White Book

Mastering the complexity of crises in a connected environment

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Key words : *Command & control* [C2] ; Defense; Future Military Conflicts; Sensors; Effectors; Emerging and Disruptive Technologies; Asymmetric and Hybrid Strategies; Military Innovation; *Common operating picture* [COP] ; JADC2

Summary :

This document explores the concepts of "Command and Control" (C2) in today's world. It is a complex concept, difficult to define precisely, yet increasingly central to the management of military operations and crisis situations. Long reserved for major powers in their military operations, C2 has now become a growing area of interest for many countries.

Today, C2 represents a strategic challenge in contemporary conflicts, particularly for nations such as Russia and China. Positioned at the intersection of organizational, military, and technological issues, C2 is a fundamental element in conducting operations in increasingly unstable environments. Thanks to new technologies, often originating from the commercial sector, C2 has been evolving and, in recent years, has found applications in civilian domains.

Summary

Emerging in military lexicon in the 1980s, the concept of Command and Control (C2) today refers to the set of elements and processes that mobilize human, material, technological, and informational resources to achieve given objectives. Currently, C2 is being transformed by both exogenous and endogenous factors:

- The intrusion of technology and data: Military organizations must integrate emerging technologies such as artificial intelligence and safeguard against new risks like cyberattacks.
- The end of siloed missions: Operations are now conducted in a "multi-domain" approach.
- Increased cooperation and integration: These have become crucial, if not indispensable.
- New disruptive powers: Some states are developing capabilities that require adapting C2 to counter threats arising from hybrid and asymmetric strategies in a contested and highly dynamic environment.
- Increased complexity of conflicts: Conflicts are becoming more unpredictable and complex, requiring renewed operational approaches.

All major military powers have tackled C2-related challenges to develop new approaches in conducting their operations. However, C2 presents a dual challenge: (1) it lacks a precise definition and theoretical orientation, making it difficult to establish comprehensive doctrines; (2) it encompasses numerous concepts and technologies, which can make it challenging to grasp the subject as a whole.

- United States: Under the "JADC2" project, C2 encompasses a series of disparate efforts across different military services, making the integration of developed systems complex, especially with international partners. Nevertheless, C2 remains a pillar of the U.S. military's modernization, as it will ultimately enable a more "information-driven" approach to warfare. The U.S. conducts numerous C2-focused exercises and collaborates with major national corporations to integrate the latest innovations into its systems.
- China and Russia: These countries have emphasized developing technological capabilities (AI, system automation, drones, etc.) to counter U.S. advancements. However, the Russo-Ukrainian war demonstrates that an effective C2 system must rely on a comprehensive and coherent ecosystem, combining technical capabilities for organizing and tracking operations with a command hierarchy that facilitates rapid and informed decision-making.
- European Powers: The United Kingdom, France, Germany, Italy, and Poland have also been working on C2 for several years. Although their projects receive less media attention, Europe appears to be developing military C2 philosophies and ecosystems comparable to U.S. efforts.
- NATO: With its unique international role, NATO plays a leading role in developing C2 doctrines and guidelines adopted by various militaries worldwide. Interoperability is at the core of modern C2 capabilities, and NATO has proposed an in-depth reflection on an "agile C2" philosophy

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With the emergence of the "C2" concept in military doctrines, commercial players are now offering ready-to-use C2 solutions, leveraging the latest civilian technologies:

- Data storage and protection (e.g., cloud-based solutions);
- Control interfaces for autonomous drones;
- Satellite communication systems;
- Real-time information-sharing platforms;
- Cyber defense and cybersecurity systems;
- Mission planning tools;
- Native sensor integration;
- 2D and 3D mapping for comprehensive operational theater visualization;
- Decision-support tools based on artificial intelligence technologies.

The commercial sector has also successfully extended C2 applications to civilian domains, such as event security, hospital management, and smart cities, by adapting military products to these new contexts. As a result, some

major military C2 providers now offer solutions for border protection, event security, and post-earthquake crisis management.

Commercial C2 applications drive innovation by enabling the rapid evaluation of emerging technologies—such as artificial intelligence and digital twins—often at a faster pace than in military contexts.

C2 is not a final state but a continuous pursuit of ever-advanced integration, with numerous challenges to overcome. After incorporating cutting-edge technologies from the commercial sector into military institutions—the so-called "hard issues"—it is equally essential to address the "soft issues," namely organizational and human factors.

