INDOPACIFIC GESINTELLIGENCE FORUM

11-12 JUNE 2024 VIVANTA- DWARKA, NEW DELHI

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INDO PACIFIC GE INTELLIGENCE FORUM

11-12 JUNE 2024 VIVANTA- DWARKA, NEW DELHI

With over 600 participants representing 24 countries, the breadth of expertise contributed to the conference's resounding success. Bringing together professionals, thought leaders, and innovators from around the globe, the conference promoted collaboration, idea exchange, and exploration of emerging trends. The event focused on fostering resilience across multiple domains through the integration of space and geospatial technologies. Our diverse group of speakers and panellists provided in-depth technological insights and presented actionable, plausible solutions for maintaining regional stability and security. In addition to the plenary discussions and tracks, the two-day conference featured showcasing of cutting-edge technological advancements and fostering strong partnerships.



KEY FIGURES



DELEGATE SEGMENTATION



KEY TAKEAWAYS FROM THE ADDRESS

Lt Gen AKS Chandele, PVSM AVSM

Lt. Gen. A.K.S. Chandele welcomed attendees to the Indo–Pacific Geo– Intelligence Forum 2024, organized by Geospatial World with the Director General of Information Systems as a knowledge partner. He introduced key dignitaries: General V.K. Singh, renowned for his extensive military and public service, Lt. Gen. Rakesh Kapoor, instrumental in curating the conference agenda along with DGIS and his team. Vice Admiral Tarun Sobti, a distinguished naval officer. He described Geospatial World as a knowledge company which promotes the use to geospatial technologies across every various sector of the human endeavour, largely, defence. He promoted the recently launched Geospatial World Chamber of Commerce to promote bi-lateral and multi–lateral trade in geospatial and space technologies. He emphasized on the importance of stability and security in the Indo–Pacific region, bringing together experts from over two dozen countries to discuss geospatial technology in the realm of defence and security. He particularly expressed gratitude to the uniformed fraternity, both serving and veterans.



We can proudly say with all modesty that we are a globally recognized organization. We are an India headquartered knowledge company with a global footprint, advocating the adoption of geospatial technology in every sector of the human endeavour be it agriculture energy water transportation infrastructure and largely in defence and security."



Lt General Rakesh Kapoor, AVSM, VSM DCOAS (IS&C)

Lt Gen Rakesh Kapoor emphasized the critical role of technology in improving governance and monitoring activities within the Indo– Pacific region, a dynamic area characterized by both cooperation and competition. He highlighted the importance of geospatial technologies for trade, supply chains, and overall human progress, while also addressing the significant challenges posed by climate change (such as rising sea levels, earthquakes, tsunamis, floods, and pandemics) and non-traditional threats like cybercrime and human trafficking. Despite the diminishing authority of international institutions and the evolving nature of space as a new frontier, he stressed the need for robust governance mechanisms, economic interdependencies, and strategic patience to ensure stability and growth. India's commitment to regional security and collaboration underscores the need for convergences and shared initiatives to navigate the complexities of the Indo–Pacific.

The authority of international institutions is diminishing, and space is the new frontier requiring mechanisms to prevent astrophile politicking. Despite challenges, the Indo-Pacific remains stable yet sensitive due to economic interdependencies, cultural links, and strategic patience. Focusing on convergences, initiatives like the Indo-Pacific Ocean Initiatives can enhance human security, address climate change, and build robust governance structures. India remains committed to regional security and growth through collaboration and mutual engagements.⁷⁷

KEY TAKEAWAYS FROM THE ADDRESS

Vice Admiral Tarun Sobti, AVSM, VSM, DCNS

"The Indo-Pacific region, spanning from the Gulf of Oman to the US Pacific coast and encompassing the Indian and Pacific Oceans across 70 million square kilometers, holds strategic importance with 40 countries, 64% of the world's population, and 50% of global trade. Vice Admiral Tarun Sobti highlighted the escalating maritime security threats including hybrid incidents, piracy, Illegal, unreported and unregulated (IUU) fishing, contraband smuggling, and illegal migration, alongside frequent maritime insurance incidents. Surveillance challenges arise due to the vast area and 'dark shipping', requiring advanced technologies like AI and space-based assets. Emphasizing international cooperation through initiatives like IP MDA, he underscored the Indian Navy's reliance on satellite systems like NavIC and RISAT for enhanced domain awareness. He urged Indian industry's role in developing space applications, citing initiatives like New Space India Limited and iDEX to foster innovation and contribute to national development."



The Indo-Pacific, spanning 70 million square kilometers (about twice the area of Africa) and harboring strategic and economic importance, faces diverse maritime threats from piracy to cyber security. Addressing these challenges demands advanced geospatial technologies, space-based surveillance, and international collaboration. India's role in the global space industry, bolstered by made in India initiatives like NAVIC, RISAT and advanced satellite projects, underscores our commitment to enhancing maritime domain awareness and fostering national development through innovation and AI integration."

Sanjay Kumar, Founder & CEO, Geospatial World

Sanjay Kumar, CEO of Geospatial World, highlighted India's pivotal role in the evolving global order during his vote of thanks. He emphasized the Indo–Pacific's centrality in global economics and resources, underscoring India's demographic and economic significance. Kumar outlined India's strategic investments in technology and innovation across geospatial, space, ocean, and cyber domains, aimed at enhancing self–reliance and regional security. He proposed the establishment of a Defence Geospatial Information Enterprise to integrate and advance capabilities across these sectors. Kumar acknowledged the collaborative efforts with international partners and urged for proactive leadership and preparedness in navigating geopolitical complexities. He concluded by thanking stakeholders and sponsors for their support in advancing these critical initiatives.



As a nation, we have a vital responsibility towards the protection, prosperity, and peace of the Indo-Pacific region, emphasizing preparedness and proactive leadership. We need to create something like a Defence Geospatial Information Enterprise, a system of systems that can leverage existing capabilities and develop a strategy to augment and advance our objectives in security and technology."

INAUGURAL ADDRESS BY CHIEF GUEST



General Vijay Kumar Singh, PVSM, AVSM, YSM, ADC

General VK Singh's address underscored several key takeaways crucial for addressing contemporary security challenges. He light heartedly highlighted the disparity between perception and reality. He emphasized the imperative shift from superficial discussions to in-depth analyses of multi-dimensional security, emphasizing the pivotal roles of intelligence, geospatial technologies, AI, and modern tools in threat mitigation. He stressed the significance of human decision-making over excessive reliance on machines, urging robust training of human resources and optimal utilization of technological platforms. He called for enhanced coordination and intelligence sharing among nations and organizations to foster actionable insights. Recognizing the growing affordability and strategic value of technology, he spotlighted India's proactive stance in advancing cutting-edge solutions. Finally, he addressed conflicts involving proxy participation across diverse domains, emphasizing the urgency of synthesizing information swiftly to formulate effective strategies and mitigate operational delays.

Today's global landscape necessitates the rapid synthesis of extensive information spanning economic factors to information warfare. The ability to effectively translate this synthesis into actionable strategies is paramount for achieving our strategic objectives in the Indo-Pacific region. As conflicts evolve with multipolar dimensions and proxy engagements, the agility to analyze and respond swiftly becomes critical in securing our interests and maintaining regional stability."

SPECIAL SESSIONS

Lt Gen RS Raman, AVSM, YSM, DGMI

In his Special Address, Lt Gen RS Raman, AVSM, YSM, DGMI, emphasized the critical role of geospatial operations in the armed forces. The military's traditional use of maps has evolved into sophisticated geospatial operations, significantly enhanced by integrating data and location information, which unlocks numerous strategic and operational possibilities. He highlighted the overlap between military and civil applications of geospatial data, noting that demographic and social development data can influence internal security by shaping public attitudes and perceptions. The importance of data collaboration was also stressed, as sharing remote sensing data can prevent disasters, citing the recent natural calamity in Sikkim as a potential example. Geospatial technology is an evolving ecosystem involving acquisition, transmission, hosting, and data analytics, which must be viewed and managed as continuously enriching. He underscored the need for rapid development cycles to ensure that products remain relevant, emphasizing the importance of collaboration between users and developers to anticipate future needs, such as advanced visualization tools for drones and counterdrone technology.



At the periphery of each of the systems that we, in each of our organizations, are using, we should be able to couple them together into a mega system, into a gridded system, wherein the information, data, and insights flow in and out of the system freely, without any hindrances, of course, taking care of the security protocols in it. So, we need to evolve these bridging technologies."

Royston Ong, Business Development Manager (National Security) – APAC

Royston Ong, emphasized the critical role of integrating geospatial data for enhanced national security. Key solutions include using AI and Big Data for real-time digital twins, rapid data processing, and extracting insights from unstructured data. He stressed on the importance of public-private partnerships and collaborative platforms for real-time data sharing. A clear geospatial strategy, effective leadership, and customized solutions are essential for system interoperability and future proofing. These approaches enable better decisionmaking and efficient operations across defence and intelligence sectors. Rapid data processing is crucial, especially in crisis situations, and platforms that can quickly ingest and analyze large volumes of data are vital. Advanced methods are necessary to extract insights from unstructured data, such as identifying foreign activities through unusual patterns. Futureproofing involves adopting modern technologies and methodologies to predict and prepare for future challenges. Effective leadership and governance are also essential, with governance boards overseeing geospatial strategies to ensure alignment across all branches and agencies.



It's not just about how you harness data together in a geospatial format. But also, geospatial strategy to make sure that when they gather all this data its able to be generated well fast enough and analysed for dissemination. Technology is not just the key piece, its ultimately about the people and the process you need to think through for the geospatial strategy."

