Scenarios should involve "data poisoning" attacks where commanders must fight through a corrupted Common Operating Picture (COP) using analogue backups and intuition.[54]

- **Interface Design and "Explainable AI" (XAI)**
  - **Demand XAI from Vendors:** The Ministry of Defence (MoD) must mandate that all AI acquisitions (foreign or indigenous) include Explainable AI features. The system should not just say "Target Hostile," but "Target Hostile because: Speed > Mach 2, Altitude < 500ft, IFF Negative." This allows the operator to critique the logic.[55]
  - **Confidence Intervals:** Interfaces should display uncertainty. Instead of a green box, the system should display a probability (e.g., "65% probability of

human infiltration"). This forces the operator to engage System 2 thinking to assess the risk, rather than passively accepting a binary classification.[56]

- **Legal and Institutional Frameworks**
  - **Liability Legislation:** The MoD must draft specific legal guidelines for AI liability in combat. Commanders must be protected from liability if they override an AI recommendation based on reasonable judgment, even if the outcome is suboptimal. This removes the perverse incentive to blindly follow the machine.[57]
  - **Standardized Data Architecture:** Accelerate the integration of Army, Navy, and Air Force data networks to reduce the "silo effect" that feeds bias. A unified data standard ensures that AI systems have a holistic view, reducing the frequency of errors that require human intervention.[58]
- **Specialized Selection for AI Operators**

  Not all personnel are psychologically suited for monitoring automated systems. The selection process for operators of strategic systems (like S-400 or drone swarms) should include psychometric testing for "vigilance decrement" and "complacency potential." Personnel with a high predisposition for automation bias should be filtered out of these roles.[59]

Conclusion Part 1

The Indian Armed Forces' pursuit of Artificial Intelligence is a strategic necessity, an inevitability of the 21st-century battlefield. The "Sudarshan Chakra" of AI promises a decisive edge in the cognitive domain, accelerating the OODA loop and enabling domination over adversaries. However, this sword has a double edge. Automation bias represents a silent, internal threat that could undermine the very efficiency AI seeks to create.

By outsourcing critical judgments to opaque algorithms, the Indian military risks creating a fragility in its decision-making architecture, one where a single sensor glitch or an

adversarial spoof could trigger a cascade of catastrophic errors. The solution lies not in rejecting the technology, but in mastering the psychology of its use.

The future of Indian military superiority will not be determined solely by who has the best algorithms but by who has the most resilient human operators, commanders who are trained to trust their machines but are verified to doubt them. Unless the "human software" is upgraded alongside the digital hardware, automation bias remains a dormant virus in the Indian defence network, waiting for the fog of war to activate it. The ultimate safeguard in the loop is not a line of code but a sceptical mind.

The Strategic Imperative and the Indian Context

- **The Geopolitical Drivers for AI Adoption**

  The strategic calculus of New Delhi is dominated by the reality of a "two-front" threat: a technologically sophisticated China (PLA) to the north and a sub-conventional/hybrid threat from Pakistan to the west. This duality creates a unique pressure cooker for modernization.

  - **The China Factor: Asymmetry and Speed**

    China's People's Liberation Army (PLA) has aggressively pursued "intelligentised warfare," integrating AI into every echelon of its force structure. Reports indicate the PLA spends nearly as much on AI as the US military.[60] For India, this creates an asymmetry that cannot be bridged by manpower or conventional platforms alone. The PLA's focus on autonomous swarms, AI-backed cyber warfare, and hypersonic delivery systems necessitates that India develops counter-capabilities that operate at machine speed.

