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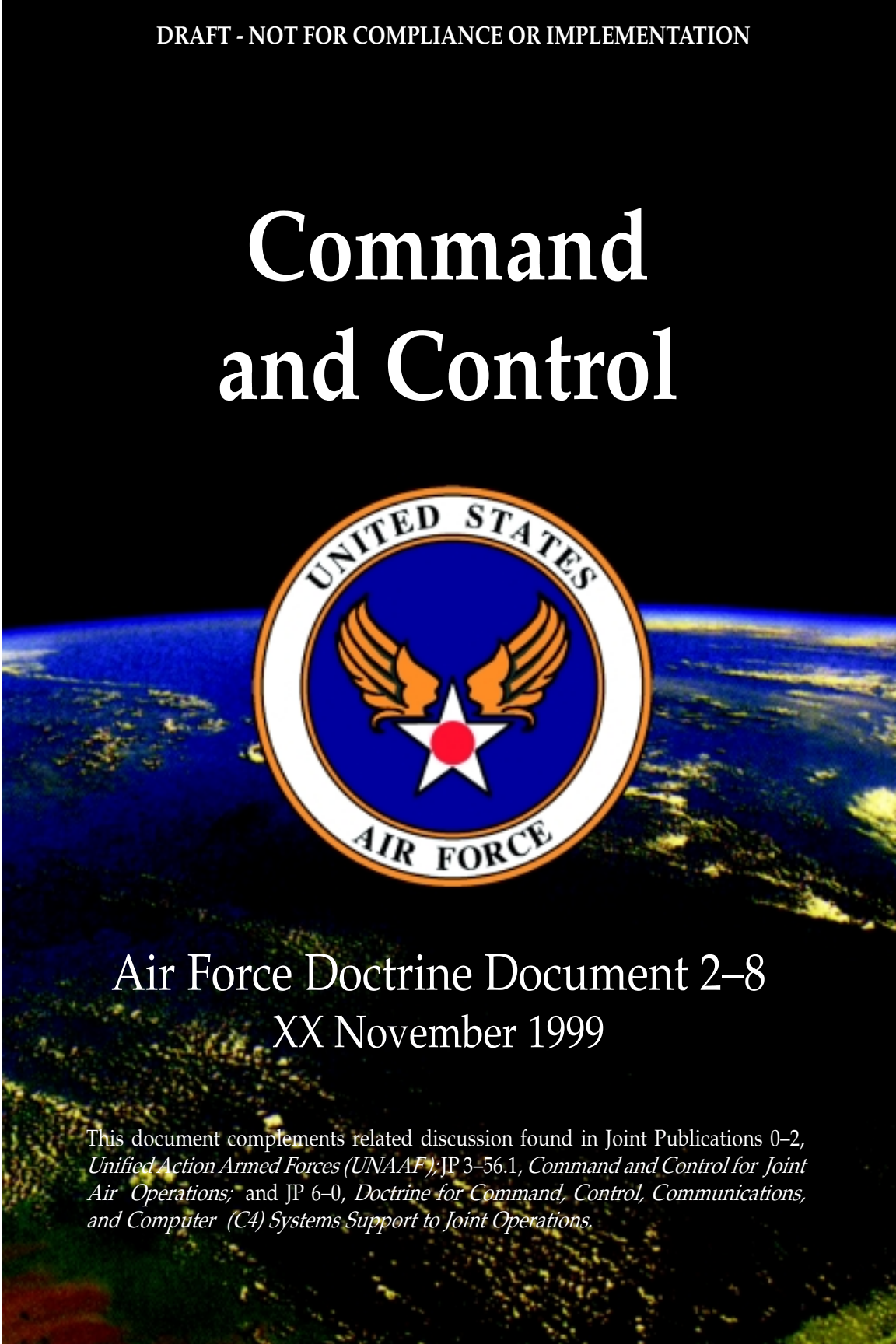
Command and Control



Air Force Doctrine Document 2–8

XX November 1999

This document complements related discussion found in Joint Publications 0–2, *Unified Action Armed Forces (UNAAF);* JP 3–56.1, *Command and Control for Joint Air Operations;* and JP 6–0, *Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations.*

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BY ORDER OF THE
SECRETARY OF THE AIR FORCE

AIR FORCE DOCTRINE DOCUMENT 2–8
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FOREWORD

Command and control (C2) operations are an integral part of warfighting. When commanders make decisions to exploit the capabilities of aerospace power, they are performing command and control. When commanders make organizational decisions to preserve unity of command while maintaining decentralized execution, they again are performing command and control. At its core, command and control is planning, directing, coordinating, and controlling forces to meet mission objectives. Airmen, who are experts in the art and science of making aerospace decisions, set the US Air Force apart from the other Services.

Communicating aerospace decisions often involves advising the joint force commander (JFC). The joint force commander's estimate process happens early in campaign planning. If we plan to merely deconflict surface and aerospace forces, synergy is lost. While planning integrates aerospace forces into the joint force commander's concept of operation, control of aerospace power is the key to orchestrating joint campaigns. Airmen should seize and maintain the initiative made possible by being a global aerospace power. *Air Force Doctrine Document 2-8, Command and Control,* assists airmen and their leaders in planning and executing effective aerospace operations. Take time to read it, debate it, and understand it—it is that important.

MICHAEL E. RYAN
General, USAF
Chief of Staff

XX November 1999

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INTRODUCTION

PURPOSE

Air Force Doctrine Document (AFDD) 2-8, *Command and Control,* was prepared under the direction of the Chief of Staff of the Air Force (CSAF) and implements Air Force Policy Directive (AFPD) 10-13, *Air and Space Doctrine*. It establishes doctrinal guidance for organizing and employing aerospace forces at the operational level of conflict across the full range of military operations. Together, the keystone publications collectively form the foundation from which commanders plan and execute assigned aerospace missions.

APPLICATION

This AFDD applies to all Air Force military and civilian personnel (includes Air Force Reserve Command [AFRC] and Air National Guard [ANG] units and members). The doctrine in this document is authoritative but not directive. It provides guidance on how command and control is used to conduct aerospace operations in peace and war. Commanders should consider both the circumstances of the particular mission along with the contents of this doctrine document before making decisions.

SCOPE

The US Air Force provides aerospace forces that are used across the full range of military operations at the strategic, operational, and tactical levels and across the spectrum of conflict, from war to military operations other than war (MOOTW). AFDD 2-8 discusses the principles and tenets of US Air Force command and control that are essential to planning and executing missions assigned by senior commanders. More detailed guidance can be found in Air Force Tactics, Techniques, and Procedures (TTPs) documents and US Air Force Instructions (AFIs).

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CHAPTER ONE

FOUNDATIONS OF COMMAND AND CONTROL FOR AEROSPACE OPERATIONS

> ***The war in the air is the true war of movement, in which swift intuition, swifter decision, and still swifter execution are needed. It is the kind of warfare in which the outcome will be largely dependent upon the genius of the commanders.***
>
> **Giulio Douhet**
> ***The Command of the Air***

Early twentieth century aerospace pioneers recognized that air warfare requires an intuitive and fast decision cycle. Clausewitz's concept of the "genius of the commanders" can be separated into its human aspects of leadership and command and operational aspects of command and control. The AFDD on Leadership and Command details the leadership and command aspects. This document details the command and control aspects. The theme of this document is that command and control is an inseparable part of warfighting.

Command and Control Defined

Understanding command and control (C2) requires examining the definition found in Joint Publication (JP) 1-02, *DOD Dictionary of Military and Associated Terms*:

> Command and control is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. Also called C2.

This definition acknowledges three predominant categories by using the words "personnel, equipment, communications, facilities, and procedures." The first category is personnel, which covers the human aspects of command and control. The second category is the technology element, which covers the equipment, communications, and facilities needed to overcome the war-fighting problems of integrating actions across space and time. Technology elements tend to dominate command and control doctrine, because high technology warfare characterizes American warfare. The third category, labeled in this document as "processes," encompasses "procedures." This AFDD extracts doctrine concepts from generalized command and control processes. The details of command and control processes and associated procedures are found in tactics, techniques, and procedures documents and instructional documents. Personnel, technology elements, and processes come together in executing command and control functions.

Command Defined

The definition of command is also found in JP 1-02.

> The authority that a commander in the Armed Forces lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions. It also includes responsibility for health, welfare, morale, and discipline of assigned personnel.

Although commanders may delegate authority to accomplish the mission, they cannot delegate the responsibility for the attainment of mission objectives. The various levels of authorities used by commanders include four command relationships and three "other authorities." The levels of authorities are introduced in the next chapter and are defined in the glossary. A Service component commander, such as the Commander, Air Force Forces (COMAFFOR), normally has operational and administrative responsibilities and should have the proper levels of authorities to accomplish the mission.

Control Defined

Control is defined as the processes by which commanders plan and guide operations. The processes happen before and during the operation. These processes involve dynamic balances between commanders directing operations and allowing subordinates freedom of action. These processes are often two-way and involve influencing subordinates and monitoring results. Often distance and time factors limit the direct control of subordinates. Commanders should rely on delegation of authorities and "commander's intent" as methods to control forces. The commander's intent should specify the goals, priorities, acceptable risks, and limits of the operation.

Command and Control Functions

JP 1-02 lists command and control functions as planning, directing, coordinating, and controlling.

Planning is the process of examining the environment, relating objectives with resources, and deciding on a course of action (COA). Commanders make planning decisions through a rational analysis of costs, evaluation of benefits, and acceptance of residual risks approach.

