Seminar Report

IMPACT OF CLIMATE CHANGE ON MILITARY OPERATIONS: AN APPRAISAL

Seminar Coordinator: Col Akhilesh Kumar

Centre for Land Warfare Studies
RPSO Complex, Parade Road, Delhi Cantt, New Delhi-110010
Phone: 011-25691308; Fax: 011-25692347
email: landwarfare@gmail.com; website: www.claws.in

The Centre for Land Warfare Studies (CLAWS), New Delhi, is an autonomous think tank dealing with contemporary issues of national security and conceptual aspects of land warfare, including conventional and sub-conventional conflicts and terrorism. CLAWS conducts research that is futuristic in outlook and policy-oriented in approach.

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EXECUTIVE SUMMARY

Climate change is a major global challenge....We, in India, face consequences and see the risk to our farmers. We are concerned about rising oceans that threaten our 7,500 km of coastline and 1,300 islands. We worry about the glaciers that feed our rivers and nurture our civilisation.

Prime Minister Modi
November 2015

- **Climate Change**
  - There is evidence that the temperatures around the planet are raising. Scientific consensus shows that this is caused by human activity. Humanity can and should try to stop this, mitigate its effects, and prepare to adapt.
- **Challenges of Climate Change**
  - There is difference in geographical scope, severity of impact, temporal, cascading non-linear impact. The biggest threat is the non-homogenous impact of climate change, even within a country. Asia, for instance, has had the maximum impact, both in terms of loss of life and economic loss.
  - Global scale, complex dynamics, incomplete and imperfect knowledge, long-term implications.
  - Number of actors, complexity of action, decentralised action, cross-cutting impact.
  - Differing capacity and capability, significant time lags.
- **Future Potential Climate Induced Events**

  The Himalayas
  - Glaciers and permafrost in the fragile Himalayas and Tibetan plateau, already under strain from military deployment, are

melting abnormally. The meltdown may become very rapid, which has its own military implications such as disruption of communication and water flow variation.

– In 2007 out of 9,575 glaciers in India, research had been conducted only on around 25 to 30.

Siachen Glacier

– Need to factor in impact of the sudden and accelerated meltdown of glaciers in the next 10-15 years. Once the glacier/snow caps melt, only the rocks would remain. Rapid melting would bring in flash floods and a series of mini-disasters downstream.

- **Impact of Climate on Defence Forces**
  - Increased risk to infrastructure and life by erratic climate and weather extremes, altered ecosystems and habitats, human health, and society.
  - Change in role: HADR, civilian support/aid to civil authorities.
  - Strategic, operational and tactical changes: Nature of operations, force structure, and platforms, multifunctionality.
  - Need to review strategy, policies, operational plans, and training.
  - Investments in capability and infrastructure.
  - Strategic communications and outreach.
  - Environmental assessment and prediction.
- **Climate Change and the Navy**
  - It is empirically proved that higher temperatures affect aircraft operations on board aircraft carriers. Temperature variation affects hydrological conditions thus affecting sonar operating conditions on ships, radar operations, helicopter operations, communications, etc.
  - Rising sea temperature will impact underwater warfare.

  - Rise in sea level will affect naval establishments located on the sea coast—may have to be re-located leading to enormous infrastructural costs.
  - Re-location in populous areas can be difficult leading to operational consequences.
  - Ships would require greater sea-keeping ability for higher sea states and prolonged extreme weather operations.
  - The entire Indian Ocean region—especially South Asia has experienced numerous natural disasters during the last few decades. With climate change, such calamities are likely to increase in frequency and intensity.
  - This would demand the frequent deployment of militaries from the region for humanitarian assistance as was evidenced by the role of the Indian Navy for HADR activities during the tsunami of 2004.

- Armed forces must have institutional expertise in climate science and mechanisms, invest in sophisticated modeling techniques to understand micro-level impact in geographies of interest, and develop capabilities to manage risks from a number of possible imaginable scenarios and attend to unimaginable ones.
- **Science**
  - Set up a Climate Science Department, preferably in a defence think-tank/Indian Defence University (INDU) that ensures sufficient uniformed officers have expertise in climate science.
  - Collaborate with Survey of India, DRDO, Meteorological Department, Department of Space, universities, and private sectors.
- **Intelligence**
  - MoD, IDS and Services HQ must incorporate climate intelligence into strategic plans.
  - MI, Naval Intelligence, and Air Intelligence must be able to provide operational and tactical climate assessment inputs to

their commanders. For instance if a glacier melts, what will be the watershed path, potential impact on bases around it?

