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EMPOWERING MILITARY COMMAND AND CONTROL THROUGH INFORMATION TECHNOLOGY

Major Jawad Yaqub

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Solo Flight

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Major Jawad Yaqub

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Command is a military matter, almost mystical.

– Brooke Claxton, Minister of National Defense

INTRODUCTION

The outlook, character and functions of military organisations always reflect the socio-economic and political orders which create them. These organisations evolve and change in accordance with these drivers as demonstrated through history, from ancient times to the modern world. As per Alvin Toffler's *"Third Wave"*, human society has stepped into a third wave of change, owing to a remarkable revolution in the field of information and technology (IT).[1] The proponents of a revolution in military affairs (RMA) have gone a step further in calling this change a new domain (*info-sphere)*, which would bring unprecedented changes to the character of war. As anticipated, IT has found its place in all the major militaries around the world, just it has in all other businesses of life.

Other than its general application in military armament, IT has significantly penetrated our Command and Control (C2) structures and systems. In fact, only an efficient and effective C2 structure will be able to meet the diverse C2 challenges of the contemporary environment in order to achieve synergy of effects. Moreover, spectrum and scope of operations in the modern conflicts requires a much larger and efficient span of control involving complex machines, weapons and humans. Realising the fact, militaries across the world are investing billions of dollars in acquiring modern IT enabled C2 systems and developing new concepts/ models to meet the futuristic C2 requirements. David S. Alberts notes that

[1] Alvin Toffler, The Third Wave, (New York: Bantam Books, 1991), 30; Alvin and Heidi Toffler, War and anti-War: Survival at the Dawn of the 21st Century (New York: Warner Books, 1995), 33-37

IT has somewhat reduced the fog of war[2] (specially in physical domain) by optimizing battlespace information, which may gradually push C2 towards speed and efficiency. However, the true potential offered by the modern IT has still not been operationalized owing to various underlying reasons and problems. Therefore, it is important to analyse those critical aspects, shortcomings and obstacles in order to fully integrate IT in our conventional/ traditional C2 systems and adapt as per the dictates of the global environment.

This paper will demonstrate that IT leverages tremendous potential to military organisations in improving C2, rendering it much more efficient and effective in the modern battlespace. However, conventional C2 would have to be re-designed and re-adjusted, in order to fully adapt and capitalise the dynamic trends in IT in true sense. This paper is a broad *theoretical discourse* which will unfold in three major sections, starting with setting the context by discussing conceptual contours of C2, followed by analysis of traditional C2 in relation to the modern IT concepts and finally addressing the way forward by suggesting few feasible C2 models.

AN OVERVIEW OF CONVENTIONAL C2

Defining C2 is a complex proposition owing to the diversity and varied interpretation of the term, which is evident from the vast literature and theoretical perspectives available on the subject. For the same reason, it carries reputation of being arcane and murky among the scholars and even the people / organizations who are or have been its practitioners. Therefore, it is important to first put into context, by means of

[2] David S. Alberts, Information age Transformation-Getting to a 21st Century Military (CCRP,1996), 54.

certain definitions and concepts, the domains of C2 which arguably have been or will be most effected by revolution in IT.

As per the definitions given in US JCS Pub. *Command* is "The responsibility for effectively using available resources, planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions. It also includes the responsibility for health, welfare, morale, and discipline of assigned personnel." [3] Whereas, *C2* is "The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. C2 functions are performed though an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission."[4] As evident from similarities in definitions, command and control are also often used interchangeably. However, many practitioners, and scholars have tried to draw a distinction these two activities to include: one between art (command) and science (control) and one between the commander (command) and staff (control).

C2 as Decision Making is perhaps one of the most influential and pervasive perspectives. This explains heavy investments by militaries across the world in acquiring modern communication systems to improve information acquisition, intelligence fusion and achieve Dominant Battlefield Knowledge (DBK) [5] for efficient decision making. In

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[3] US Department of Defense Dictionary of Military and Associated Terms. Joint Pubs. 1-02. http://www.dtic.mil/doctrine/jel/doddict/.

