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Shared Understanding, Distributed Judgment: USAF Command and Control in Complex Operations

by Maj Greg Galey, USAF

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Abstract

After three decades of operating in largely permissive environments, the United States now faces adversaries specifically organized to deny its traditional operational advantages. Rather than contesting American forces in a single domain, these competitors seek to disrupt the information, communications, and decision-making processes upon which U.S. military effectiveness depends. Under these conditions, legacy command and control systems become increasingly brittle and vulnerable to disruption, delay, and complexity. To combat these risks, U.S. Air Force command and control must deliberately separate information from decision authority by tightly coupling information through shared awareness across the force while loosely coupling decisional authority by distributing judgment to subordinate commanders within the bounds of commander's intent.

Organizational theory, particularly Charles Perrow's concept of system coupling, as well as Marine Corps and Air Force doctrine, provide a conceptual basis for effective operations that relies on distributing decision authority to the point of action while maintaining a shared understanding across the force. Historical air campaigns, including the Battle of Britain and Operation Overlord, demonstrate that successful command and control architectures consistently combine tightly shared information with decentralized decision making. Although doctrine provides a foundation for this approach, these principles remain under-realized in practice. Planners and commanders must treat coupling as a deliberate design variable, using distributed control to pre-delegate authority, simplify plans, and preserve initiative in contested environments.

Introduction

After decades of sustained operations in relatively permissive environments, the United States now faces increasingly contested operational conditions as near-peer adversaries seek to deny the advantages of precision strike, networked operations, and information superiority. Against these conditions, legacy U.S. command and control (C2) systems become increasingly brittle and vulnerable to disruption, delay, and complexity. Modern warfare, therefore, demands a C2 approach that deliberately separates information from decision authority by tightly coupling information while loosely coupling decisional authority.

Tightly coupling information means cultivating a shared understanding of the operational environment across the force, enabled by the deliberate integration of sensors, networks, command nodes, and warfighters. Loosely coupling decisional authority separates that shared understanding from centralized permission, allowing subordinate leaders to exercise timely judgment before time, friction, or enemy action render opportunities obsolete. Operational effectiveness in complex, contested environments depends less on centralized permission than on distributed human judgment guided by shared understanding.[1]

Although advances in sensing, networking, and data fusion have dramatically increased the commanders' ability to see the battlespace, accelerated tempo, and expanded operational reach, they also increased the dependence on secure communications and data transfer across domains. As a result, senior leaders, particularly within the U.S. Air Force (USAF), have strong incentives to centralize decisionmaking authority in order to manage risk and ensure coherence. Yet this reliance on an incorruptible connection to a central decision-making authority produces brittle command structures that struggle to adapt under disruption, delay, and uncertainty.

Historical air campaigns illustrate this tension clearly. Successful operations have repeatedly depended on separating the rapid circulation of information from the authority to make tactical decisions, creating systems that share understanding broadly while allowing judgment to operate where time and uncertainty demand it.

The central challenge of modern C2 is therefore not choosing between centralization and decentralization, but deliberately designing systems, plans, and cultures that separate information from permission.[2] By synthesizing Charles Perrow's organizational theory on system coupling and Marine Corps doctrine with USAF doctrine, Air Force senior leaders and planners can evolve their decision culture and C2 architectures to meet contemporary warfighting realities. This evolution requires designing concepts of operations and C2 schemes that avoid tight decisional coupling where unnecessary and apply it only where risk truly demands it. These approaches should use distributed control as the doctrinal basis for implementing tightly coupled information with loosely coupled decisional authority at the operational and tactical levels.

Theoretical Foundation

Marine Corps doctrine provides a useful conceptual foundation for understanding coupling. Marine Corps Doctrinal Publication 5, Planning, (MCDP 5) presents planning as a shared, adaptive process that must loosely link higher intent to subordinate action: tight enough to create common understanding and unity of effort, but loose enough to allow decentralization and adjustment under friction, uncertainty, and time pressure.[3] Planning, in this context, is not a mechanism for centralized control but a method of shaping shared understanding across echelons before execution begins.

Marine Corps Doctrinal Publication 6, Command and Control, (MCDP 6) further clarifies this logic by distinguishing between the flow of information and the exercise of authority. Command is defined as the authority and responsibility to make decisions, rooted in judgment and intent, while control is described as the regulation of forces to accomplish the mission under uncertain conditions and tension.[4] Control, in this view, is necessarily imperfect. It supports coordination but does not guarantee compliance. This distinction matters because it frames command as an inherently human decisional function and treats control as a supporting function rather than a substitute for judgment.

