AD NUMBER

ADB170170

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Critical Technology; 30 NOV 1993. Other requests shall be referred to Defense Information Systems Agency, Attn: Joint Tactical Command, Control and Communications Agency, Reston, VA 22090-5006.

AUTHORITY

ATSE-CDA-A, via ltr dtd 10 Aug 1994

AD NUMBER

ADB170170

NEW LIMITATION CHANGE

TO

Distribution authorized to U.S. Gov't. agencies and their contractors; Critical Technology; 30 NOV 1993. Other requests shall be referred to Defense Information Systems Agency, Attn: Joint Tactical Command, Control and Communications Agency, Reston, VA 22090-5006.

FROM

Distribution authorized to DoD only; Critical Technology; 20 NOV 1992. Other requests shall be referred to Defense Information Systems Agency, Attn: Joint Tactical Command, Control and Communications Agency, Reston, VA 22090-5006.

AUTHORITY

30 Nov 1993, DCA.

AD NUMBER

B170 170

LIMITATION CHANGES

TO — Distribution Authorized to U.S. Gov't Agencies and Their Contractors..
— — Code: C/2

FROM

NA

AUTHORITY

— DISA/JTC3A (Reston, VA)

L 0

DEFENSE INFORMATION SYSTEMS AGENCY

JOINT TACTICAL COMMAND, CONTROL AND COMMUNICATIONS AGENCY

Reston, VA 22090-5006

FUNCTIONAL C3 INTEROPERABILITY ARCHITECTURE FOR

AIR OPERATIONS

JCS VALIDATED/OSD APPROVED VERSION

92-29716

JTC3A REPORT 8034
20 AUGUST 1991

FUNCTIONAL C3 INTEROPERABILITY ARCHITECTURE FOR AIR OPERATIONS

20 AUGUST 1991

FOREWORD

The Functional Command, Control and Communications (C3) Interoperability Architecture for Air Operations, Joint Tactical Command, Control and Communications Agency (JTC3A) Report 8034, was validated on June 11, 1991 by the Joint Chiefs of Staff and approved on June 26, 1991 by the Assistant Secretary of Defense for C3I. It is one of nine functional interoperability architectures being developed as the Joint Tactical C3 Architecture. The document specifically addresses the following:

- Service roles and responsibilities in the air operations functional area,
- Connectivity requirements identifying command and control elements that must exchange information in a joint operational environment,
- Supporting C2 systems and communications equipment that provide connectivity, and
- Interoperability deficiencies that may prevent effective joint operations.

JTC3A developed this architecture after a review and analysis of joint and service documentation and discussions with unified, component command, and service staff personnel. An interim report, referred to as the supporting analysis, was previously distributed for service comment and provides extensive supplemental information on C3 for joint air operations. The supporting analysis will be available as soon as it is updated.

Please pay particular attention to the attached letter from ASD, C3I concerning instructions to Department of Defense components on implementation of this architecture.

Questions regarding this document may be directed to JTC3A, Interoperability Programs Directorate, C3A-TDF, DSN 364-8050 or commercial 703-487-8050.

R. J. MALLION
Brigadier General, USA
Director

ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D C. 20301-3040

COMMAND, CONTROL,
COMMUNICATIONS
AND
INTELLIGENCE

June 26, 1991

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Approval of Functional Command, Control, and Communications (C^3) Interoperability Architecture for Air Operations

As requested by the Joint Staff, this office has reviewed the validated Functional C^3 Interoperability Architecture for Air Operations. This architecture is approved for implementation by the components of the Department of Defense and should be the basis for achieving compatibility and interoperability of Air Operations C^3 systems.

DoD components are expected to implement this architecture by utilizing it as authoritative guidance for preparation of Program Objective Memoranda. Specifically, all requirements for new or modified C^3 systems in this warfare area will be measured against this architecture for interoperability. The Joint Tactical Command, Control, and Communications Agency (JTC^3A), in accordance with the provisions of DoD Directive 4630.5, will be guided by this architecture in evaluating requirements documents, investigating technology, and reviewing test documents.

Recognizing that this architecture is a dynamic document, configuration management will rest with JTC^3A and the Joint Staff. It is further anticipated that the concepts, interface exchange requirements, and command and control relationships identified in this architecture will, within two years, be reflected in Joint Staff doctrinal publications.

Duane P. Andrews

cc:
Commanders-in-Chief, Unified and Specified Commands

SUBJECT: Functional C3 Interoperability Architecture for Air Operations, JTC3A Report 8034

DISTRIBUTION:

Office of Secretary of Defense, Assistant Secretary of Defense for C3I, ATTN: T&TC3, Washington, DC 20301-3040
The Joint Chiefs of Staff, ATTN: J6E, Washington, DC 20301-5000
USCINCEUR, ATTN: ECJ6, APO New York 09128
USCINCSO, ATTN: SCJ6, APO Miami, FL 34003
USCINCCENT, ATTN: CCJ6-PM, MacDill AFB, FL 33608-6001
USCINCPAC, ATTN: J6, Camp H.M. Smith, HI 96861
USCINCLANT, ATTN: J6J, Norfolk, VA 23511-6001
USCINCSPACE, ATTN: J4-J6PA, Peterson AFB, CO 80914-5001
USCINCSOC, ATTN: SOJ6, MacDill AFB, FL 33608-6001
CINCTRANS, ATTN: TCJ6-PA, Scott AFB, IL 62225-5001
CINCFOR, ATTN: FCJ6, Ft McPherson, GA 30330-6000
CINCSAC, ATTN: SCPT, Offutt AFB, NE 68113
CINCUSELEMENT NORAD, ATTN: J5P, Peterson AFB, CO 80914-5002
Department of the Army, ATTN: DAMO-FDQ, Washington, DC 20310-0107
Chief of Naval Operations, ATTN: OP-940, Washington, DC 20350-2000
Commandant of the Marine Corps, ATTN: Code C2I, HQ US Marine Corps, Federal Bldg 2, Washington, DC 20380-0001
Headquarters, US Air Force, ATTN: XOOTC, Washington, DC 20330-5040
Defense Intelligence Agency, ATTN: CS-2B, Washington, DC 20340-3071
National Security Agency, ATTN: NSA-P22, Ft George G. Meade, MD 20755-6000

COPIES FURNISHED:

Office of Secretary of Defense, Under Secretary of Defense for Acquisition, ATTN:Deputy Under Secretary for Tactical Warfare Programs, Washington, DC 20301-3040
Office of the Joint Chiefs of Staff, ATTN: J3/J4/J5/J7/J8, Washington, DC 20301-5000
USCINCEUR, ATTN: ECJ3, APO New York 09128
USCINCSO, ATTN: SCJ3, APO Miami, FL 34003
USCINCCENT, ATTN: CCJ3, MacDill AFB, FL 33608-6001
USCINCPAC, ATTN: J3, Camp H.M. Smith, HI 96861
USCINCLANT, ATTN: J3, Norfolk, VA 23511-6001
USCINCSPACE, ATTN: J3, Peterson AFB, CO 80914-5001
USCINCSOC, ATTN: SOJ3, MacDill AFB, FL 33608-6001
CINCTRANS, ATTN: TCJ-3, Scott AFB, IL 62225
CINCFOR, ATTN: FCJ3, Ft McPherson, GA 30330-6000
CINCSAC, ATTN: DO, Offutt AFB, NE 68113-5001
Department of the Army, ATTN: DAMO-ZA/DAMO-FDC/DAMO-FDG/ SAIS-ADM/SAIS-ADO, Washington, DC 20310
Commanding General, USFK/EUSA, ATTN: FJ-AI, Seoul, Korea 96301-0009
HQ, USAREUR, DALFA, APO New York 09403
Commanding General, USAISC, ATTN: DCSPLANS/ATSI-CD, Fort Huachuca, AZ 85613-5000
Commanding General, USASIGCEN, ATTN: ATZH-DAC, Fort Gordon, GA 30905
Commanding General, USACACDA, ATTN: ATZL-CDC-A, Fort Leavenworth, KS 66027-5300
Commanding General, USAFAS, ATTN: ATSF-CT/ATSF-TSM-C3, Fort Sill, OK

SUBJECT: Functional C3 Interoperability Architecture for AIR Operations, JTC3A Report 8034

73503-5600
Commander, US Army Pacific, ATTN: APIM, Ft Shafter, HI 96861
Commandant, USACGSC, Fort Leavenworth, KS 66027
Commander, USATRADOC, ATTN: ATCD-C/ATCD-M/ATDO-J, Fort Monroe, VA 23651
Commander, CECOM, ATTN: AMSEL-ISD, Fort Monmouth, NJ 07703
Commandant, USAICS, ATTN: ATSH-CD, Fort Benning, GA 31905-5009
Commanding General, USAAC, ATTN: ATZK-CD, Fort Knox, KY 40121-5000
Commanding General, Combined Arms Support Command, ATTN: ATCL-C/ATCL-S, Fort Lee, VA 23801
Commander, 35th Signal Brigade, ATTN: S3, Fort Bragg, NC 28307-5000
Commander, USAJFKSWCS, ATTN: ATSU, Fort Bragg, NC 28307-5000
Chief of Naval Operations, ATTN: OP-607, Washington, DC 20350-2000
Commander, Space and Naval Warfare Systems Command, ATTN: SPAWAR 03 Washington, DC 20363
CINCLANTFLT, ATTN: N3/N63, Naval Base, Norfolk, VA 23511
CINCPACFLT, ATTN: N6/N34, Pearl Harbor, HI 96860-7000
CINCUSNAVEUR, ATTN: N356, FPO New York 09510
Commander Naval Air Force, U.S. Atlantic Fleet, ATTN: N336, Norfolk, VA 23511-5100
Commander Naval Surface Force, U.S. Atlantic Fleet, ATTN: N3, N6, N911, Norfolk VA 23511-6292
Commander Naval Air Force, U.S. Pacific Fleet, ATTN: N3, NAS North Island, San Diego, CA 92135-5100
Commander Naval Surface Force, U.S. Pacific Fleet, ATTN: N3/N6, Naval Amphibious Base, Coronado, San Diego CA 92155-5035
Commander, 2nd Fleet, FPO New York 09501-6000
Commander, 3rd Fleet, Pearl Harbor, HI 96860-7500
Commander, 6th Fleet, FPO New York 09501-6002
Commander, 7th Fleet, FPO San Francisco 96601-6003
Commander, Naval Special Warfare Group Two, NAB Little Creek, Norfolk, VA 23521
Commander's Office, EOD Group Two, Fort Story, VA 23459-5030
Commander, Fleet Deception Group, Atlantic, NAB, Little Creek, Norfolk, VA 23520
Commander, NAVEODTECHCEN, ATTN: Code 903C, Indian Head, MD 20640-5070
Commandant of the Marine Corps, ATTN: Code POR, HQ US Marine Corps, Federal Bldg 2, Washington, DC 20380-0001
Commanding General, Marine Corps Combat Development Command, MAGTF Warfighting Center, ATTN: Codes WF11A/WF12E, Quantico, VA 22134-5001
President, Marine Corps University, MAGT&E Center, MCCDC, Quantico, VA 22134
Commanding General, Marine Corps Research, Development and Acquisition Command, ATTN: Codes C2CM/PM Ground/C2/C2OI, Quantico, VA 22135-5080
Director, Communication Officer School, MCRDAC, Quantico, VA 22134
Commanding Officer, Communication-Electronics School, MCAGCC, 29 Palms, CA 92278-5001
Commanding Officer, Marine Corps Tactical Software Support Activity, ATTN: CO MCTSSA, MCB Camp Pendleton, CA 92055
Commanding General, Fleet Marine Forces Atlantic, FMFLANT, ATTN: Code G3/G6, Norfolk, VA 23515-5001
Commanding General, Fleet Marine Forces Pacific, FMFPAC, ATTN: Codes G3/G6, Camp H. M. Smith, HI 96861-5001

SUBJECT: Functional C3 Interoperability Architecture for AIR Operations, JTC3A Report 8034

Commanding General, I Marine Expeditionary Force, I MEF, FMFPAC, ATTN: G-6, MCB Camp Pendleton, CA 92055-5401
Commanding General, 5th Marine Expeditionary Brigade, 5th MEB, ATTN: CEO, FMFPAC, MCB Camp Pendleton, CA 92055
Commanding General, 7th Marine Expeditionary Brigade, 7th MEB, FMFPAC, ATTN: CEO, Marine Corps Air Ground Combat Center, MCAGCC, 29 Palms, CA 92278-5001
Commanding Officer, MAWTS 1, ATTN: CEO, MCAS, Yuma, AZ 85364
Commanding General, II Marine Expeditionary Force, II MEF, FMFLANT, ATTN: G-6, MCB, Camp Lejeune, NC 28542-5401
Commanding General, 4th Marine Expeditionary Brigade, 4th MEB, FMFLANT, ATTN: CEO, FPO New York, NY 09502
Commanding General, 6th Marine Expeditionary Brigade, 6th MEB, FMFLANT, ATTN: CEO, MCB Camp Lejeune, NC 23542
Commanding General, III Marine Expeditionary Force, III MEF, FMFPAC, ATTN: G-6, FPO San Francisco, CA 96606-8401
Commanding General, 1st Marine Expeditionary Brigade, 1st MEB, FMFPAC, ATTN: CEO, MCAS Kaneohe Bay, HI 96863
Commanding General, 9th Marine Expeditionary Brigade, 9th MEB, FMFPAC, ATTN: CEO, FPO San Francisco, CA 96602
Commanding General, Landing Forces Training Command Atlantic, LFTCLANT, NAB Little Creek, Norfolk, VA 23521-5350
Commanding General, Landing Forces Training Command Pacific, LFTCPAC, NAVSURFPAC, NAB Coronado, San Diego, CA 92155-5034
Communication-Electronic Officer, Fleet Marine Forces Europe, FMFEUR, USNAVTC, Box 33, FPO New York, NY 09510
Commanding General, 4th MARDIV, FMF USMCR, 4400 Dauphine Street, New Orleans, LA 70146-5400
Commanding General, 4th MAW, FMF USMCR, 4400 Dauphine Street, New Orleans, LA 70146-5400
Marine Corps Liaison Officer, DCD-USAFS, ATTN: ATSF-CD-A, Fort Sill, OK 73503-5600
Marine Corps Liaison Officer, AMSEL-LN-MC, US Army CECOM, Fort Monmouth, NJ 07703
HQ USAF, ATTN: SCM/SCX, Washington, DC 20330
HQ AFCC, ATTN: TIC-TIA, Scott AFB, IL 62225
HQ AFSC, ATTN: SD/XR, Andrews AFB, MD 20331
HQ TAC, ATTN: DR/SCM/SCX, Langley AFB, VA 23665
HQ USAFE, ATTN: DOY/DOQ, APO New York 09012
HQ PACAF, ATTN: DOC/DOQ, Hickam AFB, HI 96853
HQ ESD, ATTN: TCJ/TCV, Hanscom AFB, MA 01731-5000
USAF Tactical Air Warfare Center, ATTN: CC, Eglin AFB, FL 32542-5000
USAF Air Ground Operations School, ATTN: CC, Hurlburt Field, FL 32544
23rd Air Force, ATTN: XPX, Hurlburt Field, FL 32544-5000
HQ AFOTEC, ATTN: CV-SEAD, Kirtland AFB, NM 87117-7001
National Security Agency, ATTN: NSA T4/S24, Ft George G. Meade, MD 20755-6000
Defense Intelligence Agency, ATTN: DP-1, Washington, DC 20340-5264
Defense Communications Agency, ATTN: C4S-SA/C4S-SM/C4S-SS, Washington, DC 20305
JTC3A, ATTN: C3A-D/C3A-SA/C3A-SP/C3A-ST/C3A-AR, Isaac Newton Square North,

SUBJECT: Functional C3 Interoperability Architecture for AIR Operations, JTC3A Report 8034

Suite 210, Reston, VA 22090-5006
JTC3A, ATTN: C3A-AC/C3A-AI/C3A-S, Fort Monmouth, NJ 07703-5513
JTC3A, JITC, ATTN: C3A-TE/C3A-TEO/C3A-TEE-C/C3A-TEE-S/C3A-TEE-T, Fort Huachuca, AZ 85613-7020
Commandant, AFSC, ATTN: JCEWS, Norfolk, VA 23511-6097
Commander, Intel Center, ATTN: ATSI-DE, Fort Huachuca, AZ 85613
Commander, JEWC, ATTN: JA, San Antonio, TX 78243
Joint Doctrine Center, NAS Norfolk, VA 23511-5380
Joint Assessments and Initiatives Office, The Pentagon, Washington, DC 20301
Defense Technical Information Center, Cameron Station, Alexandria, VA 22314

CONTENTS

CONTENTS - continued

CONTENTS - continued

CONTENTS - concluded

LIST OF FIGURES

This Page Intentionally Left Blank.