PLENARY 1: GEOSPATIAL TECHNOLOGY: KEY TO BOOST INDO PACIFIC REGIONAL SECURITY

SPEAKERS

L Vdm LS Pathania, Chief Hydrographer, Govt of India Dr Prateek Sharma, Vice Chancellor Delhi Technical University Maj Gen (Dr) Ashok Kumar, VSM, CENJOWS Andy Stephenson, Senior Vice President, Blacksky Lt Col Gil Elmalem, R&D Attache, Embassy of Israel

- **Strategic Importance of the Indo-Pacific Region:** The Indo-Pacific region holds immense strategic significance due to its busy shipping lanes, rich natural resources, and geopolitical dynamics. Ensuring security and stability in this area is crucial for global economic stability and security.
- **Security Threats and Flashpoints:** The Indo–Pacific region faces both traditional (territorial disputes, military modernization, nuclear proliferation) and non–traditional (cybersecurity, environmental degradation, transnational crimes) security threats. Key flashpoints include border disputes, the Taiwan Strait, North Korean nuclear issues, and humanitarian crises, all of which contribute to the region's volatility.
- Role of Geospatial Technology: Geospatial technology, encompassing tools like satellite imagery, GPS, and data analysis, plays a crucial role in enhancing maritime safety, security, and navigation. It enables the creation of detailed maps, nautical charts, and real-time monitoring systems that help manage maritime traffic and predict environmental changes.
- Importance of Maritime Domain Awareness: Understanding and monitoring the maritime environment to ensure security and safety. Geospatial technology aids in tracking vessel movements, identifying suspicious activities, and providing accurate navigation information. While geospatial technology offers significant benefits, it also faces challenges such as data sharing issues, the need for skilled personnel, and infrastructure development. Addressing these challenges requires international cooperation, investment in education and training, and robust infrastructure.
- Need for robust International Cooperation in the Indo-Pacific region: Geospatial technology
 provides a common platform for collaboration, enabling countries to share data, coordinate actions,
 and build trust. This cooperation is vital for addressing regional security challenges and ensuring the
 effective use of geospatial data.
- Space as the New Frontier: Geospatial technology plays a crucial role across various domains subsurface, surface, aerial, and space. It helps in delineating territorial boundaries, predicting conflicts, and providing comprehensive mapping and monitoring capabilities. The importance of space technology is growing, with activities ranging from satellite deployments to anti–satellite weapons. The speaker calls for the peaceful use of space and stresses the role of geospatial technology in predicting and managing potential conflicts in space, ensuring international cooperation and stability.





High–quality geospatial data requires robust infrastructure for data collection, processing, and dissemination. We need to invest in infrastructure for satellite systems, remote sensing platforms, and data centers. Emerging technologies, such as artificial intelligence and machine learning, hold great promise for geospatial applications.³⁹

V Adm LS Pathania

Chief Hydrographer, Govt of India







As engineering disciplines evolve, artificial intelligence will become pervasive, transforming traditional fields into subdomains of AI. The basic framework will remain, but AI and machine learning will dominate these technologies. Counter–AI technologies will also be necessary to address inappropriate uses of AI.**??**

Dr Prateek Sharma

Vice Chancellor, Delhi Technical University



Geospatial technology has multiple uses and requires no introduction. It can help countries geofix their territorial boundaries and predict where conflicts are likely to occur. This allows right-minded people and their coalition partners to address these challenges well in time.**?**



Maj Gen (Dr) Ashok Kumar

VSM, DG CENJOWS



We're offering real-time intelligence capability with analysis and analytics to our customers, and that gives us the ability to offer High refresh revisit but also Insight on a particular point target or location you are looking at. **?**

Andy Stephenson

Senior Vice President, Blacksky

"We are focusing on three pillars of our Space Program, first, trying to bring together a lot of government funding to companies big and small, we also support the academia and early-stage research. The second pillar is the agile combat proven military solutions and third is international partners."

Lt Col Gil Elmalem

R&D Attache, Embassy of Israel



SPEAKERS

Lt Gen Anil Bhatt, PVSM, UYSM, AVSM, SM, VSM, Director General ISpA Lt Gen PJS Pannu, PVSM, AVSM, VSM, SIA India AVM Rajiv Ranjan, ACIDS (ICT) IDS Col Marcin Mazur, Vice President, Polish Space Agency, Poland Dr S P Aggarwal, Director, North Eastern Space Applications Centre (NESAC)

- Diverse Threat Landscape: The speech highlights a range of threats in space, both natural (like space weather) and man-made (such as cyber attacks, spoofing, and anti-satellite capabilities). Understanding and mitigating these threats are essential for maintaining resilient space operations.
- **Resilience through Technology:** Achieving resilience in space operations involves three critical aspects: adequacy (redundancy and contingency measures), adaptability to threats (such as debris and cyber attacks), and accurate, timely data for effective decision–making.
- **Rise of Private Sector:** India's space sector has seen significant growth in the private sector, which is now at the forefront of developing resilient space infrastructure. Initiatives like IN–SPACe and Mission Defence Space Challenges have catalyzed this growth.
- **Diversification of Space Capabilities:** There has been a diversification of space capabilities beyond traditional Earth Observation (EO), including Synthetic Aperture Radar (SAR), hyperspectral imaging, ELINT (Electronic Intelligence), and edge computing. Private startups are actively contributing to these advancements.
- Shift to Digital and Autonomous Warfare: The evolution of warfare from analog to digital and then to autonomous systems underscores the increasing importance of space-based assets and technologies. This shift necessitates a deep understanding and integration of GeoINT applications to support modern military operations.
- **Resilience Begins Early:** Resilience in space operations starts not only when satellites are in orbit but during the initial phases of defining customer needs and technological choices. This early planning and decision–making are crucial for ensuring robust space capabilities.
- **The concept of Mosaic Warfare:** Integrated autonomous vehicles and Internet of Military Things (IMT), emerges as crucial for future military strategies. India's focus on defining borders and leveraging exercises to program mosaic operations underscores strategic planning amidst technological advancements.
- **Global Cooperation is Key:** Cooperation and partnerships among nations are emphasized as crucial for enhancing resilience in space operations. This includes sharing technologies, standards, and procedures to manage the increasing number of satellites and ensure effective space traffic management.





Sharing knowledge and monitoring the space environment would be a precursor for space resilience. Data sharing would be a mandatory requirement, and collaborative efforts are essential as you move with SSA and create your resilience. **?**

AVM Rajiv Ranjan

ACIDS (ICT)IDS





"

When you talk about resilience, it is really the ability to deliver the mission in the face of man-made or natural interference. We also know that in the future, if there is any environmental shift happening, it will call for a technological shift to ensure that whatever we are trying to achieve remains resilient. Today, we are increasingly dependent on space not only for the military but also for our day-to-day existence. **??**

Lt Gen PJS Pannu, PVSM, AVSM, VSM SIA India

Achieving resilience in various space verticals hinges on three critical aspects. First is ensuring an adequate level of redundancy, backup systems, and contingency measures. Secondly, enhancing the ability of space systems to withstand and adapt to threats. Finally, accurate and timely data is the lifeblood of space operations, enabling effective decision-making, situational awareness, and coordinated responses *****



Lt Gen Anil Bhatt, PVSM, UYSM, AVSM, SM, VSM

Director General ISpA





We need to adopt a system to establish a flexible responsive and affordable space ecosystem with a robust industrial base need meticulously planned disaggregated architecture that can distribute the space assets and services into multiple orbital planes. *****

Dr SP Aggarwal

Director, North Eastern Space Applications Centre (NESAC)



Resilience in space starts not when the satellites are on orbit, but when we start talking about space, defining customers, and seeking options to fulfil requirements. **??**

Col Marcin Mazur Vice President, Polish Space Agency, Poland



PLENARY 3: CYBER RESILIENCE: SAFEGUARDING CRITICAL INFRASTRUCTURE

SPEAKERS

Dr V S Subrahmanian, Professor, Northwestern University

Dr Chalee Vorakulpipat, Head, Information Security Research Team, NECTEC, Thailand **Cmde Atul Deswal,** DDG NCG & CISO (NAVY)

Dr Anupam Tewari, Advisor (Cyber) to Principal Advisor, Ministry of Defence

- Three Dimensions of Information Security: Understanding the pillars of confidentiality, integrity, and availability is crucial in grasping the concept of information security. Confidentiality ensures data access is restricted to authorized individuals, integrity ensures data remains unaltered by unauthorized parties, and availability ensures systems are consistently online and accessible.
- **NIST Cybersecurity Framework:** The NIST framework provides a structured approach to managing cybersecurity risks, beginning with identifying risks and continuing through detection, protection, response, and recovery. Governance is emphasized as integral throughout the process.
- **Cyber Resilience:** Embracing a new mindset of cyber resilience is imperative. Rather than solely focusing on prevention, organizations must be prepared to swiftly recover and minimize the impact of cyber incidents, acknowledging that attacks may still occur despite preventative measures.
- **Emerging Trends:** Key emerging trends include the convergence of cybersecurity and data protection, the dual role of AI in both aiding and posing risks to cybersecurity, the challenges posed by IoT in critical infrastructure security, and the importance of adopting privacy–enhancing technologies (PETs) for data encryption and protection.
- **Zero Trust Model:** The zero trust model, based on the principle of not trusting anything by default, represents a new paradigm shift in cybersecurity. Although not elaborated extensively, it highlights the importance of questioning assumptions and verifying every access request or action.
- **Regulatory Evolution:** Acknowledgment of the evolving regulatory landscape, where laws and regulations must adapt to changing threats and technologies. Collaboration between regulatory bodies, such as those overseeing cybersecurity and data protection, is essential for effective governance and response to incidents.
- **Quoting Rocky Balboa:** Deswal emphasizes the essence of resilience, stressing the importance of bouncing back from setbacks and challenges, which is crucial in the context of cyber resilience.
- Importance of Continuous Improvement: Emphasis importance of continuous improvement in cyber defences, highlighting the need for vigilance, innovation, and active collaboration across sectors.
- **Generative AI in Action:** Use cases of generative AI in action, showcasing a system called Gem that automatically generates engaging ads or posts for various scenarios, including businesses, safaris, food, and gaming. These examples highlight the potential for AI–generated content to be used for both legitimate advertising and malicious purposes.





