Manohar Parrikar Institute for Defence Studies and Analyses

DELHI DEFENCE DIALOGUE

ADAPTIVE DEFENCE: NAVIGATING THE CHANGING LANDSCAPE OF MODERN WARFARE

Inaugural Session

Opening Remarks: Amb. Sujan R Chinoy, Director General, MP-IDSA, New Delhi.

Special Address: Shri Rajnath Singh, Hon'ble Raksha Mantri, Government of India and President, MP-IDSA, New Delhi.

The inaugural session of the DELHI DEFENCE DIALOGUE was addressed by Shri Rajnath Singh, Hon'ble Raksha Mantri. Director General Amb. Sujan R Chinoy delivered the opening remarks.

Director General Amb. Sujan R Chinoy

DG Amb. Chinoy thanked the Hon'ble Raksha Mantri for kindly accepting the invitation to deliver the special address. He extended a warm welcome to all the panelists and the distinguished audience. Some of the key points made by Amb. Chinoy are highlighted below:

- It is a privilege for MP-IDSA to be hosting the inaugural Delhi Defence Dailogue today. It is indeed a privilege to be hosting the event on the occasion of the 59th anniversary of the establishment of the institute.
- The Delhi Defence Dialogue focuses on the concept of Adaptive Defence, in the context of the revolution in military affairs. In the era of network centric and multi-dimensional warfare, the sensor-to-shooter kill chain has reduced while the lethal autonomous weapons systems (LAWS) are not yet subject to effective regulation.
- Uncrewed vehicles have become the norm today. AI will involve big data and those that have more data will have the upper hand, especially in perfecting the machine learning and autonomous weapon systems. Use of sanctions, cyber-attacks, manipulation of markets can create havoc.
- Modernisation of the military is a time and resource consuming process.
- State and non-state actors working in tandem pose unique challenges to our security. The role of private players in warfare is growing at a fast pace.
- India is located in a complex region and faces some unique threats and challenges. With adaptive defence, it can deal with these threats and challenges effectively.

Shri Rajnath Singh

Raksha Mantri Shri Rajnath Singh ji welcomed the participants from across the globe and appreciated MP-IDSA, especially the Director General Amb. Sujan R Chinoy for launching the

first edition of Delhi Defence Dialogue. During his special address, he emphasised on the following points:

- We are living in quite a challenging time where changes are taking place at an unprecedented pace. The world is in a geopolitical and economic flux with fear of uncertainty increasing day by day. Technological advancements in almost every sphere of human endeavour has made a profound impact. Emerging technology and evolving strategic partnerships have been reshaping the traditional notions of war giving ways to new perspectives, doctrines and concepts of operations within the armed forces.

- Given the changing nature of complex threats, it is pertinent to adapt to the evolving security dynamics and constantly work on enhancing the ability to perceive, develop and implement innovative solutions. The information age, as it is called, has made a deep impact on the conceptual and practical domains of defence and security.

- Grey Zone warfare and Hybrid warfare has not only gained traction in recent times but is posing a serious challenge to our conventional ways, means and mechanism of defence. In such a situation, adaptation appears to be the best strategy to deal with the challenges.

- Adaptive Defence is a strategic approach that helps us continuously evolve our armed forces and defence mechanisms to effectively cope with and counter the emerging threats and challenges. While doing so, we need to be proactive in anticipating the emerging threats and challenges in the field and prepare ourselves proactively to respond to any untoward situation. The key to adaptive defence is situational awareness, flexibility at both tactical and strategic level, resilience, agility and most importantly integration with the emerging futuristic technologies. There is a need to translate and imbibe these principles into the defence and security apparatus.

- India and the world have been facing a diverse set of security threats and challenges; from border conflict and terrorism to cyber-attacks and hybrid warfare. The emerging geo-political and technological scenario has made it more complex. India has taken several measures and initiatives to build a robust and self-reliant defence ecosystem. To this end, we are focusing on enhancing our indigenous capabilities and capacities. India is determined to employ adaptive defence strategies to counter the menace of information warfare against its national security.

- The Atmanirbhar Bharat Abhiyan, which is the bedrock of our vision, focuses on self-reliance in the defence sector. We have increased the limit of Foreign Direct Investment in the defence industry up to 100 per cent in specific cases. The procedure to invest in the defence manufacturing industry has been streamlined. We are also promoting co-development and co-production of niche defence technologies with foreign manufacturers. The establishment of Defence Industrial Corridors in Uttar Pradesh and Tamil Nadu is aimed to attract investment and promote defence manufacturing clusters in the country.

- The government is quite keen to have state of the art AI capabilities. Every Defence Public Sector Undertaking (DPSU), for instance, has an AI roadmap. Given the size, potential and human resources, India must have the capability and wherewithal to deal

with the global innovations of AI in defence. In today's times, drone and swarm technologies are making fundamental changes in the ways and means of warfare. India aims to transform itself into a drone hub which will certainly help boost the Indian economy and significantly contribute to the Make in India and the Atmanirbhar Bharat programme.

- A collaborative approach is critical to deal with contemporary issues and challenges in the field of defence and security. Given the nature of emerging threats to security and the fast changing geo-political environment, adopting a collaborative approach is the need of the time. The ambiguities in the cyber domain, developments in AI, unfathomed potentials of quantum and nanotechnologies further require collaboration and sharing of knowledge, perspectives, information, and if possible, strategies.
- It is no less than an irony that the world on the one hand is seen increasingly as a global village which emphasises upon collaborative spirit to deal with common challenges, but on the other we continue to be divided on ideological and geo-political walls of our own creation. In today's challenging time, Adaptive Defence is a necessity. It can become a reality when it is also a reflection of collaborative defence.
- Delhi Defence Dialogue seeks to generate innovative ideas and collaborative strategies to enhance our defence posture. I am sure that the event will help us analyse aspects of jointness and integration as part of the proceedings.

Key Takeaways

Adaptive defence is an important strategic concept to deal effectively with the changing geo-political environment, emergence of complex threats and challenge to security in the era of network-centric and multi-dimensional warfare and revolution in military technologies.

Report prepared by Dr. Ashish Shukla

Fireside Chat with General Anil Chauhan, CDS

Q. The revolution in military tech, which changes the nature of warfare is now happening at a telescopic speed, especially disruptive trends of HGV and UAVs and others. What are the implications of it for military doctrine and operational strategies?

Answer:

- Technological change has affected warfare and often technology is developed to be used in war. In earlier times there was one single battlefield. The emergence of railroads, which helped in war-time mobilisation and telegraph meant that command and control did not have to be at the battlefield.
- Disrupting technologies are ones which are developed for purpose other than warfare. Technologies such as robotics, unmanned systems are changing warfare in ways unimaginable.

- From traditional human to human combat, we are now looking at human to machine and machine to machine combat.
- These technologies have added velocity and lethality, to the weapon systems, as visible in hypersonic glide and cruise vehicles and swarming drones. Stealth and celerity is making weapon systems un-targetable, thus increasing the vulnerability of forces. It also means the days of large platforms are increasingly behind us.
- Automation led by AI and big data has further transformed warfare from net-centric to data-centric and opened the cognitive domain.
- The combination of technologies, such as hypersonic and advanced material have made faster and lighter weapons system and led to battlespace expansion, decision-making time compression and cross-domain operations.

Q: What are the implications of the changing character of warfare, induced by rapid technological change, on joint-ness, including theatre command, civil-military-fusion, integration between armed forces with Central Armed Police Forces, and integration at the MoD?

Ans:

- In times of cross-domain and multi-domain operations, cooperation among the three services is important. Integration is a physical process across services and headquarters and departments and involves intelligence, training, legal and human resources.
- Integration helps achieve saving in manpower, finance, time.
- The process of civil-military fusion has also been initiated, for example in flexible use of air space by civilian and military aviation and in maritime domain as well.

Q. Is the integration at higher levels such as one border-one force- one command desirable?

Ans: The process of integration is a gradual one and such kind of integration is some distance away.

Q: What is the right balance between introduction and absorption of technology and size of the armed forces in the Indian context?

Ans:

- As warfare becomes joint and digitised, restructuring, optimisation and de-layering of the traditional hierarchy including staff, is required to create new capabilities. The process of optimisation is necessary to address capabilities gaps in space, cyber and ballistic missiles.

Q: How does the changing character of warfare in four domains of air, land, space and cyber create new challenges in the strategic and operational environment for armed forces especially in protracted conventional wars and grey-zone conflicts?

Ans:

- In terms of domains, distinction needs to be made between near-space, where platforms like balloons and hypersonic vehicles operate and aerospace, which is higher. Cyber is a synthetic or man-made domain and together with space domain, it sees combat from the outside.

- In grey-zone conflicts, instead of combat between organised armed forces, combat elements become irregular including non/quasi-state actors, mercenaries, jihadis and even defence contractors. The sub-conventional conflicts are ones where use of force remains restrained.

Q: With the emergence of AI and quantum computing in warfare without proper regulations are we entering an era where notions of honour, proportionate use of force and bravery have become outdated?

Ans:

- Trust, which is the edifice of military and warfighting, is important. Traditionally trust-building was between the leader and the led, increasingly it is about trust between the three services and also between technology and the leadership, which is responsible for planning and conduct of operation.

- These technologies also challenge the traditional debate whether warfare is art where leadership decisions during the conduct of war are of more significance, or science which puts emphasis on planning. Even as both conduct and planning of warfare increasingly becomes scientific, leadership will still be required.

