

*Lt Gen PS
Rajeshwar,
CISC*



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Integrated Air & Missile Defence

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The Seminar Report

The reaction by the Pakistani Air Force to the Indian Air Force's legitimate action in Balakot has underscored the fact that air threats are for real. The spectrum of these threats has also widened in recent years with UAVs and drones giving them a new dimension besides making them more complex. With increasing threats to India's security from its neighbours and their proxies it is incumbent on our planners to evolve a long-term strategy to counter the same. This would of necessity demand induction of new technologies and formulation of appropriate concepts to take on the challenges head on. Integration of new technologies and weapon systems in a tri service domain is another aspect that requires regular deliberations so that we have the requisite levels of operational preparedness. Being a technology intensive field, AD operations involve complex and multiple layers in execution and need to be understood by commanders at all levels in the three services.

A one day seminar on 'Integrated Air and Missile Defence' (IAMD) was held at the ISDA Auditorium, New Delhi on 04 Jun 2018. It was organised by 'South Asia Defence & Strategic Review' in concert with CENJOWS. The seminar brought together leading representatives of the military, R&D, think tanks and the industry on one platform. It focused on development of the requisite capability by all the three services against current and futuristic air threats, particularly those posed by UAVs/drones.

OPENING & KEYNOTE SESSION

**Chairman's Address. Lt Gen Vinod Bhatia
PVSM, AVSM, SM (Retd)
Director CENJOWS**

- The seminar will focus on future technology and capacity enhancement and the aim thereof is to provide a platform to all stake holders to discuss the strengths, opportunities and concerns in the AD domain.
- Our modernisation plans have not taken off as envisaged. There is a need to give an impetus to the same and provide the best whilst adopting a pragmatic approach keeping budgetary constraints in mind.
- As Air power will play an important role in future wars AD is a going to be a very crucial component of the war fighting machinery.
- There are voids in communication systems which must be addressed urgently.

**Opening Address. Lt Gen PS Rajeshwar, AVSM, VSM, CISC
Overview of Indian Ground Based Air Defence: Current Capabilities
and Future Challenges**

- Biggest testing ground for AD weapon systems has been Syria due to the phenomenal use of air power during the said war.
- We need to combine innovative tactics and technology to achieve the best results against all possible modes in which air threats are likely to manifest themselves.
- It is critical that Army AD caters for all army assets whether stationary or mobile. The delineation of the TBA and allotment of assets as required at specific points, is of the essence.
- As far as capabilities are concerned, we need to correctly identify the various types of assets required for AD, both at the Western and Northern borders.
- Tri Services integration must be accorded priority in the field of AD.
- The Air Force is well poised as far as the C&R capabilities are concerned. The Army AD, however, needs to catch up in this regard.
- AD must be poised for threats that manifest themselves in the pre war period, during war and post war scenarios.

Special Address. Mr U Raja Babu, OS and Programme Director, Ballistic Missiles, DRDO
India's Ballistic Missile Defence Programme: Implementing New Technologies to Complement Current Air Defence Capabilities

- The present operational environment poses different type of threats from ballistic missiles, cruise missiles, manned and unmanned aircraft and rockets and artillery.
- AD and Ballistic missiles are two separate missions as they have different characteristics of dealing with threats from different ranges and heights. As we cannot have finite resources there is a need to integrate BMD with AD.
- IAMD enables to coordinate and efficiently utilise available resources to maximise AD, even though systems engineering poses some challenges.

Keynote Address. Lt Gen AP Singh, AVSM, DG AAD
Countering Evolving Air Threats

- The nature of the air threat in the TBA has changed in last few years due to stealth technologies, drones and missiles also posing threats besides the existing threat from aircraft.
- The threat from UAVs and drones would be the most disruptive and prevalent. However, at the present juncture we are not specifically equipped to take on these threats essentially because of their peculiar characteristics.
- Due to the threat from UAVs and drones there will be an enhanced role for ground based AD systems to defend assets in TBA.
- AD is the best place for the industry to experiment as there are a multitude of requirements.

