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Fifth-Generation Command and Control

The Human Levers of Change and the Characteristics of a Fifth-Generation Air Commander

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Abstract

Fifth-generation air warfare rewrites the delivery of air power by bringing together all components of air operations. Fifth-generation command and control (C2) will need to mitigate against adversaries denying, obfuscating, imitating, and degrading the information that commanders require to make the right decision while ensuring agility and allowing for high-tempo operations. Australia's 'Hierarchical Command, Agile Control' concept proposes a hybrid model for future C2; however, realizing a vision such as this depends on human factors and the ability of air commanders and their subordinates to adapt to new ways of working. Air commanders will need to be able to disseminate intent, priorities, and restrictions with limited communications, while air forces will need to be able to implement directions at the necessary operational tempo by making tactical decisions in complex scenarios without constant oversight. As such, fifth-generation C2 will require leaders adept at training new ways of thinking and cultivating a culture of trust across the air power enterprise.

Introduction

Since the advent of a generational structure for air combat capabilities, the idea of a generational change in air power delivery has expanded beyond a purely technical description into one that describes a new concept for all components of air operations. Fifth-generation air warfare can now be conceived as comprising four parts: a network, a combat cloud operational concept, a multi-domain focus, and a fusion warfare construct (Layton, 2017). This paper begins by exploring the characteristics required of fifth-generation command and control (C2) through the perspective of the operational environment. The paper then explores the organizational goals and methods related to fifth-generation C2, exploring the human levers of change necessary for this evolution. Finally, this paper brings together the implications of the fifth-generation C2 to consider the key characteristics of a fifth-generation air commander.

Re-Defining Command and Control

*"We will have fifth-generation capabilities led by third-generation commanders."
- Navy 2-star defining the need for new C2 concepts*

Recent experiences of C2 in low-intensity, permissive information environments have created a culture that does not appropriately optimize capabilities for fifth-generation warfare. There are many definitions for C2 in use across military services, but it is necessary to create new definitions for C2 in fifth-generation warfare. The Australian Defense Force (ADF) has identified the need for command and control to be separated to emphasize the difference between each component. As such, the *Concept For Future C2* in Australia determined that to embrace the philosophy of 'mission command,' commanders need to determine *what* is to be achieved, while 'control' elements will determine *how* to coordinate forces towards those required outcomes (ADF, 2019). Updated definitions such as these will prove crucial in allowing air commanders to direct their forces more effectively using alternative methods in C2. As this paper ultimately focuses on understanding the characteristics of a fifth-generation air commander, it is essential to understand the goals of the C2 system that they will be part of. The purpose of a C2 system is to direct military forces toward a goal. The function

of a C2 system is, therefore, to ensure unity of effort toward goals for which the force is employed. Further to this purpose and primary function of command, C2 systems will also need to allow the integration and synchronization of force elements at required operational tempos while ensuring the most efficient use of resources.

Fifth Generation C2: The Operational Environment

Fifth-generation platforms have been built to gather large amounts of data. These expanded streams of information will need to be rapidly processed to allow air commanders a better understanding of the battlespace. Autonomous systems and high-speed networks will make it possible for operations to be conducted at very high tempos and enable rapid timelines to execute actions and effects. The potential results of this change will be profound: Imagine joint fires coordination conducted through a system similar to ride-sharing services and a targeting coordination system similar to social media platforms. On the other hand, adversaries will increasingly be able to deny, obfuscate, imitate, and degrade the information that air commanders require to make the right decision, to prevent the decision from being actioned or by overwhelming commanders to the extent of making them ineffective (ADF, 2019). Future C2 will therefore need to make possible agile decision-making and high-tempo operations, which allow forces to respond rapidly against adversaries utilizing similar capabilities or with an ability to exceed our decision-making cycles.