Indeed, technological advancements and the evolving nature of military operations (acceleration, contested environments, multi-domain operations, etc.) necessitate adaptations in hierarchical processes, operator training, and traditional doctrines. Successfully adopting C2 therefore requires the mobilization and reform of all its components:

- Technological: Systems must become more resilient, modular, open, and increasingly automated.
- Human: Personnel must be trained in C2-related challenges and have confidence in the adopted procedures, systems, and hierarchical structures.
- Organizational: C2 functions, particularly collaboration (between agencies and with allies) and decision-making (assisted by AI)—must be facilitated by a command structure that is (1) better aligned with challenges and their timelines, (2) more agile, and (3) more open to integrating multiple actors

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As in the 20th century, C2 will be profoundly transformed by the technologies of the coming century. These diverse technologies (artificial intelligence, quantum computing, cloud computing, autonomous systems, etc.) open several perspectives:

- Faster and better-informed operations: Operations will take place at an increasingly rapid pace with a higher level of information; command levels could be streamlined thanks to a shared real-time global view accessible to all.
- Partial automation of C2 systems: C2 systems will be at least partially automated, redefining operators' tasks; human-machine interfaces will play a key role in establishing effective C2 systems.
- Technological resilience: New technologies must be resistant to potential disruptions, including external destabilization attempts; AI tools must be reliable for sensitive operations.
- Data at the heart of operations: Data will be central to the functioning of C2 systems and informed decision-making; data reliability and protection will be crucial to ensuring operational continuity.
- Interoperability and coherence: The proliferation of technological tools must rely on overall coherence to prevent interoperability risks and confusion. The objectives, system use contexts, and operators' roles must be considered to ensure that introducing new technologies does not compromise the functionality of existing systems. The complexity of a C2 ecosystem, particularly from a technological standpoint, could paralyze the entire system and hinder mission execution.

List of Key Abbreviations

A2/AD	*anti-access et area denial* déni d'accès et interdiction de zone
ABMS	ÉTATS-UNIS *Advanced Battle Management System* Système de gestion de combat avancé
BMS	*battle management system* système de gestion de combat
C2	*command and control* commandement et contrôle/conduite
C2D2E	*C2 denied or degraded environment* environnement C2 indisponible ou degradé
C2 IA	FRANCE Joint Command and Control
COP	*common operating picture* image opérationnelle commune
COTS	*commercial off-the-shelf* commercial prêt à l'emploi (produit)
COVID-19	Coronavirus Disease 2019
DCDC	ROYAUME-UNI *Development, Concepts and Doctrine Centre* Centre de développement, de concepts et de doctrine
DoD	ÉTATS-UNIS *Department of Defense* ministère de la Défense américain
DYJQZ	CHINE *多域精确战* (*Duō yù jīngquè zhàn*) guerre de précision multi-domaines
EDT	*emerging and disrupting technology* technologie émergente et perturbatrice/disruptive
DES	Desired End State
GIDE	ÉTATS-UNIS *Global Information Dominance Experiments* Expériences de domination mondiale de l'information
AI	Artificial Intelligence
IT	*information technology* technologie de l'information
JADC2	ÉTATS-UNIS *joint all-domain command and control* commandement et contrôle multi-domaines interarmées
JCN	ROYAUME-UNI *Joint Concept Note* Note conceptuelle interarmées
M2MC	FRANCE multi-domain and multi-field
MDO	*multi-domain operations* opérations multi-domaines
ML	*machine learning* apprentissage automatique
MoD	ROYAUME-UNI *Ministry of Defence* ministère de la Défense britannique
NICT	New Information and Communication Technologies
OODA	*observe–orient–decide–act* observer–orienter–décider–agir
UN	United Nations
OSINT	*open-source intelligence* renseignements de source ouverte
NATO	North Atlantic Treaty Organization
CP	Command Post
PRC	CHINA People's Republic of China
SASU	*Situational awareness and situational understanding* pleine conscience et compréhension de la situation

SDA	ÉTATS-UNIS *Space Development Agency* Agence de développement spatial
SoS	*system of systems* système de systèmes
UAS	*uncrewed aircraft systems* systèmes d'aéronefs sans équipage
EU	European Union
USAF	ÉTATS-UNIS *United States Air Force* Force aérienne des États-Unis

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Introduction

Command and Control" (C2), is a key function of military operations. C2 provides the direction for an operation, and its capabilities enable the achievement of the designated objective. More than just one of the eight elements that constitute combat power (along with leadership, information, movement and maneuver, intelligence, fires, sustainment, and protection), C2 synchronizes and integrates all these elements to successfully accomplish a mission.

