



CENTRE FOR
JOINT WARFARE
STUDIES

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SEMINAR REPORT ON UAS AND C-UAS INDIA 2024

ORGANISED BY CENJOWS & IMR INDIA
17 MAY 2024



SEMINAR REPORT
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The Centre for Joint Warfare Studies (CENJOWS) in partnership with Indian Military Review (IMR) organised the seminar on “UNMANNED AERIAL SYSTEMS AND COUNTER UNMANNED AERIAL SYSTEMS INDIA 2024”, on 17 May 24. The seminar was held at DRDO AUDITORIUM, New Delhi.

The seminar featured distinguished speakers including senior serving officers from the tri-services, senior scientists from DRDO and representatives from the UAS and C-UAS industries and organisations. The seminar provided the industry an insight into the plans and requirements of the three services as well as the paramilitary forces so that the private industry can provide the required solutions. The seminar also gave a platform to the industry to showcase their existing capabilities and products which updated the defence and paramilitary consumers about the technological advances made by the DRDO and the private industry in the field of UAS and C-UAS.

SESSION 1 - INAUGURAL SESSION

In his welcome address, **Maj Gen (Dr) Ashok Kumar, VSM (Retd), Director General CENJOWS** stressed on the importance of UAS and C-UAS in the contemporary world. He highlighted how the Unmanned Aerial Systems are shaping the conflicts by giving examples from Russia-Ukraine war, Israel-Hamas conflict and the Houthis' obstructions in the Red Sea. Touching upon these conflicts, he highlighted that the UAVs have acted as a force multiplier in these conflicts. In context of India, he stressed upon indigenisation of the UAS and C-UAS to provide the nation with a greater offensive and defensive capabilities. He talked about how the ongoing conflicts are a lesson for us to create fully indigenised inventory for UAS and C-UAS systems as it is cost effective, less time consuming and have huge amount of applications both in civil as well as in military domains. He expressed gratitude towards the panel for taking out time to discuss on such a critical topic and exuded confidence that the sessions will help in shaping a better tomorrow.

Lt Gen Rakesh Kapoor, AVSM, VSM, Deputy Chief of the Army Staff (IS & C), delivered his inaugural address and highlighted the following:-

- He talked about the constant state of non-contact, non-kinetic conflict which exists in every state thereby thinning the lines between peace and war.
- The use of UAS in the contemporary conflicts has proven to be lethal, cost efficient and offered plausible deniability.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- The use of UAS in ISR applications is tremendous; in a time where militaries are trying everything to better understand their enemy. The Unmanned Aerial Systems provide an edge with their reach beyond the borders, enabling precision attacks and providing in depth look into the territories.
- He emphasised the importance of building autonomous systems, by incorporating AI and Edge Computing that enhance the capability of these UAS systems.
- He mentioned following steps that could be taken to exploit a potential market in India:-
 - Improving the Civil-Military Fusion (CMF).
 - Use the lessons from current conflicts to build UAS that enhance our capability.
 - Launching more programmes like the Drone Shakti programme to exploit the market.
 - Provide proper funding in Research and Development, may be even joint (Industrial and Government).

Lt Gen Ajai Kumar Suri, AVSM, Director General Army Aviation, gave the keynote address and the following points were addressed:

- He brought out the tactical, strategic and operational advantages of UAS by citing examples from the Armenia-Azerbaijan and Russia-Ukraine conflicts and underscored the cost benefit analysis of UAS when compared to an advanced fighter jet like F-35.
- Emphasising on their multi-faceted applications, he stated that the reliability, affordability and sustainability of these systems is tremendous and UAS can act as immense force multipliers for the Indian Armed Forces.
- He also highlighted that the key to create indigenous potential in the technological space, enhance our Atmanirbharta and to be at par with the contemporary powers, India will have to heavily invest in emerging military technologies and R&D.
- He stressed on the point that India stands at a juncture where the future will be decided on how much input we give towards these technologies.

Air Vice Marshal PV Shivanand, VM, ACAS Ops (Air Defence) delivered the special address and brought out the following points:-



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- He referred to the UAS and C-UAS technology as “the fastest developing niche technology in the aerial world” as it has huge scope and scale in both the civilian and the military domain.
- He underscored the fact that the UAS technology has brought in a paradigm shift in military operations by providing a large number of applications like ISR, loitering munitions, target acquisition, imaging, logistics, etc.
- He highlighted that proliferation of cheap and powerful drones are the lessons that can be drawn from the ongoing conflicts viz Russia-Ukraine conflict, Israel-Hamas conflict and the Houthis intervention in the Red Sea.
- He emphasized on the importance of creating a roadmap for both the civilian and the military domain and introducing more Production-Linked Incentive (PLI) schemes for the drone industry.
- He stressed on improving the synergy between the tri-services in order to better utilise UAS for operations.