LIST OF TABLES

This Page Intentionally Left Blank.

CHAPTER 1

INTRODUCTION

1-1 BACKGROUND

This report provides a tactical command, control, and communications (C3) functional interoperability architecture (FIA) for joint air operations. It is one of a series of FIAs published by the Joint Tactical C3 Agency (JTC3A). These architectures constitute important elements of the Joint Tactical C3 Architecture, which serves as a basic mechanism for achieving compatibility and interoperability of U.S. tactical C2 systems and communications equipment, as required by DOD policy. The FIAs for maritime and amphibious operations, intelligence, and joint task force control are being developed. The FIAs for special operations, air defense and airspace control, combat service support, fire support operations and land combat operations have been validated by the Joint Staff and approved by Assistant Secretary of Defense (ASD) (Command, Control, Communications, and Intelligence) (C3I).

DOD policy, contained in DOD Directive 4630.5, is "to develop, acquire and deploy tactical command, control, communications and intelligence (C3I) systems and equipment that effectively meet the essential operational needs of U.S. tactical forces. They must be compatible and interoperable, where required, with other U.S. tactical C3I systems and equipment, and with nontactical C3I systems and equipment."

The responsibility for developing and maintaining the Joint Tactical C3 Architecture is assigned by DOD Directive 5105.19 to the Director, JTC3A, "...who shall: develop and maintain a joint tactical C3 architecture by defining the architecture for joint tactical communications systems (including nonstrategic nuclear forces C3) and by defining interface specifications required to ensure interoperability and information flow among C2 systems in accordance with the guidance and direction provided by the CJCS."

The Joint Chiefs of Staff provide the following additional direction in JCS MOP 160 regarding the architecture: "The Joint tactical C3 Architecture will be developed by JTC3A, in coordination with the CINCs, Services, and Defense agencies. This architecture will not necessarily be a single document, but may consist of a hierarchy of unified and specified command, service, and agency architectures already in use. As portions of the architecture are completed, they will be validated by the Joint Chiefs of Staff, approved by the Secretary of Defense, and implemented by the DOD components."

1-2 OBJECTIVE

The objective of this report is to establish a tactical C3 functional interoperability architecture for joint air operations in a conventional war. The architecture addresses the connectivity requirements during joint operations for the

following missions, tasks, or functions: offensive counterair, strike warfare, air interdiction (including Air Force battlefield air interdiction and deep air support by Navy and Marine Corps), air reconnaissance and surveillance, electronic warfare, airlift, aerial refueling, combat search and rescue, aeromedical evacuation, and weather support. These terms are defined in chapter 3 of this report. Chapter 2 discusses the Navy terms "antiair warfare" and "strike warfare," and the Navy/ Marine Corps term "deep air support." These functions are subsumed for purposes of this architecture under the sections covering offensive counterair or air interdiction.

The task encompasses interoperability considerations of tactical information exchanges that must take place during these functions, missions, and tasks. The report also serves as the basis for identifying deficiencies involving the interoperability of service command and control systems and communications equipment involved in joint air operations. The report identifies impediments to interoperability associated with related functions including joint operating procedures and training.

The C3 interoperability architectures developed by the JTC3A provide communications planners with the functional joint interface requirements that have been validated by the joint staff and approved by ASD C3I. In conjunction with the supporting analysis on which they are based, they will aid commanders in planning joint operations, evaluating effectiveness of tactical C3 in joint operations, and identifying solutions to interoperability deficiencies.

1-3 SCOPE AND APPROACH

The scope of this architecture is limited to the tactical C3 interoperability requirements of U.S. forces conducting joint air operations. The architecture is generic, not tailored to a specific geographic area, and excludes order of battle and other CINC specific considerations. The analyses of interoperability focus on information exchange requirements within the chartered responsibilities of JTC3A. Service doctrine and operating procedures are discussed to identify the service C2 elements and intraservice connectivity requirements for air operations that are the basis for a joint architecture. The supporting analysis from which this report is extracted contains a list of joint doctrine publications and other references that were considered in establishing the connectivity requirements established in this FIA.

This report notes the importance of identifying the relationship between it and the supporting analysis from which its information is drawn. The supporting analysis for this FIA was prepared by the Institute for Defense Analysis (IDA) and submitted to JTC3A as IDA Report R-348, July 1989 (S). The supporting analysis, staffed at the service and agency level, contains extensive technical data and comprehensive analyses of the functions addressed in this architecture. Although the information provided in this architecture is drawn from the supporting analysis, the level of detail contained in it is reduced to that judged appropriate for review by the joint staff. The supporting analysis is the primary reference in those instances when additional information on the discussions in this report is desired.

The architecture identifies joint C3 interface requirements for a generic joint task force that includes five components: U.S. Army, U.S. Air Force, U.S. Navy, U.S. Marine Corps, and a Joint Special Operations Task Force. As explained below, joint interface requirements for special operations are identified in a separate architecture. Interface requirements for special operations are discussed in this report only as they pertain to tactical functions included in this architecture.

Several supporting tasks and missions associated with air operations are addressed in other JTC3A functional architectures published separately. For example, connectivities for the airspace control/air defense functions necessary to integrate the Antiair Warfare Commander (AAWC), Control and Reporting Center (CRC), and Tactical Air Operations Center (TAOC) during offensive counterair operations are addressed in the Airspace Control /Air Defense FIA. These tasks are referenced in this report when necessary for clarity, but the joint interface requirements for these functions are not duplicated. The joint interface requirements for these related functions and the reports in which they are identified are listed below:

1. Air defense and airspace control - JTC3A Report 8006, May 1988.

2. Close air support - JTC3A Report 8016, the fire support FIA, November 1989.

3. Special operations - JTC3A Report 8015 March 1990.

4. Air operations in a maritime environment - the maritime and amphibious operations C3 architecture - JTC3A Report 8121, January 1990.

5. Intelligence support - the C3 interoperability architecture for intelligence, JTC3A Report 8030, March 1990.

1-4 ORGANIZATION OF THE DOCUMENT

The architecture contains the following:

a. Discussions of the internal C3 functions for air operations conducted by the joint force headquarters and each component of the joint force.

b. An analysis of the tactical functions that make up the air operations architecture, and a determination of joint tactical C3 interface requirements involved in the execution of these functions.

c. A series of figures, matrices, and tables that depict the interface requirements for each C2 element, the categories of information involved, and the means by which the information is exchanged.

d. Discussions concerning the interoperability findings of the report. This analysis identifies existing or potential impediments to joint interoperability

identified during research for the report, and provides recommendations to reduce or eliminate these deficiencies.

Chapter 2 discusses the organization and C2 functions of each component force during air operations. These discussions are intended as an overview of service connectivities and an explanation of service C2 functions that are related to the joint interfaces identified in the architecture. As explained above, these discussions and other information in the report are a condensation of the more detailed information in the supporting analysis.

Chapter 3 is an analysis of joint C2 functions within each of the nine tactical functions addressed in this architecture. The C2 functions at the joint force headquarters also are discussed with an emphasis on the air resources allocation process for a joint force. The joint interface requirements for each of the nine functions are provided in matrix format.

Chapter 4 portrays the C3 functional interoperability architecture for air operations. The C2 elements and connectivity requirements are presented in a series of matrices, tables, and organizational connectivity diagrams.

Chapter 5 contains the interoperability findings of the report. In general, the findings comprise the deficiencies and issues that research and analyses identified as impediments to interoperability. Recommendations to reduce or eliminate the deficiencies are provided.

Appendix A is a glossary of terms.

CHAPTER 2

COMMAND AND CONTROL OF AIR OPERATIONS

2-1 JOINT FORCE HEADQUARTERS ORGANIZATION AND C3 FUNCTIONS

A. Introduction. A joint force commander has the authority to organize all elements of assigned and attached forces deemed necessary for accomplishment of assigned missions. Usually, this authority is exercised through service component commanders. The purpose of this section is to discuss the organization of the joint force commander's headquarters, accenting staff elements and C3 functions concerned with air operations. An example of a generic joint force is shown in figure 2-1.

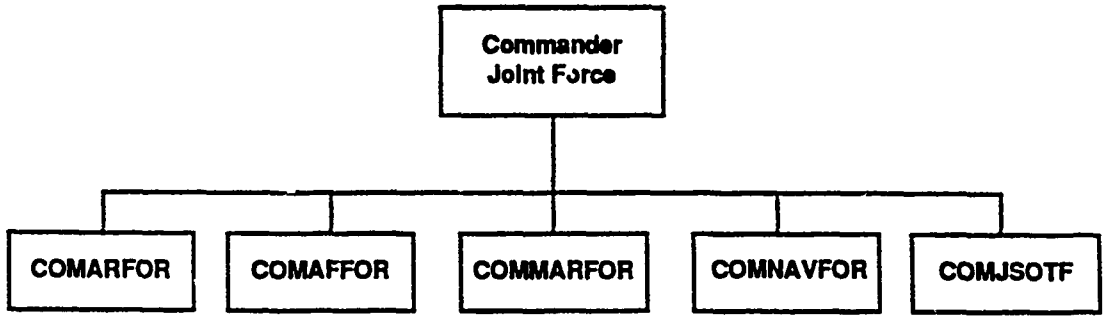
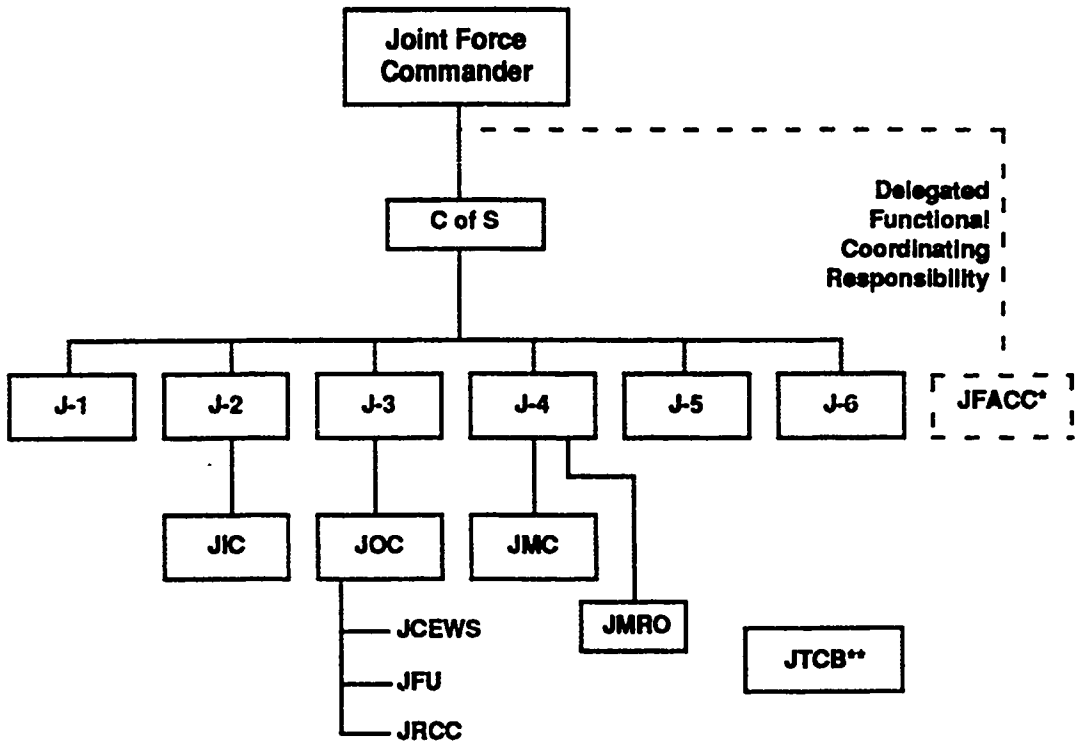


Figure 2-1. Generic Joint Force Organization

B. Staff Organization and C3 Functions. The staff structure of the joint force headquarters is characterized by a complement of directorates, functional support staff elements, and a number of centers, boards, and other authorities. Key agencies of a representative joint force headquarters are illustrated in figure 2-2 and described below.

1. Joint Intelligence Center (JIC). The JIC is formed at the discretion of the commander and is staffed jointly to provide essential intelligence to the commander and to supplement intelligence available to the components. The JIC Intelligence Director is the J-2 staff officer. Specific functions include collection management. maintenance of order of battle, and other functions related to the preparation and dissemination of intelligence products. The J-2 provides the joint force commander with the enemy threat situation to assist the apportionment decision.

2. Joint Operations Center (JOC). The JOC serves as the focal point for all operational and intelligence matters pertaining to the joint force. Tasks performed include planning, direction, execution supervision, situation monitoring, reporting, and evaluation of the operations of the forces and resources assigned.



* JFACC is a coordinating responsibility that may be delegated by the joint force commander to an air capable component.

** A staff agency chaired by the J-3 with representation from J-2, other staff agencies, and the components, as appropriate.

Figure 2-2. Representative Headquarters Staff Elements for Air Operations

3. Joint Rescue Coordination Center (JRCC). When established, the JRCC may be at the joint force headquarters or headquarters of the component commander designated as the Search and Rescue (SAR) Coordinator. At the joint headquarters, the JRCC usually falls under staff supervision of the J-3.

4. Joint Force Commander's Electronic Warfare Staff (JCEWS). The joint staff operations section (J-3) has primary staff responsibility for EW activity and for planning, coordinating, and integrating joint force EW operations with other combat disciplines. The JCEWS assists the J-3 and JOC in carrying out assigned EW responsibilities.

5. Joint Targeting Coordination Board (JTCB). A JTCB may be established to coordinate targeting information, provide targeting guidance and priorities, and prepare or refine the joint target list (JTL). Additionally, the JTCB monitors the effectiveness of targeting efforts, coordinates and deconflicts all joint targeting operations, validates no-fire areas, and approves new target nominations for inclusion in the JTL. Usually, the JTCB is chaired by the J-3 or his representative and consists of J-2 and other staff representatives and components.

6. Joint Forecast Unit (JFU). Meteorological support of all operations requires a weather support cell appropriate to the headquarters structure. The JFU is staffed to satisfy this requirement and is headed by the JTF staff weather officer, who usually reports to the J-3.

7. Joint Movement Center (JMC). The JMC coordinates the use of all means of transportation to support the commander's concept of operation. The JMC functions under the staff cognizance of the J-4. Tasks performed include coordination with the joint deployment system (JDS) to monitor and effect changes to deployment of forces and supplies; validation and approval of airlift requests; analysis of user capabilities to ship, receive, and handle cargo; and advising the J-4 on transportation matters.

8. Joint Medical Regulating Office (JMRO). The JMRO coordinates the movement of patients within and out of the assigned area of responsibility. The Staff Surgeon, in coordination with the JMC, may supervise functioning of the JMRO.

9. Joint Force Air Component Commander (JFACC). A key consideration for the joint force commander is the means used for unifying the efforts of air forces assigned to the joint force. The joint force commander usually designates a JFACC. The JFACC's responsibilities will be assigned by the JFC. These duties will include, but not be limited to planning, coordination, and allocation and tasking of air sorties based on the joint force commander's apportionment decision. Using the joint force commander's guidance and authority, and in coordination with other Service component commanders, recommends to the joint force commander apportionment of air sorties to various missions or geographic areas. The joint force commander may designate any one of the air capable service component commanders the JFACC, or he may designate one of his staff elements to perform the functions of the JFACC. To illustrate, this FIA considers the Air Force component commander to be so designated. The interfaces established in the architecture assume that U.S. Army, U.S. Navy, and U.S. Marine Corps components are conducting air operations, and that responsibilities of the JFACC are carried out through commanders of those components. In this architecture, connectivities associated

with the JFACC will coincide with those of the Air Force component commander. Parallel connectivity requirements would be valid regardless of which air capable component commander is designated as the JFACC. Therefore, for clarity and simplicity of presentation, connectivities depicted in the matrices do not specify the JFACC as a separate C2 element. The analyses in support of this report considered the C3 implications for each of the alternatives available to the JFC regarding designation of the JFACC. No interoperability deficiencies are inherent in any alternative that precludes operating as JFACC.

C. C3 Support for Joint Force Headquarters. When approved by the Chairman, Joint Chiefs of Staff (CJCS), the Joint Communications Support Element (JCSE) supports the joint headquarters and Joint Special Operations Task Force (JSOTF). JCSE support includes installation, operation, and maintenance of C-E facilities and systems of these two headquarters and, when required, satellite terminals at service components and supported or supporting CINC or allied headquarters. USCINCCENT has been assigned responsibility for operation, maintenance, manning, readiness, and periodic testing of the JCSE. This architecture considers that the JCSE has been assigned to support the joint force headquarters.

