CENTRALIZED CONTROL WITH DECENTRALIZED EXECUTION: NEVER DIVIDE THE FLEET?

by
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Acknowledgements

Abstract

Air Force Doctrine Document 1, *Basic Aerospace Doctrine*, the U.S. Air Force's capstone doctrine document highlights the tenet of centralized control with decentralized execution as crucial to the effective application of airpower. However, numerous forces are changing the applicability of that doctrine. U.S. involvement in wars with limited aims, combined with the technology that allows senior commanders to see the common operational picture and view from the cockpit, is driving the Air Force toward the centralized airpower execution. At the same time, the development of Network Centric Warfare can either centralize or decentralize the control and execution of airpower depending upon its implementation. Airmen, however, have long held to the doctrine of centralized command with decentralized execution without serious thought to the impact of the political environment and technological advances on this doctrine. Although Air Force doctrine has changed 13 times based on over 50 years of experience, the doctrine of centralized control with decentralized execution has not been seriously challenged.

This study explores the foundations of command and execution and explores options other than centralized control with decentralized execution of airpower. The paper explores and defines the characteristics of control and execution and provides a historical review of the foundation of the Air Force's tenet of centralized control with decentralized execution. It then addresses the impact of technology and political constraints on current operations and the most effective application of airpower. Finally, the paper frames technologies and strategic situations where centralized command and decentralized execution is not the most effective way to employ airpower. The paper concludes with doctrinal recommendations for a more flexible mindset on the proper control and execution of U.S. airpower.

I. Introduction

The system of command of military air power should consist in having the greatest centralization practicable...Unity of command is essential to air forces. These can not be operated efficiently in time of war if scattered and assigned to ground and water organizations.

William 'Billy' Mitchell

An incident during Operation Southern Watch, the patrolling of Iraqi airspace following the first Gulf War, demonstrated one of the major disconnects between U.S. Air Force doctrine and practice. Saddam Hussein had once again violated U.N. Resolution 688 by firing on coalition aircraft, and the Joint Task Force Southwest Asia (JTF SWA) Commander had directed airstrikes against an Iraqi radar site in the town of Al Nasiriyah in accordance with the standing rules of engagement. Due to the political sensitivity of the coalition mission in southern Iraq, the JTF SWA Commander took great pains to ensure that coalition airpower struck the proper target, limiting collateral damage. Airborne Warning and Control System (AWACS) controllers directed a U-2 into the area to image the target. The imagery immediately provided the commander a picture of the target area. Unfortunately, the commander needed more information and directed an F-14 Tactical Air Reconnaissance Pod System (TARPS) to image the target. Analysts assessed this image in near real time on a nearby aircraft carrier and sent it to the commander. He now had enough information to direct strike aircraft into the area, but not enough information to satisfy his requirement for weapon release with minimal collateral damage. To gain the necessary information, the JTF SWA commander directed the strike aircraft's run-in heading and required the pilot to describe the target seen in his targeting pod over the radio. Once satisfied that the pilot identified the proper target, the JTF SWA commander directed release of a laser guided precision bomb, destroying the target with minimal damage to the surrounding neighborhood. This pattern was repeated numerous times during Operation Southern Watch.[1] The JTF SWA Commander had exercised centralized control with *centralized* execution of airpower in that he controlled all aspects of the weapon engagement from the Combined Air Operations Center. This, of

course, is contrary to the U.S. Air Force doctrinal mantra of centralized control with decentralized execution.

Although meeting the Southern Watch objectives, airmen at the tactical level were confused and frustrated at what they considered higher headquarters micromanagement. The pilots were highly trained and experienced and considered this kind of personal attention an insult to their technical competence. In fact, their frustration stemmed from the fact that they *were* highly trained and *knew* that airpower is best employed through centralized control and decentralized execution. Further, Air Force doctrine and tactics contained no guidance on the highly restrained application of airpower.

Yet, these pilots had just participated in a textbook example of centralized execution. Air Force Doctrine Document 1, the Air Force capstone doctrine document, highlights the fact that decentralized execution is crucial to the flexibility of airpower. It states, "Just as central to the proper application of airpower is the concept of **decentralized execution.** *Delegation of execution authority to responsible and capable lower-level commanders is essential to achieve effective span of control and to foster initiative, situational responsiveness, and tactical flexibility."*[2] Did the JTF SWA commander not understand the most responsive and flexible employment of airpower? Were the fighter pilots unfit to perform their mission? Has technology and political reality made the U.S. Air Force's central tenet of centralized control with decentralized execution outdated?

This paper aims to explore the Air Force's tenet of centralized control with decentralized execution. Airmen have long strived for the most effective employment of airpower via centralized control, under an airman, combined with decentralized execution. This arrangement proved effective during Desert Storm. However, one must ask if this is still the **most** effective method to employ airpower. More importantly, is it the **only** way to employ airpower, or is there a more appropriate combination in the centralization and decentralization of control and execution based on technology and strategic context?

This paper explores the foundations of command and execution and explores options other than centralized control with decentralized execution of airpower. To set the stage for discussion of the control and execution of airpower, this paper will explore and define the characteristics of control and execution. Once a common framework is established, this paper will provide a historical review of the foundation of

the Air Force's tenet of centralized control with decentralized execution by tracing its roots from experience in World War I through the Gulf War. It will then address the impact of technology and political constraints on current operations highlighting the most effective applications of airpower. Finally, the paper will frame technologies and strategic situations where centralized command and decentralized execution is not the most effective employment of airpower. The paper concludes with doctrinal recommendations for a more flexible mindset on the proper control and execution of U.S. airpower.

II. Origins of Control and Execution Doctrine

> *The inherent flexibility of air power is its greatest asset...such concentrated use of the air striking force is a battle-winning factor of the first importance. Control of available air power must be centralized and command must be exercised through the air force commander if this inherent flexibility and ability to deliver a decisive blow are to be fully exploited.*

Army Field Manual 100-20 Command and Employment of Air
Power
21 July 1943

Current Air Force doctrine fails to adequately and consistently define the central terms of command, control, and execution. This causes major weaknesses in the debate of command, control, and execution concepts because there is no agreed upon definition of the terms. The lack of definitions breeds semantic problems that distract from discussion on the central tenet. This chapter aims to define the concepts of command, control, and execution as they relate to the execution of airpower by first discussing the characteristics of command, control, and execution. Once defined, the discussion will highlight the historical development of Air Force command and control philosophy. By clarifying these concepts, discussions can more adequately address future command, control, and execution of airpower.

Command

Air Force doctrine is unified with the joint community in its definition of command. Air Force Doctrine Document 2-8, *Command and Control,* uses the Joint definition of command from Joint Publication 1-02, *DOD Dictionary of Military and Associated Terms*: "The authority that a commander in the Armed Forces lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions."[3] Important

aspects in the definition of command are that it is a legal authority for the direction, coordination, and control of military forces. Commanders may delegate authority to accomplish the mission; they cannot delegate the responsibility for the attainment of mission objectives.[4]

Control

Implicit in the definition of command is control. In fact, without control there is no reason for command. Control is the path for passing intent of the operation, its objectives, and its desired effects to subordinate echelons. In Joint Publication 1-02 and Air Force Doctrine Document 2-8, control is defined as, "the process by which commanders plan and guide operations."[5] According to Air Force Doctrine Document 2-8, control occurs before and during execution (hinting at centralized execution), and time and distance factors often limit the direct control of subordinates (hinting at decentralized execution). Control may be procedural, as in the generation of an Air Tasking Order, or it may rely on delegation of authorities and "commander's intent" as methods to control forces. The commander's intent should specify the goals, priorities, acceptable risks, and limits of the operation.[6] Control encompasses the responsibility for implementing orders or directives. Control is not a system, but a process whereby the commander exerts influence on subordinate units. Command is the *authority* to direct forces while control is the *process* of directing those forces.[7]

Unfortunately, Air Force doctrine from the earliest days considered command and control synonymous, when actually they have always been quite different. This causes confusion in the discussion of the centrality of airpower command and control. The two issues are quite different and should be handled differently. The first point of confusion revolves around the issue of command. Should a single air officer such as the JFACC command airpower, or should it be parceled out to separate commanders? Second, should the single commander centrally control his assets so that he can concentrate effects, or should he allow decentralized control so that lower echelon commanders can develop and implement plans in accordance with the JFACC intent? Command is an issue of organizational doctrine while control is an issue of operational doctrine. This study assumes that unity of command is essential and that centralized command assures that unity. Discussion will focus on the control and

execution of airpower. For example, a commander may provide objectives that subordinate commanders pursue independently through decentralized control.

Execution

Current Air Force doctrine is very weak on both the origins and definition of decentralized execution. Due to the lack of an accepted definition, there is great disagreement among airmen on the meaning of decentralized execution in the employment of airpower. Joint doctrine defines decentralized execution as the delegation of execution authority to subordinate commanders, but it fails to define execution itself.[10] Air Force Doctrine Document 1, *Air Force Basic Doctrine,* defines decentralized execution as, "delegation of execution authority to lower-level commanders is essential to achieve effective span of control and to foster initiative, situational responsiveness, and tactical flexibility."[11] This is not really a definition but rather a rationale for decentralized execution. These definitions as applied to the Air Force basic tenet leave the airman wondering which lower-level commanders are receiving execution authority and when does control end and execution begin. Air Force doctrine neither adequately defines execution nor does it delineate the lines between control and execution. There are no Air Force definitions of "execution" in the Air Force Glossary (Air Force Doctrine Document 1-2) or the primary documents of Air Force Doctrine Documents 1, 2, or 2-8. This paper will attempt to fill that void with a definition of execution as it applies to Air Force operations.

Foundations of U.S. Air Force Control and Execution Doctrine

Historical Development

World War I provides the basis for Air Force centralized control doctrine. During World War I, US ground unit leaders commanded air elements, and air units were organized as integral parts of these ground units. Subordinate Air Service commanders could suggest missions, but

final decisions rested with higher unit ground officers. Airpower was very useful for localized operations, but it could not be massed to provide significant, theater wide effects. Because command was not centralized, control of assets was fragmented. The attack on St. Mihiel in September 1918 proved the necessity of centralized control of airpower to air advocates. This was the first air action to mass air elements against a theater objective. General Billy Mitchell controlled the operation under First Army, but he actually reported directly to General Pershing and General Headquarters. He controlled an air force that was much larger than that of the First Army alone. Although he controlled a large force, he did not have command authority over all units. He was frustrated with the difficulties of not having command of the force. Mitchell states, "As is usual under these conditions, every objection has to be overcome, and every reason has to be advanced as to the necessity for such things as distinguished from the concentration of maximum force in another place."[12] In short, centralized control allowed massing of airpower effects while centralized command made the job easier. St. Mihiel was a smashing success for allied airpower and allowed Americans virtually complete protection from German air interference.[13]

Mitchell's experience and success in controlling air units during the war formed the basis for his desire to command and control air centrally. He believed that for any given operation, available air units should be placed under the centralized control of an Air Service commander. The purpose of centralization was to concentrate force at the vital point, which was not necessarily the ground forces point of attack.[14] However, the War Department and Secretary Baker took the opposite view. According to Secretary Baker's 1919 Annual Report, the separation of the air arm would weaken overall military efficiency. The benefits of theater unity of command would be offset by the loss of training synergy. He states, "The temporary unified control which might be achieved during combined actions was no substitute for continuous, integrated training and operations."[15] The Army was concerned that lack of day-to-day interaction would provide less coordinated support to the army, a complaint that rose many times in the succeeding years.