    - **Implication:** India is not adopting AI merely for modernization; it is adopting it for survival. This existential urgency often leads to rapid deployment cycles where thorough testing of human-machine interaction (HMI) might be deprioritized in favour of fielding

capabilities.[61]

- **The Pakistan Factor: The Proxy War**

  On the Western Front, the threat is characterized by infiltration, drone-based arms drop, and hybrid warfare. AI offers India the ability to monitor the porous Line of Control (LoC) with a persistence that human eyes cannot match. Projects like the "Silent Sentry" robot are direct responses to the need for 24/7 surveillance in hostile terrain.[62]

- **Institutional Architecture: DAIC and DAIPA**

  Recognizing these drivers, the Ministry of Defence (MoD) established a robust institutional framework following the recommendations of the N. Chandrasekaran Task Force in 2018.[63]

  - **The Defence AI Council (DAIC)**

    Chaired by the Raksha Mantri (Defence Minister), the DAIC is the highest decision-making body. It includes the three Service Chiefs, the Defence Secretary, and the DRDO Chairman. Its mandate is to provide the "strategic direction".[64]

    - **Significance:** The high-level composition ensures that AI is not a niche R&D experiment but a central command priority. However, the centralization also risks a top-down approach where technology is pushed onto operational units without adequate bottom-up feedback regarding usability or cognitive load.

  - **The Defence AI Project Agency (DAIPA)**

    DAIPA acts as the execution arm. It has identified over 75 priority projects and tasked Defence Public Sector Undertakings (DPSUs) with AI roadmaps.[65] It manages a dedicated budget of ₹100 crore annually for AI projects.[66]

- **Key Insight:** While DAIPA focuses on "project completion" (e.g., delivering 40 out of 70 projects), metrics often focus on technological readiness (TRL) rather than cognitive readiness. A project is deemed "complete" when the code works, not necessarily when the operator can use it without bias.

➢ **Key Indigenous Projects and Capabilities**

The Indian AI portfolio is diverse, reflecting the multi-domain nature of its threats.

Domain	Project/System	Function	Status
Air Defence	**Project Kusha / Sudarshan (S-400)**	Long-range interception; automated target prioritization.	Operational / In Development.[67]
Surveillance	**Silent Sentry / CAIR AI-IDS**	Rail-mounted robot for perimeter security; Intrusion Detection System.	Deployed on borders.[68]
Maritime	**Maritime Domain Awareness (MDA)**	AI for anomaly detection in vessel traffic (likely Project Trigun or similar).	Integrated into Navy networks.[69]
Medical	**ATMAN.AI**	Chest X-ray analysis for	Deployed by DRDO.[70]

		COVID/Pneumonia in field hospitals.	
Logistics	**PROM** (Predictive Maintenance)	AI-based supply chain and vehicle health monitoring.	In pilot phases.[71]

Deep Insight: The diversity of these projects highlights a fragmentation risk. A soldier might deal with a CAIR-developed surveillance bot, a BEL-developed radar, and a private-sector drone feed. Each has different "trust cues" and false-alarm rates. This inconsistency makes it difficult for operators to develop a calibrated level of trust, oscillating instead between blind faith and frustration-induced rejection.

Theoretical Framework: The Cognitive Mechanics of Bias

To understand why an Indian officer might trust a faulty algorithm, we must delve into the cognitive psychology of command.

- **The Dual Process Theory and Military Cognition**

  Daniel Kahneman's model of System 1 (Fast) vs. System 2 (Slow) thinking is the foundational framework for understanding automation bias.[72]

  - **System 1:** Intuitive, automatic, low-effort. (e.g., Swerving a car to avoid an obstacle).
  - **System 2:** Analytical, deliberate, high-effort. (e.g., Solving a complex math problem).

  In a command centre, interpreting raw radar noise requires System 2 effort. It is taxing and slow. Reading a processed label that says "HOSTILE AIRCRAFT"

appeals to System 1. It is fast and easy.

- **The Bias Trap:** As cognitive load increases (due to battle stress, noise, and fear), the brain sheds System 2 tasks to conserve energy. It defaults to System 1. The AI, by design, presents information in a "System 1-friendly" format (clear icons, alerts). Therefore, as stress increases, the reliance on AI increases linearly.