Effective cyber defence requires proactive measures and continuous adaptation to emerging threats. ******

Dr V S Subrahmanian Professor, Northwestern University







The traditional mindset is that we must not be hacked. Our system must be strong enough that no hacker can breach it. But the fact is that you cannot avoid hackers or incidents, because they can hack anything in the world. The key is that once you get hacked, you need to know how to recover your system immediately, how to continue your business, how to minimize further risk, and how to stop further threats. This new mindset is cyber resilience. *****

Dr Chalee Vorakulpipat

Head Information Security Research Team, NECTEC, Thailand



Our reliance on networks is a vulnerability that can be exploited by adversaries. The current conflicts underway are definitive statements to the same, making cyber resilience not just a strategic advantage but a fundamental necessity. **??**

Cmde Atul Deswal

DDG NCG & CISO (NAVY)







When research work is going on you can well be assured either it is already in place or it will definitely come in times to come and we have to be prepared for prepared does not mean commercially of the shelf we have to be indigenous. **?**

Dr Anupam Tewari

Advisor (Cyber) to Principal Advisor, Ministry of Defence

PLENARY 4: BUILDING NEXT GEN APPLICATIONS IN DEFENCE

SPEAKERS

Lt Gen Rajiv Sahni, VSM, DG DGIS Maj General SA Kulatunge RWP, RSP, VSV, USP, psc, Sri Lanka Army Rohan Verma, CEO & Executive Director, MapmyIndia Dr Pankaj Dalela, Director C–DoT

- Importance of Geospatial Intelligence: Understanding complex threats and rapidly evolving challenges requires the strategic use of geospatial technologies at hand. Highlighting Sri Lanka's aim to establish an Integrated Defence Command Control and Intelligence Communication Center (DC3IC) to enhance defence capabilities, crisis management, and disaster response using geointelligence.
- The 3 Cs: The DC3IC will integrate command, control, communications, and intelligence functions to improve battle space awareness and protect national resources. It will support conventional warfare, internal security operations, crisis management, disaster mitigation, and intelligence gathering. Sri Lanka also prioritizes advancing spatial data utilization through the National Spatial Data Infrastructure (NSDI) program to facilitate smart decision-making.
- **Challenges within the Avenue:** Challenges include building capacity and infrastructure for optimal utilization of geospatial technologies. Training programs and investment in technical infrastructure are essential. Effective data integration from diverse sources is crucial, requiring robust governance frameworks and emerging technologies like AI and machine learning. International cooperation is key for knowledge exchange and technology transfer.
- Leveraging Geointelligence: Optimal use of gathered geointelligence promises to enhance Sri Lanka's inland security, fortify against emerging threats, and preserve sovereignty. Underscoring the importance of a comprehensive approach to defence and disaster management, emphasizing collaboration and innovation.
- **Diverse Focus:** Diverse focus areas, including maps, IoT, navigation, drones, AI, and geospatial solutions, offering India's self-sufficient alternative to global mapping platforms. International cooperation innovative solutions like AI, satellite imagery analytics, and AR headsets, ultimately aiming to contribute to national defence and strategic empowerment by leveraging their comprehensive technological stack.
- **Telecommunication Supply Chain:** Three main components are Hardware, Software, and Data. Underscoring the importance of addressing vulnerabilities in this increasingly collaborative and open–source environment, particularly in light of the country's socioeconomic structure and reliance on digital transactions.
- Leveraging Technologies: Outlining several areas of focus for defence telecommunications, including secured 4G/5G networks, fiber networks, cybersecurity, emergency alerting, and military AI. Insights into C–Dot's solutions, such as homegrown 4G and 5G technologies, cyber security solutions deployed at national and enterprise levels, and emergency alerting systems implemented across India and other countries.







In our defence networks, it's imperative that data governs the networks, guiding us to acquire the right information at the right time, while collaborating to effectively manage legacy data and secure sensitive information.³⁹

Lt Gen Rajiv Sahni, VSM DG DGIS



At the end of the day, we're focused on an "atma nirbhar bharat" (selfreliance India), helping defend our nation, empowering our allies by leveraging this whole 30e stack of Mind dags – Maps, IoT, navigation, drones, AI, geospatial platform, and satellite AI analytics. *****

Rohan Verma

EO & Executive Director, MapmyIndia







Leveraging geointelligence promises to enhance Sri Lanka's inland security, fortify against emerging threats, and preserve sovereignty. ******

Maj General SA Kulatunge RWP, RSP, VSV, USP, psc, Sri Lanka Army



We understand the vulnerabilities in today's collaborative environment and prioritize cybersecurity solutions developed indigenously.³⁷

Dr Pankaj Dalela Director C-DoT





"The Indo-Pacific region's strategic importance brings complex geopolitical dynamics and security challenges, from traditional maritime disputes to newer threats like terrorism, piracy, and climate change. Ensuring stability is crucial but challenging, hindered by issues in data sharing, technical capacity, and infrastructure for geospatial applications. Robust international cooperation and advanced geospatial technology are vital for enhancing maritime safety and security in the region."

V. Adm. L.S. Pathania Chief Hydrographer, Govt of India

PROPOSED SOLUTIONS

"BlackSky leverages platforms, open APIs, AI, and machine learning to revolutionize space access for defence, intelligence, and national security. These innovations enable near-real-time data collection and analysis, detecting changes and patterns effectively. With robust infrastructure for data handling, BlackSky addresses challenges in data sharing, technical capacity, and infrastructure. This enhances maritime safety and security, supports international cooperation, and leverages geospatial technology for the Indo-Pacific region."



Andy Stephenson

Senior Vice President, Blacksky

To tackle Indo–Pacific geopolitical challenges, robust international cooperation and strategic use of geospatial technology are crucial. Improving data sharing, enhancing technical capacity, and investing in resilient infrastructure for geospatial applications are essential for ensuring maritime safety, security, and stability in the region.



Dr Prateek Sharma

Vice Chancellor, Delhi Technical University



"India's space infrastructure faces challenges in achieving resilience due to the need for robust redundancy, backup systems, and the ability to withstand threats like space debris and cyber-attacks. Accurate, timely data and effective PNT systems are crucial, but the current reliance on only seven satellites creates vulnerabilities, necessitating expansion and integration of ground-based systems."

Lt Gen Anil Bhatt PVSM, UYSM, AVSM, SM, VSM Director General, ISpA General, ISpA

PROPOSED SOLUTIONS

"To enhance India's space infrastructure resilience, prioritize expanding and integrating ground-based systems with satellite networks. This strengthens redundancy, backup systems, and defences against threats like space debris and cyber-attacks. Accurate data and effective Positioning, Navigation, and Timing (PNT) systems are crucial, requiring a strategic increase in satellite numbers beyond the current seven."

Col Marcin Mazur

Vice President, Polish Space Agency, Poland

Achieving resilience in space operations relies on redundancy, backup systems, and contingency measures. To withstand threats like space debris, cyber-attacks, and environmental hazards, we need advanced materials, shielding, autonomous systems, and self-healing capabilities. Strong cyber and jamming protection, resilient ground systems, cyber-secured networks, and multiple launch centers are essential. Additionally, we need space debris avoidance and early warning systems for space hazards.

Dr SP Aggarwal

Director, North Eastern Space Applications Centre (NESAC)





In today's cybersecurity landscape, traditional methods against malware, ransomware, and phishing are inadequate. Al-generated threats, quantum computing attacks, and data poisoning present new challenges. Organizations need indigenous encryption and security frameworks to protect critical infrastructure and data integrity from these advanced threats.

Dr Anupam Tewari

Advisor (Cyber) to Principal Advisor, Ministry of Defence

PROPOSED SOLUTIONS

"To address cybersecurity challenges like AI threats, quantum attacks, and data poisoning, prioritize strong indigenous encryption and security frameworks. These protect critical infrastructure and ensure data integrity against advanced threats, keeping organizations ahead in cybersecurity and safeguarding sensitive information."

Dr VS Subramanian

Professor, Northwestern University

To tackle AI threats, quantum attacks, and data poisoning in cybersecurity, organizations need indigenous encryption and security frameworks. These safeguard infrastructure and ensure data integrity, enhancing resilience against evolving threats.

Cmde Atul Deswal

DDG NCG & CISO (NAVY)

Nations should use frameworks like NIST for cybersecurity, covering risk identification, protection, detection, response, recovery, and governance. Strong governance and collaboration among regulators improve cyber resilience. Embracing AI and Privacy–Enhancing Technologies, with ethical AI standards, strengthens defences against new threats to critical infrastructure and more.

