

NETWORK-CENTRIC OPERATIONS: A PRE-REQUISITE FOR HIGH-TEMPO OPERATIONS AND SYNERGY

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INTRODUCTION

In an era defined by rapid technological advancements and information proliferation, Network-Centric Operations (NCOs) emerge as a crucial paradigm for modern warfare. The NCO refers to a strategic approach that leverages information sharing, real-time communication, and collaborative decision-making to enhance operational effectiveness.

From the early days of the telegraph and radio to the present-day interconnected digital networks, the evolution of the NCO has been a response to the growing need for efficient command and control mechanisms. The NCO's roots can be traced back to the recognition that information superiority directly translates into operational advantage. These technologies allowed commanders to gain real-time situational awareness and make informed decisions on the battlefield. With the advent of satellite communications, data links and advanced sensor systems, NCOs evolved into a comprehensive concept that transcends traditional boundaries.

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ESSENTIALS OF MODERN WARFARE

The landscape of modern warfare has undergone a seismic shift driven by technological advancements that enable the armed forces to extend their reach, enhance their speed and elevate their vision. In this era, the fusion of technology, communication and strategy has brought forth a paradigm where satellite-based real-time intelligence and the utilisation of unmanned platforms in all three domains serves

as a crucial factor in redefining the dynamics of conflict.

Extending Reach Through Sensor and Satellite-Based Real-Time Intelligence

Sensors have emerged as crucial enablers in modern warfare, significantly extending the reach of the armed forces by providing unparalleled real-time intelligence. Satellite networks deliver instantaneous data on enemy movements, geographic terrain and infrastructure. This real-time situational awareness empowers commanders to make informed decisions, enabling swift responses.¹

The use of satellites during the Gulf War allowed the coalition forces to monitor Iraqi troop movements, enabling rapid tactical adjustments and informed target selection.²

Sensor networks play a pivotal role in elevating the vision of the armed forces, enabling them to monitor large areas and gather intelligence with unmatched precision. Multi-domain surveillance allows for constant monitoring of areas of interest, ensuring that no movements or activities go unnoticed.³ During the 2011 Syrian civil war conflict, satellite imagery revealed changes in troop deployments by the pro-Assad camp, thus, aiding

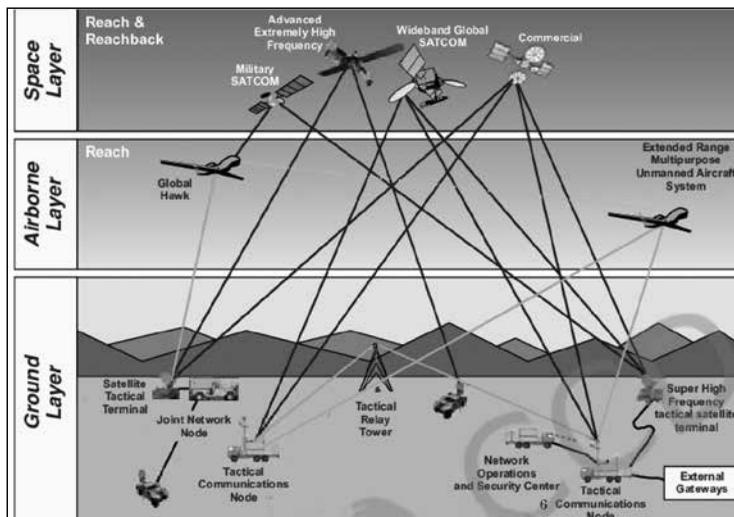
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1. G. Mann, "Satellite Imaging for Rapid Disaster Response," *Geomatica* 63(4) (n.d.), pp.431-440.
 2. J. R. Roehrig, and T. Holmes, *China's Military Strategy: Assessing Current Trends* (Washington, D.C.: Georgetown University Press, 2017).
 3. D. Arquilla and J. Ronfeldt, *Cyberspace and the Changing Nature of Warfare* (RAND Corporation, 1997).

in the anticipation of an impending attack and thereafter a successful response to the attack by the organised rebel militias supported by the United States (US) and European Union (EU).⁴ In the Yemen conflict, the Saudi-led coalition utilised satellite intelligence to target Houthi missile launch sites swiftly, reducing the threat to the civilian populations.⁵

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Fig 1: Sensor Network⁶



4. Roehrig and Holmes, n.2.
5. R. Szafranski, *Joint Operations and the Revolution in Military Affairs: From Panama to Iraq* (Naval Institute Press, 2015).
6. "Network-Centric Warfare", *Indian Defence Review*. Accessed on September 6, 2023, <http://www.indiandefencereview.com/news/network-centric-warfare/>.