Q: Is India able to fully utilise its strategic partnership with range of countries such as the US, France, Israel and Russia in areas of defence and security?

Ans:

- India, while favouring partnerships, has always been averse to alliances.

- Our partnerships can contribute to military preparedness, and involve countries, which are geographically closer in the Indian Ocean region. Also, we enter into partnerships based on cooperation in technology or finance.

Q: Amid the ongoing conflict, large forces have suffered from shortage of supply chains, while new players such as ROK and DPRK have emerged as exporters. What lessons we derive for ‘atmanirbharta’ in defence manufacturing including in new age technologies?

Ans: Atmanirbharta is important both in capital acquisition and sustenance in terms of spares, ammunition and fuel. It is a whole package not just limited to cutting-edge tech.

Q. Given most countries who participate in joint ventures are reluctant to part with cutting-edge technology, is 100 percent FDI with complete ownership is the pathway to make India part of the global supply chains?

Ans:

- In addition to the challenge of finding a balance between Lowest1 bidder and creating ‘national champion,’ defence procurement increasingly needs to adopt the Fastest1

model. With warfare changing fast, there is need for players who can offer platforms for trial quickly to ensure that they are adopted in time.

Q&A from the floor

- In reponse to a question about cognitive domain and information warfare, Gen Chauhan noted that while using information as weapon, target, source and content of information is important. Information Warfare has three components: cyber, electronic and perception management.
- Responding to a question about using defence offsets to develop manufacturing, Gen. Chauhan concurred that India has not leveraged its civilian aircraft purchase, except when it comes to setting up MRO facility in India.
- Civilian military cross-dependency will go a long way in creating supply chain resilience.
- In response to a question on India's dependence on others in use of space for intelligence collection, Gen. Chauhan noted that space as a domain of warfare also affects other domains. India is focused on developing capabilities in use of space for communication, ISR and navigation.
- Responding to a question about vulnerabilities to sanctions, especially US sanctions for Indian business and PSU, Gen. Chauhan noted that amid ongoing wars Indian companies have not encountered sanctions. The challenge for Indian public sector defence manufacturers has been that they are not supplying markets involved in war.

Report prepared by Dr Deepika Saraswat.

Session – I: Full Spectrum Threats - Challenges of Changing Character of Warfare

Chair: Amb Sujan R Chinoy, Director General, MP-IDSA, New Delhi, India

Speakers:

1. Col Rajneesh Singh, PhD (Retd) Research Fellow, MP-IDSA, on *Conventional Wars Reassessed: In Times of Great Power Competition and New Age Technologies*
2. Prof Sascha Dov Bachmann, University of Canberra on *Hybrid Warfare, Grey Zone and Multi Domain Warfare* (Online)
3. Mr Riccardo Valle, Director of Research, The Khorasan Diary on *From Territory to External Operations to Statecraft to Adaptability: Main Trends in Jihadist Militancy*
4. Amb D B Venkatesh Varma on *Non-Conventional Threats: WMD*

The first session of the DELHI DEFENCE DIALOGUE is on the theme "**Full Spectrum Threats - Challenges of Changing Character of Warfare".** The session was chaired by Amb Sujan R Chinoy, Director General, MP-IDSA, New Delhi, India. In his opening remarks, the Chair highlighted the changing character of warfare, particularly due to advances made by new

emerging defense technologies. Today the world is witnessing 'Slow Burn' wars or protracted wars where weapon platforms like cheap drones and rockets are enhancing military capabilities. He noted that in present times there is a blurred boundary between war and peace that makes the battlefield more challenging. He also emphasised that with future wars being multi-domain and battlefields more complex, we need to be prepared for them and hence the importance of the session is quite evident. He pointed out in the coming years, emerging AI technologies will create more difficult situations in warfare where the roles of chivalry, bravery, and leadership have lesser roles to play and the AI may make decisions during the course of war.

Col Rajneesh Singh, PhD (Retd) Research Fellow, MP-IDSA, *on Conventional Wars Reassessed: In Times of Great Power Competition and New Age Technologies*

- Col. Rajneesh Singh commenced his presentation highlighting the issue that the character of warfare is changing driven by the social and political context of time and technology. There is a flux in international order.
- The great power competition and geopolitical hotspots have the potential to engulf wider geographies, create fissures and destabilise an already fragile global security situation.
- There has been a significant transition from counterterrorism focussed operations to large scale protracted conventional operations against near-peer adversaries. The ongoing wars in Ukraine and Gaza are cases in point.
- Technology has created the greatest impact on the changing character of warfare which is manifested in the ongoing wars in Ukraine and Gaza, and therefore, technologies will become operational imperatives in the foreseeable future.
- Technological advancements will play a critical role, influencing military strategies and tactics as also force structure and training programs, while dynamics in supply chain management, along with sanctions and export control regimes, will directly impact modern warfare.
- To effectively navigate this shifting landscape, military organisation must flexible to adapt and innovate. This involves not only the integration of emerging and disruptive technologies but also the development of flexible strategies that can respond to the multifaceted nature of modern warfare.
- Technology will enhance tempo of operations. AI in military operations will dominate in future.

Prof Sascha Dov Bachmann, University of Canberra on *Hybrid Warfare, Gray Zone and Multi Domain Warfare*

- Prof Sascha Dov Bachmann remarked that the applications of hybrid warfare, Gray zone warfare, and Multi domain warfare has changed the nature of warfare in contemporary times.

- Hezbollah showed the element of hybrid warfare strategy in the Middle-east in early 2015 where the term first emerged. Military kinetic element forms part of Gray zones activities and acts as the force multipliers that prepares the battlefield for greater intensity wars.
- In the case of China, the country uses unrestricted warfare as a means to challenge great power like the US. Another example of changing character of warfare is the Russia's application of irregular forces in Crimea and Ukraine.
- In the case of Ukraine war, economic sanctions have been imposed on Russia to negatively impact its military capability.
- He suggested that in the case of Russia, 'War and Peace' is a new gray zone, and what is peace can be turned into war, if required.
- For India, he recommended that the country should develop its gray zone tactics by making use of civil society, fusion of military and civil forces, and augmenting its information system.

Mr Riccardo Valle, Director of Research, The Khorasan Diary on *From Territory to External Operations to Statecraft to Adaptability: Main Trends in Jihadist Militancy*

- Mr Riccardo Valle said in his remarks that militancy, and specifically, jihadist militancy is not a static phenomenon. Jihadist organisations have been historically framing a strategy and a long-term vision tied to ideological aspects and practical goals.
- The militant scenario has become more difficult to dissect due to competition between different factions of jihadist groups such as Islamic State, Al-Qaida, for resources, recruits and territorial strongholds on several fronts, from Africa to Afghanistan and Central Asia and Europe.
- Furthermore, militants are progressively taking advantage of international crises and developments to advance their own goals. Some jihadist militant organisations effectively reached their goal and established Islamic states, enacting their form of government.
- Within the last three years, several militant organisations have focused their attention on shifting from only pure brutal attacks and occupation of territories to a more calculated approach that combines a mix of warfare, deadly operations, and localized strategies to win the support of communities in order to maintain prolonged footholds in regions.
- The trend of jihadists taking control of swathes of territory and setting up parallel administrations with the aim of ultimately establishing Islamic states/emirates is largely shared in parts of Africa.
- The conflict in Gaza is just one of the recent international events exploited by jihadist organisations to advance their goals. Bangladesh has also become a spotlight for jihadist

propaganda, possibly anticipating attempted infiltration by jihadist militants, should the situation in the country deteriorate.

- Today, the jihadist landscape is possibly undergoing a transitory phase from the post-9/11 period and the rise to power of the Islamic State in 2014 to a new chapter of militancy that might have huge repercussions on regional and international dynamics. The transition of the Afghan Taliban from insurgency to functioning state; the intra-jihadist competition and quest for proto-states in Africa; the adoption of tactics by jihadist groups that were usually performed only by states, such as the use of proxies; and a new phase of dispersed individual jihad might be all signs of the next chapter in the world of jihadist militancy.

Amb D B Venkatesh Varma on *Non-Conventional Threats: WMD*

- Amb D B Venkatesh Varma identifies weapons of mass destruction (WMD) as the means of non-conventional threats and among them are biological and chemical weapons, and nuclear weapons. Biological and Chemical weapons are largely under control.
- Nuclear weapons, by themselves, are not effective deterrent in the present times.
- He categorises six phases of nuclear deterrence as a non-conventional threat from 1945 till date. In these six phases, countries like the US and Russia have learnt lessons from each other regarding the use of nuclear deterrence.
- He pointed out that unlike the US and Russia, China has set a different example in the recent past by managing to create effective deterrence against its competitors and rivals with limited nuclear capability in comparison to Russia.
- In the US-Russia conflict, China has taken the opportunity to partner with Russia to better equip itself in terms of technologies that can upgrade its weapons or equipment for posing deterrence.
- He recommended that India should build its strategic forces backed by military doctrine, and subsequently the defense budget should be increased from 1.9 percent to 3 percent of the Indian GDP.

Q and A

Q: Hybrid warfare tactics have been USED by the countries in the past, including by Pakistan in Kashmir conflict in 1947. So is Hybrid warfare a new concept?

Col. Rajneesh Singh responded and said that the concept of hybrid warfare is not new and many unconventional activities, which form part of hybrid wars, were conducted as part of classical conventional wars of the past.

Key Takeaways

- Technology will be one of the most important factors influencing the conduct of wars.