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Fifth Generation C2: The Organizational Goals

In the past, successful operations were achieved through a single unified command that delegated authority through a hierarchy of subordinates. It is a

process that has been utilized for centuries, and communications systems have been perfected to route information through rigid hierarchies to centralized commanders. Traditionally, a hierarchical C2 structure has been regarded as the optimal approach to C2, both by positive and negative reinforcement. However, the future operational environment will limit the ability of such systems to achieve the goals for which it was designed. Recent conflicts have increasingly proven centralized C2 structures to be the least resilient to attack, a trait that was exploited during the 1991 Gulf War to cripple the decision-making ability of Saddam Hussein's military. In that conflict, United Nations (UN) forces prevented Iraqi tactical commanders from receiving orders from their leadership. Owing to the centralization of authority and the reluctance of these tactical commanders to act without authorization, UN forces could seize the decisive advantage.

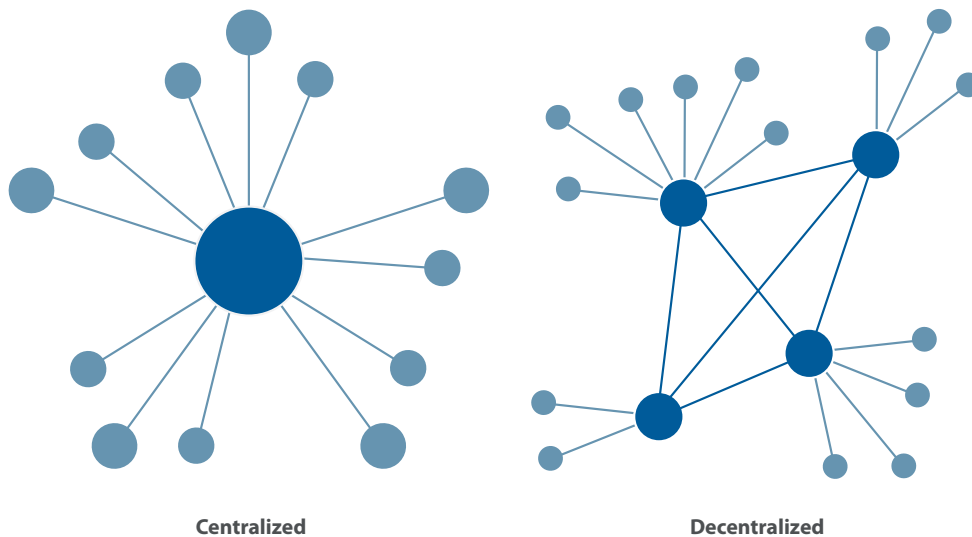


Figure 7.1: Network Structures

Centralized C2 structures have led to centralized information processing, which provides air commanders with the information needed to make the decisions required. This has created information systems with inherent vulnerabilities that adversaries can attack and placed increasing burdens on the communications infrastructure. Despite recent gains in communications technology, for example, the demand for communications bandwidth continues to outstrip supply. Future conflicts will see air forces confronting adversaries that will limit the ability of air commanders to direct forces by attacking centralized C2 nodes and information

systems. Fifth-generation C2 needs decentralization to make it more survivable and agile in adapting to rapidly changing circumstances. Future C2 systems t, therefore, need to be redesigned using agile approaches so that threats can be mitigated in information warfare environments and so that operational tempos which exceed that of adversaries can be generated.

The shift towards more agile C2 may come at the expense of unity of effort and efficiency. Air forces must balance the traditional need for unity of effort against new demands for agility to create an operational advantage from future C2. Deeply entrenched hierarchies will need to be transitioned to make them fit for more collaborative environments, where the level of direct control is much less. In return, joint forces will gain from the ability to access and coordinate with force elements more efficiently without being stifled by multiple layers of complex organizational structures and processes. As a result, existing organizational models and systems will be challenged by fifth-generation C2. Network designers will find fifth-generation C2 far more challenging than has been the case with hierarchical organizations. Figure 7.2 provides an abstract illustration of the options space in C2 design. There is, however, an opportunity for air forces to adopt organization models for C2 alongside modern architectures that can adapt in real-time to the state of the network. This contrasts with rigid C2 organizations, where it is the networks instead that need to adapt.