Network-Centric Operations

In the modern landscape of warfare, Network-Centric Operations (NCOs) have emerged as a transformative framework that redefines the way the armed forces operate. With the integration of advanced technologies and real-time communication, NCOs facilitate agile decision-making, enhance situational awareness and optimum utilisation of resources.

According to Admiral Arthur K. Cebrowski and John J. Gartska in their seminal work “Network-Centric Warfare: Its Origin and Future,” these factors include interoperability, information dominance and adaptability. Interoperability ensures that various units and systems can seamlessly exchange information, enabling real-time collaboration and decision-making. Information dominance empowers commanders with timely and accurate data, enabling them to make informed choices. Adaptability allows the armed forces to adjust rapidly to the changing circumstances, maintaining the initiative. In simple words, Network-Centric Warfare (NCW) is defined as an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision-makers and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronisation. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battle space.⁷

The effectiveness of an NCO is amplified through the integration of a wide range of sensors and assets, each contributing to real-time situational awareness and rapid decision-making. The development of high-definition sensors has meant more information is now yielded. All-weather sensors can now gather data at night and in bad weather.

Communication Assets: High-frequency radios, satellite communication terminals and secure data networks facilitate instant communication and data sharing across various operational levels.

7. “Network-Centric-Warfare-21st-Century” @ www.Militaryaerospace.com,” n.d., <https://www.militaryaerospace.com/home/article/16706659/networkcentric-warfare-21st-century>.

Surveillance Sensors: The radars, Airborne Warning and Control System (AWACS) and Airborne Early Warning and Control (AEW&C) provide real-time data on enemy air assets' movement. In the maritime domain, pickets provide pick-up and data on naval as well as aerial objects. However, the coverage area would depend on the location of the vessel (the picket being mobile in nature).

Environmental Sensors: Weather sensors and atmospheric data collection tools offer insights into changing conditions that can impact military operations.

Platforms: The mating of sensors with a wide variety of platforms means they can be moved into positions or spaces from where their input can be maximised. For example, space and air platforms provide a unique vantage point. Similarly, the growing use of unmanned platforms means that air, ground, surface, sub-surface (under water) intelligence can now be gathered in dangerous situations.

Battlefield Transparency in the Digital Age

NCOs entail the integration of multiple components, including technology, information-sharing and operational synergy, to enable real-time collaboration, and exchange of real-time information to achieve mission objectives with enhanced efficiency. The interconnectedness of NCOs allows for synchronised actions across different operational domains, enabling the armed forces to respond effectively to dynamic and evolving situations.

EXISTING TECHNOLOGIES IN NCOS

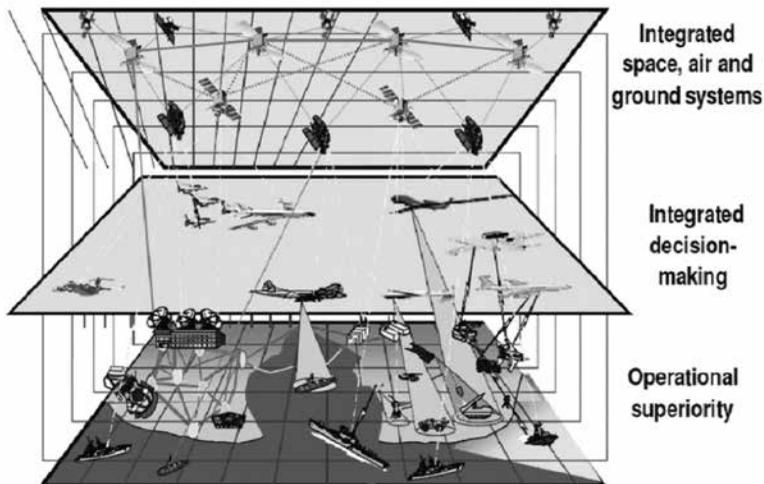
The bedrock of an NCO lies in its utilisation of existing technologies that have revolutionised the way the armed forces conduct operations. These technologies form the backbone of NCOs, enabling real-time communication, data sharing and informed decision-making.

