CENJOWS

CALL FOR PAPERS
SYNERGY: FEBRUARY 2024 ISSUE

THEME: SPACE: BOLSTERING NATIONAL AND MILITARY SECURITY

CONCEPT NOTE

Though the launch of rockets by ISRO began in the early 1960s, India ventured into space with the successful launch of Aryabhatta in 1975. The Indian space sector has witnessed remarkable growth over the past few decades, including impressive strides in space exploration, by successfully launching Mangalyaan, Chandrayaan, Aditya-L1 and Gaganyaan (TV-D1) missions in recent times. India created history with the path breaking landing of the Chandrayaan-3 Lander (Vikram) and Rover (Pragyan) near the Southern Pole of the Moon on 23 Aug 2023. ***India's Space Policy***, released in April 2023, has opened new opportunities, with a *vision to augment space capabilities for the* ***Nation's socio-economic development and security****, protection of environment and lives, peaceful exploration of outer space and scientific quest.* It is expected that space technology will penetrate into other sectors like aviation, marine applications, agriculture, energy and telecom, with service delivery even in remote areas. The role of Starlink in the ongoing Russia-Ukraine conflict has spot-lighted the salience of commercial and civil capabilities in space for information management, command and control (C2) and precision strikes on the battlefield.

Burgeoning Indian Space Ecosystem

Earlier, exploitation of space could only be afforded by Government supported entities. However, in recent times, India has witnessed the entry of startups, MSMEs and academic institutions in the Indian space sector, spurred by access to ISRO assets and technology. This is fostering innovation, competition and collaboration, besides driving technological advancements, economic growth and job creation, aligned with the vision of an 'Atma Nirbhar Bharat'. This spurt is expected to push the Indian space sector from $10 Bn a year, to $ 44 Bn by 2040. Role differentiation with creation of NSIL, IN-SPACe, ISpA and the demonstrated potential of startups like Skyroot Aerospace (launch systems), Pixxel (imagery), Dhruva Space (satellites) and Agnikul Cosmos (India's first private space vehicle Launchpad), is underpinning this unprecedented growth. Currently, 68 private firms hope to build payloads, 30 plan to develop rockets and parts, and another 57 want to make ground stations and applications. The Indian space ecosystem, including private investments, is indeed buoyant.

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Congested, Contested and Militarised Space

The Outer Space Treaty (OST) of 1967 declares space to be "the province of all mankind", free for exploration and use by all states, while prohibiting stationing of weapons of mass destruction (WMD) on celestial bodies/ outer space; use of Moon and other celestial bodies exclusively for peaceful purposes; and forbidding claims of sovereignty by occupation or other means. ***However, enforcing the rule of law in space is the biggest challenge.***

At the start of 2023, there were 9,984 orbiting satellites, of which only 6,718 were operational, leaving 3,266 inoperative satellites orbiting uselessly. In addition, in the first half of 2023, 1,354 objects have been launched. In just 5 years, between 2018-2022, more objects have been launched, than in the previous 60 years between 1957-2017. With the cost of bringing back a non-operational satellite from space being high, ***nearly 100 million debris pieces of diameter 1 mm and more remain in orbit, presenting unprecedented risks for the operational satellites.***

Exploitation of Space. Of the 6,718 operational satellites, ***4,823 are for communications, 1,167 for earth observation, 414 for technology development, 155 for PNT***, 109 *for Space observation*, 25 *for Earth science and* 25 *for other purposes*. Notably, 5,280 satellites have commercial usage, ***688 are used by governments, 588 by the military and 162 by the civil.*** Globally, over 75 countries operate satellites, besides multinational ones. The ***US presently operates 4,511 of them, China 586, UK 561, Russia 177 and India 53*** (Communications-21, Earth Observation-21, Navigation-8, Science-3). India, as a nation, is leveraging satellite enabled data and services for broadcasting, DTH, mobile communications, tele-education, tele-medicine, weather, ocean state, agriculture, forestry, irrigation, watershed management and disaster risk reduction.

Growing Militarisation of Space. In addition to the physical domains (air, land, maritime), cyber, and information, space is a domain which binds and enhances capabilities in all other domains. Space meets the critical requirements of ISR, communications, PNT, missile warning, space weather forecasting and meteorology. It is an arena of strategic competition. Growing counter-space capabilities of nations is hence worrisome, with no binding protocols or rules for activities in space. Many countries have developed anti-satellite (ASAT) capabilities (kinetic kill and non-kinetic), besides co-orbital threats. China reportedly carried out a Fractional Orbital Bombardment System (FOBS) test using a Hypersonic Glide Vehicle in 2022, presenting a new challenge. ***The US is reportedly operating 220-235 military satellites, China 130-140, Russia 102-105, and France, Italy and Israel between 11 to 18 satellites, and the number is likely to grow exponentially, especially Low Earth Orbit (LEO) satellites.*** UNGA resolution 76/231 has recently created an Open-Ended Working Group in Dec 2021, for ***reducing space threats through norms, rules and principles of responsible behaviour.***