- **The "Cognitive Miser" Hypothesis**

  Humans are "cognitive misers" we seek to expend the least amount of mental energy required to solve a problem.[73] If an automated system has a track record of being 90% reliable, the operator will stop checking the raw data because checking is "expensive" in mental energy, and the payoff (catching the 10% error) is rare.

  - **Indian Context Application:** In the monotony of border patrolling, where 99.9% of sensor alerts might be wind or animals, the operator's vigilance degrades. When the AI finally flags a real (or false) event, the operator has no recent "mental model" of the environment to contrast against the AI's claim. They simply accept the alert because they have effectively been "out of the loop" for hours.[74]

- **Environmental Stressors: The High-Altitude Factor**

  The Indian Army fights in the "Third Pole", the Himalayas. This environment is hostile to both silicon and neurons.

  - **Hypoxia:** At 15,000 feet (Ladakh/Siachen), partial pressure of oxygen drops. This directly impacts the prefrontal cortex, the seat of judgment and System 2 reasoning.[75] Studies on Indian soldiers show significant decline in cognitive performance and vigilance at these altitudes.[76]

  - **Thermal Stress:** Extreme cold further degrades motor skills and cognitive

processing.[77]

- **The Result:** A hypoxic, freezing commander is physiologically incapable of sustaining the high-level scepticism required to counter automation bias. The AI becomes a lifeline. If the tablet says "Enemy Ahead," the compromised brain will latch onto that certainty with desperation. This makes automation bias not just a psychological issue but a physiological inevitability in high-altitude warfare.

Operational Scenarios of Risk

The theoretical risks manifest in specific, high-stakes scenarios relevant to India's current security posture.

- **Scenario A: The S-400 and the "Hair-Trigger"**

  The S-400 Sudarshan is a game-changer, but it brings the risk of "automation-induced escalation."

  - **The Setup:** Tensions are high with Pakistan. The S-400 is tracking airspace. An incoming track is detected.

  - **The Loop:** The S-400's radar algorithms classify the track as a "Cruise Missile." The reaction time to intercept is 9 seconds.[78]

  - **The Bias:** The operator sees the classification. The system is in "Semi-Automatic" mode, asking for authorization to fire. The operator has no time to cross-reference with civilian Air Traffic Control (ATC) or visual observers. The "Fear of Omission" (letting a missile through) outweighs the "Fear of Commission" (shooting the wrong thing). The operator authorizes fire.

  - **The Reality:** The track was a scheduled civilian drone or a friendly fighter with a transponder glitch. The AI misclassified it based on a flight profile anomaly. The operator, trusting the "Sudarshan's" legendary reputation,

failed to question it.

- **Precedent:** This mirrors the USS Vincennes incident, but at 5x the speed. The "Sudarshan Chakra" (divine disc) mythology surrounding the system [79] contributes to a "halo effect"; operators believe the system is infallible because of its prestige and cost.

- **Scenario B: The Silent Sentry in the Fog**
  - **The Setup:** A "Silent Sentry" robot is patrolling a sector of the LoC in Kashmir during heavy fog.
  - **The Loop:** The robot's thermal sensors pick up heat signatures. The AI, trained on clear-weather data, struggles with the thermal scattering caused by fog.[80] It identifies the heat signatures as "Crouching Humans."
  - **The Bias:** The remote operator, sitting in a warm bunker miles away, sees the red bounding boxes on the screen. The video feed is grey and fuzzy (fog), but the computer graphics are crisp and red. The operator trusts the graphics over the video. He calls for mortar fire on the coordinates.
  - **The Reality:** The heat signatures were a herd of Bharal (blue sheep) or heated rocks venting at dusk. The AI's confidence score was actually low (55%), but the user interface didn't show the percentage, just the red box. [81]

- **Scenario C: Swarm Drones and Emergent Behaviour**

  India is heavily investing in swarm drones for offensive operations.[82] Swarms rely on "emergent behaviour", simple rules leading to complex actions.
  - **The Risk:** A swarm is deployed to suppress enemy air defences (SEAD). The swarm encounters unexpected jamming. Its "regroup" logic interacts with its "attack" logic in an unforeseen way (emergent error). The swarm identifies a nearby Indian signals unit as the source of the jamming

(because it is emitting high energy) and attacks it.