- **Digitisation:** Information data/intelligence generated by sensors, mated with the appropriate platforms, is digitised. This makes it amenable to transfer with speed and security over a variety of media.

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- **Communication and Connectivity:** High-speed communication networks, secured data channels and encrypted communication terminals enable commanders to access real-time intelligence, provide instructions and receive updates promptly. This interconnectedness bridges geographical gaps and ensures that relevant stakeholders remain informed, enhancing the speed and precision of military responses.⁸ New technologies and products which have been customised to form different factors allow for vastly increased connectivity down to the last mile and lowest unit.

Fig 2: NCW Digital Battlefield⁹



- **Data Analytics:** Data processing technologies and systems have improved by leaps and bounds. This, in turn, yields clear analysis and

8. W.L.Mitchell, *The Essential Network-Centric Warfare Primer* (Naval Institute Press, 2016).
 9. "Network-Centric Warfare Domains - Information/Cognitive/Social..." Samim. Accessed September 6, 2023, <https://samim.io/p/2020-01-03-domains-information-cognitive-social-physical/>.

overall picture formation by transforming raw data into coherent insights. Data analytics supports decision-making processes, ranging from mission planning to resource allocation. This technological capability empowers the armed forces to adapt strategies in real-time, based on dynamic shifts in the operational environment.¹⁰

- **Drones, UAVs, UGVs, USVs and UUVs:** Unmanned Aerial Vehicles (UAVs) or drones, have become the game-changers in NCOs, extending the reach and versatility of the armed forces. Drones offer agile reconnaissance capabilities, allowing military units to gather real-time intelligence without exposing personnel to danger. Additionally, armed drones provide precision strikes, enabling the engagement of targets with reduced collateral damage.¹¹ Unmanned Ground Vehicles (UGVs), the ground counterparts of UAVs, facilitate operations in hazardous and hostile environments, thus, preventing vulnerability to the operators and ground troops.

Unmanned Surface Vehicles (USVs) or drone boats/ drone ships have taken a long leap from being used as minesweepers during World War II to the modern-day utilisation as reconnaissance vehicles, and maritime attack vehicles. Unmanned Underwater Vehicles (UUVs) are the submersible versions of naval drones and are capable of reconnaissance using Sound Navigation and Ranging (SONAR) without getting detected by the surface radars. During the Russian invasion of Ukraine in 2022, Ukraine used 7 USVs and 8 UAVs to attack Russian naval vessels at the Sevastopol naval base.

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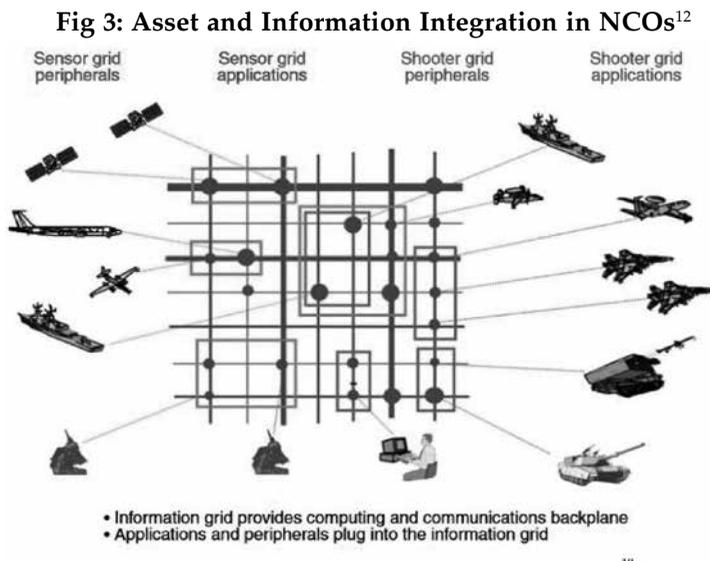
10. D.Cerruti, "Data Analytics for Network-Centric Operations: Opportunities and Challenges," *Defence Science Journal* 68(4) (n.d.), pp. 382-386.