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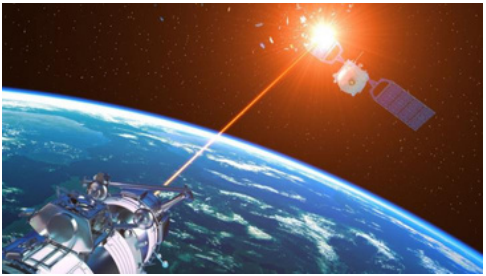
India's Military Space Capabilities - Evolutionary Milestones. China's ASAT in 2007 and the Mumbai terror attack by Pakistan in 2008 impelled the Indian Armed Forces to enhance military space capabilities and newly created Space Cells/ Directorates helped evolve the Defence Space Vision-2020. Though RISAT-2 and Cartosat-2 series satellites were launched and DSCC and DIPAC were created around 2008, the first military communication satellite, GSAT-7 (Navy), was launched only in 2013, followed by GSAT-7A (Air Force & Army) in 2018 and EMISAT in 2020, while the GSAT-7B (Army), GSAT-7C (Air Force) and GSAT-7R (Navy) are scheduled for launch in the coming years. Similarly, indigenous navigation system NavIC (erstwhile IRNSS) took shape between 2013 and 2016;the Defence Space Agency (DSA), which subsumed DSCC and DIPAC, and Defence Space Research Agency (DSRA) were created in 2018; and India conducted an ASAT demonstration in Mar 2019. In 2022, the DSA launched 23 space problem statements through DISC-8, addressing joint and services requirements, drawing out a very promising response from the startups. ISRO has set up the Directorate of Space Situational Awareness and Management (DSSAM) in 2020. NSIL (2019), IN-SPACe (2020) and ISpA (2021) define the new architectural framework of the Indian Space ecosystem.



However, much remains to be done. Factors which will catalyse the space prowess are high-level leadership, long-term planning, funding, private sector capability development, leveraging relevant technologies need greater scholarship. Accordingly, the **February 2024 volume of 'Synergy', CENJOWS calls for papers** that examine, but are not limited by, the following **sub-themes:**

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CONCEPT NOTE

Global Space Military Landscape & Competition

- Implications of China's 'Space Powerhouse' Dream on India and the World.
- Space Race Parameters– Resilience, Orbital Slots, Bandwidth and Frequency slots, Quantum, 6G / 7G Communication and Technological Supremacy & Options for India's Asymmetric Approach for Space Superiority.
- Space Diplomacy for Regional & Global Cooperation.

Policy

- Global Governance and Legal Frameworks.
- Synergising ISRO, DRDO and DSA Capabilities for a holistic SSA.
- Financial and Procedural Pathways for Space Acquisitions.
- Space Debris and Space Traffic Management

Space Security

- Shaping Strategic Environment through Space Capabilities and Deterrence.
- Whole of Nation Approach to enhance Cross-Domain Synergy by Integrating Space Power with National and Military Security.
- Space Threats Landscape- Capabilities of Adversaries.
- Deterring and Responding to Counter Space Capabilities- Reconnaissance, Offensive and Defensive Capabilities.
- Challenges and Options for Responsive Space Capabilities
- Space Domain Awareness, Space Situational Awareness (SSA) and Space Surveillance Networks (SSN).
- Cyber Threats to Critical Space Infrastructure.
- Space and Electronic Warfare.

Military

- Indian Defence Space Vision 2047/ Defence Space Strategy/ Defence Space Doctrine.
- Concepts of Space Power, Space Control, Dominance and Superiority- Relevance and Actualisation for India.
- Enhancing Multi-Domain Warfighting Capabilities in and Through Space.
- Enhancing Warfighting Capabilities in Air, Land, Maritime Domains **(Separate Themes)**

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CONCEPT NOTE

- Enhancing Space based ISR, EW and Cyber Capabilities **(Separate themes)**
- Enhancing Target Acquisition Accuracy and Resolution- Spatial, Temporal and Spectral for Multi-Domain Precision Targeting.
- NavIC - Enhancing Capabilities for Multi-domain Military Capabilities.
- Space for Intelligence and Threat Integration on the Borders.
- Space Commands & Military Aerospace Forces- Global Experience & Lessons for India.
- Space Command and Military Aerospace Forces- Operational, Institutional and Human Resource Model for India.
- Leveraging Real-time, Resilient & Integrated Space and Terrestrial Communications.
- High-Capacity Optical Communications, Relay & Datalinks for Space-Earth Integrated Information Network.
- Enhancing Hyper-spectral Imagery and Interferometric SAR Capabilities.
- Multi-payload and Multi-sensor satellites – PNTRC Convergence.

Civil-Military Fusion

- Space Commercialisation Eras- Leveraging Commercial Space Capabilities and Services through Autonomisation, Informatisation, Intelligentisation and Robotisation.
- R&D and Indigenous Space Infrastructure Development.
- Organisational Restructuring and Reforms to Harmonise and Integrate Multiple Agencies, Ministries and Stakeholders.
- Need for Space Industrial Parks and Zones- Role of States and Leveraging Corporate Space Responsibilities..
- Spurring Innovation for Defence Space Capabilities - Lessons from iDEX and DISC.
- Leveraging Innovations & Startups in Space Technology for the Military.
- Leveraging Space for weather predictions and meteorology.
- Leveraging Space for marine scientific research.
- Leveraging Space-based Telemetry, Tracking and Control and On Orbit Capability Development- IMINT Interpretation, Analysis, Relay Stations, Servicing and Manufacturing.
- Domain Specialisation, Super-Specialisation, Space Talent Acquisition, Development and Harnessing.

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Emerging Areas

- Novel Energy and Power Options for Satellites.
- Growing Challenges and Capabilities in Very LEO and Near Space.
- Deep Space Exploration- Small Celestial Bodies and Securing Resources for the future.
- Economising Space through Reusability, Ride-share and other cost saving measures.

GUIDELINES

➢Research papers of **3000-4000 words, Font Size 12, Font Style Arial, 1.5 Spacing and Chicago Style Referencing** is preferred. Serving and Retired officers of the 3 Services, Paramilitary Forces, R&D and Academia fraternity, Industry, Innovators and Start-ups are invited;

➢ Refer to: Guideline for Contributors

➢Appropriate Honorarium will be paid for articles selected for publications after peer review.

➢ 12 to 15 papers for the SYNERGY Issue will be printed and other selected papers will be published on the CENJOWS Website.

➢ Prospective Contributors are requested to seek further details on

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