- **Equipment and Operational**
  - Amphibious capacity for beach landing and inland riverine movement.
  - Heavy lift (especially airlift).
  - Expeditionary or Assistance Force (two divisions).
  - Civil-Military Cooperation for Conflict Resolution (CIMPCOR). Need to go beyond peacekeeping in a conflict zone, like need engineers to build roads, teachers to educate, etc.
- Climate change exacerbates threats to national security. It poses direct and indirect threats to military. Integrating climate risk into military strategy is no longer a question of 'if' but of 'when'. Early action equals better preparedness. Building resilience and adaptation capacity is essential.
- **The Way Ahead**
  - A detailed study to explore the precise effects of the climate change in the maritime medium that effect naval operations and creating a roadmap is essential.
  - A modification of the doctrinal and tactical approaches accommodating such changes/challenges is necessary.
  - Modification of training patterns is needed.
  - Incorporating such changes in equipment parameters and infrastructure is required.

DETAILED REPORT*

- The CLAWS conducted a Seminar on the 'Impact of Climate Change on Military Operations: An Appraisal' on 31 January 2017. Important issues highlighted at the Seminar are given as follows:

Climate Change: Introductory Session

- Climate change can be defined as statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer).

  A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

  – UNFCCC

- Climate Change does not generate votes in the short-term. It is irreversible and the potential ramifications cannot be fully imagined. Impact on military will be multi-faceted.
  - Sea level rise can change maritime borders. Since rights are determined using the baseline according to the principles of UNCLOS. This could lead to increased disputes.
  - There can be increase in frequency and intensity of natural disasters where the military has to step in; for instance, loss of uniformed personnel in avalanches has increased. Military bears the brunt of the impact.
  - Tactical impact: Higher temperatures will affect data related to aircraft carrier operations, temperature range of submarines, etc. Equipments will have to be recalibrated.

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* The aspects enumerated as part of this Report are exclusively based on the deliberations by panellists. These do not necessarily conform to the views of the Centre for Land Warfare Studies (CLAWS) or that of the Indian Army or the Ministry of Defence, Government of India.

  - Environmental impact can snowball into military issues. Any change in coast line will realign territorial waters, may shift fishing areas, or even displace fishing.

- The automobile industry could witness a revolution with the introduction of battery operated cars, with battery tanks as norms.

Climate Change and its Implications for National Security

- Evidences are galore that the temperatures around the planet are rising. There is scientific consensus that it is being caused by human activity. Humanity should therefore, try to stop this, mitigate its effects, and adapt.
- Two types of effects are envisaged. The first one is absolute effect. This is because we will be directly impacted regardless of other. The second one is the relative effect. It will affect different countries in different ways and to different extents, and this brings in the strategic dimension. Many people around the world will rearrange their lives to mitigate the impact of climate change and therefore, it is a real and immediate risk. Changes to the pattern of international arrangements can result in security concerns for environmental refugees.
- It is better to manage risks than to predict events because predictions can only be limited. It is far more useful as strategists to plan and build capacity for a multitude of risks.
- Managing natural factors will be relatively limited but can be done by multilateralism, diplomacy, mitigation, adaptation, and risk management. Army can play a vital role in risk management. Human agency can be controlled to a greater degree; for instance, China can be persuaded not to dam rivers. The possible methods to manage human agency are multilateralism, diplomacy, deterrence, defence, and punishment. The Army needs to step in for deterrence, defence, and punishment.
- This implies that the armed forces must have institutional expertise in climate science and mechanisms, invest in sophisticated modeling techniques to understand micro-level impact in

geographies of interest, and develop capabilities to manage risks from a number of possible imaginable scenarios and attend to unimaginable ones.

