Empowering India’s Defence Sector

This editorial is based on "As GPS Disruptions Grow, India Eyes Indigenous Quantum Navigation Boost," published on 07/08/2025 in Business Standard. It highlights that while India is advancing in defence technology, persistent challenges remain, which can be addressed through continued investment, innovation, and strategic collaboration.

For Prelims: Operation Sindoor, BrahMos missiles, iDEX scheme, Defence Industrial Corridors, Defence Space Agency, Positive Indigenization Lists, INS Vikrant, Aatmanirbhar Bharat, NETRA’ UAV, ADITI Scheme

For Mains: India’s Defence Sector: Technological Innovation, Challenges & Way Forward

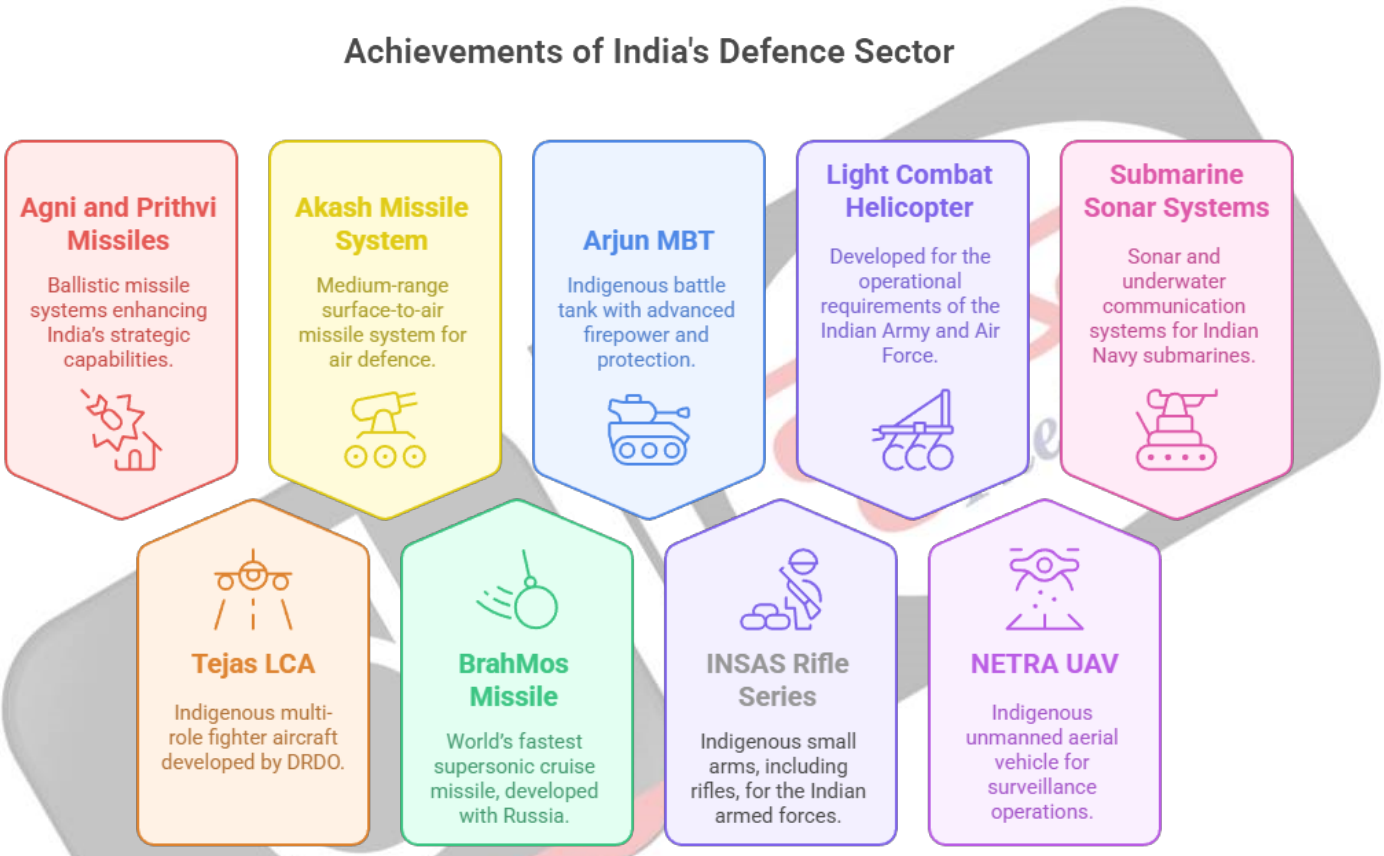
India’s advancements in defence technology are making its military smarter and more agile. Under the "Aatmanirbhar Bharat" initiative, India is leveraging **innovations in AI, robotics, cyber warfare**, and advanced manufacturing to strengthen its capabilities. While these efforts are addressing modern security challenges and strengthening deterrence**, India continues to face challenges** such as dependence on foreign components and slow integration with the private sector, **hindering its goal of becoming a global defence leader**.