[4] ibid

[5] David J. Lonsdale, The Nature of War in the Information Age: Clausewitzian Future (Frank CASS, Great Britain, 2004), 9.

any military organization C2 can be equated with a nervous system in terms of the human body, as both receive information from different sensors and process it in order to make appropriate decisions.[6] Boyd explained this concept through his famous OODA loop underlining importance of speed to make correct decisions and achieve an edge over the adversary by interrupting its OODA loop.[7]

Much of the classical historic literature describes *command as an art* and takes a strong stance that C2 is a *Human Endeavour*.[8] Only human commanders possess the degree of creativity, inventiveness and diligent purposefulness necessary to accomplish mission objectives and take responsibility required to solve intractable problems of C2. Clausewitz viewed command as a *military genius*[9] - a human enshrined with extra-ordinary traits and attributes which not only help him effectively command his men but subdue the enemy. For Sun Tzu it's not the intuitiveness of the commander but his measured and well calculated approach which is decisive.[10] Although explanation varies among classical war strategists and commanders, *human* remains to be the center piece of their ideas on C2. Nonetheless, this makes a lot of sense when we look through history into our present military C2, where command has always remained associated with a human commander.

C2 is also often regarded as an *Organizational Process*. This concept argues that due to the complexities and dimensions of C2, it cannot be limited to the individual(s)

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[6] Thomas P. Coakley, "Command and Control for Peace and War.", 1991.

[7] Grant T. Hammond, The Mind of War: John Boyd and American Security (Smithsonian Institution Press, 2001).

[8] David J. Lonsdale, The Nature of War in the Information Age, 9.

[9] Carl Von Clausewitz, On War (London, David Campbell, 1993), 115.

[10] Handel, Masters of War, 83; Sun Tu Zu, The Art of War.

and therefore requires a deliberate organizational process.[11] This process is sequential and methodical which runs across various components/ branches of the system, ending up achieving the desired product. It postulates that rather than relying on military genius, which is rare to find, genius should be institutionalized through deliberate processes, best practices and procedures. In effect, it points toward the principle of hierarchical structures which operate as per standard operating procedures (SOPs), ultimately having a single human executive at the top.

David S. Alberts and Richard E. Hayes explain *C2 as a function* of four domains of warfare (physical, information, cognitive and social).[12] As per their conceptual model, physical domain includes C2 sensors, systems and platforms. Information collected, processed, and saved fall in the information domain. The perception and interpretation of this information including mental models, biases and values that serve to influence the analysis of information, as well as the nature of responses fall in Cognitive domain. Interactions among individuals and entities that fundamentally constitute the organization and doctrine exist in the social domain. Most importantly, the model explains direct and delegated role of C2 in the information age and highlights that social behaviors shape the final outcome of C2 processes.

[11] Colin S. Gray, Modern Strategy (Oxford, Oxford University Press, 1999)53; Martin van Crevald, Command in War, (Cambridge, MA, Harvard University Press,1985), 143.

[12] Understanding Command and Control, David S. Alberts Richard E. Hayes, US DoD CCRP, page 53-54; Martin Révay, Miroslav Líška, "OODA Loop in Command & Control Systems", Armed Forces Academy of Gen. M. R. Štefánik.