A discussion of other joint force headquarters functions including the air apportionment process and helicopter support of the joint force headquarters is provided in chapter 3 as an element of the analyses of joint C3 functions.

2-2 U.S. ARMY AVIATION C3 FUNCTIONS AND ORGANIZATION

A. Introduction. Army aviation forces are designed to operate as an integral element of the combined arms team. Combining speed, mobility, firepower, and lift capabilities, these forces perform an array of missions across the range of combat, combat support, and combat service support. U.S. Army aviation plays a key role in the Army's AirLand Battle Doctrine, which addresses the simultaneous conduct of the close, deep, and rear battles. U.S. Army aviation elements participate in joint operations when such operations are conducted, and when called upon and available through direct support provided to other services.

B. U.S. Army Aviation Missions. Army aviation combat operations include attack, reconnaissance and security, air assault, air combat, special operations, and command and control missions. The main purpose of attack operations is to defeat enemy armored, mechanized, and helicopter forces during offensive and defensive operations. Reconnaissance operations provide intelligence and assess damage from friendly and enemy fires. Aviation security operations detect enemy forces and help prevent unexpected attack. Air assault operations use helicopter assets to maneuver on the battlefield to engage and destroy enemy forces. Air combat operations protect combined army maneuver forces, augment air defense forces, and provide aviation self defense. U.S. Army aviation supports special operations in a joint environment by furnishing dedicated aircraft and accomplishes the C2 mission by providing specially configured aircraft for commanders and their staffs.

Combat support (CS) operations by U.S. Army aviation assets provide operational assistance to combat elements. This report notes that these operations differ from air assault missions that are combined arms maneuver operations. These forces also may participate in mine and countermine operations and search and rescue.

Combat service support (CSS) operations provide assistance to sustain combat forces in air movement and aeromedical evacuation. Air movement operations using aviation utility and cargo assets for other than air assault operations and CS air movements are combat service support operations. CSS air movements are performed to support close and rear operations. CSS missions into the deep area are considered to be air assault combat missions. Army medical forces employ air ambulances to support medical evacuation throughout the close and rear areas and possibly during deep operations.

C. **U.S. Army Aviation Organizational Structure**. Aviation brigades are organic to divisions, corps, and selectively, echelons above corps (EAC). Figure 2-3 portrays a typical U.S. Army aviation organizational structure at EAC, heavy corps, and heavy division levels.

The aviation organizational structure at EAC includes a theater army aviation battalion (THTR AVN BN), a CH-47 medium lift battalion (MDM BN), and possibly an Air Traffic Services (ATS) unit.

Aviation assets are provided in a number of units in the heavy corps. The typical aviation brigade includes an aviation group and two attack helicopter regiments. The aviation group includes an ATS battalion, two UH-60 assault helicopter (ASLT) battalions, a CH-47 battalion, and a command aviation battalion (CMD BN) with companies that provide aircraft for field artillery aerial observers in corps artillery and for corps command, control, and communications. The corps armored cavalry regiment (ACR) includes an organic aviation squadron (AVN SQDN) equipped with utility, scout, and attack helicopters. Aerial exploration (AE) battalion of the corps military intelligence (MI) brigade includes aerial surveillance (AS) and electronic warfare (EW) companies. The AS company provides the corps with an airborne platform for imagery collection (OV-1D, MOHAWK). The EW company provides an airborne electronic intelligence (ELINT) capability (RV-1D QUICK LOOK) and the airborne segment (RV-21) of the Guardrail communications intelligence (COMINT) system. All of the aerial assets of this battalion are fixed wing. Medical evacuation battalion of the medical (MED) brigade includes a number of air ambulance companies in direct support of divisions and in general support of the corps.

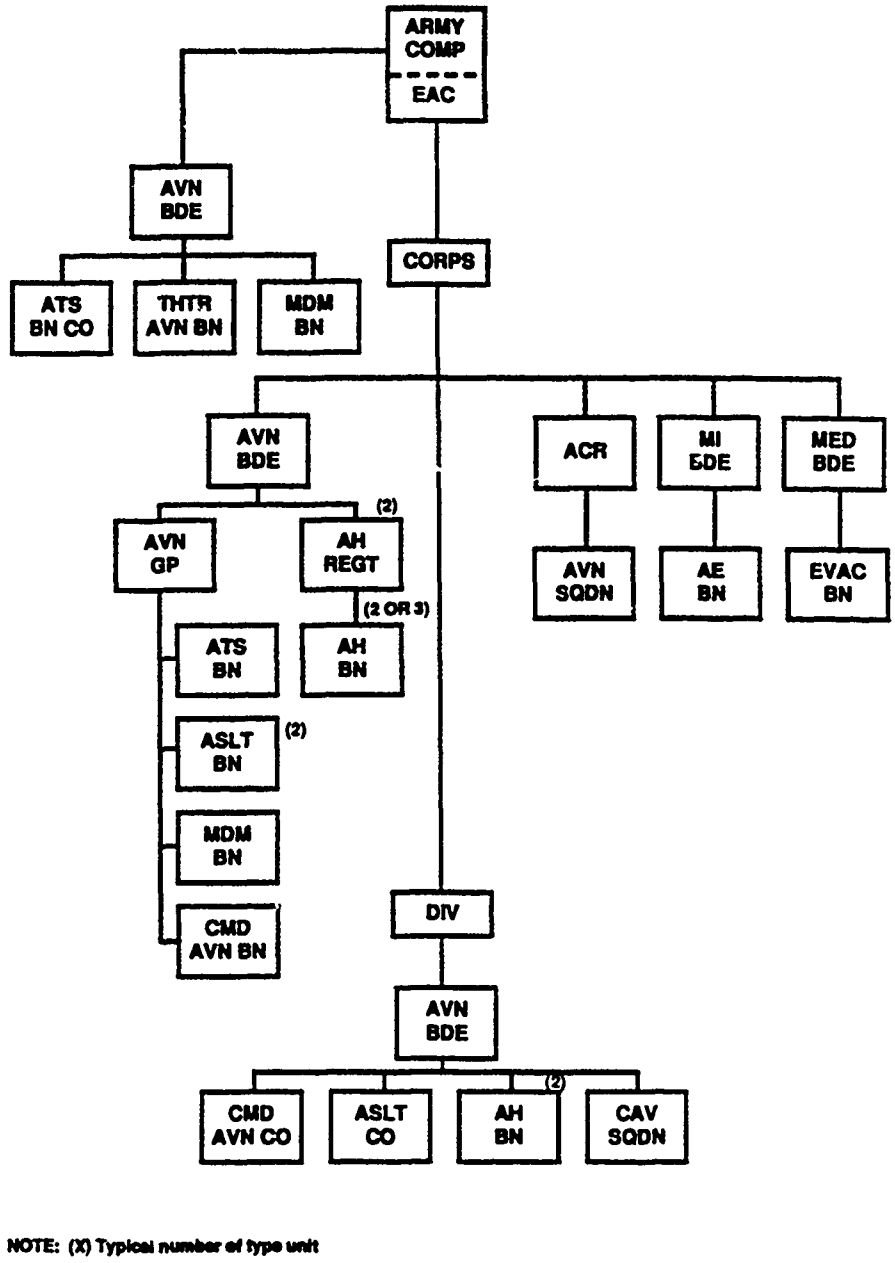


Figure 2-3. Typical U.S. Army Aviation Organizational Structure (Heavy Corps and Division)

An aviation brigade is organic to all Army divisions and has four principal elements in a heavy division. The command aviation company (CMD CO) provides the division with observation and utility aircraft for command, control, and communications enhancement; field artillery observation; and combat electronic warfare and intelligence (CEWI) operations. The assault helicopter company (ASLT CO), equipped with utility aircraft, conducts air assault operations and moves personnel, supplies, and equipment. The attack helicopter battalion employs scout and attack helicopters to destroy enemy forces. The cavalry squadron is equipped with scout, attack, and utility helicopters to conduct route, zone, and area reconnaissance.

The organizational structure of U.S. Army aviation in the contingency corps, the light infantry division, the airborne division, and the air assault division varies from that of the heavy forces analyzed in this architecture. Aviation assets within each of these organizations are task organized; however, joint connectivity requirements do not vary significantly from those identified in this generic architecture.

D. U.S. Army Aviation C3 Structure. Command and control of U.S. Army aviation is oriented to employment of aviation units rather than individual aircraft sorties. Planning and execution of aviation operations generally are decentralized to commanders to whom aviation units are assigned.

The aviation brigade is the principal U.S. Army aviation unit. The C3 system it employs consists of organizations, facilities, processes, and communications necessary to perform assigned tasks. The C2 organization of the brigade consists mainly of the brigade staff structured to meet mission requirements. Command post (CP) facilities include a main CP and a rear CP. A tactical CP is established when required to control a key operation. Single-channel radio is the primary means of tactical communications for C3 functions at CPs and Tactical Operations Centers (TOCs).

The Battlefield Coordination Element (BCE) is integral to C2 functions involving Army aviation operations. It provides the U.S. Army force commander with direct liaison with the Tactical Air Force commander and is responsible for synchronizing tactical air support with the scheme of maneuver. The BCE is located at the Tactical Air Control Center (TACC); specific tasks within its overall mission include planning and coordination, deconfliction, integration of air defense operations, and interchange of intelligence information. The Air Support Operations Center (ASOC), discussed in the U.S. Air Force section of this chapter, executes parallel functions at the CTOC.

U.S. Army commanders at all levels consider use of Army aviation in estimating the situation and formulating a concept of operations for accomplishing their assigned mission. Aviation units assigned at EAC, corps, and division and organic aviation in corps nonaviation units are tasked in normal command channels. Levels without assigned aviation units (maneuver brigade and below) request aviation support from the next higher headquarters in command or operations channels. The following paragraphs address air assault, CSS, air combat, and aeromedical operations conducted by Army Aviation elements.

1. Air Assault Operations. Air assault operations involve extensive integration of various units into a combined arms team. Either the ground or the aviation commander is designated air assault task force commander (AATFC) to ensure command unity. The assault helicopter company or battalion provides the airborne mission commander (AMC) who is responsible to the AATFC for the related air operations. This C2 element has been identified previously as the air battle captain or attack helicopter company commander. He plans for and coordinates actions along the flight route and employs air cavalry, attack helicopters, tactical air, or artillery, as necessary.

2. CSS Operations. CSS air movement operations involve command and control processes for aerial resupply using airland, airdrop, and extraction techniques. U.S. Army and U.S. Air Force assets are used to provide this support; however, most airdrop and all extraction deliveries are executed by the Air Force.

3. Air Combat Operations. These operations can be offensive or defensive. Offensive Counterair (OCA) consists of attacks against air-related targets forward of the forward line of own troops (FLOT). Planning, coordinating, controlling, and executing these attacks involves the aviation commander, the air defense coordinator, and the fire support coordinator under the direction of the G-3. These responsibilities include coordination of these operations with the JFACC, ACA, and other appropriate C2 elements. Active Defensive Counterair (Active DCA) involves air combat. During deep maneuvers and close combat along the FLOT, aviation units conducting reconnaissance, security, or antiarmor missions will plan for and conduct air combat for self-defense and to protect the ground maneuver force. In rear operations, aviation units usually are employed in an active DCA role to protect friendly maneuver forces and combat support/combat service support elements from threat helicopters and CAS aircraft. Corps aviation units in an active DCA role usually will be placed under operational control (OPCON) of the maneuver commander.

4. Aeromedical Evacuation. These missions are conducted in response to requests processed through medical channels for approval. The surgeon or his medical regulating officer (MRO) at each level, battalion and higher, carries out the medical regulating function to determine the movement of patients to medical facilities. Approved requests are forwarded for execution to the supporting air ambulance detachment. Since aeromedical evacuation is a secondary capability of all lift aircraft, CSS air movement may support medical evacuation.

5. Joint Operations. C3 interfaces for U.S. Army aviation operations in support of the nine tactical functions identified for inclusion in this architecture are discussed in chapter 3.

E. C2 Systems and Communications Equipment

1. C2 Systems. The overall function of U.S. Army C2 systems, as they relate to Army aviation, is to integrate aviation operations into the commander's scheme of maneuver. The Army Tactical Command and Control System (ATCCS) is

the principal means of achieving this objective. One of the objectives of the ATCCS is to integrate aviation operations into the five battlefield functional areas (BFAs): maneuver, intelligence or electronic warfare, fire support, air defense, and combat service support. In support of this objective, designated supporting elements within the ATCCS are established to support specified C2 functions for aviation operations. The Army Battlefield Interface Concept (ABIC) documents the interface requirements within the ATCCS. The Army Airspace Command and Control (A2C2) system is designed to coordinate concurrent use of airspace to maximize employment of combat power within a designated sector of airspace over the battlefield. When fully operational, the Maneuver Control System (MCS) will enhance the exchange and processing of data significantly among Army C2 elements, including those involved in aviation operations. The BCE and ASOC support the integration of U.S. Army and U.S. Air Force C2 systems during joint air operations involving these forces. When the U.S. Army conducts operations as a component of a joint force, C3 functions involving aviation operations are coordinated with the Airspace Control Authority (ACA) and the Joint Force Air Component Commander (JFACC) to ensure coordination of U.S. Army aviation operations with components of the joint force.

2. Communications. The primary means of communications supporting C2 functions for Army aviation operations is single-channel radio. Other means employed to meet specified requirements include multichannel, satellite, and wire connectivities. The aviation brigade establishes and controls internal and external radio and telephone nets to meet its own C3 requirements and those of its subordinate units. Key internal radio nets include VHF-FM for operations, intelligence, and logistical requirements. Other internal nets use UHF and HF nets to support aviation operations and radio teletypewriter requirements. Key external radio nets support VHF-FM interfaces with the DTOC for operations and intelligence functions and HF connectivities with the DTOC for radio teletypewriter requirements. The Corps aviation brigade establishes the same internal and external nets as the division aviation brigade.

The primary means for requesting, coordinating, and employing support of the assault and attack helicopter battalion is secure FM radio. U.S. Army aircraft are equipped with VHF-FM, VHF-AM, and UHF-AM radios. Some Army aircraft equipped for special missions employ HF radios.

The U.S. Army is improving its information exchange capability on the battlefield with the introduction of several advanced communications systems. Mobile Subscriber Equipment (MSE) is being introduced incrementally, with full fielding expected by 1994. With the fielding of MSE, radioteletype systems are replaced by facsimile. This system will integrate wire and radio systems, automatically locate subscribers, and enhance information exchange across the battlefield. This system will facilitate planning and coordination of aviation operations, particularly at the corps and division level. The Single Channel Ground and Airborne Radio System (SINCGARS) is a new series of VHF-FM radios that are replacing the current AN/VRC-12 family of radios. SINCGARS provides more channels, increased equipment reliability, expanded data exchange capability, and increased resistance to electronic countermeasures. These radios will enhance

information exchange between maneuver elements and will facilitate planning and coordination of aviation operations.

2-3 U.S. AIR FORCE C3 FUNCTIONS AND ORGANIZATION

A. Introduction. An underlying principle for U.S. Air Force command and control operations is that tactical air forces must be prepared to perform all missions and tasks of air operations simultaneously, using limited assets capable of performing several or all of the functions. Accordingly, the U.S. Air Force has established C3 systems and operating procedures that centralize the authority and capability to shift assets among mission areas and tasks, while providing decentralized execution of detailed planning and mission execution.

This guidance also is used to determine the size and composition of the Tactical Air Control System (TACS) deployed to provide C2 of the forces. The TACS considered in this report is a generic organization referred to in U.S. Air Force documents as a Contingency TACS. As depicted subsequently in this section, this architecture considers the Tactical Air Force (TAF) headquarters to be collocated with the senior C2 element of the TACS: the Tactical Air Control Center (TACC). Integral to the C3 functions of the TACS is the Air Support Operations Center (ASOC). The ASOC is an Air Force liaison element located at the Corps Tactical Operations Center (CTOC). An ASOC may be provided to other maneuver elements conducting independent operations. A primary function of the ASOC is to ensure expeditious response to the requests for tactical air support originated by the supported U.S. Army maneuver element.

B. U.S Air Force Missions. The air operations addressed in this architecture are categorized by the U.S. Air Force as missions and tasks. The mission areas identified for analysis in this architecture are counterair, air interdiction, theater airlift, tactical reconnaissance, and surveillance, and aeromedical evacuation. The specialized tasks are electronic combat, combat rescue, aerial refueling, and weather service. As explained in chapter 1, the functions of defensive counterair, close air support, and airspace control are addressed in separate C3 architectures. The following paragraphs discuss missions and tasks conducted by the Air Force that are included in this architecture.