What Are the Key Technological Innovations Driving India's Defence Growth?

- **Leveraging AI to Strengthen India's Defence Capabilities:** India is strategically advancing its use of AI to strengthen its defence capabilities, enabling faster and more accurate decision-making, **minimizing human errors**, and enhancing operational efficiency to address evolving security challenges.
    - In 2022, **75 newly developed AI products/technologies** were developed during the first-ever ‘AI in Defence’ (AIDef) symposium.
    - In 2024, the Department of Defence Production has earmarked approximately **USD 12.6 million annually for AI projects**
        - AI is being applied in defence for various purposes, **including AI-driven intercept management, predictive maintenance systems**, decision intelligence, and target tracking and identification.
- **Advancing Military Dominance with Autonomous Systems and Robotics:** The rapid development of autonomous defence systems and technologies is becoming a crucial element of military dominance.
    - The Indian Armed Forces are increasingly incorporating unmanned aerial vehicles (UAVs) for a variety of roles, including reconnaissance, combat, and logistics support.
    - Robotics technology is also gaining significant attention, **with innovations like**

the ‘NETRA’ UAV, an indigenous unmanned aerial vehicle designed for surveillance and reconnaissance missions.
        - Additionally, the **DRDO's Remote Operated Vehicle (ROV), Daksh, serves as a versatile tool for detecting and managing** improvised explosive devices (IEDs), conducting surveys of nuclear and chemical contamination, and handling hazardous materials.
- **Enhancing Defence with Cybersecurity and Electronic Warfare: Cybersecurity** and electronic warfare (EW) are essential for detecting anomalies, countering intrusions, and adapting communication protocols in real time.
    - The **National Technical Research Organisation (NTRO)** and the **Defence Intelligence Agency (DIA)** are investing in advanced technologies and developing specialized cyber defence units.
    - The electronic warfare networked **command, control, communications, computers, intelligence, surveillance, reconnaissance (C4ISR)**, and advanced sensor systems, including those used in **Operation Sindoor** with **Rafale and Tejas aircraft**, enhance India's capability to disrupt enemy communications and radar systems.
        - Additionally, the DRDO has developed jamming systems like the advanced EW system **‘Shakti’**.
- **Revolutionizing Defence Manufacturing with 3D Printing:** In India, one of the significant advancements in defence manufacturing is additive manufacturing, particularly **3D printing**, which is revolutionizing defence production.
    - The adoption of 3D printing enables rapid prototyping and the creation of complex components, thereby **reducing costs and shortening lead times for developing critical items** such as missiles, UAVs, and protective gear.
        - Additionally, **Hindustan Aeronautics Limited (HAL) and Wipro3D** have partnered to 3D print metal parts for aero engines, further enhancing India's defence manufacturing capabilities.
- **Indigenous Defence Production Surge:** India has made significant progress in achieving **self-reliance in defence manufacturing**, reducing dependence on imports, exemplified by **Positive Indigenisation Lists**.
    - This effort has contributed substantially to both national security and economic growth.
    - In FY 2023-24, **India's indigenous defence production reached ₹1.27 lakh crore**, up by 16.7% from 2022-23.
        - Moreover, 65% of defence equipment is now produced within India, showcasing the effectiveness of the **Make in India initiative**.