Present C2 - Evolution and Peculiarities

As per historical evidence described by Alvin and Haiedi Toffler, human society has stepped into information age leaving behind the first (Agrarian) and second (Industrial) waves.[13] The Industrial Wave brought major transformations in militaries, especially with regards to their size, structure and C2. Most of the *management principles* practiced by industrial age economies and businesses were replicated to the military C2 as well. However, same cannot be said about current/ information age military C2, as it still seems to carry certain legacies of the Industrial Age. Before analysing the effects of IT on our C2, it is important to see few major but common structural characteristics of existing C2:

- Overall Command authority and power rests with one individual who is legally empowered to take decisions based on his rank/ position in the organization. He is often assisted by principle staff officer(s) and advisors depending on the type and size of organization. In terms of methodology we are close to following the combination of Command by plan and Command by influence. [14]

- Like industrial age, most militaries today have divided their roles as precisely as possible into *coherent branches/ sub-sets* that could be mastered with the existing knowledge, technologies, and personnel. These staff branches are represented through J codes/ tasks i.e. personnel, intelligence, operations, logistics, etc. which monitor, report, plan, and implement functional activities within their areas of competence only.

[13] Alvin Toffler, The Third Wave (New York: Bantam Books, 1991), 30; Alvin and Heidi Toffler, War and anti-War: Survival at the Dawn of the 21st Century (New York: Warner Books, 1995), 33-37.

[14] Martin van Creveld, Command in War (Cambridge, Mass.: Harvard University Press, 1985), 53.

- The organizational consequence of the branching and division is that our C2 is hierarchical with layers of middle leaders / managers referred to as staff. The authority is delegated down to centre management to maintain synergy by translating executive intent to lower echelons. The size of the staff and number of layers is based on the tasks, overall size of organization and the required span of control.

- Present C2 processes relies heavily on control measures to de-conflict the elements of force operating on ground. These control measures serve to dispose authorities and responsibilities within C2 structure by defining areas of responsibilities (AOR), altitude restrictions, no-fire zones etc. and provide each element of the force with best possible operating environment.

- Centralised planning still remains to be pivotal which enables commanders to arrange forces and events in time and space for mission accomplishment. Moreover, to cater for the dynamic battlefield environment and fragility of plans, decentralised execution is encouraged as was practiced by German's during the World War II.[15]

[15] Charles Messenegr, The Art of Blitzkreig, Second Edition (London, Ian Allan, 1991); Davenport, T.H. and Prusack, L, Working Knowledge: How Organizations Manage What They Know (Cambridge, MA: Harvard Business School Press, 1998).

FUTURE EXPECTATIONS, IT AND EXISTING C2

Net–Centric Warfare

NCW is a futuristic war fighting concept, central to US' Joint Vision 2010 and 2020, designed to create and leverage information.[16] It is focused towards enhancing information enabled combat power by integrating sensors, decision makers and shooters thereby achieving common operating picture (COP), efficient C2, self-synchronization and greater lethality. Although the conceptual contours have been conceived, studies to determine its C2 structure are still underway and likely to be continued in near future. However, the tenets relevant to create C2 for NCW are conceived to be as follows:[17]

- A robustly networked force enabling information sharing and collaboration to enhance shared situational awareness and quality of information among users.
- Shared situational awareness and COP leading to self-synchronization contributing significantly towards increased mission effectiveness.
- Provision of vastly increased access to information at all echelons, and redefinition of the relationships among participants in a mission and between commanders and subordinates.

Pan-Domain Force Employment Concept (PFEC)[18]

PFEC is an emerging concept in Canadian Armed Forces (CAF), central to *How We Fight,* which entails achieving broader set of capabilities, integrated across various

[16] Alberts, David S., John J. Garstka, and Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority (Washington, DC: CCRP. August 1999), 2.

[17] Network Centric Warfare Department of Defense Report to Congress. July 2001, 1.

[18] Pan Domain Force Employment Concept – Prevailing in an Uncertain World, Ministry of National Defence 2019.

domains (physical and cognitive) and applied in concert with other elements of national power. In addition to three conventional domains of military warfighting, cyber and space have also been tailored in the concept. It identifies fourteen key elements which address the imperatives of future strategic and operational environment, in order to generate comprehensive response with the *speed of operational relevance*.[19] Its C2 element entails new cross-domain approaches, based on advanced communication networks, high level of integration, linkages with new partners and common information management practices –regionally, nationally and abroad.