Directing is giving specific instructions and guidance to subordinate units. Superior commanders often give specific instructions to subordinates on mission objectives, situation, resources, and acceptable risks. Commanders should also give their guidance or "intent" to subordinates as a way to encourage initiative, reduce the uncertainty of war, and handle the dynamics of MOOTW.

Coordinating is sharing information to gain consensus, explain tasks, and optimize operations. Commanders should ensure the shared information produces trust relationships and gains agreements necessary for efficient multinational and joint operations. Sharing information is a way to minimize fratricide.

Controlling is a composite function that uses parts of the planning, directing, and coordinating processes to ensure efficient execution of multinational and joint operations. Controlling requires current information to produce feedback. Feedback is essential to correct errant results or to issue new orders that exploit advantages.

General Kenney, in the aftermath of WWII, gives some tips on controlling an organization (in his book "General Kenney Reports"). "It turned out to be another scrambled outfit of Australians and Americans, with so many lines of responsibility, control, and coordination on the organization chart that it resembled a can of worms as you looked at it. I made a note to tell Walker to take charge, tear up that chart, and have no one issue orders around there except himself. After he got things operating simply, quickly, and efficiently he could draw up a new chart if he wanted to."

General George C. Kenney
General Kenney Reports

Commanders should avoid functions that are unnecessarily complex, slow, and inefficient. Command and control functions are performed in the aerospace environment. The environment influences and interacts with personnel, technology elements, and processes. Understanding these influences and interactions will help in examining C2 systems and ultimately understanding the nature of command and control operations.

The Aerospace Environment

The aerospace environment and C2 are related. With the advent of the airplane, a commander's area of responsibility grew into a hundred-fold larger "volume of responsibility" or battlespace. The United States, as a space-faring nation, now conducts aerospace operations in a potential battlespace that again is a billion-fold larger. This brings into focus the driving issues that affect US Air Force command and control. The immense expanse of the global battlespace demands highly trained people, state of the art technology, and efficient processes for successful C2. Unsuccessful C2 is often traceable to poor training, bad equipment, or disjointed processes.

Modern conflicts demand fast and efficient C2 operations that are sufficiently flexible and adaptable to overcome the inevitable fog and friction of warfare and the dynamics of MOOTW. Fast and efficient C2 operations are prerequisites for successful expeditionary operations.

In the 1980 Iranian hostage rescue mission, EAGLE CLAW, multiple commanders allowed helicopters to fly low-level in a dust storm while under strict communications security. Transport aircraft that flew above the storm had critical weather information desperately needed by the helicopter pilots. The weather information never made it to the pilots. Poor decision making and restricted information flow contributed to the tragic failure of the mission.

Admiral James L. Holloway
Testimony to US Senate

Aerospace Expeditionary Force (AEF)

The idea of an expeditionary aerospace force concept is not new. America began its air expeditionary operations prior to World War I by attaching aircraft to the ground forces pursuing Pancho Villa in Mexico. Today's aerospace expeditionary operations span the globe, with aerospace forces operating from forward bases in Southwest Asia, the Balkans, and many other locations. Equally important to expeditionary operations are the home bases that plan, surge, support, and supply these forward bases. Figure 1.1 depicts the central role C2 plays in making the AEF a viable and valuable war-fighting force.

Figure 1.1. Command and Control links home bases with forward bases.

In WWII, General Kenney, who desperately needed replacement aircraft in the South Pacific, describes a good example of the operational links between forward and home bases. "The first squadron of B-24 bombers arrived that day from Hawaii and at the same time a radio (message) came in from (General) Arnold, telling me to check the anti-shimmy collars in the nose-wheel gears for cracks and to ground all airplanes that showed cracks. We checked them. They all showed cracks. I wired the information to (General) Arnold and asked for replacements to be flown out immediately…. Now the B-24s would be no good to me for another couple of weeks. In the meantime, I'd sent twelve B-17s back home, so I was just out both ways."

General George C. Kenney
General Kenney Reports

Although the timely communication from General Arnold prevented accidents, the home base should have ensured its squadron was mission ready. Good C2 operations allow forward-based commanders to ask the right questions and allow home-based commanders to get the answers right. Commanders use C2 systems to integrate aerospace power in spite of distance and time obstacles.

Command and Control Systems

The term "command and control system" is often narrowly construed as the highly visible technological elements, such as satellite communication or computer systems. JP 1-02 defines command and control system as the "facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned." For aerospace forces, C2 systems consist of mission essential technology elements and processes needed by people to perform their assigned command and control functions. The C2 operations section of this document describes how people and C2 systems work together.

The World War II Battle of Britain demonstrated the primacy of C2 systems in modern warfare. Although heroic aerial combat may be the most memorable part of the battle, people using C2 systems comprised of then-modern equipment and efficient processes won the Battle of Britain. A C2 system bought Fighter Command about ten minutes of warning time and vectoring information, which was enough to be decisive.

General Spaatz had a first-hand look at part of the British command and control system and formed his own opinions about the importance of C2 in operations. "Spaatz spent much of his time with Fighter Command, particularly with No. 12 Group under Air Vice-Marshal Trafford Leigh-Mallory. At that point he finally got a good look at radar, including its early warning, ground-controlled intercept, and identification friend or foe variants. This equipment enabled the RAF accurately to track and to intercept German raids, as well as to distinguish its aircraft from enemy aircraft. Spaatz ... spent all of August 9 in the operations room at No. 12 Group getting a full explanation of night and day procedures."

Richard G. Davis
Carl A. Spaatz and the Air War in Europe

US Air Force Command and Control Operations

US Air Force C2 operations enable commanders to lead missions within the contextual constraints of policies, resources, and environment. Often, C2 operations are simply referred to as "enablers" or "supporters" of warfighting operations. Since the details of most C2 operations are not specified by superior commanders, the responsibilities for the details of implied tasks normally fall upon operational commanders. Commanders should describe their C2 objectives, intent, resources, acceptable risks, and strategies to subordinates. A centralized plan for C2 operations is developed through the iterative campaign planning process as detailed in US Air Force and joint publications. The uncertainty of war and the dynamics of MOOTW make the C2 planning process just as important as the C2 section of the war plan itself.

When American forces fight as part of a joint or multinational force, responsibility for C2 operations are by necessity shared between national, functional, and Service component commanders. It is up to the JFC or multinational force commander and staff to determine a workable theater C2 plan. A primary consideration is choosing between parallel, lead nation, or multinational command and control structures. See JP 3-0, *Doctrine for Joint Operations,* for details on these C2 structures.

In complex multinational operations, C2 operations often prove to be the essential mission enabler, without which effective coalition operations would be impossible. The multinational 1948 Berlin Airlift serves as a good example of this.

Named 'Operation Vittles,' the airlift forced AACS [Airways and Air Communication Service] personnel to improvise new methods of air traffic control to handle the volume of traffic needed to bring the minimum 4,500 tons of coal and food into Berlin daily.... The area control operators kept in touch with the aircraft until they turned them over to the ground-controlled approach radar operators who talked them down to a safe landing. Airplanes that missed their first landing approach were dispatched back to their home base unless they could be later vectored back into the landing pattern. Flight plans, position reports, and clearance phraseology were streamlined to limit the length of radio transmissions and accelerate operations. Ground-controlled approach radar was the keystone upon which the airlift system was built.

Thomas S. Snyder, ed.
History of Air Force Communications Command

Command and Control Principles and Tenets

Principles and tenets guide C2 operations just like other aerospace operations. Unity of command is a principle for C2 operations, which in turn assures unity of effort. Airmen firmly believe in the tenet of centralized control and decentralized execution that is fundamental to integrating and orchestrating aerospace power. This is much more than centralized planning, which focuses on preserving geographic boundaries and limits the effectiveness of aerospace power. An enduring tenet of C2 operations is informed decision making. Accepting and taking reasonable risks to achieve mission success is necessary for successful command.

Unity of Command

According to AFDD 1, *Air Force Basic Doctrine*, "Unity of command ensures the concentration of effort for every objective under one responsible commander. This principle emphasizes that all efforts should be directed and coordinated toward a common objective." For example, the joint force air component commander (JFACC) could also be the area air defense commander. Commanders are empowered by several command authorities to ensure unity of command. JP 0-2, *Unified Action Armed Forces (UNAAF)*, covers the four command authorities that are also command relationships. These are combatant command (command authority) (COCOM), operational control (OPCON), tactical control (TACON), and support. A detailed discussion on these command authorities is found

in AFDD 2, *Organization and Employment of Aerospace Power.* The support command relationship warrants particular attention because, according to the UNAAF, it is a "somewhat vague, but very flexible arrangement." Other UNAAF-covered command authorities, critical to C2 operations, are administrative control (ADCON), coordinating authority, and direct liaison authorized. Commanders should thoroughly understand command authorities and the concept of command relationships as this area might be a source of confusion.

Some commanders may fulfill their responsibilities by using C2 operations to personally direct units engaged in missions or tasks. However, the political nature of multinational warfare, the uncertainty of war, the dynamics of MOOTW, and distributed aerospace operations normally preclude an operational commander from doing this. Thus, C2 operations normally allow the assignment of responsibilities and the delegation of authorities between superior and subordinate commanders.