- **The Operator's Role:** The operator sees the swarm engaging a target. Due to the complexity of the swarm's movement (hundreds of dots on a screen), the operator cannot mentally parse what the swarm is doing. They assume the swarm is working as designed. This is "Automation Surprise", where the operator has no mental model of the AI's internal state and thus cannot predict or prevent failure.[83]

Structural and Technical Vulnerabilities

- **The Data Integrity Problem**

  AI is only as good as its training data. In the Indian context, obtaining "battlefield-grade" data is a challenge.

  - **Synthetic Data Reliance:** Much of the training data for Indian AI systems comes from simulations or peace time exercises.[84] An AI trained to detect tanks in the deserts of Rajasthan (Exercise Poorvi Lehar) may fail spectacularly in the snows of Sikkim.

  - **Adversarial Vulnerability:** If adversaries (China) know the training datasets used by Indian algorithms, they can design camouflage or electronic signatures specifically to trigger false negatives (evasion) or false positives (spoofing). Automation bias ensures that Indian operators will likely fall for these spoofs because they trust the system's detection capabilities.[85]

- **The "Silo" Effect**

  The lack of jointness, a persistent criticism of the Indian armed forces, bleeds into AI development.

  - **Fragmentation:** The Army, Navy, and Air Force are developing separate AI roadmaps.[86] This leads to "Data Silos." An Army AI system might not

recognize a Navy helicopter's IFF signature because it wasn't in the Army's training set.

- **Integration Hell:** When these systems are forced to work together in a Joint Command scenario, the friction creates "interface chaos." Operators dealing with conflicting information from non-integrated systems will default to the one they know best, ignoring potentially critical warnings from other services' systems.

- **The "Black Box" of Imported Tech**

  India operates a "zoo" of military hardware.

  - **Russian Hardware / Indian Software:** Integrating Indian AI algorithms onto Russian hardware (like the Su-30MKI or T-90 tanks) involves "wrapping" legacy systems. This wrapping can mask underlying sensor errors. If the Russian radar gives a faulty raw feed, the Indian AI might interpret it as a valid signal with high confidence. The operator sees "Confidence: High" and assumes it's accurate, not knowing the root sensor is malfunctioning.[87] The "Black Mirror" leak reports regarding the Zhuk-ME radar illustrate precisely this vulnerability that manufacturers may overstate reliability, and AI layers on top can hide these flaws until catastrophic failure.[88]

The Legal and Doctrinal Void

- **The Doctrine Gap**

  The Joint Doctrine of the Indian Armed Forces (2017) mentions "technology" but predates the generative AI revolution.[89] It does not address:

  - **Delegation of Authority:** At what point is a commander allowed to blame the AI?

- **Human Override:** Is a soldier punishable for not firing if the AI said fire?

- **Verification Protocols:** What is the standard procedure for verifying an AI target?

Without written doctrine, these decisions are left to individual discretion, which is notoriously unreliable under stress.

- **The ETAI Framework: Assessment**

  The release of the ETAI Framework in October 2024 is a landmark.[90]

  - **Strengths:** It establishes criteria for "Trustworthiness", Reliability, Safety, Transparency, Fairness and Privacy.

  - **Weaknesses:** It is a development framework, not an operational one. It tells the DRDO how to build the system, but it doesn't tell the major in the field how to doubt the system. It assumes that if a system is built "trustworthy," it will be used correctly. It misses the psychological component of over-trusting even a reliable system.