By 1935, General Headquarters (GHQ) Air Force was formed, and while airmen stressed the mobility and adaptability of a centralized air force, air advocacy was split between the GHQ Air Force and the Air Corps. GHQ Air Force contained combat units, while the Air Corps was responsible for war planning, acquisition, and air staff functions. General

Benjamin Foulois argued that this command structure divorced the authority for training and operations from the functions and responsibility of procurement, experimentation, etc.[16] Training Regulation 440-15, *Fundamental Principles for the Employment of the Air Service,* described the advantage of GHQ Air Force as, "…possible to rapidly concentrate superior forces at important point when necessary."[17] However, the doctrine stressed that once the land campaign began, "…air forces further the mission of the territorial or tactical commands to which they are assigned."[18] Interwar doctrine stressed the need for centralized control of airpower. General Patrick, Commander GHQ Air Force, clearly stated the need for centralized control of theater air assets as early as 1923: "The principle of concentration of air force becomes a maxim."[19] However, official doctrine and organization was, in effect, a compromise between the extreme viewpoints of both air and ground officers.[20] In 1939, the divided air authority was recognized and corrected by placing GHQ Air Force under the Air Corps. The main arguments for centralized control continued to stress the ability of airpower to mass forces in time and space to gain air superiority and strike against critical centers.

Operation Torch and Kasserine Pass

Observing the success of the British against the Luftwaffe in the Battle of Britain, airmen continued to press for unity of command and centralized control. According to Brigadier General Carl Spaatz, "A great part of this British success has, undoubtedly, been due to the realization for the necessity of a unified command which centralizes control of all military air matters under an air high command concerned solely with air matters."[21] Centralized command and control was essential in gaining air superiority and repelling the German attack of the English islands.

The British had fought the Italians and Germans in Libya and Egypt since September 1940. They learned that air superiority was crucial to successful ground operations and that one key to air superiority was centralized control. Air Marshal Coningham established liaisons at all command levels and collocated his headquarters with Eighth Army headquarters. The liaison system allowed decisive use of small concentrations of airpower.[22] Airpower was so successful in the Western Desert that General Montgomery became a staunch supporter of Coningham's system and published a directive on the effective use of

airpower. Montgomery highlighted major tenets that are still accepted today:

> The greatest asset of air power is its flexibility, and this enables it to be switched quickly from one objective to another in the theater of operations. So long as this is realized, then the whole weight of the available air power can be used in selected areas in turn; this concentrated use of the air striking force is a battle-winning factor of the first importance.[23]

He also emphasized the need for concentration:

> It follows that control of the available air power must be centralized, and command must be exercised through R.A.F. channels. Nothing could be more fatal to successful results than to dissipate the air resources into small packets placed under command of army formation commanders, with each packet working on its own plan. The soldier must not expect, or wish, to exercise direct command over air striking forces.[24]

Clearly the British learned hard lessons on the most effective organization and control of airpower. Unfortunately, the Americans would have to relearn some of the same lessons.

Although air leaders where arguing for centralized command and control of air assets, U.S. forces entered World War II with airpower divided both in organization and doctrine. Field Manual 1-5, *Employment of the Aviation of the Army,* dated 15 April 1940, continued to allow split control of army aviation. The manual states, "portions of GHQ aviation could be attached to armies or corps for the accomplishment of specific missions, but they were to revert to GHQ control as soon as the necessity for the attachment ended."[25] Unfortunately, attached armies were typically unwilling to release local control. With this untenable command arrangement, airmen would be unable to concentrate airpower at the moment it was most needed.

U.S. forces for Operation Torch did not implement the West African derived British doctrine because it conflicted with Field Manual 1-5, and the forces were already en-route to the battlefield when the British

lessons were first published.[26] U.S. employment of airpower early in the European war was split into an Army controlled element and an Army Air Forces element. An air commander controlled the bomber and fighter commands while an Army ground commander controlled the Air Support Command, which was tasked to support ground forces.[27] Many airmen were irked by the fact that the Army commander had final decision over which targets the Air Support Command would strike, even though in reality the Army Commander, Major General Fredendall, rarely interfered with target selection, and Air Support Command made most decisions.[28]

This arrangement did not last long however, as Eisenhower centralized control of allied air forces. He agreed with Air Chief Marshal Sir Arthur Tedder who wanted to centralize air forces including tactical aviation in December 1942.[29] Eisenhower understood and encouraged the centralized command of air resources and demonstrated his conviction when he denied the permanent apportionment of air units to Major General George S. Patton after the successful landing of his division.[30] By January 1943, the Combined Chiefs of Staff had met at the Casablanca conference and approved the unified command for all Allied air forces in the Mediterranean.[31] Major General Carl Spaatz assigned Brigadier General Laurence Kuter to command the newly created Allied Air Support Command, to centralize the command, and hence control, of all tactical air units in Northwest Africa. Thus, by the time of the famed battle for Kasserine Pass, tactical airpower was functionally already under centralized control.[32]

Air Force operational history attributes the foundation of centralized control doctrine to Operation Torch and Kasserine Pass by highlighting the danger of breaking airpower into "penny packets," but the lessons to be learned are much more complex. By the time of Kasserine Pass, airpower was already centralized under one air commander. The true lesson of Kasserine Pass was that air units were ineffective mainly due to insufficient training, lack of equipment, and poor weather. Aircrews were sent to England on the assumption that they would finish training there. Instead, they were shipped to support the invasion of Northern Africa. General Jimmy Doolittle estimated 75 percent of his airmen arrived in theater only partially trained. To compound the lack of training, few of the ground units were equipped with mobile anti-aircraft weapons to defend themselves from attacks by the Luftwaffe.[33] Due to this lack of self-protection, ground units looked for air umbrellas as protection, putting allied airpower on the tactical defensive.[34] Due to poor

weather, in the height of the battle for Kasserine Pass, Allied Air Support Command flew an average of only 365 sorties a day in all of Northwest Africa.[35] Kasserine became the siren song for generations of airmen concerning centralized control; but at closer inspection, it actually highlights the dangers of operationally employing inexperienced airmen into combat.

Kasserine Pass provided airmen several lessons over and above the need for unity of command. The primary lesson is that a quickly assembled, under-trained, under-equipped military force, will suffer when encountering a battle-hardened and experienced adversary.[36] Kasserine Pass and Operation Torch did show that unity of command likely produces better results than fragmented command. Moreover, it showed that airpower is most effective when the air force commander is collocated with the headquarters of the largest ground formation in the theater.[37] However, airmen must not be too attached to Kasserine Pass as the watershed event highlighting the dangers of decentralized control of airpower since unity of command and centralized control of airpower was already established.

Kasserine Pass did give airmen a 'red herring' event for continuing their advocacy for an independent air force and centralized control of air. They argued that split command caused the disintegration of unity of command and concentration even though air forces were already centralized for the battle. However, it did provide a convenient opportunity for airmen to change operational doctrine and organizational relationships in favor of command of air forces under an airman. Army Chief of Staff General George Marshall authorized Eisenhower to form a team of air and ground officers to revise the existing air doctrine while the shocking defeat provided the proper environment for reform in Washington.[38] Army Field Manual 100-20, *Command and Employment of Air Power,* dated 21 July 1943, reflects many of Coningham's propositions on air employment.[39] The manual equates centralized command with centralized control to provide unity of effort and maximize the speed and flexibility of airpower. It states, "…control of available airpower must be centralized and command must be exercised through the air force commander if this inherent flexibility and ability to deliver a decisive blow are to be fully exploited."[40] The lessons of Africa became a fixed underpinning for basic Air Force doctrine. Army Field Manual 100-20 codified the Air Force independent command relationships and centralized air command.[41] The Air Force position on centralized control

as a means for flexibility and concentration has remained unaltered since World War II.[42] Among airmen, serious inquiry into the effectiveness of other control arrangements ceased in 1943. The Air Force then turned its eye toward how to execute a centrally devised plan to maximize the principal qualities of airpower: speed and flexibility.

Decentralized Execution Foundation

Although implicit in the air operations of World War I through Korea, decentralized execution became an Air Force doctrinal tenet with the 1971 release of Air Force Manual 1-1, *United States Air Force Basic Doctrine*. It contained the first written use of the term "decentralized execution" in Air Force doctrine. Subsequently, every edition of Air Force Manual 1-1, including its current iteration as Air Force Doctrine Document 1, highlights the need for decentralized execution to harness the flexibility of airpower.

The 1971 edition of Air Force Manual 1-1 linked the centralized control of air assets with decentralized execution as fundamental to employing airpower effectively. Basic doctrine presented the concept as a characteristic of aerospace forces:

> To realize the full potential of these characteristics, aerospace forces must be centrally allocated and directed at a level which permits exploitation of diverse capabilities in support of overall objectives. Concurrently, mission control and execution of specific tasks must be decentralized to a level which permits maximum responsiveness to local conditions and requirements. These complementary concepts—centralized allocation and direction and decentralized control and execution—are fundamental to the effective application of aerospace power.[43]

This paragraph, a sub-paragraph under "Characteristics of Aerospace Forces", leads the reader to believe that decentralized execution is the inherently proper method of airpower employment. Although this is the first reference to execution in Air Force doctrine, "execution" is never defined and the doctrine makes no reference on what levels of command are appropriate for control and execution.

The 1975 edition of Air Force Manual 1-1 simplified this concept into the now familiar Jominian maxim: centralized control and decentralized execution. The document listed centralized control and decentralized execution as a basic principle of aerospace employment in modern combat. Once again, Air Force Manual 1-1 did not define decentralized execution, what level of command should control airpower, or where the demarcation lies between control and execution.[44]

The 1979 edition of Air Force Manual 1-1 split control and execution into their individual components and expanded the discussion of each:

> Under the principle of decentralized execution, higher echelons of command define missions and tasks, and then direct lower echelons to conduct the operations. This principle allows lower echelon commanders to maintain a responsive and effective force and frees high echelon commanders to focus aerospace power on achieving overall mission objectives. This arrangement in no way limits the operational commander's authority nor lessens his responsibility; it places details for mission planning at the action level.
>
> *At the same time, higher echelon commanders must ensure that the capabilities of their forces are not exceeded. This philosophy is required because a single commander cannot personally direct all of the detailed actions of a large number of air units or individuals.* (Emphasis in original)
>
> Decentralized execution allows for the wider use of judgment in employing the capabilities and characteristics of warfare systems.[45]

This rendering provides the most clarified reasoning in doctrine on the relationship between superior and subordinate commanders involved in decentralized execution and reveals Air Force reasoning behind the principle. The doctrine still does not describe the tasks of control and execution, but it does give the airman a basic understanding of the concept.

The description of decentralized execution takes a cyclic path in subsequent doctrine. In one manual it is barely described, and in the next,

it is captured in great detail. The 1984 edition of Air Force Manual 1-1 minimally described decentralized execution, stating that it provides the flexibility for subordinate commanders to use ingenuity and initiative in attacking targets.[46] Eight years later, the 1992 Air Force Manual 1-1 Volume II provided the most in-depth discussion to date on the foundation of the concept and importance of the tenets of aerospace power. According to Vol. II, decentralized execution was raised to the level of tenet in reaction to the centralized direction of bombing of North Vietnam. The document suggested that decentralized execution first appeared in the 1971 Air Force Manual 1-1 as a reaction against the extensive control, or "centralized control run amok," exerted by the Johnson administration in the bombing campaign against North Vietnam. According to Vol. II, President Johnson not only took personal control of targets, but he also dictated timing, ordnance loads, sorties, and alternate targets.[47] Although the document considers this level of control as "control run amok," it is simply a rather unsuccessful example of centralized execution at the strategic level. President Johnson controlled all parameters of high visibility missions to ensure his political objectives were met. Essentially, he restricted the flexibility of subordinate commanders to local circumstance, the definition of centralized execution.

The 1992 Air Force Manual 1-1 did address the fact that changes in technology would affect the timelessness of decentralized execution: "The complementary concept of decentralized execution also raises some thorny problems. Modern technologies seem to make decentralization of many important decisions increasingly inappropriate or even unnecessary."[48] Although the writers of Air Force Manual 1-1 acknowledged the impact of technology on the execution of airpower, this concept has seen little doctrinal discussion since.

The current Air Force Doctrine Document 1, *Basic Aerospace Doctrine*, replaced the Air Force Manuals in 1997 as the Air Force basic operational-level doctrine. It posits that centralized control and decentralized execution are critical operating tenets for successful airpower employment. Air Force Doctrine Document 1 describes decentralized execution as delegation of execution authority to lower-level commanders essential to achieve effective span of control and to foster initiative, situational responsiveness, and tactical flexibility.[49] This edition of Air Force Doctrine Document 1, however, lacks sufficient detail on how decentralized execution provides the most effective use of airpower

considering advances in technology and the sophistication of the world stage.

