Centre for
Air Power Studies

INDIAN MILITARY REVIEW
IMR

EMERGING TECHNOLOGIES AEROSPACE APPLICATIONS

8 August 2025
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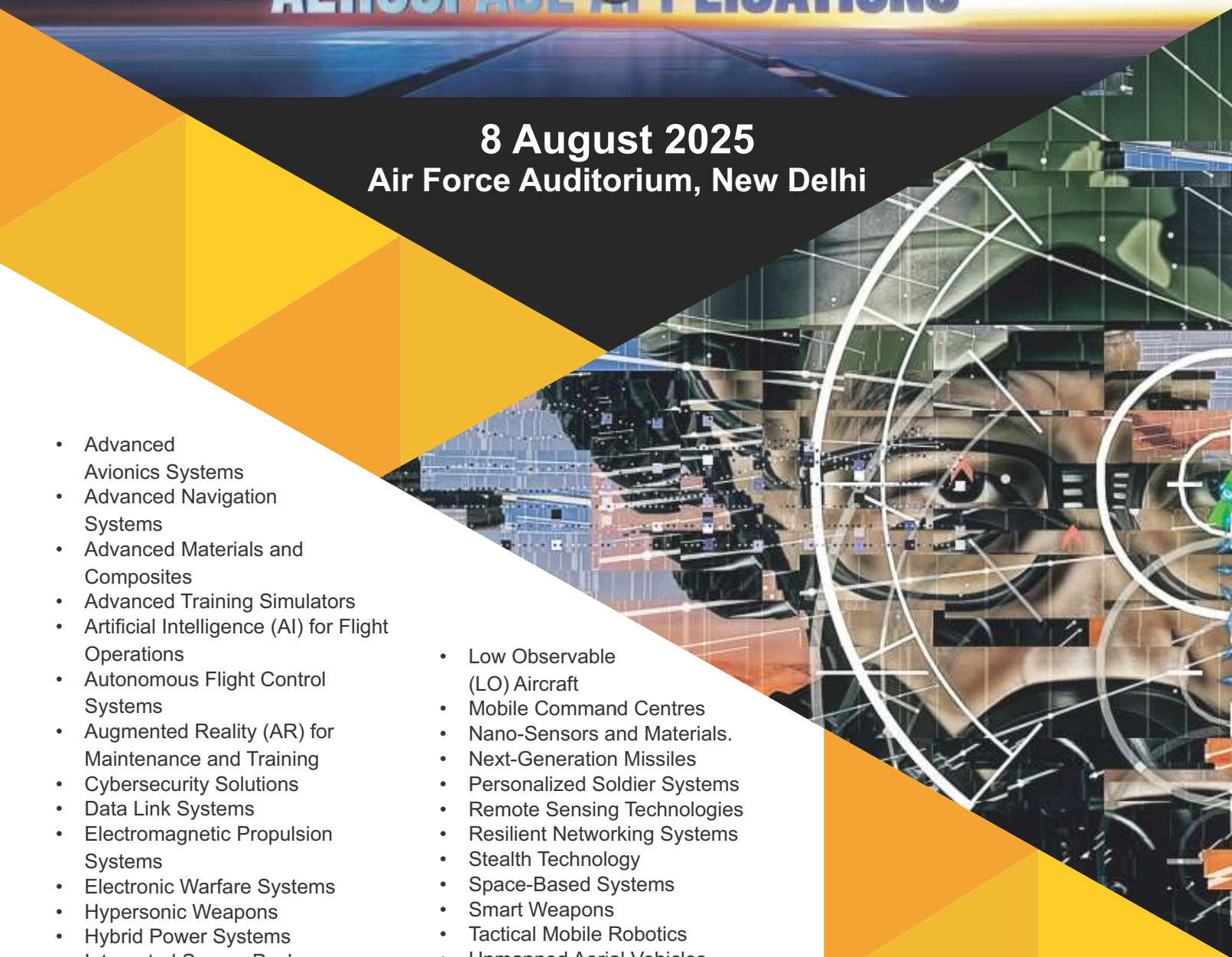

- Advanced Avionics Systems
- Advanced Navigation Systems
- Advanced Materials and Composites
- Advanced Training Simulators
- Artificial Intelligence (AI) for Flight Operations
- Autonomous Flight Control Systems
- Augmented Reality (AR) for Maintenance and Training
- Cybersecurity Solutions
- Data Link Systems
- Electromagnetic Propulsion Systems
- Electronic Warfare Systems
- Hypersonic Weapons
- Hybrid Power Systems
- Integrated Sensor Packages
- Intelligent Maintenance Solutions
- Integrated Logistics and Supply Chain Systems
- Low Observable (LO) Aircraft
- Mobile Command Centres
- Nano-Sensors and Materials.
- Next-Generation Missiles
- Personalized Soldier Systems
- Remote Sensing Technologies
- Resilient Networking Systems
- Stealth Technology
- Space-Based Systems
- Smart Weapons
- Tactical Mobile Robotics
- Unmanned Aerial Vehicles
- 3D Printing for Aerospace Components