11. P W Singer and Joanne J Myers, "Wired for War: The Robotics Revolution and Conflict in the 21st Century," *Industrial Robot: An International Journal*, 37, no. 5, 2010, pp.1-10, <https://doi.org/10.1108/ir.2010.04937eae.001>.

- **Cyber Security Systems:** Intrusion detection systems and encryption technologies safeguard critical communication networks and data from cyber threats.

TEMPO OF OPERATIONS

The air force is critical in any operation and the rapidity with which the Indian Air Force (IAF) can orientate, act, react and execute air operations defines its tempo.



The heart of effective tempo of operations lies in the strategic cohesion between the surface forces and air operations. The Gulf War of 1991 offers a prime illustration of the symbiotic relationship between the ground and air forces. The air force’s ability to coordinate an expansive air campaign by incorporating naval air assets and naval and land long range fires, to execute precision air strikes, and neutralise enemy defences, creates a conducive environment for the surface forces to progress their operations.

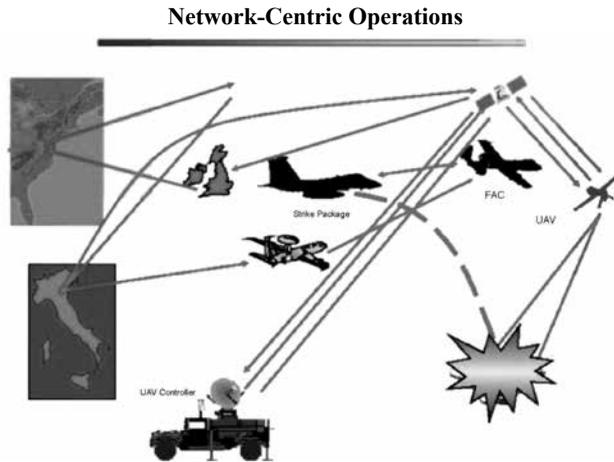
12. “Secure Space-Based Network-Centric Operations Network”, https://www.researchgate.net/figure/Secure-space-based-network-centric-operations-network_fig10_247464126. Accessed on September 6, 2023.

NCOs serve as the backbone of operations, amplifying the effectiveness of coordination, communication, and decision-making. The reach-speed-visibility amplification is the basis of quick and informed decision-making.

The Integrated Air Command and Control Systems' (IACCS') Common Operation Picture (COP), available to the field forces and right up the decision-making chain, brings a certain rapidity in operations that helps in/out manoeuvring of the enemy. The Russia-Ukraine conflict demonstrated the influence of NCOs on the tempo of operations through information warfare. Ukraine's collection of data from civilian mobile phones, gathering of photos and videos and integrating them into its information warfare campaign comprised a prime example. The ability to rapidly disseminate such material across global networks disrupted the tempo by manipulating perceptions and influencing the strategic narrative. The cyber attacks by the Russians on the Satellite Communication (SATCOM) facilities to disrupt Ukraine's kill chain [the methodology of Finding, Fixing, Targeting, Tracking, Engaging, and Assessing (F2T2EA) an adversarial objective], was a direct attempt to neutralise the NCO capability of the Ukrainians and, in turn, their operations.

Balancing Offensive Counter-Air (OCA) and Air Defence (AD): The equilibrium between offensive air strike and defensive counter-air /air defence within operations is paramount. Offensive actions maintain pressure, while defensive measures safeguard critical assets. The air force's precision strikes constitute the offensive thrust, providing rapid, lethal responses to emerging threats. Simultaneously, AD safeguards key installations, thwarting potential adversarial offensives. This balance prevents over-extension, while ensuring constant pressure on opponents.

Fig 4: Role of NCOs in Air Strikes



In the realm of modern warfare, NCOs have revolutionised the way the armed forces plan, execute and manage their strategies. By combining technology, communication and strategy, the armed forces can maximise their efficiency and impact on the battlefield.

