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REMEMBERING THE FUTURE

OF

CENTRALIZED CONTROL-DECENTRALIZED EXECUTION

by
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Abstract

The advent of technological advancements in computers and communications capability has resulted in a frightening tendency to centralize execution of military operations. This thesis will focus on command and control (C2) as an operation and show that the USAF command and control tenet of "centralized control-decentralized execution," is vital to the success of current and future command and control employment concepts which should drive system development.

Although the doctrine and principles of command and control discussed in this thesis can be applied to all military operations, the content will center on the command and control of air, space and information forces in direct support of theater operations, specifically the operational and tactical levels of command and control. As in any dynamic mixture of men and machines used to execute war, there are blurred lines between the defined levels of war and a subsequent friction between the need to control aerospace power from the operational level, while allowing decentralized execution at the tactical level.

To realize the significance of the USAF C2 tenet of "centralized control-decentralized execution," one must understand how C2 is executed, in contingency theaters of operation. The best way to view the execution of C2 is to start with the effect desired within the battlespace and work backwards. As you read this thesis, it is important to focus on this distinction. Visualizing command and control of aerospace power this way, will highlight the importance of tactics,

techniques and procedures, and their relationship to decentralized execution resulting from centralized control.

The historic success of air and space power, since its first use as a military tool, has centered on the evolution of “centralized control and decentralized execution.” With the onslaught of technological advances in communications and real-time battle space situational awareness, the natural tendency is to make tactical decisions at the operational level. This evolution has been exasperated by the lack of integration of intelligence, surveillance and reconnaissance data at the tactical level of execution. Centralizing execution or even over controlling the execution of the master aerospace attack plan (MAAP) from the operational level is detrimental to initiative, ingenuity, flexibility and autonomy, which are the key attributes enabling the successful employment of aerospace power.

About The Author

Col Patrick “Bull” Sheets, is a command air battle manager with 23 years weapons controller experience in the ground control environment in both manual and semi-automated command and control systems and over 2,000 hours executing tactical command and control from both the E-3B/C Airborne Warning and Control System (AWACS) and the E-8C Joint Surveillance and Target Attack Radar System (JSTARS). He is a graduate of the USAF Weapons School and has extensive background in the operational art of command and control which resulted in his assignment as the first commander of the Nellis Combined Air Operations Center (CAOC-N), established in 2001 at Nellis AFB, NV.

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God, our great Nation and my loving family are my motivation. Special thanks to Gen John Jumper, Chief of Staff of the USAF, for his leadership and devotion to principles discussed in this thesis. Leadership has little to do with where you come from but everything to do with where you are going.

Chapter 1

Introduction

Command and control is critical to the success of any military operation. This thesis will focus on command and control as an operation and show that the USAF command and control tenet of "centralized control-decentralized execution," is vital to the success of current and future command and control employment concepts and systems development required to globally project air, space and information power into the future.

Command and Control, commonly referred to as "C2", has become the buzzword of the new millennium. Currently, the only words used more often and are less understood are "military transformation." There are multitudes of written attempts to shed light on the subject of C2. Some are very good, some are very poor and some should have chosen a different topic. All of what is written either focus on the semantics of the words command and control or are attempts to describe differences between a C2 system and the requirement to make command decisions. None of what is written comes close to describing C2 as a weapons system having its own operation with distinct roles and responsibilities at all levels of war. This thesis attempts to provide a basic understanding of the execution of C2, which is necessary to realize the criticality of centralized control-decentralized execution. Although this thesis will focus on C2 of air, space

and information forces, it can similarly apply to land and sea power. Throughout the rest of this thesis, the use of the term *aerospace* will mean air, space and information power.

C2 is doctrinally acknowledged by all of the services as the requisite for the employment of aerospace, land and sea power. The USAF is the only service that embraces the amplifying C2 tenet of centralized control-decentralized execution. To understand the importance of centralized control-decentralized execution, one must understand the execution of C2, starting with the *effects desired*[1] within the *battlespace*[2] and work backwards. As you read this thesis, it is important to focus on this distinction. Visualizing command and control of aerospace power this way, will highlight the importance of tactics, techniques and procedures, and their relationship to decentralized execution resulting from centralized control.

Historically C2, in the USAF, has taken second stage to the development of individual weapons systems. Not only did individual weapons systems, like F-15s, F-16s, F-117s, B-1s, B-2s, or C-17s command the preponderance of the resources for development, but their flying training and tactical employment also came first, before any consideration of system integration into a C2 structure. "The consequences of failing to factor C2 questions into Air Force long-term war-fighting and acquisition strategy are enormous. In the tactical arena, whole weapons systems have been built, tested and delivered with little thought given to how senior leadership will employ these forces effectively in battle."[3]

Fortunately, over the past ten years, this thought process has dramatically changed. The earliest initiative to consolidate a multitude of USAF C2 and sensor programs under one agency resulted

in the formulation of the Air Force Command and Control and Intelligence, Surveillance and Reconnaissance Center (AFC2ISRC), headquartered at Langley AFB, VA. Shortly after this, the USAF was involved in a series of contingency operations in the Balkans concluding with Operation Allied Force and the Air War over Serbia. These operations further reinforced the significance of C2 and the importance of taking a "system of systems" approach to the development of both the concept of operations and the equipment used to employ C2, unfortunately, along with these initiatives followed a lot of misunderstanding and confusion.

Much of the misunderstanding stems from the great intentions of self proclaimed C2 experts. Those who have been given a position of responsibility at the Air Staff or C2 Center at Langley AFB, to facilitate the transformation of a previously disparate C2 environment into a weapon system. But they have never actively trained or participated in the execution of C2 at any level of war, leaving them void of experience and insight into C2. Additionally, the focus of the transformation looked predominantly toward the future with no regard to current programs or combat capability. In some cases, fielded C2 systems, like the ground based Control and Reporting Centers (CRC), were stripped of funding and manpower to program for future system development. Leaving a huge void in the air-to-air sensor coverage beyond the already over tasked Airborne Warning and Control System (AWACS).

Then there is the confusion brought on by all the names and acronyms like C2ISR. This label is one of many labels over the years used to capture the requirement for integration of systems and capabilities used to support C2. C2 of any combat power, whether aerospace, land or sea, is a basic military tenet. Commanders can execute command and control of forces with or with out

situational awareness, which comes from the other functions. Whether it is communications added to C2, which led to the term C3, or it is communications and computers added to C2, which led to the term C4, or it is communications, computers and intelligence added to C2, which led to the term C4I, or if it is the latest joint term C4ISR, it is still just about C2 with or without situational awareness for combat decisions.

The bottom line challenge to transforming C2 into a weapon system is the lack of integration in the development of weapons systems from the beginning. C2 as a "system of systems" cuts across all disciplines (*weapons systems*) in the employment of aerospace power. Yet each of the individual weapons systems, built in the past, were not developed with this C2 system of systems as its road map. But rather, individual weapons systems were designed to execute a specific mission or aerospace task and the C2 of the weapons system was considered an end result of whatever communications capability was available at the time. This system of systems concept is further exasperated by the rapid onslaught of technology resulting in a rapidly changing acquisition process to try and take advantage.

In spite of the past or any technological advances in computer, communications and sensor system capabilities in the future, any move to centrally execute aerospace missions will be disastrous. Even though technological advances in existence today or those proposed for the future could make centralization possible, it would be tactically irresponsible to do so. Just because you can is not a valid reason to act. Of greater significance, are the time, energy and resources lost, by not embracing the C2 tenet of centralized control-decentralized execution, in the designing of C2 as a weapons system. Again, it is the intent of this thesis to show why the C2

tenet of centralized control-decentralized execution must be applied to future weapons system development and combat training.

Centralized control-decentralized execution is vital to the future of aerospace power. To make this case, this thesis will first describe, in Chapter 2, the doctrinal evolution of C2 showing how and why the tenet of centralized control-decentralized execution came into existence. This doctrinal evolution provides the basis for the current C2 operations as described in Chapter 3, defining who the commanders (decision makers) are at the tactical operational and strategic levels of war. Chapter 4 will introduce the concept of a continuum of control to span the tactical, operational and strategic levels of war. This continuum of control evolves out of the tactical level of war and is critical to the future of centralized control-decentralized execution. Chapter 5 builds on the facts presented in Chapters 2, 3 and 4, demonstrating the seriousness of deviating from the C2 tenet of "centralized control-decentralized execution" and will conclude with specific recommendations for future C2 concepts of operation, system development, training and doctrine considerations.

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[1] "effects desired" in the context of this thesis means, any action taken, either inside or from outside the theater joint operating area (JOA), resulting in either kinetic or non-kinetic employment of aerospace weapons. The concept of effects intrinsically ties tactical action to operational objectives.

[2] "battlespace" means the air, space, surface or subsurface surrounding the joint operating area (JOA).

[3] Richard T. Reynolds, *What Fighter Pilots' Mothers Never Told Them About Tactical Command and Control—and Certainly Should Have*, Harvard University, Center for Information Police Research, November 1991, 9.

Chapter 2

Doctrinal Evolution of Command & Control

Command and Control (C2) is a basic function of employing military power. It is skillfully described in the following Joint doctrine excerpt:

> **Command** includes both the authority and responsibility for effectively using available resources to accomplish assigned missions. Command at all levels is the art of motivating and directing people and organizations into action to accomplish missions. **Control is inherent in command**. To control is to regulate forces and functions to execute the commander's intent. Ultimately, it provides commanders a means to measure, report, and correct performance.[1]

In addition to Joint Doctrine, C2 is also addressed in Air Force, Army, Marine and Navy service doctrine. The doctrine and principles of command and control discussed in this thesis can be applied to all military operations. But the specifics of this thesis, will center on the C2 of aerospace forces in direct support of theater operations. The USAF is the only service that takes the definition of C2 beyond the joint definition by adding the tenet of "centralized control-decentralized execution."

Centralized control-decentralized execution, as a C2 tenet, has evolved over the years beginning in 1917, when Billy Mitchell assumed command of all Air Service units, both tactical and strategic, in the American Expeditionary Forces (AEF) Zone of Advance.[2] This move facilitated the first of many initiatives to stop the piecemeal employment of air power, by other commanders, and centrally command (*by an airman*) and control air power to meet military objectives. The first formal documentation of the centralized control of air forces did not come until 1943 with the publishing of Field Manual 100-20, *Command and Employment of Air Power*.[3] This publication was the first doctrinal shift placing centralized control of theater air power under a single Air Force commander. From this publication forward, airmen have heralded centralized control of theater air power as the essential first step towards its effective command. During the early days of struggle to centrally control air power the decentralized execution was by default. Without the technological advantages of global communications, massive bandwidth for data flow or computers, all execution of the centrally controlled air assets was autonomous and completely decentralized.

