NAVAL WAR COLLEGE

Newport, Rhode Island

The Joint Air Operations Center in the Realm of Network Centric Warfare

By

CDR Michael J. Coury, USN

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

Signature _____

18 May 01

_____
LT COL J. Dill
Faculty Advisor

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
18052001	N/A	-

Title and Subtitle The Joint Air Operations Center in the Realm of Network Centric Warfare	**Contract Number**
	Grant Number
	Program Element Number
Author(s) Coury, Michael J.	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Naval War College 686 Cushing Road Newport, RI 02841-1207	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes	
Abstract	
Subject Terms	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU
Number of Pages 34	

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED

2. Security Classification Authority: N/A

3. Declassification/Downgrading Schedule: N/A

4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

5. Name of Performing Organization:
JOINT MILITARY OPERATIONS DEPARTMENT

6. Office Symbol:	**7. Address**: NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207
C	

8. Title (Include Security Classification):
The Joint Air Operations Center in the Realm of Network Centric Warfare (U)

9. Personal Authors:
COMMANDER MICHAEL J. COURY, USN

10.Type of Report: FINAL	**11. Date of Report**: 18 MAY 01

12.Page Count:

13.Supplementary Notation: A paper submitted to the Faculty, Naval War College, in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.

14. Ten key words that relate to your paper:
JFACC, JAOC, Network Centric Warfare, Air Tasking Order, Self-synchronization, Shared Awareness, Massing Effect, Rule Set, Combat Plans, Combat Operations.

15.Abstract:

The concept of Network Centric Warfare (NCW) is advertised to significantly change the way the military operates in the future. The proliferation of information technology and its ability to provide for centralized control while decentralizing execution are but two foundations for these changes. Those concepts, however, are not novel. In fact, the evolution of the Joint Air Operations Center (JAOC) demonstrates a continual effort to achieve those same objectives. Unfortunately, the JAOC still falls short in achieving the expediency of execution so necessary in modern warfare. The ability to support significantly increased operational tempo will be required not only in the JAOC's domain of airspace, but on the ground and at sea as well. Given the adherence to the manner in which the JAOC currently organizes and functions, there is only so far technology can go to improve timely and efficient execution. With the advent of NCW, the JAOC has an opportunity to metamorphose again, achieving improvements to support vastly increased operational tempo. Limitations of organization, function and execution can be resolved by applying the NCW concepts of shared awareness, self-synchronization and massing effect. By rethinking the current function and execution methodology of the JAOC and melding them into a Joint Operations Center (JOC) organized by capability rather than operational medium, we will provide for the efficiency inherent in NCW and a more robust and high tempo at all levels of military operations.

16.Distribution / Availability of Abstract:	**Unclassified**	**Same As Rpt**	**DTIC Users**
	X		

17.Abstract Security Classification: UNCLASSIFIED

18.Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT

19.Telephone: 841-6461	**20.Office Symbol:** **C**

TABLE OF CONTENTS

Abstract

The concept of Network Centric Warfare (NCW) is advertised to significantly change the way the military operates in the future. The proliferation of information technology and its ability to provide for centralized control while decentralizing execution are but two foundations for these changes. Those concepts, however, are not novel. In fact, the evolution of the Joint Air Operations Center (JAOC) demonstrates a continual effort to achieve those same objectives. Unfortunately, the JAOC still falls short in achieving the expediency of execution so necessary in modern warfare. The ability to support significantly increased operational tempo will be required not only in the JAOC's domain of airspace, but on the ground and at sea as well. Given the adherence to the manner in which the JAOC currently organizes and functions, there is only so far technology can go to improve timely and efficient execution. With the advent of NCW, the JAOC has an opportunity to metamorphose again, achieving improvements to support vastly increased operational tempo. Limitations of organization, function and execution can be resolved by applying the NCW concepts of shared awareness, self-synchronization and massing effect. By rethinking the current function and execution methodology of the JAOC and melding them into a Joint Operations Center (JOC) organized by capability rather than operational medium, we will provide for the efficiency inherent in NCW and a more robust and high tempo at all levels of military operations.

Introduction

The concept of Network Centric Warfare (NCW) is advertised to significantly change the way the military operates in the future. The proliferation of information technology and its ability to provide for centralized control while decentralizing execution are but two foundations for these changes. Those concepts, however, are not novel. In fact, the evolution of the Joint Air Operations Center (JAOC) demonstrates a continual effort to achieve those same objectives. As a result, the effectiveness of the JAOC has progressively improved since the concept originated during the Vietnam War in the form of the Tactical Air Control Center (TACC)[1]. Unfortunately, the JAOC still falls short in achieving the expediency of execution so necessary in modern warfare. The ability to support significantly increased operational tempo will be required not only in the JAOC's domain of airspace, but on the ground and at sea as well. Given the adherence to the manner in which the JAOC currently organizes and functions, there is only so far technology can go to improve timely and efficient execution. Simply put, "efforts to speed up the process so that more responsive plans can be developed are fast approaching the laws of diminishing returns"[2]. With the advent of NCW, the JAOC has an opportunity to metamorphose again, achieving improvements to support vastly increased operational tempo. Just as the organization, function and execution of military operations as a whole will change significantly, so must the organization, function and execution of the JAOC change in the realm of NCW.

Background

The JAOC is primarily thought of as the command and control (C2) center, which controls piloted, "air breathing", combat and supporting aircraft. In addition to that function, the JAOC has

coordinated unmanned aerial vehicle (UAV) sorties, and with the advent of Combined Air Operations Center -X (CAOC-X), will also include air mobility and space system integration[3]. CAOC-X is proof that the organization, function and execution of the AOC (Combined or Joint) are improving with current technology in typical linear fashion. Unfortunately, "linear extensions of current concepts and practices will not be truly innovative"[4] and provide for the maximum benefit of NCW. In order to realize the changes, which can occur to the JAOC in the realm of NCW, the current organization, function and execution methodology of today's JAOC must be reviewed. For a more in depth discussion of the JAOC, see Joint Pub 3-56.1.