Marine Corps doctrine assumes degraded communications and contested execution as normal conditions of war: It accepts that decisional authority cannot remain tightly coupled to higher headquarters without undermining tempo and initiative.[5] Authority must migrate toward subordinate leaders when centralized direction becomes impractical; at the same time, shared understanding and commander's intent must maintain coherence across the force.[6] In effect, Marine Corps doctrine anticipates the logic of loose decisional coupling supported by tight informational coupling, providing a service-tested foundation for applying coupling concepts to contemporary joint and USAF C2 challenges.

This doctrine addresses the enduring problem of distrust in decentralized decision-making by grounding delegation in a shared understanding of the mission, goals, and battlespace, rather than faith. Effective delegation depends on confidence that subordinate leaders perceive the operational problem in the same way their commanders do.[7] MCDP 6 emphasizes commander's intent, common appreciation of the environment, and clarity of purpose precisely to ensure that decentralized decisions remain aligned with higher-level objectives. When subordinates share the same situational perspective, constraints, and intent as their commanders, they can anticipate higher-level thinking and exercise judgment that converges rather than diverges.[8]

In this sense, tightly coupled information does not merely inform decentralized execution; it makes it possible by reducing cognitive divergence across the force. Delegation becomes a rational design choice rather than an act of extending the benefit of the doubt when conditions constrain more centralized command. Shared perspective, not centralized permission, is the true foundation of effective command. This logic is central to understanding why separating information from permission is not a relinquishment of control, but a redesign of how coherence is achieved. Unity of effort emerges not from constant direction, but from aligned judgment exercised at speed.[9]

The tension between information and decision authority is not new, but contemporary technologies have sharpened it considerably. Advances in communications, sensors, and data aggregation enable unprecedented situational awareness at higher headquarters, encouraging the belief that better information naturally justifies tighter control. This belief persists because mission complexity and political risk appear to demand synchronization across domains and echelons.[10]

The USAF experienced this trend of tightly coupled decisional authority during decades-long counter-insurgency operations, which produced highly refined targeting processes and centralized execution in permissive environments. Yet as operational environments grow more complex, the costs of centralized decision-making increase faster than its benefits. Decisions delayed by hierarchy often arrive too late to matter, while opportunities created by friction and uncertainty are lost to procedural lethargy. Networked sensors and collaborative platforms, however, enable higher headquarters to observe tactical engagements in nearreal time, creating a persistent temptation to translate awareness into intervention.[11]

The problem lies not in technology itself, but in conflating the ability to observe with the obligation to decide. Early C2 systems often comprised a bespoke, headquarters-centric architecture designed around specific organizational requirements, encoding assumptions about who decides courses of action. Over time, these architectural choices shaped command behavior as much as doctrine did, reinforcing centralized decision norms even as operational environments grew more complex and contested.[12] When networks become permission structures rather than information-sharing structures, they constrain initiative and invert their intended purpose. The true advantage of networked operations lies in enabling shared understanding and self-synchronization, not in extending hierarchical control.

Organizational theory helps explain why tightly coupled decisional systems are particularly vulnerable in complex, contested environments. Charles Perrow defines tightly coupled systems as those characterized by rapid processes, minimal slack, and strong interdependencies, conditions under which small disruptions can cascade into systemic failure.[13] Applied to military command, this framework suggests that when authority, approval, and adjudication are concentrated at higher echelons, the system becomes hypersensitive to delay and disruption. Centralized bottlenecks magnify the effects of friction rather than contain them. Historical air operations illustrate this relationship clearly. Before organizational theorists described tightly coupled systems, successful air campaigns had already learned to separate the rapid circulation of information from the authority to make tactical decisions.

Coupling Theory and C2

Charles Perrow's coupling theory describes the degree to which activities within a system depend on one another. In tightly coupled systems, actions occur rapidly, sequentially, and with little margin for delay or error. Small disruptions can quickly cascade because each component is contigent on the successful completion of another. Loosely coupled systems, by contrast, provide greater flexibility, local adaptation, and buffering against disruption because components retain greater independence. Coupling is neither inherently good nor bad; effective organizations deliberately determine which functions require tight coordination and which benefit from autonomy. By deliberately tightening informational coupling while loosening decisional coupling, military organizations can preserve unity of effort without creating fragile decision bottlenecks. The result is a C2 architecture that remains resilient under disruption, absorbs friction rather than amplifying it, and enables the force to sustain tempo even when communications are degraded or denied.