Implications

Several factors need to be highlighted when considering the basic tenet of centralized control. First is that the doctrine was formulated at a time when the Air Force was struggling for independence. Indeed, the struggle for centralized control was inextricably tied with the struggle for Air Force independence. An independent Air Force could not exist as long as air forces were under subordinate command of army commanders. Army Field Manual 100-20 became the airman's emancipation proclamation.[50] The doctrine was used in a public relations campaign that advocated the need for an independent Air Force while highlighting the ideas of Douhet and Mitchell. Brigadier General Lawrence Kuter persuaded a *Saturday Evening Post* writer to present a piece on Army Air Force operations that discussed the coequal and coordinate ideas presented in Army Field Manual 100-20.[51] This document provided the official support for strategic air campaigns and the centralization of air for supporting ground operations. As long as the Army Air Force was struggling for independence, airmen would be unable to consider anything other than centralized command under an airman.

Another condition worth noting is that Air Force control doctrine is fundamentally based on experiences in total conventional war. Airpower experience that matured late in WWI and throughout WWII provided the foundation for centralized control doctrine. Both reflected conflicts of total war, where all resources were employed against the enemy. These wars were fought in a circumstance where each belligerent nation totally directed its resources to the conduct of war.[52] Victory in battle was necessary to meet war aims, and destruction of the enemy's military and industrial capacity was the main mechanism for achieving victory. Centralized control provided the means for shifting severely limited resources throughout the theater. Air superiority required both total attention of the air forces and concentration due to the limited assets available. Evident in all early doctrinal writing is the need for the flexibility of airpower to concentrate for mass effects both in the air and on the ground.

Finally, from a technology perspective, this doctrine developed when large numbers of aircraft were required to achieve a given effect. Incredible improvements in aerospace technology may have made this doctrine obsolete as technological development changed the meaning of mass and concentration. For example, during World War II, over 9,000 two-thousand-pound bombs and 3,000 sorties were required to destroy a 60 x 100 foot target. By the time of Desert Storm, only 30 bombs and 8 aircraft were required to achieve the same damage with unguided bombs. U.S. dominance in the areas of stealth and precision has reduced these numbers to the case of one target, one bomb.[53] Combined with situational awareness provided by systems such as Joint Surveillance Target Attack Radar System (JSTARS), Airborne Warning and Control System (AWACS), and the U-2, single aircraft are now able to produce the effects of bombardment groups during World War II. A single B-2 can now engage and destroy 16 targets on one mission. These improvements are not only evident in the strike community, but air mobility has shown a corresponding improvement as well. During the peak of operations of the Berlin airlift in 1948-1949, U.S. forces moved 1.7 million ton miles (MTM) per day. Desert Shield/Desert Storm far surpassed earlier airlifts by moving 17 MTM per day.[54] Interestingly, doctrine concerning the control of airpower has changed little considering these monumental improvements in aircraft capability.

The tenet of decentralized execution has the impact of dogma in today's Air Force. Little consideration has been given to the impact of technology on execution doctrine. Airmen address the need for decentralized execution without a true understanding of the meaning and impact of the term on operations. Many confuse the concept of decentralized execution with the physical dispersion of operations. There is an important distinction between decentralization and distribution. Distribution refers to geographic or spatial location while decentralization is a quality independent of location.[55] Although in the past geographic distribution implied a level of decentralization, modern communications have overcome the effects of spatial distance. Because of this, geographically separated units may be centralized to the point wherein a single senior commander can make execution decisions.

In summary, doctrinal descriptions of the fundamental tenet of airpower have failed to adequately define decentralized execution. Doctrine neither adequately defines execution nor delineates a suitable definition of decentralized versus centralized execution. Instead, it tends

to describe the results of proper execution while leaving the reader to ponder what decisions are being made where.

Execution of Airpower

Considering the primacy of the centralized command with decentralized execution tenet in Air Force doctrine, the lack of definition is disturbing. This terminology vacuum distracts from serious study on the effectiveness of the employment of airpower, and it invites the airman to take only a haphazard view toward his basic doctrine. Webster's dictionary defines execution as, "to follow out or through to the end; to carry out into complete effect; to complete; to finish; to effect; to perform."[56] Although useful, this definition fails to shed sufficient light on the meaning of decentralized execution. Based on an informal poll of Air War College students, execution can be defined across a spectrum of actions ranging from any action after an execute order to deploy, to when the Air Tasking Order is published, to takeoff of tasked aircraft, to the actual release of ordinance. Clearly, the lack of definition makes the concept of centralization or decentralization difficult to discuss. Several students at the U.S. Air Force's School of Advanced Air and Space Studies have attempted to apply a better definition of execution in an airpower context. One defined it as, "the act of launching a vehicle or formation, marshaling, maneuvering, and accomplishing an airpower role for the purpose of supporting a strategy. Execution begins upon the assignment of a mission to an operator and weapons system at the lowest level of an organization"[57] Another definition posited was, "those actions taken to accomplish a mission, after a higher echelon assigns it to a unit."[58] The critical attribute of execution is that it begins with the assignment of a task at the lowest level and requires some type of action be taken to completion. For this paper, execution includes unit level actions taken to employ/deploy air assets from the receipt of tasking to the termination of the mission. Execution is decentralized if decisions after mission assignment lie with the operator of the weapon system, and it is centralized if detailed decisions reside in a higher command authority or automated system controlled by that authority.[59] This definition provides the framework for analysis of the Air Force central tenet.

Air Force doctrine does not consider numerous factors when discussing the effectiveness of the control and execution of airpower. One

prominent factor affecting the degree of control over command and execution is the political context in which the air operation is conducted. Although current doctrine states that commanders may deviate from doctrine due to circumstances, it does not do an adequate job of presenting situations where alternate control and execution methodologies may be desired.   The next chapter provides an analysis of political factors affecting the degree of control necessary for a successful air campaign.

Decentralization and centralization are a matter of degree, and in most air operations the amount of centralization will be a matter of degree. There will be operations across the control and execution spectrum. For the purposes of this paper, the amount of centralization of both control and execution will be based on the majority of the air effort with full knowledge that some operations will be controlled entirely separate based on the mission.

III. Political Influence Centralizing Airpower Control and Execution

> *While nations have always aimed in war to gain their objective with the least cost, in modern war, achieving decisive political aims may not require achieving decisive military results.*
>
> General Wesley K. Clark
> ***Waging Modern War***

Sixty years of centralized control doctrine and thirty years of decentralized execution doctrine have given the concepts the standing of dogma within Air Force doctrinal discussions. Numerous factors have converged in the last decade to lead airmen to believe that this central doctrinal tenet needs serious examination. First, the employment of force in Bosnia, Kosovo, and Iraq in the last decade has revealed a significant amount of centralization in both control and execution due to political concerns in each of these limited conflicts. The political circumstances of these conflicts required high level decision makers to manage force application, often to the annoyance of lower level commanders. Second, technology has provided the commander with the option to either centralize or decentralize his control and execution options. On one hand, advanced sensors, combined with long range, and high bandwidth communications provided the senior commander an unparalleled amount of information to facilitate control and execution of air forces. On the other hand, the networking of sensors and weapon systems gave the lowest level commander an unheard of level of situational awareness where he could take advantage of transitional opportunities through the decentralization of command and execution. Amazingly, with the profound technological developments since the First Gulf War and political complexity of missions, there has been relatively little discussion in Air Force professional journals on alternative methods for controlling and executing airpower. Airmen have tended to view warfare very mechanistically without regard to the human element and friction, leaving them to not question their doctrine seriously.[60] Experience in the last decade shows that airmen still are reluctant to apply the lessons learned from events that do not 'fit the mold.'

If the technology and political context are not enough to warrant alternate control and execution options, then there are several military reasons for considering other approaches. First, the increase in the speed of real time operations can quickly overwhelm a centralized decision making authority. Second, centralized command and control presents an adversary with a single critical center of gravity (COG) regardless of where it is located. Such a COG will require significant defenses to protect it from either physical or information attacks.[61] Clearly, a discussion of command and execution authority is important and requires an analysis of when one method is more appropriate than another.

Political Context

While U.S. forces are primarily armed, trained, and equipped to win wars, they are increasingly used for a wide range of political purposes. Air Force doctrine tends to emphasize conventional state-versus-state conflict rather than smaller scale contingencies. However, as U.S. forces continue to be involved in actions ranging from peace enforcement to low level military action, doctrinal guidance needs expanding.[62]

The political context of the application of military force significantly impacts the level of control and execution authority required for airpower. U.S. involvement in limited wars or small-scale contingencies where political stakes are high but the need for overwhelming force is low requires a different control and execution structure than large-scale conventional war. Small-scale contingencies such as operations Deliberate Force, Allied Force, or Southern Watch require a very measured and controlled use of force, while large-scale actions such as the Gulf War or Korea could accept a less restricted use of force. Therefore, the type of war changes the amount of control required over planning and execution.

Desert Storm

Desert Storm represents the model execution of the airman's tenet of centralized control with decentralized execution. General H. Norman Schwarzkopf, Coalition Commander, was given fairly wide latitude on the application of military force.[63] The Joint Forces Air Component Commander, Lieutenant General Charles Horner, exercised air command and control during the Gulf War. The Gulf War was the first conflict

since World War II where U.S. air forces were under some form of unified control. The forces were tasked through an integrated Air Tasking Order that focused effects while preventing conflicts. The single air plan implemented Schwarzkopf's vision while it allowed lower echelons to execute the tasking. Decentralized execution was required due to the large number of forces deployed. General Horner executed over 112,000 sorties with roughly 2,800 aircraft.[64] He deployed air forces that were so large that operations had to be decentralized to maintain an adequate span of control. Air Force doctrine clearly addresses the conventional application of airpower in large-scale conflict, but it does not address the impact of political or coalition context in small-scale contingencies. The case studies below highlight the fact that centralized control with decentralized execution is, in many cases, not the appropriate employment of airpower.

Deliberate Force

Operation Deliberate Force represents the challenge of employing airpower in a politically charged environment where airpower assets strike quickly to achieve limited political goals. The entire operation lasted only 16 days (30 August to 14 September 1995), and the total sorties were only a minor fraction of those flown in Desert Storm. Nonetheless, NATO's first sustained air strike operation offers insight into the aspects of controlling the employment of airpower for the effect of coercion of an opponent to limited objectives.