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Emerging Technologies are Changing the Face of Aerial and Space Warfare

The future holds great promise for a number of emerging technologies that are set to change the face of the aerospace sector by enabling faster and superior sensor-decision-shooter response, more efficient use of resources, and better chances of survival in a contested environment. There has been a growing interest in Autonomous Flight Systems, automation and AI and ML-aided surveillance, navigation and operations without human direct involvement.

Some of the emerging technologies which are becoming pivotal and revolutionizing military aerospace operations through improved surveillance capabilities, mission accomplishment, and the overall survivability of assets and personnel are as follows:

- **Artificial Intelligence:** AI algorithms analyze vast amounts of surveillance data in real time, identifying threats and patterns that might be missed by human operators. AI also enhances autonomous mission capabilities, allowing drones and other aircraft to execute complex tasks with minimal human intervention, improving mission success rates and survivability.
- **Augmented Reality & Virtual Reality:** These technologies provide immersive training environments that closely mimic real-life scenarios, improving pilot and crew readiness for various mission types. During operations, AR systems can overlay critical data onto a pilot's view, improving situational awareness and reaction times, which is crucial for mission success and survivability.

- **Big Data & Analytics:** Big Data tools process and analyze real-time data from multiple sources to provide actionable intelligence. This enhances surveillance capabilities, allowing for better decision-making and quicker responses to emerging threats. Analytics also support strategic planning and resource allocation, optimizing mission outcomes.
- **Blockchain:** Provides secure and tamper-proof communication channels and data storage, ensuring the integrity of mission-critical information. This enhances trust and coordination among units, reducing the risk of misinformation and ensuring that accurate data drives operations.
- **CleanTech:** Innovations in clean technologies lead to the development of more efficient and sustainable propulsion systems. These advancements reduce the environmental impact of military operations and enhance the endurance and range of aircraft, contributing to longer mission durations and increased operational reach.
- **Cloud Computing:** Cloud-based systems facilitate the rapid sharing of intelligence and operational data across different units and locations. This ensures that all decision-makers have access to the latest information, improving coordination and the speed of response during missions.
- **Connectivity Technologies:** Advanced communication technologies, such as 5G, ensure reliable and high-speed data transfer between aircraft and command centers. This real-time connectivity enhances situational awareness, enabling swift decision-making and coordinated actions during critical missions.
- **Internet of Things (IoT):** IoT devices provide real-time monitoring and data collection from various assets in the field. This enhances situational awareness, enabling predictive threat detection and faster response times, which are essential for mission success and survivability.
- **Advanced Robotics:** Robotics technology allows for the deployment of unmanned systems in high-risk environments, reducing the exposure of human personnel to danger. These systems can conduct surveillance, reconnaissance, and combat operations autonomously, enhancing mission effectiveness and survivability.
- **Additive Manufacturing:** Enables the rapid production of mission-critical components on-site, minimizing downtime and ensuring aircraft are always mission-ready. This allows for quick adjustments to aircraft configurations to adapt to different mission needs, enhancing operational flexibility and effectiveness.

In addition, new generation aircraft and platforms are incorporating several cutting-edge technologies to enhance their capabilities. Here are some examples.

- **Advanced Propulsion Systems:** Hybrid-electric engines and potentially even nuclear, offering greater power and efficiency.
- **Artificial Intelligence (AI):** AI integration for real-time decision-making, threat analysis, and autonomous operations.
- **Advanced Stealth Technology:** Enhanced designs to minimize radar and infrared signatures across multiple frequencies.
- **Manned-Unmanned Teaming (MUM-T):** Seamless coordination with drone swarms for reconnaissance or combat.
- **Hypersonic Weapons:** Ability to carry and deploy hypersonic missiles for unmatched speed and range.
- **Directed Energy Weapons:** Lasers and microwaves to counter threats.
- **Enhanced Sensors and Avionics:** Advanced systems for improved situational awareness and targeting.
- **Advanced Materials and Manufacturing Techniques:** Use of lightweight, durable materials produced through methods like additive manufacturing.
- **Cybersecurity and Network-Centric Warfare:** Robust systems to protect against cyber threats and enable secure communication.
- **Advanced Cockpit Design and Pilot Interface:** Virtual cockpits and helmet-mounted displays for improved pilot situational awareness and control.