Organization, Function and Execution of the JAOC

The joint force structure organization outlines how the JAOC fits to support the Joint Force Commander (JFC) intent. As directed by the National Command Authority, the Joint Chiefs of Staff (JCS) provide specific guidance to the JFC in regards to strategic objectives. The JFC then determines the theater objectives and provides determination on the prioritization of effort, apportionment of resources and delegation of authority[5]. As delineated in Joint Pubs 3-0 and 1-02, the JFC further delegates authority and responsibility to component commanders. These can be service and/or functional component commanders. When functional component commanders are chosen, these include the Joint Force Land Component Commander (JFLCC), Joint Force Maritime Component Commander (JFMCC), Joint Force Air Component Commander (JFACC) and Joint Force Special Operations Component Commander (JSOCC). Note that in cases where a conflict is of limited duration, scope, and/or complexity, the JFC staff may be able to handle the responsibilities of a JFACC and therefore not need to assign a component commander[6]. Working

directly for the JFACC or JFC staff in developing plans and directing operations of air power is the JAOC. The JAOC is supported by other services to coordinate their air power requirements in the form of the land component's Battlefield Coordination Element (BCE) and maritime component's Naval and Amphibious Liaison Element (NALE).

The JAOC performs functions, which provide for the planning and systematic application of air power with implications from the strategic to tactical level. Generally, these functions have been categorized into several sequential areas, which must be accommodated by the JAOC. They include the planning, coordination (to include air space and air defense coordination), allocation/apportionment and tasking of air assets. In addition, the JAOC must also perform the functions of directing and monitoring. The two subdivisions of the JAOC, which are primarily responsible for performing these tasks are the combat plans and combat operations divisions. Finally, the JAOC must ensure sufficient connectivity or communications exist to complete all the aforementioned tasks[7].

Once planning is completed, the JAOC provides for the specific and detailed tasking of assigned units using an Air Tasking Order (ATO). ATO development begins 36 hours (or more depending on the size/importance of the mission) in advance of execution. The goal is to distribute the ATO 12 hours prior to execution to allow sufficient time for planning by tasked units. ATOs generally cover a 24-hour period of operation. Following distribution of the ATO, the JAOC directs and monitors its execution. JAOCs are equipped and manned through the combat operations division to adjust operations as changes occur in the battlefield to some degree depending on timeliness of information and asset availability. These adjustments may occur within the ATO cycle "by diverting a sortie from a preplanned target or waiting for the next cycle"[8] (i.e., deferred to a subsequent ATO).

Limitations of Today's JAOC

Upon scrutiny of the JAOC, there are several limitations to its current organization, function and execution, which will be discussed in detail separately. In general, the organization of the JAOC is hindered by its footprint (size/location) and command structure. Its current function has limitations due to rigidity of doctrine affecting target engagement methodology. Finally, the JAOC is limited in speed of execution.

Limitations of Organization

In the past, the size of the JAOC in terms of human requirements was immense. In fact, during Desert Storm the JAOC was comprised of over 2,000 specialized personnel requiring up to thirty-seven C-141 sorties to transport the personnel and AOC structure[9]. With the advent of CAOC-X, technology has facilitated a significant downsize of those requirements. The JAOC will become much more portable and this will ease the burden on lift and space at bed down sites. However, even a smaller more portable JAOC is a liability if it is necessary that it be forward deployed, either on land or at sea. Land sites may be restricted by political constraints, as was the case in El Salvador[10]. U.S. support in that conflict was limited by the Reagan Administration to a total of 55 advisors in the AOR to "assuage public and congressional fears of a second Vietnam"[11]. Additionally, forward deployed personnel may be at risk in high threat areas or pose a problem of operational security, as the Joint Force Commander may need to minimize pre-hostilities moves to keep a low profile[12]. Consider the risk U.S. forces in Saudi Arabia, Bahrain or afloat on the Arabian Sea would be at if Iraq possessed and were willing to use weapons of mass destruction

(WMD) equipped with improved precision capability. Future technology will allow a forward deployed JAOC to be located in an aircraft. While such innovation would be useful in eliminating issues of footprint, it still involves a greater level of risk than if the JAOC could simply be located on U.S. territory.

Integration of Multi-Service Assets

In its current organization, the JAOC incorporates Navy, Army and Marine Corps assets through the use of the BAC and NALE. However, since there is a division along service lines (regardless of the fact that they are operating jointly), the tendency is to prioritize the allocation of those air assets to their respective services first, leaving the remaining portion for allocation to the requirements of the overall air campaign. An obvious example is carrier aircraft operating in the Arabian Gulf. The carrier will allocate a percentage of sorties toward battle group defense and the JAOC will coordinate and account for those air operations in the ATO. However, while some of these "battle group allocated" assets may be equipped and available to complete alternate missions, there is rigidity in their assignment, which prevents such action. Consider an example where a credible airborne threat to surface vessels exists, requiring a continuous/rotational combat air patrol (CAP) with supporting tanker and electronic warfare (EW) assets. If a power projection strike is diverted, current operations provide no means for the JAOC to quickly reassign the CAP and supporting aircraft to strike the original target even if the current threat situation allows. The opportunity to flexibly use them is lost.

Limitations of Function

Limitations to the function of the JAOC have lead to target engagement rigidity. The ATO pre-assigns targets to specific platforms, but only partially compensates for dynamic changes to the battlefield. The combat operations division of the JAOC attempts to make the process more responsive by directing changes real time, but its ability to do so requires an intelligence input be relayed to them, a decision be made to divert an asset from a pre-planned target, and an ability to communicate that direction to the appropriate asset. To compound matters, support assets such as electronic warfare, suppression of enemy air defense, and reconnaissance assets may also have to be redirected. The amount of time necessary to complete that process may be too great and an opportunity will be lost, or worse, friendly forces will be jeopardized by delayed action. Even waiting until the next launch of aircraft, with new mission in hand, may be too late.