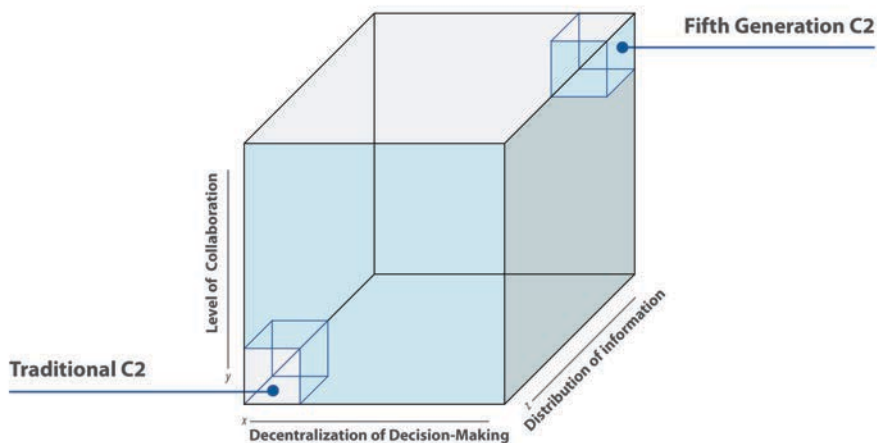


Figure 7.2: The Options Space for Command and Control (C2) Design

Fifth Generation C2: The Method

"If I can't communicate, I can't command."

- Air Force 1 star commenting on their requirement for multiple forms of communication during an exercise

Elements of legacy C2 systems may need to be retained to ensure that some fundamental tenants of C2 can be preserved. The ADF has utilized the separation of command and control to develop the concept of 'Hierarchical Command, Agile Control' (ADF C2 Concept 2019). The Hierarchical Command, Agile Control concept identifies different structures that can be used for each component of C2, arguing that unity of effort can be maintained by a hierarchical command structure that *determines* mission goals, whereas an agile control structure can *implement* those goals. Within a fifth-generation C2 structure, the purpose of command is to determine 'what' is to be achieved: Commanders, taking direction from government, will determine the forces that will be utilized to achieve this direction and define their intent on how those goals should be achieved. A hierarchy of command is used to achieve unity of effort through unity of command. Unlike with agile control, changes to command structures will need to be rare and directed precisely: If an agile approach is taken to command, the focus of military effort could change as frequently as new commanders adjust the operational goals each time command is changed.

On the other hand, the purpose of control is to determine *how* directives from command can be achieved. Agile control structures are envisioned to ensure resilience in information warfare environments with an ability to rapidly adjust, forming and changing collaborative relationships to determine the most efficient ways of achieving assigned mission goals. Controllers will need to utilize the commander's priorities and intent to collaborate with force elements in ways that optimize the use of available resources. During such collaboration, platforms that can control the action of other force elements will form and re-form relationships with each other and proactively alter the C2 structure. Such a level of agility will ensure that the effectiveness of the air force can be maintained as its ability to understand the environment and communicate changes. The Hierarchical Command, Agile Control concept also provides a foundation to effectively C2 autonomous systems. Autonomous systems can be utilized to assist the decision-making of commanders and controllers by

presenting options or testing plans. As there is a different definition for control, autonomous systems could also be used to direct the action of force elements, allowing the advantages of autonomy to be realized while maintaining human oversight of operations.

Finally, the communications aspect: Air commanders have had the luxury of communicating by any means they desired in most recent conflicts. Real-time communications links from the tactical to strategic levels were largely available without interruption. However, all communications will be contested in future conflicts, presenting complex challenges for communications architecture designers. What communications will need to be prioritized for hardening, and in the event of an attack, which elements will need to be prioritized for restoration? Hierarchical Command, Agile Control offers an answer by emphasizing the need for assured communications at the control level but allowing command to utilize 'bursts' of communications instead to gain information and disseminate orders rapidly. This way, air commanders will be allowed to remain effective even with limited communications availability, 'coming up for air' before going silent again.