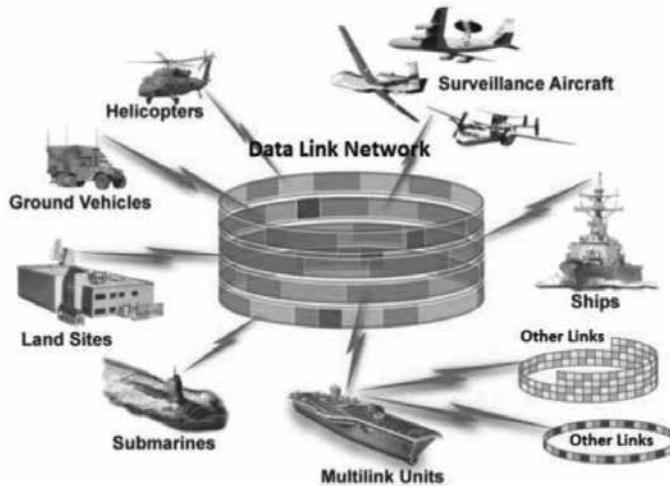
OPERATIONS AND SYNERGY

Dynamic Tasking: This approach, as highlighted by Lieutenant Colonel Robert P. Smith in “Network-Centric Warfare: A Primer,” enables the armed forces to adapt swiftly to changing circumstances, and capitalise on emerging opportunities. In traditional warfare, tasking was often pre-planned and inflexible which limited the ability to respond to unexpected developments. Dynamic tasking addresses this limitation by utilising real-time information gathered from various sources. This information is then processed and analysed to identify the most pressing needs and opportunities on the battlefield, ensuring that the armed forces can exploit the vulnerabilities in the adversary defences or aid units in need.

Furthermore, dynamic tasking facilitates the concept of “mission tailoring” wherein missions are customised to fit the capabilities of specific units. This optimisation increases the likelihood of mission success while

minimising risks. For instance, if a particular unit possesses specialised skills or equipment, dynamic tasking can ensure that it is assigned missions that align with its strengths.

Fig 5: Data Linking in Networks



Mission Integration: This is a strategy that leverages the capabilities of various units to achieve a common objective. This approach is advocated by Vice Admiral Arthur K. Cebrowski and John A. Garstka in “Network-Centric Warfare.” With real-time access to accurate and comprehensive data, commanders can make informed decisions about which units to deploy and how to best coordinate their actions. For instance, in joint military operations involving the land, air and naval units, mission integration ensures that each branch contributes its unique strengths to achieve success.

Rapid Response Framework: It is a vital factor of NCOs, emphasising the importance of swift decision-making and deployment. This framework, as detailed in the “Handbook of Network and System Administration” by Jan Bergstra and Mark Burgess, recognises that in the modern battlefield, delays can have dire consequences. Therefore, the armed forces must adopt a streamlined approach that minimises the time between identifying a threat

Data fusion techniques, which integrate data from multiple sources such as sensors, satellites and intelligence reports, provide commanders with a comprehensive and clear picture of the battlefield.

and executing a response. Key components of the rapid response framework include:

- **Decentralised Decision-Making:** The framework encourages decentralised decision-making, allowing commanders on the ground to assess situations and make informed choices without waiting for approval from the higher-ups. This decentralisation is facilitated by the availability of real-time data and communication networks.
- **Agile Communication:** Effective communication is essential for a rapid response. The unified communication grid, as discussed in “Network-Centric Warfare and Coalition Operations” by David A. Lambert, ensures seamless information-sharing across units and branches.
- **Real-Time Data Fusion:** A rapid response relies heavily on accurate and up-to-date information. Data fusion techniques, which integrate data from multiple sources such as sensors, satellites and intelligence reports, provide commanders with a comprehensive and clear picture of the battlefield. By adopting the rapid response framework, the armed forces can capitalise on the element of surprise, seize opportunities, and mitigate threats promptly.