NATO executed Operation Deliberate Force as a subset of Operation Deny Flight, supporting United Nations (UN) peace operations in Bosnia-Herzegovina.[65] The main objective of Operation Deliberate Force was to coerce Bosnian Serbs to cease attacks on Sarajevo and other UN-mandated safe areas in Bosnia.[66] In an attempt to maintain separation between the UN and NATO missions to allow UN impartiality, NATO airpower employment was approved through a "dual-key" chain of command established earlier for Operation Deny Flight.[67] Lieutenant General Michael E. Ryan, Allied Air Forces Southern Command (AIRSOUTH), was designated Combined Force Air Component Commander (CFACC) and exercised control over NATO air forces. However, NATO also had to coordinate target assignments with the commander United Nations Protection Force (UNPROFOR), Lieutenant General Rupert Smith, and Commander of UN forces in the former Yugoslavia, Lieutenant General Bernard Janvier. American forces were

operating under NATO command to achieve objectives authorized by the UN. Figure 1 shows Deliberate Force command relationships.[68] Due to the dual-key arrangement, General Ryan's actual execute decisions in Operation Deliberate Force depended on a series of delicate diplomatic arrangements between the NATO and UN command structures.[69]
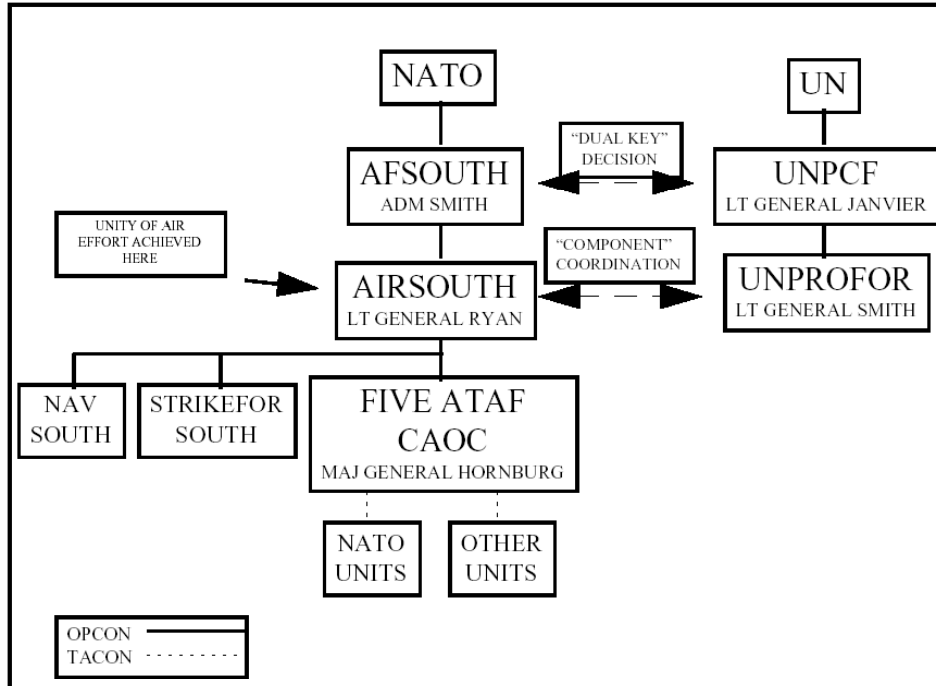

Figure 1. Deliberate Force Command Relationships

General Ryan and the Combined Air Operations Center not only centrally controlled the air war, but they were also very involved in numerous execution decisions. Because General Ryan was extremely concerned with the impact on NATO politics due to fratricide or collateral damage, he personally selected each target that the aircrews attacked throughout the operation.[70] General Ryan took a direct role in the air plan execution by personally directing actions. He moved his headquarters from Naples to the Coalition Air Operations Center in Vicenza to be personally available during the execution. He felt that personal accountability was required in an operation this sensitive.[71] This tight control was also exercised by the Combined Air Operations Center over executing aircraft. Special instructions issued by the Combined Air

Operations Center directed pilots to attack only their assigned targets, even if that meant dropping a weapon in a crater. The Air Tasking Message specified loads and standard configurations with little flexibility at the unit level for determining appropriate loadouts. Additionally, because of collateral damage concerns, General Ryan and his staff even directed tactics such as number of passes and allowable weapons-release pulses.[72] Although Airborne Command and Control Center aircraft were deployed to provide decentralized execution authority, major decisions were all passed to the Combined Air Operations Center making the Airborne Command and Control Center a veritable communications relay.[73] In a sense, the Combined Air Operations Center provided General Ryan with a Napoleonic view of the battlefield for overseeing and controlling events.[74] Convinced that "every bomb was a political bomb," Ryan wanted accountability to rest on his shoulders alone.[75]

Due to the lack of doctrine concerning centralized execution of air assets, subordinate units were frustrated and confused with the heavy interaction by the Combined Air Operations Center and AIRSOUTH. The assessment at the unit level was that the low tolerance for mistakes seemed to take the judgment out of the cockpit.[76] General Ryan kept battle damage assessment (BDA) on close hold, even keeping it from tactical units. He had the following reasons for BDA control: 1) He did not want his judgment second guessed, 2) he did not want outside organizations making assessments of BDA, and 3) he did not want to be held to his first assessment if it should change. Although Ryan withheld BDA due to concerns about behind-the-back political maneuvering, tactical units suffered by flying combat missions with no idea of the real ground situation.[77] Ryan not only centrally executed the air operation, but by controlling vital information to subordinate units, he essentially guaranteed their need for centralized command and centralized execution.

Despite all the problems of NATO/UN coordination, Deliberate Force successfully met NATO goals. The operation demonstrated the inherent flexibility of airpower not through decentralized execution, but through a tightly planned and executed air campaign crafted by General Ryan and his staff. NATO air units flew 3,535 sorties and dropped more than 1,100 bombs with minimal collateral damage and only one aircraft lost. The air campaign was designed specifically for a potentially explosive diplomatic and alliance situation where centralized execution minimized unfavorable effects.[78] Thus, the centrally executed airpower campaign successfully met both U.S. and NATO objectives.

Allied Force

In response to Serbian ethnic cleansing in Kosovo, NATO airpower again launched a major offensive in Operation Allied Force in 1999. Initially envisioned as a short operation, the aerial bombing of Serbian forces in Kosovo and Serbia lasted for seventy-eight days. During the period between March 24 and June 7, NATO conducted an air campaign against Yugoslavia in an effort to halt continuous human rights abuses against ethnic Albanians. Once again, due to political constraints and the lack of commitment to introduce ground forces, NATO air forces were called upon to coerce Milosovic to stop ethnic cleansing in Kosovo.[79]

NATO command structure was similar to Deny Flight with the exception that UN coordination on targets was not necessary since no UN troops were on the ground in Kosovo. Lieutenant General Michael Short, the Commander, Allied Air Forces, Southern Europe, who was also the Combined Force Air Component Commander, now became the U.S. Joint Force Air Component Commander as well. General Short commanded all NATO air forces under NATO authority and also reported through American channels as the 16th Air Force Commander. As Combined Force Air Component Commander, General Short had operational control over all of the air assets assigned to the theater, including B-2s that flew round-trip bombing missions directly from the United States.[80] Allied Force command structure is shown in Figure 2.[81]
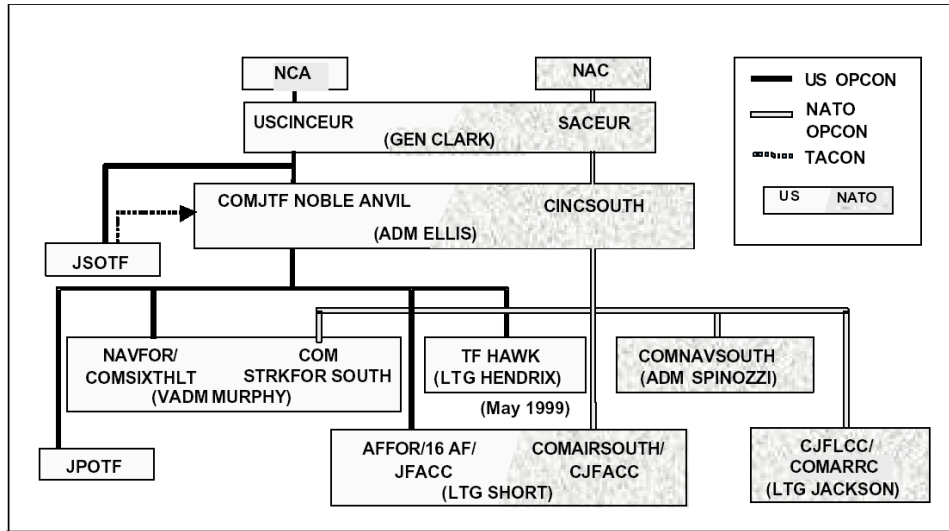
Figure 2. Allied Force Command Structure

Once again, NATO air assets were employed to support a campaign of limited objectives against Milosevic. Like Operation Deliberate Force, General Short planned a campaign that tightly controlled the execution of air assets to limit civilian casualties. Like Operation Deliberate Force, General Short was forced to execute an air campaign for limited objectives in a politically charged environment. The plan's stated aim was to reduce Serbia's ability to continue abusing the Kosovars, with the declared goals of achieving a halt to Serbian ethnic cleansing in Kosovo; a withdrawal of all Serbian military, police, and paramilitary forces; the return of all ethnic Albanian refugees; and the political groundwork for a settlement that would allow Kosovar autonomy under continued Yugoslav sovereignty.[82] The plan was conceived as a coercive operation to inflict enough pain to persuade Milosevic to capitulate to NATO demands.

During the course of the campaign, NATO developed mechanisms for delegating target approval authority to military commanders. For selected categories of targets—for example, targets in downtown Belgrade, in Montenegro, or targets likely to involve high collateral damage—NATO reserved approval for higher political authorities. NATO leaders used this mechanism to ensure that member nations were

fully cognizant of particularly sensitive military operations, thereby helping to sustain the unity of the alliance.[83]

The need to coordinate the target approval for 19 NATO nations required centralized control and execution of the air war by General Short and the Combined Air Operations Center. Allied Force was an extremely politically charged effort highlighting competing priorities on target selection and national sensitivities to collateral damage. Quite often control and execution decisions migrated to higher-echelon commands with the Combined Forces Commander directly involved in targeting decisions and national leaders exercising veto power over specific target sets.

Due to the relatively limited air campaign, the Combined Forces Air Component Commander was able to exercise a large degree of control as seen earlier in Operation Deliberate Force. Once again, Allied Force was a relatively small air campaign in geographical scope, the number of sorties flown, and the political objectives desired. Centralized control and execution prevailed due to the level of precision required to limit collateral damage. Due to the limited nature of the conflict, theater sensor and communications capabilities allowed close monitoring and control of execution; thus, centralized execution provided the means for the Air Component Commander to effectively manage military and political objectives.

Implications

The Deliberate Force and Allied Force case studies highlight the hypothesis that centralized control *and* execution is the *an effective*, and possibly the *most effective*, use of airpower when conflicts for limited objectives are pursued in a politically charged environment. Although opinions differ on alternate courses of action, these two case studies highlight the fact that political environments exist where a very measured application of force is required. In fact, this environment has become the norm for the application of military power in the late 20th century. Air Force participation in Operations Northern Watch, Southern Watch, Allied Force, and Deliberate Force emphasize the use of centralized execution to manage the application of airpower. In each instance the operation's small scale, limited objectives, and excellent communications allowed the

C/JFACC to pay individual attention to the execution of the air effort and thereby to achieve the desired political and military objectives.

IV. Impact of Technology on Control and Execution

The creative leader is the one who will rewrite doctrine, employ new weapons systems, develop new tactics and who pushes the state of the art.

John O. Marsh, Jr.
Secretary of the Army
June 8, 1981

Not only does the political environment affect the control and execution of airpower, but also the technology available to the commander for controlling and employing airpower. Stealth, precision, long-range high bandwidth communications, and information networking have changed the basic calculus of command and control. Additionally, technologies such as autonomous network agents, long duration autonomous unmanned aerial vehicles (UAV), autonomous weapons seekers, and unmanned combat aerial vehicles (UCAVs) dramatically change the command and execution functions for the commander. In order for airpower doctrine to be relevant, it needs to address the changes that technology brings to command and control.

Information and Decision Systems

Networking of command and control along with intelligence, surveillance, and reconnaissance (ISR) information is driving execution in polar opposite directions. In *Future War: An Assessment of Aerospace Campaigns in 2010,* Colonel Jeffery Barnett argues that information technologies, combined reliable communications, stealth and precision drive the centralization of airpower command and execution.[84] During recent conflicts in Bosnia and Kosovo, along with Operations Northern Watch and Southern Watch, this relationship seems to ring true. The ability of sensor information and political leverage to converge in a single location tends to centralize airpower control and execution as seen in the Allied Force case. On one hand, information technologies such as sensor fusion and long-range communications allow the commander to centralize airpower execution in situations where he has adequate span of control and political sensitivities are high. On the other hand however, Network

Centric Warfare proponents argue that the same technologies should provide the push to decentralize both control and execution.[85] Network Centric Warfare theorizes that control will decentralize as subordinate units with dominant knowledge make execution decisions based on commander's intent.[86] They propose that "self-synchronization" will allow a "bottom-up" rather than "top-down" command structure that executes the commander's intent within a bounded limit.[87] Although Network Centric Warfare provides exciting possibilities, it also clashes with traditional military culture.