The demand to continue the practice of decentralized execution evolved out of the military experiences of the Vietnam War. It was a reaction against the extensive control exerted by the Johnson administration in the bombing campaign against North Vietnam. The first official writings surfaced in 1971 when Air Force Manual (AFM) 1-1 linked the centralized allocation and direction of air power to the concept of decentralized control and execution.

> To realize the full potential of the 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.[4] (Italics added)

Follow-on editions of AFM 1-1 linked these complementary concepts into the now familiar dictum, centralized control-decentralized execution. In 1975, the tenet was further reinforced as an essential ingredient for successful action, "The basic principles of centralized control, decentralized execution, and coordinated efforts are fundamental to the success of aerospace operations."[5] Labeled under the heading of C2 in the doctrine manual, these principles became intrinsically associated with C2 concepts of operation. The manuals did not, however, stipulate how these terms applied to the different levels of war or various echelons of command. The term "decentralized execution " was not clarified until 1979.

The 1979 edition of AFM 1-1 split the terms into their individual components and expanded discussion of their characteristics:

> Under the principle of decentralized execution, higher echelons of command define missions and tasks (*operational level of war*), and then directs lower echelons (*tactical level of war*) to conduct the operation. This principle allows lower echelon commanders

> to maintain a responsive and effective force and frees higher echelons 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.[6] (Italics added)

For the first time, doctrine codified the relationship between superior and subordinate commanders involved in decentralized execution and gave reasoning behind the adoption of this principle. Higher echelons provide the "what to do," while lower echelons determine the "how to do it." AFM 1-1 went on to state:

> This heritage produces leaders who are able to trust commanders and individual members of our armed forces to make good decision and 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. Decentralized execution allows for wider use of judgement in employing the capabilities and characteristics of warfare systems.[7]

Further reconstruction of the doctrinal evolution of centralized control-decentralized execution showed little change in the 1984 edition of AFM 1-1, which offers a scant half sentence to the term stating that it "provides the flexibility for subordinate commanders to use ingenuity and initiative to attack targets."[8] Eight years later, the 1992, two-volume edition of AFM 1-1, provided the clearest discussion of the challenges faced in balancing centralized control with decentralized execution. AFM 1-1, Vol. II went on to state that:

Since 1943 the most vexing control issue has been the level at which control should be centralized, including the question as to whether all aerospace power (Air Force, Army, Navy and Marine Corp) should fall under a single aerospace component commander. Too much or too little centralization has proved counterproductive the former delaying responsiveness and the latter leading to dissipation of effort…

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…

Still success in war at the tactical level requires attention to details and the ability to adapt quickly to exploit fleeting opportunities. Although centralized control can effectively concentrate aerospace power within a campaign, commanders exercising such control are likely to be faced with many units and too little time to make timely adjustments for tactical effectiveness…

Decentralized execution answers these problems in span of control and survivability. In many cases, beginning in World War II, those exercising centralized control of air forces have defined areas of responsibility, assigned tasks and command of forces, and delegated authority for execution to subordinate air echelons. These subordinate air echelons have been responsible for supervising the details and making the rapid adaptations that lead to tactical success.[9]

The evolution of Command and Control in the USAF has led to a firm belief that theater level aerospace forces must be centrally controlled for the purpose of mass, unity of effort, synchronization and economy to meet theater mission objectives. Additionally, the execution of aerospace tasks to meet these objectives must be decentralized throughout the forces, maximizing individual commanders initiative, ingenuity, responsiveness and flexibility.

No matter how technologically savvy the C2 systems, the focus of the C2 concept of operations and subsequent system capabilities must support the potential for maximum control to produce mass, unity of effort, synchronization and real-time assessment, necessary to meet operational aerospace objectives. While producing an environment to maximize decentralized execution, at the tactical level of war, taking full advantage of initiative, ingenuity, flexibility and the potential for autonomy.

Future discussions on the friction between centralized control, and the operational art of “what to do” versus the decentralized execution, and the tactical art of “how to do it,” will follow in Chapter 4. Next will be a brief overview of the Theater Aerospace Control System, in Chapter 3, establishing insights into the decision makers (commanders) and their roles and responsibilities in the execution of aerospace

[1] JCS Pub *Joint Doctrine Capstone and Keystone Primer*, 10 Sep 2001, 33.
[2] The *US Air Service in World War I, Vol. II*. (Washington D.C. : US Government Printing Office, 1978), 139, 165.
[3] War Department Field Manual 100-20, *Command and Employment of Air Power* (War Department 21 July 1943), 2.
[4] Air Force Manual 1-1, *Unites States Air Force Basic Doctrine*, 28 September 1971, 2-1.
[5] Air Force Manual 1-1, *Unites States Air Force Basic Doctrine*, 15 January 1975, 3-1.
[6] Air Force Manual 1-1, *Functions and Basic Doctrine of the United States Air Force*, 14 February 1979, 5-2
[7] Ibid., 5-3.
[8] Air Force Manual 1-1, *Functions and Basic Doctrine of the United States Air Force*, 16 March 1984, 2-21.

[9] Air Force Manual 1-1, *Basic Aerospace Doctrine of the United States Air Force, Vol. II*, March 1992, 114-115.

Chapter 3

The Theater Air Command and Control System

Combatant command in a theater normally starts with the establishment of a Joint Forces Command (JFC). The JFC determines appropriate military objectives and sets priorities for the entire joint force. This results in the establishment of service components determined by the resources allocated to accomplish the joint force tasks. When air and space capabilities are required, an aerospace component is established. The aerospace component has two distinct branches. The first is an administrative branch designated as Commander Air Force Forces (COMAFFOR) who is responsible for overseeing the morale, welfare, safety and security of all Air Force Forces assigned to the JFC. The second is the combatant branch where a Joint Forces Air Component Commander (JFACC) is designated to organize, plan, coordinate, allocate and task joint aerospace capabilities assigned to the JFC. Depending on the theater and predetermined command relationships, the COMAFFOR will also be the JFACC. Figure 2-1 depicts the two branches of combatant and administrative.

It is not the intent of this thesis to debate the pros or cons of the dual branch arrangement, but only to acknowledge its existence for the purpose of distinguishing administrative

versus combatant commanders at echelons below the AFFOR/JFACC. Also to acknowledge the administrative AFFOR branch is a service exclusive chain, where as, the combatant JFACC chain is multi-service.

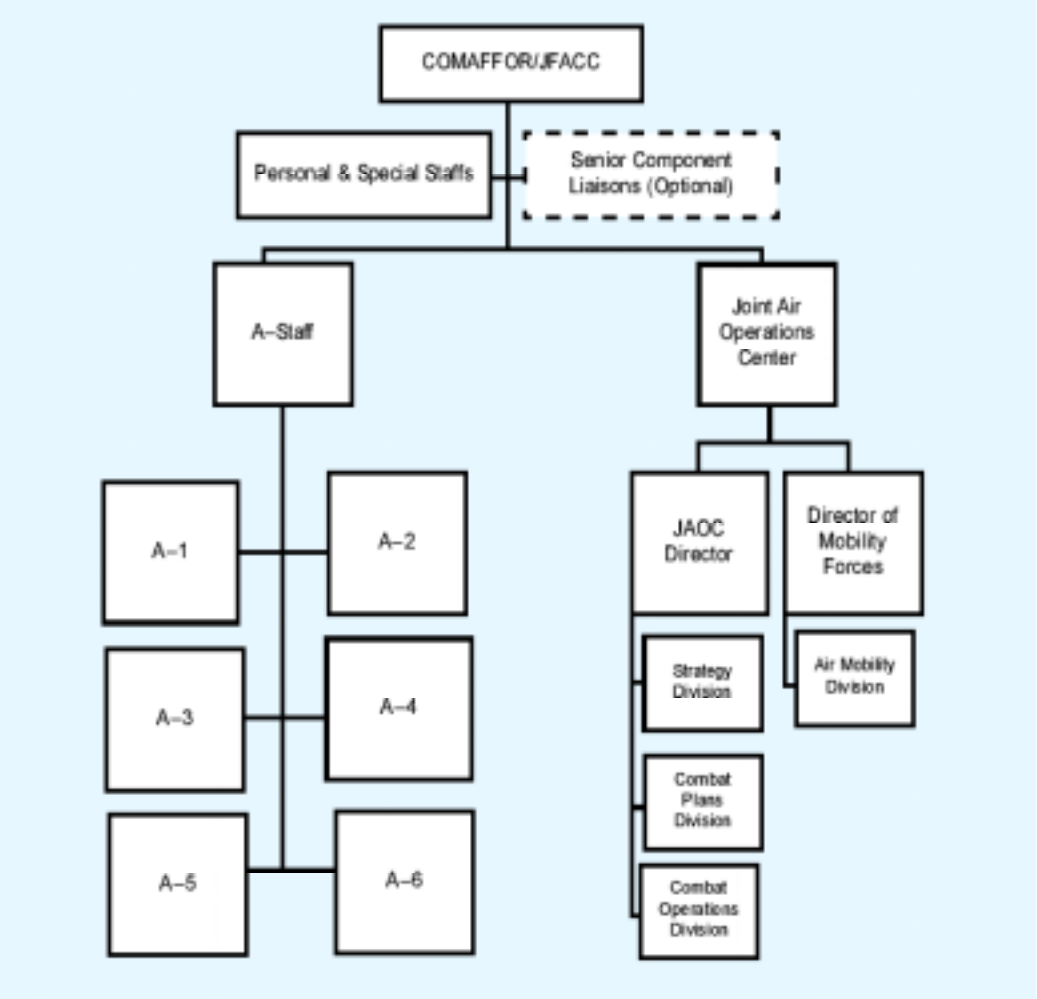

Figure 3-1 Notional Aerospace Component Headquarters with COMAFFOR as JFACC[1]

The AFFOR branch of command, for administration and support functions within a theater of operation, is depicted in figure 2-2. Contrary to land and sea forces, aerospace

forces supporting a theater will likely be globally dispersed throughout the theater of operations as well as other theaters to include the continental United States (CONUS). Additionally, commanders of Air Expeditionary units are not combat decision makers (commanders), in the employment of aerospace power unless they are actually performing an aerospace commander function in the form of package commander, flight leader, aircraft commander, mission crew commander, etc. These combat decision makers (commanders) are participants in the Theater Aerospace Control System, which will be described next.