1. Counterair Operations. The ultimate goal of counterair operations is to gain air superiority. These operations are intended to gain control of the aerospace environment, protect friendly forces, ensure the freedom of friendly forces to use the airspace over the battlefield and deny the use of this airspace to the enemy. Counterair operations are categorized as discussed in the following paragraphs.

a. Offensive Counterair (OCA). These missions are conducted to seek out and neutralize or destroy enemy air forces by gaining air superiority. Offensive counterair is designed to secure a favorable situation by seizing the offensive at the initiation of hostilities, conducting operations in the enemy's

airspace, and neutralizing or destroying his forces and the infrastructure supporting his air operations.

b. Suppression of Enemy Air Defenses (SEAD). These operations are conducted to neutralize, destroy, or degrade enemy air defensive systems in a specific area by physical or electronic attack. The goal of SEAD is to permit friendly forces to perform missions effectively without interference from enemy air defenses.

2. Air Interdiction (AI). These missions are conducted to delay, disrupt, divert, or destroy an enemy's military potential before it can be brought to bear effectively against friendly forces. Typical targets include enemy surface forces, communications networks, C2 systems, and combat supplies. A subset of AI is battlefield air interdiction (BAI), which is directed against land force targets having a near-term effect on the scheme of maneuver of friendly forces. BAI requires joint coordination at the component level during planning; but once planned, BAI is controlled and executed as an integral part of a total AI campaign. Both tactical and strategic aircraft may be employed in air interdiction.

3. Airlift Operations. These missions are used to deploy, employ, and sustain military forces. Theater airlift is performed within a theater of operations and supports theater objectives through the rapid and responsive movement of personnel and supplies. Theater airlift comprises four basic tasks: logistical airlift, airborne operations, intratheater aeromedical evacuation, and special air support operations.

4. Reconnaissance and Surveillance. The objective of these missions is collecting information from airborne, orbital, and surface based sensors. Tactical and strategic aircraft perform these operations.

5. Electronic Combat (EC). These missions are categorized by the Air Force as a specialized task. The objective of EC is to protect friendly electromagnetic capabilities and actions while neutralizing or destroying the enemy's electromagnetic capabilities. This report focuses on electronic countermeasures (ECM) and electronic support measures. Not addressed are electronic counter countermeasures (ECCM) or self-protection systems.

6. Combat Rescue (CR). Another specialized task identified by the Air Force is combat rescue of downed combat aircrew personnel. These operations are conducted in both permissive and hostile environments. The task is assigned to the Military Airlift Command (MAC). U.S. Navy and U.S. Marine Corps use the term Combat Search and Rescue (CSAR) to describe this task.

7. Aerial Refueling. This is a specialized task to support strategic, tactical, and mobility operations by extending the range, payload, and flexibility of operations. The aerial refueling task is assigned to the Strategic Air Command (SAC), who also is designated the worldwide manager of dedicated refueling aircraft.

8. Weather Support. Weather service gathers, analyzes, and provides meteorological and other data for mission planning and execution. In accordance with a joint agreement, the Air Force weather service is responsible for providing meteorological support to all Army units and to designated unified and specified commands. Normally, aircraft do not provide weather support within a theater or JTF.

C. Other Operations. Supplies and equipment may be delivered to ground forces by the Low Altitude Parachute Extraction System (LAPES), or by airdrop operations. Airdrop also may include personnel. These missions may be performed on a sustained, selective, or emergency basis to dispersed areas throughout a wide spectrum of climate, terrain, and combat conditions. Air logistics support permits rapid delivery with a minimum of transshipments and enhanced responsiveness. The key C2 element in coordinating these joint operations with the requesting component force is the joint movement center (JMC). The joint connectivities among the tactical C2 elements during the enroute and terminal control of these operations are the same as those discussed in paragraph 3-7 of this report.

D. U.S. Air Force C3 Structure for Air Operations. The Air Force command and control structure is founded on the idea of centralized control and decentralized execution under a single air commander. This concept is evident in the organization and functions of the contingency Tactical Air Control System (TACS), illustrated in figure 2-4. Centralized control is exercised through the Tactical Air Force Headquarters (TAF HQ) and the Tactical Air Control Center (TACC). The function of the TAF HQ is to advise and assist the commander in developing and implementing an overall air campaign strategy based on the joint force commander's guidance, to manage force disposition, and to ensure logistics and communications support. The TACC is the operational facility in which the TAF Commander has centralized the functions of planning, direction, and control over tactical air operations. While the functions are centrally controlled by the TACC, mission execution in several mission areas is directed by subordinate organizations such as the Control and Reporting Centers (CRC), and Air Support Operations Centers (ASOC). Collocated with and operationally connected to the TACC is the Airlift Control Center (ALCC), which directs theater missions for the TAF commanders and the Commander of Airlift Forces (COMALF). In the absence of a TACC, as in the early stage of a contingency operation, the Airborne Battlefield Command and Control Center (ABCCC) may serve that function. The ABCCC also may serve as an airborne extension of the TACC to provide extended communications with assigned forces.

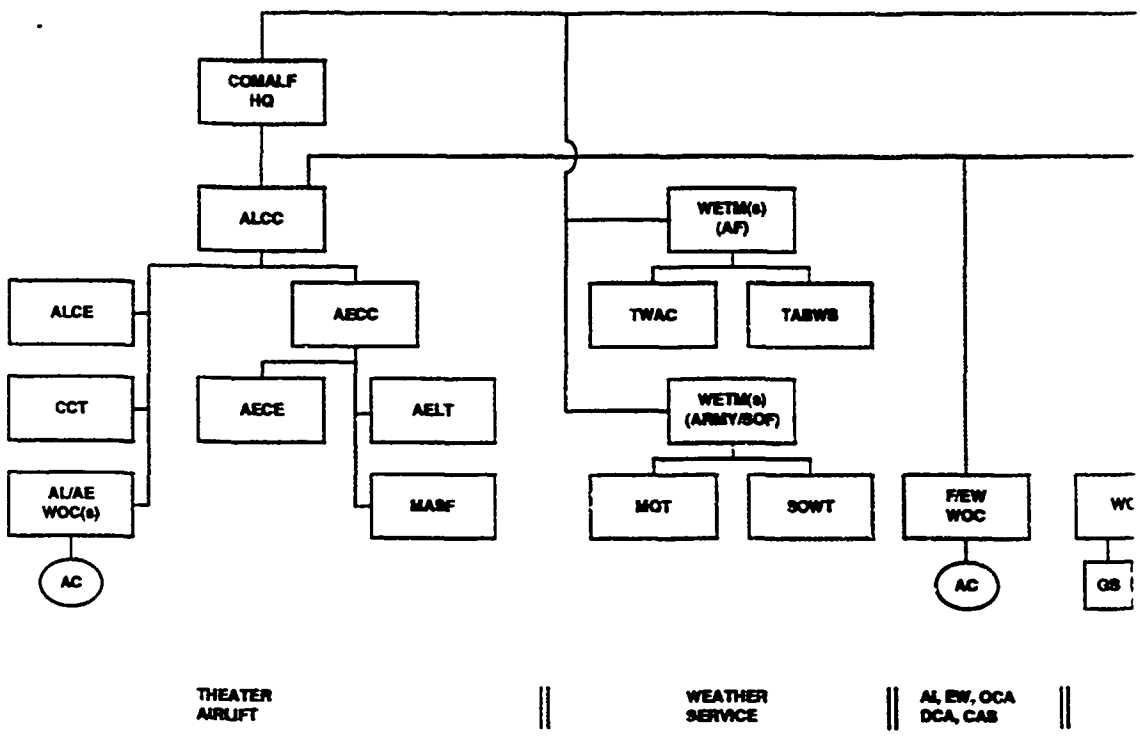

COMAFF HQ
ALCC
ALCE
CCT
AL/AE WOC(s)
AC
AECC
AECE
AELT
MASF
WETM(s) (AF)
TWAC
TABWB
WETM(s) (ARMY/SOF)
MOT
SOWT
F/EW WOC
AC
THEATER AIRLIFT
WEATHER SERVICE
AI, EW, OCA DCA, CAS

Figure 2-4

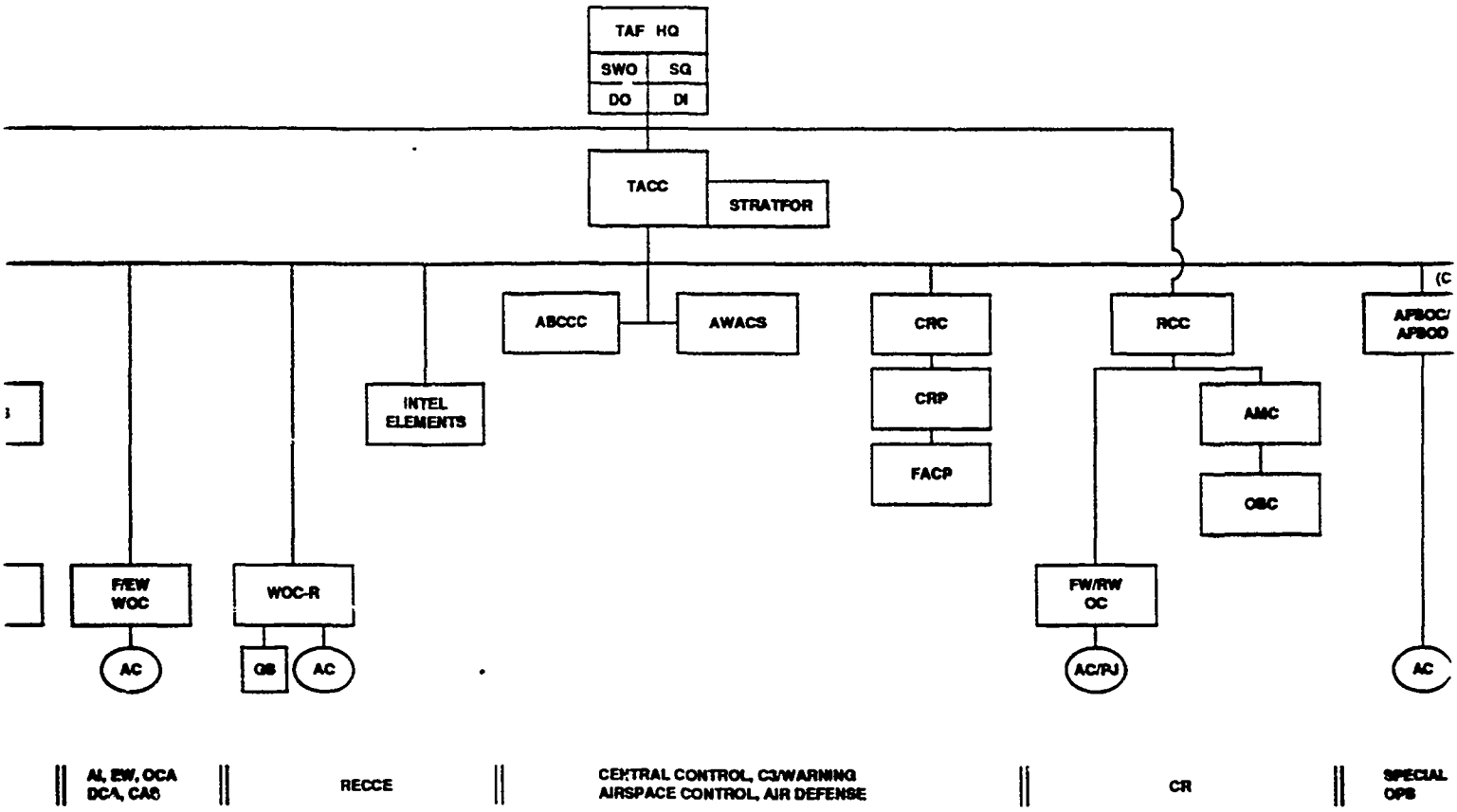
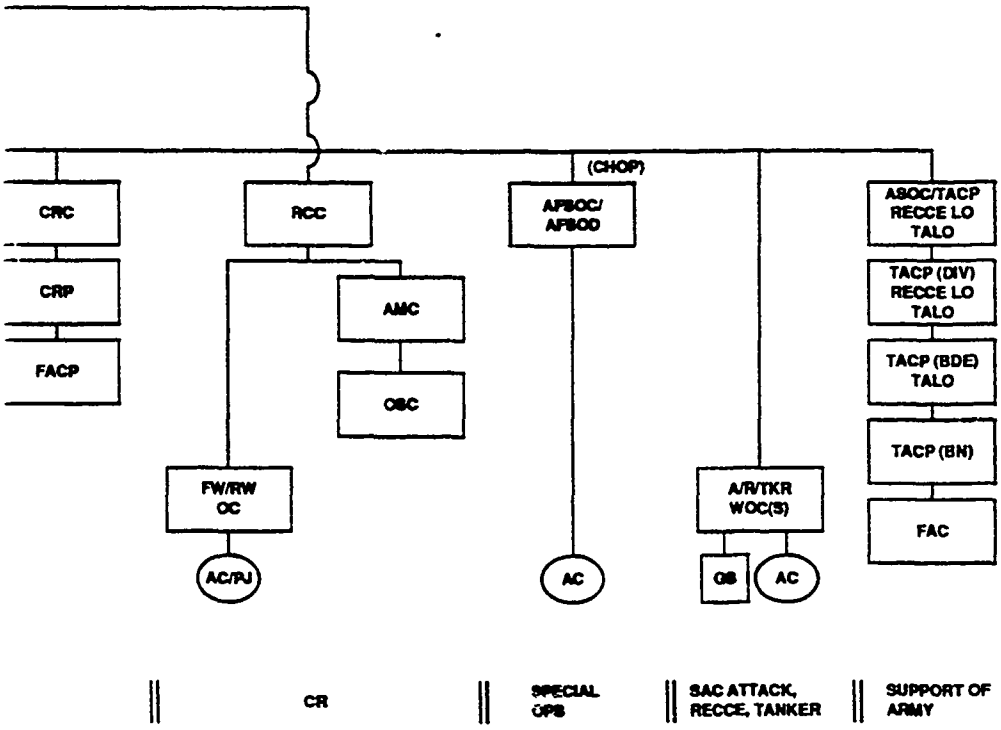


Figure 2-4. U.S. Air Force Contingency TACS Structure for Air Operations Architecture


(CHOP)
CRC
CRP
FACP
RCC
AMC
OBC
FW/RW OC
AC/PJ
AFSOC/ AFSOD
AC
A/R/TKR WOC(S)
GB
AC
ASOC/TACP RECCE LO TALO
TACP (DIV) RECCE LO TALO
TACP (BDE) TALO
TACP (BN)
FAC
CR
SPECIAL OPS
SAC ATTACK, RECCE, TANKER
SUPPORT OF ARMY

e for

3 2-13/14

The TACC is organized into four primary divisions. The Combat Plans Division is responsible for developing and issuing the air tasking order (ATO) that tasks units, already assigned or attached, to accomplish specific missions. The Combat Intelligence Division supports the Combat Plans Division in developing the ATO with information on the enemy threat, target lists, and reconnaissance collection activities. The Combat Operations Division supervises execution of the ATO and coordinates and directs adjustments as necessary. The Enemy Situation Correlation Division determines the immediate threat to friendly forces and the most lucrative targets to eliminate that threat. The remainder of this section summarizes subordinate TACS elements responsible for the decentralized execution of missions and tasks.

1. Attack Mission C2 Elements. Once missions have been tasked by the TACC, the Wing Operations Center (WOC) is the primary element in planning and directing the execution phase of planned missions such as AI, OCA, SEAD, and EC. The WOC also functions as the detailed planning and operations center for each flying unit. The WOC is the focal point at which ATOs are translated into specific missions and sorties by scheduling aircraft, crews, and weapons loading. WOCs are established for tactical units of fighter and electronic warfare aircraft as well as SAC bombers that have been assigned a conventional role and placed under the operational control of the Air Force component commander.

2. Reconnaissance Mission C2 Elements. The execution phase of reconnaissance missions is similar to that for attack missions in that it is executed directly from the TACC to the WOC. Reconnaissance requires addition of ground stations to process and distribute information collected by the airborne sensors.