Information gathering capability has increased dramatically in the last half of the twentieth century; the commander's ability to 'see' a battlefield has also improved dramatically. The Coalition Air Operations Center developed during Allied Force was the centralized controlling and execution element. Data-link and communication architectures allowed the Coalition Air Operations Center to have an unprecedented situational awareness of the tactical situation. The Coalition Air Operations Center received real-time surveillance and intelligence feeds from national intelligence assets, Airborne Warning And Control System, Joint STARS, Rivet Joint, U-2, and the Predator and Hunter UAVs, and it synthesized this information into the Balkan Operational Picture to monitor the campaign in near real time. The overarching picture presented a networked view of information received from all the various intelligence, surveillance and reconnaissance assets in theater as well as satellite imagery, allowing Lieutenant General Michael Short, the Combined Forces Air Component Commander, and the Coalition Air Operations Center to adjust to real-time developments in theater.

A principle feature of the Balkan Operational Picture was the situational awareness it provided not only to the Coalition Air Operations Center but also to higher and lateral command centers as well as to the National Military Command Center in the Pentagon. This availability of rapid and widely disseminated information to all levels of command seriously affected General Short's ability to exercise sole control in the employment of airpower due to the influence on decision making from higher echelons. The influence of higher echelons slowed the targeting process by limiting allowable targets, which nearly forced the air plan to run out of targets early in the air campaign.

In addition to General Short and the Coalition Air Operations Center receiving near-real-time information, modern communications allowed Short and the Coalition Air Operations Center to communicate

execution decisions directly to the cockpit, sometimes bypassing airborne command elements. A series of remote transmission sites tied to a robust system of both military and pre-existing commercial lines allowed clear and secure communication throughout Bosnia, Kosovo and parts of Serbia. The system was intended to greatly expand the ability of airborne command elements to communicate with the Coalition Air Operations Center, but it also allowed the Coalition Air Operations Center to speak directly to strike aircraft. The following transcript highlights the friction when the Coalition Air Operations Center has better situational awareness than the cockpit on the scene:

> About 5 o'clock in the afternoon, we had live Predator video of three tanks moving down the road in Serbia and Kosovo. As most of you know, my son is an A-10 pilot, or he was at the time. We had a FAC [Forward Air Controller] overhead and General Clark [Gen. Wesley K. Clark, SACEUR] had the same live Predator video that I had. "Mike, I want you to kill those tanks." I quickly responded, I had something else in mind, "Boss, I'll go after that for you." When shift time came, [Maj. Gen.] Garry Trexler was on the floor, finishing up in the daytime, and Gelwix arrived to take the night shift. I was there because the SACEUR wanted those three tanks killed. We had a weapon school graduate on the phone talking direction to the FAC on the radio. Call went something like this: "A lot of interest in killing those tanks, 421. I'd like you to work on it." "Roger." Two or three minutes went by, and 421 clearly had not found those tanks. The young major's voice went up a bit and said, "ComAirSouth, and SACEUR are real interested in killing those tanks. Have you got them yet?" "Negative." About two more minutes went by and the weapons school graduate played his last card. "General Short really wants those tanks killed." And a voice came back that I've heard in my house for the better part of 30 years and he said, "God damn it, Dad, I can't see the fucking tanks!"[88]

Unfortunately, this radio exchange highlights the frustration at the tactical level when training and doctrine do not address centralized execution.

The Air Operations Center as a weapon system was born as a result of the availability of real-time intelligence and robust communication systems that could transmit command decisions by the air component commander directly to airborne aircraft. The level of control and information available to General Short during Allied Force allowed him to alter the execution of on-going missions to meet rapidly changing mission requirements. Short re-tasked entire packages while they were airborne based on detailed information available at the Air Operations Center that was perhaps better than information available at the aircraft involved in the missions. The Coalition Air Operations Center was privy and responsive to the Coalition Forces Commander, who also had access to the same information, and in-turn, ordered attacks against targets he viewed on his displays. While Allied Force demonstrated that advances in sensors, data-links, and communications technologies have made centralized execution feasible, certain lessons on its desirability can be drawn.

Admiral James Ellis, Commander in Chief Allied Forces Southern Europe, notes a warning on the dangers of centralized control and execution of airpower at the Air Operations Center. In an interview in early September 1999, he states that too much information has the potential to reduce a military leader's awareness of an unfolding situation. Too much data leads to sensory overload, "…uncontrolled, it will control you and your staffs and lengthen your decision-cycle times."[89] Information superiority overload can actually degrade mission performance, or even worse, it can be exploited by a cunning foe.

To avoid this paralysis at the staff level, advocates of Network Centric Warfare advocate direct access to information by subordinate commands. Direct access to information empowers leaders at lower levels, since they do not have to rely on higher levels for time-sensitive, decision-quality information. In Network Centric Warfare, units at all levels have greater access to alternative, albeit frequently conflicting, sources of information. This proliferation of information to all levels allows 'intent-based' leadership as opposed to 'directive' leadership. Leaders no longer have to direct tasks and organizational relationships; the freedom and proliferation of information allows subordinate leaders to make decisions based on the intent of the leader.

Network Centric Warfare is the networking of intelligence, surveillance, and reconnaissance assets and combat elements into a distributed network providing the warrior with the combat oriented

version of the Internet. The forecast architecture for Network Centric Warfare will probably comprise three elements: the sensor grid, the information grid, and the shooter grid.[90] The sensor grid architecture is depicted below in Figure 3.[91]
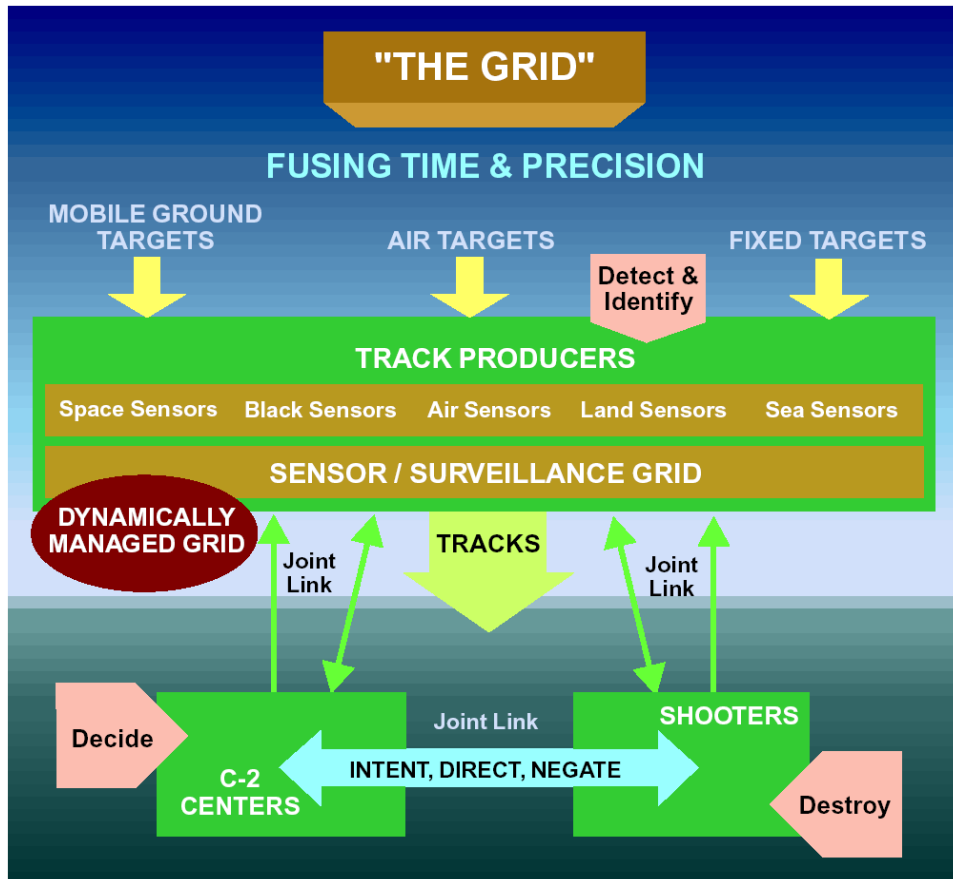
Figure 3. The Grid

The *sensor grid* encompasses a networked collection of diverse sensors such as radars, radio frequency and infrared receivers, optical devices, acoustic systems, and people. These sensors could be on orbit, in the air, on the ground, or at sea. Some would be permanently in place, others plugged in as and where needed and available.[92] This grid provides the eyes and the ears to the combat force and forms the foundation of the overall system.

The *information grid* is the nervous system of the battle network. It comprises the transmission system of information of all types and includes communications satellites, data-transmission lines, microwave relays, computers, and command centers. The information grid transmits sensor information, recommendations and orders, intelligence, and real-time information about operations, logistics, and other functions—information that today is centralized at the Air Operations Center for the Joint Forces Air Component Commander's staff to plan, monitor, and control operations.[93]

The *shooter grid* draws from the sensor and information grids to pair weapons incorporated into it with targets and then to guide weapons to targets as necessary. Pairings can be assigned in real time from the overall commander or based on the initiative at the lowest level as a result of advanced situational awareness.[94]

The shooter grid is not limited to air assets only, but it encompasses the whole combat power of the U.S. military. The advantage of a network approach is that, for example, an Army Tactical Missile System, an Air Force Joint Standoff Weapon, a Navy Tomahawk missile, or an armored platoon can target a surface-to-air missile easily. Assignments can be made in real time as threats emerge, concentrating combat power on enemy targets. The shooter grid, reinforced by Global Positioning System (GPS), digital maps, computers, and display systems, can accurately merge data from sensors. The combination of all grids will make it common for ships, aircraft, and other weapon-launching platforms to have engagement-quality information about targets that their own sensors have not detected.[95]

Decision-quality information provided via a distributed network empowers individual aircraft and commanders to cause strategic effects aligned with the commander's intent. Lone combat units armed with knowledge of desired effects and outcomes, coupled with outstanding battle space awareness, enable positive strategic outcomes. When combat units plug into the network, the action cycle shortens because they are able to adapt to emerging situations. Parallel war is the ultimate byproduct when dominant battle space knowledge combines with a networked shooter grid.[96] Because of the modern information barrage, today's leaders can either be delayed by ambiguous information and distracting subordinates or they can produce a clear intent and empower subordinate organizations to take advantage of emerging opportunities.[97] Decentralized empowerment frees organizational authority allowing

subordinate units to exercise initiative and agility and to apply unlimited firepower.[98]

The challenge of Network Centric Warfare is not technical, but cognitive and doctrinal; it requires a new way of thinking. Integration into the wired battlefield causes the diffusion of power away from the highly centralized hierarchies that now make up military command and control. Once individual soldiers or aircraft plug into the network, self-organization begins to emerge. As the soldiers interact with the grid, they produce synergistic, emergent properties not displayed by the individual components. They learn from experience, change to apply lessons learned, and anticipate what is needed to be successful in the future.[99] This diffusion of authority and adaptability creates real difficulties for very large organizations that depend on strong, hierarchical control.[100] According to Dr. Wheatley, a behavioral theorist, the danger in Network Centric Warfare is that strategy gives way to reaction:

> They [the U.S. Army] have the technology to move information down to the lowest level so that it is possible for the men inside tanks to have as much information as their commanders…. But once you give that information to tank crews, and they start working for their own safety, their own victory, how are they going to respond to commands from above? And what happens to battle strategy? Is it in the head of the commander, or do you just train the crews and let them figure it out for themselves as the situation demands?[101]

Complexity theorists illustrate self-organization by pointing out that New York City never runs out of food. The city is a model of a self-adaptive system that meets the strategy of self-survival. No one is in overall charge of feeding New York; no detailed movement plans are drawn up; no master schedule of shops and supermarkets is distributed. However, market forces drive the supply system; the city manages to feed itself anyway.[102]

Clearly, the challenge for military strategy is to assess the situations where centralized control and execution are necessary while allowing for the advantages of the self-adaptive advantages brought by Network Centric Warfare. In recent conflicts, airpower employment with "the grid" shows a propensity for centralized execution due to the

convergence of information and communications with the air component commander at the Air Operations Center. This experience is based on situations where political stakes were high, war aims were low, and span of control was small, allowing for the commander's individualized attention. In large-scale, dynamic, complex engagement situations, the decentralized aspects of Network Centric Warfare are advantageous. The challenge today is to experiment and refine Network Centric Warfare approaches so that self-adaptive behavior can be leveraged to support the Air Component Commander's strategy.

