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THE AIRSPACE CONTROL SYSTEM – A KEY TO OPERATIONAL MANEUVER

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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9 February 2004

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Abstract

The Airspace Control System – A Key to Operational Maneuver

The Airspace Control System (ACS) was developed out of a need to conduct operational maneuver and still protect the safety of forces in any combat environment. This paper examines the tension that is created between the force conservation focus of the ACS and the Joint Forces Commander's need to freely conduct operational maneuver to achieve decisive advantages over the enemy. The discussion begins with a historical illustration of ACS trends, which explores operations that were constrained due to inadequate freedom of maneuver, ill-conceived command and control, and tactics that risked air and ground forces.

It will be shown that joint doctrine today still fosters these trends by not delineating an adequate means to achieve desired fundamentals of war via the ACS. Further complicating what the ACS can deliver are service-centric Command, Control, Communications, Computers, and Intelligence (C4I) systems that detract from the ability to positively control and protect users due to inadequate interoperability and standardization. Joint Tactics, Techniques, and Procedures (JTTP's) attempt to integrate overarching joint doctrine and service-centric C4I systems, but limit maneuver in the interest of safety.

In order to mitigate the tension between the force conservation focus of the ACS and the need to freely conduct operational maneuver, it is necessary to revise joint doctrinal and JTTP methodology, as well as enhance joint ACS training in order to understand and overcome some of the self-imposed limits. In order to eventually eliminate this tension, which is vital to future military effectiveness, the joint community and services must develop, acquire, and program/fund a truly joint net-centric ACS that can safely integrate, manage, and harness positive control of all users and missions in real time.

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The first and absolute requirement of strategic air power in this war was control of the air in order to carry out sustained operations without prohibitive losses.

Air control can be established by superiority in numbers, by better employment, by better equipment, or by a combination of these factors.

— General Carl A. 'Tooey' Spaatz

INTRODUCTION

Imagine the following...an A-10 is on a mission to support ground troops that are engaged in a ground battle with the enemy. Suddenly, an Unmanned Aerial Vehicle (UAV) that has been re-tasked to monitor an emerging threat begins to pass 300 feet below the A-10. The A-10 pilot takes drastic measures to avoid the UAV. The incident jeopardizes important real-time imagery, key and expensive military assets, and potentially the lives of the pilot and the ground troops he was in the process of supporting. This is a true account of an actual mission that has been sanitized for unclassified release.¹ It is one of many incidents that occur within the Airspace Control System (ACS) during combat air operations.

Current joint doctrine and operating procedures do not adequately address the tension between the force conservation focus of the ACS and the Joint Forces Commander's (JFC) need to freely conduct operational maneuver in order to achieve decisive advantages over the enemy. This tension is the result of three factors. First, joint doctrine places a greater emphasis on achieving fundamentals of war than on the means in which they must be executed. While concepts in joint doctrine present an operational commander with numerous desired conditions and outcomes, they provide little guidance on how to achieve these within the actual capabilities of the ACS. Second, each of the services, together with alliance and coalition partners, brings service-centric Command, Control, Communications, Computers, and Intelligence (C4I) systems to the fight. Due to the lack of interoperability and standardization, there is no way to positively command and control all the various systems

within the ACS, which complicates the real-time maneuver and security of forces. Lastly, the Joint Tactics, Techniques, and Procedures (JTTP's) that attempt to integrate overarching joint doctrine and service-centric C4I systems into the ACS exacerbate the problem. The ACS uses procedural control measures constructed to enable safe and successful mission accomplishment, yet these measures restrict operational maneuver without eliminating safety risks. This paper will examine these dilemmas by first providing historical examples that illustrate this tension and its outcomes. Analysis will then be conducted with an eye to developing concrete reasons why this tension exists and why it might be viewed as acceptable. Finally, recommended short-term and long-term solutions will be presented so that this tension can first be mitigated, and eventually be eliminated.

HISTORY OF AIRSPACE CONTROL

The ACS was conceived with the intention of assisting combat air assets to achieve missions expeditiously and safely. Despite the best intentions of ACS developers, there are three major historical ACS areas that still plague operational commanders today. The first is JTTP's that limit freedom of maneuver. The second is caused by the inadequate integration and execution of service-centric C4I systems. The third are safety risks to friendly military air and ground assets and personnel. These problem areas manifest themselves as tensions between conserving war fighting assets and the ability to positively maneuver forces.

The advent of radar in the early 1900's enabled operational commanders to positively control aircraft. Positive airspace control is defined as, "a method of airspace control which relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility

therein.”² However, since radar had a limited range and was rarely available in areas of conflict, another means to deconflict battle space users had to be developed.