- **International Law and LAWS**

  India's position at the UN is nuanced. It opposes a ban on LAWS but supports "International Law compliance".[91] This "middle path" creates ambiguity. If India develops autonomous systems but refuses to call them "Lethal Autonomous Weapons" (preferring "Autonomous Weapon Systems" or similar euphemisms to avoid stigma), it risks deploying systems without the rigorous legal reviews required for LAWS. This lack of legal clarity contributes to the "accountability gap" where operators feel shielded by the machine's autonomy.

Recommendations and Mitigation Strategies

To secure the "human edge" in the age of AI, the Indian Armed Forces must implement a comprehensive strategy that addresses the psychological, technical, and doctrinal aspects of automation bias.

- **Cognitive Engineering and Training**
  - **Red Teaming the Mind:** Training must move beyond "how to use the tool" to "how the tool lies." Introduce "Trojan Horse" scenarios in simulators where the AI confidently identifies a neutral target as hostile. Trainees who blindly shoot should fail the module.
  - **Bio-Feedback Loops:** Use wearable technology (already in pilot phases) to monitor operator stress levels. If an operator's heart rate variability indicates high stress/hypoxia, the AI system should automatically switch to a "Verbose Mode," providing more explanations and slowing down the decision cycle to force System 2 thinking.[92]
- **Technical Interventions: "Design for Doubt"**
  - **Uncertainty Visualization:** Ban "Green/Red" binary classifiers for ambiguous targets. Use "heatmap" probabilities or confidence bars. A "60% Confidence" label triggers a different psychological response than a solid red box.
  - **Active "Keep-in-the-Loop" Prompts:** For long-duration surveillance (Silent Sentry), the system should periodically prompt the operator to perform a manual check (e.g., "Confirm target visual") to prevent the vigilance decrement associated with complacency.[93]
- **Doctrinal and Legal Clarity**
  - **The "Human-on-the-Loop" Doctrine:** Explicitly define the roles. "The Operator is responsible for negative control (veto), not just positive control."

- **Liability Shield:** Create a legal framework where a commander is indemnified if they choose not to engage a target due to AI doubts, even if that decision turns out to be wrong (Type II error). The current culture punishes "inaction" more than "action," which incentivises trusting the AI's aggression.

- **Strategic Data Integration**
  - **Joint Data Cloud:** Accelerate the creation of a unified defence cloud that pools data from all three services. This reduces the "silo" error rate. If the Air Force knows a flight is friendly, the Army's air defence AI should know it too, instantly.

Conclusion (Part 2)

The integration of Artificial Intelligence into the Indian military is a fait accompli. The operational advantages speed, persistence, and scale are too great to ignore in a neighbourhood defined by the military modernization of China and the hybrid threats of Pakistan. The "Sudarshan Chakra" of the 21st century will indeed be digital.

However, as this report demonstrates, the introduction of AI does not remove the "fog of war"; it merely changes its frequency. Automation bias is the new fog. It is a psychological blinder that can turn a sophisticated defence network into a mechanism for inadvertent escalation or tragic fratricide.

For India, the challenge is not just to build "Atmanirbhar" (self-reliant) algorithms, but to build "Atmanirbhar" operators, soldiers, and commanders who possess the cognitive resilience to stand apart from their machines, to question the green box, and to assert the primacy of human judgment in the lethal application of force. Without this psychological firewall, the Indian military risks becoming a spectator in its own wars, watching helplessly as its automated servants make decisions that no human intended and no human can reverse. The ultimate safeguard in the loop is not a line of code but a sceptical mind.

DISCLAIMER

The paper is the author's individual scholastic articulation and does not necessarily reflect the views of CENJOWS, the Defence forces, or the Government of India. The author certifies that the article is original in content, unpublished, and it has not been submitted for publication/ web upload elsewhere and that the facts and figures quoted are duly referenced, as needed and are believed to be correct.

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