Several attempts have been made to shrink the decision cycle known as the Observe, Orient, Decide, Act (OODA) loop[13]. The first is assignment of alternate targets to provide a flex targeting option. However, flex targeting can only accomplish so much since it relies on a relatively static battlefield and will not be able to predict all unanticipated changes in a dynamic environment. The inception of "kill boxes" is another attempt to alleviate this problem, but it is geographically limited and assets may be wasted awaiting tasking. Airborne Battlefield Command and Control Centers (ABCCC) have also been used as an extension to the JAOC by providing divert information to strike packages en route to target[14]. While these aircraft may provide some reduction in time, they still require sufficient time for the intelligence-decision-reassignment process to occur. Consider an observation from the Kosovo conflict, which discussed the inability of aircraft to strike mobile targets. The reason given was the delay in "reaction time required to pass data from EC-130 (ABCCC) aircraft to NATO's CAOC at Vicenza, Italy, and then on to strike assets"[15]. Also, in a

dynamic environment, the ABCCC operators may be inadequate due to the shear volume of changes. "Beyond some threshold, a human decision maker is overwhelmed, resulting in sub-optimal assignments, or worse, unacceptable delays in allocating fires"[16].

Finally, the inability to use assets not assigned to the JFACC limits the JAOC's options. Target allocation may shift, not just changing the target a specific platform prosecutes, but shifting the platform "type" which is most suitable to engage a specific target. For example, the JAOC has no means of reactively assigning shipborne weapon systems. Available assets such as radars, jamming equipment, surface to air missiles, and surface to surface missiles cannot be allocated by the JAOC even if one can be used instead of an airborne platform's sensors or weapons. With the exception of static targets, an ATO in its current form quickly becomes cumbersome.

Limitation of Execution

Plan formulation and execution does not provide for maximized operational tempo. Lessons learned from Desert Storm included the fact "that moving or time-sensitive targets posed a problem when the JFC and his targeting cell begin discussing target priorities 36 to 48 hours before mission execution"[17]. Unfortunately, regardless of how quickly a plan and ATO can be formulated and transmitted, even a one hour delay from target identification to destruction may be too long. Modern warfare requires reaction to immediate changes in the battlefield. Potential enemies may not be as cooperative as the Iraqis. In fact, other adversaries have already used our delayed target identification to destruction process to their advantage. Consider the recent Kosovo conflict in which it was determined that "strikes on fake targets indicated that the Serbs let NATO daytime reconnaissance flights see real targets and then replaced them at night"[18]. Time delays between

detection and targeting resulted in significant expenditure of ordnance against fake targets or jettisoned ordnance when no target was found at the directed location.

What does NCW Bring to the Fight

The JAOC of today and near future has definite limitations in organization, function and execution. Some will argue that these limitations can be reduced or negated by improved technology, which will decrease the JAOC footprint, improve connectivity and increase speed of command. While these changes will certainly be helpful, they can only achieve so much since no change to the overall function and execution methodology will occur. In other words, these will only be linear improvements. The JFC will still provide his intent to the JFACC. The JFACC will still determine defined apportionment percentages. The JAOC will still develop plans based on the apportionment of "JFACC controlled" assets, distribute an ATO in delayed/cyclical fashion, monitor execution and hold authority for most dynamic changes. Given the technological advances expected within the next few decades, the only means to effectively utilize them will be to modify our methodology and doctrine. One way to do so is to incorporate the concept, which has been termed NCW. NCW is defined as "an information superiority enabled concept of operations that generates increased combat power by networking sensors, decision makers and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability and a degree of self synchronization"[19]. Once you regain your breath after reading that definition, what NCW really boils down to is improved organization, function and execution through the use of information superiority. The manner in which that superiority is gained

in each of those areas is through the networking of sensors for the purposes of both gaining and distributing information.

Making significant changes in methodology and doctrine first requires some concept of the capabilities NCW will purportedly provide. Some baseline assumptions are in order on the capabilities of future technology through explanation of abstract terms as "shared awareness", "self synchronization" and "massing effect". Given these assumptions, ascertaining both improvements and vulnerabilities will be possible. While these improvements are futuristic, there needs to be an acceptance that technology will eventually facilitate development and application of these improvements to the way we conduct military operations.

Shared Awareness

Shared awareness is the first result of networking sensors. The need for improvements in this area has been recognized in the aftermath of Kosovo operations. The Defense Advanced Research Projects Agency (DARPA) has intensified efforts to improve methods to "combine and pass target data through networks to aircraft or weapons" to include not just overhead sensors, but piloted and remotely piloted vehicles[20]. Given future advancements in automated analysis and display systems, the network of sensors will provide for a "common operational picture (COP). A COP will include: location data on friendly and enemy forces; status of forces; available courses of action and predicted actions for enemy forces; and information on the environment"[21]. This information will be available all the way down to the tactical level including specific actor entities and will only be modified by "filters" implemented by the actors. Shared awareness allows for the lowest actor with a COP to make a decision since information necessary to make that decision no longer rests with

just the C2 organization. As such, the JAOC/JFACC no longer has to be the hub for dispensing information and consequently, making all dynamic decisions. These can be delegated through a process known as self synchronization.

Self Synchronization

Self synchronization is defined as "a mode of interaction between two or more entities: two or more robustly networked entities, shared awareness, a rule set, and a value-adding interaction. The combination of a rule set and shared awareness enables the entities to operate in the absence of traditional hierarchical mechanisms for command and control"[22]. Consider that a rule set is determined from the JFC's intent and applied by the JAOC. Examples could be a priority logic pre-assigned to specific types of targets and between targets of similar type, or simply the assignment of a protected entity for a given set of actors. Such rule sets would allow dynamic changes in action by specific actors in the battlespace without the need to seek directed action from higher authority. Given proper rule sets and automated algorithms, both piloted and unmanned vehicles can modify their actions without first requesting permission of the JAOC/JFACC. The decision-to-execute process is compressed not because of increased speed of data transfer, but by removing decision nodes like the JAOC from the process when possible. This may not be desirable in all situations. When it is not, JAOC/JFACC control can be retained through restrictive rule sets.