System of Systems (SOS)

This concept underlines the need for joint strategic doctrine and high level of integration among various components in future military operations. Its pioneer, William Owen, notes that a 'SOS' can be created through integration of three technologies: Intelligence, Surveillance and Reconnaissance (ISR); Command, Control, Communication, Computers and Intelligence (C4I); and precision force.[20] C2 segment of SOS will be pivotal to achieve the powerful synergy between ISR, C4I and Precision Force. C2 will be highly robust and interoperable and dependent upon well orchestrated contributions of all military services.

While the conceptual contours of these concepts may differ a great deal, the expectations from C2 broadly pointed towards need for increased integration, shared awareness/ COP and speed of decision. Having contextualized few relevant dimensions of

[19]Pan Domain Force Employment Concept – Prevailing in an Uncertain World, Ministry of National Defence 2019.

[20] Admiral William A. Owens, "The Emerging Systems of Systems", Military Review, 75, 3(1995).

C2, discussed its broad structure and future expectations, now an in-depth analysis of these C2 aspects would be carried out in order to determine where our C2 stands today and what can we do about it.

Decision Making and Integration

Fast and accurate decision making is necessary to achieve synergy/ massing of effects in the today's complex battlefield. In simple terms, decision making involves acquisition of correct and timely information, extracting options based on analysis and finally selecting feasible course of action. This simple and effective process, known as OODA loop[21], follows natural discourse and therefore widely adopted as C2 function. Although, it has not changed much over time, the environment, means and ways to execute it are quite different today. Information technology has significantly improved speed and quality of OODA loop, owing to fast acquisition of information through sophisticated ISR platforms, employing robust wireless communication networks and using Big Data analysis capabilities. Commanders today have luxury of access to real time triple play services (voice, video, data) irrespective of the time and weather, which has added realism in decision making. However, still there are many voids to achieve the desirable level of integration, both in terms of means employed and effects desired on ground. Two major impediments to this are *slow speed of flow of information within* our multi-layered hierarchical C2 structure and *non-uniform/ irregular* distribution of information.

[21] The late John Boyd, a Colonel in the United States Air Force, developed several bodies of work that expressed the ability to detect and solve problems in terms of a figurative loop. The loop was an expression of this process over time. The larger the loop, the more time the OODA loop process took to complete. He developed his ideas from his early days as a fighter pilot. The OODA loop cycle, though initially developed as a tactical level model for fighter aircraft engagements, has implications and utility at the operational and strategic levels of war as well as externally in the competitive civilian world.

The slow speed and delays can be attributed to long monotonous chains of command, in which information flows upwards and downwards in multi layered topology which also limits direct superior-subordinate interaction. A sizeable middle management (often considered as control mechanism)[22], that was created to streamline things, appears to be a major choking zone – more the layers, longer it takes and higher the probability of an error or distortion.[23] Moreover, there exists a culture and tendency (often exaggerated) to limit the information access to the users in the name of secrecy and notion of *need to know basis*. While there is absolutely no question to keep requisite confidentiality, this strangulation of information has become part of our organizational culture specially at middle management level.

Secondly, the distribution of information across C2 structure is non-uniform as it tends to reside in pockets and compartments. There is a clear disconnect amongst our specialist branches which act as stovepipes[24] and barrages to horizontal flow of information and restrict developing shared awareness/ synchronization. These stovepipes have their own cultures and orientation based on which they tend to form their own narrow objectives.[25] Information exchanges and collaboration are not a norm and often have to be accomplished by pressures. Such biggest traditional divide is between operations/ plans and logistics/ administrative branches, which are often found oblivious of each other due to many deep rooted biases. This adversely effects the planning and execution of the operations. Moreover, a lot of information is hoarded with commander and his principle

[22] David S. Alberts, "Command Arrangements", 7.
[23] David S. Alberts, "Information Age Transformation", 60.
[24] David S. Alberts, "The Future of C2, Agility, Focus and Convergence-Future of command and control" (CCRP, Vol 1, no.1, 2007), 216
[25] *ibid*

staff, and not disseminated down below. This jamming of information may seem a lesser problem in a short, high profile targeted operations, which are directly monitored by commanders themselves, it could be extremely hazardous in conventional or protracted military operations.