Command and control operations have had many successes, one of which was the World War II North African Air Force (NAAF) operation in Sicily. General Spaatz ordered "a direct communication link set up between NAAF War Room in La Marsa (Tunisia) and the forward command post of Tactical, Strategic, and Coastal Air Forces. He also directed that each air force's command post have present for duty at all times an officer with the authority to make binding decisions for that air force."

Richard G. Davis
Carl A. Spaatz and the Air War in Europe

A reluctance to delegate decisions to subordinate commanders slows down C2 operations and takes away the subordinate's initiative. Senior commanders should provide the desired end-state, desired effects, rules of engagement, and feedback on the progress of the operation without directing the tactical operations.

Centralized Control and Decentralized Execution

Centralized control and decentralized execution provide commanders the ability to exploit the speed, flexibility, and versatility of global aerospace power. The unique abilities of aerospace power to maneuver, to achieve strategic and theater effects, and to complement joint operations are inherently dependent on centralized control by an airman.

Centralized control has its roots in the World War II North African Campaign. The idea of a centralized Allied command structure for airpower took final form at the Casablanca conference in January 1943. The Combined Chiefs of Staff "approved a unified command for all Allied air forces in the Mediterranean."

Richard G. Davis
Carl A. Spaatz and the Air War in Europe

The fundamental concept of a functional component commander, as described in the UNAAF, embodies the Air Force's commitment to the tenet of centralized control of aerospace power. AFDD 2 describes the joint air operations center (JAOC) where centralized planning, directing, controlling, and coordinating take place. A balance exists between too much and too little centralized control. Overcontrolling aerospace power robs it of flexibility and takes the initiative away from the operators. Under controlling aerospace power fails to capitalize on joint force integration and orchestration, thus reducing its effectiveness.

"[President] Johnson's personal control of the air war limited options for the air commanders implementing ROLLING THUNDER. The Tuesday lunch group at first assigned targets in 'packages' of one a week, then changed to packages of three every two weeks by September 1965. The group members also allocated a specific number of sorties against selected targets to achieve an 80 percent rate of destruction. Until accomplishing that amount of damage aircrews repeatedly attacked the same targets for the one or two week period. Losses increased as the North Vietnamese realized that the constraints would allow them to mass their defenses for extended periods around a small number of targets."

Mark Clodfelter
The Limits of Air Power

Centralized control of aerospace forces levies a major requirement on US Air Force C2 operations. This requirement is to establish and maintain two-way information flow among commanders, operators, and combat support elements that must be effectively integrated to achieve the desired combat effects. Using timely and available information, commanders make and communicate decisions. A good example is the air tasking order (ATO); it embodies command decisions that must be communicated to the operators.

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The two-way information flow between commanders and operators is often depicted as a vertical or "up-and-down" flow. Commanders rely on vertical information flow to produce a common tactical picture of the battle. Senior commanders, like the JFC, may subsequently use several common tactical pictures to produce a common operational picture of the theater. Vertical information flows are fundamental to centralized control. Without this flow, commanders cannot give meaningful feedback when controlling operations. Another type of information flow is horizontal or "peer-to-peer" communication, which normally occurs between operators and among combat support elements.

Decentralized execution by aerospace forces levies another major requirement on US Air Force C2 operations. This requirement is to ensure the two-way horizontal information flow that reduces the uncertainty of the war and the dynamics of MOOTW. Information such as battlespace observations should freely flow between operators. Horizontal flow of information enhances operator initiative. As the battlespace environment changes, operators are free to act within the guidelines of the commander's intent and rules of engagement. The balance between vertical and horizontal information flows should be described in the C2 section of the operations plan. Maintaining this balance during the uncertainty of war or the dynamics of MOOTW is a job of C2 operators.

Successes in information flow lead to spectacular victories. In the Gulf War, Airborne Warning and Control System (AWACS) aircraft alerted and vectored Coalition fighter aircraft against Iraqi aircraft that were tracked from take-off. More than a dozen Iraqi aircraft were shot down in aerial combat as compared to no aerial combat losses for Coalition aircraft.

Elliot A. Cohen, ed.
Gulf War Air Power Survey Summary Report

Work still needs to be done to integrate horizontal and vertical information flows. When the vertical flow dominates, subordinate commanders and operators may suffer as the initiative is passed to senior commanders. When the horizontal flow dominates, commanders may suffer because they do not have the information necessary to exercise focused control of present operations and to plan future operations. Senior commanders making decisions about operations, combined with subordinates free to exercise initiative in executing those decisions, make up the heart of C2—centralized control and decentralized execution.

Failures in information flow lead to tragic losses. The accidental shoot down of two US Army Blackhawk helicopters by AWACS-vectored fighters can be traced to successive failures in information flow, vertically between commanders and operators and horizontally between operators.

Air Force Chief to Review Blackhawk Actions
OD News Release No. 414-95

Informed Decision Making

Command and control should support an informed decision making process at all levels of command. The process should be adapted to the circumstances presented by the mission and aerospace environment. The process should not be blindly used in a checklist fashion. A key attribute of informed decision making is choosing among competing courses of action. Commanders preserve the flexibility of aerospace power by making timely and efficient decisions. Deferring decisions by moving them up or down the chain of command loses the initiative and limits the flexibility of alternatives.

The decision to drop two atomic bombs on Japan to end World War II is still a hotly debated issue, but is one of the most poignant aerospace power decisions of the 20th century. One school of thought viewed Japan as defeated and waiting for an opportune time to surrender. Another school of thought viewed Japan as desperate and busily training forces for a homeland defense. The increased frequency of suicide kamikaze attacks was an indicator of a desperate adversary preparing for the invasion. After considering available intelligence, and with air superiority being challenged, President Truman ordered the bombings to avoid risking Allied and Japanese lives that would be lost in an invasion.

Russell F. Weigley
The American Way of War

The US Air Force uses a six-step operational risk management (ORM) process to optimize informed decision making. The six steps include identifying the threat to the mission or "hazard," assessing the risks, analyzing risk control measures, making control decisions, implementing risk controls, and supervising and reviewing. Through the ORM process, commanders should understand and accept risks necessary to accomplish the

mission. Accepting risks also acknowledges the possibility of failure. Assessing risks may be a time-consuming process that may impact mission accomplishment. Not assessing risks turns the decision-making process into a dangerous gamble.

A bad risk management decision that severely backlogged the US access to space was the January 1986 cold weather launch of Challenger. As a member of the Rogers Commission investigating the disaster, Dr. Feynman noted this about estimating and accepting risks. "It appears that there are enormous differences of opinion as to the probability of a failure with loss of vehicle and of human life. The estimates range from roughly 1 in 100 to 1 in 100,000…. The argument that the same risk was flown before without failure is often accepted as an argument for the safety of accepting it again." The catastrophic loss of the Challenger exacerbated another poor risk management decision—the over-reliance on the shuttle for access to space.

Rogers Commission Report, 1986

Command and control processes are the structured basis of informed decision making. Technology elements either automate or speed-up these processes with things like digital electronic communications, computers, and expert systems. Yet, there is no substitute for trained personnel using intuition and common sense in making the final decision. In the words of General Shaud (former Chief of Staff, Supreme Headquarters Allied Powers Europe), "Process is no substitute for careful thought."

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CHAPTER TWO

COMMAND AND CONTROL PLANNING, PROCESSES, AND SYSTEMS

Called 'Instant Thunder' this concept won Schwarzkopf's endorsement; its name was intended as a clear signal that any air campaign would be quick, overwhelming, and decisive—not a gradualist approach as had been the case with Vietnam's 'Rolling Thunder' 25 years before.

Richard P. Hallion
Storm Over Iraq

Planning and Deciding

Planning is the C2 function of examining the environment, matching objectives with resources, and deciding on the course of action. Successful planning focuses on future operations. The US Air Force recognizes the importance of the Joint Operation Planning and Execution System (JOPES) to the warfighter, as described in JP 5-0, *Doctrine for Planning Joint Operations*. The JOPES process includes threat identification, strategy determination, course of action development, detailed planning, and implementation. These broad steps are generally followed by each of the three categories of joint operational planning. These categories are campaign, deliberate, and crisis action planning and are described in JOPES doctrine and procedural publications. The key C2 component of these planning activities is the commander's estimate decision process.

The JP 1-02 defines the commander's estimate of the situation as "a logical process of reasoning by which a commander considers all the circumstances affecting the military situation and arrives at a decision as to a course of action to be taken to accomplish the mission." The US Air Force assists in the development of the JFC's estimate process: assessing the mission, developing COAs that are responsive to the situation, analyzing adversary COAs, comparing friendly COAs, and making a decision. As detailed in AFDD 2, the US Air Force's estimate process integrates aerospace power into COAs that are presented to the JFC for a decision. The US Air Force's estimate process is the primary way for airmen to influence the JFC's COA decision process. The time relationship between the JFC's and the US Air Force's estimate processes is critical. Both pro-

One thing I cannot overemphasize is that DESERT SHIELD/STORM was a coordinated effort. My boss, General Schwarzkopf, approved the air war plan we developed and gave it his full backing. The commanders of the other US Central Command components cooperated with us to the fullest, as did the commanders of allied forces. Back at home, we knew that President Bush was committed to letting his military commanders run the war; the secretaries and the Joint Chiefs of Staff gave us their full support and cooperation. The Air Force led off the fighting, but in the end, every Defense Department and allied element contributed to the victory. It was truly a combined effort.

General Charles Horner
***Air Power History*, Fall 91**

cesses are interrelated and should be accomplished simultaneously. A desired goal is to have one staff, one process, and one product.