Characteristics of the Fifth Generation Air Commander

To seize the advantage in future operating environments where it is not possible to implement constant command oversight, air commanders will need to be able to conduct their functions by effectively communicating intent, priorities, and restrictions. Decentralized C2, therefore, requires commanders that can communicate intent clearly using limited means of communication, be confident about making decisions based on limited information and have the trust that force components will execute the necessary tasks with limited oversight. As air commanders will not have the luxury of direct tactical interventions, it will be necessary for them to be able to communicate intent that is broad enough to permit the necessary degree of action by edge warfighters while preventing unacceptable consequences. A critical test for air commanders will relate to how well they can ensure that forces can operate with the fewest possible restrictions. For instance, rather than designating specific operating areas to each force element, air commanders will instead need to identify areas where

operations are restricted or prohibited. Such an approach will allow force elements the broadest ability to conduct action.



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Degraded communications environments will also demand that commanders be comfortable making decisions based on limited information. Commanders need to be able to determine what decisions they need to make and what information is required to make them, but they will not have all the information necessary to make those decisions at their disposal. Depending on subordinates to push the information required to perform their role, air commanders will need to be confident that they will obtain the information necessary to make required decisions when they 'come up for air.' They will also need to be confident that short bursts of orders will be understood because the luxury of lengthy exchanges that allow tactical execution to be refined and monitored will not be possible. To lead in such a way, air commanders will need to trust that warfighters and personnel operating at the lowest possible levels of decision-making will implement their intent and perform their roles without constant oversight or the option to refer to higher authority for guidance.

At the same time, the necessary integration of forces allowing control elements to collaborate effectively will need to be ensured. Operational success will depend on trust between control elements and their ability to collaborate remotely without constant direction. The commander's intent will still be the single most valuable tool to guide the actions of controllers and allow them to make appropriate judgments related to prioritization, apportionment, and actions, even in unforeseen scenarios. But such behaviors will need to be trained through experience and exercises where the C2 system is forced into such modes of operation. Shifting to agile control is necessary for mission success but may not come easily given established ways operational approaches in the air force. Commanders will be required to accept failures in training events so

that the force can learn in the most realistic operational environments. However, establishing the levels of trust required between air commanders and subordinate controllers will demand transformational leaders adept at cultivating a culture of trust across the enterprise.

Conclusion

"We can't fix this if we can't trust each other"

- Army 2-star commenting on the key driver to centralized C2

Future operating environments will produce quantities of information that far exceed the ability of current C2 capabilities. Adversaries will deny, obfuscate, imitate, and degrade the information that air commanders require to make the right decision, preventing those decisions from being actioned or overwhelming air commanders by making them ineffective. To achieve a decisive advantage in future operational environments, air forces will need to adopt a hybrid C2 model, such as that envisioned by the Hierarchical Command, Agile Control concept. Fifth-generation air commanders will need to achieve their role by disseminating intent, priorities, and restrictions that can be implemented without constant command oversight. The level of trust required by air commanders is such that they must be confident that their intent will be achieved even when they cannot communicate or disseminate orders in more than short bursts. Controllers will need to trust that commanders will support the decisions they take through action.

Air commanders will need to train new mindsets allowing control elements to make the necessary decisions in complex scenarios and be adept at cultivating a culture of trust across the enterprise. It is difficult to change cultures, but military organizations are adept at generating trust among their personnel, starting with young soldiers trained to a level that provides their leadership the trust that they can lawfully and ethically take a human life. Over an entire career, senior officers are given training and experience that provides their leaders the trust that they can lead thousands of personnel and billions of dollars in equipment into war. By providing their personnel with the appropriate training, assessment, experience, authorization, and supervision, air commanders can build a culture of trust that allows their forces to perform highly in fifth-generation C2.

References

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