Human Aspects of C2

Despite diverging viewpoints, as a matter of fact, command still rests with individuals in military organizations, the way it has been historically. These individuals execute command through directives and have the final authority to make decisions on behalf of the outfit. However, interestingly, it is perhaps the human aspects of C2 which are now being challenged by the most IT. The extraordinary capability, creativity and intuitiveness associated with the human mind (commander) to tackle the range of complex issues is put to test in an unprecedented manner today. Artificial intelligence (AI) is leading the way in problem solving and decision making and has already stepped into many military planning and war gaming programs around the world.[26] The super computers can not only analyse and manage huge amount of incoming data at a lightning speed, but also capable of creating logical models, plot predictions and making accurate decisions much beyond human comprehension.[27] Many computer software used in corporate world today are more efficient in carrying out tasks associated with traditional military staff functions, computing, monitoring and routine coordination. However, our C2 structure is still human-heavy with very less control leveraged to machines and computers. Besides resistance to

[26] Jensen, Benjamin, Scott Cuomo, and Chris Whyte, "War gaming with Athena: How to Make Militaries Smarter, Faster, and More Efficient with Artificial Intelligence." War on the Rocks, June 5, 2018.

[27] Leonhard, "The Principles of War for Information Age", 176.

change, security and cultural issues, these technologies based models are often considered a direct threat to the notion of human command and power.

Command has a major leadership role in social and psychological domains – one of the reason it is often regarded as an *art*. Knowing your men, interacting and establishing relationship is pivotal to the management of forces. This role of military commander is considered a key dimension in analysing his ability and effectiveness to *Lead the People.*[28] Montgomery notes that command is all about building relationships with the subordinates based on trust.[29] For the same reason Alexander the Great used to visit his troops even when he was wounded himself.[30] IT unfortunately has started to reduce intimate interactions and weaken those traditional relationships. Field visits, tours and personal interactions have squeezed and often been replaced by telephonic calls, video conferences and chats. Not only it has effected an important C2 function, but subsequently causing issues of low morale, retention of people and maintaining high readiness of forces.

Perception Management and Joint Vision

Narrative building and perception management, both within and outside the military organisation, has come up as an important command responsibility in modern conflicts. As mentioned by Emile Simpson in *"War from ground up"*, globalization and IT has increased and diversified the *strategic audience* of any conflict, whose perception is consequential in defining final outcome of military operation.[31] In addition to maintain

[28] Leadership in Canadian Forces-Conceptual Foundations (Canada Department of National Defense, 2005)

[29] Bernard Law Montgomery, The Path to Leadership, (Collins, 1961), 9.

[30] John Keegan, The Mask of Command (London, Penguin, 1988), 46.

[31] Emile Simpson, War from Ground Up- twenty Fist Century Combat as Politics (Oxford University Press, New York, 2018); David S. Alberts, Information age Transformation-Getting to a 21st Century

strategic narrative, control of information and sharing of command vision down till tactical level has become challenging, owing to availability of multiple sources of information to our soldier today. Diverse interpretative environments, influence of social media and utterly confusing character of war has further compounded this issue.[32] Commanders on ground have often faced difficulties to enforce their intent on ground, as the tactical commanders tend to see things differently and want to do things differently. Emily Simpson, while describing his personal experience mentions that such discrepancies are growing as command echelons are unable to synchronise their vision, which has often lead to botched execution of operations in complex battlefields of Afghanistan and Iraq.[33] As a matter of fact, the abundance of information (other than coming from chain), its frequency and the sequence in which it is received is creating serious C2 challenges in 21st century.