What evolved was a procedural ACS system. Procedural airspace control is defined as “a method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures.”³ This was basically a system of horizontally and vertically separated routes and restricted areas.⁴ The thought was that this could safely achieve the desired mission beyond the eyes of positive radar control – what resulted was displeasure due to inflexibility. Some World War II operational commanders found that the new ACS “was grievously cramping the freedom of action and success.”⁵ Operational commanders were upset that, “restrictive procedures, rather than solutions based on freedom of movement within the combat zone airspace,” were the only answer to this complex dilemma.⁶ In order to solve this, ACS doctrine and JTTP’s were developed and introduced. A driving factor for this development was the inadequate interaction between air and ground forces in Vietnam. The Air Force did not want to, “dedicate airspace to the peculiar use of any particular service,” and demanded that artillery fire be, “shut off when potential low altitude interference existed.”⁷ On the other hand, the Army wanted to, “reserve block airspace for helicopter use in an attempt to eliminate interference with fixed wing close air support aircraft and other fast traffic transiting the area and allow for freedom of helicopter movement as required for their ground forces.”⁸ The air war over Kosovo encountered similar issues. “Persistent problems with the flexible targeting effort,” as well as operations that, “sought to deconflict allied aircraft by parceling out the most impacted airspace so that only a given number of friendly aircraft would be operating inside a block at a given time,” left operational commanders with few options, and very upset with ACS.⁹

The second category of ACS displeasure has been a result of the use of service-centric C4I systems that attempt to harness positive control to provide greater maneuver while conserving forces. In an attempt at a solution, weapons systems such as AWACS in Desert Storm, tried to enhance maneuver by providing vectors and directions to aircraft, but each was “limited in its capacity to provide control because it did not have a real-time air...picture.”¹⁰ During Kosovo, the ACS was, “unable to track military aircraft operating from the several aircraft carriers that were deployed in the Adriatic and, for that reason, faced serious deconfliction problems with civil traffic flying along the southern air routes.”¹¹ This was due to the, “absence of a robust alliance-wide [Identification Friend or Foe] IFF system.”¹² The disparity and lack of standardization between service-centric and alliance C4I systems magnified the need for more concise doctrine and JTTP’s, as well as a system that could provide an operational commander the ability to safely and positively run an ACS.

While the ACS lacked flexibility and control, it also failed to deliver in terms of safety for equipment and forces in the air and on the ground. The rigidity of the procedural ACS in Desert Storm often led to a, “predictable axis of attack [similar to that] used in Vietnam.”¹³ In Kosovo, “unlike in the more permissive Desert Storm operating environment, airspace availability limitations in the war zone typically made for high predictability on the part of attacking NATO aircraft, and collateral damage avoidance considerations frequently prevented the use of the most tactically advantageous attack headings.”¹⁴ These issues presented the enemy with an operational insight into a key strategic vulnerability. Additionally, because the airspace inside and around the Area of Operations (AO) was generally congested, there was a high probability of midair collisions. In Desert Storm, some pilots would turn on their anti-collision system because they thought there was, “more danger

of a midair collision...than being engaged by Iraqi defenses.”¹⁵ In Kosovo, “there were numerous reported incidents of near-midair collisions caused by marginal weather and an insufficiency of battle management information relayed by AWACS to friendly aircraft operating in and near the combat zone.”¹⁶ Added to the safety equation is the effect of interactions between air and ground forces and the risk of fratricide. During Operation Iraqi Freedom (OIF), “reports indicate that U.S. A-10s killed nine U.S. Marines on March 23 [2003], the day on which the United States lost 29 personnel and which some analysts have called the worst day of the war. These figures are much more consistent with the pattern of fratricide in the Gulf War, where 35 out of 147 combat deaths—some 24 percent—were the result of friendly fire.”¹⁷ Despite the fact that these ACS shortcomings are experienced time after time in conflicts fought by the U.S. military, our doctrine, systems, and JTTP’s today do not adequately manage the tension between force conservation and operational maneuver.

ANALYSIS OF ACS DEFICIENCIES

This analysis will first address the areas where joint doctrine focuses more on the desired outcomes or fundamentals of war rather than on the means in which they must be executed, which leads operational commanders into false understandings on what the ACS can deliver. Then a look at service-centric C4I systems will explain how unique and independently implemented architectures further complicate the ACS. Finally, the JTTP’s that integrate doctrine and systems use a variety of procedural control measures that create the tension experienced between force conservation and operational maneuver.

Joint Doctrine

Joint doctrine provides, “fundamental principles and doctrine that guide the Armed Forces of the United States in the conduct of joint and multinational operations,” and gives

operational commanders a guiding document or pathway to assist them in preparing for and executing military operations.¹⁸ Appendix A shows some of the operational art considerations that an operational commander should consider and strive to achieve when preparing and executing military operations. The concept of synergy is one of these considerations. Joint Publication (JP) 3-0, Doctrine for Joint Operations, states that:

Synergy achieved by integrating and synchronizing the actions of air, land, sea, space, and special operations forces in joint operations and in multiple dimensions enables JFCs to project focused capabilities that present no seams or vulnerabilities to an adversary to exploit. JFCs are especially suited to develop and project joint synergy given the multiple unique and complementary capabilities available only within joint forces. The synergy of the joint force depends in large part on a shared understanding of the operational situation. JFCs integrate and synchronize operations in a manner that applies force from different dimensions to shock, disrupt, and defeat opponents.^{19*}

If an operational commander expects and plans that the ACS will be able to deliver operations in line with this definition of synergy, he or she will be significantly surprised with the limitations that the ACS imposes. Additionally, the concept of joint fires states that:

Air, land, maritime, amphibious, and special operations forces...move, maneuver, and control territory, populations, airspace, and key waters. Joint fires and joint fire support may include, but are not limited to, the lethal effects of close air support by fixed- and rotary-wing aircraft, naval surface fire support, artillery, mortars, rockets, and missiles, as well as non-lethal effects such as EW. Integration and synchronization of joint fires and joint fire support with the fire and maneuver of the supported force is essential.²⁰

Note that the underlined conditions all speak to concepts of seamlessness, fluidity, multiple systems working in unison in multiple dimensions, free movement, common understanding amongst users – all working in harmony. Joint doctrine ignores the fact that the ACS may not be able to provide these expectations to the operational commander by failing to integrate the system and JTTP limitations that obstruct these ideal conditions from being attained.