A JFC may also need to synthesize COAs from the ones recommended by subordinates in order to satisfy the criteria of adequacy, feasibility, variety, and completeness. The inputs of airmen are critical in this synthesis process. Aerospace power requires early consideration when integrating aerospace missions into a campaign plan. Planning based solely on deconfliction, either geographically or temporally, denies aerospace power its flexibility. Planning should focus on integrating aerospace power into operations that will achieve specific objectives and effects.

Once a COA decision is made, the JFACC or COMAFFOR produces the detailed plan to achieve assigned objectives. The detailed planning process for airmen is the five-step joint aerospace operations planning process. For more information on the process, see AFDD 2. The output of the process, the joint air operations plan (JAOP), forms the basis for the day-to-day tactical operations. Another important JFC decision is the apportionment of airpower to accomplish the JAOP and to satisfy joint objectives.

Decision Models

Effective C2 decisions use a dynamic process that starts when the data are received from various sources and are processed to form information. This information is then used as the basis for making decisions. The six-step operational risk management process adds the necessary rigor to

help make decisions. Once the appropriate decisions are made, the commander ensures these decisions are communicated to subordinates for execution. Delegation of a decision is appropriate when time and information factors allow a subordinate to make a better decision. Making effective decisions is especially difficult during crisis operations due to the uncertainty created by the fog and friction of war and the dynamics of MOOTW. This uncertainty generates "noise."

When applied to C2, noise serves as a metaphor for anything that interferes with people receiving, processing, and transmitting information during the decision-making process. Noise in this sense originates from human and technological sources. As the central receiver of information, commanders may face overload with too much, hindering their decision making. Commanders need to select mission essential information and defer the rest. In the processing stage, noise often comes from preconceptions that limit commanders' abilities to analyze ambiguous information that contradicts the current view of the situation. The development of and adherence to a systematic decision-making process reduce the effects of noise.

The use of established decision-making processes would not entirely eliminate the uncertainty of war and the dynamics of MOOTW encountered by all commanders. However, it can guide commanders and their staffs through logical steps that lead to better decisions, given the available information. There are many other notional decision-making models available for use such as the monitor, assess, plan, and execute (MAPE) model. (For more information on MAPE, see the AFDD on the Air Force Task List). Each model requires an awareness of the environment, an evaluation of the information received, a decision based on that information, and execution of orders or plans. These models can add detail to the commander's estimate process described earlier. Aerospace power provides effects throughout the battlespace. Communicating aerospace ideas and COAs during the estimate process requires an understanding of C2 systems characteristics.

Command and Control System Characteristics

The fundamental purpose of C2 systems is to ensure commanders receive mission essential information, make informed decisions, and issue appropriate commands to subordinates. To achieve this purpose, C2 systems must meet the cost, schedule, and performance criteria set during the requirements phase of the acquisition process. In establishing these

requirements, users and developers must also ensure C2 systems are interoperable, sustainable, and survivable. The interrelated C2 system characteristics of interoperability, sustainability, and survivability are shown in Figure 2.1. These three characteristics are critical to ensuring future aerospace expeditionary forces have the C2 operational flexibility, sustained combat support, and full-dimensional protection required by the warfighter.

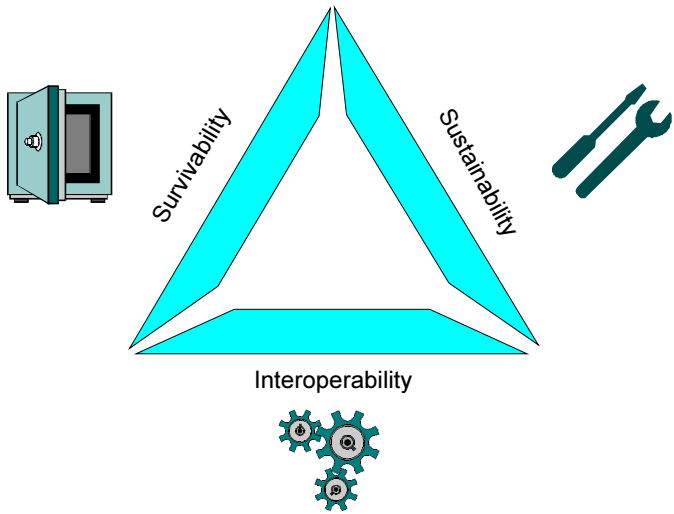

Figure 2.1. Interrelated C2 System Characteristics that Commanders Should Know

There has been a dramatic increase in the ability to conduct military operations at great distances and with great speed. The C2 systems of the future should balance the requirements of bandwidth, latency, and information fidelity with the often-conflicting demands of horizontal and vertical information flows. Information technology advances are accelerating the merging of C2 systems with intelligence, surveillance, and reconnaissance systems.

Interoperability

Interoperability is the ability of C2 systems to exchange information, with the ultimate goal of allowing warfighters to operate effectively together. Interoperability is best achieved by adhering to technology and process standards that allow information flow. Unity of command is dif-

ficult, if not impossible, to achieve when C2 systems do not work together. In the past, most C2 systems were designed strictly to meet the needs of a particular Service or functional commander. This is changing.

Numerous directives require the Services to migrate existing Service or function specific C2 systems and applications to a standard defense information infrastructure. This infrastructure is not a C2 system, but provides a common operating environment or a foundation for building where functionality is added or removed in small manageable segments. To achieve interoperability, the DOD established the Joint Technical Architecture (JTA) and the Command, Control, Communications, Intelligence, Surveillance, and Reconnaissance Architectural Framework. The JTA identifies a common set of mandatory information technology standards and guidelines to be used for sending and receiving, understanding, and processing information. The Air Force's detailed standards and guidelines are addressed in the Defense Information System Agency's JTA-Air Force document. The Framework provides for the implementation of a standard DOD architecture that provides the needed structure while systems are in the system engineering phase of acquisition.

Flexibility, a feature of interoperability, allows the massing or combining of C2 systems needed to satisfy C2 requirements. C2 systems should work in a complementary and synergistic fashion that avoids unnecessary duplication of functions. C2 technological developments and capabilities are growing well beyond what is affordable by one Service or one organization. Numerous commercial and government efforts have produced unique and flexible C2 capabilities. Commanders, who want effective operations at minimum costs, should fully integrate these C2 capabilities.

Satellite communications (SATCOM) systems provide flexibility by allowing cross-Service and cross-functional communication between diverse joint force elements. The SATCOM "force mix" should be an interoperable blend of military and commercial systems that are based on deliberately planned requirements. Deliberate planning, by the warfighter, clarifies actual wartime network requirements, which in turn provides a sound basis for sizing needed bandwidth and throughput during a crisis.

Versatility, another feature of interoperable C2 systems, enables commanders to do missions across the various levels of war and during MOOTW with existing resources. Scarce C2 systems are now labeled "low asset

The demand for military satellite communications (SATCOM) systems represents a good example of C2 system flexibility. The Gulf War used at least five different SATCOM systems to support operations with the military DSCS [Defense Satellite Communications System] and commercial INTELSAT [International Telecommunications Satellite Organization] systems being the most notable.

DSCS III Satellite

Alan D. Campen, ed.
The First Information War

availability" to reflect the low number of platforms and high operations requirements for these resources.

Sustainability

Aerospace power's expeditionary focus and rapid global mobility make unique demands on C2 system sustainability, maintainability, and redundancy. Leading edge C2 technology often has both military and commer-

A good example of a versatile intelligence, surveillance, and reconnaissance system with C2 implications is Joint Surveillance Target Attack Radar System (JSTARS). This airborne ground-looking radar system made history as a sensor-to-shooter platform in the Gulf War. Radar pictures of the highway exit routes from Kuwait gave commanders an operational picture that showed Iraq's retreat from battlefield positions. Other uses of the versatile JSTARS include tactical monitoring of peacekeeping operations and guiding rescue workers in humanitarian assistance operations. Strategically, JSTARS may have a role in the Middle East peace process by monitoring activity in the various buffer zones that contribute to Israel's security.

cial uses. The US Air Force supports using a cost-effective mix of military and commercial C2 systems to reduce expensive research and development costs when possible. However, sustainment of this mix poses long-term issues for commanders. Commanders should consider these issues and incorporate their decisions into C2 plans. These decisions are most critical for combined and joint force commanders as host nations considerations greatly influence the mix and use of coalition C2 systems.

US Military Precision Lightweight GPS Receiver

Global positioning system (GPS) navigation technology enables precision command and control of maneuver forces and fires. This technology also enables a worldwide, multibillion-dollar, civilian navigation and positioning market. Sustainment decisions on military and commercial versions of C2 systems should be made ahead of time. For example, degrading an adversary's C2 system by lowering the precision of GPS signals may also affect friendly C2 systems.

Commercial GPS Receiver

Radio frequency (RF) spectrum management is a key area in sustaining C2 systems. Global demand and advances in information technology make the RF spectrum a scarce commodity. As demand increases, management and coordination tasks become much more complex. Deliberate planning uses reasonable assumptions to anticipate RF spectrum requirements. RF spectrum management in a crisis situation demands rigorous procedures and rules. C2 systems that receive or transmit in the RF spectrum must be certified and licensed. Commanders should pay particular attention to this area.