Dr Chalee Vorakulpipat

Head Information Security Research Team, NECTEC, Thailand









A significant challenge we face involves managing legacy data spanning over 50 years, ensuring accurate integration without complications. Equally critical is the secure handling and segregation of unclassified and sensitive data. While daily operations manage unclassified data on a few screens, operational tasks require navigating complex supply chains and directives involving sensitive information.

Lt Gen Rajiv Sahni

VSM, DG DGIS

PROPOSED SOLUTIONS

The solution streamlines the integration of 50+ years of legacy data with advanced, accurate data ingestion techniques. Ensuring secure segregation of unclassified and sensitive data, facilitating smooth transitions between routine and sensitive operations. IND GIS or MGIS Suite platforms provide localized deployments for data security and operational efficiency, particularly for field personnel in mobile GIS scenarios.

Rohan Verma

CEO, & Executive Director, MapmyIndia

"At C-DOT, we've led telecommunications innovation since 1984, evolving from TDM to IP and now Next Generation technologies. We prioritize cybersecurity with quantumsecured communication and AI-driven solutions to keep India's digital landscape safe. Our indigenous 4G, 5G, and fiber networks, along with disaster management and IoT platforms, ensure resilient, homegrown solutions to empower the nation."

Dr Pankaj Dalela

Director, C–DoT

"Implementing Sri Lanka's DC3I enhances national security by integrating command, control, communications, and intelligence functions. Leveraging geointelligence, DC3I improves situational awareness, crisis management, and disaster response, strengthening defence capabilities and supporting strategic decision-making against evolving threats."

Maj Gen SA Kulatunge RWP

RSP, VSV, USP, psc, Sri Lanka Army









TRACK Defence geospatial enterprise

DEFENCE GEOSPATIAL DATA INFRASTRUCTURE, ARCHITECTURE & STANDARDS

- Geospatial data is crucial for enhancing situational awareness, improving mission planning, and increasing operational effectiveness in defence operations. Effective geospatial data management can significantly improve the accuracy and reliability of defence operations.
- The Defence Geospatial Data Infrastructure (DGDI) consists of several key components, including data collection, storage, analysis, sharing, and security. Each component is integral to ensuring that the data is accurate, accessible, and secure for various defence applications.
- IGIF (Integrated Geospatial Information Framework), developed by the United Nations, provides a strategic approach to strengthening geospatial information management. It consists of an overarching strategy, an implementation guide, and country-level action plans, promoting interoperability, data sharing, and standardization in defence operations.
- This framework offers best practices for designing, deploying, and maintaining geospatial systems. Its key pillars include integration, observability, automation, reliability, security, performance, and deployment. These pillars are crucial for ensuring that geospatial systems are efficient, secure, and reliable.
- Linking IGIF with the RGIS Well–Architected Framework ensures that strategic principles are operationalized with technical best practices. This cohesive approach enhances defence capabilities by ensuring agility, informed decision–making, and effective mission fulfilment through improved geospatial data management.
- There is a need for emphasis on the critical role of data standardization in geospatial infrastructure. Standardizing data across various platforms and types (e.g., vector, raster, IoT) ensures interoperability, enhances data quality, and facilitates efficient data sharing.
- Managing geospatial data involves navigating through various stages, including data collection, consolidation, processing, analytics, and decision-making. Adding complexity, and effective management requires robust systems and strategies.
- Keeping pace with technological advancements is crucial. As is the need to adopt new technologies like AI, machine learning, and GPU clusters for data processing, analytics, and interpretation to enhance capabilities and efficiency.
- Implementing a well-structured geospatial infrastructure not only supports defence and civil applications but also improves decision-making, scalability, and security. Standardized data practices lead to cost efficiency, operational effectiveness, and enhanced system operability.



The Army has fought many wars successfully, whether it's the military survey, DRDO or any other agency that supports the defence. While there may be some challenges in connectivity, I'm sure they are moving in the right direction.»

Lt Gen Girish

Former Survey General of India





By linking the IGIF with the Well-Architected Framework, we ensure that the strategic principles of the IGIF are operationalized with technical best practices, creating a cohesive approach to managing geospatial data in defence. **#**

Ollie David Brown Solution Engineer, Esri

Future directions include AI enablement, operationalization of the software, integration of sensor inputs like AWS, satellite communication data for real-time asset tracking, and further scalability. *****







Our flagship product in GIS is INDIGIS, a comprehensive and robust indigenized geospatial technology platform. Over and above this platform, we have developed around 20–25 different use cases specific to defence users. *****

Giridhar M Aekbote Director, Microgenesis

The really interesting thing we can now do is near real-time registration of video on top of that. You have all the benefits of being able to work in two dimensions with satellite imagery, and then you bring in situational awareness and real-time data from drones and other UAVs. *****



Matthew Jackson Solution Architect, Maxar



Data is getting streamed from all different platforms and data is of different types. We need some consolidation layer and there's lots of interfaces between platforms and your servers and everything else. In all this complexity and infrastructure, how can data standardization help? I think it adds a lot of value as money also and your efficiency also increases.»

Radha Krishna Kavuluru

Principal Engineer– Firmware & Software, Dhruva Space

- GEOINT is crucial for modern military operations, providing situational awareness and context for decisionmaking in complex environments like the Indo–Pacific region. It helps military forces anticipate and respond to emerging threats effectively.
- Digital twins have broad applications in enhancing regional security, including optimizing supply chain management, improving training and simulation, and simulating complex scenarios like naval and air operations. Challenges discussed were data integration, interoperability, cybersecurity, and the significant cost and complexity involved in developing and implementing digital twins.
- Addressing these challenges is crucial to fully harnessing the potential of digital twins in military operations. The integration of artificial intelligence (AI) and machine learning (ML) into digital twins is a promising trend. This integration will enhance their accuracy, responsiveness, and predictive capabilities, enabling better anticipation and response to emerging threats in real-time.
- Collaboration between academia, military leaders, and industry could define and implement digital twin applications. Integration of existing research, such as condition monitoring of wireless networks or aircraft availability prediction, into digital twins is crucial for advancing military capabilities.
- There's a significant opportunity for entrepreneurs and innovators to leverage digital twin technology, supported by initiatives like the Center of Excellence in Cyber Physical Systems at IIT Indore. This initiative provides resources and support for developing and scaling digital twin solutions in military and industrial contexts.
- Digital twins are applicable across various domains including urban planning, disaster management (like flood monitoring and landslides), heritage conservation, and defence systems. This underscores the versatility and practical utility of digital twins beyond theoretical concepts.
- Emphasis is placed on the integration of advanced technologies such as LIDAR, optical sensors, UAVs (drones), and AI/ML algorithms. These technologies are crucial for data capture, modeling, simulation, and real-time monitoring, illustrating a sophisticated technological infrastructure.
- Digital twins will impact urban development, infrastructure management, disaster response, and defence preparedness. With involvement of the right technologies, it can also lead to avenues of Metaverse integration and community-driven use case development through hackathons, indicating a forward-looking strategy.



Challenges arise, but solutions abound, interoperability, a bridge to be found. Cybersecurity, a fortress to be built, ethics and privacy, a balance to be tilted. The future beckons with Al and ML, quantum computing, a new tale to tell. Augmented reality, a window to the world, blockchain, a shield against threats unfurled. In the Indo-Pacific, a new era dawns, where GEOS special intelligence and digital twins spawn. A symphony of technology, a dance of might, securing the region with digital sentinels' light.³⁹





Maj Gen (Dr) Dilawar Singh

Senior Advisor–Indian Centre for Interdisciplinary Studies in Science and Technologies



We want the real–world replica that should be accurate and that's why our focus is that whatever we are generating, a very accurate digital replica of the real world. ******

Dr Aniruddha Roy

CTO, Genesys International Corporation Ltd

The value of a digital twin provides a comprehensive and dynamic view of the environment for all users, expanding the role of GIS professionals beyond 2D representations to 3D and 4D representations.



Christopher Oxendine

Industry Solutions Manager, Esri



A digital twin when given a location context becomes a geo-digital twin, integrating physical conditions, geology, terrain, city regions, environment, traffic conditions, patterns, into a holistic feature analysis. *****

Vishal Anand COO, Mappls Geosystems

We are at the cusp of this industrial ecology digitalization. In the words from the Science and Technology report of NATO 2020 and it very clearly says that in the coming 10 years it will not be uncommon to see digital twins of military systems. *****

Col Joydeep Majumdar



- Many critical technologies and infrastructures, such as Operating systems, AI models, Supercomputers, and Semiconductor manufacturing, are predominantly controlled by foreign entities. This highlights a significant lack of indigenous capabilities in key technological domains.
- There is a strong concern raised about the vulnerabilities in data security due to reliance on foreign technologies and infrastructure. Examples include potential breaches through side channel attacks, lack of control over encryption standards, and challenges with securing data transmitted via undersea cables.
- Despite the concept of data sovereignty, achieving true sovereignty over data within national borders is challenging. This is due to the interconnected nature of global technologies and the dependency on international standards and infrastructure.
- Developing indigenous capabilities in crucial technological areas like AI, semiconductors, cybersecurity, and infrastructure is the need of the hour as this is seen as essential for asserting greater control over national data and enhancing security against external threats.
- Growing challenges of cybersecurity in various sectors such as healthcare, education, and defence require strategies like threat profiling, blockchain technology for decentralization, and the use of AI and machine learning for pre–emptive defence.
- The intersection of data sovereignty and cybersecurity, emphasizing the legal, policy, and technical aspects that organizations need to address to safeguard data effectively. This includes compliance with regulations and ensuring data integrity across distributed networks.