SESSION 2 - INDUSTRY'S POTENTIAL AND CAPABILITIES

The second session was chaired by **Maj Gen CS Mann, AVSM, VSM, Head, Army Design Bureau** who highlighted the wide range of applications of the UAS and C-UAS systems namely, ISR, precision strikes, loiter munitions, electronic warfare, communications, logistics, target detection and acquisition etc., that have a huge market for the drone industry.

- Talking about mitigating risk to life via the use of drones, he stressed that the high potential of UAS systems, the cost effectiveness they provide and the high ambiguity add on to the success of military operations.
- He highlighted the importance of looking beyond the development of UAS and C-UAS technologies in terms of:-
 - Stealth and Counter-Stealth.
 - Anti-Deception measures.
 - Jamming and Anti-Jamming in GPS denial environment.
 - Edge Computing.
 - Swarming ability.
 - Counter-Drones.
- He called upon for development of Directed Energy Weapons, spoofing and jamming to enhance the hard kill ability of C-UAS.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- He stressed on developing UAS as per the demand of the geographical terrain of the country as since the Indian armed forces operate at very high altitudes.

Key takeaways from talk by Mr Martin Woywod, Product Manager, Rhode & Schwarz:-

- Mr Woywod gave his presentation on passive solutions for Small UAS (sUAS) and out-of-band counter measures in which he highlighted the importance of sUAS as force multipliers which are changing the course of war.
- He classified the sUAS into three domains namely ISR, direct (explosives) and indirect (precision strikes). These sUAS are controlled via short range low power radio link.
- He talked about the R&S drones that operate with high sensitivity and high accuracy; these are able to detect fast hopping signals and have the capability to create new profiles in varied frequencies, thereby, not allowing detection and have alarm triggering capabilities.
- Mr Martin also talked about the capabilities that their C-UAS systems provide, namely, multilayered jamming and spoofing, creation of 'no fly zones' and deep and effective scans.

Key takeaways from talk by Mr Ravi Hazarika, Sales Director, PBS India:-

- Mr Hazarika mentioned the wide range of aerospace and defence products offered by his company, emphasising their prowess in the production and integration of turbojet engines. PBS has manufactured over 15,000 turbojet engines, spanning thrust categories from 395N to 3400N, and has undertaken more than 30 engine modifications to meet various application needs.
- The company's turbojet engines are designed to support diverse unmanned applications. Their engines are tailored to meet specific requirements - the 100N-500N thrust range is ideal for counter-UAV loitering munitions; the 500N-1000N range suits precision-guided munitions and aerial targets; and the 1000N-4700N range is well-suited for land attack, cruise missiles, decoys, and subsonic missiles.
- Mr Hazarika highlighted that this versatility underscores PBS's ability to cater to a broad spectrum of defence and aerospace needs, cementing their position as a key player in the market.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



Key takeaways from talk by Mr Gajendra Kashyap, CTO, Next Leap Aeronautics:-

- Mr Kashyap introduced his company and mentioned that they heavily focus on indigenous technological development.
- He highlighted creation of drones by Next Leap Aeronautics as per the requirements of the Indian Armed Forces.
- Stressing on self-reliance, he talked about the role of all the stakeholders in building an ecosystem for an Atmanirbhar Bharat.
- He unveiled his company's Black Drongo UAV at the event which packs ISR capabilities in a tiny form factor and with the weight of a smart phone.
- While speaking of capabilities in the civil domain, he talked about the Next Leap drones that have huge applications in agriculture and railways.

Key takeaways from talk by Mr BM Chandrakanth, Sr GM Marketing & Sales Astra Microwave:-

- Mr Chandrakanth talked about the focus of their company towards building EW missile capabilities and avionics and mentioned that they have been a Tier-II supplier to the Defence PSUs and the DRDO.
- He talked about the company's capability in manufacturing airborne and naval radars (Uttam AESA and AAAU), EW systems (Vivaldi Antennas, Arena Units), Frequency Modulated Continuous Wave (FMCW) Radar that provide hard kill capabilities to C-UAS etc.
- He highlighted his company's constant effort towards the creation of Photonics based Radar systems that are more advanced and powerful in the battlefield.
- The company is heavily working towards integration of stealth technology in UAS.