- **Recommendations**
  - Set up a climate science department, perhaps in a defence think-tank/Indian Defence University (INDU) that ensures sufficient uniformed officers have expertise in climate science.
  - Collaborate with the Survey of India, DRDO, Meteorological Department, Department of Space, universities, and private sectors to train personnel in Climate Science and also obtain input on matters that concern armed forces.
  - MoD, IDS and Services Head Quarters must incorporate climate intelligence into strategic plans.
  - Military Intelligence, Naval Intelligence, and Air Intelligence must be able to provide operational and tactical climate assessment inputs to their commanders. For instance if a glacier melts, what will be the watershed path, potential impact on bases around it?
  - Amphibious capacity for beach landing and inland riverine movement.
  - Heavy lift (especially airlift).
  - Expeditionary or Overseas Assistance Force (Two divisions).
  - Civil-Military Cooperation for Conflict Resolution (CIMPCOR). Need to go beyond peacekeeping in a conflict zone, like need engineers to build roads, teachers to educate, etc.

Changing Climate: Impact on Military and the Way it Executes its Mission

- There are varying opinions with respect to the gravity of the challenge—whether it is the greatest challenge of our times or one of the biggest challenges but, climate change as a threat cannot be questioned anymore.

- **Challenges of Climate Change**
  - Differ in geographical scope, severity of impact, temporal, cascading non-linear impact. The biggest threat is the non-homogenous impact of climate change, even within a country. For instance, Asia has had the maximum impact, both in terms of loss of life and economic loss.
  - Global scale, complex dynamics, incomplete and imperfect knowledge, long-term implications.
  - Number of actors, complexity of action, decentralised action, cross cutting impact.
  - Differing capacity and capability, significant time lags.
- **Impact on Defence Forces**
  - Climate change will lead to increased risk to infrastructure and life by erratic climate and weather extremes and altered ecosystems and habitats.
  - Armed Forces will have to play a major role in Humanitarian Assistance and Disaster Relief (HADR), civilian support, and Aid to Civil Authorities.
  - Strategic, operational, and tactical changes will have to be made in term of nature of operations, force structure, and platforms and multifunctionality. For example the United States has a new Arctic Strategy Ops today.
- **Threats and Likely Impact**
  - Heat extremes: There is larger cooling requirement for equipment, changes in design, constraints on operational exploitation, excess personnel mortality due to heat stress.
  - Precipitation (intra-seasonal variability, extremes): Risk of flooding, inundation, damage to infrastructure is possible.
  - Drought/decrease in water availability: Loss of operational/trg time; additional effort to mitigate, and overcome water scarcity. Climate change implies such changes could become more long-term.

  - Tropical cyclones: there can be damage to infrastructure, inundation and loss of communication.
  - Glacier melt/avalanches: Put strain on logistic chain. Alternate routes or heavy airlift capacity is required. There is increasing unpredictability and increased number of casualties can occur. Severity and scale of impact cannot be predicted accurately.

- **Conclusion**
  - Climate change exacerbates threats to national security. It poses direct and indirect threats to military. Integrating climate risk into military strategy is no longer a question of 'IF' but of 'WHEN'. Early action equals better preparedness. Building resilience and adaptation capacity is essential.

Impact of Climate Change on Maritime Security and Naval Aspects

- **Current Scenario**
  - 40 per cent of Asia's population of nearly 4 billion lives within 45 miles of its 1,30,000-mile-long coastline. Some of the most vulnerable regions to sea level rise are along the coasts of Pakistan, India, Sri Lanka, Bangladesh, and Myanmar. Along with the inundation of Maldives, approximately 18 per cent of Bangladesh's total land would be under water impacting 11 per cent of the Bangladeshi population even with a modest rise in sea levels. It has been seen that severe effects of climate change are already being faced in Sunderbans area with eroding land mass resulting in frequent migrations.
- **Why it is so Important?**
  - Changes in the natural climatic systems can lead to less availability of basic resources (like food and water), higher average temperatures, rising sea levels, etc., all of which have consequential effects leading to societal tension and regional turbulence.
  - The resultant situation can further exacerbate leading to

conflagration and conflict between states and hence national security concerns. All this create environment refugees and is also matter of national security because people from Bangladesh are moving into India (Kerala and Delhi). Thus, it is a matter of concern.