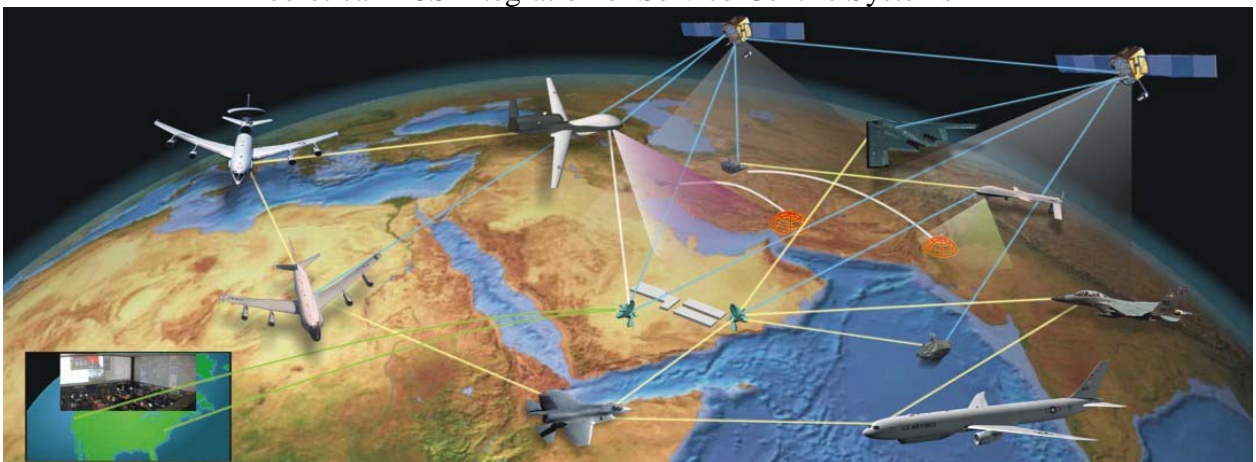
**Note: underlined conditions, done by the author throughout this section of the paper, emphasize desired conditions for purposes of examination.*

JP 3-52, Joint Airspace Control in the Combat Zone, provides a closer look at the ACS and what the operational commander should expect in terms of the functionality and results. Appendix B shows some of the fundamental considerations of airspace control that an operational commander should consider and strive to achieve when preparing and executing military operations. One ACS consideration is, “the need for the combat zone airspace control system to be responsive to the requirements of the joint force. The airspace control system [also] needs to be capable of supporting high-density traffic and surge operations as may be required by the joint force commander.”²¹ While these considerations do support synergy and maneuver expected in JP 3-0, they too fail to consider the inflexibility of the procedural ACS as well as the inherent complications between service-centric and coalition system differences. Some of the basic ACS principles (see Appendix C) state that, “procedural control needs to be uncomplicated,” and that, “flexibility and simplicity must be emphasized.”²² Although these principles do meet the expectations of JP 3-0, they do not take into consideration or explain the complicated structure of the ACS and the lack of flexibility that is inherent to achieving safety. Finally, procedures and methods for the ACS (see Appendix D) should prevent interference, facilitate identification, safely expedite the flow of all traffic, prevent fratricide, and positively identify, track, and direct all air assets.²³ Again, these procedures and methods meet the expectations of JP 3-0, but assume that there is a process and system that can deliver each expected result – there is not. An examination into the service-centric systems and JTTP’s will show why the ACS cannot seamlessly deliver the fundamentals of war joint doctrine desires, as well as why the tension between force conservation and operational maneuver exists.

Service-Centric Systems

The land, naval, and air forces all have systems that require the use of airspace. Some aerial operations that land units expect to perform are troop movements, surface-to-air air defense operations, and ground-to-ground close combat operations. Naval units may use even more air to employ assets in the performance of undersea, surface, strike, command and control (C2), amphibious, and air defense warfare. Though primarily composed of fixed and rotary winged assets, naval units may also launch unmanned Tomahawk cruise missiles. Air units, which may include a combination of services, may execute counter-air, counter-space, counter-land, counter-sea, strategic attack, C2, airlift, special operations, combat search and rescue, and intelligence, surveillance, and reconnaissance (ISR) missions. The magnitude of service-centric missions and equipment that must work in unison to achieve the desired fundamentals and outcomes of war is overwhelming. An illustration of what must be considered when attempting to synergistically integrate and synchronize these complex and diverse ACS operations is provided in Figure 1. Unfortunately, each service-centric system

Figure 1
Theoretical ACS Integration of Service-Centric Systems²⁴



cannot currently be integrated into a common operating picture, such as that depicted in Figure 1, that can flexibly and safely command and control all of these assets.