- **Driving Innovation in Defence Technology through iDEX:** The Acing Development of Innovative Technology with iDEX **(ADITI) scheme**, a sub-scheme under the iDEX initiative, is designed to support the development of critical and strategic technologies. Its goal is to create a **'Technology Watch Tool'** for monitoring advancements.
    - Through iDEX, companies are harnessing advanced manufacturing techniques and algorithms **for next-generation technologies, fostering indigenous research and development (R&D**) and strengthening India’s technological capabilities.
- **Strengthening Defence with Quantum Technologies:** In 2025, DRDO launched the Quantum Technologies Research Centre (QTRC) to develop **quantum communication systems**, focused on distribution techniques that enable ultra-secure communication to protect national security in the post-quantum era.
    - Recently, **DRDO’s Industry-Academia Centre of Excellence** at IIT Delhi successfully demonstrated free-space quantum secure communication over a distance exceeding 1 km.
        - Additionally, **private companies have supported these initiatives**, positioning India as a strong contender in next-generation warfare technologies.
- **Defence Industrial Corridors (DICs) Development:** India has established two **Defence Industrial Corridors** in Uttar Pradesh and Tamil Nadu to boost indigenous defence production and attract foreign investments.
    - These corridors provide significant infrastructure and incentives to industries, creating a conducive environment for defence manufacturing.
    - **Over ₹8,658 crore has already been invested in these corridors**. These corridors aim to attract a potential investment of ₹53,439 crore, making them critical to India's defence industrial expansion.

- **Strategic Defence Partnerships and Global Diplomacy:** India's growing role as a global defence exporter is supported by strategic partnerships with nations like the USA, France, and Russia.
    - The **BrahMos missile** export deal to Indonesia, valued at ₹3,800 crore, showcases India's technological prowess in missile systems.
    - Additionally, India's participation in **multilateral defence exercises with countries** like Japan, the Philippines, and Malaysia further cements its position as a dependable partner in global security.
- **Indigenisation of Critical Defence Platforms:** India is significantly reducing its reliance on foreign military platforms through the indigenisation of critical systems.
    - One key development is the **INS Vikrant, India's first indigenous aircraft carrier**, commissioned in 2022. The ship, which has 76% overall indigenous content, demonstrates India's ability to design and manufacture complex naval platforms.
    - Furthermore, the **T-90 Bhishma tank overhaul by the Indian Army** highlights the nation's commitment to enhancing the life cycle of its existing fleet.



What Are the Key Challenges Hindering India's Defence Growth and Self-Reliance?

- **Struggle with Achieving Complete Defence Self-Reliance:** Despite advancements in **indigenisation**, the defence procurement cycle is still slow, and India continues to face limitations in developing high-end defence technologies.
    - As of 2023, **36% of India's defence procurement budget is still allocated to imports**, highlighting the gap in technological capabilities.
        - **'Atmanirbharta' is the government slogan**, but jet engines, radars, missile seekers, and stealth tech are still sourced abroad.
    - Ensuring complete domestic capability to meet its defence needs remains a major challenge.
- **Cybersecurity Challenges & Digital Vulnerabilities:** India's cyber and digital defence capabilities are still developing, limiting its ability to counter advanced threats.