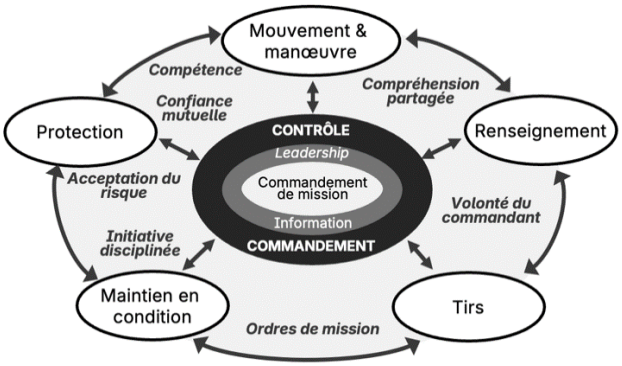

Figure 1 *Combat Power Model (Source : Adapted from* Department of the Army[1]*)*

C2 is currently undergoing a profound transformation—a true "paradigm shift," to use the terms of historian Thomas Kuhn. The discussions on C2, initiated as early as the 1980s, are now being reexamined in light of a multitude of new parameters. C2 operates in a complex military environment, an unpredictable "information era," and within technologies that are advancing so rapidly that this report may already be outdated by the time of its publication.

As a result, the discussion around C2 is gaining new momentum, both through theoretical analyses and transformation projects led by military institutions. In the 21st century, C2 must be redefined to remain relevant.

This report aims to provide a comprehensive overview of C2 from theoretical, operational, and practical perspectives. C2 remains a complex theoretical concept, sometimes misunderstood due to its lack of precise definition; therefore, clarifying this term and its implications is essential to understanding its applications (**Part One**).

Despite the ambiguity surrounding it, major state powers have taken up the issue, developing high-performance C2 architectures tailored to contemporary challenges—to the extent that C2 has become a central issue in modern conflicts (**Part Two**).

Finally, despite efforts to design an "optimal" C2 for today and the future, several aspects remain: (1) unresolved questions and uncertainties, (2) potential developments that could further transform C2, and (3) a growing ecosystem of actors and applications still taking shape (**Part Three**)

[1] Department of the Army. (2019). *ADP 6-0 – Mission Command: Command and Control of Army Forces* [ENG]. https://irp.fas.org/doddir/army/adp6_0.pdf.

Chapter One: Foundations and Evolution of Command and Control

Theoretically, C2 is a field that is both poorly defined and poorly delineated. Beyond the simple juxtaposition of "command" and "control," C2 represents a complex and unique concept. Since its emergence in the 1980s, the concept of C2 has been regularly challenged. Although it has persisted it now encompasses a multitude of additional military concepts, making it difficult to establish a single, stable philosophy of C2.

I. Definition and Conceptualization of Command and Control

A. The Origins of Command and Control: The « Revolution in Military Affairs »

In the late 1980s, Soviet Marshal Nikolai Ogarkov theorized an ongoing "Revolution in Military Affairs" (RMA) in the United States. This revolution, both technological and organizational, focused particularly on networking all elements of a theater of operations (sensors, effectors, and decision-makers) to enhance information sharing and accelerate the speed of command and execution of operations.

Between 1985 and 1995, Western military powers launched various modernization projects for their operations, supported by digitization and communication technologies. Operationally, these efforts were characterized by a desire to shorten the observe-orient-decide-act (OODA) loop, as theorized by American strategist John Boyd, by optimizing information processing—specifically the "OOD" stages of the loop—within the context of the "information era." These technologies primarily enabled (1) more effective data collection, (2) improved cooperation, and (3) the transformation of data into combat power.

Though not explicitly named at the time, modern C2 emerged as a direct result of the Revolution in Military Affairs and remains its most significant legacy in contemporary military doctrines and concepts.[2]. C2 has become the military function that enables more effective operations through the combination of military, technological, human, and organizational resources. Information and its utilization (sharing, exploitation, and protection) are at the core of C2 functions.