Massing Effect

Massing effect is simply a means of optimizing time, space and force to achieve the desired result in the most expedient and efficient manner. Given our current mode of operation with platform-

centric warfare, problems occur in trying to coordinate the efforts of different functional component forces. "The entire effort is held hostage to the speed of the slowest combat cycle, all other units being deliberately kept from achieving their optimum operational tempos so as to mass effects or be mutually supportive"[23]. Massing effect through networked actors allows for the application of force more quickly with fewer assets by utilizing forces that would otherwise not be considered or not be capable. Improved weapons with advanced precision guidance capability and extended range will facilitate our capability to mass effect from actors operating in different molecular conduits. Massing effect will be a result of "shared awareness" and "self-synchronization" in that the JAOC or just the actors individually will adjust to dynamic scenarios to bring the best combination of resources to bear.

Combining Shared Awareness, Self-synchronization and Massing Effect

Given these three capabilities applied in concert, they would speed operations by eliminating the need for airborne assets to depend on the JAOC for information and new tasking whenever dynamic changes occur. In other words, they "permit a flattened, decentralized command structure, with decisions made at the lowest practical level of command."[24] Optimization of force occurs because decision to execute time is significantly reduced and all JAOC forces, which can contribute to a specific effort, are able to do so. Optimizing force execution will have the added benefit of minimizing total force requirement to achieve a specific objective. Unfortunately, the problem that still remains is that the JAOC still operates with finite forces reducing its potential capability.

Recommendations

A clean sheet of paper needs to be brought out to adapt current JAOC functions into the doctrine of NCW. We must dispense with stovepipe organizations, which even when operating in a joint environment, do not allow for the optimal effort and effect. We must dispense with organizations, which function exclusively to a singular service or component commander's interpretation of JFC guidance. Finally, we must dispense with execution methods, which inhibit the massing of effect, and inhibit an ability to not only react in a dynamic environment, but also provide for dynamic proactive measures.

Network Centric Organization

Flexibility is limited by the manner in which we organize and hence, command our forces. General Krulak suggests that "by defaulting to functional componency we leave consideration of the mission completely out of the process"[25]. The JAOC, while having liaison with other component commanders, operates under the concept that its control is limited in space and force. Given that limitation, there is also a limitation to the operational flexibility with which the JFACC, and subsequently the JFC, can respond to specific dynamic situations. Such limitations made sense when our ability to network was limited. In the realm of NCW, that will no longer be the case. NCW will provide "operational flexibility which will enable commanders to plug and play sensors, shooters, command and control, and support capabilities into task-organized combat packages, including appropriate collections of sensors and weapons[26]. For that reason, it makes sense to reorganize under the JFC to provide for unfettered access to all those capabilities in whatever service they exist. Experts in each of the service capabilities will still serve to appropriately assign

capabilities within the organization, but the focus should not be service capability allocation. The organization "should be designed to facilitate the flow of information and materials needed to carry out the tasks at hand with no organizational barriers or speed bumps that degrade performance"[27]. The JAOC operating in its current doctrine has become one such organizational barrier. As such, the JAOC organization and method of function and execution as it currently exists should be terminated. A new approach to the control of assets, regardless of the environment from which or within which they operate, must be developed.

A proposed organization schematic is provided in Appendix A, Figure 1. In this proposal, the JFC remains the head decision maker and developer of courses of action. However, rather than having functional component commanders working for him, it has been suggested that the organization be developed using the concept of the Mission Capability Package (MCP)[28]. NCW describes an MCP as "consisting of a concept of operations, command approach, organization, systems and people with a prescribed level of expertise"[29]. Therefore, working directly for the JFC will be Mission Capability Package Commanders (MCPC) in charge of specific missions, which define a given operation. . The total number of MCPCs will be dependant on the size of the operation and the number of coincident or sequential missions, which will be phased into the operation. Each of these MCPCs will have experts from the services (Navy/USMC, Air Force/Space, and Army) to advise on plan formulation and asset requirements. Working for the MCPCs will be a Joint Operations Center (JOC). Specialists of today's JAOC will be incorporated into the JOC. The difference will be that their expertise, along with other service/functional component experts, will be divided among capabilities (sensor, actor/shooter, network), deconfliction (zone) and support, rather than the medium (air, land, sea) in which

platforms operate. Based on the aforementioned issues of footprint/location, improved technology and networking, the JOC can function equally well on U.S. territory or forward deployed if security permits.

Network Centric Function

The functions of the JAOC are also subsumed in the JOC. The JOC will perform planning, coordination (to include zones or space of operation), allocation/apportionment and tasking. Unlike the JAOC, which is limited by asset allocation, the JOC has the advantage of assigning any asset, regardless of its service orientation (massing effect). The MCP plans (MCPP) for each MCPC will be developed and deconflicted within the JOC. Not only will these plans include battlespace focus and desired timelines of execution, but since all assets will receive a COP (shared awareness), the plans will provide guidance on decision processes by stipulating/delegating levels of self-synchronization. An example scenario of how this organization may function is contained in Appendix B.

Network Centric Execution

Execution must provide for the fastest operational tempo feasible. An ability to respond immediately to changes on the battlefield keeps the enemy off balance and prevents his ability to predict actions. Coalition forces failed at this during Allied Force, allowing "Milosevic's air defense personnel to template US and NATO air operations based on their performance during the Gulf War and in Bosnia"[30]. The result was an ability to predict our operations and, at least to some degree, control the operational tempo. While plans or tasking orders will still be required from the

MCPC to provide units with necessary guidance, there should be several distinct differences.