Data sovereignty refers to the idea that a country or a jurisdiction has the authority and right to govern and control the data generated within its border. That's the basic premise of data sovereignty. *****

Dr Anupam Tewari

Principal Advisor (Cyber), Ministry of Defence

So, cyber security has become a very critical concern that needs the attention of researchers, academicians, and organizations to confidently ensure the protection and security of information systems and IT infrastructure. *****





HS Randhawa ACP, Delhi Police

But in the last 40 years, we see another type of war which is going on very beautifully, peacefully, and that is called data colonization. *****

Vinit Goenka Data Sovereignty Expert

No more are kings but the government still controls things under them, and no external party has any control over them. The Sovereign power makes rules regulations and way and method to use it exploit it or not to use it is all. The same applies to data. Not having complete data sovereignty over data is a challenge of today. *****



Cdr Mukesh Saini

Former National Information Security Coordinator (GOI)

TRACK Space infrastructure & situational domain Awareness

SPACE SURVEILLANCE & EARTH OBSERVATION CONSTELLATION

KEY TAKEAWAYS

- There's a shift from traditional force-on-force tactics to hybrid warfare strategies that integrate space assets. The speech underscores the blurred lines between commercial and military uses of space technologies.
- The future lies in advancements such as AI, machine learning, and edge computing to enhance satellite capabilities. Swarms of satellites, inter–satellite links, and data fusion are identified as critical technologies for improving efficiency and effectiveness in space operations.
- Protecting space assets and ensuring space surveillance are vital for national security. The Defence Space Agency plays a pivotal role in coordinating these efforts and meeting the space-related requirements of the Armed Forces.
- Combining of synthetic aperture radar (SAR) and EO (Electro-Optical) sensors on a single satellite platform aims to reduce ambiguity in satellite imagery, which is crucial for better data interpretation.
- The integration of SAR and EO sensors has significant implications for various applications, including surveillance, disaster monitoring, and environmental assessment. This approach promises to deliver more accurate and timely data, enhancing decision–making processes.
- The use of hyperspectral Earth Imaging from space, offers detailed information across hundreds of bands beyond visible light. This allows for precise analysis of environmental factors like chemical contamination and vegetation health.
- This technology has significant implications for national security. It enables early detection of changes indicative of illicit activities, environmental threats, and infrastructure monitoring.



Human security is also a very important dimension of security as a whole. We have here a problem statement which is multi-dimensional, and we have here a number of possible technological solutions coming from space which may have solutions. *****



AVM DV Khot Principal, Consultant INSPACe



The importance of high ground in warfare – from times immemorial – in warfare, we've always gone as high as possible for observation. Once we had aerial platforms, we used these. And now, we've graduated to satellites which don't have the limitation of operating only over your sovereign space. *****

Brig G Manoj Defence Space Agency Ambiguity arises from multispectral imagery in tropical countries like ours, where clouds often obscure views. Traditional EO imagery is intuitive but limited by cloud cover, requiring multiple satellites to fill the gaps. SAR, on the other hand, can penetrate clouds and operates in all conditions but is less intuitive for new users from different domains. *****



Suyash Singh

Galaxeye Space



SAR data can provide topography and estimate soil moisture, aiding decisions on surface movement for defence vehicles.

Kapil Kumar Malik

Regional Sales Manager, Synspective

What's important is the speed and precision of intelligence. It's not just imagery if it comes to you as a pixel, it's upon you to decide what this means. Our machine learning and our artificial intelligence turns it into intelligence that's actionable. "



Sean Cantrell

Director – International Govt Engagement, Maxar Intelligence



Al and Machine Learning gives the power behind this technology to narrow down the area of search for you by indicating where the recent changes are made. **?**

Abhineet Jain

Director Sales & Business Development, BlackSky

So within our constellation we can do the tipping and queuing activity plus we are also taking to some of the high resolution satellites providers to implement queing technology with them. **?**



Srinibas Patnaik

Commercial Director, Asia Pacific Region, EarthDaily Analytics



In lithium solution mining we were able to actually look at a certain area. We were able to look at the complete pattern of life in and around that area, like the vegetation stress we soil nutrition composition other anomalies and or bodies or certain rare Earth minerals. *****

Aakash Parekh

Chief Commercial Officer, Pixxel Space Technologies

SSA / SDA SECURING SPACE BASED ASSETS/ COUNTER SPACE OPERATIONS

- The importance of Space Domain Awareness (SDA) is due to increasing dependence on space-based capabilities for various critical functions like weather prediction, communications, and national security.
- SDA is highlighted as crucial for both defence and commercial sectors, providing early warning systems for missile launches, protection against threats like anti-satellite weapons and space debris, and managing space traffic to prevent collisions.
- SDA offers nations a strategic advantage in conflicts by safeguarding space-based assets and enhancing national security. It also strengthens geopolitical alliances through collaborative efforts among allied nations.
- It categorizes threats into natural and intentional categories. Natural threats include collisions and space weather, while intentional threats include jamming, spoofing, cyber-related threats, and anti-satellite weapons.
- There is a strong emphasis on developing robust defence strategies against these threats. This includes global SDA capabilities, advanced software and hardware solutions, redundancies in technology, and cyber hardening both on the ground and in space.
- Technological preparedness such as AI-based tools, quantum technologies, and reconstitution capabilities (like launch on-demand and repositioning assets) to respond swiftly to threats in space.
- International cooperation could address space threats effectively. Advocating for the establishment of Space as a global common, adhering to international laws, and fostering dependencies among nations to ensure mutual protection of space assets.
- The rapid transformation and growth in the space sector, with projections aiming to increase India's share in the global space market from 2% to 8–10%. This growth is seen as achievable but challenging.
- Emphasis is placed on developing indigenous capabilities in SDA, reducing dependence on foreign systems. Initiatives include leveraging ISRO for space-based sensors and fostering public-private partnerships to accelerate development.
- Challenges such as the increasing number of satellites and space debris, stressing the need for sustainable solutions. Efforts are underway, including on-orbit maintenance and autonomous operations, to address these challenges effectively.







We're entering a phase of unprecedented transformation. Accurate, comprehensive and timely space situation awareness is foundational to space traffic management. "

Col Manik Anand Ministry of Defence

To build up that space domain awareness, you've got to have a very robust global SSA ability. The operative word is global, you cannot do with just regional space capability. *****

Air Cmde Ashish Baduni

Defence Space Agency





The most important aspect as far as Space Warfare is concerned emerges from a point of view of SSA, that is, space situational awareness. *****

Gp Capt Ajay Lele

Deputy Director General, MP–IDSA, New Delhi

Since our software, our satellites are software defined, we are kind of equipped with Advanced sensors and tracking capability to monitor space objects and provide real-time data for SSA. **7**

AL AL

Sangeetha Sundara

Head – Business Development, ReOrbit

- Resilience is crucial for Positioning, Navigation, and Timing (PNT) signals due to their omnipresence and susceptibility to jamming and other disruptions. This resilience ensures that correct signals are maintained despite environmental challenges.
- There is a debate on whether assured PNT leads to resilience or vice versa. Both concepts are intertwined and essential for maintaining operational integrity and accuracy in adverse conditions.
- PNT systems face various challenges such as jamming, spoofing, space-based anomalies, and natural sources like solar radiation. Understanding these challenges is critical for developing resilient solutions.
- Strategies for achieving PNT resilience include diversifying signal sources, implementing robust cybersecurity measures like zero-trust architecture, and developing open standards. These steps aim to mitigate vulnerabilities and ensure reliable PNT capabilities in all circumstances.
- It started with the IRNSS (Indian Regional Navigation Satellite System) and evolved into NavIC(Navigation with Indian Constellation), which is now operates with seven satellites. NavIC functions as a satellite constellation providing precise positioning information (latitude, longitude, altitude, and time) to users on Earth. It operates using dual frequencies for enhanced accuracy, crucial for both civilian and defence applications.
- The system serves various applications including civilian services like navigation, vehicle tracking, and railway crossing alerts. It also supports defence-related services such as marine, aeronautic, and terrestrial navigation, UAVs, and guided missiles.
- These technologies enhance the system's reliability and security. Several applications and products have been developed based on NavIC, such as track recording apps for security operations, project management tools for field data collection, distress alert systems for emergencies, and strategic surveying and mapping tools for defence purposes





The fact remains that GNSS as a signal is omnipresent, probably a weak signal that is always present, which makes it prone to jamming and other such influences. At the same time, there is also a reason that we've become reliant too much on GNSS, which makes its availability almost ubiquitous. As a result, there are very many people, even with malicious intentions, who might just end up doing something with it. So, that is the reason why resilience becomes important. *****

Lt Col Vivek Gopal NSCS





People have different kinds of networks for different applications. One is basically for GPS and navigation applications, one is for much more accurate positioning infrastructure for constructions and other high requirements applications, and one more if we have setting up a very high positioning requirements for some specific applications in defence and other core areas. *****

Subhash Kumar

Regional Sales Manager, Trimble Advanced Positioning

As part of Hexagon, we are a provider of positioning, navigation, and timing technologies, including OEM multi-GNSS receivers. *****



Vyom Kaushik Product Manager, NovAtelHexagon



Gnss positioning technology is evolving fast offering better Solutions. Gnss Hardware technology is helping to maintain this pace of fast changing scenario particularly regarding spoofing as it is a serious threat. *****

Dr Anindya Bose

Senior Scientific Officer, The University of Burdwan

Our distress alert system uses NavIC to send signals for search and rescue operations, crucial for emergencies. *****