- While numerous studies have addressed the impact of such changes on geographical regions and human societies– comparatively very little attention has been a paid to its impact on the operating methodologies of Armed Forces, its effect on war fighting, or on national security. This essentially means that the Armed Forces are ill-equipped both materially and doctrinally to respond to these cataclysmic changes.
- The only in-depth study to explore the effects of climate change on military operations and methodologies was undertaken by the US Military under the CNA. A roadmap has also been prepared by the US Military.
- 'National Security and the Threat of Climate Change', explores ways in which climate change acts as a 'threat multiplier' in already fragile regions of the world, creating the breeding grounds for extremism and terrorism.

- **Climate Change Affects**
  - **In Military Terms**
    - Strategy, policy, and plans.
    - Operations and training.
    - Investments in capability and infrastructure.
    - Strategic communications and outreach.
    - Environmental assessment and prediction.
    - India yet to go for the road map.
  - **In Maritime Dimension**
    - Maritime examples include the opening of the Arctic Ocean and the potential for sea level rise to reduce the availability of overseas ports for refueling and re-supply.

Examples affecting expeditionary operations include altering demand for utilities work (wells, grids, etc.), increasing requirements for earthmoving projects due to sea level rise and erosion, and changes in requirements for water/fuel storage.

- There are increasing incidents of environmental refugees like in Sunderbans and the requirement of Armed Forces.

- **Why South Asia is so vulnerable to Climate Change?**
  - There are high levels of poverty and population density close to coastline.
  - It is highly susceptible to natural disasters.
  - It relies heavily on the monsoon due to its over dependence on agriculture and food production.
  - There are retreating glaciers of the Himalayas.
  - Sea level rise is a major concern in the Region.
  - There are cascading effects of more variable rainfall and higher temperatures.
- **Climate Change and the Navy**
  - Naval war fighting as a whole is likely to be affected by climate change.
  - It has been proved that higher temperatures affect aircraft operations on board aircraft carriers. Similarly changing temperatures affect hydrological conditions thus affecting sonar operating conditions on ships. Changing temperatures may also affect air temperatures/local weather conditions, which in turn could possibly affect radar operations, helicopter operations, communications, etc.
  - With rising sea temperatures underwater warfare is likely to see many changes and also with the sound patterns being affected–sonar efficacy is also likely to be affected.
  - Since most of the naval establishments are naturally located

on the sea coast on both the sea boards–with the rise of sea level these establishments and dockyards will have to be re-located leading to enormous infrastructural costs.

- Associated problems of re-location in populous areas can be difficult leading to operational consequences.
- Ships would require greater sea-keeping ability for higher sea states and prolonged extreme weather operations.
- The formation of anomalous sound ducts like off the Arabian Sea in winter months is likely to be enhanced in certain places and diminished in others.
- The entire Indian Ocean Region, especially South Asia, has experienced numerous natural disasters during the last few decades. It has been estimated that over 50 per cent of South Asians have been affected by a natural disaster during the last two decades. According to a World Bank report the human and economic toll has been high with almost 2,30,000 deaths and about US$ 45 billion in damages.
- With climate change, such calamities are likely to increase in frequency and intensity.
- This would demand the frequent deployment of militaries from the Region for humanitarian assistance as was evidenced by the role of the IN for HADR activities during the tsunami of 2004.

- **The Way Ahead**
  - A detailed study is needed to explore the precise effects of the climate change in the maritime medium that affect naval operations. It is essential to create a roadmap.
  - There is requirement to modify the doctrinal and tactical approaches accommodating such changes/challenges.
  - Training patterns need to be modified.
  - Such changes should be incorporated in equipment parameters and infrastructure.