C2 as a Process

Our present C2, specially the middle management, works in a mechanical order which is both sequential and time consuming usually based on standard operating procedures (SOPs). Today, two of the main functions of staff i.e. information transfer and worker supervision can be executed by using IT solutions with requisite amount of security and efficiency. Large number of staff can also be slashed, who is only committed to conduct cumbersome staff checks asked by the commanders as part of planning process. Years old data, records and reports etc. available on files and papers can be easily digitized

Military (CCRP,1996), 54; Boucher, Jean-Christophe. "Evaluating the Trenton Effect: Canadian Public Opinion and Military Casualties in Afghanistan (2006-2010)." American Review of Canadian Studies 40, no. 2 (2010): 237-258.

[32] ibid

[33] ibid

and placed centrally for easy access in a paper free environment to reduce our reliance on clerical staff.

On the other hand, with the induction of hi-tech equipment there is a growing need to incorporate expert handlers, operators and trouble shooters in our military organisations specially at operational and strategic levels. Increasing dependence on civilian contractors and specialist staff is creating new command challenges in terms of reliability, security and especially training. Difficulty does not only lie in imparting requisite military training, but to establish traditional/ authoritative control over civilians while keeping in view the legal and ethical thresholds.

WAY FORWARD

Network Based C2

In order to address the increasing need for integration in C2, switching to network model from our traditional hierarchal structure appears to be an attractive option. In such C2 system all individuals will be equal and autonomous, will have equal access to information and share common vision /understanding in highly synchronised environment. There will be no hierarchal hiccups, single decision maker or commander, rather decisions would be based on shared awareness and consensus. The authority, resources and power would be extended down to the lower/ tactical level which would lead to creation of an Edge Organisation,[34] where quick decisions would be made based

[34] David S. Alberts, "The Future of C2, Agility, Focus and Convergence-Future of command and control" (CCRP, Vol 1, no.1, 2007).

on dictates of the situation. Such organization will be highly agile and well suited to deal with uncertainty and unfamiliarity by giving innovative solutions.[35]

However, ideal picture aside, it is important to understand some of grave issues with such networks and feasibility to adopt them at full scale. While group thinking is beneficial, decision making based on consensus of large audience/ stakeholders is a very difficult proposition. Rather than squeezing the decision time, it may cause delays and lead to less appropriate decisions. As per Jomini, decisions based on consensus tends towards lowest denominators and create decisions which are devoid of risk.[36] This is especially true in time compressed and contested battlefield environment. Now consider such networked decision making situation in a coalition perspective[37], the likely way in which we would be fighting a future war. The deviating interests, legal and national caveats and other differences would make it extremely difficult to make a collective decision making.

Pushing power/ authority to the edge and delegating equal authorities all across the organisation can prove detrimental, specially in this age of information dominance and propaganda. After all, sound decision making need requisite level of competence, creativity and breadth of outlook which every person in the network cannot have. As explained by Pigeau and McCann in their CAR model[38], only the person having high level of competence and experience should be given higher authorities to achieve

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[35] David S. Alberts, "The Future of C2, Agility, Focus and Convergence-Future of command and control" (CCRP, Vol 1, no.1, 2007).

[36] Handel, Masters of War,155

[37] Martin Révay, Miroslav Líška, "OODA Loop in Command & Control Systems", Armed Forces Academy of Gen. M. R. Štefánik

[38] Pigeau, Ross, and Carol McCann. "Re-conceptualizing Command and Control." Canadian Military Journal 3, no. 1 (2002): 53-63.

balanced C2 envelope. Small actions often trigger strategic effects in the present era, which make this concept extremely difficult to implement in entirety.

Last but not the least are the unintended consequences of the increased homogeneity and visibility into operations at all levels, to include potential for information overload, micro-management and stifling of initiatives.[39] There is already a growing tendency of intervention by the operational commanders in to the tactical aspects and execution of the tactical operations. While this can also be partially attributed to the stakes of various players involved, growing careerism and organisational pressures, increased visibility to lower levels is one of the overarching reasons to this effect.