Key takeaways from talk by Mr Navdeep Arshi, Dassault Systèmes:-

- Mr Navdeep talked about a different aspect of Model-based acquisition for defence programmes. He highlighted the need to work on the processes involved in technology building and adapt digitally to get a better overview.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- He talked about how Model-based and Knowledge-based acquisitions are interlinked and follows a continuous loop, so developing models helps in building technology that is suitable for use.
- He underscored the 3-D Experience model designed by Dassault Systèmes that helps in model-based acquisitions as there is a single authoritative source of truth and the models can be built as per the requirements in a more efficient and virtual manner.

Key takeaways from talk by Mr Amit Mahajan, Director (Tech & R&D), Paras Defence and Space Technologies:-

- Mr Mahajan highlighted that his company is at the forefront of developing advanced Electro-Optical (EO) and Infrared (IR) systems for C-UAS, air defence and UAV operations. Smart Vision represents their cutting-edge solutions designed to enhance situational awareness and operational efficiency in these critical areas.
- He underscored how EO/IR systems are pivotal in detecting, tracking, and neutralising aerial threats, offering precise and real-time data crucial for defence and surveillance missions.
- He further emphasised the company's innovative approach, focusing on integrating sophisticated EO/IR technologies to deliver superior performance and reliability. Their commitment to research and development ensures continuous improvement and adaptation of their systems to meet the evolving demands of modern warfare and surveillance operations.

SESSION 3 - UAV REQUIREMENTS

The chair of the third session, **Brig Anurag Asthana, Brig (Ops), Artillery Directorate, Army HQ**, opened the session by stating that traditional warfare is increasingly challenged by continuous innovations in technology. Describing the role of Unmanned Aerial Systems, he referred to the current ongoing conflicts of Israel-Hamas, Armenia-Azerbaijan, and Russia-Ukraine, which indicate the autonomous nature of future battlefields. The session was intended to bring to fore the UAS and C-UAS requirements of the armed forces for the industry to take note and develop solutions.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024

INDIAN MILITARY REVIEW
IMR

Key takeaways from talk by Gp Capt NK Chaubey, Gp Capt Ops (NBC & RPA), Air HQ on IAF's UAV plans:-

- He started with a brief background of the earliest drone attack and then gave the current example of use of drones by Russia for attack on Kharkiv city.
- He opined that over the years the nature of warfare has changed, referring to Grey Zone Warfare and information battle in the information age. He, thus, stated that the time demands faster recognition ability because of the ambiguity of actors.
- He highlighted the 3Ds- Dull, Dirty, and Dangerous to explain the current nature of warfare.
- He mentioned few of the systems currently being used by the IAF in various categories like MALE, HALE, aerial targets, UAS munitions, micro-UAVs and Counter-UAS.
- Highlighting the multi-frontal utilization of UAVs, he specifically pointed out that combat search and rescue, aerial targets and decoys, and HADR missions are some of the excellent use cases.
- He mentioned that proliferation of drone operators blurring the future warfare, availability of bandwidth, and airspace management as some of the big challenges being faced.
- He recommended certain strategies to enhance India's capability in UAS such as indigenous product development, inter-service operations, Networked

- Operations of UAS through Mission Operations and Intelligence Centre (MOIC), and monitoring sensitive locations and delivering the inputs to a central location like MOIC.

Key takeaways from talk by Col Jasbir Singh Maan, Col Avn-10, Army Avn Dte on Army's HALE UAV Requirements:-

- He began by introducing the present inventory of the Indian Army and the need of HALE UAVs to keep India's vast land border under surveillance.
- He highlighted the requirement of radar system, RWR, encryption system, anti-jamming or spoofing measures for survivability of UAS.
- As mitigation strategies, he highlighted the need of data management, adopting MOIC to have a centralized system, AI integration, and integrating the operations with the services network.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



Key takeaways from talk by Col NR Choudhary, Col Inf-5, Infantry Dte, Army HQ on Army's Tactical UAV Requirements:-

- He introduced the key features of tactical drones: versatility, lethality, mobility, and survivability.
- He stated that there is a need to bridge the gap between Indian Army's demand and industry's supply capacity.
- He highlighted the criticality of speed of deployment for conduct of speedy operations and also the need to operate from restricted areas, and therefore the need of vertical take-off in drone design.
- Referring to the categories of tactical drones such as nano drone, SYL Copter, RPAV, mini-RPAs, logistics drones, kinetic attack drones, mobile drones, and tethered drones, he emphasized that there is a need to assess the industrial capability in terms of the available finance, especially in case of MSMEs and that they should tie up with the large companies to enhance the production capacity.