- Gray zone and hybrid warfare are not a new concept but have acquired renewed salience in recent times. These are here to stay and hence we need to adapt and prepare for accordingly.
- Jihadist activities will evolve and there is a strong need to be proactive against the mind-set.
- Nuclear Deterrence alone is not going to work. However, for India, there is no immediate need to change nuclear doctrine or renew testing.

Report prepared by Dr. Abhishek Kumar Darbey

Session – II: Organisational Agility – Meeting the Challenges of Modern Wars

Chair: Maj Gen B.K. Sharma (Retd), Director General, United Service Institution of India, New Delhi, India.

Speakers:

5. Air Marshal (Dr.) Rajeev Sachdeva (Retd.), Former Deputy Chief of Integrated Defence Staff, HQ IDS on *Organisational Agility: Jointness a Necessity for Modern Warfare*
6. Col Vivek Chadha (Retd), Senior Fellow, MP-IDSA on *Framework for Enhancing Jointness in the Armed Forces*
7. Lt Gen Rajeev Sabherwal (Retd), Former Signal Officer-in Chief, *Indian Army on Size vs Technology in Modern Armies: A Dance for Agility*
8. Lt Gen Samir Gupta (Retd), Former Director General Financial Planning, *Indian Army on Resourcing For Military Capability Development and Effectiveness*

The second session of the DELHI DEFENCE DIALOGUE on the theme **"Organisational Agility: Meeting the Challenges of Modern Wars."** The session was chaired by Maj Gen B K Sharma (Retd), Director General, United Service Institution of India, New Delhi. In his opening remarks, the Chair highlighted the need for new doctrinal requirement considering the critical gaps at strategic level.

Air Marshal (Dr) Rajeev Sachdeva (Retd), shared his views on why Jointness in the Indian military forces is essential in order to achieve successful outcome in modern warfare.

- Though 'Military Integration' and 'Military Jointness' are related, yet there are differences in concept. Jointness refers to the ability of three services to work together in operations; whereas, 'integration' is more about deeper level of cohesion, especially in the areas of capability development, doctrines and organisational structures, where in the process becomes less distinct.
- Jointness is a necessity for modern warfare. The Kargil review Committee highlighted the urgency in the Indian context. Indian armed forces are neither joint nor integrated in a true sense.

- The speaker highlighted that the Government of India created the position of Chief of Defence Staff (CDS) on 1 January 2020 to oversee the functioning of the Indian armed forces, however, following issues need attention:
    - First, 'Joint National threat perception' need to be identified using the information gathering agencies available with respective services and later amalgamated as 'National Military Threat' under the CDS.
    - Networking and communication systems such as the terrestrial and space spectrum, sensors and networks including satellites communication, unmanned aerial systems etc need to integrated by the three services.
    - Establishing a joint logistic command and joint capabilities is vital for maximising the benefits of technologies and minimise the logistic costs.
    - Whole of Armed Forces approach is a must to take jointness forward.

Col Vivek Chadha (Retd) shared his views on the development of Indian military jointness by critically evaluating the past experiences. He identified weaknesses and strengths of the system and also the key attributes for future course of military jointness.

Jointness is a cost-effective option, yet perhaps the least developed and pursued policy initiative among countries. A brief assessment of jointness across major nations reinforces this reality. The Indian experience suggests that despite the same higher defence organisations in the country, the record of jointness varies from war to war. The Kargil conflict reflects this reality with the initial period characterised by major challenges only to be ironed out as the conflict progressed. This is also evident in the case of the Ukraine War, where Russia faced a series of initial setbacks, which can be related to poor implementation of jointness initiatives. The US Goldwater-Nichols Act of 1986 was also preceded by embarrassing failures during the 1980 and 1983 military operations in Iran and Grenada.

Some of the common issues that were highlighted through these experiences include:

- Civil-military relations and jointness within the security establishment must be characterised by an equilibrium unique to each country. Unless such a state is achieved, its adverse impact will be felt, especially during wars.
- The physical integration of the armed forces does not necessarily bring about jointness in functioning, even as integration is a desirable facilitator for it.
- Jointness is a continuous process. The mere process of creating an integrated command or other structures does not suggest the finalisation of the process. This can be seen from the US experience over the decades in an attempt to achieve excellence.
- Jointness during war under pressure and duress is not enough as a long-term solution for enhancing jointness. The examples of the Kargil Conflict and the Ukraine War are suggestive of this reality.
- Individuals will always matter positively and negatively. Ideally, jointness limits the adverse impact of their influence on nations fighting a cohesive campaign.

- The jointness model recommended by the speaker suggests the identification of seven elements, these include a sequential joint vision, policy, training, operations and feedback process, duly supported by a joint capacity building and support structure. These elements will suggest an integrated structure that functions as a facilitator. This is further supported by processes and procedures that will ensure the smooth functioning of the model. In addition, other facilitators can include an AI-supported decision-making framework, common data and communication networks.

Speaker 3: Lt Gen Rajeev Sabherwal (Retd) shared his views on restructuring of Indian armed forces. He critically examined the debate between the importance of having large-size armed forces versus technology oriented but smaller sized militaries. The former approach stresses the importance of having large armed forces, whereas the latter approach give importance to adoption of technologies-intensive military capabilities and consequently smaller size of armed forces.

- Several factors explains the reason why India maintains large standing armed forces, which include; securing long and disputed line of control and line of actual control; internal security situations in North East and Kashmir; regional geopolitical tensions in which South Asian region remain fragile; since India is prone to natural disasters, i.e. floods, earthquakes and cyclones, large man power is vital for humanitarian relief operation; complex geographical terrain to include high mountains, deserts and long coastal lines.

- The fundamental reason for the demand to invest in technologies and modernizations is essentially an outcome of the changing nature of modern warfare, which include: hybrid warfare, information warfare, precision strike, autonomous systems and space as war fighting domain and non-state actors. Evolving nature of warfare demand Indian armed forces to transform, by inducting and absorbing new and disruptive technologies, doctrinal changes and enhanced cooperation with other security agencies.

- Several countries like the United States, China and Israel have adopted a strategy of leveraging technological superiority to maintain a smaller, more agile force. Thus, India can draw valuable insights from such countries to steer its own defence modernization, which includes:

    - India should prioritize investment in technology to enhance capabilities of its armed forces and developing indigenous defence capabilities. Encourage domestic defence industry to innovate and produce high-quality technologically advanced systems.

    - Need to diversify sources of new and disruptive technologies by developing partnership with multiple nations and from private sectors.

    - Need to foster inter-service cooperation and integrating technologies across armed forces.

- Investment in R&D to compete globally in the field of technological advancements. Defence establishment also need to engage in strategic partnerships with partner countries for technology sharing and R&D collaborations

Lt Gen Samir Gupta shared his views on restructuring of Indian military forces from economic perspective, covering three aspects: role of economic development and its impact on military effectiveness; resources availability and budget allocation.

- Strong economic development is vital for enhancing military effectiveness as it helps in furthering country's technological prowess, industrial capability, human capital and infrastructure development. Some of the ways in which states can develop military capabilities include: indigenisation, investment in R&D, induction of disruptive technologies and involvement of private players.
- With regards to funding the speaker highlighted, there has been an absolute increase over 10 years -110%. However, if inflation is considered, it gets roughly evened out and increase is hardly significant.
- In order to promote military effectiveness, funding should be prioritised on five key areas:
    - This first is the need for sustained technological progress, where aggressive and coordinated R&D is vital. In this regard collaborative approach is important and government agencies, academia and industry should get involved.
    - Second, 360-degree capability development in which jointness within the services and government agencies is fundamental.
    - Third, for the preparation for prolonged conflicts, adequate stocking and production of equipment should be prioritised.
    - Fourth, for infrastructure development, new technology is essential, where procedural delays should be streamlined in timely manner.
    - Fifth, for the development of defence industrial ecosystem, there is a need to create specialisation in niche technologies, modify procurement procedures, reform funding and taxation regimes and incentivise indigenous development.

Q and A

- On the issue of how to compete with China's increasing military budget, it was stated that India is still lacking in innovation as well as 'group thinking', which is needed to critically evaluate the doctrines of war. To achieve such an objective, the role of think tank is vital. On the other hand, one should not ignore China's limitations wherein the country faces challenges in various theatre commands. China has been able to enhance its deterrence in specific fields effectively hence, India should develop its own counter doctrines.

Key Takeaways

- In the backdrop of complexity of modern warfare, military jointness has become an imperative. The way forward includes think and plan bold, restructure and reorganise and train to fight together.
- Investment in R&D is vital to compete with global technological advancement. Private sector needs to get involved.
- A balanced approach between large standing armed forces and absorption of new technologies is the way forward for India.

Report prepared by Dr. Opangmeren Jamir.

Session – III: Navigating Domains of Wars – Addressing Operational and Administrative Challenges

Chair: **Air Mshl Anil Chopra (Retd),** Former Director General, Centre for Air Power Studies, New Delhi

Speakers:

1. **VAdm S N Ghormade (Retd),** Former Vice Chief of the Naval Staff, Indian Navy on *Adaptive Defence: Addressing Operational and Administrative Challenges in Maritime Warfare*
2. **Dr Sanu Kainikara,** Adjunct Professor in the School of Humanities and Social Sciences at the University of New South Wales on *Air Power Dynamics in Modern Warfare*
3. **Prof Pascal Vennesson,** Senior Fellow and Head of Research at the RSIS, Nanyang Technological University, Singapore on *When Generals Matter: Strategic Intuition and Military Effectiveness in Land Warfare*
4. **Lt Gen Subrata Saha, PhD (Retd),** Former Deputy Chief of Army Staff and Member NSAB on *Information Warfare: Key Determinant*

The third session of the DELHI DEFENCE DIALOGUE on the theme "**Navigating Domains of Wars – Addressing Operational and Administrative Challenges**". The session was chaired by **Air Mshl Anil Chopra (Retd)**. In his opening remarks, the Chair elucidated the five war fighting domains namely land, maritime, air, space and cyberspace. He brought out that while the land and maritime domains of warfare existed since ancient times, the domains of air, space and cyberspace have emerged over the last century. He highlighted that cyberspace which is the most recent domain that has emerged has the potential to decisively influence the outcome of modern wars. This is due to the fact that unlike the other four domains, the cyberspace is not constrained by physical dimensions. With these opening remarks, he invited the first speaker to make his presentation.