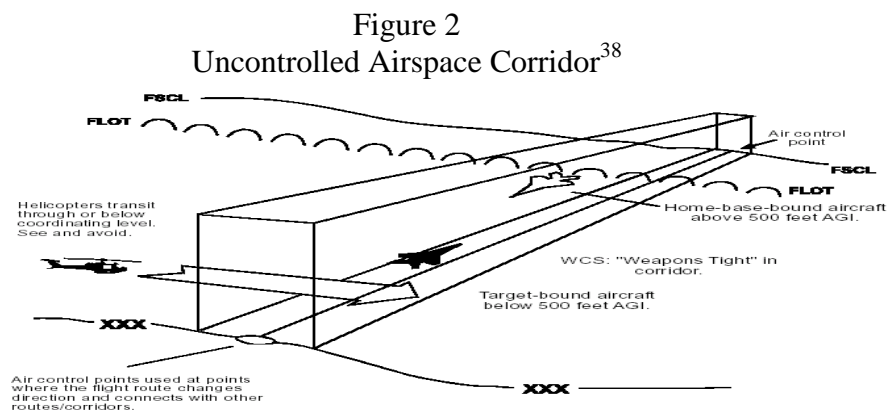
During OIF the U.S. was able to develop and display a common operating picture that displayed most airspace users; however, it could not be used for real-time positive C2. “[OIF] was not fought by U.S. forces using well-structured architecture for joint warfare, or a system of systems that effectively cut across service lines in any integrated manner. It was fought using a range of evolving C4I and training systems that were still heavily service-centric.”²⁵ For example, some ACS systems and users had data-link capabilities, called LINK-16, which enabled combat systems of aircraft, ships, ground based air defense systems, and others to exchange digital information to assist with flexible maneuver and collision avoidance.²⁶ Assets without data-link were not able to maneuver as quickly and safely, and often required linkages that had to be “cobbled together or improvised” due to “serious gaps and incompatibilities” with the ACS.²⁷ Other ACS systems had access to the Army’s “Blue Force Tracker,” which displayed coalition ground troop locations.²⁸ While this presented ground forces with situational awareness, it was not interoperable with LINK-16, which could have improved aerial visibility of ground forces and lessened fratricide risks.²⁹ The intention of the respective systems is sound--they provide some level positive control that can translate into force conservation. However, when implemented in a piecemeal fashion, it further complicates the procedural system that seeks to integrate all ACS systems, and gives the operational commander a false sense of operational flexibility and safety in trying to achieve the desired fundamentals and outcomes of war.

JTTP's

The Integrated Combat Airspace Command and Control (ICAC2) establishes JTTP's "for planning, implementing, executing, and deconflicting airspace, including addressing specific airspace control issues for specialized missions [such as UAV's]. [It also] outlines the information, interfaces, and communications required for supporting the integrated airspace control function."³⁰ Its purpose is to coordinate service-specific uses and systems for the ACS, then implement procedural airspace control measures (ACM's) and fire support coordinating measures (FSCM's) that can achieve desired doctrinal fundamentals and outcomes of war. This part of the analysis will describe how the service-specific uses and C4I systems that operate within the ACS, together with the JTTP's that attempt to integrate those systems, create tension between operational maneuver and force conservation.

The ACS is implemented and executed based on, "time constraints, preliminary preparation, available service or functional component resources, and the situation assessments" of the airspace control plan (ACP).³¹ The ACP provides specific planning guidance and procedures for the ACS and summarizes the JFC's guidance on airspace control, joint force airspace control organization, airspace control processes, and, if authority is delegated, explicitly defines the responsibilities delegated to each components.³² During the ACP process operational commanders will make determinations on the degree of acceptable risk in controlling airspace users, which control methodology (degree of positive and/or procedural control) to use, and the means required to institute control measures.³³ Positive control methods are preferred, "providing the maximum safety and efficiency for airspace users," yet procedural control is always used because there is no positive means to integrate and control all ACS users.³⁴ Because of this, ICAC2 only offers procedural airspace control measures (ACM's) and fire support coordinating measures (FSCM's).

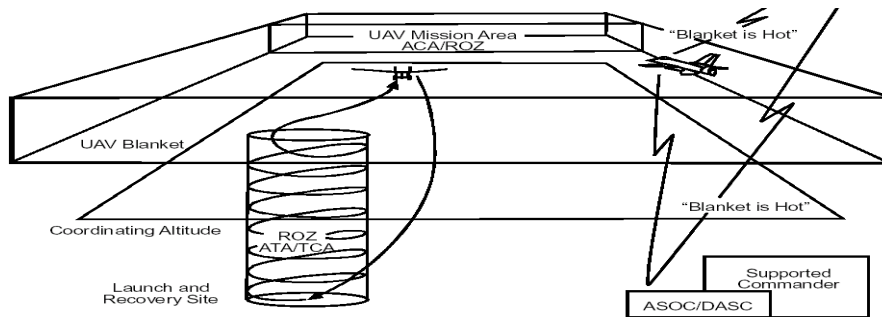
During OIF, the “air battle involved some 1,800 airspace control measures, of which an average of 1,200 had to be implemented a day” forcing considerable deconfliction measures.³⁵ An air corridor, an example of an ACM, is a “restricted air route of travel specified for use by friendly aircraft and established to prevent friendly forces from firing on friendly aircraft.”³⁶ It can be seen in Figure 2 that this procedural measure provides a level of protection to the user, but at the same time limits an operational commander from maneuvering other forces through the corridor unless risk is assumed. For example, corridors to and from air refueling tracks during Operation Enduring Freedom (OEF) and OIF, as well operations in the tracks, generated over 30 near-midair collisions.³⁷ “The



coordination problems in such efforts create a need for dedicated forms of air control management [other than procedural control].”³⁹