Key takeaways from talk by Cdr Anant Agarwal, Cdr (AW)-RPA on Navy's Experience with Drones and Future Plans:-

- He started his talk by highlighting the rapidly changing situation in the Indian Ocean Region (IOR) and the chokepoints to which India's access for its dependence on trade should not be ignored.
- He emphasized that India's primary responsibility and Maritime Domain Awareness (MDA) in the IOR is the key requirement.
- He mentioned a few of the UAS being operated by the Indian Navy at present.
- Highlighting the future requirements, he said that the IN is looking for ship-borne fixed-wing UAVs, mid-air refuelling of drones and loitering UAVs.
- He put forth the requirement of developing a simulator for the Dristi-10 Starliner UAS.
- The Navy also wants anti-jamming equipment and indigenisation of payloads to meet its specific requirements.

SESSION 4 - COUNTER UAS



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



The opening remarks were delivered by the Chairperson **Air Vice Marshal IS Walia, AVSM, VM, Air Defence Commander, HQ Western Air Command, IAF**. He acknowledged the role of UAS loitering munition since its inception. He further added that we have to deal with them in a different way and must design some new methods to engage them. He remarked that the policing functions must be distinguished from military roles when it comes to matters pertaining to the functions of UAVs. He suggested that we could have something simple yet robust.

Key takeaways from talk by Col Rakesh Zutshi, Col AD (Ops & Op Lgs), Army Air Defence Dte on Counter-UAV Technologies - Emerging Threats and Defensive Measures:-

- Citing a relevant example of the challenges faced during Gatwick Airport incident of December 2018, and how it disrupted the runway for over an hour, Col Zutshi said that the biggest issue is the identification of intent.
- He added how the UAS threat is intrinsic to the existing air threat envelope.
- He suggests that detection, interdiction, and counters be integrated into a single platform with an integrated system dedicated to the hard kill and the soft kill mechanisms.
- He broke down the nuances of the hard kill and soft kill mechanisms with a comprehensive budget analysis. Two of the most important challenges that he mentioned were multispectral detection and situational awareness.
- Considering the vulnerabilities of data links, satellite links, and GCS signals (Control signals), he proposed a few mitigation solutions such as jamming and spoofing under the soft kill category and small arms under the hard kill category.
- He emphasised that to counter a swarm drone attack, India needs multispectral detection and interdiction capability with faster data processing.
- He also stated that there is an utmost need to integrate a variety of counter-UAS in multiple terrains and situations.

Key takeaways from talk by Shri V Kishore Kumar, Scientist E, DLRL, DRDO on R&D in Counter-UAV Technologies:-

- In his presentation, he demonstrated various jammers and killer drones being developed by DRDO.
- Killer drones being developed by DRDL have long-range interception capabilities and can operate by day or night.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- He also highlighted the importance of handheld and portable RF counter-drone systems. The former covers ISM bands, while the latter covers wide bands from 400-600 MHz.

Key takeaways from talk by Mr Udi Lowy, D-Fend Solutions on Counter-drone System based on RF Cyber Takeover Technology:-

- Mr Udi Lowy from D-Fend Solutions presented about the process of detection, mitigation, and C-UAS mechanisms.
- He mentioned that it is imperative to distinguish between friendly and non-friendly drones. He stated how necessary it is to be ready to address a wide range of commercial & DIY drone threats.
- He presented his product which uses RF cyber takeover technology wherein the hostile drone is hacked and its control is taken over to land it at a safe place and prevent it from completing its task.
- As few mitigation strategies, he highlighted the next-generation RF Cyber approach, India needs to create multilayered defence and should prioritise safety control and continuity.