V Adm S N Ghormade (Retd)

The Admiral began his presentation by highlighting the profound transformations that have taken place in the domain of maritime warfare. The first stage of this transformation took place in the nineteenth century when the transformation of naval vessels from wooden hulled sail ships to iron-clad steam propelled warships occurred. The second stage was the twentieth century with the introduction of naval aviation, radar systems, guided missiles and integrated battle management systems. The third stage of this transformation is unfolding now with the advent of artificial intelligence (AI), autonomous systems, cyberwarfare, space-bases surveillance and network centric warfare. In light of these transformations, V Adm Ghormade made the following key points and recommendations:

- In the contemporary maritime domain small, agile and well-armed platforms can be used to achieve asymmetric advantage over a powerful adversary. Such platforms may include unmanned surface vessels (USVs) and maritime drones. This has been illustrated by the Ukrainian Naval operations against Russia in the ongoing Ukraine War.
- There are growing complexities in the contemporary maritime domain as both conventional and non-conventional threats co-exist. The rise of non-state actors like Yemen's Houthis equipped with high end technology can create serious maritime security challenges as evident from the ongoing Red Sea crisis.
- Future naval warfare will be characterised by five cardinal aspects which are as follows
    - **Speed of Operations** – Outmanoeuvring adversaries by reducing decision making cycles and response times.
    - **Enhanced Battlespace Awareness** – Leveraging Command, Control, Communication, Computers and Intelligence systems (C4I)
    - **Precision Fire Power** – Use of advanced weapon systems for carrying out cost-effective and sustained operations.
    - **Low-Cost Weapons** – The economic use of force for damaging large combat platforms and resources of adversaries.
    - **Sustained and Long -Drawn Conflicts** – Use of hybrid fleets and grey zone tactics.
- In the context of the above aspects, India must ensure sustainable financial strategy for achieving self-reliance and indigenisation in the following capabilities
    - AI enabled manned and unmanned systems
    - Space and Cyberwarfare capabilities
    - Long range detection and precision targeting weapon systems
- The human element will continue to be the most important driver in the modern battlespace. As a result, there needs to be continued emphasis on developing psychological warfare capabilities and creating leadership capabilities in military personnel for swift decision making.

- India's Defence Acquisition Procedures (DAP) needs a revamp for further boosting private sector participation in defence manufacturing.
- For strengthening India's naval ship building capability there must be greater allocation of funds for R&D, reducing the dependence on foreign technology and enhancing the productivity of Indian shipyards.
- A dynamic defence industrial base can be created in India by moving away from the traditional L1 model of acquisition. Instead, an approach should be adopted which would enable the acquisition of best possible technologies.

Dr Sanu Kainikara

- Airpower is a strategic capability and an integral part of the national power of a country. This is because control of the air remains a prerequisite for ensuring freedom of operations for the nation's armed forces during times of war. Also, the operational reach, swiftness and versatility of airpower makes it an indispensable element of any nation's military strategy.
- Building a credible air power capability rests on two critical aspects. At the operational level there is a necessity to adapt to the latest technology. At the strategic level, there is a need for efficient doctrines for guiding the application of airpower.
- In the face of growing unpredictability of war, the operational philosophy of airpower must incorporate a centralised strategy & command, decentralised planning and distributed flexibility of assets. To achieve this there is a need for the realignment of the organisational structure of the air force which is traditionally pyramidical in nature.
- Despite the emphasis on jointness and integration at the operational level, Airpower at the strategic level must always remain independent and outside interferences.

Prof Pascal Vennesson

- Thucydides' account of the Peloponnesian War gives key insights on the cognitive psychology of expert intuition, formulated a proto-theory of command decision and battlefield effectiveness, which can be termed as Command Intuition Theory (CIT)."
- The theory highlights three conditions for generals' intuition to increase battlefield effectiveness which are as follows:
    - Their experience, the stability and validity of central features of their operational environment (the enemy and geography)
    - Their capability to adapt through learning (reliance on routines of proven value)
    - Their ability to make innovation (generation of new solutions).
- The Battle for Hostomel Airport in the ongoing Ukraine War is an important case study to understand this theory. This is because experts generally agree that the Battle for Hostomel Airport, as well as the broader strategic failure suffered by Russia during its

initial invasion of Ukraine, can be attributed to effective decision-making on the part of the Ukrainians, as well as blunders committed by the Russians.

- On the Ukrainian side, CIT can be applied to explain their successful counteroffensive after Russian forces had captured the airport from the defensive troops stationed to protect the airport. Although the attacks had taken the Ukrainians by surprise, and the defensive forces stationed at the airport were outmatched by the Russians both in terms of equipment and manpower—therefore, Ukrainian commanders relied on their intuition and experience to recognize the strategic implications of the situation and react swiftly.
- However, intuition alone was not the only factor influencing the outcome of events at Hostomel airport. Ukrainian forces were also able to make use of the operational environment: not only were they operating in familiar territory, they also modified the environment to their advantage. For instance, Ukrainian forces placed large vehicles and other obstacles on the runway to prevent Russian aircraft carrying reinforcements from landing, and, while retreating, managed to destroy crucial infrastructure, rendering the airfield inoperable. This was crucial for success of their subsequent counteroffensive, as Russia was unable to deliver reinforcements to defend the airport, allowing the counterattacking Ukrainian forces to encircle and bombard the occupying forces at the airport.
- The advent of AI can be increasingly integrated into military decision-making to enable leaders to make more efficient and effective decisions on the battlefield. Thus, AI does not replace the human element in CIT but strengthens the conditions which enable commanders' intuition to guide effective decision-making.

Lt Gen Subrata Saha, PhD (Retd)

- Information is the key determinant in gray zone warfare and an essential component of all the domains of warfare.
- China has made great progress in developing their Information Warfare (IW) capabilities. China established an IW taskforce comprising of senior politicians, military leaders and intellectuals in 1999. This taskforce adopted a four-pronged strategy which is as follows:
    - Targeting critical infrastructure like water and telecommunication networks, while avoiding political and military targets until required.
    - Establish business links and insert malware
    - Target through third countries' cyber operations
    - Launch attacks during elections
- The PLA has a dedicated force structure with three separate forces for serving achieving this strategy which are as follows:
    - Space troops for gathering intelligence and surveillance

- Cyber troops for hacking
- Early waring and electronic warfare troops

- It is imperative for India to urgently incorporate IW strategies into its military doctrine. In India, the ambit of IW warfare cannot only be restricted to the MoD but have inter-ministerial participation.

Q and A

Responding to a question about excessive reliance on CIT for battlefield efficiency, Prof Pascal responded by saying that the formal decision-making process and established procedures will continue to be the bedrock upon which CIT strategies can be developed. Responding to a question on the sixth domain of warfare, Air Mrshl Chopra elaborated it as the domain of civilian leadership, bureaucrats, policymakers and defence industries ecosystem of a country.

Key Takeaways

- The human element will continue to be the most important driver in the modern battlespace.
- India's Defence Acquisition Procedures (DAP) needs an urgent revamp.
- A dynamic defence industrial base can be created in India by moving away from the traditional L1 model of acquisition.
- There is a need for the realignment of the organisational structure of the air force which is traditionally pyramidical in nature.
- AI does not replace the human element in decision-making process during war but strengthens the conditions which enable commanders' intuition.
- In India the ambit IW warfare cannot only be restricted to the MoD but have inter-ministerial participation.

Report prepared by Dr. R. Vignesh

Session – IV: Age of Disruption: Transformative Technologies in Modern Wars

Chair: **Prof K. VijayRaghavan**, Former Principal Scientific Adviser to the Government of India

Speakers:

9. **Dr Rain Liivoja**, Professor and Deputy Dean (Research), University of Queensland Law School on *Law and Ethics in the Governance of Autonomous and AI-enabled Weapon System*
10. **Col Artsrun Hovhannisyan**, Head of the Command and Staff Faculty at the Vazgen Sargsyan Military University on *Autonomous, Robotic Systems in the Transformation of Modern Warfare*

11. **Dr Uzi Rubin**, Senior Researcher in the Begin Sadat Centre for Strategic Studies on *The Evolving Air and Missile Threat: Defender's Perspective*
12. **Prof Manindra Agarwal**, Director IIT Kanpur on *Network Centric Warfare*

The fourth session of the DELHI DEFENCE DIALOGUE on the theme "**Age of Disruption: Transformative Technologies in Modern Wars**". The session was chaired by Prof K. VijayRaghavan, Former Principal Scientific Adviser to the Government of India.

In his opening remarks, the Chair pointed that we are at a juncture where emerging technologies like artificial intelligence, autonomous systems, quantum computing, and cyber and information warfare capabilities are fundamentally reshaping the nature of wars and conflicts, military operations and ensuing battlespace dynamics. Operationalisation of many of these technologies are likely to raise issues concerning laws and ethics. The fact that technologies are now used to remotely take decisions may negatively impact human decision-making. Over-reliance on network systems create vulnerabilities.