FIGURE 3-2 Administrative Chain of

Parallel to the COMAFFOR branch, is the combatant branch of command under the JFACC, where the centrally controlled aerospace forces assigned to a theater of operation are given specific tasks to mission plan and execute in a decentralized fashion. The USAF system designed to facilitate the JFACC employment of assigned and attached aerospace forces, is the Theater Air Control System (TACS). The TACS is both a concept of operations and conglomeration of communications, computer and sensor systems, put together to support the C2 of both the operational and tactical levels of aerospace employment. The TACS is made up of all the assets assigned or attached to the JFACC, to perform the operational control and tactical execution of aerospace power. The nucleus of the TACS is the Air Operations Center (AOC), commonly referred to as the Joint and/or Combined AOC (J/CAOC). Anticipating future aerospace operations will always be Joint and most often Combined, CAOC will be the common term used for AOC throughout the rest of this thesis.

The combatant chain of command used to command and control aerospace power, is a very fluid and dynamic concept which is not purely a vertical or horizontal structure, but it is collaborative and incorporates a network decision making construct relying on three key elements. The first element is the Master Aerospace Attack Plan (MAAP), which includes the Aerospace Tasking Order (ATO), the Airspace Control Order (ACO) and Special Instructions (SPINS). The second element is the Rules of Engagement (ROE). And the third element is battlespace situational awareness. These three key elements establish the framework to centrally control aerospace power while allowing for decentralized execution. In the combatant chain of command, any one of the designated

participants is expected to make command decisions and execute them based on the predetermined MAAP (as promulgated in the ATO/ACO/SPINs), the rules of engagement (including basic flight discipline) and situational awareness.

To operationally control aerospace forces, the CAOC first produces a strategy in the form of a Joint Air and Space Operations Plan (JASOP), to meet theater military objectives. This overall JAOP is then developed into an application plan, which is called the Master Aerospace Attack Plan (MAAP). This results in the key centralized control products of the ATO, ACO, SPINS and ROE, which become the "what to do" that is transmitted to all assigned/attached aerospace forces. Depending on the specific aerospace effects desired, from the MAAP, packages are constructed, within the ATO, fusing multiple weapons system capabilities to meet operational mission objectives. Examples of packages are: A strike package consisting of fighters (F-15C) for escort, Bombers (F-15E, F-18, B-1, B-52) for striking, and electronic countermeasures (ECM) support (EA-6B,EC-130) for suppression of enemy air defenses (SEAD). Another effect desired could be high value airborne asset (HVAA) protection, with a package consisting of fighters (F-14, F-15C, F-16), to protect the Airborne Warning and Control System (E-2C or E-3B/C), the Joint Surveillance Target Attack Radar System (E-8C), the Rivet Joint (RC-135) and high altitude reconnaissance (U-2). The packages in these examples are tasked to produce specific effects, within the battlespace, in accordance with the MAAP.

As part of the package assignment process, there is a package commander designated, to facilitate the "how to do it" tactical planning, by integrating all of the ATO assigned

resources into a package execution plan. This package commander is also a decision maker during the real-time execution of the package's mission tasks. Within packages, there are flight leaders, who are in command of a section of like aircraft ranging from 2, 4, 6 or 8 aircraft. These flight leads are also key decision makers responsible to support the package commander in the planning process and successful execution of the packages' mission tasks. Beyond the flight leads are the individual pilots-in-command or aircraft commanders. They too are decision makers who support the flight leaders, who support the package commander, in the planning and execution of the mission tasks. These commanders perform critical roles within the C2 process of planning and execution, and are directly responsible for the successful decentralized execution of aerospace power.

In addition to the predominately kinetic shooters, just described, there are information operators who provide a non-kinetic capability to produce desired effects in and around the battlespace, in direct support of the MAAP. These information operations are critical to the success of tactical execution and require integrate control for synchronization, timing and authorization. Although information operations predominantly originates outside the tactical area of operations, the effects of information operations are critical to tactical success.

Working back from the effects desired in the battlespace, as described in the ATO/ACO/SPINs and ROE and the combatant commanders tasked to mission plan and execute the effects, come the tactical C2 decision makers who are responsible for mission

planning and supporting C2 of the decentralized execution of the aerospace functions in the tactical area of operation. These C2 operators include mission crew commanders, senior directors, air surveillance and sensor management officers, electronic combat officers and weapons controllers. These C2 operators make up the crews on AWACS, CRCs and JSTARS.

Tactical C2 is executed from three different radar sensor platforms: the Airborne Warning and Control System (AWACS) which is a modified Boeing 707 with an air moving target indicator (AMTI) radar used to detect and track airborne objects anywhere within line-of-sight out to and beyond 300 nautical miles from the radar and moving faster that 80 nautical miles per hour. The Control and Reporting Center (CRC), which is a ground, based version of AWACS using a different radar and control vans, but providing the same offensive and defensive weapons control capability. The Joint Surveillance and Target Attack Radar System (JSTARS), which is another, modified Boeing 707 (cargo version) with a ground moving target indicator (GMTI) radar used to detect vehicles moving on the surface as well as slow moving targets in the air but close to the surface. JSTARS, using the same radar, can also process and display synthetic aperture radar (SAR) snapshots of the earth's surface. SARs are images of the surface and everything on it that are developed by bouncing radar signals off the surface versus optically sensing. All of these C2 platforms have a mixture of different computer and communications capabilities including line-of-sight radios (VHF, UHF), beyond line-of-sight radios (HF, SATCOM) and tactical data links (TADIL A/J). Figure 3-3 depicts a notional TACS lay down showing the CAOC as the nucleus and the surrounding sensor,

communications and computer systems used to produce battlespace situational awareness, to support both operational control and tactical execution.

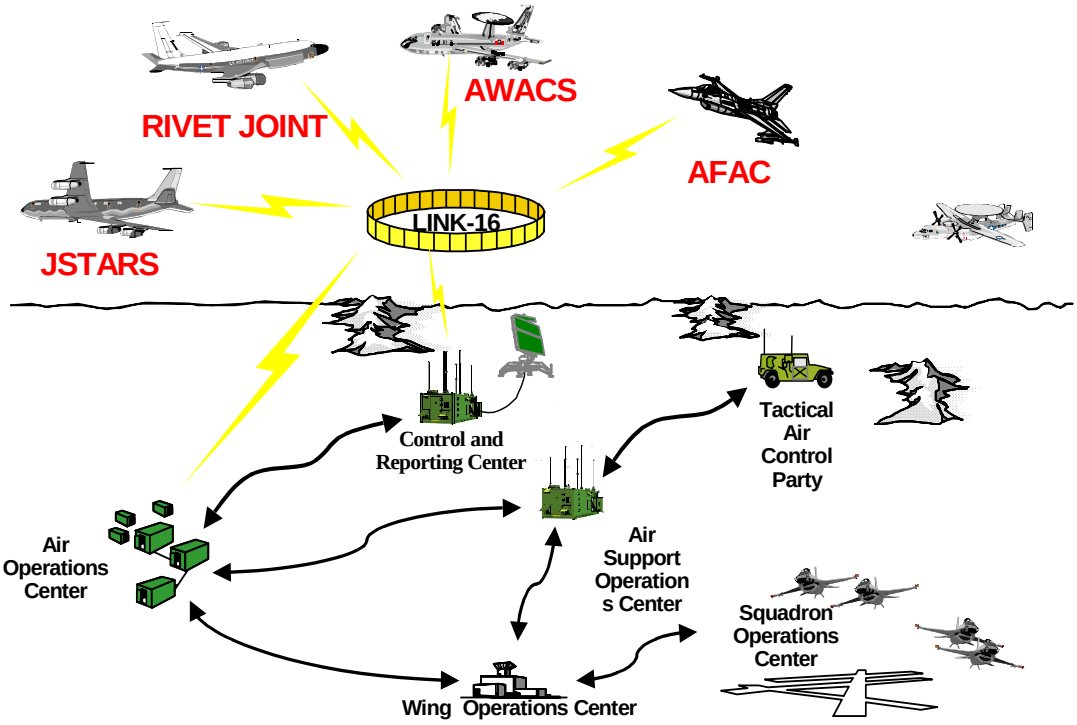

FIGURE 3-3 - Notional TACS

The tactical C2 crews support the CAOC combat operations center, which is responsible for controlling and flight following the execution of the MAAP as it is reflected in the ATO, ACO, and SPINs. The central commander for the employment of aerospace power is the JFACC. The JFACC normally delegates the day-to-day decision making to the Director of Combat Operations (DCO), who will oversee the operational execution of the MAAP. In this role, the DCO is responsible for controlling the dynamics of the execution of the ATO/ACO/SPINs and ROE. These dynamics include real-time changes to the

MAAP based on target or situational changes taking place within the battlespace, which have direct effect on the operational objectives or the success of tactical execution. Examples range from detection of a higher priority target than one assigned by the ATO requiring airborne retargeting to changes in the threat environment over a local operating area requiring a shift in targeting priorities. Additional targeting responsibilities have evolved under the dynamic construct of time-critical-targeting where some packages and/or flights of fighters/bombers are tasked to fly and attack targets, which are unknown up until the actual finding and fixing, then the targets are passed to the shooters, who are airborne for execution.

The DCO's aerospace operations staff, made up of offensive and defensive elements, perform critical roles in monitoring the execution of the MAAP and are continuously working to deconflict and adjust the days plan (ATO/ACO/SPINs), find, fix, track, target, engage and assess previously unknown targets, as well as respond to ROE actions, based on real-time activity and results within the battlespace. The offensive and defensive aerospace operations are supported by three primary cells. Specifically the Intelligence, Surveillance and Reconnaissance (ISR) Cell that fuses the multitude of national and theater sources of information and sensor data into real-time battlespace situational awareness for operational assessment and combat actions. The Time Critical Targeting (TCT) Cell, acts on the battlespace situational awareness by targeting previously unknown threats. The cell chief vets targets through a nomination process, and forwards them for JFACC/DCO approval based on the MAAP. The Combat Search and Rescue

(CSAR) Cell is responsible to react to downed airman within the battlespace and take the lead to advise the JFACC on reallocation of resources to respond to the emergency.