SESSION 5 - INNOVATIONS AND RESEARCH & DEVELOPMENT

The last session of the day was chaired by **Cmde SK Singh, OIC Technology Development Acceleration Cell, NIIO, Naval HQ**. He began the session by highlighting how technology has played a role in changing the manner in which warfare creates offsets and asymmetry by virtue of distributing the sensors in multiple domains which leaves nowhere to hide. He said that the ability to strike has proliferated so much that it has become a commodity. Large platforms are expensive and take time to develop, procure and operationalise, therefore, there is need to have low-cost attritable assets. There is need for technologies like meshed networks, M2M interaction and technologies that are easily adaptable along with the agility

towards interactive and incremental growth. He brought out that the Indian Government has been very supportive in easing the process for involvement of the private industry and their growth in the drone sector. He emphasised on how UAS and C-UAS are impacting the nature of warfare and the need to progress the concept of MUM-T.

Key takeaways from talk by Ms Ruma Dhaka, Sc G, IRDE, DRDO on Advanced Sensors and Payloads for Military UAVs:-



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- The speaker started by explaining the importance of 'Sensor Fusion' as a solution as no one sensor can meet all the requirements of ISR. Therefore, fusion of technologies like EO/IR and SAR, and imaging techniques like panchromatic, multispectral, hyperspectral, etc., is the need of the hour.
- She said that the systems being developed for the military today should be SWaP (size, weight and power) optimised and have single LRU (Line Replaceable Unit) with reduced operator workload.
- She highlighted IRDE's achievements in advancements in EO/IR technology like Common Aperture Optics Design, Folding Optics, Common Electronics Design, Modular Design, Single LRU Systems, SWaP Optimised Systems, Tandem BLDC Motor Drive, Multiple HD Sensors and Image Fusion.
- She insisted that indigenous production capability exists with the Indian industry with support from IRDE's design expertise and transfer of technology by DRDO to the industry.
- She brought out that IRDE has developed airborne EO/IR systems for ISR applications like LEOP, MREO, LREO, CAMOP and CLASS and is working on reducing the RCS of EO systems and EO payloads for stratospheric region (HAPS), IRST (Infrared Search and Track) and MAWS (Missile Approach and Warning System). IRDE is also working on hyperspectral sensors, airborne DEWs, and multi-sensor data fusion for airborne systems.

Key takeaways from talk by Col Manik Anand, Planning Officer, Aerospace Systems, Dept of Defence Production:-

- Col Manik Anand familiarised the audience with the ground realities of the status of the drone industry in the country with respect to the announcement by the PM that India should become a drone hub by 2030.
- He said that work is in progress to increase indigenous content to 70% and highlighted dumping by our adversary is a major challenge.
- He emphatically stressed on the need for the industry to move away from aggregation and assembly. It has to be a whole-of-the nation approach and the military and civil drone industry cannot be segregated.



SEMINAR REPORT
UAS AND C-UAS INDIA 2024
ORGANISED BY CENJOWS AND IMR
17 MAY 2024



- He noted that despite the Govt's PLI scheme, R&D is not commensurate to the incentives. A lot of programmes are ongoing but are running behind schedule because the industry is unable to cope up.
- He emphasised on the urgent need to indigenise critical technologies like flight controller, sensors and data streaming.
- He said that Make programme is not kicking off as the industry is not responding the way it should. There are a total of 150 projects under the Make-I/ II/ III categories but there is hardly anything concrete to mark it as a success. iDEX, on the other hand, has been a success story.
- He also noted that there has been criticism of the Defence Acquisition Procedure (DAP) 2020 but he said that the industry needs to acquaint itself better with the policy. The recent amendments to the DAP aim to give more opportunities to startups and MSMEs, handhold them and promote their growth.
- He insisted that the gov't's policy is very supportive, what is needed is more effort on part of the industry and the end users to make it happen.

The chairman, while summarising the session said that innovation is top-driven and we need to continue scanning newer and better technologies for induction. He said that the defence services are excited to collaborate with the industry like never before and the solutions being dual-purpose provide greater opportunities to the industry as well.

Maj Gen (Dr) Ashok Kumar, VSM (Retd), Director General CENJOWS, closed the seminar by complimenting all the session chairs and the panellists for having conducted the sessions very well and sharing their knowledge and insights on the various topics and issues that were covered. He also complimented all the participants for the interest and involvement displayed. He complimented the team of CENJOWS and IMR for successfully organising the event.

Maj Gen Ravi Arora, Chief Editor, Indian Military Review, ended the seminar with a vote of thanks to the Director General CENJOWS for having personally selected the speakers and prepared the programme for the event, all the sponsors for their efforts and the delegates present for making the event a success.