SESSION 1

UAVS: EMERGING AERIAL THREATS AND COUNTERMEASURES

Lt Gen Kuldip Singh, PVSM, AVSM, (Retd), Former DG AAD was in the chair. He began the session by stating that the full potential of UAVs was first exploited during the first Gulf War and the utilisation further evolved during the second Gulf War. Since then there have been immense advances in the variety of UAVs with drones joining the bandwagon. It is important for understand how the subset of drones will work in aerial threat canvas.

Brig Jagroop Singh, DDG (Ops & C&R) AAD. He spoke about Technological Advancements in Military Grade RPAs: Threat Evaluation. He stated that RPAs (another acronym used for UAVs/drones) have evolved from intelligence collection to flexible platforms due to the tremendous advancements in technology which has enabled RPAs with characteristics like stealth etc come in and the new game changer in the field is Artificial Intelligence. We have palm sized RPAs which can process and react hundred times faster than humans. We also have

smart drones which can work in swarms and thus pose threats to several targets at the same time.

Gp Captain Piyush Dhawan, IAF. His subject pertained to Tactical Innovations in Employment of UAVs. He said that RPAS pose various types of challenges to AD as they come in multiple forms and sizes and have multiple launch options and have different kind of capabilities. At the same time, they have limitations like slow speed and are band width intensive, these limitations must be exploited by the defender.

Mr Russ MARTIN, Head of Technical and Military Operations, MBDA spoke on UAS Threat and Countermeasures and said that there is a need to fix, track and destroy hostile UAS/UAVs, for this there is a need to have extremely sensitive seekers, appropriate warheads and have the flexibility to launch from MANPADS or from airborne platforms. He gave out details of the systems being developed by MBDA to defeat UAS/UAVs and the characteristics thereof.



Mr Saurabh Kumar and Mr Gaurav Nigam, HEXAGON spoke on Air and Missile Defence Systems. He said that there are solutions available to integrate sensors, software, domain knowledge and AD workflows into intelligent information ecosystems that deliver actionable information. The ability to rapidly integrate sensor data in a visual environment provides the geospatial location, intelligence and situational awareness necessary for mission

critical operations. The above will greatly facilitate decision making as AD operations are very time critical.

Mr Ajay Dahiya, Sr Commandant, IGI Airport spoke on Threat to Vital Installations from UAVs and Countermeasures. He gave out the details of various measures being taken by CISF to counter the UAV/drone threat. He also gave out details of various policies formulated by the government to regulate the use of UAVs and drones.

Panel Discussion

Lt Gen Kuldip Singh, PVSM, AVSM, (Retd), Former DG AAD was in the chair during the discussion on Anti-UAV Systems-Trends and Technologies; Integrated Approach to Counter the Threat

The panellists were Maj Gen Subodh Kumar (Retd), former ADG, AAD, Brig Jagroop Singh, DDG AAD, Cmde AD Theophilus, IN, Air Cdre Rajiv Ranjan, IAF, Mr Russ Martin, MBDA and Mr Saurabh Kumar, HEXAGON

- Requirements of AD for TBA and the rear areas are different and therefore we must prepare accordingly.
- We must have a coherent strategy to deal with the UAV threat with simple to complex systems both operating under an overarching authority.
- We cannot afford to fire missiles on UAVs due to the comparative cost disadvantage of firing a missile.
- We need to evolve innovative methods to tackle the UAV/missile threat.

SESSION 2

DEVELOPING INTEGRATED SOLUTIONS TO COUNTER FUTURISTIC THREATS



The Chairman for the session was Lt Gen Satinder Singh, AVSM, Commandant AAD School. He stated that we need to have cogent policies and procedures to ensure adequate and appropriate capability building.

Brig Vikash Sharma, DDG (Proc & EM), AAD, spoke about Integrating Anti UAV technologies and systems into existing inventory. He dwelled on the loop of engagement which includes detection, identification and destruction and pointed out that our detection capabilities at present are in a nascent stage. As far as identification is concerned, we have

the wherewithal. However, there are gaps in the destruction aspect and these need to be closed.