The combat operations center (COC), which is the C2 node of the CAOC, uses a multitude of computer and communications systems capabilities all focused at providing situational awareness of the activities taking place in the battlespace for the JFACC, the DCO and the aerospace operations team to monitor and assess the execution of the MAAP. This includes the use of resources from space, within the atmosphere, on the surface and sometimes even below the surface. Inputs to combat operations include, but are not limited to, sensors in space (satellites), sensors within the atmosphere (AWACS, JSTARS, RJ, Hawkeye, U-2, Global Hawk, Predator, Fighters, Bombers, Tankers, etc….) and sensors on the surface (Aegis, CRC, Patriot). These inputs come over a variety of media from voice to streaming video. The greatest technological challenge facing the design of the future C2 system is to integrate all of these inputs producing a decision-making information output to support the centralized control of aerospace power and its decentralized execution. The complexity associated with this "system of systems" integration challenge goes far beyond the purpose of this thesis, yet this challenge is at the core of this thesis. All concepts of operation and C2 systems development must embrace the C2 tenet centralized control and decentralized execution.

The C2 crews on AWACS, CRCs and JSTARS provide the critical situational awareness and communications link between the operational commander (JFACC/DCO) and the tactical execution commanders in the form of package, flight and aircraft commanders. These decision makers make up the combatant chain of command, which is expected to

network information for battlespace situational awareness and execute their assigned mission tasks based on the MAAP and ROE. Figure 3-4 graphically captures the USAF traditional C2 decision makers described in this chapter.

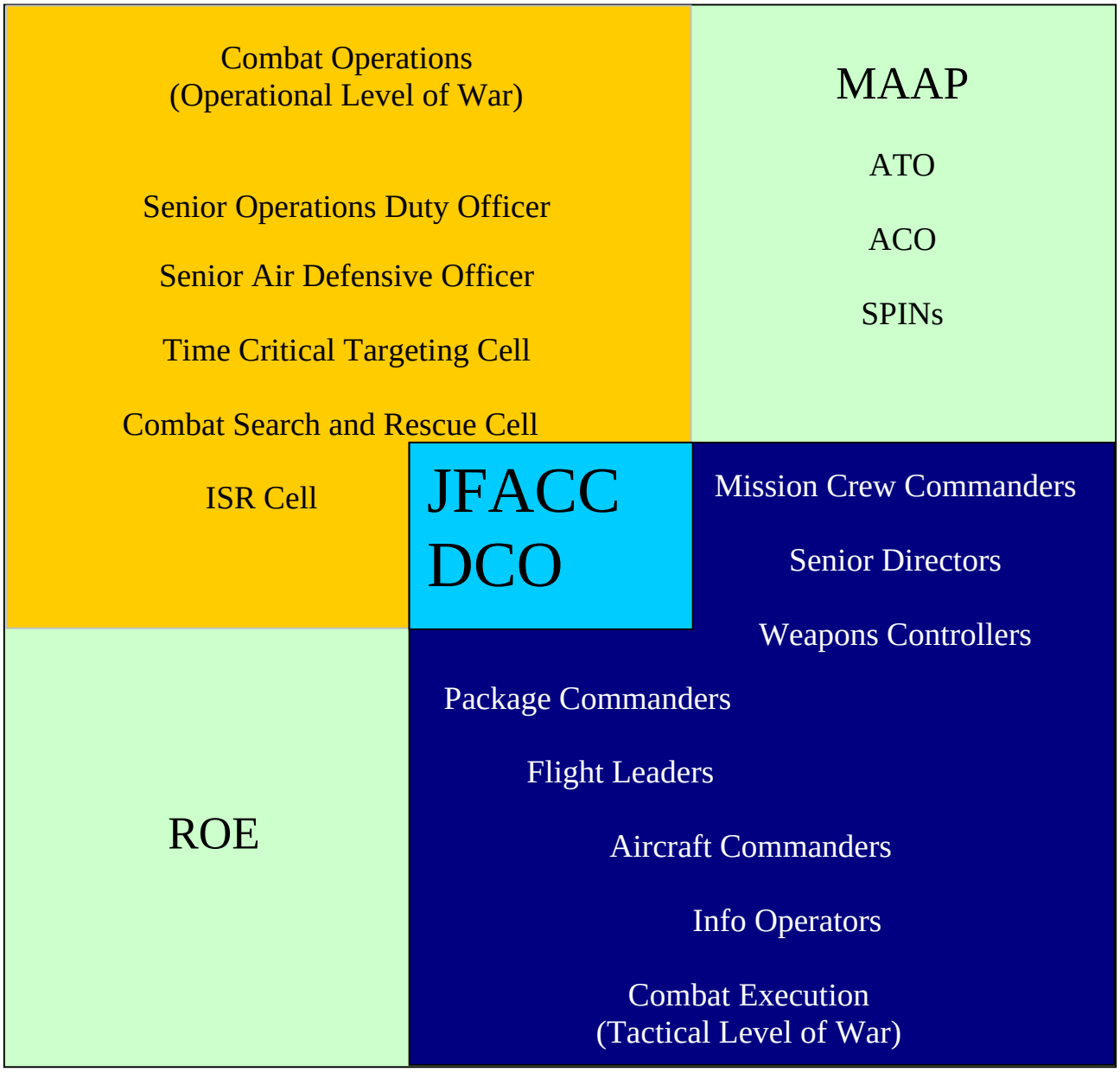

Figure 3-4 USAF C2 Decision Makers (Commanders) at the Operational and Tactical Levels of War

The key to successful C2 of aerospace employment rests on solid, well defined, tactics, training and procedures which define the roles and responsibilities of each of the combat commanders described in this chapter. This has not happened in the past, specifically at the CAOC and its operational level of employment. The next chapter will describe C2 employment at all three levels of war and will offer a way forward to fill the void of tactics, techniques and procedures (TTP) at the operational and strategic levels of war by employing a continuum of control like the one developed over the past twenty years, for the tactical level of war.

The combat decision makers at the strategic level of war include the Joint/Combined Forces Commander, the Theater Combatant Commander, the Secretary of Defense and the Commander and Chief. Since the focus of this thesis is on the C2 employment of aerospace power, most of the discussion will remain centered on the operational and tactical levels of war. Discussion of strategic C2 is important because the strategic level of war will inevitably influence operational decision-making and has the technological ability to reach all the way down to the tactical level of war. Thus all of the references in the next chapter to a continuum of control for C2 at the operational level of war will be applied to C2 at the strategic level of war as well.

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[1] Air Force Doctrine Document (AFDD)–2, Organization and Employment of Aerospace Power, 17 February 2000, 59
[2] Ibid, 62

Chapter 4

Command and Control Levels of War and the Continuum of Control

Now that the key players in the aerospace combatant chain of command have been described, the next step is to understand the levels of warfare and how they apply to C2 of aerospace power. Both the joint and Air Force definitions of the levels of war will be used to describe the application of C2 at the tactical, operational and strategic levels of war. Because the focus of C2 and the employment of aerospace power should always begin with the effect desired and work back to the strategy, the aerospace levels of war described in this chapter will begin with the tactical level of war. An additional reason to start with tactical C2 is to introduce a unique "*control continuum"* which has evolved at the tactical level of C2 and is used to circumvent the continuous friction between control and execution. Understanding the levels of war and the associated roles and responsibilities of decision makers (commanders) will help demonstrate the need for a continuum of control, like the one developed for the tactical level of execution, to be defined, trained and practiced at the operational and strategic levels of war. David Gerber, in his *Adaptive Command and Control of Theater Air Power*, comes close to describing this continuum concept by depicting the Joint Forces Air Component Commander (JFACC) as "needing a single C2 architecture that offers the flexibility to operate at either end of the spectrum (centralized versus decentralized) or anywhere in between. [1]

Any further discussion of centralized control and decentralized execution, as a C2 tenet, requires bounding of the terms *control* and *execution.* The term control means to *task* and *direct*, which, by the doctrinal definition of C2, carries with it the authority to do so. The term execution means to plan and carry out fully, assigned *tasks* as *directed*.

The levels of war, from a doctrinal perspective, clarify the links between strategic objectives and tactical actions. Although there are no finite limits or boundaries between them, the three levels are strategic, operational and tactical. Actions can be defined as strategic, operational or tactical based on their effect or contribution to achieving strategic, operational or tactical objectives.[2] Air Force doctrine further defines the three levels of war by assigning them words to describe their application to commanding aerospace power.

> The tactical level of war deals with HOW we fight…
>
> The operational level of war determines WHAT we will attack, in WHAT order and for WHAT duration…
>
> The strategic level of war addresses the issues of WHY and WITH WHAT we will fight and WHY the enemy fights against us. [3]

The focus at a given level of war is not on the specific weapons used, but rather on the desired effects.

The tactical level of war is defined as the level of war at which battles and engagements are planned and executed to accomplish military objectives assigned to tactical units or task forces. Activities at this level focus on the ordered arrangement and maneuver of combat elements in

relation to each other and the enemy to achieve combat objectives.[4] To further define this concept for aerospace forces, the tactical level of war deals with how we fight. We tend not to fight "battles" with aerospace power but focus at the tactical level on the individual engagement. The tactical level of aerospace war deals with how these packaged forces are employed, and the specifics of how engagements are conducted and targets attacked.[5] The aerospace combatant units who execute at the tactical level of war are flights of fighters, bombers and support aircraft, both manned and unmanned, as well as information warfare operators, formed into packages depending on the mission objective and effects desired within the battlespace. The aerospace C2 units who execute at the tactical level of war are airborne and ground based sensor platforms formed into a package to support combatant execution. These activities cover the entire spectrum of aerospace functions[6] and constitute the "tip of the spear," in the execution of aerospace power.