B. The Concept of Command and the Concept of Control

C2 is a catch-all term that encompasses two successive and repetitive dynamics in achieving an objective, without being limited to them. Any definition of C2 must first clarify its two fundamental principles: command and control. These two concepts, though often associated, are sometimes mistakenly conflated—terms such as "control" appear in certain definitions of "command," and control is sometimes defined using concepts that belong to command. However, in military lexicon, these two notions have distinctly different meanings.

1. Command

Command is the ability to exercise authority based on recognized criteria such as competence, hierarchy, or even popularity. It also requires essential qualities such as trust, delegation, understanding, loyalty, and

[2] As pointed out by Per WIKBERG, David BRYANT, Peter HOUGHTON et Magdalena GRANÅSEN (2020), A significant number of expressions were created in the 1990s to describe concepts very similar to C2: *dynamic engagement* ; *knowledge management* (a concept used in management) Revolution in Military Affairs; *digitalisation of the battlespace* ; *network-enabled capability* ; *information superiority* ; *warfare in the Information Age* ; etc. Among these concepts, many were not followed by formal doctrines, and it is C2 that has remained in military vocabulary.

wisdom. Within a hierarchical structure, command transmits energy and courses of action to teams. It operates at three overlapping operational levels (excluding the political domain), increasingly interconnected through new technologies to link various decision-making processes:

- Strategic: This level involves major decisions related to the planning and execution of large-scale military operations, including defining the Desired End State (DES). These responsibilities fall to senior officers, typically generals, who oversee operations.
- Operational: This level focuses on coordinating and implementing military operations on the ground.
- Tactical: This level is exercised directly on the battlefield, where operations take place. Unit commanders make real-time operational decisions to achieve assigned objectives.

To some extent, these levels also exist in the civilian world, adapted under terms such as global strategies, team management, and more.

Today, while the fundamental nature of conflicts remains unchanged, their characteristics are evolving, requiring commanders to integrate two new dimensions:

- Allied relations: These demand consideration of multiple political opinions and systems.
- The military-political relationship: This is becoming increasingly crucial yet delicate due to (1) the ability of political authorities to intervene almost in real time during operations and (2) the volatility of political directives.

Command remains the most human component of C2, as only humans can respond to complex operational challenges through creativity—although artificial intelligence (AI) is increasingly approaching this capability.

2. Control

The concept of control, which emerged in military lexicon in the late 1980s, refers to the ability to direct and maintain a system by countering entropy (to manage or eliminate changes and reduce uncertainty). Control involves measuring and assessing the situation; it is simultaneously informative (measuring a state), preventive (anticipating deviations from the Desired End State (DES)), and incentivizing (promoting appropriate actions). Historically static and predefined (through procedures and processes), control is becoming increasingly dynamic thanks to communication technologies, Big Data, and other advancements.

Control enables the development of situational awareness and understanding (SASU). It requires personnel, material capabilities, and coordinated processes to execute a mission or achieve an objective. By its nature, control structures impose certain constraints on freedom of action.

Today, within the framework of C2, control is particularly manifested through the integration of various data and information sources to build a common operating picture (COP). This shared situational visualization serves as the foundation for command decision-making and can also function as a planning tool.

C. *Command & Control*

1. Integration of Command and Control Concepts

C2 combines the characteristics of command and control: it is the exercise of command over means and resources to achieve an objective or mission. C2 operates within the spheres of information (acquisition, analysis, etc.), planning, organization, and strategy execution to reach the intended goal. It plays a crucial role in achieving an objective (or Desired End State (DES) in the military context) through complex operations that may have significant, even catastrophic, consequences.

C2 functions within large, complex systems composed of numerous actors, risks, resources, and methods. As highlighted by Gilles Desclaux and Bernard Claverie (2016), C2—by its application to complex problems and organizations—distinguishes itself from both management and simple technology. C2 is, in fact, a

system with intricate uses, integrating human and technological elements that interact (human-human, machine-machine, or human-machine), thus possessing an "anthropotechnical dimension."

A C2 system is based on several fundamental principles: knowing the position of allies (blue forces) and enemies (red forces) and visualizing them; assessing the capabilities of both allies and enemies; examining different possible courses of action; transmitting the commander's orders; receiving field feedback and iterating the process. This repetitive C2 cycle is greatly facilitated and accelerated by technology, whether in information collection, communication systems, or visualization tools.