Unmanned and Autonomous Systems

The technology advances of autonomous intelligent agents sifting data in the Air Operations Center, self-thinking UAVs and UCAVs, and improved peer-to-peer communications allows the decentralization of control. Integration of these technologies into the wired battlefield causes the diffusion of power away from the highly centralized hierarchies that now make up military command and control.

Future battles will have unmanned systems as forward sensor/observers to detect and identify high-value targets combined with autonomous UCAVs to strike the identified targets. This future addition of multi-use unmanned air vehicles is likely to change the nature of air warfare. The Air Force currently relies on unmanned Predator and Global Hawk to provide long duration surveillance; however, unmanned air vehicles are just the beginning of the robotic combat zone. In Afghanistan, the Hellfire-armed Predator essentially became the first UCAV.[103] In 2001, an unmanned Global Hawk performed an aviation first by flying autonomously across the Pacific Ocean to Australia.[104] These systems will likely proliferate eventually taking over long duration and critically dangerous missions, but due to communications bandwidth constraints future systems will operate more autonomously.[105]

The Air Force and the Defense Advanced Research Project Agency are developing UCAVs that will complete unaided missions that today require a great deal of human interaction. These UCAVs will be given an objective and will be able to independently execute a mission with limited human interaction after the mission is put into the UCAV. However, several recent Global Hawk crashes highlight the dangers of

autonomous systems. Programming mistakes or programming without understanding employment concepts can cause critical errors.[106]

There will even be smart and dumb UCAVs where the smart UCAV will direct the operations of the less smart, cheaper vehicles.[107] The infusion of smart autonomous vehicles that interact with each other within the battle space will likely create a less linear battle space where Air Component Commanders will have less control. Research shows that autonomous systems will likely decentralize control and execution ability and cause swarming behavior in the battle space.[108]

The trend towards fully autonomous systems seems inescapable and Air Force doctrine should address the changes in battlefield control and execution necessary for autonomous systems. Current military thinking is particularly careful to indicate that human decision-making will be involved at some level in the operation of autonomous systems. However, there is no reason why this should be so. Quantum increases in processing power combined with self-learning computer programs will continue to increase autonomy in the battle space. Inevitably, the need to make decisions in split-second timing will remove the human from battle space decisions. In fact, several weapon systems already fielded have relegated the human-in-the-loop to a 'kill-switch' operator.[109] This infusion of self-adapting weapon systems on the battlefield is likely to diffuse both execution and control decisions away from the commander and into the weapon system itself. Air Force doctrine and thinking need to address the impact on control and execution when autonomous systems lead to swarming behavior.

Swarming Behavior

Organizationally, a swarm is a collection of autonomous, continuously sensing and reacting members who have local communication with other nearby autonomous members. An autonomous member generally reacts as an individual according to internal rules and the state of its local environment as opposed to obeying orders through a hierarchy or reacting in lockstep to a rigid set of rules. In a swarm, these autonomous members are highly interconnected, but not to a central hub. Since there is no center of control, management and execution is distributed throughout the system.[110] This distribution and interaction allows for continual interactions among the agents as they form and

reform in fluid, shifting networks and shifting hierarchies as well. These fluid networks may persist for some time or may break down and recombine rapidly based on the available agents, rule set, and environment. Information may flow quite freely from one agent to the next about conditions near them in the model; with distributed knowledge there is no centralized hub for dispensing top-level commands among all the agents.[111]

Independent tactical systems with self-thinking will likely show characteristics of swarm behavior. Swarming will likely have the biggest impact on organization, command, and control of airpower in the future and has the greatest likelihood of changing the way U.S. forces fight. Rand studies suggest that the technologies supporting swarming already exist; for example, unmanned aerial vehicles, precision-guided munitions and very advanced communications form the basis for swarm behavior.[112] Swarming has tremendous impact on command since it is the outgrowth of highly decentralized execution systems.

A move toward swarm behavior is more a function of experimentation and doctrine, cultivating an appropriate turn of mind, and an agile networked command and execution function. This notion already seems to be borne out by the Marine Corps' experiments with its Sea Dragon operational concepts, which use existing technology and emphasize networks.[113] Numerous independent devices are likely in the battle space of the future. According to developing concepts, autonomous military tactical devices will likely be able to process information, sense their environment, move, and communicate, thus forming the fabric of a decentralized battlefield network. Extreme miniaturization of the processors and vehicles allows the development of concepts such as "surveillance dust," a cloud of millions of microscopic airborne sensors that could blanket a target area for extended periods to gather and report data.[114] The battle space of the future may have a "mesh" of thousands of small robots, each several inches in size, scattered across a battlefield to do both surveillance and attack functions, or clusters of orbiting small-scale satellites providing near-continuous ground coverage at relatively low cost.[115] These trends point to a battlefield dominated by offensive platforms sharply different from today, begging the question of their impact on command and execution.

The mesh of autonomous unmanned platforms could change command from plan-based to goal-based, where the actual execution of military operations is created on the fly by constantly innovating

participants at the lowest level. They respond to changing situations without requesting or needing permission. In future campaigns, leaders may draw up a list of fixed and mobile targets and attach point values to them. Then units on the ground, in the air, and at sea could autonomously pick targets available within their area of influence. The commander would review periodic progress, adjust point values if needed from time to time, and basically stay the hell out of the way of the swarm.[116] With the introduction of swarming autonomous units, command and execution radically changes.

Swarming has already been seen in military operations providing a diffuse network that is very effective yet difficult to counter. For example, the Vietcong exhibited a degree of swarming behavior in their attacks during the Tet Offensive in 1968. While the attacks were ordered by Hanoi, the attackers themselves enjoyed a very large degree of freedom of action—in line with Mao's strategic dictum of "strategic centralization, tactical decentralization."[117] Current terrorist organizations also exhibit a large degree of networking and swarming. For example, Hezbollah uses a swarming approach to counter Israeli commando raids in southern Lebanon. Small, distributed units converge on Israeli patrols based on general instructions. Like antibodies, units using cellular communications and general directions have been able to converge on any intruder in a given area. No central leadership is required, and Israeli commandos have found themselves overwhelmed more than once by swarming attacks from which they sustain serious losses. The inability of the Israeli military to deal with these Hezbollah swarms may have contributed to Israel's unilateral withdrawal from southern Lebanon. Finally, Al Qaeda has engaged in "strategic swarming" by striking simultaneously, or with close sequencing, at widely separated targets from dispersed cells, thereby swarming to concentrate effects. This strategy was seen in the embassy bombings in Kenya and Tanzania, the World Trade Center and Pentagon attacks, and the recent bombings in Kenya.[118] Al Qaeda exhibits the qualities of decentralized command and decentralized execution through a diffuse network that acts on specific timing yet general execution instructions from the group's leadership.

As beneficial as swarming seems, its decentralized nature does have serious disadvantages. Resources are not efficiently allotted and duplication of effort is always rampant.[119] The military case requires a necessary mechanism to provide top-down direction when needed to focus swarms on necessary objectives. To do this without succumbing to the

temptation to over control events in the field may become an essential element of information-age command.[120]

Implications

In summary, the advances in information and decision systems, the prevalence of unmanned systems, and the trend toward automation results in the development of systems that take the human out of the loop, with the potential of shifting system behavior into a realm where command and execution are at odds with one another. The proliferation of long duration, unmanned autonomous devices, combined with automated decision aids, greatly increases the speed of combat. The additional development of very cheap and very small military systems will also help to move combat even further out of human control and decision making. The combination of these advances has the potential for synergistic effects in warfighting. Decision-making will likely decentralize to take advantage of the strengths of the grid. Humans may retain symbolic authority, but automated systems move too fast and the factors involved are too complex for real-time human comprehension. When computers become self-learning, the situation will be even further from anything humans can reasonably expect to understand, much less intervene in successfully. Doctrine and training need to address the fact that technology may make it necessary to decentralize control and execution of airpower.

Initial Air Force implementation of these new technologies is showing a tendency to centralize not only control but also execution. Technology leaps from Desert Storm to Enduring Freedom has allowed Air Operations Centers to have excellent situational awareness of tactical events. However, this awareness combined with excellent communications has led commanders to manage execution decisions at the tactical level. Numerous images are available of senior leaders watching events unfold in front of video walls and computer consoles while personally directing aircraft hundreds of miles away. This preoccupation with information may be acceptable in small operations but risks overwhelming the command center in large-scale operations. One must ask what is happening tactically while captivating real-time UAV video mesmerizes the operations center.

The question for the military is whether we will also take the lead in new operational concepts for exploiting information and

communication on the battlefield. New technology allows the Air Force to look at emerging concepts for the control and execution of airpower. Centralized control with decentralized execution may not provide the most effective employment of air assets. The Air Force must aggressively experiment with network and swarming concepts and update Air Force doctrine to take full advantage of the flexibility that these new technologies afford.

V. Additional Options for Control and Execution

New conditions require, for solution – and new weapons require, for maximum application – new and imaginative methods. Wars are never won in the past.

General Douglas MacArthur

Military doctrine evolves from military theory and experience and addresses how best to use military power. It is intended to be a collection of best practices based not only on history and experience, but also on emerging technological developments. Experience over the last decade shows the Air Force is leaning toward centralized execution in the application of airpower. Deliberate Force and Allied Force highlight the fact that the Air Force currently employs airpower contrary to its own central tenet of centralized control and decentralized execution. The Air Force has fallen victim to one of the most dangerous doctrinal problems— the tendency to let doctrine stagnate. Current operational and command and control doctrine is on the verge of being irrelevant because the supporting assumptions have not been reexamined for continued validity. Changing circumstances must constantly be evaluated because it changes the calculus of past experience.[121] Air Force Doctrine Document 1, *Basic Aerospace Doctrine,* states these tenets require informed judgment in application. It highlights that employment requires a skillful blend of the tenets to tailor them to the ever-changing operational environment.[122] Air Force Doctrine Document 2-8, *Command and Control,* adds that political considerations tend to centralize command at a higher level while admitting that execution decisions may be outside the normal chain of command.[123] Although it is admirable that current doctrine addresses the fact that operational conditions dictate the levels of execution, it does a disservice to serious study by touting centralized command, decentralized execution as a bumper sticker phrase. Current doctrine does not adequately provoke thought on the control and execution of airpower in a complex international environment. Additionally, it does not address the impact of emerging technology on control and execution. This chapter will explore the possible combinations of command and execution and ask what technologies or situations make these combinations applicable.

Control and execution can each be considered as either centralized or decentralized and can collectively be presented in a quad chart with

each quadrant representing one of the four combinations of command and execution. Although pure centralization or decentralization exists only in theory, thinking of these extremes highlights the characteristics of each method of command and control. Figure 4 illustrates the possible combinations of command and execution.
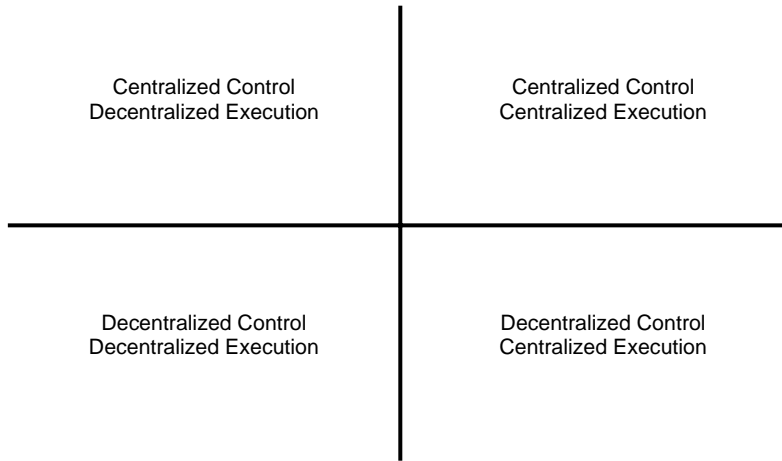
Centralized Control Decentralized Execution	Centralized Control Centralized Execution
Decentralized Control Decentralized Execution	Decentralized Control Centralized Execution

Figure 4. Command and Control Matrix

Each quadrant is examined for its suitability for airpower. The conditions and technical developments that will likely drive the commander from the basic tenet into one of the other three quadrants are highlighted.