Flexible Task Forces: This strategy, as outlined by Commander Lisa M. Kennedy and Captain Lee Ann A. Hepner in “Network-Centric Warfare: Developing a 21st Century National Military,” involves assembling specialised units that can adapt quickly to changing circumstances. Flexible task forces break down traditional silos and focus on cross-functional collaboration, where units from different branches and specialities work together seamlessly. The NCO allows for composite task forces to quickly form, disperse and then re-form, as per the scale and complexity needed for any task. The ability of smaller units / task forces to work together means that at the individual unit/task force level, they may retain a low signature, allowing them to

operate without detection or interference. But the combined effect of many such task forces/ units operating in collaboration through an NCO could cause a complete overwhelming/mis-balance of the adversary's system, producing an effect greater than the sum of individual effects. The key features of flexible task forces include:

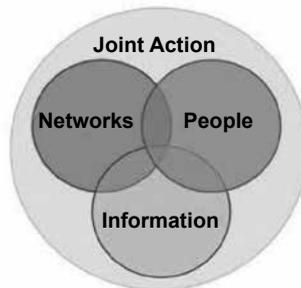
- **Multi-Disciplinary Expertise:** Flexible task forces bring together personnel with diverse skills and expertise. This diversity allows the task force to address a wide range of challenges without relying solely on a single unit's capabilities.
- **Rapid Composition.** These task forces can be composed quickly based on the mission's requirements. Units can be selected and integrated into a task force in a matter of hours, allowing the armed forces to respond promptly to emerging threats.
- **Modular Design:** Flexible task forces often follow a modular design, where units can be easily integrated or replaced as needed. This modularity ensures that the task force can be tailored to suit specific mission objectives.
- **Shared Resources:** Resource-sharing is a hallmark of flexible task forces. Rather than duplicating resources within each unit, shared resources are allocated where they are most needed. This approach optimises the utilisation of personnel, equipment and supplies.
- **Unified Command:** Despite the diverse composition, a flexible task force operates under a unified command structure, ensuring clear lines of authority, streamlined decision-making and coordinated actions.
- **Interoperable Communication:** The unified communication grid, as discussed earlier, plays a pivotal role in flexible task forces. It enables

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real-time communication and information-sharing among units, enhancing their ability to collaborate effectively.

Joint War Room: The concept of a joint war room stands as a testament to the collaborative nature of network-centric operations. As highlighted in the “Guide to the Systems Engineering Body of Knowledge” by the International Council on Systems Engineering (INCOSE), the joint war room serves as a centralised command centre where representatives from different branches of the armed forces collaborate. This physical or virtual space fosters real-time decision-making, synchronised actions and the exchange of critical information. Key features of the joint war room include:

Fig 6: Joint Action Room Diagram



- **Shared Situational Awareness:** The joint war room is equipped with advanced tools and technologies that provide a comprehensive and real-time view of the battlefield to facilitate seamless communication and information-sharing.
- **Collaborative Decision-Making:** The physical or virtual set-up of the joint war room encourages collaborative decision-making. Commanders and experts can discuss strategies, evaluate options and reach a consensus more efficiently than through traditional communication channels.¹³

13. Michael E. O'Hanlon, “The Senkaku Paradox”, <https://www.perlego.com/book/777798/the-senkaku-paradox-risking-great-power-war-over-small-stakes-pdf>. Accessed on September 6, 2023.

- **Rapid Response:** The centralisation of decision-making in the joint war room allows for a rapid response to emerging threats or opportunities. Commanders can assess situations quickly, allocate resources and initiate actions without delays caused by hierarchical approval processes.
- **Cross-Functional Expertise:** The joint war room brings together personnel with diverse skills and expertise, fostering interdisciplinary collaboration and providing a wider range of perspectives.
- **Crisis Management:** During crises or complex operations, the joint war room becomes a hub for crisis management. It provides a dedicated space for coordinating humanitarian efforts, disaster response, or multifaceted military operations.
- **Unified Communication Grid:** It stands as a critical enabler of NCOs, transforming the way the armed forces exchange information, make decisions and coordinate actions. As discussed by David A. Lambert in “Network-Centric Warfare and Coalition Operations,” the unified communication grid involves integrating various communication systems into a seamless and interconnected network.