ACM’s (full listing at Appendix E) also make it extremely difficult to coordinate UAV’s that may need to move for real-time intelligence gathering, as well as other ACS users that may need to use UAV airspace to respond to Time Sensitive or Critical Targets (TSTs/TCTs). As shown in Figure 3, this inefficiency exists because airspace the UAV uses

Figure 3
UAV Protocol⁴⁰



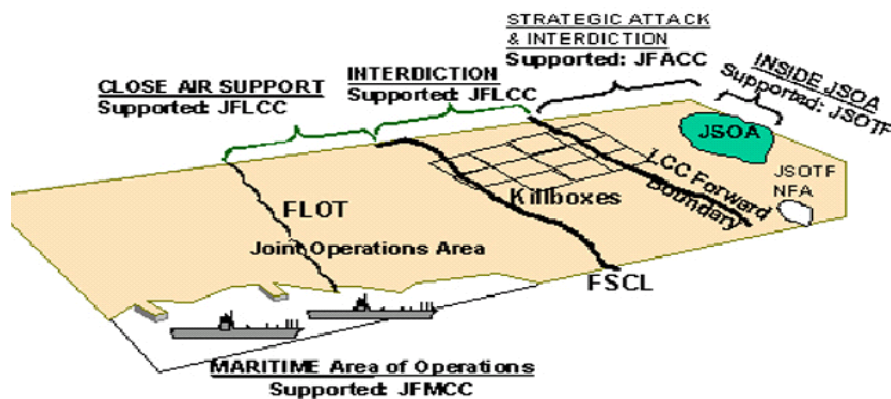
has to be blocked off or restricted from other ACS users, so there is no means to adequately deconflict unplanned missions. TSTs are those requiring immediate response because they pose, or will soon pose, a danger to friendly forces or are highly lucrative, fleeting targets of opportunity.⁴¹ TCTs are TSTs with an extremely limited time window of vulnerability, the attack of which is critical to ensure the successful execution of the JTF operations.⁴²

Analysis on this issue after OIF indicated that “the U.S. and its allies simply do not yet have a fully effective and reliable set of sensors, processors, and methods to...support near-real-time allocation of force assets for either tactical or targeting purposes.”⁴³ The procedural environment in OIF generated “a wide range of problems affecting the sensor-to-shooter gap, time-urgent targeting, and dynamic targeting as well as deconflict and avoiding traffic.”⁴⁴ There are measures airspace planners take, such as stacking aircraft at pre-positioned areas in the AO, to try to avoid ACM conflicts and expedite TST/TCT response; however, this limits the use of those assets and creates further issues with the synchronization of other ACS users due to additional procedural restrictions placed on the stacking area.⁴⁵

Similarly, FSCM’s are procedural measures used to enhance the expeditious attack of targets and protect forces or objects.⁴⁶ These are fire and fire support lines that are created to identify where troops are (Forward Line of Troops--FLOT) and where fire support can be executed without jeopardizing safety (Fire Support Coordination Line--FSCL). These procedural measures provide a level of protection to the user, but limit an operational

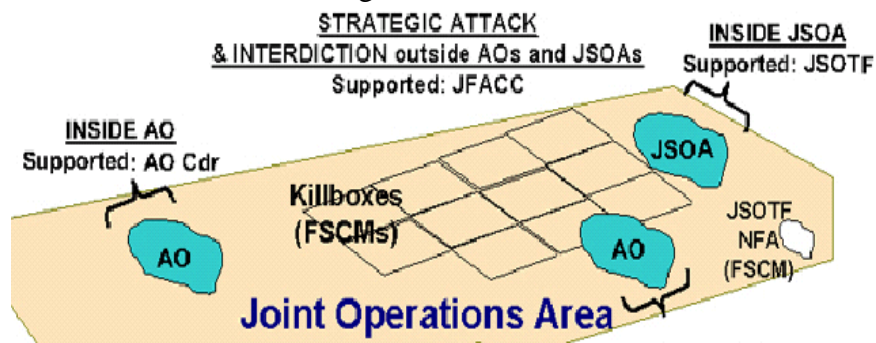
commander from striking targets near the FLOT or inside the FSCL unless positive communications and contact can be established between ground and air forces using systems that may or may not be interoperable. A way to currently get around this is through the use of kill boxes (see Figure 4). These 30-minutes-of-latitude by 30-minutes-of-longitude grids clear the area for attack, yet add another procedural measure that limits maneuver for the sake of force conservation.⁴⁷ Although lessons learned from OIF find that the “kill box”