The fundamental question which this session explored was how disruptive technologies are transforming modern warfare and how military leaders and policy makers can navigate this complex emerging landscape.

Dr Rain Liivoja

- He explored regulations and issues of governance in the field of artificial intelligence employed in military weapons systems.
- There are eight potential applications of artificial intelligence – targeting; intelligence surveillance, reconnaissance (ISR) capabilities; autonomous systems; command and control; battlespace healthcare; combat training and simulation; logistics and transportation; cyber security.
- Speaker highlighted two types of military artificial intelligence risks – General Risks of Artificial Intelligence Technology (safety risks; cyber security risks; human-machine interaction risks) and Risks of Artificial Intelligence to Global Security (Miscalculation; Escalation; and Proliferation risks).
- There have been various attempts at creating a governance framework for military artificial intelligence
- From 2013 onwards, there have been six parallel initiatives that are trying to regulate the use of artificial intelligence in military. These initiatives include the ones by the United Nations Human Rights Council (UNHRC); CCW; United Nations General Assembly (UNGA); Political Declarations led by the U.S. Government; Responsible Use of Artificial Intelligence in the Military (REAIM) report.
- Concepts like laws and ethics have significant interrelationships since they can inform/influence each other particularly in the field of military artificial intelligence.
- The negative impact of West led initiatives is a tendency to reflect western conceptions of what is responsible and ethical; potentially oversimplifying and misconstruing the

law; potentially conflating obligations and the practical means to comply with obligations; it requires further operationalisation and is not suited for codification as law.

- Their positive impacts include that these principles highlight technology-specific issues; they facilitate a multi stakeholder discussion; and they potentially support the development of a governance structure.

Col Artsrun Hovhannisyan

- He stressed that modern warfare is transforming due to profound changes in military science and technological developments.
- Post Cold-War technologies, like the first generations of high-precision weapons guided only by satellite systems are being easily supressed now by means of electronic warfare systems.
- Development of new technologies like Unmanned Autonomous Systems (UAVs), which are cheap, small, and possess some of the characteristics of cruise missiles, have become irreplaceable.
- He proposed the concept of a multi-layered/complex war or compound warfare which comprises of a set of actions conducted separately or together.
- These actions can be conducted in three or four physical environments – in the cyber environment, in information-psychological environment which is also known as the "cognitive" environment.
- Soft power, ideological power, subtle military interventions known as "hybrid" should be combined to the large-scale combat operations of regular troops.
- The simultaneous applications of all these actions is complex, and its planning, implementation and management will require great efforts and skills to succeed.
- Combined Joint All-Domain Command and Control (CJADC2) are constantly evolving. They may not be ideal, with troops often complaining about the efficacy of their work, but they offer great perspective.

Dr Uzi Rubin

- He noted that the present landscape of air and missile threats is fast evolving and growing complex. The days of threat from crewed aircraft and Keplerian trajectory ballistic missiles have now evolved into a full spectrum of threats. They range from rotary wing drones to cheap cruise missiles, to hypersonic, atmospheric ballistic missile that follow non-Keplerian trajectories.
- The cost of defending against any air and missile threat is now higher than the cost of the threat itself.

- Air threat was effectively managed by air defence, which in turn compelled the emergence of the threat of ballistic missiles whose steep trajectory and high speed made them immune to air defences.
- There are four kinds of air threats – Combat aircraft; Ballistic missiles; Cruise missiles; and modern UAVs. All of them operate within a unique envelope, which was relatively easy to define. Subsequently, this led to devising of either generalized or specific defensive systems or tactics.
- There are three main families of disruptor threats – hypersonic missiles; combat UAVs; and rotary wing drones.
- Hypersonic threats are of three kinds – Aeroballistic hypersonic missiles which fly along minimum energy trajectories but once they re-enter the atmosphere at hypersonic speeds, perform violent and unpredictable manoeuvres. The second type is hypersonic glide vehicles and the third type is hypersonic cruise missile which uses air breathing propulsion.
- Combat UAVs come in two forms - attack UAVs and suicide UAVs which contains built-in warheads within their fuselages.
- Rotary wing drones are unique in combining precision with very low cost. Their affordability means that the more you shoot them down, the more they come.

Prof Manindra Agarwal

- He noted that the infusion of technologies including the advent of drones for defensive and offensive tasks is creating the way for a new period of network-centric warfare.
- Warfare becomes network-centric when the domain of cyber space through which we make decisions and act gets added to the traditional dimensions of land, sea, and air.
- He stated that there are four grids – Information grid (connection of all the data needs to be accessible readily and amenable to analyses); Sensor grid (more and more soldiers on the battlefields are getting wired); Communication grid (network backbone which allows the data to move from one point to another); and Engagement (weapon systems are connected through this grid and actions get initiated through this grid).

- As we rely more on digital infrastructure, the possibility of manipulation also increases through cyber-attacks (communication grids, networks, and command and control systems could be attacked by adversarial actors).
- We are witnessing a new domain of warfare – called “Information warfare”. The type of techniques available to both state and non-state actors are unusual and effective. Information warfare by state actors against other states is a continuous process which is going on all time.

- The future of warfare is changing rapidly with every nation state moving towards a net-centric future. But how it will look like in the future is something we can only speculate.

Q and A

- In the Q and A round, the main question that was asked revolved around how to reconcile the current pace of development in artificial intelligence with respect to regulations. Prof Rain Liivoja explained the requirement to balance between what is desirable and what could actually be delivered, when it comes to international regulatory framework.
- There was also a question on the impact of climate change, artificial intelligence, and biotechnology on the nature of warfare.

Key Takeaways

- The challenge for military leaders and policy makers is to find the appropriate ways to define deterrence in a non-conventional domain of warfare.
- No military wants to use technology that are unsafe for themselves. Therefore, safety standards and a governance framework for the regulation of artificial intelligence in military affairs.

Report prepared by Dr Abhishek Mishra

Session–V: Strategic Partnerships - Enhancing National Security through Collaboration

Chair: **Amb Ashok Sajjanhar,** Member, Executive Council, MP-IDSA, New Delhi, India

Speakers:

1. **Mr Derek Grossman**, Senior Defence Analyst, RAND Corporation on *Nothing is Guaranteed: Considering the Future of US-India Strategic Partnership*
2. **Dr Andrey Kortunov**, Academic Director of the Russian International Affairs Council on *Collective Security in (Eur)Asia: Views from Moscow and from New Delhi* (Online)
3. **Dr Frédéric Grare**, Senior Research Fellow, ANU National Security College on *Enhancing National Security through Collaboration: The EU-India Strategic Partnership*
4. **Dr Oshrit Birvadker**, Senior Research Fellow at the Jerusalem Institute for Strategy and Security (JISS) in Israel on *The Changing Trends in India-Israel Defence Equation: The Iron Swords War*

The fifth session discussed on **"Strategic Partnerships - Enhancing National Security through Collaboration"**. The session was chaired by Amb Ashok Sajjanhar, Member Executive Council, MP-IDSA. The chair introduced the session, and welcomed the paper presenters. Amb Sajjanhar emphasised on the importance of peace, security, dialogue and diplomacy as wars cannot resolve conflicts. The session provided an in-depth discussion on the issue of building strategic partnerships and boosting national security.

Mr Derek Grossman

Mr Grossman briefly discussed about the historical background of America's relations with India, particularly during the Cold War period when both countries had frosty relationship. However, the bilateral relations saw a positive change after the 11 September 2001 incident, and the United States-India nuclear deal in 2005.

- Mr Grossman argued that, despite the surge in the partnership between these two nations, the hangover of the past and mutual suspicion still impedes the relationship between Washington DC and New Delhi.
- Nonetheless, there have also been efforts to overcome the contentious issues and promote cooperation between US and India in the Indo-Pacific and establish a democratic alliance of the "like-minded" countries of the region.
- There have been convergence of interests between the US and India with regards to China's rising assertiveness, the need to secure the supply chains of economic production and freedom of navigation in the Indo-Pacific. There has also been cooperation between the two countries on security issues, defence technologies and other areas of mutual interests.
- Mr Grossman also highlighted certain issues of concern between the US and India and concluded that the future of US-India strategic relations shall depend on overcoming these challenges.

Dr Andrey Kortunov

Dr Kortunov began by describing the positive aspects of Russia-India relations based on mutual respect and understanding. However, both countries face different sets of security challenges. Russia faces threats from the Western powers whose interest is in keeping the Asian continent divided and weak.

- India's approach towards the presence of external powers in Asia is different from Russia, as for New Delhi Asian power like China is the primary threat. Therefore, India has joined several US-led multilateral forums to counter Beijing's rising military power. As a result, the strategies of Russia and India vary on the issue of Asian security.
- For Moscow, the presence of external forces in Asia is the vestiges of the Cold War and is not needed in the present circumstances. But from Indian perspective, due to the absence of any regional grouping to counter China, external powers play a balancing role. Also, views on the issue of Indo-Pacific significantly differ in Russia and India.
- Moscow has been striving to build a security coalition or the "new Eurasian System" which would be inclusive and comprise of all states of Asia and Europe. However, Indian perspective is different from this Russian approach on collective security in Eurasia, as New Delhi has been more focused on the security dynamics in its neighborhood and the Indian Ocean region.