The definition of the C2 framework means that its primary applications are military; however, potential applications can also be identified beyond the military sector, in fields where security, time management, and responsiveness are critical factors (see Part Three, II.A):

- Anticipating consequences;
- Crisis management (e.g., in transportation, public safety);
- Error control (e.g., in space programs);
- Action synchronization.

Ultimately, C2 functions as a "system of systems" (SoS), where diverse components work in synergy to achieve set objectives, despite the inherent challenges in its design, management, and implementation—challenges that are especially relevant today. In this perspective, C2 is not merely a hierarchical organization; rather, it is based on collaboration and influence, concepts that highlight the communication challenges often encountered—whether between systems or between human operators.

This collaboration is essential, but it does not rely solely on technology; it is also built on shared cultures and doctrines. As a system, C2 consists of different entities working together across various functions (understanding, execution, regulation, etc.).[3].

Several key concepts can help pave the way toward establishing an effective and high-performing C2 system while also highlighting the inherent challenges in its implementation and maintenance:

- Objective, intent, and purpose: This involves not only defining a clear objective but also considering the acceptable risks for the organization and understanding uncertainties, whether they are deemed controllable or not.
- Performance: This is assessed through (1) the analysis of situations and challenges, (2) the selection of appropriate actions, and (3) the execution of the chosen actions.
- Integration: This focuses on collaboration and the sharing of a common vision, resource optimization, trust-building (which influences contributions and interactions), and the development of a "culture of convergence."
- Standardization and coordination: Ensuring alignment over time and across all levels of decision-making processes.
- Centralization: A C2 system can be structured vertically, with minimal delegation, or more horizontally, allowing for greater responsiveness and decentralized decision-making in immediate situations.

2. From C2 to C6I2SR and the Babylonian Confusion

The acronym "C2," globally adopted since the 1980s, has been revised and redefined over time by various authors, agencies, and other entities. Military literature is filled with proposals to replace the term C2 in an effort to clarify its concepts and better reflect the evolving theoretical, technological, and military challenges that shape its application.

[3] A Theoretical Generic Model of C2 : Niven, G. (2023, novembre). *The Anatomy of Command and Control: a Generic Functional Model* [ENG]. International Command and Control Research and Technology Symposium. https://assets.publishing.service.gov.uk/media/65e84b114e2a8a00115c37a2/Anatomy_of_Command_and_Control_GOV.pdf.

As noted by Thomas Withington (2023), C2 has progressively integrated communication and information dimensions, evolving into C3, then C3I. In recent years, more complex acronyms have emerged, such as C5ISTAR (incorporating computers, cyber, intelligence, surveillance, target acquisition, and reconnaissance) and C6I2SR (adding combat systems and interoperability). In another perspective, C2 has also transformed into MDC2 to reflect multi-domain integration (see Chapter One, III.A).

One could argue that these acronyms and expressions are unnecessary, as C2 has always relied on these interconnected concepts and is now inseparable from new technologies and the integration of different operational environments. These new terms can be seen as ways to address the contemporary challenges of C2.

Additionally, the term "command and control" is sometimes replaced by other dual expressions that reflect a shift in mindset, such as "adapt and collaborate."[4] ; « Concentration and Convergence »[5] ; etc. These changes reflect not only the evolving understanding of C2 but also a certain lack of cohesion in terminology. This led David Foster Wallace, in 1998, to describe C2 theory as "rudimentary," "conjectural," and "apparently random."[6] Once again, these terms hinder the intelligibility of the concept, particularly in the military context, where "command" and "control" are clearly defined—unlike more ambiguous terms such as "concentration."

For these reasons, and in the interest of clarity, it may be preferable to simplify designations as much as possible (C3I, MDC2, etc.) and retain the overarching term "C2."[7] However, since state-led projects each have their own specific designations (JADC2 in the United States, DYJQZ in China, etc.—see **Part Two, I.A. and II.A.1** respectively), it will be necessary to use some of these acronyms.

Similarly, subtle shifts in meaning due to translation should be avoided. For instance, in French military terminology, "commandement" already encompasses the notion of control, which is why the term "commandement et conduite" is sometimes used instead of the original English "command and control." To ensure clarity, it is preferable to prioritize general and easily understandable definitions and concepts.