3. Airlift Mission C2 Elements. Within a given theater, the airlift effort is managed through the Airlift Control Center (ALCC). Subordinate to the ALCC are Airlift Control Elements (ALCEs) established at departure, en route, and arrival airfields, and landing zones used by tactical airlift aircraft. The ALCEs are responsible for control of aircraft movement, supervision of loading and offloading, and coordination of aeromedical evacuation at each operating airbase. At locations (other than airbases) used for airdrop, landing, or extraction zones, Combat Control Teams (CCTs) serve as the C2 element. The CCT is composed of jump-qualified Air Force personnel operating under the control of the ALCC. Lastly, Tactical Airlift Liaison Officers (TALOs) are assigned to Tactical Air Control Parties (TACPs) at Army brigades, divisions, and corps to advise the ground force commanders on the capabilities, limitations, and employment of MAC airlift resources.

The primary C2 element for aeromedical evacuation is the Aeromedical Evacuation Control Center (AECC), which is responsible for coordination with the supporting ALCC. The AECC is supported by Mobile Aeromedical Staging Facilities (MASFs) and Aeromedical Evacuation Liaison Teams (AELTs) as required.

4. Combat Rescue C2 Elements. The primary C2 element for Combat Rescue (CR) is the Rescue Coordination Center (RCC). Frequently, the RCC also will serve as the JRCC and be operated by personnel of two or more services. The Airborne Mission Commander (AMC) is an airborne representative of the controlling RCC designated to exercise overall control and coordination of CR activity in a specified rescue area. The AMC may designate an On Scene Commander (OSC) positioned in the immediate vicinity of the survivor who will coordinate the rescue efforts throughout the objective area. The PRT (Pararescue Team) consists of specially trained personnel to provide emergency medical treatment in remote or restricted areas and assist distressed or isolated personnel in survival and recovery.

5. Aerial Refueling/Strategic Support C2 Elements. Tactical air operations may be supported by SAC assets consisting of tankers, reconnaissance platforms, and bomber aircraft. The details of tasking and control arrangements may vary by asset and tactical situation. A Strategic Forces (STRATFOR) advisor element may be established to provide detailed information regarding employment of SAC resources. When established, the STRATFOR element interfaces with the TACC and is responsive to the TACC d rector for planning, preparing the ATO, and executing tasks assigned to the supporting strategic forces. While selected SAC bomber forces have been assigned a conventional role and may be placed directly under the Air Force Component Commander (AFCC), other SAC resources such as tankers and reconnaissance platforms may be made available to the AFCC. However, Commander in Chief, SAC (CINCSAC), retains operational command of such forces to ensure that they can be reintegrated quickly into a higher priority mission.

6. Weather Service C2 Elements. The Air Force Weather Team (WETM) is the basic unit supporting weather customers in a tactical theater. It may be established at control and operations centers, forward operating bases, airfields, divisions, corps, squadrons, wings, numbered air forces, and other levels. The WETM provides observations, briefings, forecasts, and other environmental information services. The Tactical Weather Analysis Center (TWAC) is located adjacent to the TACC and serves the WETMs as the main weather data processing element for the TACS.

7. Airspace Control/C2 Warning Elements. These TACS elements consist of the following radar elements: Control and Reporting Centers/Posts (CRC/CRP), Forward Air Control Posts (FACP), and the Airborne Early Warning and Control System E-3 (AWACS). Their principal roles are air defense, airspace control, and early warning. Additionally, they provide a range of services to all air operations conducted within their assigned areas of responsibility.

8. U.S. Air Force C2 Elements Supporting the U.S. Army. The TACS elements having the role of supporting the U.S. Army are the ASOCs, TACPs, FACs, and Enlisted Tactical Air Controllers (ETACs). Each has been covered in the fire support C3 architecture (JTC3A Report 8016), primarily as it pertains to requesting and controlling CAS aircraft. These elements also have advisory responsibilities for other types of air support: tactical air reconnaissance, and airlift. The TACPs at corps and division level include reconnaissance liaison officers (RLOs) and tactical airlift

liaison officers (TALOs). TALOs may be located at brigade level. The role of TACS elements in the C2 processes for conducting various missions and tasks in a joint environment is described in chapter 3.

E. U.S. Air Force C2 Systems and Communications Equipment

1. Systems Supporting the TACC. The Tactical Air Control System (TACS) through which the U.S. Air Force executes C3 functions is being upgraded with TRI-TAC communications equipment that will enhance C3 interoperability with other component forces. Programmed replacement systems will automate many of the TACS functions at the TACC. The TACS modernization program also includes the Contingency TACS Automated Planning System (CTAPS). The CTAPS hardware will host the functionality that the discontinued Ground Attack Control Center (GACC) and Enemy Situation Correlation Element (ENSCE) programs were to provide. ENSCE was replaced by the TAF Linked Operational/Intelligence Centers Europe (TAF LOCE) capability (TAFLC). Other future systems , such as the Modular Control Equipment (MCE), that will provide communications and computer support to air operations are addressed in the supporting analysis from which this report is extracted.

2. Systems Supporting the WOCs. WOCs are the primary elements in the execution phase for preplanned tactical missions. They rely primarily upon manual information transfer and processing for generation of aircraft missions, scheduling of aircrews, munitions loading, and other related tasks.

3. Systems Supporting Reconnaissance and Surveillance. Reconnaissance WOCs rely primarily on manual C2 operations in the tasking and planning phases. Ground stations for receiving, processing, and distributing collected data are supported by assorted levels of automation. The RF-4C is capable of employing a variety of sensors. Its photography (film based) is processed by a photographic processing and interpretation facility (PPIF). Tactical ELINT reconnaissance can provide near-real time threat emitter information via data link by way of the Commanders Tactical Terminal (CTT), or can provide recorded tapes for more complete analysis subsequent to the mission. For the TR-1 aircraft, imagery is transmitted via data link to an interim ground-based system called the Tactical Reconnaissance Exploitation Demonstration System (TREDS), or it can be recorded onboard for post-flight processing.

4. Systems Supporting Theater Airlift C2. Current systems supporting theater airlift operations include the MAC ALCE Reaction Communications (MARC) system, the Theater Airlift Management System (TAMS), and the Global Decision Support System (GDSS). Near term enhancements are the C2 Information Processing System (C2IPs) and the UHF Satellite Terminal System (USTS). The MAC C2 architecture calls for GDDS to support the top echelons of MAC; that is, HQ MAC, the numbered Air Forces (NAFs), and Airlift Divisions (ALDs). C2IPS will interface with GDDS at the ALD level and provide for the lower echelons. The lower echelons are ALD, ALCC, ALCE and units. C2IPS will pass C2 information vertically from the units up through the echelons to HQ MAC, as well as flowing information horizontally to

the functional areas. C2IPS is primarily a deployable C2 automation system that also supports fixed location. C2IPS will use USTS, HF, digital data network (DDN), and various other communications to provide for the connectivity it requires.

5. Systems Supporting Combat Rescue Missions. Current C2 systems for use under tactical wartime conditions assist CR forces to locate and navigate to the object of combat rescue. Automatic direction finder (ADF) equipment is used by several types of aircraft in CR operations for locating sources of UHF and FM signals generated by the survivor's radio. In addition, various aircraft are equipped with features such as GPS terminals, terrain-following and terrain-avoidance radars, a FLIR system, INS, a map display, a radar beacon finder, and computer generated search patterns.

6. Systems Supporting Weather Support. The primary C2 systems in weather services that impact on tactical operations are the Automatic Weather Network (AWN), the Advanced Weather Analysis and Prediction System (AWAPS), and the Tactical Imagery Display Satellite (TIDS) system. The AWN is a meteorological data collection and dissemination system interconnecting overseas digital weather switches and the Air Force Global Weather Central. The primary mission of the AWN is to transmit weather intercept data rapidly from the point of intercept to the Central to support high priority missions.

The AWAPS is a computer system that performs global weather analysis. It takes weather observation data collected worldwide and develops a numerical model that forecasts weather at the surface and various pressure levels. The TIDS system allows weather imagery data to be received at the Joint Forecast Unit at the joint force headquarters as well as the WETMs. The imagery data is transmitted by satellite and received by receive-only terminals at tactical locations.

2-4 U.S. MARINE CORPS AVIATION C3 FUNCTIONS AND ORGANIZATION

A. **Introduction.** U.S. Marine Corps forces are organized for combat as Marine Air Ground Task Forces (MAGTFs). A MAGTF is an integrated, balanced air-ground combined arms force, organized for combat under a single commander. Regardless of size, a MAGTF always consists of four basic components: a Command Element (CE), a Ground Combat Element (GCE), an Aviation Combat Element (ACE), and a Combat Service Support Element (CSSE). The Marine Expeditionary Force (MEF), used for the interoperability analyses in this architecture, is composed of a Command Element, division, aircraft wing, and a force service support group. It is capable of conducting a wide range of amphibious assault and other operations, with 60 days of support for sustained operations ashore. The Marine Expeditionary Brigade (MEB) used in this architecture is composed of a command element, a reinforced infantry regiment, an aircraft group, and a brigade service support group. A Marine Expeditionary Unit (MEU), the smallest MAGTF, usually consists of a reinforced infantry battalion, a composite aircraft squadron, and a MEU service support group. A MEU is capable of special operations.

B. U.S. Marine Corps Aviation Mission Areas. This section will provide a brief overview of the capabilities of the U.S. Marine Corps in each of the six mission areas in which U.S. Marine Corps aviation assets conduct air operations. These functions are air reconnaissance, antiair warfare, assault support, offensive air support, electronic warfare, and control of aircraft and missiles.

1. Air Reconnaissance. Tactical air reconnaissance involves use of air vehicles to obtain information concerning terrain, weather, and the location, disposition, composition, movement, installations, lines of communication, and electronic and communication emissions of enemy forces. The MAGTF ACE uses aerial reconnaissance capabilities ranging from visual air observers to sophisticated all-weather day and night photography, radar, and infrared imagery systems.

2. Antiair Warfare (AAW). AAW is defined as Navy/Marine Corps air operations required to destroy or reduce an enemy air and missile threat to an acceptable level. This report emphasizes offensive antiair warfare operations. Offensive antiair warfare involves preemptive measures to weaken the enemy air threat, suppression of enemy air defenses (SEAD), and local air superiority measures. Preemptive measures include air strikes on enemy airfields, attacks on C2 facilities and surveillance systems, air strikes on means of aircraft supply and support, and offensive air-to-air sweeps. SEAD operations include direct confrontation of enemy air defenses with ground forces, attack of enemy air defenses with air forces, use of naval forces against enemy air defenses, and Command, Control, and Communication Countermeasures (C3CM). Local air superiority measures may include offensive Combat Air Patrols (CAPs), escort and self escort tactics, and use of aircraft self-protection countermeasures and maneuvers. The basic C2 process for AAW flows from the Aviation Combat Element (ACE) apportionment plan, proposed by the Tactical Air Commander (TAC), and approved by the MAGTF commander. The apportionment decision is reflected in an air tasking order (ATO). Coordination of command and staff actions for SEAD missions involving the Ground Combat Element (GCE) may take place at the MAGTF level.

3. Assault Support. Assault support operations provide tactical mobility and logistic support for ground combat elements, movement of high priority cargo and personnel within the immediate area of operations, in-flight refueling for fixed and rotary wing aircraft, and evacuation of personnel and cargo. These operations may be tactical or administrative and fall within the categories of vertical assault airlift, air delivery, inflight refueling, and air evacuation.

a. Vertical assault airlift is use of assault aircraft to provide tactical mobility and logistic support required by ground combat elements. Vertical assault operations are planned by lifting and lifted units. Whenever possible, the mission is briefed with ground and aviation commanders present.

b. Air delivery is the use of fixed-wing tactical transports to move high priority cargo and personnel within the immediate area of operations. An example is air delivery by parachute from a KC-130. Requests for air delivery can be directed to the Tactical Air Command Center (TACC) via the Direct Air Support

Center (DASC) or up the chain of command through the MAGTF Combat Operations Center (COC) to the TACC. Battlefield illumination is an assault support mission that can be performed as air delivery by fixed-wing aircraft.

c. Aerial refueling by the KC-130 aircraft extends the range and time of operation of fighter/attack aircraft and certain helicopters. Since the KC-130 cannot accompany deploying flights due to its slow cruise speed, it must rendezvous with aircraft to be refueled. Planning and execution of aerial refueling operations must be precise. The TACC will task the tanker assets, while user and KC-130 operations personnel will complete the planning of refueling operations. In-flight refueling operations will be controlled by an airborne refueling mission commander.

d. Casualty and medical evacuation by helicopter and fixed-wing aircraft are implicit tasks of air evacuation. The use of fixed wing aircraft for medical evacuation is governed largely by a theater or joint aeromedical evacuation plan. MAGTF KC-130s, when configured for transport missions, may be used for medical evacuation. The helicopter is the primary platform for tactical battlefield casualty evacuation. Helicopters provide a rapid and efficient system for evacuation of casualties directly from the battlefield to a medical facility ashore or afloat.

4. Offensive Air Support. Offensive air support consists of air operations that deliver firepower against enemy ground forces and destroy or neutralize installations, equipment, and personnel. Offensive air support missions are classified by the degree of coordination required with ground elements, and fall into the categories of close air support (CAS), requiring detailed integration, and deep air support, requiring only a modest degree of coordination. Deep air support missions, normally flown beyond the fire support coordination line (FSCL), are planned to destroy, neutralize, or delay enemy ground forces before they can be brought to bear effectively against friendly forces. The MAGTF ACE would have the same systems available for deep air support or air interdiction as discussed under offensive antiair warfare. Targeting and establishing deep air support target priorities are responsibilities of the ACE commander, with input from other MAGTF elements, subject to approval by the MAGTF commander. The ACE commander identifies air interdiction targets and establishes target priorities to support the MAGTF concept of operations. The ACE commander estimates the aviation capability required to attack these targets. Deep air support operations need to be balanced with the requirements for CAS.

5. Electronic Warfare (EW). U.S. Marine Corps EW operations primarily involve electronic countermeasure (ECM) and electronic support measures (ESM), performed from a single aircraft platform: the EA-6. Airborne ECM activities are conducted in general support of other tactical aviation missions and may be part of planned deception operations. On the other hand, ESM operations are conducted in general support of the MAGTF.

6. Control of Aircraft and Missiles. Control of aircraft and missiles is a U.S. Marine Corps aviation function required for exercise of authority over and direction of air support elements during the conduct of air operations. It consists of

a multitude of tasks to integrate the functions of air reconnaissance, antiair warfare, assault support, electronic warfare, and offensive air support. It is defined as the coordinated employment of facilities, equipment, communications, procedures, and personnel that allows the MAGTF commander to plan, direct, and control the efforts of the ACE to support the accomplishment of the MAGTF's mission.

7. Joint Operations. Joint C3 interfaces for U.S. Marine Corps air operations conducted in support of the nine tactical functions identified for inclusion in this architecture are discussed in chapter 3.

C. U.S. Marine Corps C3 Structure for Air Operations

1. Introduction. As discussed briefly in the preceding section, the Marine Corps is organized for combat as a combined arms team identified as an MAGTF. Because the forces in each MAGTF, including air assets, are under the command of a single commander, C2 of U.S. Marine Corps air operations must be addressed in the context of the overall MAGTF C2 structure.

2. MAGTF Command Element (CE). The interoperability analyses in the architecture identifies this element as the MEF CE, consisting of the commander, staff, headquarters section, and requisite communications and service support facilities. The MAGTF commander is the senior Marine commander in the area of operations as well as the individual responsible for air-ground operations. He is provided with a separate headquarters structured for conduct of operational functions and tailored to the mission and task organization of the MAGTF. The primary C2 elements affecting air operations at the MAGTF headquarters are the individual MAGTF commander, the combat operations center (COC), and the intelligence center. The MAGTF commander establishes an overall concept of operations, MAGTF objectives, and priorities with respect to apportionment and allocation of air resources. In this architecture, the MEF CE COC is the C2 element responsible for advanced air-ground planning, targeting, and monitoring of tactical operations. It also contains the long-range reconnaissance, intelligence, and electronic warfare (EW) capabilities derived from units resident within the surveillance, reconnaissance, and intelligence groups (SRIGs). The MAGTF All-Source Fusion Center (MAFC) is responsible for coordination of the overall intelligence effort including requests for national collection assets, and provides target intelligence as well as processed intelligence from collected information.

3. Ground Combat Element (GCE). The GCE is constructed around a battalion, regiment, or division infantry unit. The GCE commander is a key participant in air operations C2, since maneuver is the focus for MAGTF air support operations. He also controls field artillery that must be integrated with supporting assault and offensive air support operations. The GCE commander also recommends deep air support targets.

4. Combat Service Support Element (CSSE). The CSSE is task organized to provide the full range of combat service support necessary to accomplish the mission. The CSSE commander's involvement in air operations is primarily in

generating airlift and aeromedical evacuation requirements or requests. The CSSE also provides the helicopter support teams (HSTs) to improve the functioning of helicopter assault support operations.