    - The **Cybersecurity Strategy** is in a transitional phase, lacking a cohesive defence architecture and a **Cyber Offensive Strategy, focusing mainly on defence**.
        - Cybersecurity infrastructure faces inadequate investment, and policies need constant updates to adapt to evolving technologies and threats.
        - A 2024 report revealed that **92% of Indian organizations experienced cybersecurity breaches** in the past year.
    - Additionally, the **skills gap limits organizations' ability** to manage cyber challenges effectively.
        - As per the Data Security Council of India (DSCI), **the country needs approximately 790,000 cybersecurity experts** to meet the growing demands of the industry.
- **Budget Constraints & Bureaucratic Hurdles:** India continues to encounter budgetary constraints and challenges in prioritizing defence projects, leading to **delays in the deployment of critical infrastructure** and technological advancements.
    - While progress has been made, the technological ecosystem is still not as robust as that in more advanced defence sectors.
        - India's procurement of the **Russian-made S-400 Triumf missile system** has experienced delays due to financial constraints and geopolitical considerations.
- **Technological Lag and Capability Gaps:** India lags in developing cutting-edge counter-space systems such as space-based lasers, jamming-resistant satellites, or **AI-powered SSA**.
    - This gap reduces India's ability to deter adversaries and protect its orbital assets proactively.
    - Indigenous R&D is underfunded compared to peer rivals, and **DRDO/ISRO's defence-civil synergy is still evolving**. Dependence on foreign components also raises cyber-vulnerability.
    - ISRO's current **annual budget of approximately USD 1.6 billion** is significantly smaller compared to other major space agencies.
        - **NASA operates with a budget exceeding USD 25 billion**, and China’s CNSA gets over $18 billion.
- **Barriers to Private Sector Growth in Defence Sector:** Even though private sector participation in India’s defence sector has increased, it still faces several challenges.
    - For instance, **companies like Bharat Forge, Data Patterns, and MTAR Technologie**s are now playing a more prominent role in defence manufacturing.
    - However, despite this progress, slow integration with government procurement processes, regulatory challenges, and limitations in **scaling up production capacity remain barriers**.
        - The establishment of **defence corridors** in Tamil Nadu and Uttar Pradesh, intended to attract private investment, **has not met expectations due to fluctuating requirements** from the armed forces and inconsistent policy implementation.
- **Limited Export Market and Global Competition:** Despite significant growth in defence exports, India's share in the global arms market remains modest.
    - In the fiscal year 2024–25, defence exports reached a record high of ₹23,622 crore, with the private sector contributing ₹15,233 crore.
        - However, this still accounts for a **small fraction of the global arms trade, where the top five exporters, US, France, Russia, China, and Germany**, collectively hold approximately 72% of the market share.
- **Execution and Credibility Concerns:** India's defence manufacturing execution, particularly its ability to meet deadlines and maintain **consistent quality, has raised credibility concerns** among potential buyers.
    - Doubts persist regarding India’s capacity to ensure timely delivery and provide reliable after-sales support key factors for international buyers.
        - Despite the **growing demand for India’s Tejas fighter jets and BrahMos** missiles, logistical challenges and diplomatic hurdles continue to hinder the country's efforts in convincing global customers.
- **Lack of Integrated Defence Strategy:** India’s defence planning suffers from a lack of integration across its three armed forces, which operate in silos.
    - Despite the creation of the **Chief of Defence Staff (CDS)** position, challenges remain in harmonizing the strategies, resources, and capabilities of the Army, Navy, and Air Force.

- A notable example of these integration challenges is the delayed implementation of the **Integrated Theatre Commands, a key reform aimed at enhancing jointness among the services**.

What Steps Can India Take to Enhance Its Defence Capabilities and Self-Reliance?