R J Bhanderi Scientist SF Space Applications Centre, ISRO



MARITIME DOMAIN AWARENESS: ENSURING SECURITY AT SEA

- Effective Maritime domain awareness requires integrating data from multiple sources including space-based technologies, open-source intelligence, AIS, RF communications, and human intelligence. This integration provides a comprehensive and real-time understanding of maritime activities.
- Electronic Support Measures (ESM) play a crucial role in detecting and triangulating ships' positions using radar transmissions. This capability, now extended into space, enhances the accuracy and scope of electronic intelligence for maritime surveillance.
- Operational workflows involve tasking specific areas of interest, performing detections using multi-sensor data, integrating AIS for live vessel tracking, and using high-resolution imagery for detailed classification and identification of vessels, including dark ships.
- They provide extensive analytics including multi-mission planning, maritime domain awareness, terrain situational awareness, and persistent change monitoring.
- Inclusion of thermal imaging allows for detecting activities such as oil pumping on ships, identifying operational engines at night, and monitoring thermal hotspots at ports, enhancing proactive monitoring capabilities significantly.
- The deployment of advanced sensor technologies such as electro-optics, infrared, and hyperspectral sensors enhances the ability to detect and classify various maritime vessels and activities beyond traditional optical and radar methods.
- Beyond vessel detection, there is a growing focus on using satellite imagery to monitor environmental factors such as pollution emissions from ships. This application underscores the broader environmental implications of maritime activities.
- Weather, meteorological, hydrographic, and oceanographic data are critical for safe and effective maritime operations. Integrating these datasets with other intelligence sources improves situational awareness and decision–making in maritime domains.
- Integration of SAR, Optical, Thermal, AIS, and RF sensors into a single platform for near real-time analytics and tasking allows for comprehensive monitoring and analysis of maritime activities.





Maritime domain awareness relies a lot on Space technology certainly but there's also a whole gamut of other sensors and sources of information which needs to be integrated into one composite picture to actually give you what is known as real time Maritime domain awareness these include open-source intelligence that that refers to movement of ships in and out of harvest. *****

TIAL

Cmde Sujeet Samaddar

SAMDeS



AIS is a fantastic data source; however, it can be easily turned off or manipulated so bad actors can use that to their advantage if they're in areas where those who are trying to enforce Maritime domain awareness are reliant upon AIS.

James McAden

Senior Director, Asia-Pacific Sales, HawkEye360

Daily imagery plays a crucial role in maritime domain awareness, enabling us to monitor areas like the South China Sea with precision, even when AIS is off. *****

Partha Ghosh

Senior Presales Engineer Planet Labs





Our change detection capabilities highlight new constructions and changes over time, such as military installations or port developments. **?**

Rex Tan Solutions Engineer, Capella Space

Multi-sensor analytics and provide real-time data integration for effective maritime domain awareness. Thermal imaging provides insights into nighttime activities, such as detecting engine heat signatures and operational activities at ports. *****

Sarunisha Ramachandran

Product Lead, Suhora



TRACK Applications



- HMT emphasizes the synergy between humans and machines. Machines excel at rapid data processing and generating predictive models, while humans contribute context, intuition, and domain expertise to refine and interpret these outputs.
- By integrating autonomous systems like legged squads and UAVs with HMT, operational capabilities are greatly amplified. These systems extend the reach and capabilities of human operators while reducing risks in high-risk environments, thereby enhancing situational awareness and decision-making.
- HMT optimizes the flow of information and accelerates decision-making cycles in battlefield scenarios. This acceleration empowers operators to respond effectively to dynamic situations, leveraging both the speed of machines and the strategic acumen of human decision-makers.
- Integrating HMT into defence sectors, like in India, offers significant strategic advantages. However, to harness these benefits fully, it's crucial to invest in R&D, ensure interoperability, build a skilled workforce, and address ethical and security concerns associated with autonomous systems and AI.
- While satellite-based sensors provide valuable data, they have limitations in real-time scenarios. The speaker advocates for a combination of satellite, airborne, ground-based sensors, and UAVs to achieve optimal situational awareness.
- Examples from conflicts like the Ukraine–Russia conflict illustrate practical applications of sensor-to-shooter systems. These systems, utilizing UAVs and other autonomous tools, demonstrate effective real-time information processing and decision support capabilities in dynamic environments.
- Challenges such as secure communication links and interoperability between diverse systems, emphasize the need for secure, high-speed communication infrastructure like mesh networks to ensure effective human-machine teaming in hostile environments.





Reduced cognitive load, machine learning helps in carrying out routine tasks which gives the operator extra time to concentrate on his main mission. *****

Brig AS Nagra Geospatial Expert





In man-machine symbiosis, it is the man who has to adjust... the machine is capable of doing things thanks to technologies like artificial intelligence. **?**

Lt Gen Sanjay Verma Consultant, DRDO

Although there are softwares that can slightly determine the situation. It still requires a human to take a responsibility and ownership of action and that's where HMT of today needs. *****



Saurabh Rai CEO, Arahas



We are building a platform to process all the data through an automated process and reducing the time of data processing by 60% and while having edge processing on board because information that defence requires is very time sensitive. #

Krishna Reddy

Business Development Manager, KaleidEO

- The evolution of warfare has shifted from land-based conflicts to aerial battles and now includes cyber warfare and drone technology. Drones have emerged as efficient, effective, and cheaper alternatives to traditional airborne systems, influencing military strategies globally.
- Drones have diversified and integrated into different facets of modern military operations, like medical evacuation and resupply, combat operations and reconnaissance.
- Drones offer significant operational advantages such as operational efficiency, cost-effectiveness, risk mitigation (reducing exposure of human personnel to danger), and precision in targeting. These advantages underscore why drones have become indispensable in contemporary military strategies.
- Sophisticated geospatial and optoelectronic payloads that enhance precision and accuracy. Integration of artificial intelligence and machine learning in drone operations, indicating ongoing technological advancements.
- The drone industry has experienced exponential growth, with projections indicating significant economic potential. India aims to become a global drone hub by 2030, underscoring the industry's rapid expansion and transformative impact on business landscapes worldwide.
- The proliferation of drones poses significant security challenges. These include threats such as crossborder smuggling, attacks on critical infrastructure, surveillance, and potential privacy breaches. Effective countermeasures are essential to mitigate these risks, requiring advancements in detection, identification, and mitigation technologies.
- Effective counter-drone strategies hinge on advanced detection technologies such as radar, RF detection, acoustic sensors, and EO/IR sensors, each with its limitations and environmental dependencies.
- Effective counter-drone systems require a multi-layered approach integrating detection, classification, and mitigation techniques to safeguard critical assets and operations against evolving drone threats.
- The dominance of UAVs and precision weapons is redefining military doctrines. The ability to perform standoff precision attacks and target predetermined critical points is challenging the relevance of traditional weapon systems like tanks and ships. This evolution necessitates new tactical, strategic, and doctrinal approaches to warfare.
- The proliferation of open-source intelligence from social media and commercial satellites has empowered civilians to support military efforts by providing real-time updates. This has blurred the lines between combatants and non-combatants, making information management and cybersecurity critical components of modern warfare. Military leaders must adapt to these changes and leverage these new sources of intelligence while also protecting their own information infrastructure.







Today's war battlefield is very complex, it's a nonlinear, multispectral, multi-domain, in-depth or in close contact with the enemy. It's a very, very complex kind of a battlefield, and drones, whether it is land, sea, air, space, cyber, any field, the drones play their role. *****

Maj Gen Abhay Dayal VSM, Ministry of Defence

The focus has shifted to cyber warfare, blurring the line between military and civilian. Drones are an efficient, effective, and cheaper alternative to conventional airborne systems as they have become lighter, faster, AI-enabled, and versatile in modern warfare. *****

Cdr Pankaj Srivastava

National head, Mahindra Defence Systems Limited





Detection technology itself plays a major role in attacking the incoming target drones. We should have algorithms to exactly track and detect the drones. *****

Dr Ravi Kumar RCI, DRDO

Exploiting battlefield transparency requires realtime, robust, reliable networked command control communication computer intelligence systems. *****

Rohit Srivastava

Indian Defence Industries



- Not harnessing the potential of available technology for data collection and monitoring has led to the lack of advance warning systems, as in the case of the South Lona Glacier outburst. Highlighting significant gaps in utilizing advanced technological tools to predict and mitigate such disasters.
- This could be prevented by an integrated communication system. Lack of coordination amongst various agencies and individuals and the reporting of the incident through fragmented channels, highlights the need for a robust and centralized communication network.
- The Crime and Criminal Tracking Network System (CCTNS), while primarily focused on law enforcement, has the potential to integrate with disaster management systems. This integration can enhance data collection and analysis, helping in crisis management and improving response times during emergencies.
- Emphasis on user-triggered research rather than lab-based research is crucial. Real-world scenarios and data should drive technological advancements and research to ensure practical applicability and effectiveness in disaster management.
- The collected satellite data is used not only for immediate response but also for post-disaster analysis, such as identifying affected areas and determining compensation needs. Advanced simulations using DEMs help in planning and mitigating future disasters, potentially saving lives and reducing property loss.
- The National Disaster Response Force (NDRF) has specialized battalions and extensive training to handle various disaster scenarios, including floods, earthquakes, and CBRN emergencies. The NDRF's response mechanism, rapid mobilization, and successful operations both domestically and internationally are highlighted.
- Emphasizing the role of communities in initial disaster response, the speech advocates for community awareness programs and mock exercises. It also underscores the importance of integrating geo-intelligence, AI, and real-time data monitoring to enhance disaster response and management.
- There is a clear observation that despite having technologies and ongoing studies (like with SDC and NDMA), there was an underutilization of these resources. For instance, the warning center was washed away before it could fully function, showcasing a gap in utilizing available technology for disaster preparedness.
- Challenges such as timely and accurate data, advanced analytical capabilities, and integration of new technologies like AI and machine learning are acknowledged. Collaboration and partnerships with various stakeholders, including government agencies and technology providers, are seen as crucial for overcoming these challenges and improving disaster response efficiency.