II. Contemporary C2: Technicality, Complexity, and Technology

The wars of the 20th century marked a "technological encroachment" (Desclaux & Claverie, 2016), with the successive emergence of warfare technologies, followed by cybernetics and information technologies (IT). These developments, combined with the proliferation of information and data sources, have contributed to reducing—or even gradually eliminating—the "fog of war" in military operations.

These transformations have profoundly reshaped modern operations, not only in their execution but also in their risks and strategic implications, thereby justifying the emergence of C2 functions. Over time, military operations have become increasingly digitized and accelerated.

« What was command and control in Napoleon's time? You are a general standing on a hill, watching your troops and sending messages to your generals. That was command and control. Now, command and control is highly digital, with fast-flowing data, so commanders can make strategic decisions and get the results to the people who can act on those decisions quickly."— Craig MARTELL, Chief Digital and Artificial Intelligence Officer, U.S. Department of Defense.

[4] McChrystal, S. (2015). *Team of Teams – New Rules of Engagement for a Complex World* [ENG]. New York. https://archive.org/details/teamofteamsnewru0000mcch/page/n9/mode/2up.
[5] Alberts, D. S. (2007, juin). *The Future of C2: Agility, Focus and Convergence* [ENG]. Defense Technical Information Center. https://www.researchgate.net/publication/235155926_The_Future_of_C2_Agility_Focus_and_Convergence.
[6] Foster, G. D. (1988). *Contemporary C2 theory and research: The failed quest for a philosophy of command* [ENG]. Dans Defense Analysis, vol. 4, pp. 201–228. https://doi.org/10.1080/07430178808405354.
[7] An Opposing View: Advocating for a Shift Away from the Term "C2" : Hansson, L., Vickers, E., & McEvoy, J. (2024, mai). *If not command and control, then what?* [ENG]. Development, Concepts and Doctrine Centre. https://assets.publishing.service.gov.uk/media/66421515993111924d9d333a/20240513-Concept_information_note_5___If_not_C2_then_what.pdf.

Due to these technological advancements and the evolution of warfare, C2 and its systems increasingly face multiple levels of complexity that challenge their design, implementation, and management:

- Complexity of Information Uncertainty: Information can be contradictory, erroneous, or unreliable due to: (1) Technical errors – miscommunication, partial sensor performance, etc. (2) Deliberate human activities – hacking, disinformation attempts, etc. (3) Unintentional human factors – biases, misperceptions, cognitive overload, etc[8] ;
- Dimensional Complexity: The proliferation of systems, operational domains, and systems of systems (SoS).
- Computational Complexity: The challenges of Big Data, with massive volumes of continuously collected data from extensive sensor networks.

21st-century technology further complicates the conduct of military operations, a phenomenon that the U.S. National War College described as VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) at the end of the Cold War. The technical and technological challenges identified in the 20th century have been confirmed, while new issues continue to emerge:

- Emerging and Disruptive Technologies (EDT) (see **Part Three, III**) are transforming military operations and are at the core of current conflicts. Enhanced capabilities for information collection and exploitation enable far more effective operations, while automated systems and weapons pose significant challenges to military decision-making and execution.
- New Information and Communication Technologies (ICT) are omnipresent, particularly in civilian applications (instant messaging, cloud computing, collaborative tools, etc.). Military institutions must also develop their communication systems while addressing several key challenges: (1) Ensuring service continuity despite potential disruptions, (2) Guaranteeing interoperability and cooperation between systems, and (3) Building protected and resilient architectures against enemy threats.
- Data, abundant and diverse (hence the term Big Data), has become the new "black gold." These datasets allow for precise representations of the operational theater, facilitating decision-making through Common Operating Pictures (COPs). They provide commanders with full situational awareness and situational understanding (SASU), a cornerstone of modern C2.

III. Evolution of Military Operations and Impact on Command and Control

Among the current challenges of C2, beyond technological considerations, strategic, geopolitical, and conflict evolution issues are essential to address. Historically, C2 system architectures have been shaped by the nature of conflicts; thus, in a constantly evolving environment, traditional C2 systems are losing effectiveness. A new wave of C2 capability development could represent the necessary military revolution to conduct more integrated and efficient operations.