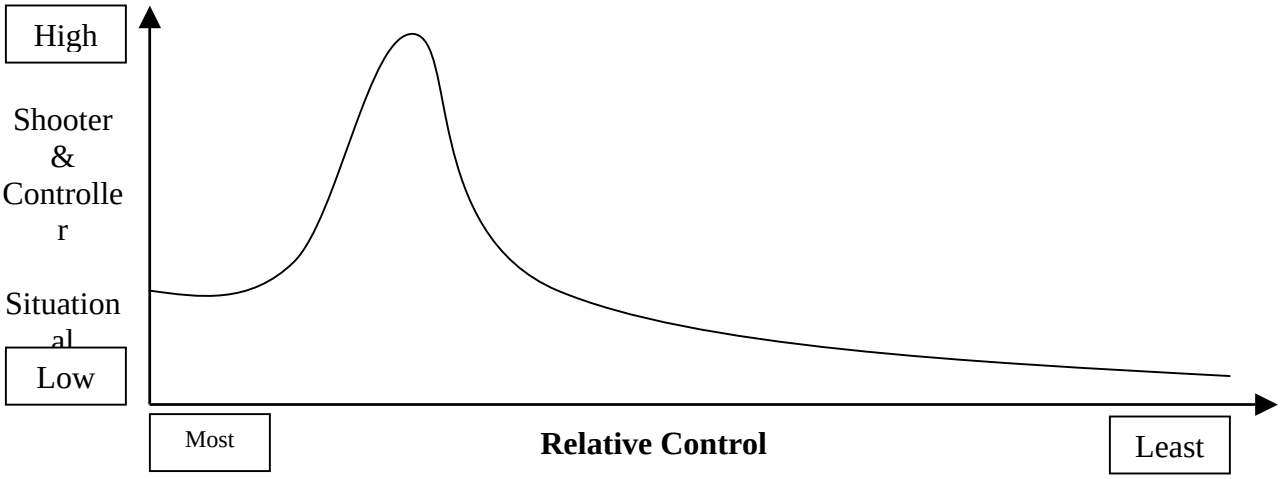
Command and control of aerospace forces at the tactical level of war has evolved over the past twenty years into a dynamic continuum, which is founded in the principle of decentralized execution. Execution of command and control at the tactical level revolves around the real-time sensors employed on AWACS, CRC and JSTARS, as well as off-board sensor data made available to these C2 platforms. Tactical C2 provides real-time air-to-air, air-to-ground and other sensor support to the execution of aerospace tasks assigned by the ATO. The primary focus of the tactical C2 crew is to aid package commanders, flight leaders and aircraft commanders in dealing with the dynamics experienced in executing whatever function they are performing within the battlespace. At the same time the tactical C2 crews act as the conduit between the CAOC combat operations center, which executes operational control and oversees the decentralized execution-taking place in the battlespace. The tasks performed by tactical C2 crews

include flight-follow, air refueling, threat warning, intercept support, retargeting and ROE declarations. Because no plan is foolproof and aerospace operations are subject to a limitless number of variations or deviations, tactical C2 crews are responsible to support battlespace situational awareness, recognize changes/deviations to the execution plan and then take appropriate actions to ensure success of decentralized execution. This is a daunting task when considering the spectrum of activity taking place within the battlespace at any given time.

Examples of changes in the plan during execution could be something as simple as tanker fallout due to aircraft availability, where the timing has changed as well as call signs. Or something much more complex as a target change for a strike package. In both examples the changes described require action by the tactical C2 crews in the form of communicating and assessing the effect these changes have on the situation in the battlespace. This, in turn, results in coordination with package, flight and aircraft commanders, for the tactical level implications, as well as coordination with the combat operations center, when appropriate, for the operational level implications.

In executing aerospace operations it is important to understand information flow, both voice and data, to include who transmits and who receives along with the cadence associated with the communications. For C2 of aerospace operations, at the tactical level, the sequence and the cadence of information for situational awareness in the battlespace evolved through an intricate trial and error development process of tactics, techniques and procedures (TTP). The centerpiece for tactical C2 TTP development is the continuum of control. This continuum, Figure 4-1, was the direct result of the evolutionary clash, in the early 1980s, between tactical C2 and

fighter/bomber weapon system capabilities. Not to over simplify this clash, it was the basic disconnect between weapons controller roles and responsibilities and fighter/bomber roles and responsibilities for the entire sequence of air-to-air combat from initial detection through weapons employment. Although the continuum evolved out of the air-to-air function, it applies to all tactical C2 of aerospace functions. This disconnect was the result of technological advancements in fighter/bomber weapons systems, which was not immediately accommodated for in the tactical C2 concept of operations (CONOPS) or system development.



Close Control	Tactical Control	Broadcast Control Autonomous	Advisory Control
Target and commit information provided to specific flights		Target information provided but not to specific	Radar target information not available and not	Communications not available and no information

Figure 4-2 The Tactical Control Continuum

C2 execution across the continuum of control is fluid. It does not matter where you are on the continuum except to acknowledge the desire to continually strive to maintain **tactical control**. The following breakdown of each area on the continuum will help to better understand the concept. To the far left, is close control, where fighter/bomber situational awareness is low and

the controller's is relatively higher. This scenario is less effective because it is communications intense and focuses the controller on one event, of potentially many events, taking place simultaneously on the control frequency. One example of close control is a fighter/bomber whose radar and/or other avionics capabilities are limited and require more controller involvement for aircraft positioning. Another example of close control could be a fighter/bomber requires clearance to fire based on ROE, where positioning or intercept are still the fighter/bomber responsibility but weapons release requires approval from the controller or other authority. A third example is close air support (CAS) using conventional dumb bombs where both positioning and clearance to fire are the responsibility of the controller. Close control is high on the spectrum of centralized control. It is time and effort intensive which makes it sub optimum to employing aerospace power and decentralized execution. But if the situation dictates, close control will drive execution.

To the right of tactical control is broadcast control, which is an environment where the controller has low situational awareness on who is on the frequency or what the mission objectives are, but has situational awareness of the enemy or known threats. The controller then would broadcast the location of these threats on the frequency for anyone listening to apply to their execution. The classic example of broadcast control was used during Linebacker II in Vietnam, where the Teaball fusion center located at Nakhon Phanom Air Base in Thailand received signals intelligence information from a variety of sources and used it to pass information on hostile aircraft to US aircraft. Broadcast control is a higher decentralized execution with some opportunity to inject information to the tactical forces, through tactical C2, for the purpose of survivability and notification of changes in the battlespace. Broadcast control is sub optimal for

employing aerospace forces because of the lack of tactical control inputs available to the participants.

Advisory control is a level less than broadcast control where threat warning is not even available, but communications are available to provide injects from the operational level. An example of advisory control would be tactical activities taking place in the battlespace where there are no AWACS, CRCs or JSTARS available at the time of execution, but a tanker (KC-135) is airborne and in communications with the CAOC. They also have the tactical secure strike frequency available to pass words from the CAOC to the fighter/bombers, as required.

Autonomous control is the greatest level of decentralization; it exists because there is no tactical or operational C2 available, yet the execution must continue. Prime examples in history go back to the first use of air forces in combat where the fighter/bombers slipped the surly bounds of earth with the best plan available based on the information at hand and had no C2 support during mission execution. This is maximum decentralized execution because there is no real-time C2 execution and no opportunity to make changes to the plan after take-off other then those determined by the package, flight and aircraft commanders based on their understanding of the commanders intent, effects desired and their own situational awareness.

On the continuum of control, tactical control is the optimum level to support maximum control (task-direct) opportunities while allowing for maximum decentralized execution (carry out directed tasks). Tactical control is based on the controller having the maximum situational awareness as possible about who is on the frequency and their mission objective. The controller

then monitors execution looking for changes in the battlespace, like pop-up threats. Additionally, the JFACC, DCO and C2 Mission Crew Commander have the ability to direct changes or update guidance to the tactical execution through the weapons controllers. Once changes are recognized, they require communication to the appropriate package commander, flight lead or aircraft commander for implementation. Examples of tactical control in combat are C2 crews support to marshalling, ingress, employment and egress while providing flight follow, tanker rendezvous, threat warning, target updates, clearance to fire when ROE required and assessments. Tactical control provides the opportunity for the maximum decentralized execution as possible with centralized control available when the situation requires.

The tactical continuum of control acknowledges the entire spectrum of roles and responsibilities from close control by the C2 crew to autonomous operations by the fighter/bombers, with the pinnacle of C2 execution being at tactical control. Tactical control provides for the optimum middle ground between control and execution, at the tactical level of war. Tactical control is based on maximum situational awareness with minimum communication required. The implicit results of tactical control allows for a network or collaborative C2 concept pushing decision making to the furthest point of execution based on the plan, ROE and battlespace situational awareness.

The operational level of war is the level at which campaigns and major operations are planned, conducted and sustained to accomplish strategic objectives within theaters or areas of operations. Activities at this level link tactics and strategy by establishing operational objectives needed to accomplish the strategic objectives, sequencing events to achieve the operational objectives,

initiating actions and applying resources to bring about and sustain these events. These activities imply a broader dimension of time and space than do tactics: they ensure the logistic and administrative support of tactical forces, and provide the means by which tactical success are exploited to achieve strategic objectives.[8] To further define this concept for aerospace forces, the operational level of war is where campaigns and major operations are planned, conducted and sustained to accomplish strategic goals within theaters or areas of operations.[9] As described in Chapter 3, the operational C2 of aerospace power is centrally planned and controlled from the CAOC, which is the JFACC's combatant headquarters. Using the five divisions of strategy, combat plans, intelligence/ surveillance/reconnaissance (ISR), air mobility and combat operations, the JFACC executes operational C2 of aerospace power. He accomplishes this by first taking the strategic objectives and assigned forces, from the JTF, and developing a joint aerospace operation plan (strategy), which becomes the flight path for the master aerospace attack plan (MAAP). The MAAP is then used to determine the sequence of effects required to meet the strategic campaign objectives. The MAAP is flowed out over time and contains critical milestones used to determine success. The MAAP is published in the form of the ATO/ACO/SPINs and ROE (combat plans). The ISR division harnesses all available sources of intelligence, sensor data and information that are initially used to predict the battlespace environment which influences strategy and plans. This predictive analysis is currently referred to as predictive battlespace awareness (PBA). ISR is then used to support real-time battlespace awareness throughout the execution of the MAAP as it is communicated to the tactical forces through the ATO/ACO/SPINs and ROE. The battlespace situational awareness derived from ISR is used to make command decisions and immediately assess results. The air mobility division

integrates Transportation Command (TRANSCOM) and strategic air mobility support into and within the theater of operations.