AI-Led C2

Many of the futuristic requirements of C2, specially those related to decision making, can perhaps be managed better by incorporating AI in our C2 structures. Owing to its decision making potential, AI today is not only a heavily invested field but extensively used in business plans by leading technology giants like Google, Facebook and Apple.[40] Similarly, leading militaries in the world have also started to invest and incorporate AI in their traditional decision making processes/ Operational Planning Process (OPP) off late.[41] Rather, some of decision making in technical level of warfare like anti-missile operations has already been fully automated.[42] While there is a sound

[39] David S. Alberts, Information age Transformation-Getting to a 21st Century Military (CCRP,1996), 9,62.

[40] Michael C. Horowitz, "The Promise and Peril of Military Application of Artificial Intelligence," Bulletin of the Atomic Scientists, last modified 23 April 2018, https://thebulletin.org/2018/04/the-promise-and-peril-of-military-applications-of-artificial-intelligence/.

[41] A large number of AI labs are funded by Defence Advanced Research Projects Agency (DARPA) in US today, Davidson, Christine Downton's Brain.

[42] Van Crevald, Command in War, 2.

argument that in future Artificial Super Intelligence (ASI) would surpass the capabilities of human brain in all aspects including learning and deep thinking, the question is not that "is it possible?" but "is it suitable or feasible?" to cede C2 to machines. Therefore, it is prudent to look into the opportunities and challenges both, in order to determine how much and what domains of C2 can be leveraged to AI.

Although human commander carries superior learning and thinking dynamic, the basic human traits, psychology and specially emotions (fear and panic) can have adverse effects on our C2 and overall execution of operations. As Clausewitz also explained that most of the psychological fog of war is created by human emotions itself. [43] Secondly, unlike computers, human is susceptible to health issues, stresses and tiredness where as the AI does not need rest or sleep and can work round the clock. Napoleon's brief absence from the battle of Waterloo on account of bad health proved to be decisive. [44]

On the flipside, AI led C2 poses many grave questions regarding its efficacy and feasibility. As of now, it seems to be lacking towards the aspects related to art of war such as subtleties of policy and strategy.[45] Its role and capability is also murky with regards to legal, cultural, humanitarian and ethical aspects of the conflicts. The human mind is considered to be more receptive to the dynamics and intricacies posed by uncertain situations as compared to a machine. There is also a possibility of biases in decision making, based on the source of machine programming. Other command aspects linked with the politics and diplomacy of war are also vague. Besides, militaries do not

[43] Van Riper, Scales, Preparing for War in 21st Century, 9.
[44] David J. Lonsdale, The Nature of War in the Information Age: Clausewitzian Future (Frank CASS, Great Britain, 2004), 9.
[45] Van Crevald, Command in War, 186.

have resources (monetary and technological expertise) required to operationalize AI and will likely remain same in near future, at least in free democratic countries. The potential held with civil industry and firms is difficult to leverage as they are reluctant to be partners in any defence projects owing to consequences for their business and reputation. [46] Last but not the least, power has always remained associated with the humans, for which he has contested and fought over history, ceding it to the machines would be an intricate issue in itself.

Hybrid Structure of C2

It is fairly evident that both C2 models discussed above come with pros and cons and it may not be feasible as well as suitable to adopt them holistically, at least as of now. However, it is also clear that present C2 is not fully optimized to the potentials offered by IT. A transformation is therefore required and one of the practical options is to systematically induct selective Network and AI based capabilities in our present C2, to convert it into an efficient and progressive hybrid structure. Rather than replacing, these network enabled capabilities (NEC) and AI would act as enablers and share the burden[47] of commanders and staff. Moreover, proposing a standard future C2 structure is also not practical owing to varied sizes, cultures and role of armies around the world. Therefore, few of the generic aspects of suggested hybrid C2 structure will be explained below.