Brig MKK Iyer (Retd), Bharat Forge. His subject was CIWS: An Effective Counter Air Solution. He dwelled on the importance of guns at the terminal end and said that a combination of guns and VSHORADS would be most suitable for close protection and went on to state that currently we have no capability against rockets and artillery and that it is important to acquire the same. He gave details of the Close in Weapon System (CIWS) developed by

Bharat Forge for the Air Force. The weapon system can be operated by only two men vis-a-vis a L 70 gun which needs six men. The system is in a state of readiness, wherein it can be fielded whenever the IAF asks for it.

Mr Jeevesh Gurumoorthy, Honeywell. Subject-Adding Precision to Air Defence. He spoke about TALIN which

is a proven, battle tested, precise and reliable inertial navigation system (INS) which is used for navigation, pointing and weapons stabilization. It has been built with high accuracy ring laser gyro and accelerometers which are the hallmark of Honeywell. He said such systems could be of immense use in AD by enhancing accuracy of platforms and the delivery means.

Panel Discussion

Lt Gen Satinder Singh, AVSM, Commandant AAD School chaired the session on **Capability Development and Self Reliance in Critical Technologies for Air Defence**

Discussants were Brig Vikash Sharma, DDG (Proc & EM), AAD, Col Rajneesh Syal, PP Dte, Brig MKK Iyer (Retd), Bharat Forge, Captain Kartik Murthy, IN, Mr Jeevesh Gurumoorthy and Cdr Arun Jyoti, Honeywell

- Induction of technology must happen without cost and time overruns.
- The Army Design Bureau is currently involved in developing 15 technologies which include AI for targets, C RAM and soft kill options against UAVs/drones.
- Naval Systems of necessity must be ruggedized due to the peculiar operating environment which is humid and has space restrictions.
- We must work towards indigenisation of critical technologies like seekers and propellants.

TAKEAWAYS

The Operational Construct. The current and future operational construct will pose many new challenges as the spectrum of threats will encompass multitude of elements varying in terms of ranges and payloads. These could be aircraft, AHs, different types of missiles and UAVs/Drones. Employment of drones in swarms will put to test the defender's ingenuity as these can overwhelm adversaries. The threats will continue to become increasingly sophisticated and lethal in this age of rapidly evolving technology.

Air Defence: Broad Framework. We need to create appropriate deterrence against all types of air threats both for war prevention and war fighting. Terrorism through the air medium, especially in the age of drones, has also to be guarded against. Thus, there is a need for a robust AD umbrella to protect both our population and critical assets including troops. This can be achieved by employment of a layered system of sensors, which is supported by failproof communications that facilitate robust and rapid command and control of a multiplicity of weapons systems which will also be deployed in layers. Network security would thus assume great importance. We also need to have appropriate weapon systems for the TBA and rear areas as the requirements are different. Our AD will thus have a role to play 24/7 through the year.

IAMD. Aircraft and missiles have different potential. Therefore, integration of the two to follow the IAMD approach is both a pragmatic and affordable option for the protection of our assets as it helps offset the resource crunch to a great extent. In this approach various command, services and systems are integrated to leverage different system

capabilities to counter threats. To be effective, any IAMD solution must provide enhanced situational awareness, optimization of sensor and weapon resources, expanded battlespace and operational flexibility, aircraft and missiles to match the threat and open architecture that allows for integration of sensors and weapon systems. It must also be scalable.

Drone Threat.

- Drones are an attacker's delight and a defender's nightmare. They come in varying sizes, ranging from palm size to the large ones, have low noise levels, low signatures, multiple launch options and a low RCS. They can carry out different tasks from surveillance, targeted killings, cyber attacks to weapon delivery. These are a force multiplier available to the terrorists.
- Swarm drones are a new dimension altogether. These are interconnected, co-operative drones that can work together. Low cost, intelligent and inspired by swarms of insects, these new machines could revolutionise future conflicts. From swarming enemy sensors with a deluge of targets to attacking several targets simultaneously; they could have a range of uses on the battlefield.
- There are no perfect detection methods available yet for UAVs.