Armed Forces Response to Future Potential Climate Induced Events and Way Ahead

- Key finding is that climate change must be factored into contingency planning and war gaming as well as for qualitative requirements where necessary. It is no more a 'Q' matter but a 'General Staff' one. Assumption that physical environment is static is no longer valid.
- **Future Potential Climate Induced Events (The Himalayas and Siachen Glacier)**
  - Glaciers and permafrost in the fragile Himalayas and Tibetan plateau, already under strain from military deployment, are melting abnormally. The meltdown may become very rapid, which has its own military implications such as disruption of communication and water flow variation. There is an urgent need to factor-in impact of the sudden and accelerated meltdown of glaciers in the next 10-15 years. Rapid melting would bring in flash floods and a series of mini-disasters downstream.
- **So What?**
  - Surface mobility will be impacted in the mountains due to increase in flash floods. Redundancy in mobility by way of rotary wing, road transport, animal transport, and foot mobility will demand training and wherewithal. Stocking levels may need to be increased due to more frequent disruption of communications and to sustain the legendary institutional capacity of Indian military in marching including animal transport and local resources like Yaks.
  - Forest die down may require adjustments to camouflage methods.
  - Health precaution such as hot weather precautions and a battle to prevent vector borne diseases will need more attention including anti-malaria (including new strains of mosquito borne vectors) precautions even in higher latitudes/ altitudes. More emphasis is required on physical fitness.

- **Technical Gunnery:** It needs to be confirmed if there would be a requirement to take measures in changed firing tables standard conditions for artillery guns, rockets, and mortars due to increase in surface temperatures.
- **Weather Forecast:** More sophistication may be required to forecast weather conditions for military operations.
- **Ammunition Dumps and Fire Precautions:** Drainage congestion and extreme weather events need to be factored to see if ammunition dumps are not in any risk zones. Storage of ammunition in higher ambient temperatures due to global warming (as also heat island effects in built up areas) must be factored.
- **Defence Works:** Like ammunition dumps, all defence works need to be checked if they are not in vulnerable risk zone.
  - **Hot Weather Warfare:** Revisit hot weather precautions for man, beast, and machines including traditional ecological knowledge. (Space cooling for equipment. How about troops?) Army Medical Corps and General Staff needs to relook on this aspect.
  - **Remote Sensing:** Urban pollution, forest fires, Atmospheric Brown Cloud, coastal pollution, and algal bloom may impact remote sensing (including in air and sea).
  - **Sea Level Rise Adaptation:** Dikes or sea walls will pose additional obstacle to amphibious operations and landing on beaches.
- **Operational Level**
  - More heat may demand higher scales of water scales in hot weather warfare conditions in operation logistics. Similarly, wear and tear on equipment may be more pronounced due to further increase in temperature.
  - Glacial Lake Outburst Floods (GLOF) and restrictions on mobility in mountains due to flash floods may require campaign planners to have alternative means of mobility or change plans. Enhanced engineering support need to be

factored for mobility. More number of bridges/engineering equipments may be required than what was considered normal in the past.

- **Strategic Level**
  - Concept of campaigning season may need a reappraisal due to projected changes in climate and weather. There is need for the Indian Navy to think of Artic operations?
  - Glaciers melt in Tibet with disturbed permafrost will impact the logistic tonnages of Chinese by surface means (road and rail) and affect military facilities like airfields. With loss of permafrost in the Region, there will not be any closed or restrictive period for conduct of operation.
  - Military will be deployed more and more for disaster relief tasks. There is need to have better dual use equipments like boats, bridges, hospital ships, earth moving equipment, and medical facilities.
- **Treaties Having a General Bearing on Protecting the Environment Indirectly**
  - Treaty Governing the Activities of States in the Exploration and Use of Outer Space including the Moon and Other Celestial Bodies (Outer Space Treaty 1967); the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and Ocean Floor and the Subsoil Thereof (Seabed Treaty) of 1971; the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Agreement on Celestial Bodies) of 1979; The 1925 Gas Protocol, the 1959 Antarctica Treaty, The Biological Weapons Convention (BWC) of 1972, The 1977 AP I and AP II (starvation of civilians), the UN Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May be Deemed to be Excessively Injurious or Have Indiscriminate Effects (CCW), 1980 (linked to The Martens Clause which affirms its importance against protecting civilians and combatants),

Chemical Weapons Convention, 1993, The Ottawa Treaty 1997 (anti-personal mines), The Hague Convention on Cultural Property, 1954.

- **MoD to Get Into Scientific Loop with the Indian National Confederation and the Academy of Anthropologists (INCAA) Type of Assessment**
  - **Measure, Model, and Monitor:** The '3 M's' is the foundation of decision-making and we need to build indigenous capacity for this. We should not be dependent on external studies to tell us about the impact of climate change on our glaciers, monsoons, and sea level rise. We need to build our own independent and credible research capacity on these issues.