- While Russian aim has been to avoid the United States from any security arrangement in Eurasia, New Delhi has been more concerned over the dominance of China in India's neighbourhood while building security partnership in the South Asian region.
- According to Dr Kortunov, the primary reason for the diversion in the strategic thinking of Russian and Indian security experts is because they apply different methodological tools in their understanding of the international relations.
- In conclusion, he argued that despite differences, Russia and India can cooperate and learn from each other's experiences.

Dr Frédéric Grare

- In his paper, Dr Grare gave the background of European Union's desire to enhance partnership with India on the security issue. However, the goal of the EU-India security partnership has not yet been realised. India's approach towards the United States in the post-Cold War phase also had little impact on New Delhi's policy towards Brussels.
- Differences also persisted between EU and India over Russia and New Delhi's nuclear weapons programme. Nevertheless, both EU and India have begun cooperation in the Indo-Pacific region and to counter newly emerging threats including terrorism.
- Dr Grare argued that the perception of security threats from China has also brought EU and India closer to some extent. But despite these new developments, the security cooperation in EU-India relationship remains weak. The cooperation in the defence production between the two sides has also been limited.
- In conclusion, the speaker emphasised on the convergence of views on the Indo-Pacific and the need for further deepening of security partnership between the EU and India.

Dr Oshrit Birvadker

- Dr Birvadker argued that the deepening defence partnership between India and Israel has provided Jerusalem with an alternative and reduce its dependence on the Western powers. The ongoing Israel-Gaza conflict has delivered important lessons to Israel regarding the risks of reliance on the Western powers especially US for the supply of arms.
- In the paper, Dr Birvadker discussed the historical background and the significance of American support to Israel's security and defence needs. However, the over-reliance on the United States has thrown challenges to Israel's autonomy in decision making and independence in foreign affairs.
- Building economic and defence partnership with India has been a significant development. New Delhi's support to Jerusalem in the ongoing conflict between Israel and Gaza is indeed unprecedented and has deepened India-Israel bilateral relationship.

- The cooperation between India and Israel regarding the production of defence equipment could be mutually beneficial to both the countries. The "Make in India" strategy and *Atmanirbhar Bharat* initiative of New Delhi have also provided opportunities for increased collaboration between the Indian and Israeli companies.

- Dr Birvadker argued that, while for Israel the United States shall remain an indispensable partner, it is imperative for Jerusalem to diversify its strategic partners and sources of defence equipment. In this regard, India could be a useful partner for Israel to achieve self-reliance in defence production and maintain sovereignty in the international relations.

Q & A Session

The Q & A session witnessed a range of queries related to the viewpoints presented by the presenters. Questions and comments were raised to Mr Grossman about the security policy of President-elect Donald Trump, and on India's domestic politics. Dr Kortunov was asked about India's engagement in the South Caucasus. Dr Grare was asked about America's policy towards the European Union under incoming Trump administration. Dr Birvadker replied on the issue of threats to Israel from the Houthis. The session concluded with insightful remarks by Amb Sajjanhar.

Key Takeaways

- The papers presented in this session highlighted the significance of India in the regional and international affairs, and the importance of New Delhi in the international perspectives of the United States, Russia, the European Union and Israel.

- The panel provided diverging and contrasting viewpoints regarding the contemporary international politics, geopolitical dynamics in the Indo-Pacific and emerging security threats.

- Mr Derek Grossman and Dr Andrey Kortunov largely explained the divergence in India's strategic perspectives vis-à-vis the United States and Russia, respectively.

- Dr Frédéric Grare and Dr Oshrit Birvadker largely discussed about the developing strategic convergence between India vis-à-vis the European Union and Israel, respectively.

Report prepared by Dr Ranjit Kumar Dhawan

Session – VI: Policy Perspectives - Advancing Domestic R&D Capacity in Defence

Chair: Dr G Satheesh Reddy (Retd), President, Aeronautical Society of India,Former Chairman, DRDO

Speakers:

1. **Gp Capt R K Narang, PhD (Retd)**, Senior Fellow, MP-IDSA on *Perspectives: Advancing Domestic R&D Capacity in Defence, particularly in the area of Government Capacities and Initiatives*

2. **Brig Ashis Bhattacharyya (Retd)**, Principal Advisor at Confederation of Indian Industry on *Private Defence Industry R&D in Defence Sector*
3. **Dr Nabanita Radhakrishnan**, Former Director General DRDO (SAM & R&M) on *Advancing Domestic R&D Capacity in Defence: Role of Academia*
4. **Prof Tai Ming Cheung,** Director, University of California, Institute on *Global Conflict and Cooperation on How China's Defence Science, Technology, and Industrial Eco-System Balances Between Absorption and Self-Reliance*
5. **Mr Jayant Patil,** Director and Senior Executive Vice President for L&T's Defence Business on *Navigating Protracted Wars and Sanctions - Mitigating Risks in Defence Resource Management (Production)*

The sixth session, titled "**Policy Perspectives - Advancing Domestic R&D Capacity in Defence**", was chaired by **Dr. G Satheesh Reddy (Retd**). In his opening remarks, Dr. Reddy explored the pivotal role of technology in the evolution of warfare. He emphasised the importance of indigenous technology, noting that achieving customisation and uniqueness is key for India to gain a strategic advantage over potential adversaries. Self-reliance in the defence sector is a fundamental aspect of *Atamnirbharta*. He also highlighted the need for widespread academic involvement through applied research, stressing that innovation in specialised areas is crucial for developing manufacturing technologies.

Gp Capt R K Narang

Historical Trajectory of Indian Defence and Aeronautics R&D. Group Captain Narang discussed the evolution of Indian domestic defence R&D and cited trajectory of Indian domestic aviation design and manufacturing industry as an example. The evolution of the Indian aeronautics industry was divided into four phases. The First phase was described as the Aeronautics Revolution spanning between 1947-1970) in which several indigenous development projects were initiated. However, the progress made in the first phase was not leveraged for *Atamnirbharta* in the subsequent the second phase, i.e. between 1970s and 2000, which he described as the period of uncertainty. The focus of the domestic industry during this phase shifted from domestic design and development to license manufacturing, which had adverse impact on domestic D&D capabilities. Subsequently, wef 2001 to 2020, was a phase of consolidation as Indian industry focused on developing critical technologies for indigenous R&D projects. He described the fourth and the ongoing phase as the Second Aeronautics Revolution began that began in 2021. This is the promising phase in which orders were placed or indigenous manned and unmanned aerial systems were inducted into Service. Some of the aviation systems that were inducted or orders were placed include the Light Combat Aircraft (LCA) Tejas, Armed Advanced Light Helicopter (ALH) MK-IV, Light Combat Helicopter (LCH), Light Utility Helicopter (LUH), Hindustan Turbo-Trainer-40 (HTT-40), Dornier-228 light transport aircraft, and TAPAS Unmanned Aerial Vehicle (UAV). In addition, significant progress has been made Tejas Mk-2, Kaveri aero-engines, Intermediate Jet trainer (IJT) and Saras light transport aircraft.

- India's UAV Program. The progress in Unmanned Aerial Vehicle (UAV) development was highlighted with contributions from both public and private sectors.

- Private Sector Integration. Gp Capt Narang highlighted certain initiatives which have been taken to integrate the private sector in a more efficient manner such as liberalised foreign direct investment (FDI) policies, increased FDI limits (74 percent via automatic route and hundred percent with government approval) and establishment of Defence Industrial Corridors in Uttar Pradesh and Tamil Nadu to attract investment and infrastructure for manufacturing. He highlighted Indian government's focus on integration of Indian private sector in defence research, development and manufacturing, recent reforms in defence acquisition procedures, launching of innovation and Start-Up India initiatives and establishing of incubation centres in academia.
- Reforms in Public Sector. He highlighted reforms in the public sector such as corporatisation of DPSUs, reorganisation of Ordnance Factories and updates in acquisition procedures, promoting private sector innovation and partnerships. In addition, defence forces have established design directorates to support innovations by the private sector especially startups.
- International Collaborations. The author highlighted progress and limitations of India's collaborations with Russia (FGFA, BrahMos missile), Israel (Barak Missile), France (helicopters, submarines), the USA (DTTI, INDUS-X, ICET), and Spain (C-295 aircraft) and he called for transformation from 'license manufacturing' to 'co-development and co-production' of defence technologies. He emphasised the need to have a roadmap for local manufacturing of critical systems, upgradation / modification and development of future variants of C295 with clear work share and joint IP creation by the Indian production partner, i.e. Tata Advanced Systems Limited (TASL).
- Challenges and Future Reforms. The speaker stressed the need for further reforms in defence R&D and called for creation of R&D structures in Department of Military Affairs (DMA), Integrated Defence Staff (IDS), Indian Army (IA), Indian Navy (IN) and Indian Air Force (IAF). This structure could be created based on learnings from international models such as Air Force Research Laboratory (AFRL), Office of Naval Research (ONR), Army Innovation Command and Army Futures Command (AFC) of the USA and Science and Technology Department (S&T Dept) and Equipment Development Department (EDD) of the Central Military Commission (CMC); and Research Laboratories of Peoples' Liberation Army (PLA) ground, air and naval forces of China. He quoted fellow panelist and China scholar Prof Tai Ming Chung, who has highlighted significant role played by the S&T Dept & EDD of CMC in the technological progress of PLA. He observed that these structures would not lead to duplication of R&D that is being undertaken by the DRDO as has been seen in China and the USA. He emphasised the need to focus on defence technology forecasting, design and indigenous development of niche technologies while suggesting improvements in funding, project timelines and called for introducing accountability principle to obviate delays and reduce failures in domestic R&D projects.
- Reforms in Civil and Private RD. GC Narang emphasised the necessity for formulating the Atmanirbhar Bharat policy for civil aviation, drones and other industries creation of R&D structures in civil Ministries and launching of civil industrial, aviation and drone innovation initiatives and alignment of R&D efforts by incubation centres of academia in sectors like semiconductors, electronics, and airspace integration to fill the technology gaps and overcome vulnerabilities

- R&D Ecosystem Enhancements. The large private companies need to become more aspirational in Intellectual Property Rights (IPR) creation by increasing investment in the R&D and hand holding of small players. These measures will help in increasing participation of the private sector in the defence and aeronautics design and development. Also, civil infrastructure needs to be created for defence, aviation and drone testing, formulation of certification standards while collaborations with global Original Equipment Manufacturers (OEMs) need to focus on co-development and co-production with clear work-sharing structures.