Fig 7: Communication Grid



Key features of the unified communication grid include:

- **Multi-Modal Communication:** The grid accommodates various communication modes, including voice, data, video and text. This multi-modal approach ensures that commanders and personnel can choose the most suitable method for transmitting information.
- **Interoperability:** It allows different communication systems and devices to work seamlessly together, irrespective of their manufacturer or technology.
- **Real-Time Information Sharing:** The timely exchange of real-time data empowers commanders to make informed decisions based on accurate and up-to-date information.
- **Decentralised Communication:** The armed forces operating within the unified communication grid can communicate directly with the relevant stakeholders, bypassing the hierarchical chains of command, if necessary. This decentralisation speeds up decision-making and response.
- **Encryption and Security:** The unified communication grid incorporates robust encryption and security measures to protect information from unauthorised access or interception.
- **Redundancy and Reliability.** To ensure continuous communication even in challenging environments, the grid may include redundancy and failover mechanisms. This redundancy enhances the reliability of communication systems during critical operations. The unified communication grid enhances situational awareness, coordination and decision-making across units, branches and even coalition partners. Moreover, it facilitates faster dissemination of intelligence, ensuring that critical information reaches those who need it most.

MAINTENANCE

Intelligent Sensor Integration: This enhances the ability of the armed forces to monitor, diagnose and maintain equipment. Explored in “Smart Sensors for Industrial Applications” edited by Krzysztof Iniewski, this strategy

involves providing equipment with advanced sensors that continuously collect data about its performance, health and usage patterns. Key features of intelligent sensor integration include:

- **Diverse Sensor Types:** Each sensor type captures specific data points that contribute to a holistic understanding of equipment health.
- **Continuous Monitoring:** The continuous and real-time monitoring ensures that potential issues are identified as soon as they arise, allowing for immediate attention.
- **Data Fusion:** Advanced analytics techniques identify correlations, anomalies and trends with data fusion that might indicate impending failures.
- **Remote Monitoring:** This remote capability reduces the need for frequent physical inspections.
- **Early Warning Systems:** By detecting subtle changes in sensor data, intelligent sensors can trigger early warning systems that alert maintenance teams to potential problems. This early warning allows the armed forces to take preventive measures before failures occur.
- **Diagnostic Insights.** Data collected by intelligent sensors can be used to diagnose the root cause of issues.

Intelligent sensor integration is particularly beneficial in situations where the equipment operates in challenging environments, such as combat zones or extreme weather conditions.

Augmented Reality Decision Support: Augmented Reality (AR) decision support is a transformative strategy that enhances maintenance practices within network-centric operations. Explored in “Augmented Reality: Principles and Practice” by Dieter Schmalstieg and Tobias Hollerer, this approach leverages AR technology to provide maintenance personnel with real-time information, guidance and visualisation tools, improving their ability to diagnose and address issues efficiently. Key features of augmented reality decision support include:

The dashboard tracks the movement and utilisation of personnel, equipment and supplies across different units and locations. This tracking has been provided through the Integrated Materials Management Online System (IMMOLS) which ensures that resources are allocated efficiently and effectively.

this dashboard provides a visual representation of resource utilisation and availability, enhancing transparency and optimising resource allocation. Key features of the resource allocation dashboard include:

- **Digital Twin:** This model allows for war-gaming, fault prediction and health monitoring of the network. These are based on Artificial Intelligence (AI) platforms, thus, are adaptive to changing scenarios.
- OPERATIONAL LOGISTICS**
- Resource Allocation Dashboard:** This serves as a pivotal tool within network-centric operations, enabling administrators to make informed decisions about the distribution of personnel, equipment and supplies. As discussed in “Operations Management” by William J. Stevenson,
- **Resource Tracking:** The dashboard tracks the movement and utilisation of personnel, equipment and supplies across different units and locations. This tracking has been provided through the Integrated Materials Management Online System (IMMOLS) which ensures that resources are allocated efficiently and effectively.
 - **Demand Forecasting:** By analysing historical data and patterns, the dashboard can forecast future resource demands. This enables administrators to proactively allocate resources based on anticipated needs.
 - **Priority-Based Allocation:** In situations where resources are limited, the dashboard can implement priority-based allocation rules. Resources are allocated based on predefined criteria, ensuring that critical missions and tasks receive the necessary support.
 - **Collaborative Decision-Making:** The dashboard promotes collaboration among administrators by providing a shared platform for resource

discussions and decisions. This collaborative approach prevents resource hoarding and promotes fair distribution.