First and foremost, tasking should be provided on a more dynamic and less cyclical nature preventing an adversary's capability to predict our operations. Certainly, an initial tasking plan will be implemented and human/platform limits will have to be constantly considered. However, since a COP is provided at all levels within the operational organization from the JFC to the platform, the ability to react dynamically will be improved. For example, the same picture studied by the JFC and MCPCs in the JOC will be the same as in a squadron ready room. With pilot controlled filters, the same picture less extraneous information will be provided in the cockpit. Coalition partners without the need to know all information contained on the COP will be provided with applicable information that they too can filter as necessary. Planning, which has already leapt from grease board to computers, will become completely automated. Since the origination point of a platform/actor is now irrelevant as is its operating medium (sea, land, or air), the solutions to dynamic changes will be readily available and optimized (massing effect). All of these innovations will allow for continuous vice cyclical operations and planning.

While tasking based on new and modified MCPPs will still come from the JOC. They will be distributed just to the affected tactical commands and units as needed. In addition, the tasks will be less detailed with the required mission specifics provided through automated processes and the COP. Additional filters at the receive station, whether an information center or weapons platform, will eliminate extraneous information as desired by the recipient. Cyclical tasking orders will no longer be necessary or desired, as changes in tasking not inherent to the rule sets will occur on a more timely and dynamic basis to specified units (air, land or sea) based on MCPC direction.

Finally, a decrease in directed tasking from the MCPCs through the JOC will occur with

increased self-synchronization. This ability to self-synchronize will allow the JOC to spend more time monitoring and analyzing execution, allowing for formulation of proactive responses rather than being engulfed in making reactive changes (something today's JAOC struggles to accomplish in a much less dynamic environment). Of course, there must be acceptance of the rule set if JOC directed dynamic re-tasking is to be minimized. In cases where the rule set is purposely restricted to prevent specific automatic re-tasking, the JOC can provide new tasking through the network. Developing a comprehensive rule set is key to minimizing JOC intervention. (Appendix B, Figure (2) provides an example rule-set).

Vulnerabilities/Challenges

Electronic warfare and electro-magnetic superiority are very dynamic and fleeting capabilities. Systems, which are considered not jammable or not exploitable one day are found to be so the next. It would be a mistake to base operations and asset availability (i.e., force structure) on the presumption that connectivity will never be interrupted. Therefore, backup systems and graceful degradation of operations must be planned and trained toward. Platforms need to retain sufficient sensors to continue operations if the network is interrupted. Force structure should accommodate the possibility of occasionally reverting to platform centric operations. Finally, while a JOC would best be supported at secure CONUS installations, there will be a need to forward deploy a portable JOC for periods when connectivity is interrupted. In this case, an airborne unit would be required as it could best facilitate line-of-sight communications between sensors and actors when satellite communications are interrupted.

A second vulnerability is that sensors are prone to error and deception. Even multiple sensors of

different type, applied to a specific detection problem using neural networking and parallel processing, will not be impervious to error and deception. Certain levels of probability, telling an operator or automated system the reliability of sensor information, will have to be assigned and incorporated into rule-sets and automated algorithms. The consequence of not doing so will be extensive wasted expenditure of weapons, or worse.

Conclusion

We are currently tripping over operational speed bumps by maintaining the same doctrine and methodology of today's JAOC. New technology alone will not eliminate this problem. However, there is promise that these limitations can be bypassed with the inception of NCW. Limitations of organization, function and execution can be resolved by applying the NCW concepts of shared awareness, self-synchronization and massing effect. By rethinking the current function and execution methodology of the JAOC and melding them into a Joint Operations Center organized by capability rather than operational medium, we will provide for the efficiency inherent in NCW and a more robust and high tempo at all levels of military operations. Correct adaptation of NCW will require doctrinal changes, education, training and modeling to ensure the methods employed will work on the battlefield[31]. Promoting such changes now will give industry guidance on how to meet the technological needs of a JOC and supporting units so we can begin the adaptation process as soon as possible.