Brig Ashis Bhattacharyya (Retd)

- India's Dependence on Imports and Need for Domestic R&D. India is the world's largest arms importer, with a significant reliance on foreign suppliers. Developing a robust domestic defence industry is crucial for self-reliance, requiring active private sector involvement in R&D.

- Global R&D Trends and India's Position. India spends 0.64 percentage of GDP on R&D, with 36.4 percentage from the private sector which is low compared to global leaders like South Korea and the US, where private sector contributions exceed 70 percentage. India ranks high in research publications but has a gap in translating research into patents and commercial products.

- Defence Production and Export Targets. India aims to boost defence production to ₹3 lakh crore by 2030 and increase exports to ₹50,000 crore, focusing on domestic production and partnerships for technology infusion.

- Self-Reliance Index (SRI). The Self Reliance Index, targeted at 70 percentage by the government in 1992, has reached approximately 40 percentage in 2023-24. This reflects moderate progress yet underscores the need for more aggressive policy reforms and private sector engagement.

- Private Sector's Role and Investments. Brig Bhattacharyya highlighted that India's private sector defence R&D expenditure remains low, averaging 1.2 percentage of revenue compared to the global average of 6.8 percentage for leading countries. Companies like Hindustan Aeronautics and Bharat Electronics are notable exceptions with higher R&D intensity, but most firms need to increase investment to be globally competitive.

Key Government Initiatives and Schemes such as TDF (Technology Development Fund) and iDEX (Innovations for Defence Excellence), ADITI (Advanced Defence Innovations and Technology Initiative) supports MSMEs and start-ups through funding, grants for defence technology projects, and emphasises on the development of disruptive technology. Another initiative, which is the DCPP (Development-cum-Production Partner Program) also works towards enhancing public-private collaboration for defence production.

- Recommendations for Strengthening R&D. To stimulate private sector investment in defence R&D, measures include tax deductions, grants, and simplified processes. Emphasis is placed on fostering innovation clusters and addressing critical technology gaps, along with offering incentives for patents and technology commercialisation.

Additionally, expanding scholarships and promoting international collaborations are key to building a skilled workforce equipped for defence innovation.

- Strategic Mix for Defence R&D. According to Brig Bhattacharyya, the ideal R&D model divides responsibilities among DRDO (basic and strategic R&D), DPSUs (strategic production and product development) and the private sector (product R&D and development). For India to achieve defence self-reliance, there is a need for deeper private sector integration into the defence R&D ecosystem, supportive government policies and enhanced collaboration across academia, industry and the public sector.

Dr Nabanita Radhakrishnan

- Role and Contribution of Academia in Defence R&D. She delved on India's defence ecosystem, where the DRDO handles core technology development while DPSUs and private sectors manage production and academia focussing on early-stage research and skill development. Academia also supports DRDO projects by offering defence-specific courses, conducting fundamental research, and engaging in DRDO-funded initiatives. India's limited academic involvement is in contrast with countries having robust private sector engagement in defence R&D, where joint IP creation and advanced infrastructure supports significant research outcomes. She underscored the need for India to bolster investments in basic science within academia, support parallel research streams, and improve collaboration and IP practices to create a self-reliant defence ecosystem.

- Private Sector's Emerging Role in Defence R&D. Recognising the critical role of R&D in defence, initiatives like **Make in India** and **Atmanirbhar Bharat** encourages private-sector involvement to reduce public sector dependency. Government schemes such as iDEX, ADITI, and TDF are fostering industry-led innovations. Advanced fields like AI, cybersecurity and autonomous systems remain underdeveloped in India's private sector compared to leading defence nations. The recommendations focus on tax incentives, grants, streamlined procurement, and IP support to boost innovation.

- Shared Challenges and Opportunities for India's Defence R&D. Dr Radhakrishnan emphasised that both academia and private industry require sustained funding and enhanced infrastructure. India's low R&D expenditure (0.64% of GDP) significantly lags behind other global leaders. The recently enacted Anusandhan National Research Foundation (ANRF) Act and increased budget allocations aim to address these deficits. Developing a skilled workforce through fellowships and international collaborations is crucial to close the talent gap, especially in high-tech fields.

- Technology Focus Areas. For both academia and the private sector, the focus on emerging technologies such as AI, quantum photonics, hypersonic propulsion and cybersecurity is critical to achieving self-reliance and global competitiveness in defence. Increased collaboration between academia and private industry, targeted funding, and incentives are necessary for India to strengthen its defence capabilities and reduce its reliance on imports.

Prof Tai Ming Cheung

- The speaker explored China's defence technology development strategy, which balances between adopting foreign technologies (via the IDAR model) and promoting indigenous innovation.
- IDAR Model. Prof Cheung spoke on how China traditionally used the IDAR model (**Introduce, Digest, Assimilate, Re-Innovate**) to build its defence capabilities by acquiring and reverse-engineering foreign technology, particularly from the Soviet Union. This approach helped bridge the gap with advanced military powers.
- Shift to Self-Reliance. Under Xi Jinping, China is moving toward indigenous innovation due to tightened global restrictions on technology access. With strategic milestones set for 2027, 2035, and 2050, China aims to lead in defence technology with self-reliant capabilities.
- Major Reforms. China has restructured its defence industrial and armament management systems, encouraged innovation at the enterprise level and strengthened its manufacturing base. Programs like Made in China 2025 and New Quality Productive Forces (NQPF) focus on modernising strategic industries with advances in cyber, AI, and precision technology. These efforts have led to significant advancements in military technology, including fighter jets, missiles, and naval vessels.
- Defence Modernisation Trends. China's weaponry and military technology have rapidly modernised, reflecting a shift from the IDAR approach to a balanced model prioritising indigenous innovation and long-term self-reliance. China's defence strategy is evolving from dependency on foreign technology through the IDAR model to a dual strategy that increasingly emphasises self-reliant innovation. Through this, China seeks to establish itself as a global leader in defence technology by mid-century.

Mr Jayant Patil

- Mr Patil addressed the multiple prolonged ongoing conflicts, including the Israeli-Palestinian conflict, Russia-Ukraine war, and civil wars in countries like Sudan, Myanmar, and Yemen. He emphasised on the global impact and the strategic implications of these conflicts.
- Multi-Domain Warfare. He highlighted the emergence of low-cost autonomous systems, misinformation, and social media manipulation as critical elements in modern warfare. Nations face challenges from multiple fronts, requiring capabilities that can be operated remotely.
- Indian Defence Industry. India has become one of the world's largest arms importers and has made significant strides in arms exports. Initiatives have aimed to boost self-reliance, such as increasing indigenous content in defence products, funding R&D, and encouraging private sector involvement. Despite efforts, private defence industry growth faces hurdles due to a non-level playing field and slower-than-expected results from government reforms.

- Policy Reforms and Challenges. Various initiatives like iDEX, TDF Scheme, and the Defence Production and Export Promotion Policy (DPEPP) have been launched to encourage domestic production. However, implementation gaps and procedural delays have limited their success.
- Historical and Strategic Perspective. Mr Patil underscored India's history of facing Western sanctions and technology control regimes, which influenced the drive for self-reliance in sectors like nuclear and space. Defence remained reserved for the State until reforms in the early 2000s allowed private sector involvement. The push towards self-reliance intensified after the Kargil War, revealing vulnerabilities in defence preparedness.
- Current Defence Spending and Production Goals. India's defence production target is set at ₹3 trillion by 2028-29, with exports targeted at ₹0.5 trillion. Despite policy support, the private sector's role in defence production remains constrained by existing institutional challenges.
- Call for Comprehensive Reforms. Mr Patil stressed the need for professionalising acquisition processes, reforming quality assurance procedures, and enhancing project management. He calls for a cohesive, long-term strategy to achieve reliable domestic defence capabilities and meet India's defence and economic needs amid prolonged conflicts and sanctions.

Questions and Answers

- A question was raised regarding the impact of China's selective restrictions on critical mineral and dual-use technology exports. However, these restrictions are seen to serve more as political signalling than as consistent policy measures.
- The second question was on what policy implementations are necessary to foster greater success between academia and the defence industry. The speaker responded that there is no gap in terms of capability while the gap in policies need to be addressed. There is a need for greater autonomy and trust between the government and industry along with creation of supportive structures in R&D, such as the US model of Defence Advanced Research Projects Agency (DARPA), to support indigenous projects cooperatively.