Figure 4
Traditional Linear Battlefield⁴⁸



system was somewhat effective, much still needs to be done to improve maneuver and TCT/TST strike capabilities, as well as the identification of fast moving land forces.⁴⁹ Add to this, complications in identification and coordination when launching deep strike weapons at targets beyond the FSCL or on a noncontiguous battlefield (see Figure 5) where Special

Figure 5
Noncontiguous Battlefield⁵⁰



Operations Forces (SOF) operate in Joint Special Operations Areas (JSOA). In OEF, a system of kill boxes and fires clearance procedures minimized the potential for fratricide while providing agility and responsiveness, but this was mostly all done informally; no clear battle space geometry for SOF was established.⁵¹ The complexity and inflexibility of procedural corridors and boundaries, combined with communications and identification that are not fully interoperable due to service-centric systems, lead to a tension between force conservation and operational maneuver. Some operational commanders may defend the system, feeling it satisfactorily won major operations with minimal casualties. Similarly, some might argue that risk can be assumed where and when necessary if it is needed to win an operation. Though these arguments confirm the military's "can do" attitude, the number of aerial systems will only increase, along with the complexity involved in synchronizing those systems. The U.S. military should be proactive in anticipating future situations that can solve ACS tensions so war can be waged more effectively.

RECOMMENDATIONS

In order to overcome the tension between the force conservation focus of the ACS and the JFC's need to freely conduct operational maneuver in order to achieve decisive advantages over the enemy, the joint community and services must revise doctrinal and JTTP methodology; enhance joint ACS training to overcome the limits self-imposed by service-centric doctrine and systems; and simultaneously acquire, and program/fund a truly joint net-centric ACS that delivers real-time positively controlled airspace.

Joint doctrine presently fails to resolve the tension between force conservation and operational maneuver in the ACS. References to this tension are sprinkled throughout JP 3-0 and JP 3-52. JP 3-0 mentions that protection, safety, and the avoidance of fratricide are

necessary, but advise operational commanders only that preventative measures should be implemented to mitigate this risk.⁵² Similarly, JP 3-52 recognizes these tensions, and presents a myriad of procedural methodology to mitigate risk.⁵³ The fact remains that these considerations do not resolve the tension between force conservation and operational maneuver; rather they continue to establish barriers that tie an operational commander's hands. The capabilities of the U.S. military and other allied or coalition partners are understood. Therefore, the expectant results of what these various systems can deliver in combat must be present in joint doctrine so that operational plans do not center on an ACS that cannot deliver. After action reports from OEF and OIF are available, and explain the ACS limitations experienced in procedurally constructed and executed systems. Joint doctrine must accurately portray the limitations of ACS barriers, as well as the capabilities and realistic expectations operational commanders can expect from any ACS environment. Technology such as LINK-16 and Blue Force Tracker can reduce this tension; ergo the lessons learned must be integrated into new control procedures and doctrinal guidance so that force conservation and operational maneuver in the ACS can continue to improve. Further, new procedures such as TCT/TST and kill boxes have not been codified in doctrinal publications, and need to be due to their assured use in future conflicts. Although this tension will not be eliminated, it can and should be predictable and realistic when the next JFC has to plan for future deliberate or emergency military operations.

Similarly, the JTTP's that create the current ACS construct fail to resolve the tension between force conservation and operational maneuver. The various service-specific requirements, ACM's, and FSCM's provide JFC's the tools to establish a safe ACS, but do not relieve the tension.⁵⁴ ICAC2, like joint doctrine, must accurately portray current

limitations of the ACS, as well as the capabilities and realistic deliverables an operational commander can expect from any ACS environment. New technology and theory used in recent conflicts such as TCT/TST, FSCM's beyond the FSCL, data-link, and Blue Force Tracker must continually be updated in ICAC2 so that JTTP's do not have to be developed by the warfighters "on the fly."⁵⁵ If this is done, service interoperability conflicts in the battle space, as well as the tension between safety and operational maneuver, can be reduced.

Joint training must be planned and executed in concert with updates to joint doctrine and JTTP's. As it stands now, joint ACS training receives a low priority as services tend to prefer training that emphasizes their core capabilities.⁵⁶ Although the U.S. military does exceptionally well at overcoming insufficient JTTP's and training when at war, this cannot be the norm. Funds are limited, enemies may not always be easily overwhelmed, and leaders expect immediate results with few casualties. Joint training exercises such as Millennium Challenge 2002 and Joint Expeditionary Force Experiment, which will happen in 2004, force the services to work together but have not yet simulated the complex and dynamic ACS environment encountered in reality. To better prepare operational commanders, as well as those that tactically execute air missions, U.S. Joint Forces Command must replicate the ACS tensions that exist between force conservation and operational maneuver during these exercises. Likewise, the respective services cannot unilaterally design JTTP's that focus only on the abilities of respective weapons systems without understanding the consequences to the ACS and joint operations. "It requires that service-centric commands train and operate with joint elements at all times, and that major changes take place in command post and field training exercises to ensure this."⁵⁷ This will not eliminate the tension, but will prepare

commanders for expected ACS realities, identify deficiencies and joint force interoperability issues, and gradually reduce the tension until it can someday be eliminated forever.