CONCEPT NOTE

Background

- The current apprehensions of environmentalists and common people about the rapidly changing climate and weather patterns have often led to serious debates about its predicted consequences and exaggerated apocalyptic scenarios. While numerous studies have addressed the impact of such changes on geographical regions and on human societies, little attention has been paid to its impact on military operations or on associated issues concerning the national security. Given the lack of serious research on the subject and the 'when it happens we will see' attitude of the military, it is doubtful if our armed forces are prepared to deal with eventualities that may arise due to climate change.
- A changing climate will have real impacts on our military and the way it executes its missions. The military could be called upon more often to support civil authorities, and provide humanitarian assistance and disaster relief in the face of more frequent and more intense natural disasters. Our coastal installations are vulnerable to rising sea levels and increased flooding, while droughts, wildfires, and more extreme temperatures could threaten many of our training activities. Our supply chains could be impacted, and we will need to ensure our critical equipment works under more extreme weather conditions. Weather has always affected military operations, and as the climate changes, the way we execute operations may be altered or constrained . . . Climate change will affect the Armed Forces' ability to defend the nation and poses immediate risks to the national security. War-fighting as a whole is likely to be affected by climate change and this would demand for an altered perspective on certain military doctrines.

Current Status

- While India has a well-defined and independent National Action

Plan on Climate Change (NAPCC), there has been no analysis of the risk and impact of climate change on national security. There is also no thought on integrating the responses to increased threats due to climate change in the existing military strategy. The US Navy has already developed a generic 'Road Map' against climate change while we are yet to assess the impact of such changes, let alone formulate doctrinal responses. We should, therefore prepare, since a World Bank report has predicted that the extremity and frequency of such climate changes will be '… outside the realm of human experience'.

Objectives of the Seminar

- To discuss and analyze the dynamics of climate change and its implications for national security.
- To identify the impact of climate changes on the Armed Forces.
- Recommend the Way Ahead.

Conduct

- The Seminar was conducted at the Manekshaw Centre, New Delhi on 31 January 2017. The theme of this Seminar was the 'Impact of Climate Change on Military Operations: An Appraisal'.
- **Programme**: The detailed programme is enclosed as Appendix I.
- **Speakers**: The Seminar brought together experts who have been working on this subject for years and making efforts to appraise the environment on the gravity of implications and concerns related to of climate change.
    - Commander Neil Gadihoke (Retired): Introductory Remarks.
    - Nitin Pai: Climate Change and its Implications for National Security.
    - Commander Kapil Narula: Changing Climate: Impact on our Military and the Way it Executes its Mission.
    - Dr PK Ghosh: Impact of Climate Change on Maritime Security and Naval Aspects.

- Colonel PK Gautam (Retired): Armed Forces Response to Future Potential Climate Induced Events and Way Ahead.

- **Participants**
  - Veterans.
  - Service officers from the Indian Armed Forces.
  - Research scholars from Think Tanks.
- **Seminar Coordinator:** Colonel Akhilesh Kumar, Senior Fellow, CLAWS.

Appendix I

SEMINAR PROGRAMME

Time	Event
1000 h – 1030 h	**Tea and Registration**
1030 h – 1035 h	**Opening Remarks** Lieutenant General BS Nagal, PVSM, AVSM, SM (Retired), Director CLAWS
1035 h – 1045 h	**Chairman's Introductory Remarks** Commander Neil Gadihoke (Retired)
1045 h – 1115 h	**Climate Change and Its Implications for National Security** Nitin Pai
1115 h – 1145 h	**Changing Climate: Impact on our Military and the Way it Executes its Mission** Commander Kapil Narula
1145 h – 1200 h	**Logistic Pause**
1200 h – 1230 h	**Impact of Climate Change on Maritime Security and Naval Aspects** Dr PK Ghosh
1230 h – 1300 h	**Armed Forces Response to Future Potential Climate Induced Events and Way Ahead** Colonel PK Gautam (Retired)
1300 h – 1345 h	**Interaction Including Comments by the Chair**
1345 h – 1350 h	**Vote of Thanks** Lieutenant General BS Nagal, PVSM, AVSM, SM (Retired), Director CLAWS
1350 h	**Lunch and Dispersal**