Key Takeaways

- Integration of Private Sector and International Collaboration. Policies like liberalised FDI and the creation of Defence Industrial Corridors support private sector participation. Key international collaborations (e.g., with Russia, Israel, France, and the USA) are enhancing technological capabilities and knowledge transfer, aligning with India's self-reliance goals.
- Policy and Structural Reforms for R&D Ecosystem. India has introduced various initiatives (e.g., iDEX, TDF, ADITI) to encourage R&D and innovation in defence, especially among start-ups and MSMEs. Reforms also aim to improve procurement processes, public-private partnerships, and support for domestic manufacturing.

Additionally, clear synergies need to be developed between the R&D sector, industry, DRDO and academia.

- Challenges in R&D Investment and Talent Development. India's R&D investment (0.64 percent of GDP) lags global averages, with limited private sector engagement. Addressing bureaucratic inefficiencies, improving infrastructure, and increasing funding and incentives for private companies are essential to bridge this gap and foster innovation. Additionally, funding for R&D also needs to be increased sufficiently to increase core capacities needed to be developed.

- Strategic Focus on Indigenous Innovation and Modernisation. Emphasis on emerging technologies like AI, cyber, and quantum systems mirrors China's model of self-reliance. India's approach combines indigenous innovation with international collaboration, aiming to reduce dependence on imports and advance global competitiveness in defence by developing a robust domestic ecosystem.

Report prepared by Dr Shayesta Nishat Ahmed.

Session – VII: Protracted Wars and Sanctions - Mitigating Risks in Defence Resource Management

Chair: ACM R K S Bhadauria (Retd), Former Chief of the Air Staff

The seventh working session of the DELHI DEFENCE DIALOGUE was on the theme "Protracted Wars and Sanctions - Mitigating Risks in Defence Resource Management". The session was chaired by ACM R K S Bhadauria (Retd), former Chief of the Air Staff. In his opening remarks, the Chair remarked on the changing Nature of war while highlighting the technological developments, including the disruptive technologies which has opened up new field of study with no predefined template.

Speakers:

1. **Maj Gen Abhay Dayal**, Additional Director General Acquisition Technical (Army) on *Navigating Protracted Wars and Sanctions: Mitigating Risks in Defence Resource Management*

2. **Mr Amit Cowshish,** Former Financial Advisor (Acquisitions) in the Ministry of Defence on *Collaboration with Foreign Partners for Self-Reliance*

3. **Lt Gen Oue Sadamasa (Retd),** Senior Fellow at the Sasakawa Peace Foundation on *Logistics in the Times of Protracted Conventional Wars Under the Shadow of Sanctions and Export Control Regimes: Japan's Perspective* (Online)

4. **Prof Mr S P Shukla,** Chairman, Mahindra Aerospace and Defence on *Indigenous Industrial Eco-Systems: The 5th Pillar of Defence*

Maj Gen Abhay Dayal

- Protracted wars are conditional in which a nation is compelled to dip into its war reserves leading to a situation where the fighting potential of its armed forces becomes a challenge. Also, while it was an accepted postulate earlier that the future wars would be short and intense, however, the ongoing conflict between Russia and Ukraine has raised serious concerns on the veracity of the forgone conclusion.
- The capacity of a nation to stage a war for a protracted period would be directly dependent on the economic and military might of the nation and can be derived from the strategic autonomy possessed in terms of its war-fighting potential, including its production and sustenance capabilities.
- India's maintenance of war reserves till now have been based on its war experience of short wars resulting in its military resource planning for maintaining the war reserves for a limited and short duration wars. But in an era of geopolitical tensions and protracted wars and conflicts, the management of defence resources, particularly in terms of manufacturing and procurement of weapon systems and other logistic items play a crucial role in national security strategy.
- Sanctions in the past had a limited impact on India due to their limited durations.
- The ongoing protracted wars in Ukraine and Gaza could impact India's defence procurements due to supply chain disruptions. To mitigate the issues of supply chain disruptions India will need to undertake two measures: international measures, through the diversification of defence sources which will help protect against supply chain disruptions and the domestic measures such as indigenisation, technology transfers, and pragmatic stockpiling after undertaking critical examination and cost-benefit analysis. Defence resource management through diversification and self-reliance through indigenisation are necessary measures against supply chain disruptions.

Mr Amit Cowshish

- Self-reliance has still not been realised. In the initial years after independence, Transfer of Technology (ToT) and imports were the best options for the young country, however, considering the advancement all around and the growth of Indian economy with matching inclusive talent there is a need for a tectonic shift.
- Self-reliance is measured on the parameters of indigenous content and what a country buys from the local industry, however, it can be misleading. There may be a product in which though the majority of parts are manufactured locally, however, critical components are still imported. In such a scenario to construe the complete product as indigenous would be incorrect.
- Supply chain disruptions and sanctions can have dire consequences on defence production.
- Real self-reliance is achieved when a country designs, develops and produces critical technology and futuristic equipment.

- ToT is part of acquisition process, but the focus should shift to in house development of the critical technology. Defence research and development (R&D) must be the primary goal of the domestic industry.
- To achieve self-reliance, changes are required in Structural, Procedural, Budgetary domains.
- **Structural Reforms**: DRDO needs structural reforms. The government has recently constituted a high level DRDO Reforms Committee, which has submitted its report.
- **Procedural Reforms**: Foreign companies are at times involved at various stages of the procurement process. Sometimes R&D also requires collaboration with foreign companies. During such processes many issues related to intellectual property rights, liabilities, sharing of sensitive data may arise. With complicated regulatory system in India there is a need for the common meeting ground where both government and private players' interests are safeguarded.
- **Budgetary Reforms**: Currently, sizable budget allotted to ministry goes for paying salaries thus leaving very little for serious research. Proportion of budget for R&D in 2023-24 has dropped as compared to 2018-19.
- **Need for Changed Attitude**: The is a need for the government to look beyond buyer-seller relationship when the new equipment is bought from private or public sector. The relationship must be that of a partnership.

Lt Gen Oue Sadamasa (Retd) (Online)

- Japan's security environment has been most severe in the post-World War II era. Globally, there is shift in balance of power and new challenges are being faced in this new world order.
- In the Indo-Pacific region, China is the greatest security challenge questioning the status quo. While on one side North Korea's development of nuclear and hypersonic weapons poses grave and imminent threat, on the other hand Russia has emerged as a strong security concern. Thus, the collusion among the three states has emerged as a bigger challenge for Japan than ever before.
- The National Security Strategy, the National Defence Strategy, and the Defence Buildup Plan of 2022 has transformed Japanese defence posture from defensive to offensive. Some of the key changes in defence related matters includes doubling of defence budget from 1% to 2% of GDP by 2027, possession of counterstrike capabilities, enhancing domestic defence industry and establishing a Joint Operation Command.
- Japan's partnership with the US is extremely important from the point of view of equipment and technological cooperation. Logistics and industrial base are inseparable parts of an integrated deterrence posture, which essentially require multilateral cooperation.

- The Indo-Pacific region presents an opportunity to deepen multilateral collaboration on regional industrial base, manufacturing and tackling production challenges. Japan, U.S. and partner countries are synchronised in reinforcing their domestic defense industry, mitigating supply chain risks and promoting bilateral logistic cooperation.
- Japan needs to transform its domestic defense industry into a more capable, sustainable, autonomous and global security infrastructure. The Three Principles on Transfer of Defence Equipment and Technology, and Implementation Guideline, together with security export control, should be adapted to today's complex security environment.
- Defense industrial cooperation needs to be expanded under the QUAD framework while the Southeast Asian countries can also play a major role in this endeavour.
- The Japanese defence industry should be pro-active in inducting advanced defense technologies not only from the U.S. but also from other partners, including NATO members and Israel.

Mr S P Shukla, Chairman, Mahindra Aerospace and Defence on Indigenous Industrial Eco-Systems: The 5th Pillar of Defence

- There is a need to change the perception and accept defence industry as an integral part of India's defence establishment and not seen as merely a supplier. This is crucial in order for a nation to grow as a military power. Therefore, defence industry needs to be an extension of a nation's national security strategy.
- The state of defence industry also depends on the state of a nation's industrial development as both cannot exist in isolation and are co-dependent. For a nation to become a major power a strong economy and industrial base is a necessity and not merely a sufficient condition.
- Conflicts in the last two decades have been shaped by new and emerging technologies. Therefore, investments towards developing critical technologies become crucial as imports at best only enables know-how.
- The possibility of non-conventional wars involving nuclear weapons has declined while that of conventional wars has increased leading to a surge in the demand for conventional weaponries. Protracted wars will lead to the depletion of military assets and resources which needs to be maintained and replenished, by strengthening the defence industry. Apart from changing the mind set regarding defence industry requires effective planning, increased R&D, investment in niche technologies, and defence exports.

Key Takeaways

- Protracted wars and sanctions impact supply chains causing disruption to defence procurement. This can be addressed through building self-reliance and indigenisation,

while next generation technologies such as AI, quantum, amongst others, would still need multilateral joint collaboration.

- The country should identify next generation technologies in the fields of AI, cyber, space, unmanned systems, among others. This can be achieved through joint collaboration with foreign partners.
- Need for change in the mindset in order to achieve self-reliance and indigenization in critical technologies along with undertaking corrective measures such as Structural, Procedural, Budgetary reforms in Defence acquisitions and procurement procedures.
- Defence Industry is to be seen as an extention of the defence esablishment.
- The Indo-Pacific region presents an opportunity to deepen multilateral collaboration on regional industrial base and manufacturing production challenges.

Report prepared by Dr Temjen Ao and Mr Niranjan Chandrashekhar Oak

Vote of Thanks

Session VII was followed by Vote of Thanks by Col Rajneesh Singh (Retd).