Anti UAV/Drone Measures

- **Detection and Tracking.** The means that can be employed for detection and tracking of UAVs/drones are radars, radio frequency (RF), electro optical (EO), IR and acoustic.

- **Kinetic Options.** Conventional weapon systems that fire regular or custom-designed ammunition can be used to destroy UAV/drones. High energy microwaves and lasers are also being developed to destroy/degrade UAVs/drones.
- **Soft Kill.** Besides the kinetic options we must also look at various soft kill options to degrade drones. These would be jammers (to jam the control/navigation links), spoofing (to take control of the targeted drone by hijacking the drone's communications link) and use of projectiles which dispense nets to entangle the targeted drone and/or its rotors.
- **Regulations.** Laying down regulations for purchase and use of drones is of the utmost importance as this will greatly reduce the possibility of rogue drones being employed.

Gaps and Challenges. We have gaps as far as technology is concerned and our modernisation programmes have not taken off as envisaged. Varying types of terrain on our borders also poses a challenge in that there is a requirement of different types of weapons and systems which need to be looked at as per the dictates of the terrain. We have several

- **Initiatives by MoCA.**
 - Certification of safe and controlled operation of drone hardware and software.
 - Air space management through automated operations linked into overall airspace management framework.
 - Contribution to establishing global standards.
 - Suggestions for modifications of existing CARs and/or new CARs.
- **Initiatives by MHA**
 - Constitution of JAC for airports.
 - Issued guidelines to detect, deter and destroy aerial threats.

Industry. AD affords a great opportunity for the industry to contribute as there are vast and varying requirements and the industry must seize this opportunity to help progress the effort towards self reliance. We still rely on imports for critical items like seekers and propellants. Industry must try and develop these. The armed forces on their part must remove the trust deficit that the industry has on account of lack of clarity regarding the actual needs of the forces. Thus, there is a need for greater engagement between the Industry and the Services to obviate the grey areas.

There should be no procrastination in our modernisation plans and we must ensure that equipment being imported is current and should be available to us for the next three to four decades

voids in communications which need urgent attention and Army AD needs to improve its C&R systems. We do not have suitable detection and tracking equipment especially radars which can pick up a small RCS. A weapon system specifically meant for drones is also not available. There are no anti artillery and anti rocket systems available with us.

Gun Systems. As missiles are not cost effective to use against UAVs/ drones and because they are unlikely to be effective against small drones there is a need for appropriate gun systems to take on the challenge. The old war horse (in new incarnations) is therefore back to playing an important role in the AD domain.

Regulations/Initiatives. The Govt of India has promulgated regulations/taken initiatives with regard to Drones/UAVS:-

- **DGCA Civil Aviation Requirements(CAR).** Lays down requirements for obtaining Unique Identification Number (UIN) and Unmanned Aircraft Operator Permit (UAOP).
- **The Digital Sky Platform.** This is the first-of-its-kind national unmanned traffic management (UTM) platform that implements “no permission, no takeoff” (NPNT). Users will be required to do a one-time registration of their drones, pilots and owners.

Way Forward. We must acquire appropriate detection and tracking systems including radars with small RCS. We need to induct suitable gun systems to take on the UAV/drone threat. There is a need to change the decision loop to make it more responsive and empowered so that timely action can be taken against hostile UAVs/drones, which may appear from just around the corner. It is important for all AD sensor networks to be centralised so that fratricide is avoided and Army AD needs to improve its C &R. Network Security is of the utmost importance and must be given due emphasis. We must look at modular designs for our systems so that different requirements posed by varying types of terrain in our context can be adequately met. Integration of anti UAV/ drone technology and systems with the current inventory needs to be seriously examined to build the requisite capability, some examples of this are provision of EO sites and FC/TC radars to fair weather gun systems, provision of ammunition like 3 P and integration of multi spectrum jammers with FC / TC radars. The voids in communication systems must be expeditiously addressed and we must have C RAM capability. There should be no procrastination in our modernisation plans and we must ensure that equipment being imported is current and should be available to us for the next three to four decades. Last but not the least we must focus on indigenisation so that we become self reliant.