The fifth division in the CAOC is the combat operations division, which is the C2 operational execution arm of the JFACC. It is the jump point from the operational C2 level to the tactical C2 level of aerospace execution. But contrary to the tactical C2 level of aerospace execution, the operational C2 level has never been permanently configured with crew positions or trained and exercised as a weapons system. It is in effect void of well-developed and trained tactics, techniques and procedures (TTP). This fact has been highlighted all too often during multiple contingency aerospace operations throughout the 1990s and is what lead to the Chief of Staff of the USAF, Gen Michael Ryan to declare the USAF CAOC as a weapons system, in 1999, following the execution of the Air War over Serbia. Simultaneously, during the 1990s, the combat operation division technologically evolved extremely rapidly with a multitude of information systems and sensor feeds being added to the operations center. Such as, streaming video from Predator unmanned air vehicles (UAVs), multiple tactical air data links producing a recognizable air picture and high-resolution optics from air breathing and space vehicles. These feeds are all focused at maximizing battlespace situational awareness for JFACC decision-making. Unfortunately, much of this technology and systems capability is not integrated and most even require separate workstations to display information or data forcing humans to be the integrators of the data. The challenge associated with future integration of these systems is extreme and vitally important to the future of C2 of aerospace power. However, as pointed out in Chapter 3, the C2 technological integration challenges of the future are not the focus of this thesis. These challenges are highlighted, again, because the termination of all this intelligence,

sensor and information data, in the CAOC combat operations division is a huge contributor to the thought process and advocacy for the concept of centralized execution.

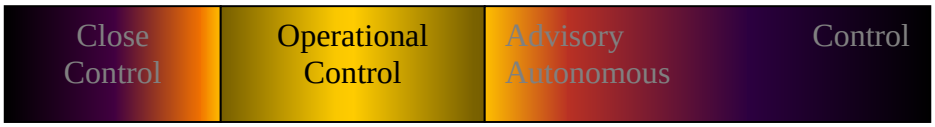
As the “CAOC as a weapons system” vision has evolved, there has been a tremendous focus on the operational command and control of aerospace power. The positive side to this focus on the “CAOC as a weapons system’” has been the acknowledgement of years of neglect and the institutionalization of an action plan to remedy the neglect. The challenge of this “CAOC as a weapons system” vision is to not lose sight of the system of systems requirement to integrate all aspects of C2 of aerospace power, tactical, operational and strategic, allowing for future exploitation of the C2 tenet of centralized control and decentralized execution.

The more information feeds terminating in the CAOC to add to the operational level battlespace situational awareness, the more prone operators are at the operational level to want to participate in tactical decisions. This is a natural tendency based on everyone’s desire to be a shooter, but can be devastating based on a false sense of what is actually happening tactically within the battlespace. This natural tendency for operators at the operational level of war to participate in the tactical level of war is the target of this thesis. The remedy for this dilemma centers on the belief that the C2 tenet of centralized control-decentralized execution is vital to future employment of aerospace power and no matter how technologically sophisticated the intelligence, sensor or information systems become, they must support this tenet. The premise for this belief will be covered in Chapter 5. The remainder of this chapter will be used to describe a concept of operations, which can be used today and in the future, to circumvent the friction between operational and tactical C2, by developing, institutionalizing and training an operational

continuum of control. The operational continuum of control, just like the tactical continuum, will define and establish levels of control to aid in the interface between the operational and tactical C2 environments, which will allow for maximum centralized control with maximum decentralized execution. This same continuum process can then be applied to the relationship between strategic C2 and operational C2 as those same natural tendencies exist for strategic players to want to act at the operational or even tactical levels of war.

The operational control continuum is depicted in Figure 4-2. It is designed to build on the tactical control continuum and complement the intricacies of the responsibilities associated with tactical planning and execution and operational planning and execution.

The Operational Control Continuum



The Tactical Control Continuum

Figure 4-2 The Operational Control and Tactical Control Continuum

C2 execution across the operational continuum of control is fluid. It does not matter where you are on the continuum except to acknowledge the desire to continually strive to maintain **operational control**. The following breakdown of each area on the continuum will help to better understand the concept. To the far left, is close control which is required when the situational

awareness of the combat operations center is higher then that of participants at the tactical level, on specific activities taking place in the battlespace or the ROE requires JFACC or higher engagement authority. Examples of operational close control would be; the detection of a previously unknown target, which has a higher priority than any other target on the ATO, and requires immediate attack; a previously unreported non-governmental organization surfaces in the battlespace and combat operations establishes an airspace control zone to ensure no targets are engaged in their vicinity; or ROE has been established requiring JFACC or higher approval to strike certain targets. In the previous examples, close control decisions and direction from the operational level are transmitted to the tactical C2 crews who then act on the information by re-tasking targets, establishing airspace control zones or clearing engagements based on JFACC approval. As in tactical C2, close control is an inefficient execution level because it is communications intense and can be fixating. The more close control is required, the less combat operations will be able to maintain situational awareness of the battlespace to perform the operational level responsibilities.

To the right of operational control is advisory control, which results from combat operations having low situational awareness of activities in the battlespace and having limited ability to direct or make inputs. Examples of advisory control would be; a breakdown in communications links resulting in the loss of the real-time battlespace picture. Or the battle taking place is happening faster then the combat operations center is capable of processing. In either scenario, advisory control is a sub-optimal environment because operational control is limited or possibly no longer available.

Beyond advisory is autonomous control, where there is no opportunity for operational level inputs to the execution of the battle and the tactical C2 units along with the shooters execute the ATO/ACO/SPINs and ROE to the best of their ability and in accordance with the tactical control continuum.

Operational control is the optimum level for C2 execution. It focuses on maximum centralized control capabilities, when required, and maximum decentralized execution, whenever possible. Operational control like tactical control is based on situational awareness and a commitment to focusing on the respective responsibilities of the level of war and level of control each participant is tasked to execute. The ideal MAAP, followed by flawless decentralized execution, would result in zero real-time inputs from combat operations. This is the goal, yet like any human endeavors, the opportunity for something changing or requiring an operational input is extremely high. How these inputs are implemented and communicated is critical to maintaining the tenet of centralized control-decentralized execution. Examples of inputs from the operational level that violate the tenet are ones where tactical participants either C2 or combatant, are told where to go and how to execute, versus the appropriate operational level input of what needs done. In today's C2 environment, this happens because the specific information to execute at the tactical level is locked up at the operational level and/or the operators at the operational level have not been trained on how to communicate operational to tactical tasking.

Recognizing the ability to control (task/direct) aerospace forces real time during the execution of the ATO/ACO/SPINs and ROE is fundamental to the principle of centralized control-decentralized execution. What is not fundamental are actions or decisions made at the

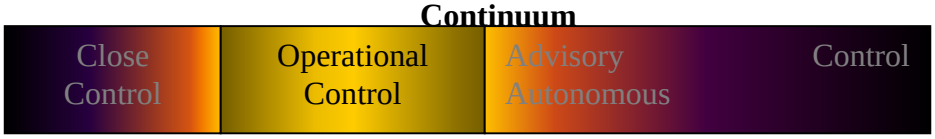
operational level, which should be pushed to the tactical level. These decisions cover the entire spectrum of effects ranging from deterrence of specific enemy actions to complete destruction of particular enemy assets. Operational decisions must remain focused on the "what to attack, "what order to attack" and "for how long." This focus is easier when strategizing, planning and publishing the ATO/ACO/SPINs and ROE, at the operational level of war. But when it comes to executing the plan, the control inputs from the operational level can be detrimental to timely, efficient and safe execution. The technological evolution of aerospace power with precision guided weapons, information operations and persistent surveillance and reconnaissance over the battlespace, along with a sometimes less sophisticated, but still as savvy and capable enemy, has produced a targeting timetable requiring results in minutes. This challenge has set the stage for what could be the most remarkable revolution if military affairs, but only if it accomplished through a concept of operations and technological solution that is built on the C2 tenet of operational level centralized control and the tactical level decentralized execution of aerospace power. Recommendations on near term and long-term actions, which would result in meeting this vision, will be discussed in Chapter 5. The rest of this chapter will cover C2 at the strategic level of war.

The strategic level of war is the level at which a nation, often as a member of a group of nations, determines national or multinational (alliance or coalition) security objectives and guidance, and develops and uses national resources to accomplish these objectives. Activities at this level establish national and multinational military objectives; sequence initiatives; define limits and assess risks for the use of military and other instruments of national power; develop global plans or theater war plans to achieve these objectives; and provide military forces and other

capabilities in accordance with strategic plans.[10] Aerospace effects at the strategic level of war include destruction or disruption of the enemy's center(s) of gravity (COGs) or other vital target sets, including command elements, war production assets, and key supporting infrastructure that impairs the enemy's ability or will to wage war or carry out aggressive activity. From an aerospace C2 perspective, the strategic level of war begins with the Commander and Chief, flows through the Secretary of Defense, to the Theater Commander and down to the Joint Forces Commander, if the Theater Commander establishes one. These commanders fulfill all of the strategic level of war responsibilities. But just like the friction between the operational and tactical levels of war, so has technological advances allowed for a similar environment to exist between the strategic, operational and tactical. Strategic commanders talking directly to tactical combatants can be done just as easily as communicating between themselves. Not to insinuate there may not be an instance when this capability would be required, it is certainly not something trained to today. Just like the control continuum developed for the tactical level of war and proposed for the operational level of war, there could also be a strategic control continuum developed. Figure 4-3 shows a strategic continuum added to the two previous continuums.

The Strategic Control Continuum

The Operational Control Continuum



The Tactical Control Continuum

Figure 4-3 The Strategic Control, Operational Control and Tactical Control Continuum

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C2 execution across the strategic continuum of control is fluid. It does not matter where you are on the continuum except to acknowledge the desire to continually strive to maintain **strategic control**. The following breakdown of each area on the continuum will help to better understand the concept. To the far left, is close control, which is used when the situation requires strategic commander engagement authority. Examples of strategic close control would be; the decision to use strategic or tactical nuclear power; or a dramatic change in the geopolitical environment which calls for immediate halt of shift in operational and tactical objectives. In these examples, close control decisions and direction from the strategic level are transmitted to the operational level who then implements the required actions either in planning or execution. As in operational and tactical C2, close control is required but may not be the most efficient execution level because it is communications intense and can distract commanders from the relative responsibilities of their respective level of war.