The forward and home bases of expeditionary Air Force operations present a unique challenge to maintaining C2 systems. Maintainers are responsible for two C2 systems: one at the home base, the other deployed. “Temporary” fielded equipment, some remaining deployed for many years, eventually becomes obsolete. Maintainers are forced to repair old equipment while operations are in progress. Technology advances should be forecast and maintainability requirements should be consistent with the forecast. For example, yearly advances in computer technology may mean

the adoption of a "disposable" computer maintenance concept in which computers are treated like a consumable item.

Redundant C2 systems provide the ability for alternative C2 systems to continue operations in the event of failure or damage to the primary system. C2 system redundancy begins with planning. Redundancy requirements should balance the goal of mission success against natural failures. Single-point-of-failure C2 systems with no back-ups, such as the joint air operations center, are good candidates for redundancy planning. An Air Force JFACC should plan for redundancy by using distributed C2 operations. For example, the commander could designate the reachback aerospace operations center (AOC) or another numbered air forces's (NAF) AOC as backup.

Survivability

Survivability of C2 systems is critical in war. C2 systems require special protection from overt and covert hostile action. Historically, C2 systems have been well protected from attack by carefully locating, hardening, and securing the system. Host nations may restrict expeditionary Air Force C2 operations by determining the placement of C2 systems. Commanders should ensure that adequate hardening and security measures compensate for lesser degrees of force protection offered by distance or terrain. Protection decisions should be based on cost, risk, and benefit factors that are continually reassessed as the threat environment changes. The global proliferation of precision-guided weapons directly threatens the US Air Force's tenet of centralized control and decentralized execution. Distributed operations that reduce dependencies on high value C2 systems, within the reach of adversaries, may counter this threat.

The US Air Force's use of global connectivity systems, such as the Internet, is increasing. Distributed operations may further compound this increase. Global connectivity opens the US Air Force to the likelihood of information attacks. Commanders should only use secure and responsive C2 systems to transmit and receive warfighting orders and information. Reliance on commingled military and commercial systems during conflict may put the commander at additional risk. One possible solution is to segregate information needed for C2. Mission critical information could use secure military channels, while routine information could use the first free connectivity channel. Another possible solution is to integrate all information and use multiple high capacity connectivity

channels to ensure information flow. The choice will depend on available C2 assets.

Redundant C2 systems offer a fair degree of survivability. New personal communication devices, redundantly connected with land and satellite links, offer a new dimension in survivable command and control. Commercial low-Earth orbiting communication satellites, numbering in the hundreds, provide commanders with significant communications capability. However, this capability is expensive and unprotected. Commanders should consider the threat environment, expected survivability of C2 assets, risks, and cost when planning to operate C2 systems. Redundancy offers a reasonable, but imperfect, assurance against friendly, natural, and adversarial sources of C2 degradation.

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CHAPTER THREE

COMMAND AND CONTROL IN US AIR FORCE OPERATIONS

E-4B National Airborne Operations Center

With abundant examples from history to suggest how unrealistic prewar conceptions of impending hostilities can be, it would appear supremely sensible to want to preserve the capacity to make new decisions when the shooting starts.

Bernard Brodie
Strategy in the Missile Age

The E-4B serves as a reminder that strategic C2 of nuclear forces continues today. Preserving nuclear C2 means maintaining the capacity to make strategic-level decisions under horrific circumstances. Less pressing circumstances are found at the other end of the operational spectrum. Decentralized operations rely on air base command and control to plan operations, generate mission sorties, reduce risks, maintain systems, and manage resources. The concept of an expeditionary Air Force has new appeal when persistent global operations become more common and, as military forces and resources become scarcer. The US Air Force follows the command relationships presented in the UNAAF and provides OPCON, TACON, and support of forces according to the JFC's concept of operations. AFDD 2 provides the details on how the COMAFFOR should exercise OPCON and TACON of US Air Force forces. In a joint operations area, the JFC will establish any supported and supporting relationships. The supported commander should ensure the supporting commander understands the assistance required. In turn, the supporting commander will provide the assistance required based on existing capabilities and other assigned tasks. When the supporting commander is unable to provide the requested support, the designating authority (superior commander) will be notified for resolution. For example, the JFACC should normally function as the supported commander for counterair operations; strategic attack operations; theater intelligence, surveillance, and recon-

naissance (ISR); and the overall air interdiction effort. The JFACC should also function as the supporting commander for close air support, air interdiction within the land and naval component area of operations (AOs), and maritime support.

US Air Force Service COMMAFFORs carry out additional US Air Force responsibilities through ADCON, a command authority, over US Air Force forces assigned or attached to the unified, subunified, and joint task force (JTF) levels. A COMAFFOR can exist at each of these levels. Although the UNAAF allows the JFC and the Service component commander to be the same person, AFDD 2 recommends that a US Air Force JFC should not also serve as the COMAFFOR. This allows a US Air Force JFC to focus on the appropriate level of warfighting, without the distraction of Service and administrative tasks.

Aerospace Expeditionary Force Operational Command and Control

Expeditionary C2 operations support both US Air Force commanders and JFCs. Expeditionary C2 operations start by supporting the organizational matrix of the AEF. AEF forces are often distributed throughout the world. C2 operations are required to support distributed force mobilization, deployment, employment, sustainment, and redeployment activities. Transition from US Air Force C2 to warfighting C2 is straightforward when forces are deployed in the theater. The UNAAF specifies the command relationships and decision-making structure of the multinational or joint force in theater. Interoperable C2 systems are the enablers of supported and supporting command relationships. The US Air Force is responsible for equipping its expeditionary forces with interoperable C2 systems. The parent major command (MAJCOM) or NAF is the focal point for ensuring expeditionary forces have interoperable C2 systems.

The situation is more complex when forces, materiel, or services are projected from outside the theater of operations. To ensure unity of command, US Air Force and JFCs should coordinate the deployment and employment of projected forces. The goal of coordination is the synergistic employment of forces to accomplish the JFC's objectives. Time or space deconfliction of forces is not sufficient to achieve this goal. While the supported commander has the final say, supporting commanders still have to make decisions about the coordinated employment of their forces. The functional warfighting commands, such as United States Transportation Command (USTRANSCOM), have developed organic command and

control operations to support decision making and coordination of these decisions.

Projecting US Air Force service, support, and operational functions from outside the theater of operations to inside the theater of operations are examples of "reachback operations." To preserve unity of command, according to the UNAAF, the JFC normally has OPCON of assigned or attached forces that are in the theater. Likewise, the JFACC should have TACON of "military capability or forces made available." In distributed operations, the JFC and supporting commanders should document when and where a JFACC has TACON over distributed assets. ADCON over distributed US Air Force assets are often split among several US Air Force commanders.

Theater Operational Command and Control

The focal point for the command and control of theater aerospace operations is the JAOC. The JFC normally designates the senior airman, with the preponderance of aerospace forces and the ability to command and control these forces, as the JFACC. The JFACC commands the JAOC. When the COMAFFOR is the JFACC, the aerospace operations center forms the nucleus for the JAOC. Details on the organization and processes of an AOC can be found in the AFDD 2, *Organization and Employment of Aerospace Power*, and the AFDDs on Air Warfare and Airspace Control in the Combat Zone.

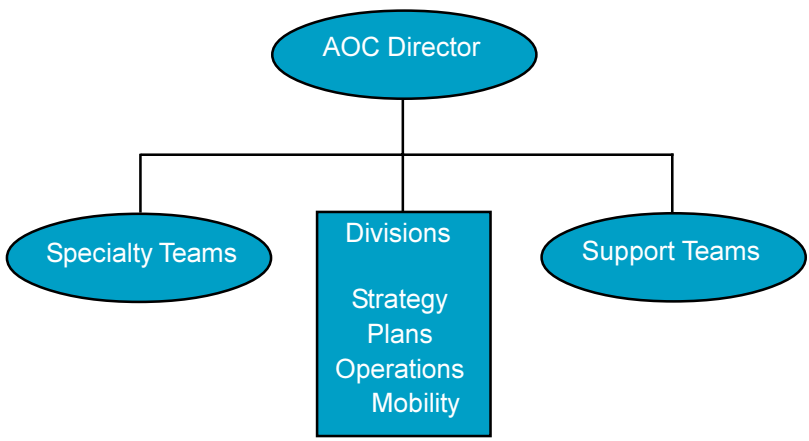

Figure 3.1. Notional Aerospace Operations Center Components

The COMAFFOR normally makes command decisions for the AOC. When elements or functions of the AOC are placed in a "reachback" location, the COMAFFOR should have the same degree of control as if they were forward deployed. An AOC director runs the daily operations of the center. The notional AOC has four divisions: strategy, plans, operations, and mobility. Specialty teams and support teams augment these divisions.

NAFs are responsible for setting up an AOC and should tailor the AOC to meet the needs of the JFC. The key C2 processes of an AOC are developing the air operations plan and master air attack plan; producing the ATO, special instructions, and the airspace control order; monitoring the execution of the plans and orders; and assessing and reporting the effects of aerospace operations in time for the next cycle of activities.

The specialty teams are not only responsible for many operational aspects of the AOC, but also are responsible for many of the technical and liaison activities with the functional supporting commands and other Services. Key C2 activities include such areas as area air defense, information in warfare, information warfare, joint fires, legal, logistics, missile defense, space, and weather. AOC support teams are responsible for areas such as administration, communications, information management, reporting, and supply.