Decision authority should stay with the human commander, either an individual or a group while reducing harsh authoritative tendencies. Maximum use of AI enablers be

[46] M.L. Cummings, "Artificial Intelligence and the Future of Warfare", Research Paper (London: Chatam House - The Royal Institute of International Affairs, 2017), 11.

[47] Martin van Creveld, "Command in War".

made in providing efficient analysis, war gaming,[48] communications, data management and administration, while minimum emphasis be laid in its application in lethal autonomous weapon systems and programs. Maximum support from the private sector be sought in this regards in order to remain abreast with latest technologies and global trends.

C2 topology should be flattened by reducing the number of layers and branches in the hierarchy. Span of control be supplemented by use of IT based capabilities, and digitization. Long, lengthy and repetitive staff functions be ceded to fast computer software. This would also cater for delays by providing more direct and fast communications among various echelons.

While it is absolutely important to create an environment of shared awareness, achieving same level of understanding and interpretation all across would still be difficult, owing to varying level of competence of human at the end nodes. This also highlights the accountability issues, as it would be extremely difficult to fix it, especially when final responsibility still rests with the senior in chain of command. Moreover, various institutional and socio-political constraints are effecting the command decisions as well.[49] Based on this fact, rather than having an open/ homogenous network, an optimized networking be carried out which would ensure appropriate and adequate visibility of operations and information at all levels and among all branches.

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[48] Jensen, Benjamin, Scott Cuomo, and Chris Whyte, "War gaming with Athena: How to Make Militaries Smarter, Faster, and More Efficient with Artificial Intelligence." War on the Rocks, June 5, 2018.

[49] Barros, Robert. "Personalization and Institutional Constraints: Pinochet, the Military Junta, and the 1980 Constitution." Latin America Politics and Society 43, no. 1 (Spring 2001): 5-28.

Although, it is good to push the authority and initiative down to tactical level, it also appears to a very tricky proposition. War today is hybrid[50] and political, more than ever before, which has made governments and strategic commanders extremely sensitive even to the tactical level execution of military operations. The stakes are high and tendency of micromanagement is likely to increase in future as the operational level of command is argued to have squeezed overtime. This means that the importance of centralised planning will likely increase, however, the concept of decentralized execution (Maneuver warfare and mission tactics used in WWII)[51] needs to be transformed. The future Pan Domain and joint operations would deem more centralised execution in order to achieve desired synergy of effects. Curtailing initiative at tactical may certainly lead to resentments, but this will have to be catered by moulding C2 from Command and Control to consultation and coordination domain by increasing linkages and interactions between various levels of command.[52] More importance would have to be laid on the leadership aspects of C2. Fast communications, flattening of organizations and use of NEC will also help to bridge this gap effectively. This would also serve well to the coalition operations where many civilian stakeholders are also involved in decision making.

[50]Brigadier Ahsan Mehmood Khan, " Hybrid Warfare: A Conceptual Perspective", Hilal, 1 Feb 2018.

[51] Charles Messenegr, The Art of Blitzkreig, Second Edition (London, Ian Allan, 1991).

[52] John Arquilla and David Ronfeldt, “Cyberwar is Coming!” Comparative Strategy, Vol 12, No. 2, Spring 1993,141–165.

CONCLUSION

Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.

– Giulio Douhet, The Command of Air

C2 is transforming as per dictates of information age, but definitely at a slow pace. The opportunities offered by IT are attractive, but not very easy to harness, due to many institutional and environmental constraints. Since an ideal and all-encompassing futuristic C2 structure is difficult to design and predict, a progressive hybrid model based on combination of NEC and AI would have to be adopted. There is a need to flatten our hierarchies and steer culture of authoritarian style of command towards more collaborative form of C2, in order to capitalize perks of technology. A balanced and phased approach will have to be adopted to operationalize new technologies and make our C2 more *efficient and effective*. However, thorough risk assessment will have to carried out before incorporating and ceding control to the NEC and AI.

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