Everyone has a stake in disaster management. Though the state has prime responsibility, we all have to do a lot of work so that we can be prepared and lives can be saved if any disaster occurs. *****



Second in Command, Indian Army





One must prepare and plan as to how you are going to mitigate those measures in case of a disaster. So, planning, mitigation, then when the disaster is struck, the most important thing is time. Time is the most critical factor. So, that needs to be addressed in terms of acquisition of communications or imagery or ground realities. And then, finally, delivery. So, how fast you can deliver this collected information to the end user on the ground. **#**

Dheeraj Mehra CEO, Micronet

Moving forward, we need an integrated approach rather than a piecemeal one. The approach should be from whole to part, understanding the overall requirements and addressing various aspects accordingly. Contributions from different sectors should be aggregated to achieve the broad objective, with a focus on user-triggered research rather than lab-based research. *****



NK Mishra IPS Former DGP Sikkim



In terms of data it's just not geospatial it's a variety of data that is now started to come in and it is dynamically changing so when we are talking about emergency response, we need to make sure that we integrate all these different kinds of data. I would divide the disasters as as expected or unexpected so we need to be fully equipped with all technologies. **#**

Vinay Babu

Vice President, Hexagon

We have deployed our satellite where most of the human population exist where the critical event happens so monitoring means that we are delivering data from acquisition to delivery within 90 minutes. *****

Yetender Singh Negi Subject Matter Expert, Satpalda



LEVERAGING GEOSPATIAL TECHNOLOGIES FOR BORDER & INTERNATIONAL SECURITY

- Getting the route alignment right in the planning stage is crucial for the success of infrastructure projects like railways and highways. It significantly impacts project timelines, costs, and feasibility.
- Technology, especially GIS (Geographic Information Systems), plays a pivotal role in improving the efficiency of infrastructure planning. Automated tools and expanded search capabilities help in optimizing routes and making informed decisions.
- There is a need for centralized information systems that integrate geospatial data with other project information. This ensures that all stakeholders have access to accurate and consistent data, improving coordination and decision-making.
- The use of satellite imagery highlights its critical role in providing near real-time data for monitoring activities such as infrastructure development, military movements, and natural disasters.
- The use of such technologies is crucial for defence and security operations, allowing for better monitoring of sensitive areas, identifying infrastructure changes, and aiding in strategic decision-making during peace and potentially conflict situations.
- The integration of satellite imagery with advanced geospatial solutions like Spectra AI demonstrates enhanced capabilities in tasking satellites, collecting data, and processing it efficiently. This integration supports various applications from defence to urban planning.
- While satellite technology offers powerful capabilities, the effectiveness of utilizing such data depends on adequate internet connectivity and bandwidth. This is particularly challenging in remote or tactical environments where infrastructure may be limited.
- There is a clear need for collaboration between industry (satellite providers) and defence forces to optimize the use of technology. This includes addressing logistical challenges, ensuring data availability during critical times, and leveraging existing tools and technologies effectively for Border security.





We take photographs, we take blueprints and we construct a 3D model, yet even today it is not Geo referenced. The reports that we make are manual so these are some of the challenges from the perspective of a user. *****

Maj Gen Praveen Chhabra VSM, IG (Ops), NSG





Access to imagery on time is a very critical uh component for our armed forces and they need to keep an eye on what is happening across the border because it affects our military movements **p**

Amit Seymour CEO, Satpalda

Our broad objective is to design information systems that are relevant to All Stages of the projects as it resolves all your interface and coordination issues, and we believe that this is scalable information, so GIS is Central to what we do but GIS has to be situated in a broader information system which captures other aspects of the project. **?**



V Vijay, Director

Omega Analytics Private Ltd



Some of you in operations might find it interesting. Now, people have moved away from traditional warfare. We are now into climatic modeling warfare, and we must bring in and include the climatic dimension into the planning of the GS. Today, war is not purely about what you're doing on the front. The climate impacts which we are managing, and Army is thinking about the impact, which it is giving to their frontier officers. *****

Krishna Rao GM, Esri

LIST OF SPEAKERS

- Aakash Parekh
 Chief Commercial
 Officer, Pixxel Space
 Technologies
- Maj Gen Abhay Dayal VSM, Ministry of Defence
- Abhineet Jain
 Director Sales & Business
 Development, BlackSky
- Gp Capt Ajey Lele Deputy Director General, MP-IDSA, New Delhi
- Amit Seymour CEO, Satpalda
- Andy Stephenson Senior Vice President, BlackSky
- Lt Gen Anil Bhatt PVSM, UYSM, AVSM, SM, VSM, Director General, ISpA
- **Dr Anindya Bose** Senior Scientific Officer, The University of Burdwan
- Dr Aniruddha Roy CTO, Genesys International Corporation Ltd
- **Dr Anupam Tewari** Advisor (Cyber) to Principal Advisor, Ministry of Defence
- Air Cmde Ashish Baduni Defence Space Agency
- Maj Gen (Dr) Ashok
 Kumar
 VSM, Director General
 CENJOWS
- Cmde Atul Deswal
 DDG NCG & CISO (NAVY)
- Dr Chalee Vorakulpipat Head, Information Security Research Team, NECTEC, Thailand
- Christopher Oxendine
 Industry Solutions
 Manager, Esri

- Maj Gen Dilawar Singh Senior Advisor-Indian Centre for Interdisciplinary Studies in Science and Technologies
- Dheeraj Mehra CEO, Micronet
- Giridhar M Aekbote Director, Microgenesis
- Lt Col Gil Elmalem R&D Attache, Embassy of Israel
- Lt Gen Girish Former Survey General of India
- Brig G Manoj
 Defence Space, Agency
- HS Randhawa
 ACP, Delhi Police Cyber
 Crime
- James McAden
 Senior Director,
 Asia-Pacific Sales,
 HawkEye360
- Col Joydeep Majumdar DRDL
- Kapil Kumar Malik
 Regional Sales Manager,
 Synspective
- Krishna Rao
 General Manager –
 Presales, Esri
- Krishna Reddy
 Business Development
 Manager, KaleidEO
- V Adm LS Pathania Chief Hydrographer, Govt of India
- Manik Anand
 Aerospace Division, MoD
- Col Marcin Mazur Vice President, Polish Space Agency, Poland
- Matthew Jackson Solution Architect, Maxar

- Cdr Mukesh Saini
 Former National
 Information Security
 Coordinator (GOI)
- NK Mishra, IPS
 Former DGP Sikkim
- Oliver David Brown
 Solution Engineer, Esri
- Pankaj Dalela
 Director C-DoT
- Pankaj Srivastava
 National head, Mahindra
 Defence Systems
 Limited
- Partha Ghosh Senior Presales Engineer, Planet Labs
- Prateek Sharma Vice Chancellor, Delhi Technical University
- Maj Gen Praveen Chhabra VSM, IG (Ops), NSG
- Lt Gen PJS Pannu PVSM, AVSM, VSM, SIA India
- AVM Rajiv Ranjan
 ACIDS (ICT)
- Lt Gen Rajiv Sahni VSM, DG DGIS
- Ravi Kumar RCI, DRDO
- Rex Tan Solutions Engineer, Capella Space
- R J Bhanderi
 Scientist SF Space
 Applications Centre, ISRO
- Rohan Verma CEO & Executive Director, MapmyIndia
- Rohit Srivastava Indian Defence Industries
- Sangeetha Sundara Head – Business Development, ReOrbit

- **Sanjay Verma** Consultant, DRDO
- Sarunisha Ramachandran Product Lead, Suhora
- SA Kulatunge RWP, RSP, VSV, USP, psc, Sri Lanka Army
- Sean Cantrell Director – International Govt Engagement, Maxar Intelligence
- Srinibas Patnaik
 Commercial Director,
 Asia Pacific Region,
 EarthDaily Analytics
- Subhash Kumar Regional Sales Manager, Trimble Advanced Positioning
- Cmde Sujeet Samaddar SAMDeS
- Suyash Singh Co-Founder, CEO, GalaxEye
- V Vijay Director, Omega Analytics Private Ltd
- Vinay Babu Vice President, Hexagon
- Vinit Goenka Data Sovereignty Expert
- Vishal Anand
 COO, Mappls GeoSystems
- Vivek Gopal NSCS
- Vivek Saxena Scientist F, DGRE – DRDO
- Dr V S Subrahmanian Professor, Northwestern University
- Vyom Kaushik Product Manager, NovAtelHexagon
- Yetender Singh Negi Subject Matter Expert, Satpalda

VALEDICTORY ADDRESS





Lt Gen Vinod Khandare PVSM, AVSM, SM Principal Advisor, Ministry of Defence

Technological Advancement and Integration:

Emphasized the necessity for upgrading skills and knowledge in technological domains, particularly for senior and ranked officers. The speech highlighted the importance of understanding and applying technology in areas such as space, cyber, information warfare, and chemical and biological warfare.