Combat Support Command and Control

Combat support enables US Air Force commanders to sustain and protect all aerospace forces and capabilities needed to accomplish assigned missions. US Air Force commanders are responsible for combat support of US Air Force forces. Effective C2 of combat support forces allows operational commanders to maintain mission readiness, conduct efficient operations, sustain the force, and eliminate unnecessary duplication of effort among the Service components. Support responsibilities for US Air Force forces, subordinate to the combatant commander, should normally follow US Air Force channels except when directed otherwise. Occasionally, Air Force commanders should be prepared to accept single-Service responsibility for common logistics items like fuels.

JFCs and component commanders should ensure their plans fully integrate combat and combat support operations. Strict prioritizing of combat activities ahead of combat support activities often leads to inefficient operations. A goal of US Air Force combat support C2 is to maintain the

equivalence between deployment planning, sustainment planning, and employment planning. This should reduce the commanders need to rely on directed emergency measures and improvisations as means to support combat operations.

Nuclear Operational Command and Control

As described in the AFDD on Nuclear Operations, survivable command and control is vital to support US nuclear deterrence strategy. Without survivable C2, deterrence is not possible as the decision processes become dominated by dangerous use-or-lose considerations. Nuclear C2 operations provide positive control of nuclear weapons and allow the National Command Authorities (NCA) to make authorization decisions during war.

US Air Force forces assigned or attached to United States Strategic Command (USSTRATCOM) execute strategic military operations under direct control of the NCA. The functional nature of USSTRATCOM's organization allows task force commanders to exercise operational control of nuclear forces. The senior US Air Force officer in the task force exercises ADCON of US Air Force members.

Nuclear C2 operations use rigorous processes and procedures to ensure total control of nuclear weapons. This rigor starts in the strategic level planning process that produces the Single Integrated Operation Plan (SIOP). At the theater level, warfighting commands should integrate nuclear weapons planning if the selected course of action calls for it. If the employment of nuclear weapons is authorized, a series of emergency action procedures are developed to comply with the authorization. Weapon system safety rules ensure that detonation of a nuclear weapon is intentional and authorized.

Command and control systems, such as the Global Command and Control System (GCCS), are designed to communicate the authorization decision. C2 security plays a vital role in ensuring valid authorization orders are communicated to the nuclear forces. Encoding and decoding processes ensure nuclear authorization orders can be transmitted rapidly and securely through available channels. Routine communications use all available C2 systems, since exclusive use of secure channels significantly slows information flow. Redundancy of C2 systems is also another key aspect of nuclear C2 operations. Critical information can be sent via redundant communications systems such as landlines, available circuits

on communications satellites, or low frequency radio equipment. Nuclear C2 operations are often the drivers for interoperable and survivable C2 systems.

Space Operational Command and Control

US Air Force space forces, no different than air forces, are organized for unity of command and use centralized control and decentralized execution. In joint operations, a COMAFFOR is designated from the US Air Force and serves as the commander of US Air Force forces that are assigned or attached to the joint force. US Air Force space forces should be presented to the JFC in a logical and consistent manner by the designated COMAFFOR.

At the strategic warfighting command level, United States Space Command (USSPACECOM) is a functional unified command containing Army, Navy, and Air Force components and is responsible for space missions. All US Air Force forces assigned or attached to USSPACECOM should normally be under command of the COMAFFOR, who is designated Commander, United States Space Command, Air Force Component (COMAFSPACE). Commander in Chief of USSPACECOM should normally delegate OPCON of Air Force forces to COMAFSPACE.

Most US Air Force space assets have global responsibilities that will normally prevent them from being under OPCON of a theater JFC. This JFC, as the supported commander, should exercise general direction of available space assets. Normally the JFC designates a subordinate commander, preferably a JFACC, as the single point of contact for space support within the theater. Thus, general direction of space assets should normally reside with the JFACC who ensures that requests for space support are consolidated, prioritized, deconflicted, and forwarded through the established support relationship with COMAFSPACE. This single point of contact should normally have direct liaison authorized (DIRLAUTH) authority with COMAFSPACE.

A working example of command relationships and command authorities is found with GPS accuracy. The accuracy may be modified for a given terrestrial region to produce a desired combat effect. Since GPS is simultaneously used by multiple CINCs, operational control cannot be given to any one CINC. Therefore, this combat effect should be requested by the supported commander, coordinated at the strategic and operational levels of war by COMAFSPACE, and executed by space warfighters.

As specified in JP 0-2, Commander in Chief, United States Space Command (USCINCSPACE) and the supported CINC must predetermine support relationships. If the supported commander were to work all the details with the USSPACECOM staff, it would be cumbersome and at the wrong level. To streamline the process, the US Air Force is creating robust, capable, and frequently exercised command and control links between the aerospace operations center and the Air Force Space Command's aerospace operation center. This will allow supported commanders, like the JFACC, to "own the effects" they need COMAFSPACE to produce, even if COMAFSPACE cannot transfer OPCON of that force to the supported commanders.

Aerospace operations centers and the Air Force Space Command's space operations center employ warfighters trained to specific standards. They use interoperable command and control processes and technology, including a common operating picture, and draw upon information from shared databases. This distributed command and control system allows for integrated aerospace operations and robust "reachback" capability. The US Air Force will continue its stewardship of space and will satisfy the space needs of both USCINCSPACE and other CINCs through the distributed command and control system.

Air Mobility Command and Control

Rapid global mobility is central to maintaining US presence and influence around the world. The AFDD on Air Mobility Operations covers the details of air mobility command and control. Commander in Chief, US Transportation Command (USCINCTRANS), normally retains OPCON of assigned forces necessary to accomplish global mobility missions and exercises OPCON of air mobility forces through the tanker airlift control center (TACC). Air Mobility Command's (AMC) TACC is the focal point for air mobility missions and requirements. It provides centralized command and control of global operations and acts as the single point of contact for air mobility customers and providers. A critical enabling feature of the TACC is its robust global C2 system. AMC also has a worldwide array of command posts and control centers that make distributed operations possible.

The global nature of air mobility requires special attention to tasking their resources because they fulfill national requirements and priorities. To accomplish this, the air mobility element (AME) deploys to the theater as the forward extension of the TACC and should reside in the AOC. The

AME provides intertheater air mobility integration and coordination of AMC forces. The AME also assists and advises the Director of Mobility Forces (DIRMOBFOR) to ensure effective integration of intertheater air mobility assets. The TACC normally retains operational control over AMC mobility forces. However, the COMAFFOR may be given tactical control over these assets to integrate their additional capabilities to support joint force requirements.

Since mobility forces often are the first to arrive in theater, these forces bring organic command and control systems with them. These C2 systems may be the only connectivity link during the initial stages of the operation. As such, the on-scene commander may require the use of these C2 assets for purposes beyond mobility operations. Crisis planning should account for such scenarios, as operations other than war become more common.

Special Operations Command and Control

As described in the AFDD on Special Operations, assigned US Air Force special operations forces (AFSOF) in theater are under COCOM of the geographic combatant commander. Operational control of theater AFSOF is normally exercised through the theater special operations command (SOC). The SOC is a subunified command that functions as the special operations component for the theater. The theater SOC commander advises the theater CINC and other component commanders in all areas of special operations, providing them with the expertise to plan the employment of special operations forces (SOF). The theater SOC fully integrates special operations forces into theater and country peacetime plans, as well as the geographic CINCs' war plans.

The SOC also provides the nucleus for the establishment of a joint special operations task force (JSOTF). The JSOTF may fight alone; however, it is normally employed under a larger joint task force (JTF). The theater SOC commander is responsible to the geographic CINC for planning and conducting joint special operations in the theater, ensuring that SOF capabilities are matched to mission requirements, exercising OPCON for joint special operations, and advising the CINC and component commanders in theater on the employment of SOF.

The COMAFFOR normally has ADCON of Air Force special operations component forces. Thus the COMAFFOR is responsible for supplying logistic and combat support.

Given the unique mission and capabilities of AFSOF, these forces use an impressive array of organic C2 systems. Interoperability issues should be resolved during the procurement and design of these systems. When civilian connectivity or security issues are paramount, custom sensors and special communications equipment are often needed to accomplish the mission. C2 operators need specialized training to effectively use the custom mix of C2 systems. During operations, commanders should make risk management decisions on interoperability, sustainability, and security issues incurred by these C2 systems.

Information Operations Command and Control

Information superiority is the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. The AFDD on Information Operations further qualifies the definition as "that degree of dominance in the information domain, which allows friendly forces the ability to collect, control, exploit, and defend information without effective opposition." The Air Force conducts information operations at the strategic, operational, and tactical levels. Command and control of strategic information operations (IO) is done at the national level. The NCA coordinate IO with supporting US Air Force units. At the operational level, C2 of information operations is the responsibility of the IO cell that works for the JFC. The JFACC should coordinate and integrate JAOC information operation activities with this IO cell.

In an aerospace operations center, operational-level information operations should always include information-in-warfare (IIW) activities such as ISR. IIW activities feed the C2 processes necessary to run the center. IIW operations are the responsibilities of the various specialty teams such as the ISR team. Information warfare (IW) operations, such as defensive counterinformation and offensive counterinformation, are the responsibility of another specialty team. C2 of IW, through all phases of an operation, requires close coordination between the JFC's IW efforts and IW efforts of supporting commanders.

At the tactical level, C2 of IW operations should be planned and executed in a similar manner to C2 of offensive aerospace operations. The AFDD on Information Operations provides the details of IW, IIW, and supporting functions.