APPENDIX A

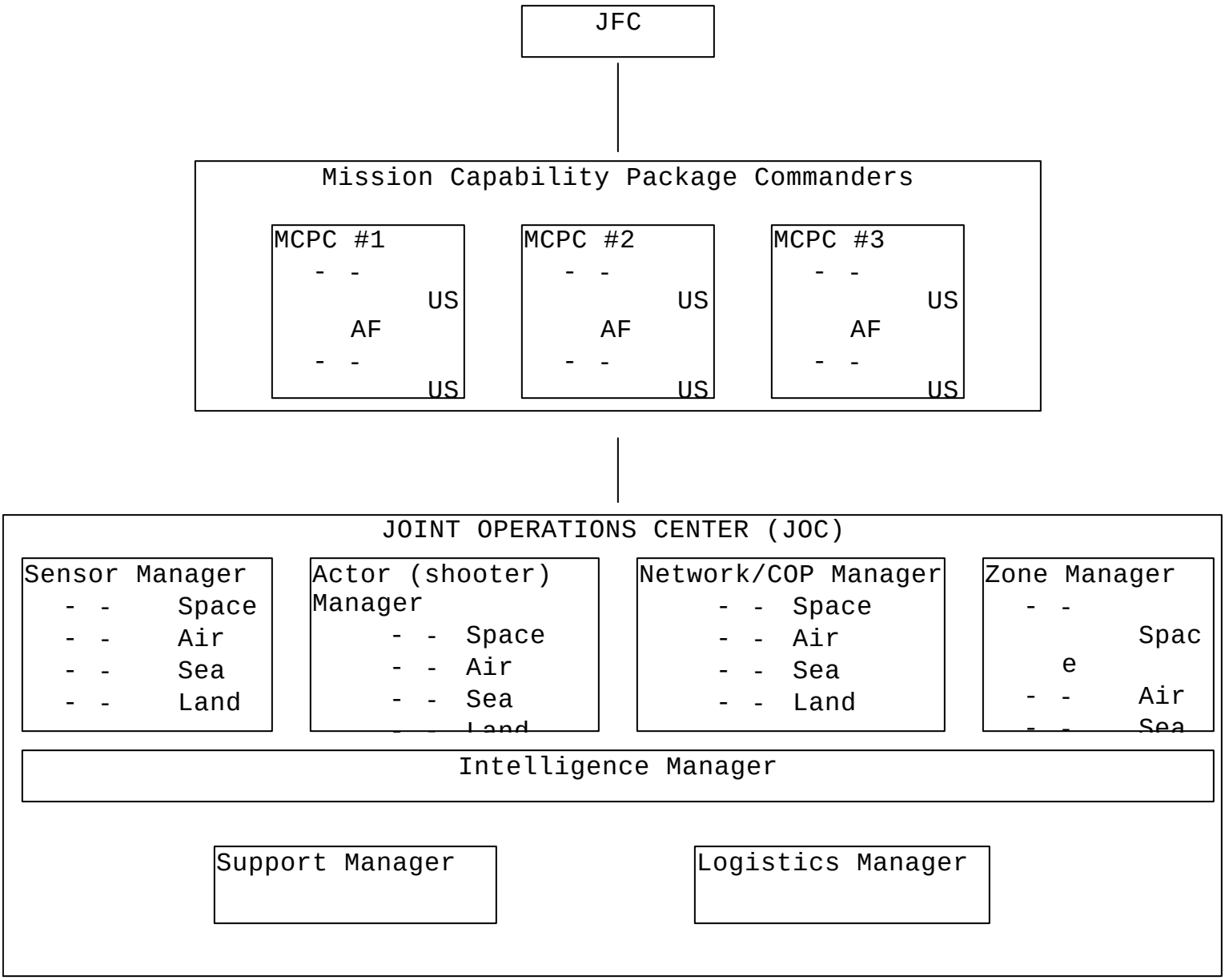

Figure (1)

Proposed JOC Organization

APPENDIX B

Author's Note. The following scenario is provided for consideration of how the JAOC will be incorporated into the JOC and how the latter will function under the proposed command structure. Only general information regarding the disposition of forces is provided in order to focus more on the function of the JOC and the application of rule sets. Rule sets provided are also considered rudimentary. The intent is only to provide sufficient information on how rule sets will facilitate reduced decision cycles through self-synchronization and optimized asset allocation through massing of effect.

Scenario.

Country X has invaded coastal country Y. X troops have control over most of the country including major sea and airports. However, a significant number of country Y refugees and freedom fighters are bottled up in a small section of country Y and are slowly and systematically being attacked by country X forces. The JFC, through direction from higher authority, determines that he has three specific missions: first, to protect the refugees and freedom fighters of country Y; second, to force country X forces out of country Y; and third, to destroy country X forces such that they no longer pose a credible threat. Given the rapidity with which events are unfolding and the mobility of country X forces, the JFC is directed to complete these missions near coincidentally but main effort should be focused on protecting the refugees/freedom fighters of country Y.

The JFC assigns these missions to three MCPCs who coordinate plans (MCPP) to complete the tasks. Each MCPC uses the JOC to ascertain the necessary assets to complete their mission given the forces available to the JFC. In this scenario, air, land and sea forces are available for JOC coordination. Since the JOC focuses on available sensors, actors and

support assets, they provide information on asset allocation capable of assisting in completing the mission in those terms, regardless of service orientation. Where apportionment becomes an issue, recommendations of asset allocation and phasing are made by the JOC. The MCPCs determine if the force availability and phasing is in accordance with JFC intent and review their MCPPs with the JFC. Tactical units are provided the plans and the execution phase begins. At this point, planning and execution occur near simultaneously with both the MCPCs (through the JOC) and tactical units maintaining the same COP (shared awareness). Sensors are allocated and shifted based on MCPC coordinated determination. MCPPs include provisions for self-synchronization and massing of effect by providing actors the authority to adjust targets as necessary to support their MCPP or to assist with other MCPPs if able under certain preset conditions (rule sets). When rule set conditions do not permit such changes, actors may be dynamically shifted by MCPC direction through the JOC.

Rule Sets

The following rule set is an example, which would be recommended by the JOC and endorsed by the MCPC to facilitate the optimization of assets in support of the JFC's intent. All rule sets will have two common factors. A level of confidence will have to be assigned to the fused sensor data to provide the actors with criteria for shifting targets. Also, a decision on "availability" of actors will have to be made using several criterion. First, determination is made that they have sufficient weapons. Second, they are not currently engaged in target prosecution, which would be adversely affected by target reassignment (i.e., at some point a weapon or aircraft cannot be reassigned). Finally, they are physically able (time, distance) to prosecute the new target. Figure (2) is a sample

Protected Entity/Targeted Entity rule set for

APPENDIX B

air-to-surface and surface-to-surface actors. This rule set allows actors to shift priority of assigned targets or change targets based on a threat to a protected entity or the detection of higher priority targets. Protected entities are formations of troops, tanks, ship(s), and aircraft.

Scenario Play

As previously mentioned, three MCPCs are assigned. MCPC #1 provides for protecting country Y freedom fighters and refugees and has the highest priority MCPP. MCPC #2 provides for the removal of X forces from country Y and is the second priority MCPP. MCPC #3 provides for destruction of X forces such that they no longer are a credible threat and is the lowest priority MCPP. As the execution phase gets underway, sensors determine with necessary confidence level that two unexpected actions have occurred. First, country X special forces are detected leaving an underground tunnel and are massing in preparation to attack country Y freedom fighters. Second, a mobile surface to air missile has been detected providing protection for the massing special forces. MCPP #1 does not have sufficient assets to counter the special forces or destroy the SAM. However, since MCPC #1 has priority, forces are diverted via rule-set logic from MCPC #2 and #3. Two strike aircraft are diverted from a 6-plane strike in support of MCPP #3. However, since support aircraft of that strike are still needed to protect the remaining aircraft, a sea based UAV jammer is launched in support of the two aircraft and ATACM fire is directed from assets supporting MCPP #2 against the pop-up SAM. Diversion of aircraft and redirection of ATACM fire occurs automatically. Since the UAV is not already airborne, its launch was directed by the JOC,

which was provided several options of jamming support from which to choose. Mission complete, reassigned assets return to their original mission or return to base.