5. Aviation Combat Element (ACE). The aviation combat element (ACE) is task organized to perform normal aviation support functions as required by the tactical situation and MAGTF size and mission. ACE structure consists of a squadron, group, or wing headquarters, flying squadrons and detachments, and supporting squadrons/units for air control, combat support, and combat service support. The Tactical Air Commander commands the tactical functioning of the ACE through the Marine Air Command and Control System (MACCS). The MACCS is organized to exercise control of operations involving the following functions: airspace and air traffic control; employment of aviation assets and weapon systems; and selection, coordination, and integration of MACCS agencies for all U.S. Marine Corps aviation tactical functions. The activities of the MACCS fall into the major categories of air direction and air control. Air direction consists of guidance and supervision that a commander employs to focus resources on mission accomplishment. Authority to exercise air direction is delegated from the MAGTF commander, who has overall responsibility for mission accomplishment, through the ACE commander, and subsequently, in varying degrees to subordinate commanders, staffs, and agencies. Figure 2-5 depicts the C2 elements of the MACCS. The following paragraphs briefly discuss these elements.

a. Tactical Air Command Center (TACC). The TACC is the senior agency of the MACCS from which the MAGTF Tactical Air Commander directs, controls, coordinates, and supervises all MAGTF tactical air operations. The TACC is also the principal operational facility for coordination of tactical air operations with other services, allies, and external agencies.

b. Tactical Air Operations Center (TAOC). The TAOC employs surveillance radar to detect, identify, and control the intercept of hostile aircraft and missiles; provides airspace management and navigation assistance to friendly aircraft and provides target assignment for weapon systems. In addition to the control of air-to-air operations, the TAOC also directs the operations of subordinate surface-to-air missile agencies. The TAOC functions as the alternate TACC when directed.

c. Direct Air Support Center (DASC). The DASC is the principal air control agency responsible for direction of air operations directly supporting ground forces. This agency is collocated with the Fire Support Coordination Center (FSCC) of the GCE. The DASC provides the means to process immediate air support requests, coordinates aircraft employment with other supporting arms, manages terminal control assets with supporting ground combat forces, and controls assigned and itinerant aircraft transiting the DASC's area of responsibility.

d. Marine Air Traffic Control Squadron (MATCS) Detachments. The MATCS detachments are provided by the MACCS. The MATCS detachments provide continuous all-weather Air Traffic Control (ATC) service at expeditionary

airfields in support of MAGTF. They can provide limited ATC service at remote landing sites.

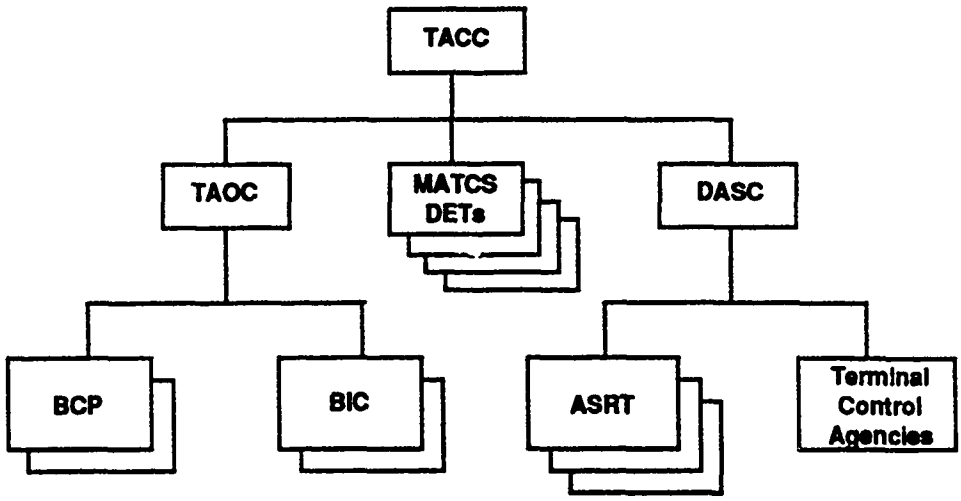


Figure 2-5. U.S. Marine Corps Air Command and Control Agencies

e. Air Support Radar Team (ASRT). The ASRT is a terminal air control agency subordinate to the DASC. It provides, operates, and maintains the facilities for precision terminal control of aircraft in day/night and all-weather conditions in support of MAGTF operations. This control agency supports deep air support interdiction missions, close air support missions, and may support assault support missions. In these situations, the ASRT may provide assistance to aircraft performing an instrument descent until it reaches visual flight conditions.

f. Organic MACCS terminal agencies include the Tactical Air Coordinator (Airborne) (TAC(A)), the Helicopter Coordinator (Airborne) (HC(A)), the Forward Air Controller (Airborne) (FAC(A)), and the Naval Aviation Observers (NAO).

g. Tactical Air Control Party (TACP). The TACP is not an organic element of the MACCS. However, it is particularly important to air operations because it advises the commander about air operations employment and provides communications connectivity with applicable elements of the MACCS.

h. Forward Air Controller (FAC). The FAC is not an organic element of the MACCS, but performs directly related functions during air operations. The FAC is a specially trained aviator or pilot and member of the TACP who controls not only close air support aircraft, but also helicopters and KC-130, when

required, for assault support missions such as helicopter troop transport or aerial delivery.

i. Air and Naval Gunfire Liaison Company (ANGLICO). As in the case of the C2 elements discussed in the preceding two paragraphs, the ANGLICO is not an integral element of the MACCS, but is involved in functions directly relating to the MACCS. The mission of ANGLICO is to provide ground control and liaison agencies for the planning and employment of naval gunfire and Naval aviation support for allied and U.S. Army forces of division size or smaller.

j. Battery Command Post (BCP). The BCPs of the Light Anti-Aircraft Missile Battalion (LAAM BN) provide command and control to the HAWK missile batteries.

k. Battery Information Center (BIC). The BIC of the Light Anti-Air Defense (LAAD) batteries provides command and control and direction to the LAAD firing platoons. The BIC is designed for the direction of Stinger missile units (LAAD Batteries) and provides the commander with the capability of monitoring missions and directing maneuvering of subordinate units.

D. U.S. Marine Corps Aviation C2 Systems and Communications Equipment

1. Introduction. The Marine Air Command and Control System (MACCS) provides MAGTFs with a system for integrating all battlefield air support missions with fire and maneuver of ground forces. The C2 elements and capabilities of the MACCS vary with the size of the MAGTF conducting combat operations. The following discussion will examine the C2 systems and communications equipment supporting the C2 elements that constitute a MACCS supporting a notional Marine Expeditionary Force (MEF).

2. Systems Supporting the TACC. The operation of this senior C2 facility of the MACCS is supported by the tactical air command central, AN/TYQ-1, consisting of shelters and facilities for operations, planning, maintenance, and communication functions. Also supporting the TACC is the Tactical Data Communications Central, AN/TYQ-3A. The AN/TYQ-3A provides all of the communications equipment for tactical data information links (TADIL A, B and NATO Link 1) and permits the TACC to serve as a Joint Tactical Air Operations (JTAO) hub and coordinate air operations with other service components of a joint force. The programmed replacement for the AN/TYQ-1 and AN/TYQ-3A is the Advanced Tactical Air Command Center (ATACC).

3. Systems Supporting the TAOC. The Tactical Air Operations Central, AN/TYQ-2, together with the AN/TYQ-3A discussed above, are the two principal tactical data systems supporting the TAOC. In addition to the TADILs listed, the TAOC also has TADIL-C and ATDL-1 capability. The Tactical Air Operations Module (TAOM), AN/TYQ-23, when fielded in replacement of the AN/TYQ-2 and AN/TYQ-3A, will be the principal tactical data system supporting the TAOC. The long-range (300NM) radar systems that support the TAOC are the AN/TPS-59 and AN/TPS-32, 3-D air surveillance radars. The AN/TPS-63 is the gap filler radar and its current range of 80 NM will be increased to 160 NM with the fielding of TAOM.

4. Systems Supporting the DASC. The improved direct air support central, AN/TSQ-155(V) (IDASC) replaced the obsolete AN/TSQ-122 in 1987. Housed in an expandable shelter, the IDASC provides a significant increase in capabilities for the MAGTF. It provides improved COMSEC internal to the shelter, has 14 operator positions and digital and analog communication terminals.

5. System Supporting the ASRT. The Radar Bomb Directing Set (RBDS), AN/TPB-1D, employed by the ASRT, provides day and night all-weather precision control of aircraft operating in support of MAGTF operations. The RBDS consists of precision tracking radar and a command and control shelter.

6. Marine Air Traffic Control and Landing System (MATCALS). MATCALS is a deployable, air transportable, modular system designed to control the high volume air traffic at expeditionary airfields. MATCAL subsystems include air traffic control system (ATCS), all-weather landing systems (ALS), and a control and communications subsystem (CCS). MATCALS has a TADIL B and C capability.

7. Position Location Reporting System (PLRS), AN/TSQ-129. The AN/TSQ-129 is an automated tactical data system that provides accurate, real time position location, navigation, and identification information under all-weather conditions to units equipped with PLRS. Helicopters and OV-10s will be equipped with PLRS user units.

8. Tactical Electronic Reconnaissance Processing System (TERPES). TERPES is a tactical data system for receiving, processing, evaluating, and reporting tactical electronic reconnaissance information and jamming data received in the form of digital tapes and crew logs from the EA-6B aircraft. The interface between the EA-6B and TERPES is by manual transfer of data tapes. A tactical digital data link is planned between an airborne EA-6B and TERPES.

9. Supporting Communications Equipment. The primary means of tactical communications supporting C2 functions in the conduct of U.S. Marine Corps air operations is single channel radio. As explained previously, the C2 interfaces within the MACCS are integrated with C2 elements throughout the MAGTF combined arms team. This requires employment of multichannel, satellite, and wire connectivities. Digital Communications Terminals (DCTs) are used to provide point-to-point and netted communications using a variety of radio, wire, and cryptographic equipment. Key combat radio nets employ VHF-FM for tactical operations. Other nets use HF to support radio teletypewriter requirements. C2 of aircraft conducting functions addressed in this architecture are carried out primarily withUHF radios. In specified functions, such as combat search and rescue, aircraft may use VHF and HF radio equipment.

2-5 U.S. NAVY AIR OPERATIONS C3 FUNCTIONS AND ORGANIZATION

A. Introduction. Joint connectivity requirements in several mission areas in which the U.S. Navy conducts air operations are addressed in other functional interoperability architectures (FIAs). These are antiair warfare, air operations conducted by Naval forces during amphibious warfare operations, antisubmarine warfare, and close air support functions. This architecture does not duplicate interface requirements identified in these separate architectures.

The U.S. Navy conducts combat operations in a multidimensional, multi-warfare environment and, simultaneously, must carry out a wide range of supporting operations. The U.S. Navy may conduct these operations unilaterally, but for this architecture, they are integrated and coordinated in joint operations. To execute the C3 functions of these complex requirements effectively, the U.S. Navy has implemented the Officer in Tactical Command/Composite Warfare Commander (OTC/CWC) concept. This concept is discussed briefly in the following paragraph.

Command and control of operations in the Naval component is vested in the OTC. The OTC has overall responsibility for successfully accomplishing the mission of the force. The CWC concept allows an OTC to delegate tactical command to a CWC in waging combat operations to counter threats to the force and to maintain tactical sea control with assets assigned. Subordinate warfare commanders are assigned to the CWC for antiair warfare (AAWC), antisurface warfare (ASUWC), antisubmarine warfare (ASWC), and strike warfare (STWC). Supporting the CWC and his warfare commanders are coordinators who manage force assets and sensors. These include the Electronic Warfare Coordinator (EWC), the Air Resources Element Coordinator (AREC), the Helicopter Element Coordinator (HEC), and the Submarine Element Coordinator (SEC).

B. U.S. Navy Air Operations Mission Areas. U.S. Navy air operations applicable to this architecture reflect selected warfare areas and functional supporting tasks. Since this architecture addresses air operations in the context of supporting a land battle, functional responsibilities discussed under the OTC/CWC concept do not translate precisely to this architecture. For example, conduct of Naval air sorties in direct support of land combat may be provided by carrier battle groups and executed outside the CWC context. The C2 elements and connectivity requirements identified in this architecture for mission areas of antiair warfare (AAW), strike warfare (STW), and aerial reconnaissance and surveillance are generic and may be revised, depending on the location of CWC/OTC and other factors. This possible revision also applies to connectivities established for air operations supporting functions (airlift, combat search and rescue, and aerial refueling) discussed in the following paragraphs. This report recognizes that AAW and Strike Warfare are conducted during air operations by maritime forces. However, these functions were selected for analysis in separate FIAs, and the joint interface requirements are not duplicated in this report. Joint connectivities for the conduct of AAW by the Navy component of a joint force are identified in the Air Defense andAirspace Control FIA. Joint connectivities for Strike Warfare are addressed in the context of deep air support beyond an amphibious objective area in the Maritime and Amphibious Operations FIA (JTC3A Report 8121).

Figure 2-6 illustrates a simplified version of a standard OTC/CWC organization.

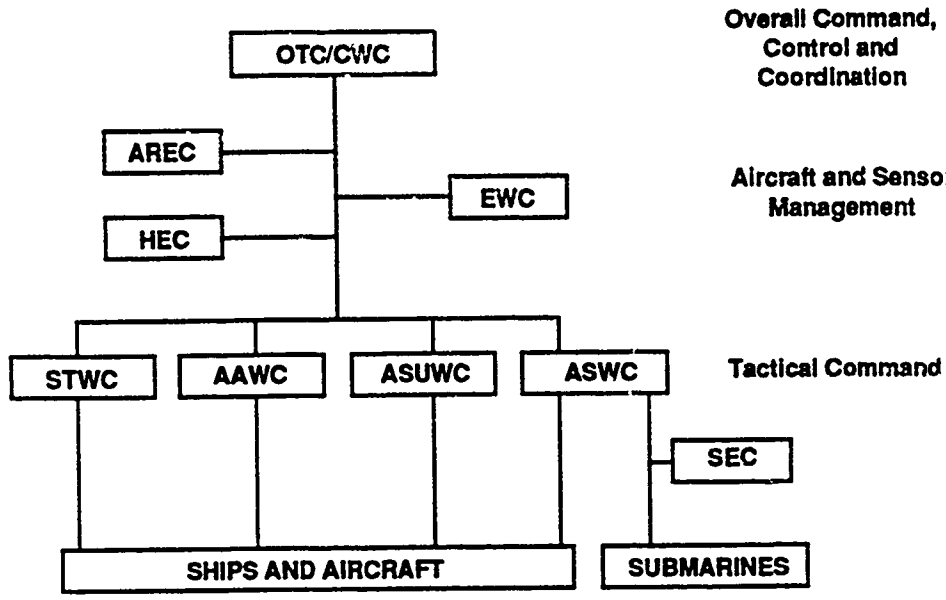


Figure 2-6. Standard OTC/CWC Organization

1. U.S. Navy Combat Search and Rescue Operations (CSAR). U.S. Navy CSAR is organized under the OTC or CWC depending on force composition and operating conditions. The C2 element responsible for supervision of the force CSAR operation is the Rescue Coordination Team (RCT). The senior element during the terminal phase of the operation is the on scene commander (OSC), who is responsible for control and coordination of elements operating in the recovery area. Recovery helicopters assigned to a CSAR mission are flown to and from the recovery area under control of the Airborne Mission Commander, who is responsible for managing CSAR radio nets, coordinating flow of aircraft to and from the recovery area, and refueling of mission aircraft. Fighter or attack aircraft employed to suppress the enemy in the recovery area remain under control of the AAWC or STWC until arrival in the recovery area, where the OSC exercises local control.

2. Aeromedical Airlift Operations. Aeromedical evacuation of injured or disabled U.S. Navy personnel from the injury site or from a staging area is accomplished routinely by specially configured helicopters. First level surgery is performed on LCC and LHA ships and may be available on CV/CVN class ships. When required, the patient is transferred by helicopter to Medical Treatment Elements (MTE) and Medical Treatment Facilities (MTF). The MTE/MTF is a medical installation ranging in size from a battalion aid station to a casualty receiving and treatment ship or fleet hospital. If additional medical care is required, patients are flown by helicopter to aeromedical Air Force staging areas, or facilities (ASA/ASF) tasked with

temporarily holding patients awaiting evacuation out of the sea or airland operating areas of responsibility. At this stage, a Joint Medical Regulating Office (JMRO) assumes responsibility for aeromedical evacuation.