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CHAPTER FOUR

EQUIPPING AND PREPARING COMMAND AND CONTROL OPERATORS

I will tell you that a commander without the proper C2 assets commands nothing except a desk. You must have the ability to communicate with the forces under your command. You must have the ability to exchange information with them freely, frequently, and on a global basis. It's one thing to have highly technical, sophisticated observation platforms, but if you can't use the information in a timely manner, it's wasted.

General Ronald R. Fogleman

Operators from across the US Air Force always play a significant role in making decisions that determine the appropriate employment of aerospace power. To employ C2, operators require state-of-the-art equipment and focused C2 training. The US Air Force relies on technology leverage in times of scarcer resources and a changing strategic environment. Recurring training with C2 technology allows airmen to develop unique C2 skills and experience. These personnel become an indispensable part of any aerospace team. Command and control operators plan, coordinate, direct, and control aerospace forces, and provide the commander with the information required for decision making.

C2 operators function in war within an environment that cannot be precisely duplicated in peacetime. Many C2 operators work continuously at C2 operations; others perform these duties only in times of crisis. Therefore, realistic training on actual C2 equipment is critical to developing personnel with the judgment, experience, and instincts necessary to effectively perform C2 tasks. People, technology elements, and processes make C2 a force multiplier. Commanders should ensure their people are proficient and confident at using C2 systems.

Equipping C2 Operators

Although the US Air Force is critically reliant on technology to overcome the C2 obstacles of distance and time, the commercial sector outspends the US Government on C2 systems. The US Air Force should

take full advantage of the commercial sector by implementing and improving partnering efforts. The US Air Force should still specify unique military interoperability, sustainability, and security requirements when needed by the warfighter. Commanders should fully integrate commercial and government C2 capabilities when planning operations. Commanders should also consider the operational risks and benefits of commercial C2 technology as the adversary might be using the same systems.

An advantage enjoyed by the US Air Force is the tight coupling of C2 acquisition and operations. The Air Force uses specialized centers to integrate C2 acquisition and operations with C2 training and experimentation. These centers ensure people, processes, and technology work together, thereby becoming an asset highly valued by joint force commanders.

Training for C2 Operators

To deliver peak performance, individuals must develop and maintain proficiency in the operation of command and control systems. Training is the tool for developing and maintaining proficiency. C2 training should continually prepare individuals for their specific roles and responsibilities as they progress within their functional areas. Operators should receive a common core of C2 training, covering US Air Force and joint doctrine, strategy, employment, and operational art topics. In addition to developing basic C2 skills and providing training for each person in the C2 hierarchy, a C2 training system must encourage flexibility of thought and creative problem solving skills under stress and in unfamiliar environments. C2 training should include realistic exercises. Technology advances in visualization, communications, and simulation increase the realism of exercises. These allow participants to experience more realistic individual and team training.

Training operators to augment C2 operations presents a significant challenge. The first step toward a solution is identifying and tracking C2-trained personnel throughout the total force. C2 augmentees can then be trained to the requirements of their assigned AEF. Ensuring standardized C2 training across the total force lays a sound foundation and develops the skills necessary for the employment of C2 systems.

Training Responsibilities

C2 system application training should be an integral part of each new C2 system acquisition. When developing C2 systems, the US Air Force should consider training requirements coequal with operability, sustainability, and reliability requirements in system design. Initial C2 system training may be provided by Air Education and Training Command (AETC) or by contractors as designated by AETC. Recurring training on new C2 systems is normally needed as the system matures. Thus, MAJCOMs receiving the new C2 system should coordinate with AETC; Air Force Materiel Command; and the Air Force Command and Control, Intelligence, Surveillance, and Reconnaissance Center on recurring training plans and requirements.

C2 Exercise Training

Frequent and varied exercises provide commanders with feedback to control training and readiness. To provide a realistic assessment, it is crucial that C2 be exercised as an overall system rather than a series of individual components. Exercises involving multiple units and various C2 systems provide needed complexity to train operators. Both joint and coalition C2 elements should be incorporated whenever feasible. Training across the spectrum of military operations may include actual operations in addition to simulations and exercises. Participation in these operations lowers the operations tempo of on-call forces and enhances the readiness of the entire force.

Airmen require appropriate level training throughout their careers. Senior-level officers likely to be assigned to joint force staffs, need training in assimilating and using the products generated by the various C2 systems. Potential joint task force commanders, JFACCs, and NAF commanders may require senior-level C2 training. Airmen likely to serve in AOCs or similar organizations should receive appropriate MAJCOM- or NAF-sponsored C2 training. Airmen and civilians required to maintain and administer C2 systems should receive the appropriate technical and vendor-level training. Generally, experience-appropriate C2 training should become an integral part of the normal career progression of all airmen.

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CHAPTER FIVE

CONCLUSION

> ***The commander must work in a medium which his eyes cannot see, which his best deductive powers cannot always fathom, and with which, because of constant changes, he can rarely become familiar.***
>
> **Carl von Clausewitz**
> ***On War***

The objective of aerospace C2 is to use available forces, at the right place and time, to accomplish the assigned mission. Unity of command is measured by the effectiveness of C2. A commander makes warfighting decisions. Centralized control is the responsibility of commanders as they are held accountable for all actions. Paralysis of friendly C2 is the aim of the adversary. C2 systems allow the decentralized execution of tasks as a way to avoid command paralysis. Commanders who empower subordinates foster initiative that overcomes the uncertainty of war and the dynamics of MOOTW.

Making informed decisions is at the heart of C2. The information age, however, threatens to overload commanders with information that severely challenges their abilities to make timely and effective battlefield decisions. The identification of mission-essential information is paramount to success. Success also requires an understanding of how the commander's estimate of the situation, course of action selection, and subsequent detailed plans are formulated and executed under real-world conditions. The end product of the planning process is a plan that effectively integrates aerospace power into joint and multinational operations.

Command and control experimentation, innovation, and training are essential to harness the revolution in military affairs. Technology now makes distributed C2 operations possible. How well a commander orchestrates aerospace expeditionary force operations may be a new measure of the "genius of the commander."

At the Very Heart of Warfare lies doctrine . . .

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Glossary

Abbreviations and Acronyms

ADCON	administrative control
AEF	Aerospace Expeditionary Force
AETC	Air Education and Training Command
AFRC	Air Force Reserve Command
AFDD	Air Force doctrine document
AFI	Air Force Instruction
AFPD	Air Force Policy Directive
AFSPC	Air Force Space Command
AFSOF	Air Force special operations forces
AMC	Air Mobility Command
AME	air mobility element
ANG	Air National Guard
AO	area of operations
AOC	aerospace operations center
ATO	air tasking order
AWACS	Airborne Warning and Control System
C2	command and control
CINC	commander in chief; commander of a combatant command
COA	course of action
COCOM	combatant command (command authority)
COMAFFOR	Commander, Air Force Forces
COMAFSPACE	Commander, Air Force Space Forces
CSAF	Chief of Staff, United States Air Force
DIRLAUTH	direct liaison authorized
DIRMOBFOR	Director of Mobility Forces
DSCS	Defense Satellite Communications System
GCCS	Global Command and Control System
GCI	ground-controlled intercept
GPS	global positioning system
IFF	identification friend or foe
IIW	information-in-warfare
INTELSAT	International Telecommunications Satellite Organization

IO	information operations
ISR	intelligence, surveillance, and reconnaissance
IW	information warfare
JAOC	joint air operations center
JAOP	joint air operations plan
JFACC	joint force air component commander
JFC	joint force commander
JOPES	Joint Operation Planning and Execution System
JSOTF	joint special operations task force
JSTARS	Joint Surveillance, Target Attack Radar System
JTA	Joint Technical Architecture
JTA-AF	Joint Technical Architecture - Air Force
JTF	joint task force
MAJCOM	major command
MAPE	monitor, assess, plan, and execute
MOOTW	military operations other than war
NAF	numbered air force
NCA	National Command Authorities
OPCON	operational control
ORM	operational risk management
RF	radio frequency
SATCOM	satellite communications
SIOP	Single Integrated Operation Plan
SOC	space operations center
SOF	special operations forces
TACC	tanker airlift control center
TACON	tactical control
TTP	tactics, techniques, and procedures
UNAAF	Unified Action Armed Forces
USAF	United States Air Force
USCINCSPACE	Commander in Chief, United States Space Command
USCINCTRANS	Commander in Chief, United States Transportation Command
USSOCOM	United States Special Operations Command

USSPACECOM	United States Space Command
USSTRATCOM	United States Strategic Command
USTRANSCOM	United States Transportation Command