A. The New Conflict Environment: A Challenge for Command and Control

Since the end of the Cold War, new arenas of conflict have emerged in the military domain: space, cyberspace, the electromagnetic spectrum, and the information environment. These domains[9] have become both defensive and offensive capabilities. "Information warfare," aimed at manipulating public opinion and

[8] Cf. the theory of Carl VON CLAUSEWITZ in *Vom Kriege* (1832) on the question, studied by Victor M. ROSELLO : ROSELLO, V. M. (1991). *Clausewitz's Contempt for Intelligence*. https://apps.dtic.mil/sti/pdfs/ADA527999.pdf.

[9] Note: for the sake of clarity, the terms "domains" and "fields" will be blended here, as their definitions fluctuate - over time and between languages - and are not universally accepted (e.g. cyberspace was a field before becoming a domain).

destabilizing democracies, is a prime example. Meanwhile, on the battlefield, military forces must contend with growing threats across new fronts, such as the disruption of communication systems.

Additionally, the boundaries of conflict are evolving. Today, the concept of C2 is increasingly discussed in the context of Multi-Domain Operations (MDO), which highlights the necessity of communication and co-operation between different branches of the armed forces to successfully conduct operations.

As a result, C2—originally developed in the 1970s and 1980s—must be reinvented to adapt and integrate into these new operational domains, both philosophically and technologically.[10]. Superiority in military operations within individual domains (maritime, land, air, space, cyber) through service-specific systems no longer guarantees victory. Many countries are now developing hybrid and asymmetric capabilities to counter the dominance of certain powers, even if they are inferior in specific domains. Among these capabilities are Anti-Access/Area Denial (A2/AD) strategies, which aim to prevent an adversary from entering and maneuvering within a designated area. These strategies include anti-air and anti-ship defense bubbles, land and naval mines, ballistic missiles, cyber weapons, and more (see below).

China in the Western Pacific, Russia in the Black Sea and the Baltic Sea, as well as Iran, India, Pakistan, North Korea, and Syria, are now focusing their disruptive efforts on A2/AD strategies, particularly in maritime domains (see **Part Two, II**).

In this new environment, access to rapid, reliable, and actionable information is becoming increasingly critical. Furthermore, to gain an advantage over an adversary equipped with A2/AD capabilities or operating jointly across multiple military branches (and more broadly using hybrid strategies), a multi-domain approach is essential. This approach to C2 strengthens both resilience and operational effectiveness in C2D2E environments (C2 Denied or Degraded Environments) situations where C2 systems are disrupted, unavailable, or severely impaired.

[10] An analysis of approaches to multi-domain operations by different powers around the world: Black, J., Lynch, A., Gustafson, Kr., Blagden, D., Paille, P., & Quimbre, F. (2022). *Multi-Domain Integration in Defense* [ENG]. RAND. https://www.rand.org/content/dam/rand/pubs/research_reports/RRA500/RRA528-1/RAND_RRA528-1.pdf.