In order to eliminate the tension between force conservation and operational maneuver forever, the joint community and services must develop, program, and fund a truly joint network-centric ACS that delivers full battle space control. “The development and deployment of a truly modern and effective C4I system is fundamental to the transformation of the US military forces...and winning wars.”⁵⁸ Due to the fact that this truly effective system does not yet exist, the approach to designing this system must be regressive in nature. The lead service or joint program office should understand but disregard current ACS JTTP’s, so that all efforts can be concentrated on what can be done to achieve the desired goal rather than on service-centric systems and undeliverable JTTP’s. It should be noted that there are some efforts to reduce the tension through concepts such as the Single Integrated Air Picture (SIAP), which seeks to enable existing and future sensors to cooperate better and share a single picture of the battlefield.⁵⁹ While the SIAP and other efforts may create a common picture from the various service-centric systems, they do not eliminate the procedural boundaries that limit operational maneuver and sensor-to-shooter timelines. The network-centric ACS must enable real-time joint/AO-wide connectivity among all ACS users, fluid ATO execution, dynamic re-tasking of any/all air asset, spontaneous TCT/TST operations/taskings, combat identification of all friendly and enemy forces, as well as reach back to operational commanders with highly reliable redundancy.⁶⁰ Until the ACS can become completely joint and integrated, barriers will continue exist that create undue tension between the conservation of forces and operational maneuver.

CONCLUSION

Operational commanders that plan, implement, and direct forces utilizing the current ACS are not able to fully realize what joint doctrine advertises. Additionally, the ACS establishes procedural barriers that impede flexibility, synchronization, and safety. Historically the ACS has consistently been a source of frustration due to these barriers, yet the same procedural framework is still applied to a system that generates tension between force conservation and operational maneuver. The ACS today, more than ever before, has become a complex system of separate parts, requirements, and demands. Every service uses the air for operations spanning from UAV reconnaissance, to strategic attack, to airlift, to sea launched tactical Tomahawk missiles. Add to this environment the myriad of service-centric C4I systems that cannot be integrated into joint net-centric system for dissemination and control, which lessens their overall utility to the operational commander. It is not enough to publish ideal fundamentals and outcomes of war in joint doctrine, and then hope that the existing ACS system can deliver. Joint doctrine, which guides operational commanders and planners, needs to be realistic and current to achieve the most decisive results. This also requires that the JTTP's that implement this doctrine need to be realistic and up to date. New technology and tactics need to be realistically integrated into JTTP's so that the link between operational commanders and ACS planners can be accomplished. This is why realistic joint training is a necessity before going to war, and is preferred over establishing ad hoc procedures in war that add to the tension between force conservation and operational maneuver. In the future, operational commanders deserve an ACS that is network-centric, enables real-time joint/AO-wide connectivity among all ACS users, can provide fluid mission execution, dynamic re-tasking of any/all air asset, spontaneous TCT/TST operations/taskings, combat identification of all friendly and enemy forces, as well as reach

back to operational commanders with highly reliable redundancy – the joint community and services must deliver.⁶¹ Because the U.S. cannot always dictate or anticipate enemy capabilities, the unpredictable future of warfare depends on an ACS that can cohesively meet these goals so that the military can be ready to plan, fight, and win any conflict anywhere in the world at any time.

Appendix A

Facets of Operational Art / Considerations for Sustained Combat Operations⁶²



Considerations for Sustained Combat Operations

1. Relationship between offense and defense
2. Linear and nonlinear operations
3. Air, naval, space, and information superiority
4. Attack of enemy centers of gravity
5. Maneuver
6. Interdiction
7. Synchronizing and/or integrating maneuver and interdiction
8. Joint fires
9. Sustainment
10. Combat Assessment

Appendix B

Fundamental Considerations of Airspace Control in the ACS⁶³

FUNDAMENTAL CONSIDERATIONS OF AIRSPACE CONTROL IN THE COMBAT ZONE

- The need for each Service or functional component within the joint force to operate a variety of air vehicles and weapon systems, both high and low speed, rotary- and fixed-wing (manned and unmanned), within the combat zone airspace control area.
- The need for each Service or functional component to use the airspace with maximum freedom consistent with the degree of risk operationally acceptable to the joint force commander.
- The need for airspace control activities to be performed in congruence with air defense operations to integrate and synchronize surface-to-air defense weapons and air defense aircraft for maximum effectiveness.
- The need to discriminate quickly and effectively between friendly, neutral, and enemy air operations and vehicles.
- The need for the combat zone airspace control system to be responsive to the requirements of the joint force. The airspace control system needs to be capable of supporting high-density traffic and surge operations as may be required by the joint force commander.
- The need for close coordination and integration of surface force operations, supporting fires, air operations, air defense operations, special operations, and airspace control activities.
- The need to accommodate US, host-nation, and multinational airspace control activities within the joint combat zone.
- Recognition of the saturation levels and limitations of airspace control networks.
- The need for temporary restrictive airspace control measures on certain areas of airspace to allow subordinate commanders total freedom of operations.
- Detailed incorporation of coordinated offensive operations using electronic warfare elements, strike aircraft, and cruise missiles to ensure that defensive elements or procedures of the force do not unacceptably inhibit or degrade offensive capabilities.
- The need to ensure that the airspace control network remains survivable and effective.
- The need to provide maximum opportunities to employ deception measures.
- The need to standardize communications data, format, and language requirements in multinational operations to reduce the possibility for differences in interpretation, translation, and application of airspace control procedures during multinational operations.
- The capability to support day or night and all-weather operations.