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EMERGING TECHNOLOGIES
PROGRAMME FRI, 8 AUGUST 2025

0830-0930 hrs Registration and Tea

SESSION 1 – INAUGURAL SESSION (0930 – 1030 hrs)

Welcome Address	**Air Vice Mshl Anil Golani,** Retd, Director General, CAPS
Inaugural Address	**Air Mshl Amar Preet Singh,** PVSM, AVSM, Vice Chief of Air Staff.
Special Address.	**Dr K Rajalakshmi Menon,** DS & Director General Aeronautical Systems, DRDO.
Industry Persp.	**Col KV Kuber,** Director Defence & Aerospace, Ernst & Young.
Release of	Knowledge Paper on Emerging Technologies for Aerospace Applications
1030 – 1100 hrs	Refreshment break.

SESSION 2 – EMERGING TECHNOLOGIES AND INDUSTRY COLLABORATION (1100–1300 hrs)

Chairperson: **Air Vice Marshal Tejpal Singh,** SM, VM, Asst Chief of Air Staff (Plans), Air HQ.

1100 – 1115 hrs	Introduction of speakers and Opening Remarks by the Chairman.
1115 – 1130 hrs	Towards Autonomous Operations With Emerging Technologies **Air Vice Marshal PV Shivanand, VM,** Asst Chief of Air Staff (Ops) Space, Air Defence, Air HQ.
1130 – 1145 hrs	Industry presentation. **Agnishwar Jayaprakash,** Founder & CEO Garuda Aerospace.
1145 – 1200 hrs	Industry presentation.
1200 – 1215 hrs	Industry presentation.
1215 – 1300 hrs	Panel Discussion/ Q&A
1300 – 1345 hrs	Lunch and exhibition.

SESSION 3 – ENHANCING OPERATIONAL SUPERIORITY IN AIR OPERATIONS (1345 – 1500 hrs)

Chairperson: **: Air Vice Marshal R Guruhari,** ACAS (Weapon), Air HQ.

1345 – 1400 hrs	Introduction of speakers and Opening Remarks by the Chairman.
1400 – 1415 hrs	Superiority In Sensor-Decision-Shooter Cycle with Latest Technologies **Air HQ Speaker**
1415 – 1430 hrs	Enhancing Domain Awareness Through Connectivity Technologies **Air HQ Speaker**
1430 – 1445 hrs	Emmersive Technologies for Crew Training **Air Vice Marshal Venkat T Mare,** ACAS (Training)
1445 – 1500 hrs	Industry presentation.
1500 – 1515 hrs	Industry presentation.
1515 – 1530 hrs	Q&A/ discussion.

SESSION 4 – EMERGING TECHNOLOGIES FOR DESIGN, PROTOTYPING & INNOVATION (1530–1630)

Chairperson: **Air Vice Mshl Ashish Vohra,** VSM, Retd, Addl DG Centre for Air Power Studies

1530 – 1545 hrs	Introduction of speakers and Opening Remarks by the Chairman.
1545 – 1600 hrs	Optimizing Aerospace Design and Prototyping Through Emerging Technologies **Air HQ Speaker**
1600 – 1615 hrs	3D and Additive Manufacturing to Meet Critical Requirements **CO 1 CIMD**
1615 – 1630 hrs	Technologies for 6th-Generation fighter aircraft **ADA Speaker**
1630 – 1645 hrs	Q&A/ Discussion

CLOSING SESSION (1645 – 1700 hrs)

1645 – 1655 hrs	Closing Remarks. **Air Vice Mshl Anil Golani,** Director General, CAPS
1655 – 1700 hrs	Vote of Thanks. **Maj Gen Ravi Arora,** Chief Editor, Indian Military Review.
1700 onwards	Refreshments and dispersal.

Highlights from Past Emerging Technologies Event

Senior subject matter experts explain Services' requirements

Patronised by the Armed Forces' Operations, Technology and Engineering officers

Network, exhibit, influence, lead!

Direct B2G meetings with procurement officers