To the right of strategic control is advisory control, which results from the strategic commanders having limited ability to direct or make inputs. Examples of advisory control would be; A breakdown in communications links resulting in a more autonomous environment at the operational level; Or the strategic level is engaged in multiple battles where the emphasis and direction may shift between battles. In either scenario, advisory is sub optimal because strategic control is limited or no longer available.

Strategic control, just like operational and tactical control, is the optimum control level where the opportunity to make close control inputs exists, but is only used by exception.

Although simplistic in nature, the operational and strategic continuums of control described in this chapter, are paramount to the continued success of the employment of aerospace power. It is not good enough to just to acknowledge the requirement for such continuums, but the USAF must organize and train C2 based on them. This is the way to conceptually operate and technologically evolve while completely embracing the aerospace C2 tenet of centralized control-decentralized execution. Chapter 5 will reinforce the premise for maintaining the aerospace C2 tenet of centralized control-decentralized execution forever.

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[1] David K Gerber, Major, USAF, Adaptive Command and Control of Theater Air Power, March 1999, 93
[2] Joint Publication 3-0, Doctrine for Joint Operations 10 September 2001, II-2
[3] Air Force Doctrine Document (AFDD)-2, Organization and Employment of Aerospace Power, 17 February 2001, 2
[4] Joint Publication 1-02, Dictionary of Military and Associated Terms, 12 April 2001, 677
[5] Air Force Doctrine Document (AFDD)-2, 2

[6] The specific Aerospace Functions are Counter Air/Space/Information/Land/Sea, Strategic Attack, Airlift, Air Refueling, Special Operations, Combat Search and Rescue, Intelligence, Surveillance and Reconnaissance.
[7] Air Force Instruction (AFI)11-214, Aircrew, Weapons Director and Terminal Attack Controller Procedures for Air Operations, 25 February 1997, 9
[8] Joint Publication 1-02, 654
[9] AFDD-2, 2
[10] Joint Publication 1-02, 653

Chapter 5

Remembering the Future of Centralized Control – Decentralized Execution

As stated in the introduction to this thesis, the author has a fundamental belief that centralized control-decentralized execution is as much the future of command and control of aerospace power as it has been of the past. So why not centralize all planning and execution of aerospace power? Would this not be cheaper, more effective and potentially eliminate the fog-of-war associated with decentralized execution. This chapter will discuss several reasons why not to deviate from the doctrinal aerospace tenet of centralized control-decentralized execution. These reasons are founded in the fundamental principles of war and leadership development.

.

PRINCIPLES OF WAR

The basic fundamentals associated with a nation-state sanctioned use of military power have been well documented since the writings of Sun Tzu. The culmination of the centuries of writing and the centuries of human experience are the current United States Joint and Service doctrine. This doctrine is the written essence of how to employ US military power. At the root of this doctrine is a commitment to three levels of war strategic, operational and tactical. Given the roles and responsibilities of commanders at the three levels of war there is no reason to believe these three levels of war will change in the future. Additionally, there is the acknowledgement that

command and control of military power is essential for success. To command and control military power in relationship to the three levels of war, one would conclude that intuitively, there is an inter-relationship between command and control of the three levels of war and there is also an intra-relationship of command and control within the three levels of war.

Joint doctrine acknowledges the roles and responsibilities of the Commander but does not provide any further guidance on the "how to command and control," but only states it is essential to do so. Air Force doctrine does build off of Joint doctrine and generalizes the tasks associated with command and control at the three levels of war. Air Force doctrine also states that the C2 tenet of centralized control-decentralized execution is fundamental to command and control of aerospace forces. Thus the C2 tenet of centralized control-decentralized execution is the basis by which commanders at the three levels of war will inter-relate. And, commanders acting at the same level of war will intra-relate based on the same tenet of centralized control-decentralized execution.

So the aerospace power C2 construct of tactical commanders (aircraft, flight, package and C2 mission commanders), the operational commanders (cell chiefs, DCO, JFACC) and the strategic commanders (JFC, Theater, SECDEF, CINC) will also not change in the future. Thus all future concepts of employment and systems development to support the command and control of aerospace power must embrace their existence and support the C2 tenet of centralized control-decentralized execution.

LEADERSHIP

Command and control of military power is about leadership not management. It is about people not things. To be successful, commanders must manage information in order to make command decisions and lead aerospace power. Centralized control-decentralized execution is the delegation of authority while retaining full responsibility for military actions. This fact is inherent in all command relationships whether administrative or combatant. Commanders can delegate any or all of their authority, but they cannot delegate the responsibility for outcomes of the decisions made under their command. This command responsibility is the nucleus of the C2 tenet of centralized control-decentralized execution. When employing aerospace power, the more decentralized you can execute, the more effective the employment. Conversely, the less control you have over decentralized execution the more vulnerable you become, as a commander, to failure. Thus proponents of technological advancements and revolutions in military affairs continually challenge the tenet of centralized control-decentralized execution to try to eliminate this friction between *control* (responsibility) and *execution* (outcome).

Instead of challenging the tenet of centralized control-decentralized execution, all future activities should be focused on growing aerospace leaders who understand the tenet and are trained in how to command by using it. Additionally, C2 system development should be supportive of all commanders, tactical, operational and strategic and push information for execution out as far as possible.

Without the development of tactical leadership, operational leadership would only suffer. Just like the lack of operational leadership development would adversely affect the growth of

strategic leaders. This building block approach to combat leadership development is the core codicil of the development of future aerospace leaders. Although tactical leadership development may be very system and sometimes individual-function focused, it is the environment where leaders learn the basics of blocking and tackling in the aerospace arena. Without these skills, the broader application of the operational art of employing aerospace power would be void of any understanding about how functions are accomplished, which would have a negative effect on the planning and decision process of what to do and with what resources that an operational leader is responsible to accomplish. Leadership development at the three levels of war is critical to the success of C2.

THE CENTRALIZED CONTROL-DECENTRALIZED EXECUTION ADVOCACY

The most important reason not to centralize execution is the vulnerability of developing a single point of failure. The greater the migration of tactical roles and responsibilities to the operational level or the migration of operational roles and responsibilities to the strategic level, the more vulnerable the employment of military power will become to the enemy. On the other hand, the more dispersed or decentralized the execution, the more survivable, lethal, flexible and successful the employment.

The key to success of centralized control-decentralized execution is commander's intent. The quality of commanders and their ideas are crucial to the entire concept of command and control. The quality of commanders and their ideas are more important to the general theory of command and control than the technical and architectural qualities of their sensors, computer and communications systems. This theory separates the art of command and control from the

hardware and software systems that support command and control. It centers on an idea of a command concept, a commanders vision of a military operation that informs the making of command decisions during the operation. The theory suggests the essential communications up and down the chain of command can (and should) be limited to disseminating, verifying, or modifying these crucial command concepts. The theory also suggests, as an extreme case, that an ideal command concept is one that is so prescient, sound and fully conveyed to subordinates that it would allow the commanders to leave the battlspace before the battle commences, with no adverse effect upon the outcome.[1]

This theory of commander's intent is the basis for the ability to centralize control of aerospace power and decentralize the execution at all levels of war. It is also the basis for the control continuum currently used to command and control at the tactical level of war and should be the one applied to an operational and strategic continuum of control.

The tenet of centralized control-decentralized execution is the future of command and control. Creating the right effect in the battlespace to meet the commander's intent is the key metric. To achieve that, one must provide the right information at the right time to the warfighter. The way to address that is to work both CONOPS and systems development to improve the velocity and accuracy of information.[2]

Command and control of aerospace power has two distinct branches, as described in Chapter 3, and these two branches are extremely different. The administrative branch used to present Air Force forces to a combatant commander is very traditional and hierarchical. Yet the combatant

command and control of aerospace power is more collaborative and network centric. Collaboration, in this military context, involves commanders actively sharing information, data, knowledge, perceptions and situational awareness to meet a common goal, which is determined by the effects desired in the battlespace and the commander's intent. This collaborative (C2 CONOPs) environment is made possible through network centric (C2 system) warfare.

Network centric warfare is predicated upon the ability to create and share a high level of (battlespace) awareness and leveraging this shared awareness to rapidly self-synchronize effects. Shared awareness will allow us to concentrate the available information and assets on the challenge at hand-multiplying our combat effectiveness… Success requires that we think about information differently—that we move from a set of monopoly suppliers of information, where I tell you what I think you need, to an information marketplace where everyone pulls down what they need, when they need it.[3]

Collaborative command and control is centralized in its ability for the commanders at different levels of war to provide control (task-direct) inputs. Yet it is wholly predicated on decentralized execution where commanders tasked to perform an aerospace function are free to formulate a plan and carry it out until such time as the responsible commander in the collaborative environment realizes a need to deviate from the plan. The commander's ability to realize the need to change or deviate actions is based on battlespace situational awareness, which must be made available through the C2 system. The key to success of the tenet of centralized control-decentralized execution is for decision makers at all levels of war to use this battlespace situational awareness to the benefit of their specific responsibilities at that level of war and not

use battlespace situational awareness to reach down and execute at a different level of war. This thought process and doctrinal attitude will only become reality when the focus of both concepts of operations and C2 systems development completely embrace the basic C2 tenet of centralized control-decentralized execution. So how does the Air Force get there from here?

RECOMMENDATIONS

The first step to embracing centralized control-decentralized execution is to expand the concept of the "AOC as a weapons system" to "C2 as a weapons system." The current C2 weapon system is made up of a variety of disparate individually developed weapons systems which are all integral to the success of C2 execution, but are seldom if ever compatible. This incompatibility is what Gen John Jumper, Chief of Staff of the USAF, calls "machines talking to machines"[4] which is the communications required to enable decision level information to be made available to decision makers in the C2 process, at all levels of war. Under the current C2 system, individual weapons system operators are the integration point as they receive inputs from multiple systems using multiple screen or displays and then attempt to simulate, correlate and eventually reach the information point required to make a decision. This dilemma exists at all levels of C2 warfare from tactical to strategic. The answer is a collaborative single network, which fuses all available sensor inputs and makes the results available to all C2 participants.