Historical Cases

During the Battle of Britain, the Royal Air Force constructed what later became known as the Dowding system, one of the earliest examples of a modern C2 architecture. The system linked radar stations, the Observer Corps, filter rooms, and sector stations into a network that rapidly aggregated and distributed information across Fighter Command.[14] This system produced a common operational picture of incoming Luftwaffe raids and enabled commanders across the system to operate from a shared understanding of the battlespace.

Yet while information was tightly coupled across the network, the authority to act was deliberately distributed. Sector stations retained control of scrambling and vectoring fighters and making engagement decisions close to the point of action rather than waiting for centralized direction from London. The result was a command structure that preserved tempo while maintaining coherence. Tightly coupled information moved rapidly across the system, but decisions, loosely coupled, remained where they could be made fastest.

A common counterargument is that defensive operations such as the Battle of Britain do not translate directly into complex offensive campaigns where large numbers of forces must be synchronized across domains. Yet large-scale offensive operations have historically confronted similar C2 challenges. During Operation Overlord, Allied air forces coordinated one of the largest and most complex air campaigns in history, flying thousands of sorties in air superiority patrols, interdiction missions, and close air support for the invasion force while integrating operations across multiple nations and commands. While the campaign was centrally planned to ensure theater-wide priorities and coherence, operational execution relied on distributed control exercised by subordinate tactical air commands. Once the operation began, local commanders re-tasked fighter-bombers, responded to German movements, and integrated air support with rapidly evolving ground conditions without waiting for higher headquarters to adjudicate every engagement.[15]

This pattern of distributed control and loosely coupled decisional authority appeared repeatedly in air campaigns where the operational complexity and dynamic operational environment outpaced the ability of higher headquarters to manage engagements in real time. During the Vietnam War, airborne controllers flying on tactical airlift platforms coordinated large numbers of strike aircraft over dynamic battlefields by directing available aircraft toward emerging targets and left execution decisions to forward controllers and strike leads. This system later evolved into the USAF Airborne Battlefield Command and Control Center (ABCCC).

Similar dynamics shaped the practice of battlefield air interdiction: Air commanders established priorities and authorities but relied on subordinate units to adapt to evolving enemy movements and changes in the battlespace. The same push-pull dynamic appeared again during Operation Desert Storm: Forces utilized ABCCC and the Joint Surveillance Target Attack Radar System (JSTARS) for distributed control to frequently redirect close air support sorties between close air support and interdiction as battlefield conditions changed.[16]

These cases represent more than routine decentralized execution or battle management; they reflect the use of deliberate planning and allocation mechanisms to distribute decision authority prior to execution, which ensures that subordinate elements possess the information, priorities, and authorities required to adapt once operations begin. In terms of coupling, planners in these cases increased informational coupling through shared situational awareness, common priorities, and established coordination processes, and they deliberately loosened decisional coupling by delegating engagement authority to subordinate commands. The result was a system capable of maintaining operational coherence without requiring higher headquarters to control each tactical interaction in real time.

These historical examples reinforce a broader design insight for modern C2: Effective operations do not require choosing between centralization and decentralization. Instead, success depends on deliberately engineering systems that tightly couple information across the force while allowing decision authority to remain as loosely coupled as operational risk allows.

Importantly, coupling theory is not an argument against integration or coordination; rather, it highlights that systems differ in the degree to which their components should be tightly or loosely linked. Highly complex and tightly coupled systems are particularly vulnerable to cascading failure, suggesting that planners should differentiate how system elements are connected based on operational demands and risk.[17] As informational coupling tightens through shared ISR, common operational pictures, and collaborative tools, the marginal benefit of centralized decision-making declines while its costs increase.[18] Decisions become stovepiped not by lack of awareness, but by hierarchy and temporal lag. As operational complexity increases, these limitations become more pronounced. Nonlinear interactions across domains, rapid adaptation by adversaries, and persistent uncertainty that cannot be resolved through aggregation alone characterize contemporary warfare; it follows that the ability to react responsively is imperative. Physical, cognitive, or temporal distances introduce latency, while information accumulation imposes cognitive overload. Attempts to compensate by pulling more decisions upward often worsen fragility rather than mitigate risk.[19]

USAF Doctrine & Distributed Control

Historically, the USAF's operational model relied on centralized planning and control to manage scarce, high-value assets across wide theaters. Potential conflicts in the Indo-Pacific amplify the need to manage limited resources very carefully in a contemporary context, where risks are high and synchronization of multi-domain effects are critical for mission success. As information accumulation increases at higher headquarters and mission complexity grows in all-domain operations, USAF leaders are understandably inclined to tighten decisional coupling in the name of coherence and risk management. Yet this inclination rests on the assumption of continuous connectivity, perfect situational awareness, and sufficient cognitive capacity; this assumption is unlikely to hold in contested environments.