- **Agile Operational Logistics:** It is a transformative approach within network-centric operations that re-imagines how the armed forces manage and deliver supplies and support. Explored in “Agile Logistics” by Michael Browne and John Allen, this strategy embraces flexibility, responsiveness and efficiency in the supply chain to meet the dynamic demands of modern warfare. Key features of agile operational logistics include:

- o **Modular and Scalable:** Agile logistics systems are modular and scalable, allowing for rapid adjustments to changing demands. Units can request specific resources as needed and the system can accommodate different levels of demand without disrupting the entire supply chain.
- o **Cross-Functional Collaboration:** Agile logistics promotes collaboration among various stakeholders, including supply chain managers, units and manufacturers. Open communication and shared information enhance coordination and decision-making.

The ability to rapidly adjust supply chains to meet evolving demands enhances the armed forces’ operational readiness and effectiveness.

The benefits of NCOs have been realised by the IAF when it conducts its training and plans its operations on the IACCS picture. AWACS operations over the Malacca Strait under the control of a decentralised node through SATCOM links are the day-to-day examples that increasingly tilt the debate towards networked operations. Though NCOs are a pre-requisite for effective

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operations, it is imperative that the networks be protected and manpower be trained to effectively use them. Certain issues that merit considerations are:

- **Secure Communication:** The vast network is open to hacking, jamming and deception by the enemy and the answer lies in securing our communication. Though the initial steps have been taken in this regard, it is imperative that both the contemporary and legacy equipment and platforms use Software-Defined Radios (SDRs) and data links for information/ communication security. With the increase of the Area of Responsibility (AoR), the required bandwidth for seamless data movement is essential.
- **Interoperability:** The essence of jointmanship is made possible by interoperability of different kinds of resources, both physical and material. This will not only ease operations but also enable optimum use of the resource in the area of interest.
- **Redundancy:** No system is safe from progress in technology. To be able to utilise the network, it is essential that the system be able to run effectively even with a certain percentage of degradation due to a physical or cyber attack. The concept of a decentralised node, as tested in the AoR, is a step to create redundant networks that can still function if the initial framework is destroyed/damaged.
- **Decentralised Nodes:** An important lesson of the Russia-Ukraine War is that no command post is safe in today's digitally transparent battlefield. Drones will buzz constantly overhead, looking for body heat or wireless signals. Ukraine has been labelled as "a graveyard of command posts"¹⁴ and the answer lies in a centralised command for strategy and autonomous control for tactical manoeuvres.¹⁵

14. "The Graveyard of Command Posts: What Chornobaivka Should Teach Us about Command and Control in Large-Scale Combat Operations", <https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/May-June-2023/Graveyard-of-Command-Posts/>. Accessed on September 13, 2023.

15. Dave Sloggett, "Drone Warfare: The Development of Unmanned Aerial Conflict", <https://archive.org/details/dronewarfaredeve0000dave/page/n5/mode/2up>. Accessed on September 6, 2023,

- **Adaptive Strategies:** The fruits of NCOs can be realised only if the planners are able to respond to the data available to them. To fully utilise the product of networking, the commanders need to lean on flexible planning and adaptive strategies that can manifest as high tempo operations.
- **Artificial Intelligence Integration:** The incorporation of AI and machine learning algorithms can help in predictive analysis, enabling the IAF to anticipate adversary actions and formulate proactive responses. A gradual move towards quantum computing will further rejuvenate operations.
- **Training:** Adoption of a full-fledged NCO by the appropriate systems, platforms, training and procedure builds in a certain dependency for the war-fighter. Any system degradation can have a corresponding negative effect on combat capabilities drastically. Thus, training for operations in denied scenarios is a must.

In the words of military strategist Liddell Hart, “The direct way to a battlefield is always the best; to the same battlefield by a different route may be the second best.” Network-centric operations offer that “different route,” allowing military forces to manoeuvre with greater precision, achieve the tempo, and harness the power of synergy for a future characterised by agile and effective warfare.

CONCLUSION

In the complex theatre of modern warfare, achieving victory is predicated on the ability to maintain the advantage in terms of information, speed and coordination. Network-centric operations offer a formidable toolkit for the military forces to achieve these goals, fostering a more agile, responsive, and effective approach to conflict. NCOs brings about a synergy in operations, maintenance and operational logistics so that high tempo operations can effectively be executed. NCOs are force multipliers when it comes to shortening the Observe, Orient, Decide, Act (OODA) loop, and taking informed decisions.