The latest vision from the AFC2ISR Center best describes the way forward in their C2 Constellation concept. The C2 Constellation is a family of C2 systems sharing horizontally and vertically integrated information through machine-to-machine conversations enabled by peer-based network sensors, command centers and shooters (both kinetic and non-kinetic). The C2

Constellation meets the conceptual requirement for a single network enabling information availability throughout the battlespace and across all levels of warfare. Its success would be to replace the TACS, which is the current C2 system, made up of disparate platforms attempting to share battlespace situational awareness to support the C2 tenet of centralized control-decentralized execution.

The most comprehensive concept of just how to accomplish this collaborative network-centric system was described in John P. Stenbit's article on "Moving power to the edge." He said, "we must replace top-down operations with distributed operations – and use information technology to empower whomever is in need of a solution regardless of where that individual is… The rate of advancing technology requires us to move from an approach based on standard applications to one based on data standards. The key is to give users of information the opportunity to use applications that make sense to their activity while maintaining ability to exchange information…We will generate much more power individually and collectively when we are connected to the Net, where we each are empowered to pull information we need – instead of hoping someone sends it to us…The Net is needed to push power to the edge."5

The next step to ensuring the future of centralized control-decentralized execution is to disassociate C2 and the term ISR, which will stop the confusion between an intelligence attempt to gain battlespace situational awareness and an entire C2 concept of operations, which is centered on battlespace situational awareness. Specifically, the C2 Constellation concept advocated by the AFC2 and ISR Center is holistic and covers the entire spectrum of sensor and data integration, for the purpose of battlespace situational awareness and command decision-

making. In light of this concept, the term ISR seems less than complete in its advocacy and appears to be more like intelligence for the sake of intelligence.

The term intelligence, surveillance and reconnaissance (ISR) means a lot of different things to a lot of different people depending on what part of ISR they may participate in. Intelligence is the product resulting from the collection, processing, integration, analysis, evaluation, and interpreting of available information concerning the enemy. This product is vital to the success of C2 because it is one of the key facilitators of battlespace situational awareness for commanders. But the performance of intelligence is not C2 it is information management.

Surveillance is the systematic observation of aerospace, surface, or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. Surveillance is a contributor to the information pool that requires management, which is an intelligence gathering responsibility. But surveillance is also used for real-time tactical execution whether that be weapons employment decisions made by a shooter who surveys a target prior to engagement or it is for tactical C2 decision-making where surveillance of the battlespace is use to determine friend or foe and make an ROE decision. Additionally, surveillance is used for operational control decision making within the CAOC. In all of these examples, surveillance is used to support real-time battlespace situational awareness and at the same time it supports intelligence gathering.

Reconnaissance is a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to

secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. The results of reconnaissance are also contributions to the information pool, which is managed by intelligence. The execution of surveillance and reconnaissance requires C2 because the systems that perform surveillance and reconnaissance are all of the weapons systems in a given battlespace. Every system from space vehicles, air-breathing vehicles like fighter/bombers, AWACS, JSTARS and UAVs to surface based CRCs and Patriots all perform some form of surveillance or reconnaissance. In the performance of this surveillance or reconnaissance there will always be information, which results as a primary product or byproduct of the weapons system. This information requires information management, which is the responsibility of intelligence. This information management then results in intelligence support to the C2 system. An example of terminology confusion is the common categorization of AWACS, CRCs, JSTARS, Rivet Joint, U-2s and UAVs as ISR systems because they execute some form of surveillance and reconnaissance in the performance of their air force functions within the battlespace. Granted some of the systems listed do either surveillance or reconnaissance as a primary mission, like Rivet Joint, U-2s or the UAVs. But this does not preclude them performing C2 missions like advisory control from the Rivet Joint by passing threat warning to a set of fighters on a control frequency, which is a tactical C2 role. Or hanging hellfire missiles on a UAV for the purpose of striking targets, which is a fighter/bomber role in support of counter air/land/sea functions. Or developing a future adaptation of the U-2 for real-time targeting functions. All of these examples highlight the confusion caused by the term ISR.

In AFDD-1, Air Force Basic Doctrine, there are a total of seventeen (17) air and space functions listed. Command and control, surveillance, reconnaissance and intelligence, are certainly among

them. But they are all listed separately because they are separate functions. Each function is a broad, fundamental and continuing activity of air and space power. Both surveillance and reconnaissance are just as important to C2 as they are to intelligence. Further more C2 is as important to the functions of counterair, counterland or countersea. So why have a doctrine document called ISR operations (AFDD 2-5.2) when what is really needed is battlespace situational awareness, which is required to execute centralized control-decentralized execution of aerospace power. The future of C2 as a weapons system has everything to do with integrated sensor data producing battlespace situational awareness made immediately available to operators at the tactical, operational and strategic level of war. The future of C2 is not about surveillance and reconnaissance for the sake of intelligence gathering.

Focusing all of the sensors and data processing into a cohesive C2 Constellation will set the stage for success in the development of a network centric C2 system that maximizes battlespace situational awareness and presents this information to the decision makers at all levels of war. The presentation of this battlespace awareness must be in a single net configuration where all participants can pull whatever data is required from planning through execution.

Clarifying the terminology surrounding C2 and embracing the centralized control-decentralized execution tenet of C2 will set the stage for success in future C2 system development. On the immediate horizon is a developmental program for the next generation airborne C2 weapons system called the Multi-sensor Command and Control Aircraft (MC2A). This weapons system will go through at least three evolutionary stages (referred to as spirals) to get it started over the next eight to ten years. The significance of the spiral development process is the opportunity to

take advantage of rapid technological advancements that become available as the weapons system is developed. These technological advancements many times are capabilities or solutions, which do not even, exist today but become reality tomorrow and can be integrated into the developmental program as rapid solutions to sensor integration and network fielding. The end result of this spiral development will be an airborne C2 weapons system capable of operational level battle management, tactical level battle management and physical control of a variety of unmanned air vehicles and their sensors.

MC2A is a giant step toward meeting both the expeditionary nature of the future aerospace force as well as the network centric requirements needed to support C2 in the future. The success of this C2 system program will result from the melding of spiral system development and a consistent vision of the concept of operations. C2 employment from the future MC2A will enable both operational level aerospace mission planning and execution along with tactical level mission planning and execution. The awesome advantage of this opportunity comes from the common knowledge and battlespace situational awareness both levels will now be able to share. The critical aspect of this evolution in C2 system development is to not try to meld the roles and responsibilities of the two levels of war into a single crew position. The tenet of centralized control-decentralized execution must remain the measure of success for both the systems development and the CONOPS, in meeting the requirements to centrally control aerospace power, at the operational level of war, while decentralizing its execution, at the tactical level of war.

The fielding of the unmanned combat air vehicle (UCAV), in the near future, will be another example of the importance of understanding and employing aerospace power by the application

of the C2 tenet of centralized control-decentralized execution. The employment of the UCAV, like all other weapons systems, will be centrally controlled at the operational level in terms of what it will attack, in what order and for what duration. But the physical control involving mission planning, programming, and flying the UCAV must remain decentralized and integrated into the tactical level, how we fight, package construct.

The final recommendation is to continue the development of the Air Force Operational Tactics Techniques and Procedures, 2-1 series regulations. These TTP should then be reinforced with training, testing and refinement through the Nellis CAOC (CAOC-N), Nellis AFB, NV, as the operational level C2 training and testing venue of the future. CAOC-N, being developed under the leadership of the USAF Air Warfare Center (AWFC), will bring to the operational level of aerospace employment, what the it has done for the tactical level of aerospace employment over the past 25 years. Additionally, an "operational control continuum" as described in Chapter 4, must be established as the center of the operational TTP, enabling a more fluid and responsive operational control capability without detracting from the benefits of decentralized tactical execution. Once the operational control continuum is established in regulation and it is trained, tested and continually refined, then you will realize the same successes that the tactical level of C2 has benefited from for years.

The bottom line—certain principles of war will never change, no matter how sophisticated weapons systems become. The aerospace C2 tenet of centralized control-decentralized is one of these principles. The more CONOPS and subsequent C2 system development remain true to this tenet, the more success will be realized in the future employment of aerospace power.

[1] David S. Alberts, John J. Garstka, Richard E. Hayes, David A. Signori, *Understanding Information Age Warfare*, Aug 2001, 222

[2] Lt General Leslie F. Kenne, *Tightening the kill chain: broadening information access*, intercom, Vol. 44, No. 1, 9

[3] John P. Stenbit, Moving power to the edge, intercom, Vol. 44, No. 1, 4

[4] General John J. Jumper, Chief of Staff USAF, every time he talks about C2 system development

[5] John P. Stenbit, Moving power to the edge, intercom, Vol. 44, No. 1, 4-5

Glossary

ACO	Airspace Control Order
AFC2ISRC	Air Force Command and Control & Intelligence, Surveillance, Reconnaissance Center
AFDD	Air Force Doctrine Document
AFFOR	Air Force Forces
AMTI	Airborne Moving Target Indicator
AOC	Air Operations Center
ATO	Aerospace Tasking Order
AWACS	Airborne Warning and Control System
AWFC	Air Warfare Center
C2	Command and Control
CAOC	Combined Air Operations Center
CAOC-N	Nellis CAOC
CAS	Close Air Support
CINC	Commander in Chief (The President of the United States)
COC	Combat Operations Center
COG	Center of Gravity
COMAFFOR	Commander Air Force Forces
CONOPS	Concept of Operations
CRC	Control and Reporting Center
CSAR	Combat Search and Rescue
DCO	Director of Combat Operations
ECM	Electronic Counter Measures
GMTI	Ground Moving Target Indicator
HF	High Frequency
HVAA	High Value Airborne Assets
JASOP	Joint Air and Space Operations Plan
JFACC	Joint Forces Air Component Commander
JFC	Joint Force Commander
JSTARS	Joint Surveillance and Target Attack Radar System

MAAP	Master Aerospace Attack Plan
MC2A	Multi-Sensor Command and Control Aircraft
PBA	Predictive Battlespace Awareness
ROE	Rules of Engagement
SAR	Synthetic Aperture Radar
SATCOM	Satellite Communications
SECDEF	Secretary of Defense
SEAD	Suppression of Enemy Air Defenses
SPINS	Special Instructions
TACS	Theater Air Control System
TADIL	Tactical Air Digital Information Link
TCT	Time-Critical-Targeting
TRANSCOM	Transportation Command
TTP	Tactics, Techniques and Procedures
UAV	Unmanned Air Vehicle
VCAV	Unmanned Combat Air Vehicle
UHF	Ultra High Frequency
VHF	Very High Frequency