Centralized Control, Decentralized Execution

Centralized control with decentralized execution is the hallmark of desired air operations as stated in existing doctrine. Arguments for this employment strategy highlight that centralized control was proven in Africa in 1943 and in the Battle of Britain.[124] The greatest advantage of centralized control and decentralized execution is that it allows the demonstration of initiative at the lowest levels. A Cold War version of Air Force Manual 1-1 linked decentralized control with a superior culture and way of life. It states:

> This heritage produces leaders who are able to trust the commanders and individual members of our armed forces to make good decisions and to perform to the best of their abilities. This is an organizational strength that must be maintained. This aspect of our national character makes possible the rapid action-and-reaction that is not found in highly centralized societies.[125]

Air Force Manual 1-1 linked airpower performance under centralized control, decentralized execution to our national character as a democratic people. Decentralized execution became a key tenet of our command and control philosophy by harnessing the initiative of lower echelon commanders in the conduct of an air campaign while maintaining overall broad guidance and direction from above.

Operation Desert Storm highlights the advantages of centralized control and decentralized execution. The majority of air assets were centralized under Lieutenant General Charles 'Chuck' Horner who tasked sorties through the Air Tasking Order. Due to span of control and available technology, however, airpower execution had to be decentralized. Units were tasked by an Air Tasking Order, but significant preparation was accomplished at the unit level. The 300 to 900-page Air Tasking Order became the synchronization mechanism for orchestrating the massive quantities of airpower flying through hostile airspace. The Air Tasking Order provided a mechanism for the efficient and safe management of air assets through centralized control. Roughly 47,000 total strike sorties with an additional 340 air-to-air sorties per day were flown; high levels of synchronization and deconfliction were required.[126] Execution was predominately decentralized with units executing the Air Tasking Order, but making tactical decisions at lower levels. Airborne Warning And Control System and airborne command element aircraft managed tankers and diverts real-time. The Airborne Command and Control Center controlled strike missions just beyond the fire support coordination line.[127] There were no cases of air-to-air friendly fire and no mid-air collisions.[128] Additionally, Joint Surveillance Target Attack Radar System aircraft directed attacks against moving targets including SCUDs.[129]

Centralized control with decentralized execution is optimized for large-scale military operations such as World War II or Desert Storm. In each of these scenarios, centralized control was necessary for assignment

of tasks, apportionment of aircraft, and synchronization of an incredibly complex plan. Centralized planning was essential due to the large scale of operations, while execution was necessarily decentralized due to span of control and the improved fidelity of information at tactical locations. The air commander was not able to maintain fine detail on the operation and required distributing execution tasks to subordinate commanders.

Although centralized control with decentralized execution was successful in Desert Storm, future commanders need to be aware of the possible pitfalls of this command scheme. The biggest complaint of large-scale centralized control is that it is not responsive to emerging threats. Many argue that the Air Tasking Order is too rigid and long lead times in its preparation hamper the flexibility and versatility of airpower.[130] For example, in Desert Storm the Air Tasking Order cycle took at least 40 hours from the first planning meeting to first sortie.[131] Improvements to the planning cycle have still not significantly shortened the cycle below 24 to 36 hours. Additionally, the Air Tasking Order system has not been significantly tested in a fluid ground battle; for the most part, U.S. airpower has been so dominant that enemy reaction on a massive scale has been absent.[132] A significant workload is placed on combat operations to build flexibility into the system with real time aircraft assignments when fluid situations erupt. Another limitation is the breakdown of coordinated effort under decentralized execution, especially in a defense against a large strike. Decentralized execution degrades defensive operations when nodes operate autonomously. In a dense threat environment, the Air Component Commander needs to deconflict firing decisions across a broad array of defensive weapons. Although by decentralizing execution each individual defender is more survivable, they are also more likely to engage the wrong target or decoys.

In general, centralized command with decentralized execution is ideal for situations where the C/JFACC will have a large span of control and the battle space is relatively fixed. Centralized control allows the assignment of tasks, apportionment of aircraft, and synchronization of an incredibly complex plan while delegating detailed planning to the tactical level. However, a significant workload is placed on lower echelons to build flexibility into the execution when fluid situations erupt.

Centralized Control, Centralized Execution

Centralized control with centralized execution predominates in wars of convenience or optional warfare. Wars of convenience are conflicts where the U.S. does not have an overriding national interest, but intervenes for motivations such as influence in world politics. Objectives differ from traditional military operations, and a great deal of control over the execution is required to ensure the desired effects are realized. The purpose of the intervention is not necessarily to win a war but to influence behavior. When a state has an option to participate in a conflict, all military considerations acquire a different perspective.[133] Diplomacy rather than military necessity dictates the pace and use of airpower. Military effectiveness is not as important as the desired political effect.[134] Governments applying any kind of military force in the peacekeeping environment are likely to be far more sensitive to criticism than when they are committed to conflicts involving vital national interests. In wars of convenience, the government has a choice about getting involved or not, and domestic politics has an overarching impact on conflict objectives. A democratic government is likely to be sensitive to the impact on domestic politics of events in peacekeeping.[135] Centralization of execution appears to correlate tightly with the ambiguities associated with peace operations and similar small-scale missions. Political sensitivities and concern about public perceptions may induce commanders to adopt procedures they might never consider in higher-intensity combat.[136] In wars of convenience, minimizing damage is a prime military consideration.[137] In short, involvement of airpower in wars of limited U.S. interest begs for centralized control and centralized execution. War aims are very measured; speed and flexibility do not dominate as much as controlling the escalation of violence. Ultimately, the failure of airmen to recognize political realities and their implications has serious implications for airpower employment. For example, General Short's desire to prosecute a Desert Storm-like campaign during Operation Allied Force directly conflicted with the political objectives of the NATO alliance.

In *Fighting by Minutes,* Robert Leonhard argues that the centralization of control is highly dependent on information flow. He argues that good decisions are not the goal of military operations, but rather that good and *timely* decisions are necessary. Good and timely decisions are best made at the level where information reaches the

decision maker. Technology has forced execution decisions to higher levels because of the marriage of communications and ISR information at higher headquarters. Previously the greatest source of battlefield information was reported from subordinate units, but now the senior commander or Air Component Commander receives information from numerous tactical and national sources with greater fidelity and precision than the tactical operator.[138] Today, the Air Operations Center often has a better tactical picture than the operator. This trend pushes decisions to the Air Operations Center and the Air Component Commander. Current Air Force doctrine does not address the realities of centralized execution, but as Operations Deliberate Force, Allied Force, and Southern Watch have shown, high-level decision-making for execution decisions is becoming the de facto doctrine in air operations, especially in wars of convenience.

Emerging Air Force doctrine of effects-based operations will also centralize both the control and execution of airpower employment. Effects-Based Operations takes national and joint force objectives and clearly links them to desired results, not to the enabling physical actions.[139] Air Force Doctrine Document 2-1, *Air Warfare*, defines effects as "the operational or strategic level outcomes that (Air Force) functions are intended to produce."[140] Effects are either direct or indirect, have an order based on time, and can accumulate and cascade in a system.[141] The challenge in assessing operational and strategic effects is the difficulty in accurately linking specific actions to outcomes. The analysis required for effects-based targeting is very complex and traditionally is performed at Air Operations Center level or above. The Air Force has used Joint Warfare Analysis Center products to assist in achieving effects-based operations.[142] The sophisticated analysis necessary for effective Effects-Based Operations centralizes planning and execution decisions at the Air Operations Center and above.

Helmut von Moltke warned of the dangers of micromanagement. One of von Moltke's greatest fears was that technologies such as the telegraph would enhance the capability of upper echelons to interfere in the conduct of operations by requests for information and advice, or even criticisms, without a full appreciation for the actual circumstances at the front. He warned of the dangers of commanding "with a telephone cord attached to the commander's back."[143] The Prussian doctrine of *Auftragstaktik* ensured flexibility and innovation. Von Moltke fostered independent thinking in subordinates: "Diverse are the situations under which an officer has to act on the basis of his own view of the situation. It

would be wrong if he had to wait for orders at times when no orders can be given."[144] Of course, mission orders are ideal for large-scale war and not in situations where national interest is low yet political stakes are high. The commander must determine the appropriate command and control relationship based on the conflict's nature. Another danger of centralized control and execution is the inability for coalition partners to participate in operations. U.S. forces will frequently operate in coalition with allies and partners, and commanders must be able to control both U.S. and coalition forces. Technological sophistication must not inhibit U.S. forces from communicating with allies and coalition partners. Finally, the most significant danger of a centrally controlled and executed conflict is that it builds a significant center of gravity for the adversary to attack. Current Air Force doctrine calls for a centralized Air Operations Center with intelligence and communications feeds converging into one location. This single command and control entity presents an extremely critical center of gravity, regardless of its location, and it is vulnerable to either conventional or unconventional attack. With highly centralized execution, lower echelons are likely to paralyze without the command and guidance from upper echelons.[145]

Decentralized Control, Centralized Execution

Decentralized control with centralized execution from an Air Component Commander perspective is most readily apparent in the employment of high cost Intelligence, Surveillance, and Reconnaissance assets. Because of their high cost, their employment in space, or both, these assets are often controlled at a level above the Air Component Commander, although he gets coordination input on operation of the assets when they are in theater. Reconnaissance satellites are the best example of a decentralized control with centralized execution system. Keplerian laws of orbital motion govern satellite orbits. Any orbit that is lower in altitude than a geostationary orbit requires the satellite ground track to move over the surface of the earth. The Air Component Commander cannot control the ground tracks over his territory; he can only input requirements for when the satellite passes overhead. Additionally, due to the limited availability of these complex, expensive assets, they are controlled by agencies that are not under the command and control of the air component commander or even the combatant

commander. The Combined or Joint Forces Air Component Commander, through the Joint Force Commander, makes requests for information for each satellite pass. That request is weighed against the requests of other users. In short, the Air Component Commander has little control of the asset in his area of responsibility. He does, however, have significant input into the tasking requests and the routing of information after the reconnaissance is completed. It can be said that the execution of the mission is centralized while control is decentralized.

As the preceding discussion implies, this execution scheme is most applicable for the execution and tasking of assets that are very limited in number or one-of-a-kind. These assets require such a considerable investment or possess such unique capabilities that their use needs to be coordinated across commands, and even when deployed to an area of responsibility, the commander may have constraints or limitations for their use. The execution ends up being an elaborate scheme to optimize the asset's use; efficiency is the goal. For satellite reconnaissance assets, the goal for the commander is to get the most critical intelligence per pass; therefore execution is centralized. The commander cannot afford to waste one of his valuable opportunities in the name of versatility or flexibility.

Decentralized control with centralized execution optimizes limited resources but is not necessarily time sensitive to theater needs since the control is performed at a level above the commander. For time critical tasks the commander must coordinate with the controlling authority for priority. With high priority, these assets can be time sensitive, but that requires the higher controlling authority to agree with the theater commander or his air component commander. The primary disadvantage of this command scheme is that the local commander loses flexibility and versatility over use of the asset.

Decentralized Control, Decentralized Execution

Decentralized control with decentralized execution is the ultimate expression of American independence and innovation. To be effective, decentralized control and execution must be prosecuted by a force with a common vision. Training and technology are essential for this command scheme to be effective.

One of the greatest obstacles is the fact that decentralized control and execution does not fit easily into the current hierarchical organization

of the military; in fact, they are at odds with one another. Hierarchies tend to be slow and plodding in response to new and unique information. At each level of command, information is filtered, added, deleted, and modified. This time consuming process often results in information either not reaching the right people or getting there too late to be of any use. This creates a cascading effect that slows the dissemination of decision-quality information to the proper level. This last point, not getting information to the right people on time, is often cited as a failure of the intelligence community. Research on military command indicates that flatter organizations with decentralized control more successfully counter the uncertainty of warfare. Martin Van Creveld, in *Command in War*, posits that higher decision levels require more time and more information to counter a given amount of risk.[146] His research suggests that decision-making at the lowest possible level with limited interference by intermediate command is the trademark of successful military organizations.