Appendix C

Basic Principles of Airspace Control in the ACS⁶⁴

BASIC PRINCIPLES OF AIRSPACE CONTROL IN THE COMBAT ZONE

- ☒ Unity of effort.
- ☒ Reduce the risk of fratricide and balance those risks with the requirements for an effective air defense.
- ☒ Close liaison and coordination among all airspace users.
- ☒ Common combat zone airspace control procedures.
- ☒ Procedural control needs to be uncomplicated.
- ☒ A reliable, jam-resistant, and, where appropriate, secure command, control, communications, and computers (C4) network.
- ☒ Durable and redundant systems.
- ☒ Responsive to evolving enemy threat conditions and to the evolving operation.
- ☒ Service component air traffic controller training needs to be augmented by combat-specific air traffic control training.
- ☒ Flexibility and simplicity must be emphasized.
- ☒ Capable of supporting day or night and all-weather operations.



Appendix E

Procedural Airspace Control Measures⁶⁶

- Air Corridor
- Air Defense (AD) Action Area
- Air Defense Area
- Air Defense Operations Area
- Airspace Control Area
- Airspace Control Sector
- Airspace Coordination Area
- Amphibious Defense Zone
- Amphibious Objective Area (AOA)
- Falcon Radials
- Firepower Umbrella
- High-Altitude Missile Engagement Zone (HIMEZ)
- Low-Altitude Missile Engagement Zone (LOMEZ)
- Air Defense Identification Zones (ADIZ)
- Coordinating Altitude (CA)
- High-Density Airspace Control Zone (HIDACZ)
- Low Level Transit Routes (LLTR)
- Minimum Risk Routes (MRR)
- Restricted Operations Area and Restricted Operations Zones (ROA/ROZ)
- Return-to-Force (RTF) Profile*
- Special Operations Forces Operating Areas
- Special Use Airspace
- Standard Use Army Aircraft Flight Routes (SAAFR)
- Weapons Engagement Zones (WEZ)
 - Base Defense Zone (BDZ)
 - Fighter Engagement Zone (FEZ)
 - Joint Engagement Zone (JEZ)
 - Missile Engagement Zone (MEZ)

Appendix F

Fire Support Coordinating Measures⁶⁷

- Coordinated Fire Line (CFL)
- Fire Support Coordination Line (FSCL)
- Free-Fire Area (FFA)
- Restrictive Fire Line (RFL)
- No-Fire Area (NFA)
- Airspace Coordination Area
- Restrictive Fire Area (RFA)
- Zone of Fire
- Boundaries
- Phase Lines (PL)
- Fire Support Area (FSA) and /or Fire Support Station (FSS)

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⁶ Armed Forces Staff College, Command and Control of Airspace in a Theater of Operations, (Norfolk, VA: 1975), I-13 & II-1-4.

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¹⁰ Fred Frostic, Air Campaign Against the Iraqi Army in the Kuwaiti Theater of Operations, (Santa Monica, CA: RAND, 1994), 33.

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¹² Ibid., 168.

¹³ Frostic, Air Campaign Against the Iraqi Army in the Kuwaiti Theater of Operations, 65.

¹⁴ Lambeth, NATO’s Air War for Kosovo, A Strategic and Operational Assessment, 102.

¹⁵ Frostic, Air Campaign Against the Iraqi Army in the Kuwaiti Theater of Operations, 40.

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²⁰ *Ibid.*, IV-16-17.

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²² *Ibid.*, I-4.

²³ *Ibid.*, III-3-5.

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²⁵ Cordesman, The Iraq War: Strategy, Tactics, and Military Lessons, 182.

²⁶ "Project Fact Files," Ministry of Defense Procurement Agency, (May 2002) http://www.mod.uk/dpa/projects/link16_jtids.htm [2 February 2004].

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³⁰ Air Land Sea Application Center, ICAC2, i.

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³⁴ *Ibid.*, II-4.

³⁵ Cordesman, The Iraq War: Strategy, Tactics, and Military Lessons, 184.

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- ³⁶ Air Land Sea Application Center, ICAC2, F-1.
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- ⁴⁴ Ibid., 227.
- ⁴⁵ Ibid., 286.
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- ⁴⁸ Mike Findlay, Robert Green, and Eric Braganca, “Fires and Maneuver – Challenges on the Noncontiguous Battlefield,” The Air Land Sea Bulletin. (March 2003): 18.
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- ⁵³ Joint Chiefs of Staff, Doctrine for Joint Airspace Control in the Combat Zone, Joint Pub 3-52, III-5.
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⁵⁶ *Ibid.*, 16.

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⁶⁵ *Ibid.*, III-3 & 5.

⁶⁶ Air Land Sea Application Center, ICAC2, F-1-12.

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