USAF doctrine already provides a sound conceptual foundation to address the likelihood of degraded operating conditions through mission command, but it remains under-realized in practice. AFDP 11 explicitly frames mission command as a philosophy executed through the framework of centralized command, distributed control, and decentralized execution (CC-DC-DE), arguing that trust, shared awareness, and understanding of commander's intent enable Airmen to operate in uncertain, complex environments.[20] In this framework, centralized command preserves strategic coherence, decentralized execution empowers tactical initiative, and distributed control is the connective tissue that moves decision rights closer to the point of action without eroding command responsibility.[21]

Revisiting Marine Corps doctrine clarifies how this philosophy translates into practice. MCDP-6 presents command as a human activity centered on intent. Combat inevitably degrades communications and disrupts oversight; commanders must rely on shared understanding and disciplined initiative to ensure subordinate actions remain aligned with the mission's purpose. This approach mirrors the operational intent of CC-DC-DE, where shared information enables leaders to make decisions consistent with the commander's goals when centralized control is unavailable and inappropriate. By emphasizing how intent and trust enable coherent action in degraded conditions, the Marine Corps' philosophy offers a doctrinally grounded model for informing and enhancing USAF mission command principles.

AFDP-30.1 sharpens this idea by defining distributed control as the delegation of specified authorities from the air component commander to subordinate commanders to conduct the C2 process, and by asking explicitly, "What is distributed, to whom, and for what purpose?"[22] The answer—authority to subordinate commanders to conduct C2—aligns precisely with the logic of loosely coupled decisional authority under tightly coupled information.

It is important to clarify that distributed control is not merely battle management, even though battle management is one important manifestation at the tactical edge. It is the operational-level mechanism that determines how far and how explicitly decisional coupling is relaxed in a given design. When planners and commanders employ distributed control deliberately, they are choosing to decouple routine and time-sensitive operational decisions from the air component commander while maintaining strong informational coupling through shared understanding, commander's intent, and common operational pictures.[23]

Distributed control has clear implications for battle management, arguing that dispersing control functions and authorities is essential for resilient C2 against peer adversaries.[24] However, if distributed control is treated only as a battle management technique, its broader design value is lost. At the operational level, distributed control is the principal doctrinal means the USAF has for institutionalizing the separation of information from permission in day-to-day practice. AFDP-1 and AFDP-11 both stress that distributed control enables commanders to delegate planning, coordination, execution, and assessment activities to dispersed locations and subordinate echelons to achieve an effective span of control and maintain initiative in contested environments.[25] Put differently, distributed control is how commanders decide which decisions should remain tightly coupled to higher echelons and which should be deliberately decoupled and delegated within a mission command construct that presumes tight informational coupling across the force.

Planning Implications

For USAF operational planners, distributed control is the natural doctrinal home for designing decoupled operations. When tempo, network conditions, subordinate initiative, and system complexity argue for looser decisional coupling, distributed control provides the recognized USAF vocabulary and authority structure to implement that choice. Instead of inventing a new concept, planners can use distributed control to predelegate specific C2 authorities, define conditions under which control transitions between nodes, and codify how shared understanding and risk guidance will be maintained across the distributed C2 enterprise. Implemented in this way, distributed control becomes more than a subset of battle management. It is the operational-level design tool that turns tightly coupled information and loosely coupled decisional authority from a theory into an executable, doctrine-backed C2 architecture.

Marine Corps and joint doctrine offer reinforcement to this concept. Joint doctrine emphasizes balancing centralized planning with decentralized execution, explicitly acknowledging that commanders must accept risk when delegating authority in order to preserve tempo and initiative.[26] MCDP 6 similarly warns against "over-control," arguing that micromanagement creates the illusion of coherence while degrading effectiveness under friction.[27] Tight control may feel reassuring at a campaign command level, but it often proves brittle in execution at lower echelons of command.

Loosening decisional coupling does not imply abandoning control or accepting chaos. Delegation must remain bounded by intent, acceptable risk, and clearly defined authorities. Doctrine provides ample guidance for such an approach through mission command principles that emphasize mutual trust, disciplined initiative, and commander's intent.[28] As the Battle of Britain demonstrated, effective command did not require directing every interception from higher headquarters, but it did require ensuring that subordinate commanders possessed the understanding and authority to act at the speed of combat. In modern practice, this means delegating decisions when tempo, proximity, and complexity demand it, retaining centralized authority over broader escalation management, critical resource allocation, and political risk efforts.