APPENDIX B

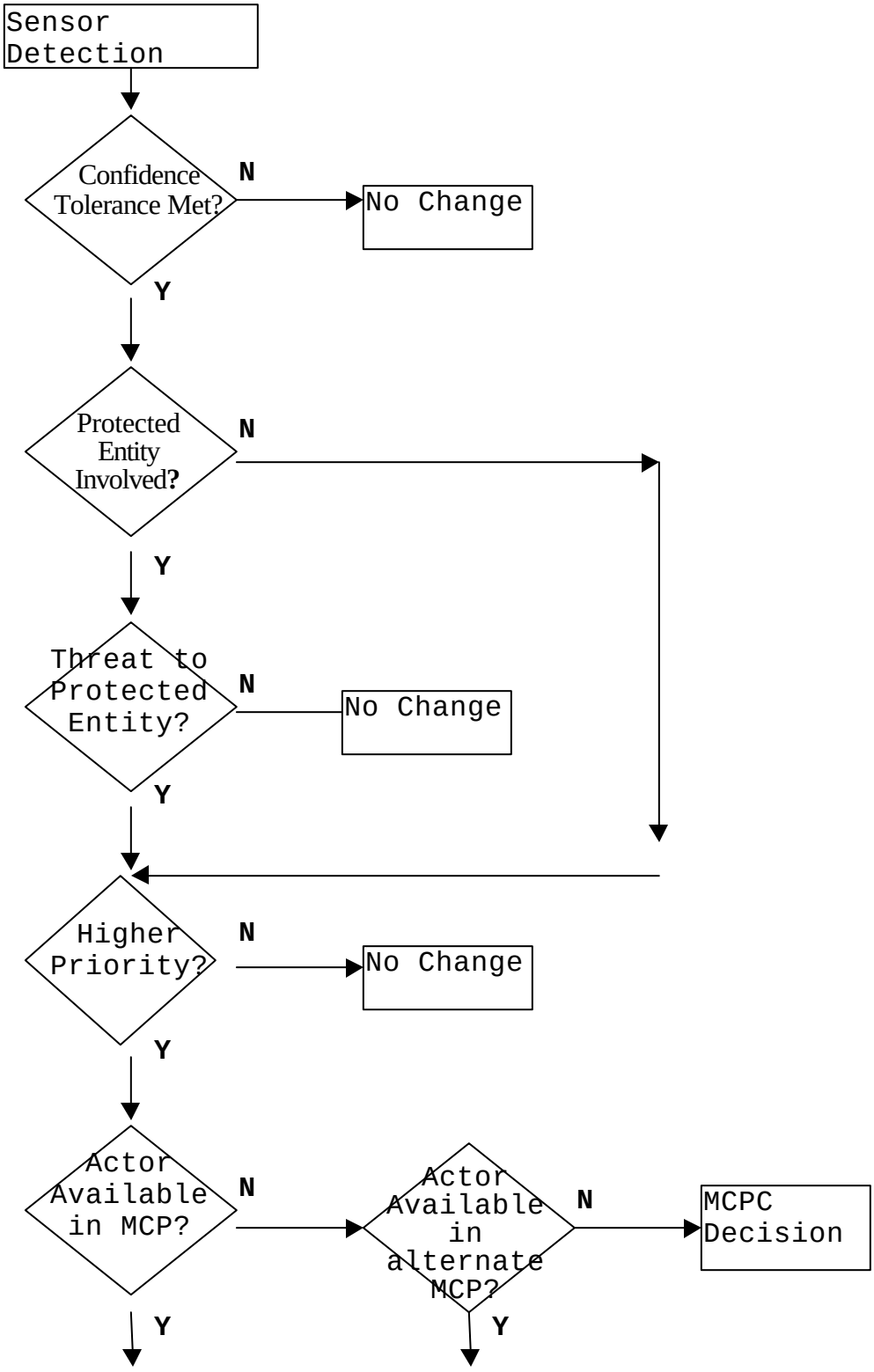

Figure (2)
Rule Set Decision Process for Air-to-Surface and Surface-to-Surface Actors

Notes

1 J. Taylor Sink, "Rethinking the Air Operations Center: Air Force Command and Control in Conventional War" (Maxwell AFB: Air University Press, 1994), v.

2 David S. Albers, John J. Garstka, Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 75.

3 Todd Fleming, "CAOC-X Undergoes Operational Assessment" Hansconian, 30 March 2001.

4 David S. Albers, John J. Garstka, Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 10.

5 David Tillotson III, "Restructuring the Air Operations Center: A Defense of Orthodoxy", (Maxwell AFB: Air University Press, 1993), 5.

6 U.S. Joint Chiefs of Staff. Command and Control for Joint Air Operations. Joint Pub 3-56.1 (Washington, DC: 14 November 1994), ix.

7 David Tillotson III, "Restructuring the Air Operations Center: A Defense of Orthodoxy", (Maxwell AFB: Air University Press, 1993), 5-6.

8 J. Taylor Sink, "Rethinking the Air Operations Center: Air Force Command and Control in Conventional War" (Maxwell AFB: Air University Press, 1994), 39.

9 L.T. Wight, "Stretching the Umbilical Cord: The Theory, Practice and Future of the Split Air Operations Center", (Maxwell AFB: Air University Press, 1998), 6.

10 Ibid., 7.

11 Ernest Evans, "El Salvador's Lessons for Future U.S. Interventions", World Affairs, Summer 1997, 46.

12 L.T. Wight, "Stretching the Umbilical Cord: The Theory, Practice and Future of the Split Air Operations Center, (Maxwell AFB: Air University Press, 1998), 31.