Collaboration and Joint Ventures:

Stressed the importance of collaboration between the private and public sectors, and the integration of various domains such as industry, academia, and the armed forces. The speech also encouraged joint ventures with foreign experts to bridge technology gaps and reduce dependency on technology transfers.

Geopolitical Awareness:

Addressed the shift in global strategic focus to the Indo–Pacific region, urging attendees to understand and prepare for this change. The speech pointed out the significance of the geospatial domain in current geopolitical scenarios and the need to stay ahead in this field.

Self-Reliance and Data Sovereignty:

Called for reducing dependency on foreign components and technologies, particularly from adversaries. The speech emphasized the importance of achieving data sovereignty and developing domestic capabilities in critical areas such as semiconductors and sensors.

Youth and Future Readiness:

Highlighted the demographic advantage of India's youth population and the need to leverage this for economic and technological strength. The speech urged for immediate action to ensure the country becomes rich and strong while its youth segment is still young, thereby securing a prosperous future for the next generation.

EXHIBITORS





Capella Space

Capella Space is an American space tech company with data and satellite solutions for government and commercial use. A leader in the Earth observation industry, Capella is the first U.S. company with a constellation of Synthetic Aperture Radar (SAR) satellites, delivering high guality, high resolution SAR imagery and easy access to frequent and timely information.



Dhruva Space

Dhruva Space, based in Hyderabad, India, is a full-stack space-engineering solutions provider specializing in satellite platforms, launch deployers, and ground stations. The company has successfully space-qualified its 1U, 3U, and 6U satellite orbital deployers, along with 0.5U CubeSats, on ISRO's PSLV missions in 2022 and 2023. Dhruva Space offers comprehensive solutions across the space, launch, and ground segments.

ESRI

THE SCIENCE OF WHERE

Esri, the global leader in GIS software and location intelligence, helps customers unlock the full potential of data to improve operational and business results. Esri software is deployed in more than 350,000 organizations globally and in over 200,000 institutions in the Americas, Asia and the Pacific, Europe, Africa, and the Middle East, including Fortune 500 companies, government agencies, nonprofits, and universities. Esri has regional offices, international distributors, and partners providing local support in over 100 countries on six continents. Esri engineers the most innovative solutions for digital transformation, the Internet of Things (IoT), and advanced analytics.

GalaxEye Space

Founded in 2020, GalaxEye aims to shape the future of Satellite Image Acquisition, providing the most meaningful dataset by setting up a constellation of advanced multi-Sensor satellites carrying the indigenous novel "Drishti Sensor" capable of sensing via it's SAR & MSI sensors. Thus, helping governments and businesses make data-driven decisions based on insights from satellite imagery. We operate on a Satellite-as-a-service model, providing Satellite Imagery Datasets and Value added services to serve Geospatial Analutics Companies and Infrastructure enterprises. We are incubated at the IIT Madras Incubation Cell and have also raised capital in the Seed round of Funding.



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Maxar Technologies

Maxar is a trusted partner and innovator in Earth intelligence and space infrastructure, providing disruptive value to government and commercial customers. They help monitor, understand, and navigate our changing planet, deliver global broadband communications, and advance space exploration. Combining decades of deep mission understanding with a robust foundation of commercial technology, Maxar delivers solutions with unmatched speed, scale, and cost-effectiveness. Driven by a passion for space's potential, Maxar's team members are committed to helping customers create a better world through innovative and reliable geospatial and space-based technologies.





MapMyIndia

MapmyIndia has developed the most comprehensive and accurate digital map dataset for India, featuring its revolutionary RealView service that offers 3D and 360-degree photo-realistic clarity. These maps support various applications, including navigation, telematics, ADAS, GIS, LBS, and Smart Cities. Besides advanced maps, MapmyIndia provides top-tier GPS-based IoT devices for navigation and tracking, leading location-based SaaS for enterprises, and consumer apps like maps. mapmyIndia.com and NaviMaps. Their range of Map and LBS APIs enables developers to create innovative location-based services and IoT devices using India's best maps and location technologies.

MicroGenesis TechSoft

MicroGenesis TechSoft Pvt Ltd, excels in Enterprise Digital Transformation and various tech domains like Geospatial Technologies and Robotics. Since 2000, they have delivered innovative solutions across industries. They developed core military solutions with DRDO using the INDIGIS platform, a "Make in India" GIS technology with over 500 APIs, supporting Linux and Windows. By acquiring INDIGIS from CAIR, DRDO, MicroGenesis enhances defence projects with advanced integration. Their expertise and strategic partnerships bolster India's self-reliance in defence, making them a trusted ally in the sector.



The North Eastern Space Applications Centre (NESAC)

The North Eastern Space Applications Centre (NESAC) is a collaborative initiative between the Department of Space (DOS) and the North Eastern Council (NEC), registered under the Meghalaya Societies Registration Act, 1983. For over 20 years, NESAC has served the eight states of India's North Eastern Region using space science and technology. The Centre's objectives include providing remote sensing and GIS-based natural resource information, satellite communication services for education, healthcare, and disaster management, and conducting research in space and atmospheric sciences. NESAC also aims to deliver comprehensive space-based disaster management support and establish regional infrastructure for capacity building in geospatial technology.

NovAtelHexagon



NovAtelHexagon, a global leader in digital reality solutions, integrates sensor, software, and autonomous technologies to enhance efficiency, productivity, quality, and safety across various sectors, including industrial, manufacturing, infrastructure, public sector, and mobility. With 24,000 employees in 50 countries and net sales of approximately 5.2bn EUR, Hexagon is driving connected and autonomous ecosystems for a sustainable future. NovAtel, part of Hexagon, specializes in end-to-end solutions for assured autonomy and precise positioning on land, sea, and air. Serving industries like precision agriculture, defence, and transportation, NovAtel's technologies focus on GNSS, INS, global corrections services, anti-jamming, anti-spoofing, and advanced algorithms for complex applications.

Pan India Consultants



Pan India Group, started operations in 1981, representing a wide spectrum of overseas OEM covering diverse customer base including Railways, Oil, Gas, Defence, Power, Nuclear, Space, Scienctific Labs and Research organization, Public & Private Sector in India and neighboring countries. Pan India offers integrated sales & services in areas of Geomatics, Natural resource mapping, Land record management, Urban planning & development, Digital terrain modeling, Remote Sensing Services, Photogrammetry, GIS, Land survey systems, Seismic analysis, Engineering Geophysics, GPS Services, Hydrographic instruments, Railway engineering and data equipment, Geophysical equipment, Navigation and Data Logging Systems, Underwater Acoustics, Sonar systems, Marine & environment equipment, Well Log; Data Archival & Transcription, Digitising – Raster–Vector conversion and Specialised Software development.

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SUHORA

Pixxel Space Pixxel Space is a space data company building a constellation of the world's highest-resolution hyperspectral earth imaging satellites and the analytical tools to mine insights from the data. The images gathered by Pixxel's satellites will provide global coverage every 24 hours and help detect, monitor, and predict global phenomena across agriculture, mining, environment and energy use cases.



SATPALDA is a leading provider of geospatial services. With over 21 years of experience in the industry, we specialize in using digital maps and location analytics to bring your data to life. Established in 2002, we have a proven track record of successfully completing a wide range of photogrammetric and remote sensing projects for a variety of sectors. We are committed to providing end-to-end innovative geospatial solutions that enable businesses to achieve a competitive advantage.

Suhora Technologies Pvt. Ltd

Suhora is a leading–edge technology firm that leverages satellite imagery, big data, and AI to solve problems surrounding earth. Suhora specialize in offering integrative all weather, day–and–night solutions by combining Synthetic Aperture Radar (SAR) Optical and Thermal data. Suhora believes in the ground–breaking potential of Earth–Observation data and its impact on different domains. Suhora have developed a unique platform, SPADE, which takes intricate geospatial data and transforms it into accessible, easy–to–understand format that can revolutionize decision–making across industries. The Company mission is to utilize technology and our expertise in geospatial intelligence to make this world a better and more sustainable place.

Survey of India

Survey of India, established in 1767, is the oldest scientific department of the Government of India and serves as the National Survey and Mapping Organization under the Department of Science & Technology. As the nation's Principal Mapping Agency, it is responsible for exploring and mapping the country, providing base maps for development, and ensuring resources contribute to national progress, prosperity, and security. Survey of India leads in delivering user-focused, cost-effective, reliable, and quality geospatial data, information, and intelligence to meet the needs of national security, sustainable development, and emerging information markets.



Trimble is a technology company that has supported critical defense operations and initiatives since 1978. Trimble leverages its core technologies in positioning, modeling, connectivity and data analytics to connect the digital and physical worlds to improve productivity, quality, safety, transparency and sustainability. Trimble's easy-to-use positioning equipment and software empowers Defense users with real-time accuracy and actionable analytics—whether you require accurate positioning for your application in the field or whether you're building or managing defence assets across their lifecycle. Trimble offers a range of NAVIC enabled GNSS receivers and OEM Boards to support the Indian Defence forces and the MII initiative in Defense.

VTOL Aviation India Pvt. Ltd.

VTOL Aviation India Pvt. Ltd. has been founded by 'Mr Kalyan Chowdhury' with the ideology driven around the vision to make a breakthrough in the conventional aviation sector and give India its first 'Make In India' technology in 'Indian Aviation Sector'. These new technologies developed would be multifaceted technologies, encompassing all the advancements in the engineering and technology fields pertaining to aviation sector. Our aim is to incorporate advanced feature and provisions to ensure highest benchmark in aviation safety in all of our products and technologies.







AT A GLANCE



































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