Definitions

administrative control. Direction or exercise of authority over subordinate or other organizations in respect to administration and support, including organization of Service forces, control of resources and equipment, personnel management, unit logistics, individual and unit training, readiness, mobilization, demobilization, discipline, and other matters not included in the operational missions of the subordinate or other organizations. Also called **ADCON.** (JP 1-02)

aerospace power. The use of lethal and nonlethal means by aerospace forces to achieve strategic, operational, and tactical objectives. (AFDD 2)

airlift. Operations to transport and deliver forces and materiel through the air in support of strategic, operational, or tactical objectives. (AFDD 1)

apportionment. In the general sense, distribution for planning of limited resources among competing requirements. Specific apportionments (e.g., air sorties and forces for planning) are described as apportionment of air sorties and forces for planning, etc. (JP 1-02)

assign. 1. To place units or personnel in an organization where such placement is relatively permanent, and/or where such organization controls and administers the units or personnel for the primary function, or greater portion of the functions, of the unit or personnel. 2. To detail individuals to specific duties or functions where such duties or functions are primary and/or relatively permanent. See also **attach.** (JP 1-02)

attach. 1. The placement of units or personnel in an organization where such placement is relatively temporary. 2. The detailing of individuals to specific functions where such functions are secondary or relatively temporary, e.g., attached for quarters and rations; attached for flying duty. See also **assign.** (JP 1-02)

battlespace. The commander's conceptual view of the area and factors that he must understand to successfully apply combat power, protect the force, and complete the mission. It encompasses all applicable aspects of air, sea, space, and land operations that the commander must consider in planning and executing military operations. The battlespace dimensions

can change over time as the mission expands or contracts according to operational objectives and force composition. Battlespace provides the commander a mental forum for analyzing and selecting courses of action for employing military forces in relationship to time, tempo, and depth. (AFDD 1)

combatant command (command authority). Nontransferable command authority established by title 10, ("Armed Forces"), United States Code, section 164, exercised only by commanders of unified or specified combatant commands unless otherwise directed by the President or the Secretary of Defense. Combatant command (command authority) cannot be delegated and is the authority of a combatant commander to perform those functions of command over assigned forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction over all aspects of military operations, joint training, and logistics necessary to accomplish the missions assigned to the command. Combatant command (command authority) should be exercised through the commanders of subordinate organizations. Normally, this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Combatant command (command authority) provides full authority to organize and employ commands and forces as the combatant commander considers necessary to accomplish assigned missions. Operational control is inherent in combatant command (command authority). Also called **COCOM.** (JP 1-02)

command. The authority that a commander in the Armed Forces lawfully exercises over subordinates by virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions. It also includes responsibility for health, welfare, morale, and discipline of assigned personnel. (JP 1-02)

command and control. The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. Also called **C2.** (JP 1-02)

Defense Information Infrastructure. The shared or interconnected system of computers, communications, data applications, security, people, training, and other support structures serving DOD local, national, and worldwide information needs. The Defense Information Infrastructure connects DOD mission support, command and control, and intelligence computers through voice, telecommunications, imagery, video, and multimedia services. It provides information processing and services to subscribers over the Defense Information Systems Network and includes command and control, tactical, intelligence, and commercial communications systems used to transmit DOD information. Also called **DII.** (JP 1-02)

doctrine. Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application. (JP 1-02)

force protection. Security program designed to protect Service members, civilian employees, family members, facilities, and equipment, in all locations and situations, accomplished through planned and integrated application of combating terrorism, physical security, operations security, personal protective services and supported by intelligence, counterintelligence, and other security programs. (JP 1-02) *[The prevention of successful hostile actions against friendly combat power while it is not directly engaged with the enemy. Force Protection measures may be defensive (passive and active) or offensive, and include the actions of every element of a combat force, encompassing the supporting community and individuals.]* {Italicized definition in brackets applies only to the Air Force and is offered for clarity.} (AFDD 2)

information. 1. Facts, data, or instructions in any medium or form. 2. The meaning that a human assigns to data by means of the known conventions used in their representation. (JP 1-02)

information-in-warfare. Involves the Air Force's extensive capabilities to provide global awareness throughout the range of military operations based on integrated intelligence, surveillance and reconnaissance (ISR) assets; information collection/dissemination activities; and global navigation and positioning, weather, and communications capabilities. Also called **IIW.** (AFDD 2-5)

information operations. Actions taken to affect adversary information and information systems while defending one's own information and in-

formation systems. Also called **IO.** (JP 1-02). *Those actions taken to gain, exploit, defend or attack information and information systems. This includes both information-in-warfare (IIW) and information warfare (IW).* {Italicized definition in brackets applies only to the Air Force and is offered for clarity.} (AFDD 2)

information warfare. Actions taken to affect adversary information and information systems, while defending one's own information and information systems. (JP 1-02)

intelligence. 1. The product resulting from the collection, processing, integration, analysis, evaluation, and interpretation of available information concerning foreign countries or areas. 2. Information and knowledge about an adversary obtained through observation, investigation, analysis, or understanding. (JP 1-02)

joint doctrine. Fundamental principles that guide the employment of forces of two or more Services in coordinated action toward a common objective. It will be promulgated by the Chairman of the Joint Chiefs of Staff, in coordination with the combatant commands, Services, and Joint Staff. See also **doctrine.** (JP 1-02)

joint force. A general term applied to a force composed of significant elements, assigned or attached, of two or more Military Departments, operating under a single joint force commander. See also **joint force commander.** (JP 1-02)

joint force air component commander. The joint force air component commander derives authority from the joint force commander who has the authority to exercise operational control, assign missions, direct coordination among subordinate commanders, redirect and organize forces to ensure unity of effort in the accomplishment of the overall mission. The joint force commander will normally designate a joint force air component commander. The joint force air component commander's responsibilities will be assigned by the joint force commander (normally these would include, but not be limited to, planning, coordination, allocation, and tasking based on the joint force commander's apportionment decision). Using the joint force commander's guidance and authority, and in coordination with other Service component commanders and other assigned or supporting commanders, the joint force air component commander will recommend to the joint force commander apportionment of

air sorties to various missions or geographic areas. Also called **JFACC.** See also **joint force commander.** (JP 1-02)

joint force commander. A general term applied to a combatant commander, subunified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control over a joint force. Also called **JFC.** See also **joint force.** (JP 1-02)

joint task force. A joint force that is constituted and so designated by the Secretary of Defense, a combatant commander, a subunified commander, or an existing joint task force commander. Also called **JTF.** (JP 1-02)

Joint Technical Architecture—Air Force (JTA-AF). The Joint Technical Architecture-Air Force (JTA-AF) forms the foundation for information transfer and processing within the Air Force and is essential to system interoperability. It supplements the Joint Technical Architecture (JTA) and provides the minimal set of rules governing the arrangement, interaction, and interdependence of Air Force system components. It provides the framework of engineering specifications, common building blocks, and product lines which guides system implementations. This technical architecture is based on operational architecture requirements and will constrain systems architecture development. (DISA and HQ USAF/SC)

logistics. The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations that deal with: a. design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; b. movement, evacuation, and hospitalization of personnel; c. acquisition or construction, maintenance, operation, and disposition of facilities; and d. acquisition or furnishing of services. (JP 1-02)

military strategy. The art and science of employing the armed forces of a nation to secure the objectives of national policy by the application of force or the threat of force. (JP 1-02)

National Command Authorities. The President and the Secretary of Defense or their duly deputized alternates or successors. Also called **NCA.** (JP 1-02)

national strategy. The art and science of developing and using the political, economic, and psychological powers of a nation, together with its armed forces, during peace and war, to secure national objectives. (JP 1-02)

operational control. Transferable command authority that may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in combatant command (command authority). Operational control may be delegated and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions. Operational control does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. Also called **OPCON.** (JP 1-02)

operational level of war. The level of war 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 or space than do tactics; they ensure the logistic and administrative support of tactical forces, and provide the means by which tactical successes are exploited to achieve strategic objectives. (JP 1-02)

operational risk management. The systematic process of identifying hazards, assessing risks, analyzing risk control measures, making control decisions, implementing risk controls, and supervising and reviewing the process. Commanders accept the residual risks. (AFI 91-213)

reachback. The process of obtaining products, services, and applications, or forces, equipment, or materiel from Air Force organizations that are not forward deployed. (AFDD 2)

reconnaissance. 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. (JP 1-02)

special operations. Operations conducted by specially organized, trained, and equipped military and paramilitary forces to achieve military, political, economic, or informational objectives by unconventional military means in hostile, denied, or politically sensitive areas. These operations are conducted across the full range of military operations, independently or in coordination with operations of conventional, non-special operations forces. Political-military considerations frequently shape special operations, requiring clandestine, covert, or low visibility techniques and oversight at the national level. Special operations differ from conventional operations in degree of physical and political risk, operational techniques, mode of employment, independence from friendly support, and dependence on detailed operational intelligence and indigenous assets. Also called **SO.** (JP 1-02)

spectrum management. Planning, coordinating, and managing joint use of the electromagnetic spectrum through operational, engineering, and administrative procedures, with the objective of enabling electronics systems to perform their functions in the intended environment without causing or suffering unacceptable interference. (AFI 33-118)

strategic level of war. The level of war 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 those 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. (JP 1-02)

strategy. The art and science of developing and using political, economic, psychological, and military forces as necessary during peace and war, to afford the maximum support to policies, in order to increase the probabilities and favorable consequences of victory and to lessen the chances of defeat. (JP 1-02)

surveillance. The systematic observation of aerospace, surface or subsurface areas, places, persons, or things, by visual, aural, electronic, photographic, or other means. (JP 1-02)

tactical control. Command authority over assigned or attached forces or commands, or military capability or forces made available for tasking, that is limited to the detailed and, usually, local direction and control of movements or maneuvers necessary to accomplish missions or tasks assigned. Tactical control is inherent in operational control. Tactical control may be delegated to, and exercised at any level at or below the level of combatant command. Also called **TACON.** (JP 1-02)

tactical level of war. 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 to the enemy to achieve combat objectives. (JP 1-02)

tactics. 1. The employment of units in combat. 2. The ordered arrangement and maneuver of units in relation to each other and/or to the enemy in order to use their full potentialities. (JP 1-02)

theater. The geographical area outside the continental United States for which a commander of a combatant command has been assigned responsibility. (JP 1-02)

war. Open and often prolonged conflict between nations (or organized groups within nations) to achieve national objectives. (AFDD 1)