13 John R. Boyd, "Organic Design for Command and Control: A Discourse on Winning and Losing", Unpublished briefing papers, May 1987, 7.

14 David Tillotson III, "Restructuring the Air Operations Center: A Defense of Orthodoxy", (Maxwell AFB: Air University Press, 1993), 45.

15 Timothy L. Thomas. "Kosovo and the Current Myth of Information Superiority," Parameters, Spring 2000, 15.

16 David S. Albers, John J. Garstka, Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 182.

17 David Tillotson III, "Restructuring the Air Operations Center: A Defense of Orthodoxy", (Maxwell AFB: Air University Press, 1993), 43.

18 Timothy L. Thomas. "Kosovo and the Current Myth of Information Superiority," Parameters, Spring 2000,16.

19 David S. Albers, John J. Garstka, Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 2.

20 Timothy L. Thomas. "Kosovo and the Current Myth of Information Superiority," Parameters, Spring 2000, 25.

21 David S. Albers, John J. Garstka, Frederick P. Stein. Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 134.

22 Ibid., 175

23 Edward A. Smith, Jr., "Network-Centric Warfare: What's the Point?" NWC Review, Winter 2001

24 Ibid.

25 Charles C. Krulak, "Doctrine for Joint Force Integration," Joint Force Quarterly, Winter 1996/97, 21.

26 David S. Albers, John J. Garstka, Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 190.

27 Ibid., 194

28 Ibid., 155

29 Ibid., 193

30 Timothy L. Thomas. "Kosovo and the Current Myth of Information Superiority," Parameters, Spring 2000, 24.

31 David S. Albers, John J. Garstka, Frederick P. Stein, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised) (Washington, CCRP, 1999), 133.

Bibliography

Air Land Sea Application Center, JAAT - Multiservice Procedures for Joint Air Attack Team Operations, June 1998.

Air Land Sea Application Center, Targeting - The Joint Targeting Process and Procedures for Targeting Time-Critical Targets, July 1997.

Albers, David S., Garstka, John J., Stein, Frederick P., Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (revised). Washington, CCRP, 1999.

Armor, Victor H., MAJ, USMC, Marine Air-Ground Task Force: A Model for Future U.S. Air Force and U.S. Army Operations, United States Army Command and General Staff College, Fort Leavenworth, Kansas, May 1996.

Boyd, John R. "Organic Design for Command and Control: A Discourse on Winning and Losing." Unpublished briefing papers, Maxwell AFB: Air University, Montgomery, AL: 1987.

Britten, Scott M. Reachback Operations for Air Campaign Planning and Execution. Air War College Center for Strategy and Technology Occasional Paper No. 1. Maxwell AFB: Air University Press, 1997.

Center for Naval Warfare Studies, Joint Forces Air Component Commander: A Historical and Operational Perspective, Naval War College, May 1992.

Evans, Ernest. "El Salvador's Lessons for Future U.S. Interventions." World Affairs (Summer 1997): 43-48.

Fleming, Todd. "CAOC-X Undergoes Operational Assessment." Hansconian (30 March 2001): 1.

Gruber, David J. Computer Networks and Information Warfare - Implications for Military Operations. Maxwell AFB: Air University Press, July 2000.

Hardy, Paul R. Reengineering the Air Operations Center. Maxwell AFB: Air University Press, April 1998.

Harter, Mark E. Rapid Dominance - Integrating Space into Today's Air Operations Center. Maxwell AFB: Air University Press, April 2000.

Henderson, James B. Structuring For Command and Control of Combined Forces in Operations Other Than War, United States Army Command and General Staff College, Fort Leavenworth, Kansas, May 1994.

Hunt, Peter C. Coalition Warfare - Considerations for the Air Component Commander. Maxwell AFB: Air University Press, 1998.

Hurley, Marcus. "JFACC: Taking the Next Step." Joint Force Quarterly (Spring 1995): 60-65.

Krulak, Charles C. "Doctrine for Joint Force Integration." Joint Force Quarterly (Winter 1996/97): 20-23.

Lescher, William K. "Network-Centric: Is It Worth The Risk." U.S. Naval Institute Proceedings (July 1999): 58-63.

Row, Lisa A. A JTF Staff Structure for the New Millennium: Leaner, Faster, and More Responsive. Maxwell AFB: Air University Press, April 1998.

Sink, J. Taylor. Rethinking the Air Operations Center: Air Force Command and Control in Conventional War. Maxwell AFB: Air University Press, 1994.

Smith, Edward A. Jr. "Network-Centric Warfare: What's the Point?" Naval War College Review, (Winter 2001).

Thomas, Timothy L. "Kosovo and the Current Myth of Information Superiority." Parameters (Spring 2000): 13-29.

Tillotson, David III, Restructuring the Air Operations Center: A Defense of Orthodoxy, Maxwell AFB: Air University Press, 1993.

U.S. Joint Chiefs of Staff, Doctrine for Joint Operations. Joint Pub 3-0. Washington, DC: 01 February 1995.

U.S. Joint Chiefs of Staff. Command and Control for Joint Air Operations. Joint Pub 3-56.1. Washington, DC: 10 January 1995.

Wessner, David, Jimmy Gonzalez, Bruce MacNeill, Musaed Al-Hawli, Ed Ireland, Rex Marshall, Herman Baker, Kurt Klausner, Susan Pardo, John Boggess, Sheron Leonard, Evelyn Spence, Steve Cash, Doug MacCrea, Mark Williams, and Dave Goldfein. Joint Air Operations Center: C4I Structure Study. Maxwell AFB: Air University Press, 1995.

Wight, L.T., Stretching the Umbilical Cord: The Theory, Practice and Future of the Split Air Operations Center. Maxwell AFB: Air University Press, 1998.

Whitlow, J. L. "JFACC: Who's in Charge?" Joint Force Quarterly, 5 (Summer 1994): 64-70.