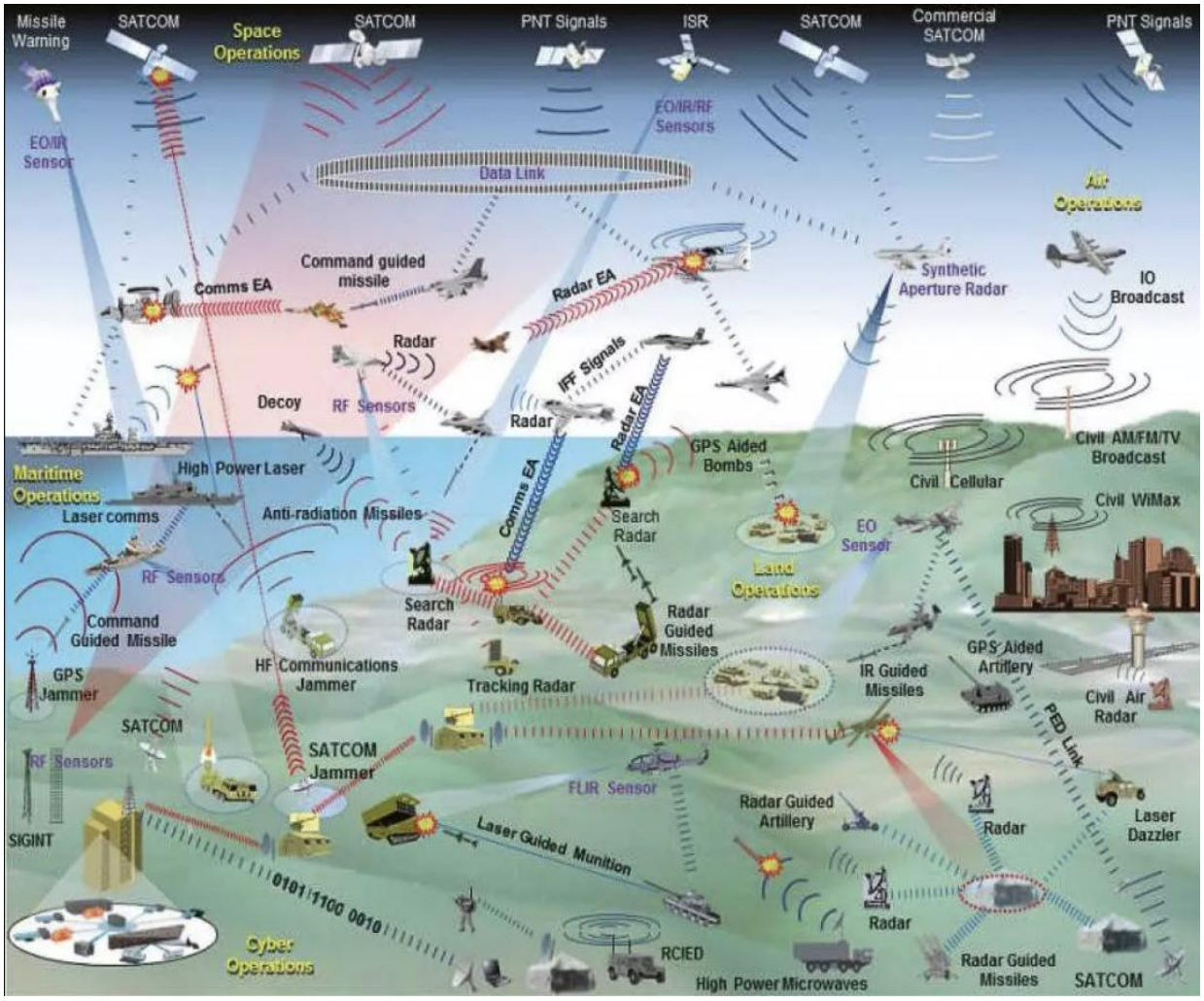

Figure 2 *Examples of Electromagnetic Spectrum Exploitation and Disruption in Electromagnetic Warfare Across All Operational Domains (Source: Joint Air Power Competence Centre)*[11]

Furthermore, the timelines and locations of conflicts have evolved: different armed forces now operate at distinct tempos but must still act in coordination. Thanks to recent technological advancements, conflicts can rapidly unfold and expand beyond their initial theaters. Warfare is no longer confined to a single front but extends into a global environment, where any element can become a target.

Moreover, the traditional distinction between peace and war is becoming increasingly blurred with the rise of non-armed but highly intense confrontations—a phenomenon known as the gray zone.

Command is being tested by these new developments, while control is becoming a central factor: it serves as a major asset when effectively implemented by allies, but poses a signi-ficant challenge when exploited by adversaries—for instance, through disruptions of communication systems.

B. Escalating Geopolitical Tensions

The 2010s marked the resurgence of rivalries between the United States and China; in 2022, Russia launched an offensive against Ukraine; in 2023, Israel engaged in a relentless war against terrorist groups following a series of attacks. Global geopolitics has been disrupted by increasingly intense conflicts, challenging

[11] NATO. (2023). *Guerre électronique*. https://www.nato.int/cps/fr/natohq/topics_80906.htm.

alliances and revealing latent tensions. The global environment is becoming more volatile, and the war in Ukraine has signaled the return of high-intensity conflicts in Europe.

In this context, major powers must be prepared to act swiftly—whether directly or indirectly—in conflict situations. The world appears to be in a pre-war atmosphere, where escalation seems imminent.

C2 has become a critical asset for military forces operating in tense environments that can evolve rapidly. Geopolitical tensions have reignited the race for military innovation, particularly in the technological domain, where C2 plays a central role. It serves as a decisive advantage for nations capable of making it fully operational, as demonstrated in the war in Ukraine (see **Part Two, II.B**).

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