3. U.S. Navy Airlift Operations. The primary function of the U.S. Navy organic airlift system is to provide logistic support to forces afloat. The Military Air Command (MAC) provides intertheater lift to the aerial port of debarkation (APOD) nearest the U.S. Navy forces to be resupplied. U.S. Navy organic airlift is used to move personnel and materiel from the APOD to the user at sea.

4. Environmental/Meteorological Factors (Weather Support). The primary source of environmental data obtained in the operating area is the observations conducted by weather elements aboard the aircraft carriers in battle groups. Other ships of the fleet conduct and process weather observations on a smaller scale. The Fleet Oceanographic Center provides global weather data via satellite that are processed by the Tactical Environmental Support System (TESS) on the aircraft carrier and disseminated to the OTC/CWC for command center display and dissemination to other fleet elements as required.

5. Joint Operations. The joint C3 interfaces for Navy air operations conducted in support of the nine tactical functions identified for inclusion in this architecture are discussed in chapter 3.

C. U.S. Navy C2 Structure and Communications for Air Operations

1. General. Prior paragraphs of this section explained the conduct of U.S. Navy C3 functions under the OTC/CWC concept. The following paragraphs describe the key C2 elements that make up the C2 structure for U.S. Navy air operations and the C2 systems and communications supporting these elements.

2. Tactical Flag Command Center/Flag Data Display System (TFCC/FDDS). The CWC conducts battle group operations from the TFCC. The TFCC provides the support necessary for him to receive, correlate, display, and disseminate tactical information. The FDDS provides a computer-automated capability to compile and display data provided by the C2 systems, sensors, and communications interfaces employed by battle group, theater, and national level sources.

3. Combat Information Center (CIC). This facility supports the required interfaces with the Navy Tactical Data System (NTDS) and the Airborne Tactical Data System (ATDS). The CIC is the focal point for coordination of the sensor and intelligence data including processed NTDS data and information from other battle group ships and aircraft. Its function is to collect, display, evaluate, and disseminate this information for coordination and implementation of functions associated with the mission of the aircraft carrier. The ATDS is installed on early warning and surveillance aircraft and is the airborne equivalent of the NTDS.

4. Afloat Correlation System (ACS). The ACS performs multisource fusion functions, and the processed data provides a surveillance of the area of

operations. The ACS enables the CWC to have a tactical picture based on data provided by surface and airborne sensors.

5. Naval Tactical Data System (NTDS). This system consists of equipment, computer programs, and personnel necessary to collect, correlate, evaluate, and display combat information and prepare force orders to execute assigned missions.

6. Navy Air Tactical Control/System (NATCS). This is a subsystem of the NTDS that provides the data necessary to execute control of aircraft within a designated area of operations.

7. Tactical Air Control Center/Tactical Air Direction Center (TACC/TADC). This is the C2 element that employs the NATCS responsible for coordination and control of aircraft conducting air operations within an assigned area of operations. The TACC is identified as the TADC in response to changing command relationships with the landing force during amphibious operations. The TACC/TADC are designations used only during amphibious operations.

8. Communications. The communications requirements for air operations conducted by U.S. Navy forces involve information exchange via data, voice, and record transmissions. When location of the U.S. Navy component requires over-the-horizon communications, the employment of line of sight communications equipment will require use of satellite, aircraft, unmanned aerial vehicles, and ships as relays. The AN/WSC-3 is used widely to support C2 functions of the CWC for operations discussed in this architecture. Most of the U.S. Navy air-to-air communications requirements established in this architecture are satisfied by UHF aircraft radios, with the exception of selected missions that employ aircraft equipped with HF and/or VHF radios.

2-6 SPECIAL OPERATIONS FORCES

Special Operations Forces (SOF), as designated by the Secretary of Defense, are those specifically organized, trained, and equipped to conduct or support special operations (SO) primary and collateral missions. The five principal SO missions are unconventional warfare, direct action, special reconnaissance, foreign internal defense, and counterterrorism. The inherent capabilities of SOF also make them suitable for employment in a range of collateral SO mission activities, such as humanitarian assistance, counternarcotics, and personnel recovery operations, among others.

U.S. Army SOF units include Special Forces, Ranger, Special Operations Aviation, and selected special mission and support units. Typically, the units are tactically deployed at Special Forces Operations Bases (SFOBs) and Forward Operational Bases (FOBs). U.S. Air Force SOF units include specially equipped active and reserve component fixed wing and vertical lift aircraft and specially trained aircrews for infiltration, exfiltration, and resupply, aerial fire support, and aerial refueling; as well as composite special tactics (combat control and pararescue), and weather support

units. U.S. Air Force SOF may be organized into an Air Force Special Operations Command (AFSOC) for theater operations, or tailored into Air Force Special Operations Detachments (AFSODs) or elements (AFSOEs). U.S. Navy organizations for special operations are active and reserve component Sea-Air-Land (SEAL) Teams, Special Boats Units, and SEAL Delivery Vehicle Teams. U.S. Navy SOF typically deploy as Naval Special Warfare Task Groups (NSWTGs) and Navy Special Warfare Task Units (NSWTUs). Marine Expeditionary Units (MEUs) are capable of conducting special operations.

Special operations missions are joint in nature; therefore, when SOFs from the services are assigned to the joint commander, operational control of these SOFs is exercised through a subordinate Joint Special Operations Task Force (JSOTF) commander. However, instances may arise when a service component commander may have operational control of the SOF elements assigned from his own service.

As explained in the introduction to this report, the overall C3 requirement for special operations is covered in a separate architecture. Special operations are discussed in this architecture only to the extent that they impact upon the specific air operations addressed here. In particular, the report discusses SOF involvement in combat search and rescue operations.

CHAPTER 3

AIR OPERATIONS IN A JOINT FORCE

3-1 INTRODUCTION

This chapter discusses the air resources allocation process for joint air operations and analyzes the nine categories or support functions of air operations included in this report. Each functional area included is addressed in a separate subsection of the chapter in a common format. First, the function is characterized in general terms; then, the command and control processes of requesting, planning, coordinating, tasking, and executing an operation or task are outlined, and finally, the joint interface requirements for the command and control process are summarized. The connectivities identified in this chapter for individual functions are consolidated in chapter 4 as the air operations FIA.

The principal command and control structures employed by the service components have been abstracted from chapter 2 and constitute a common base for the joint subarchitectures of specific air operations functions. The service component elements with multipurpose roles in air operations are shown in figure 3-1 as part of a joint force framework. Other specialized C2 elements are discussed in the sections on specific air operations functions.

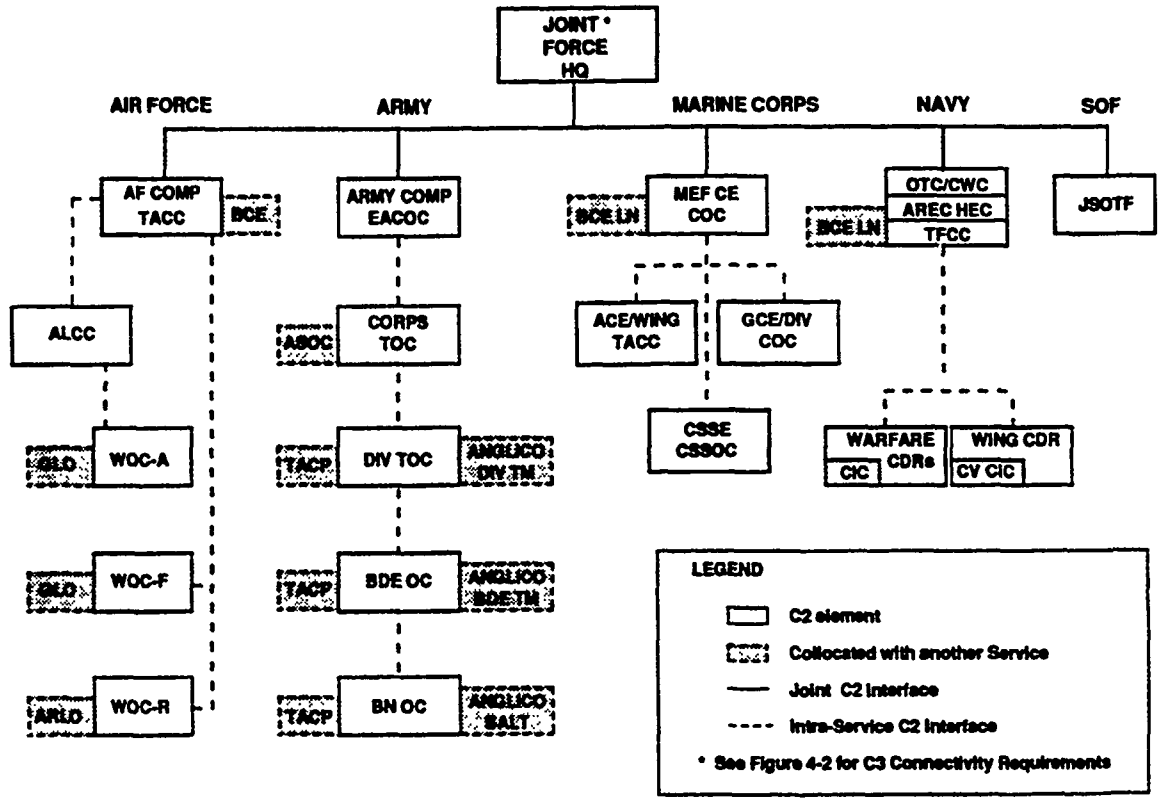


Figure 3-1. Service Component C2 Elements with Multipurpose Roles

3-2 THE AIR RESOURCES ALLOCATION PROCESS

A. General. Upon receiving apportionment decisions and air support request messages and reviewing threat situations, each air-capable component prepares an air allocation request for transmission to the JFC. The allocation request describes how the air-capable component intends to allocate air sorties to meet the joint force commander's apportionment decision. It presents the number of sorties to be flown during the air tasking day by mission and type aircraft. The allocation request also serves as a vehicle for reporting excess sorties not needed by the air-capable component and available for support to the joint force as a whole and for requesting additional air support beyond the component's own capability.

B. Sortie Allotment. The JFACC reviews each allocation and prepares a sortie allotment message to be sent to the components for the applicable air tasking day. The JFACC reviews each allocation request and proposes the allotment of sorties for the applicable air tasking day to the JFC for approval. The sortie allotment message is used to provide a means by which the JFC approves the air employment/allocation plans of his subordinate commanders and fills his subordinate commander's request to the extent possible from those sorties declared in excess in the subordinate commander's air allocation/request message. This message covers the following four areas:

1. Revisions to a component's planned allocation. These revisions are based on approval or disapproval of component requests based on availability of sorties from other components to fill approved requests.

2. Approval or disapproval of component requests and allotment of excess sorties from other components to fill approved requests.

3. Allotment of component excess sorties to fill mission requirements for the benefit of the force as a whole.

4. Revisions to mission data with respect to time or mission priority.

C. Tasking Confirmation. After receiving the sortie allotment message, the components complete their tasking process and confirm to the supported component(s) that the requested support will be provided. This information is conveyed in either an air tasking/confirmation (ATOCONF) message or a request confirmation (REQCONF) message. Joint Pub 6-40 provides message format guidance.

D. Procedures to Enhance Responsiveness to Tactical Requirements. Two common techniques for providing responsive air support to meet the demands of a tactical situation are the use of immediate requests for air support and mission-type orders. Immediate requests may be filled from previously approved on-call or alert sorties to meet unforeseen, emergency situations. If no on-call sorties are available to satisfy immediate air requests or other emergency requirements, the JFACC may revise the missions assigned by the ATO to satisfy these requirements. Such requests are forwarded to the JFACC. The request may be filled with sorties scheduled for another component. Mission-type orders specify general target types, geographic

areas, and attack windows and are used when the targets may not be known. This technique is particularly useful against mobile targets, such as those in battlefield air interdiction whose location cannot be specified with sufficient certainty for the lead times required in the air tasking process, yet the anticipated target categories permit selection of appropriate munitions. The mission-type order assures inclusion of the approved sorties in the allocation and air tasking process and permits early flight planning and coordination without early commitment to specific targets. These still would be schedule, on-call, or immediate requests. An ATOCONF message directs execution and provides specific mission data and target detail.

E. Helicopter Support in Joint Air Operations. If a tactical situation requires cross-service tasking of U.S. Army and U.S. Marine Corps helicopters, service doctrine governs the employment. Since these helicopter assets are not controlled as part of the previously discussed air tasking process, a separate procedure is used to obtain the needed helicopter support. The simplest procedure is direct coordination between the components. Request for helicopter support usually would be made to the supporting component via the JFC. If the assets needed exceed those that can be arranged directly, the requesting component forwards a free-text voice or record message request to the JOC. The JOC then tasks the supporting component either by an operations or fragmentary order with authority for direct liaison. Upon receipt of the tasking, the supporting component transmits a request confirmation message to the component requesting the support.

3-3 OFFENSIVE COUNTERAIR OPERATIONS

A. General. Air superiority permits use of the enemy's airspace to perform necessary missions, but denies the enemy the use of friendly airspace. It is achieved through offensive and defensive missions, having the ultimate goal of air supremacy. Air superiority permits nonprohibitive interference with air, land, or maritime operations.

Joint Pub 3-01.2, Joint Doctrine for Theater Counterair Operations, defines counterair operations by first defining air operations. Air operations are conducted to attain and maintain a desired degree of air superiority by the destruction or neutralization of enemy forces. Counterair operations include such measures as use of interceptors, bombers, antiaircraft guns, surface-to-air missiles, and electronic countermeasures to destroy the air or missile threat before and after it is launched. Other measures taken to minimize the effects to hostile air actions are cover, concealment, dispersion, deception (including electronic), and mobility. Both offensive and defensive actions are involved. The former range throughout enemy territory and generally are conducted at the initiative of friendly forces. The latter are conducted near or over friendly forces and are reactive to the initiative of the enemy air forces.

As explained in the introduction, a separate functional interoperability architecture addresses C2 for joint air defense operations. The interfaces established in this architecture are focused on offensive counterair operations.

B. Suppression of Enemy Air Defenses (SEAD). SEAD is a counterair task and a close adjunct of offensive counterair operations. SEAD operations are conducted to neutralize, degrade, or destroy enemy air defenses and systems in specific areas by physical attack or electronic warfare. Effective SEAD permits the primary objectives of other missions to be accomplished. SEAD requires joint coordination to employ surface and airborne weapons systems in systematic campaigns or localized operations.

C. Armed Helicopters in Offensive Counterair Operations. Joint Pub 3-01.2 indicates that armed helicopters are to be included in counterair planning. The employment of attack helicopters in air combat and for attack of ground targets requires coordination with other air operations including those conducted by other components of a joint force. This architecture considers the joint C3 connectivities required to conduct these C3 functions.

D. C3 in Joint Offensive Counterair Operations. Overall direction of counterair operations is the responsibility of the joint force commander. A fundamental tool for controlling employment of air assets is the apportionment decision exercised by the joint force commander. The air-capable components react to apportionment guidance by allocating sorties according to aircraft type and mission.

The JOC interfaces with the senior operations centers at each service component. The JIC will exchange intelligence information with the principal intelligence centers of the air-capable components, and with EACIC to support potential efforts for joint suppression of enemy air defenses. Similar considerations for coordination of operations and intelligence influence the joint connectivity requirements among service components.

E. Joint Interface Requirements for Offensive Counterair Operations. The joint C3 connectivity requirements for offensive counterair operations are shown in figure 3-2.

3-4 AIR INTERDICTION (AI)

A. General. Air interdiction attacks are part of a systematic and persistent operation designed to limit the enemy's movement and reinforcement activities. These missions destroy, neutralize, or delay enemy potential before it can be brought to bear effectively against friendly forces. Air interdiction missions are flown at such distances from friendly forces that detailed integration with supported ground forces is not required. A subset of AI is battlefield air interdiction (BAI)/deep air support (DAS) directed against land force targets having a near-term effect on the scheme of maneuver of friendly forces. The primary difference between BAI and the remainder of the AI effort is the level of interest and emphasis the land commander places on the process of identifying, selecting, and attacking certain targets. Overall guidance on conducting joint operations is contained in Joint Pub 3-03, Doctrine for Joint Interdiction Operations.