If loosening decisional coupling is necessary, tightening informational coupling is the essential enabler. Shared understanding remains critical for unity of effort, particularly in distributed operations. Tight informational coupling ensures that commanders at all echelons operate from a coherent understanding of objectives, constraints, and context, even as authority is distributed and connectivity to commanders is degraded or denied. This distinction of information without permission allows higher headquarters to retain strategic oversight while preserving initiative at the forward edge—so long as planning deliberately accounts for these considerations.

The military planner sits at a critical leverage point in the coupling of information and authority. A highly complex plan, tightly synchronized and dependent on detailed timing or sequencing, naturally drives commanders toward tighter decisional coupling because even small deviations appear to threaten coherence and increase risk.[29] Conversely, plans that deliberately simplify interdependencies, reduce artificial synchronization, and emphasize commander's intent and broad task organization create space for loosely coupled decisional authority supported by tightly coupled information. In this sense, planners are not just translating guidance into operations; they are designing the coupling structure of the C2 system.

Perrow's insights on tight coupling and complex interactions suggest that planners should treat coupling as a conscious design variable rather than a byproduct of unforeseen contingencies.[30] Plans that require numerous conditional approvals, precise cross-domain timing, or centralized adjudication of minor courses of action build in brittleness and invite higher headquarters to retain or reclaim decision authority. By contrast, plans that clarify ends, boundaries, and priorities, while leaving means and sequencing flexible, allow subordinate elements to adapt without constant permission. The result is a reduction in decision-making latency and system accident and error risk in complex environments.[31] The planner's craft, therefore, includes actively resisting the impulse to equate sophistication with complexity and recognizing when simplicity and loose coupling are the safer, more resilient choice.

At the same time, planners must avoid prescribing tight-coupling "exceptions" so broadly that every mission is treated as uniquely sensitive. If every target, sortie, or maneuver is framed as politically or strategically critical, then the coupling logic collapses and all decisions flow upward by default. Instead, planning staffs should work with commanders to define a small, explicit set of conditions in which tight decisional coupling is genuinely required, such as those involving high escalatory risk, extremely scarce assets, or irreversible strategic consequences, and ensure that these are identified as exceptions rather than norms. In all other cases, the burden of proof should fall on justifying why a decision must remain centrally coupled, not on explaining why it can be pushed down. In this way, planners help commanders operationalize a C2 design that tightly couples information across the force while keeping decisional authority as loose as the mission and risk truly allow.

Conclusion

The USAF stands at a critical juncture where the very technologies designed to enhance command have created a paradox of control. Informational connectivity is at an all-time high, yet it risks encouraging a centralization of authority that is dangerously brittle in highly contested and dynamic combat environments. The central challenge of modern C2 is not choosing between centralization or decentralization but deliberately engineering a system that separates information from permission. From the Dowding system that coordinated Britain's air defense to the distributed control exercised by Allied tactical air forces during Operation Overlord and beyond, successful air campaigns have depended on tightly shared understanding combined with decision authority remaining close to the point of action. Perrow's coupling theory and Marine Corps doctrine can help inform USAF doctrine to reach the conclusion that in complex, contested environments, information should be tightly coupled across the force, but decisional authority should be as loosely coupled as mission risk allows.

This is more than a theoretical preference. For commanders, this means deliberately designing where decision authority resides, pre-delegating authorities, and resisting the impulse to centralize simply because technology enables it. For planners, it means recognizing that plan complexity drives decisional coupling and simplicity preserves adaptability. Peer adversaries will not wait for permission from the U.S. chain of command; they will, in fact, attack these decision bottlenecks and exploit tightly coupled structures. The USAF must, therefore, move beyond declarative mission command and conduct the harder work of operationalizing tightly coupled information and loosely coupled decisional authority by design through commander guidance, planning practice, and C2 architecture. The future effectiveness of the USAF will depend not on how much it can see, but on how deliberately it aligns decision authority with the speed, uncertainty, and complexity of combat. ✪

Endnotes

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About the Author

Maj Gregory "MC" Galey is a USAF Air Battle Manager and graduate of the USAF Weapons School. He currently serves as instructor and Air University Fellow at the Air Command and Staff College, Department of Airpower. His operational experience spans from enlisted service as an MH-53 PAVELOW aerial gunner to his current role as a Senior Air Battle Manager and Weapons Officer. He has extensive combat and contingency experience across multiple combatant commands and areas of responsibility, accumulating over 2,200 flying hours. Prior to his current assignment, Major Galey served as the Chief of Advanced Programs and Future Projects, 461 Air Control Wing, where he worked to advance future command and control capabilities and design.