- **Foster Collaboration Between Private and Public Sector Giants:** Private companies have the agility to innovate, but need better integration with public sector firms like HAL and BEL. **Collaborative projects** can enhance production capabilities and technological advancements.
  - **Policy reforms should incentivize private companies** to develop indigenous technology and focus on specialized niches like drones, electronic warfare systems, and UAVs.
    - Provide **tax breaks, subsidies, and incentives to attract private sector** investments into the defence manufacturing ecosystem. This c**an help increase domestic production** and reduce dependency on imports.
- **Enhance India's Defence Export Potential and Global Credibility:** India needs to strengthen its reputation as a reliable supplier by improving its execution record, ensuring timely delivery, and providing strong after-sales services.
  - **Establishing robust supply chains** and demonstrating consistency will make India a more attractive defence exporter.
    - **Independent bodies can be established to monitor** defence projects and ensure they meet deadlines. Regular progress reviews, project audits, and clear milestones will ensure better execution.
  - **India can target specialized markets where its defence technology excels**, such as Tejas fighter jets, BrahMos missiles, and air defence systems in **Southeast Asia, Africa, and Latin America**.
    - Engagement in platforms like the **India-Africa Defence Dialogue, Southeast Asia Defence Dialogue**, and others can help foster new markets.
- **Overcoming Technological Gaps through Partnership:** To reduce reliance on foreign technologies, India should increase investment in indigenous defence research.
  - **Developing critical technologies** like jet engines, radars, missile seekers, and stealth technology domestically will reduce the gaps and make India self-reliant.
    - **Collaborating with global defence manufacturers like GE Aviation and Dassault** can help India access cutting-edge technologies, which can then be integrated into domestic defence projects.
    - India can enhance defence manufacturing by **entering into more joint ventures with foreign companies**, ensuring that critical technologies are transferred and adapted for local needs.
- **Focusing on 'Buy Indian' Over 'Buy Global':** India should prioritize "Buy Indian" policies to strengthen domestic defence manufacturing. Programs like **Defence Production and Export Promotion Policy (DPEPP)** and the Positive Indigenisation List are steps toward achieving this goal.
  - **Shifting to locally sourced defence systems** like Tejas jets and Akash missiles will support private companies and reduce dependence on global suppliers, improving strategic autonomy.
    - **Long-term contracts and incentives** can boost local production capacity.
- **Co-Development of Dual-Use Infrastructure:** Foster the co-development of infrastructure that benefits both military and civilian sectors.
  - For instance, the **Dholera Special Investment Region (DSIR) in Gujarat** is being developed as an integrated smart city with provisions for both defence infrastructure and commercial operations.
    - The region aims to become a world-class destination with efficient infrastructure for manufacturing, boosting industrial output, creating jobs, and **providing a balanced environment**
- **Comprehensive Defence Skill Development Program:** Developing a highly skilled workforce is key to sustaining growth in indigenous defence production.

- India should **establish specialized defence training institutes** and incentivize collaborations with global defence corporations for skills development.
- A **dedicated Defence Talent Academy**, in partnership with top-tier educational institutions, could create a pipeline of skilled engineers, technicians, and cyber specialists tailored to defence needs.
    - Such initiatives would address the gap in advanced skill sets and enhance R&D capabilities.

Conclusion

India's defence sector stands at a pivotal moment, with advancements in technology and indigenous capabilities driving its growth. While challenges persist, particularly in integration, technological development, and export competitiveness, the country's commitment to strengthening its defence ecosystem remains unwavering. The **continued pursuit of these goals will position India as a formidable player on the global defence stage**.

Drishti Mains Question

Examine the challenges and key initiatives for strengthening India's defence sector and enhancing its global defence position.

UPSC Civil Services Examination, Previous Years Questions (PYQs)

Prelims

Q. Operations undertaken by the Army towards upliftment of the local population in remote areas to include addressing of their basic needs is called: (2024)

(a) Operation Sankalp

(b) Operation Maitri

(c) Operation Sadbhavana

(d) Operation Madad

Ans: C

Mains

Q. "Increasing cross-border terrorist attacks in India and growing interference in the internal affairs of several member-states by Pakistan are not conducive for the future of SAARC (South Asian Association for Regional Cooperation)." Explain with suitable examples. **(2016)**

Q. The terms 'Hot Pursuit' and 'Surgical Strikes' are often used in connection with armed action against terrorist attacks. Discuss the strategic impact of such actions. **(2016)**