The need for networked and decentralized command and execution is at odds with military hierarchies whose identifying characteristic is control of information. Decentralizing and networking information provides access to information at all levels of command. Shared information helps reduce uncertainty and improve a commander's decision-making cycle. To guard against information overload, new technological innovations such as computer smart agents and data mining are needed to permit commanders at all levels to tailor their information gathering capabilities to meet their specific needs. Distributed information gathering and networked intelligence enables military organizations to make decisions based on the requirements caused by shorter timelines. Today, all levels of military command and control systems have greater access to information. To rapidly act on information, the command system needs to change from one of 'direction' to one of 'intent.' Realizing that today's environment is dynamic and shifting, soldiers must make decisions at the lowest possible levels based on commander's intent. Leaders must allow lower echelons to follow the intent, thus freeing the higher echelon commander for strategic decisions.[147] By providing intent, the Observe, Orient, Decide, and Act loop of decision-making is not slowed by passing information linearly up and down command levels.

The technology advances of intelligent agents sifting data in the Air Operations Center, autonomous UAVs and UCAVs, and improved peer-to-peer communications allows the decentralization of control.

Integration of these technologies into the wired battlefield causes the diffusion of power away from the highly centralized hierarchies that now make up military command and control. As discussed in the previous chapter, once individual soldiers or aircraft plug into the network, self-organization begins to emerge. As the soldiers interact with the grid, they produce synergistic, emergent properties not displayed by the individual components. They learn from experience, change to apply what has been learned, and anticipate what is needed to be successful in the future.[148] This diffusion of authority and adaptability creates real difficulties for very large organizations that depend on strong, hierarchical control.[149]

The current problem with these information technology advances is that Air Force doctrine lags behind business and the civilian sector in decentralizing control and execution to become operationally agile. With the proper doctrine and organization, decentralized control and execution is likely to prove useful in a wide spectrum of conflict. It should also be effective against a broad range of adversaries. Providing clear intent to subordinates and rapid decentralized decision-making combined with swarming the adversary from all directions should be an effective strategy against either massed or dispersed opponents. A true networked yet decentralized force operates in clusters capable of operating against foes of any size, combining to confront large field armies and aggregating far more loosely in operations aimed at countering guerrillas and other unconventional forces.[150]

The major challenges to implementing networked, decentralized forces are organizational in nature. For example, for Network Centric Warfare to work, "jointness" will have to broaden and deepen. True joint doctrine and training are necessary conditions for the rise of an integrated capability that highlights both the data gathering and the fire capabilities of all the services in myriad settings, across the spectrum of intensity of future conflict. Decentralization of the command and control of airpower is necessary for dispersed forces to affect opponents operating in a nonlinear battlespace.[151]

Although effective in industrial age warfare, centralized control places limitations on timeliness, flexibility, and tempo and creates potentially serious problems should we face an adversary that is operating at a faster operations tempo than U.S. forces. Decentralized organizations are very diffuse and agile and are difficult to target using hierarchical structures. As noted earlier, Al Qaeda exhibits qualities of decentralized command and decentralized execution through a diffuse network that acts

on specific timing yet general execution instructions from the group's leadership. Al Qaeda has engaged in "strategic swarming" by striking simultaneously, or with close sequencing, at widely separated targets as seen in the embassy bombings in Kenya and Tanzania, the World Trade Center and Pentagon attacks, and recent bombings in Kenya.[152] The challenge in countering organizations such as Al Qaeda is finding an organizational structure that is adaptive enough to react faster than the opponent's organization itself. It is highly unlikely for a hierarchical organization to successfully counter a capable, decentralized threat.

Decentralization is not appropriate for wars where a specific political result is vital and mistakes cannot be tolerated. Additionally decentralization requires highly trained, effective subordinates to make the proper operational decisions to ensure unity of effort. Decentralized organizations allow a large span of control, but without organizational vision and a shared sense of purpose, they can often degenerate into chaos. Decentralization causes an inefficient use of resources, duplication of effort is rampant, and some efforts may not be attempted at all. The danger of the fixation on time and streamlined schemes to attack time sensitive targets is that many targets are not strategically important enough to expend valuable resources against. In a time sensitive situation with decentralized control and execution, 'Chuckie Cheese Mole in the Hole' targeting is likely. Any target that pops up becomes a time sensitive target. The fallacy of opportunity targeting it that it assumes that any target identified by real-time reconnaissance is worth the expenditure of airpower to affect. It presupposes an abundance of strike capability and a lack of important fixed targets.[153]

Implications

Centralized control of airpower is a means, not an end. An informed and intelligent unity of effort towards common objectives is the goal. With rapid advances in computers, communications, and artificial intelligence, centralized control is no longer necessary or even desired in all situations. Air Force Doctrine Document 1 states, "Centralized control and decentralized execution of air and space forces are critical to force effectiveness," but effectiveness may take many forms.[154] Effectiveness can be measured by targets per sortie, number of long-term political objectives met, absence of negative press, lack of friendly casualties, or

simply presence. Each measure may require a different approach to the command and execution of airpower.

There is no magic formula for success and certain steps must be taken to ensure that airpower is most effectively employed. The first step is to determine an accurate picture of the nature of the conflict. According to Clausewitz, that determination is the most significant and comprehensive question the commander must ask: "The first, the supreme, the most far-reaching act of judgment that the commander makes is to establish the type of campaign upon which he is embarking."[155] Today's technology and the nature of military operations do not change that fact. Any command and execution system that does not match the conflict will likely fail.

In *Command in War,* Martin Van Creveld determined that successful armies did not turn troops into automatons and did not attempt to control everything from the top. He concluded that commanders must give lower echelons wide latitude and demand that they fill that latitude with initiative. They must be properly trained, equipped, and organized to take advantage of initiative.[156] Of course, initiative must be weighed against the political stakes involved and the corresponding acceptable amount of independent military operations. In short, the commander must manage risk by using a command and execution scheme that balances risk with initiative. Centralized control with decentralized execution is a mantra in Air Force doctrine without regard for political circumstance or technological advancement. Air Force doctrine needs to address the fact that conditions and circumstances exist where centralized control with decentralized execution is neither the most appropriate nor the most effective employment of military airpower.

VI. Conclusion

Doctrine is indispensable to an army...Doctrine provides a military organization with a common philosophy, a common language, a common purpose, and a unity of effort.

General George Decker, 16 December 1960

The Air Force doctrine of centralized control and decentralized execution has reached the status of dogma. Technology and political constraints continually change, and thus, military doctrine should also change as it relates to strategy. For the naval strategist, maxims such as "never divide the fleet" became outdated as advances such as long-range gunnery and over-the-horizon communications changed the calculus of war. Airmen, however, have long held to the doctrine of centralized command with decentralized execution without serious thought to the impact of the political environment and technological advances on this doctrine. Aviation technology has changed dramatically since World War II, but the central tenet of airpower has remained relatively consistent. Additionally, the political environment for the employment of airpower has also dramatically changed, and the Air Force is involved in limited scale conflict to a much greater extent than envisioned during WWII. Although Air Force doctrine has changed 13 times based on over 50 years of experience, the doctrine of centralized control with decentralized execution has not been seriously challenged.

Several factors need to be highlighted when considering the basic tenet of centralized command. First, the doctrine was formulated at a time when the Air Force was struggling for independence. As was mentioned earlier, the struggle for centralized control was inextricably tied with the struggle for Air Force independence. An independent Air Force could not exist as long as air forces were under subordinate command of army ground commanders. As long as the Army Air Force was struggling for independence, airmen would be unable to consider anything other than centralized command under an airman. Now that the Air Force has been an independent service for over half a century, airmen must be comfortable with this fact and allow themselves to consider subordination of airpower when necessary. Second, Air Force control doctrine is fundamentally based on experiences in total conventional war. These

wars were fought in circumstances where each belligerent nation directed all of its resources to the conduct of war. Victory in battle was necessary to meet war aims, and destruction of enemy military and industrial capacity was the main mechanism for achieving victory. Arguably, since World War II, all conflicts have been politically constrained with limited objectives. Third, from a technology perspective, this doctrine was developed at a time when large numbers of aircraft were required to achieve a given effect. Immense improvements in aerospace technology may have made this doctrine obsolete.

One impasse to the serious discussion of the validity of centralized command and decentralized execution is the lack of an effective definition of execution. This ambiguity has allowed all manner of air execution to be lumped into the central tenet's bin. In recent conflicts, the Air Force has operated with relatively centralized execution authority, but current doctrine does not reflect this fact. This conflict between doctrine and employment causes confusion and resentment among airmen at the tactical level. It has also led airmen to accuse senior leaders of micromanagement, while the leaders were only implementing intellectually and politically appropriate command and execution schemes for the unique circumstances. Without definition and discussion these misunderstandings about the proper employment of airpower will continue. Not defining and clarifying execution leaves its interpretation to the tactician. One man's decentralized execution becomes another man's micromanagement. Execution needs to be defined by tasks and level of command to provide the language for discussion of the optimal employment airpower. To clarify discussions this paper defines execution as unit level actions taken by wings and below to employ/deploy air assets from the receipt of tasking to the termination of the mission. The critical attributes of execution are that it begins with the assignment of a task at the lowest level and requires some type of action taken to completion. Execution is decentralized if decisions after mission assignment lie with the operator of the weapon system, and it is centralized if detailed decisions reside in a higher command authority or automated system controlled by that authority.

The Deliberate Force and Allied Force case studies highlight the fact that centralized control *and* execution is the most *effective* use of airpower in conflicts where limited objectives are pursued in politically charged environments. Although opinions differ on alternate courses of action, these two case studies highlight the fact that political environments

exist where a very measured application of force is required. In each instance the operation's small scale, limited objectives, and excellent communications allowed the C/JFACC to pay individual attention to the execution of the air effort.

Centralized control of airpower is a means, not an end. An informed and intelligent unity of effort toward common objectives is the goal. With rapid advances in computers, communications, and artificial intelligence, centralized control is no longer necessary or even desired in all situations. Commanders must manage risk by using command and execution schemes that balance risk with initiative. Centralized control with decentralized execution is a mantra in Air Force doctrine without regard for political circumstance or technological advancement. Air Force doctrine needs to address the fact that conditions and circumstance exist where centralized control with decentralized execution is not the most effective method for employing airpower.

Notes

[1] This sequence of events is from the author's personal experience. While deployed as U-2 pilot and operations officer all weapon employment decisions were centrally controlled by higher headquarters to the point where AWACS needed to obtain CC or DO approval for weapons releases, even if they were in accordance to the standing rules of engagement.

[2] Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine*, (Washington D.C.: Government Printing Office (GPO), September 1997), 23.

[3] Air Force Doctrine Document 2-8, *Command and Control*, (Washington D.C.: GPO, 16 February 2001), 2.

[4] Ibid., 2.

[5] AFDD 2-8, 3.

[6] AFDD 2-8, 3.

[7] Maris McCrabb, "A Normative Theory of Air and Space Power Command and Control," (Maxwell AFB, AL: essay, School of Advanced Airpower Studies, 1997), 3.

[8] AFDD 2-8, 3.

[9] AFDD 2-8, 4.

[10] Joint Publication 1-02, *Department of Defense Dictionary of Military* and *Associated Terms*, (Washington D.C.: GPO, 12 April 2001, as amended through 25 September 2002), 143.

[11] AFDD 1, *Air Force Basic Doctrine*, (Washington D.C.: GPO, September 1997), 23

[12] Thomas H. Greer, *The Development of Air Doctrine in the Army Air Arm 1917-1941*, (1955; new imprint, Washington D.C.: Office of Air Force History, 1985), 5.

[13] Ibid., 6.

[14] Ibid., 6-7.

[15] Ibid., 23.

[16] Robert Frank Futrell, *Ideas, Concepts, Doctrine; Volume 1: Basic Thinking in the United States Air Force 1907-1960*, (Maxwell AFB, AL: Air University Press, December 1989), 74.

[17] Greer, 41.

[18] Futrell, 78.

Notes

[19] Greer, 26.

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[21] Ibid., 104.

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