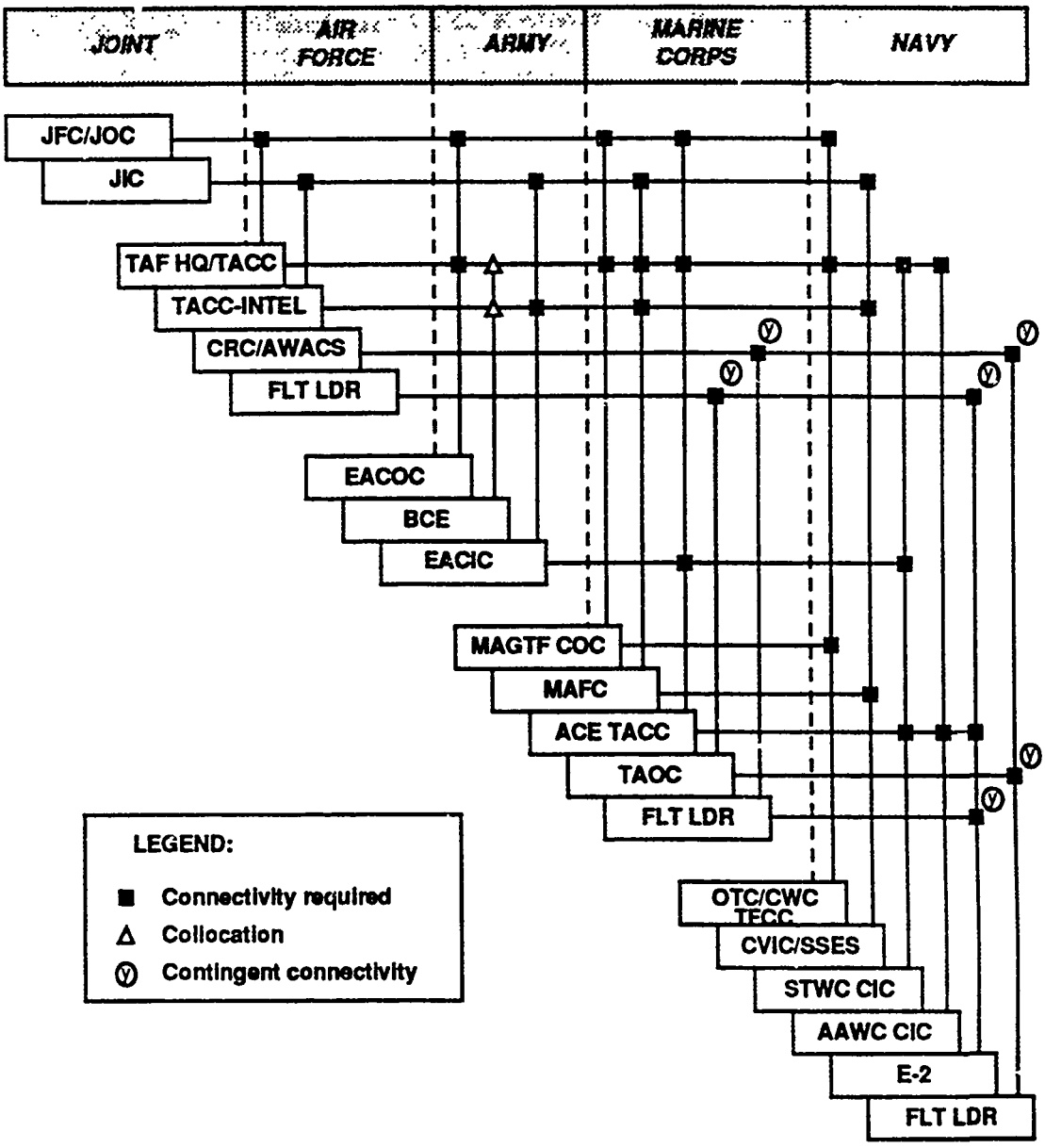


Figure 3-2. Joint C3 Connectivity Requirements for Offensive Counterair Operations

Integration of these efforts into a single, cohesive operation may be achieved through a variety of means, including establishing zones or areas of attack for each service to concentrate its interdiction efforts, deconflicting missions by times of arrival, or through integration of the service missions into composite strike forces. Regardless of the means selected, extensive planning and coordination are required prior to and during execution. Additionally, provisions must be made for safe passage of the interdicting force over friendly areas when en route to or from the target area. En route contact with the airspace control elements can provide radar following or control, and allows the commander to divert or recall the force as well as the means to provide updated information concerning weather, target, or enemy defenses.

B. The Air Interdiction Tasking Process. The air interdiction effort stems from the joint force commander's overall plan of operations that establishes the interdiction area, the effects desired, and the priority of tasks to be accomplished. The process of apportionment determines the level of effort for interdiction as a percentage or a priority. Interdiction planning is coordinated at the Joint Targeting Coordination Board (JTCB) to assure that the joint objectives are being satisfied. All components provide an input into the planning process.

Air interdiction planning for supported ground forces begins at the tactical level. At the operational level of U.S. Army EAC and U.S. Marine Corps MEF, the planning will focus on air interdiction targeting, combined arms deep strikes, and special force operations that will delay or disrupt enemy movement. In this architecture, deep air support operations conducted by the U.S. Navy and U.S. Marine Corps are subsumed in the section of the report addressing BAI operations.

If a close support relationship has been authorized by the joint force commander, the AI requests are sent directly to the supporting air-capable service component. These requests are reflected in the air allocation request as filled or requiring additional air support. If a close support relationship is not established, air support requests for AI are sent to the JFC and are addressed in the sortie allotment.

C. Joint C3 Interface Requirements for Air Interdiction. The joint C3 connectivity requirements for air interdiction operations are shown in figure 3-3.

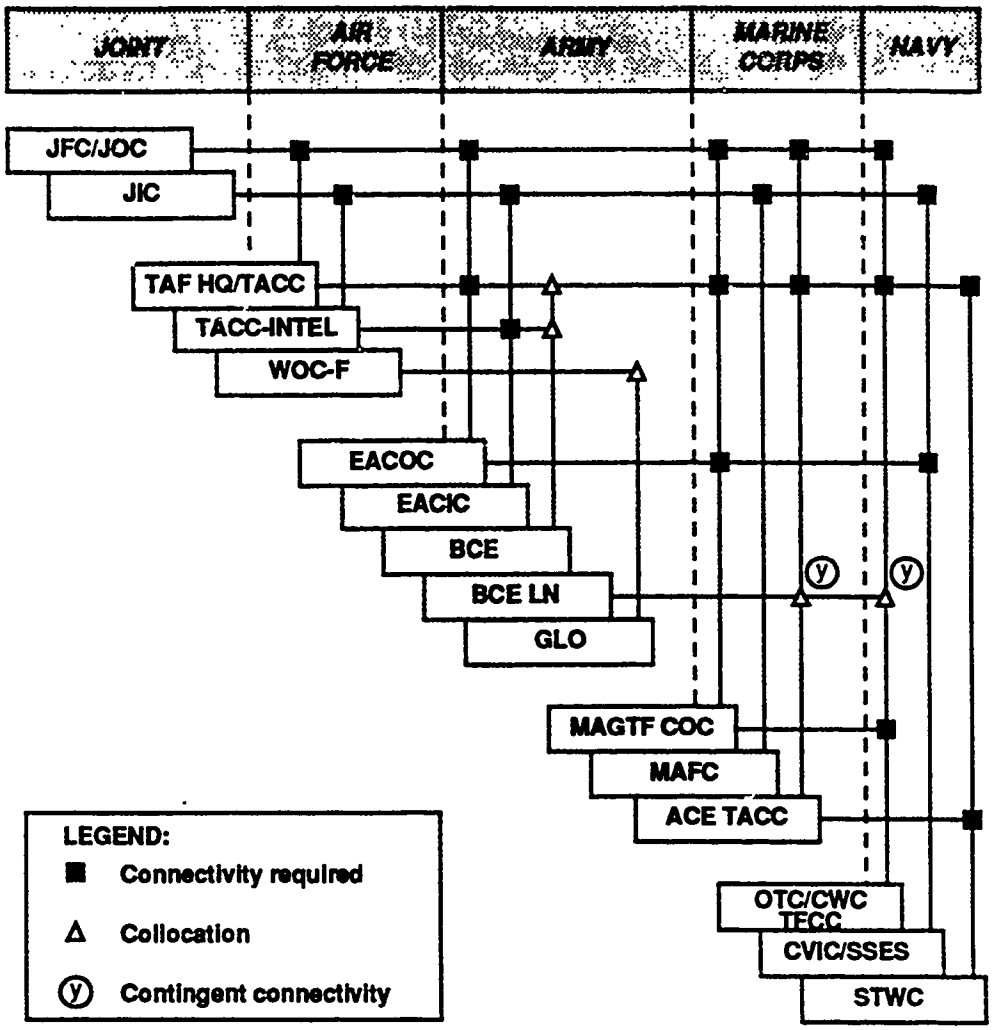


Figure 3-3. Joint C3 Connectivity Requirements for Air Interdiction

3-5 TACTICAL AIR RECONNAISSANCE AND SURVEILLANCE

A. General. The primary purpose of tactical air reconnaissance and surveillance is to satisfy the intelligence requirements of tactical commanders. Since the forces, agencies, and processes involved in tactical air reconnaissance and in tactical air surveillance operations are essentially the same, only the term "air reconnaissance" will be used in this section. Air reconnaissance employs air vehicles to obtain information concerning terrain, weather, hydrography, and the disposition, composition, movement, installations, lines of communication, and electromagnetic emissions of enemy or potential enemy forces.

The joint air operations apportionment, allocation, and sortie allocation process described previously pertains to air reconnaissance. Consequently, the following discussion identifies a limited number of additional C2 elements for joint air reconnaissance operations. For illustration, the discussion assumes that the JFC has assigned the Air Force component commander as the JFACC, and that any assigned Navy or Marine Corps fixed wing reconnaissance sorties are being managed jointly with those of the Air Force. Joint reconnaissance operations by U.S. Army and U.S. Marine Corps helicopter assets and U.S. Army fixed wing assets are requested and tasked through the JOC on a unit mission basis.

Since reconnaissance operations are responsive to intelligence collection requirements, the action agency among various C2 elements elements is the intelligence agency or staff element. As depicted in figure 3-4, the G2 and the intelligence support element in the component forces are involved principally in initiation and processing of air reconnaissance requests. Component level intelligence centers include U.S. Army Echelons Above Corps Intelligence Center (EACIC), MAGTF All Source Fusion Center (MAFC), U.S. Air Force Tactical Air Control Center Intelligence Divisions (TACC-INTEL), and the Navy carrier intelligence center or ship signals exploitation space (CVIC/SSES). Similarly, the J-2 and the Joint Intelligence Center (JIC) are involved at the joint force level.

B. Tasking Joint Air Reconnaissance Operations. The air tasking cycles described above, preplanned and immediate, apply to air reconnaissance. Figure 3-4 depicts the connectivity associated with the flow of information for those cycles. The figure depicts connectivity associated with immediate missions as a function of alternative relationships between components and different availability of on-call support.

Because processing and dissemination of reconnaissance and surveillance products are largely matters of concern to the intelligence management system, the associated connectivity is shown in truncated fashion. The first is the interface of the Air Force imagery processing center (IPC) and the U.S. Army imagery analysis (IA) section collocated with the WOC-R. The second is the down link of digital sensor data from an airborne platform (AC) to a ground support module (GSM), both of which feed intelligence information and reports to a wide range of intelligence or fire support elements. The foregoing elements are not treated as C2 elements in this architecture.

Should the U.S. Marine Corps or U.S. Navy Component Commander be designated the JFACC, the connectivity associated with the preplanned and immediate tasking cycles is unchanged in principle; however, action is centered in C2 elements associated with U.S. Army, U.S. Marine Corps and U.S. Navy. In addition to those at joint and component levels, elements included are ANGLICO teams collocated with U.S. Army elements at division, brigade, and battalion levels; the U.S. Marine Corps Aviation Combat Element (ACE)/Wing TACC with the collocated U.S. Army BCE liaison element; and the U.S. Navy OTC/CWC Tactical Flag Command Center (TFCC) with the collocated U.S. Army BCE liaison element. Connectivity with the U.S. Air Force component is principally at component level.

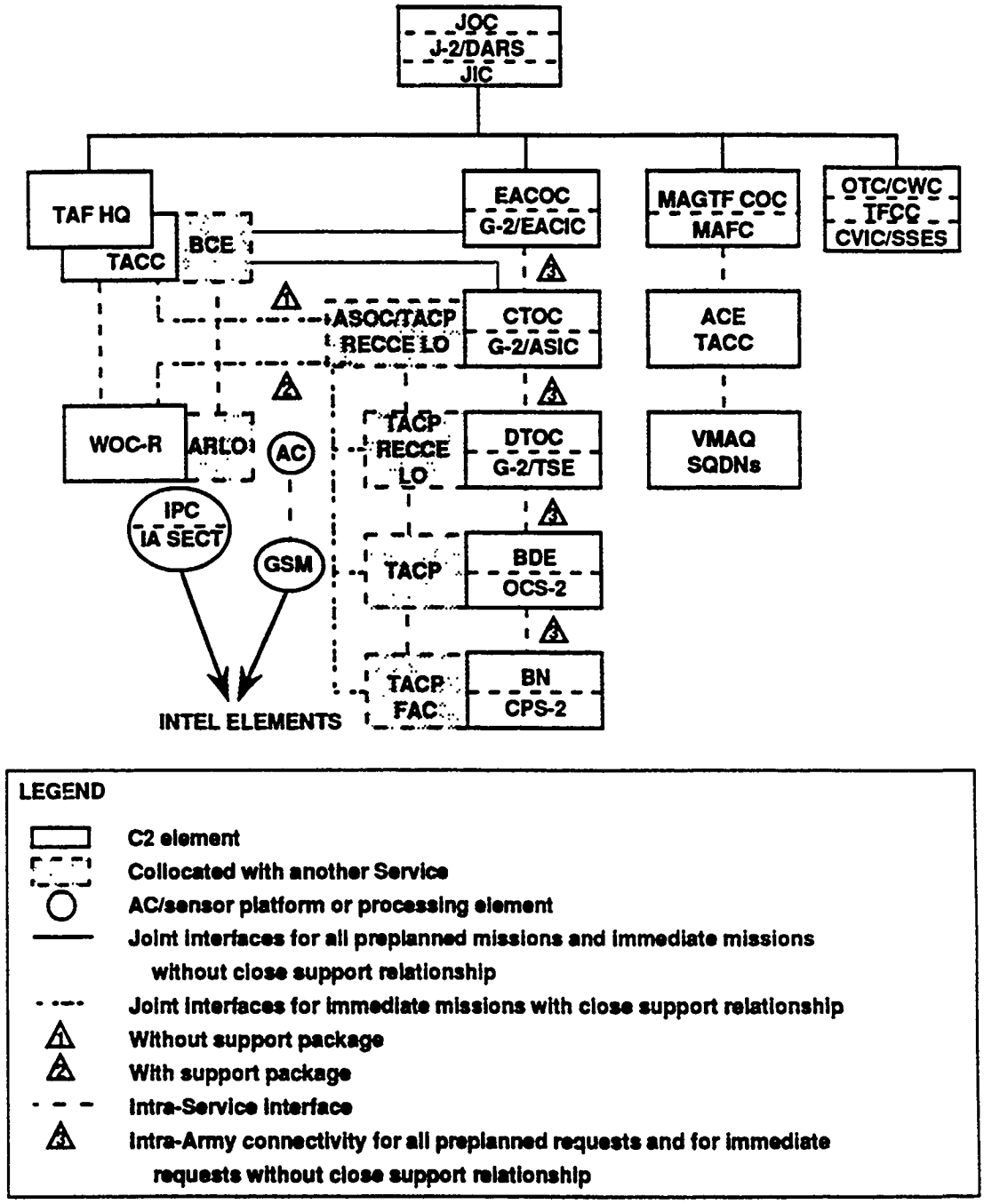


Figure 3-4. Connectivity for Information Flow in Air Reconnaissance

If a close support relationship were established between the U.S. Army and either the U.S. Marine Corps or the U.S. Navy, the flow of requests for immediate missions would be through the ANGLICO teams or through the BCE liaison element(s) with the TACC.

C. Joint C3 Interface Requirements for Air Reconnaissance. Figure 3-5 depicts the joint C3 connectivity requirements for tactical air reconnaissance operations.

3-6 JOINT ELECTRONIC WARFARE OPERATIONS

A. General. Electronic Warfare (EW) is not an isolated activity; it is planned and executed as an integral part of military operations. As explained in the introduction to this report, this integration takes place in divergent functional areas addressed in several joint tactical C3 architectures. This architecture addresses EW from the limited scope of mission areas included in this architecture. Specifically reviewed are the coordination procedures for joint EW support in air operations, accenting the use of airborne resources.

The key specialized EW element at the joint level is the Joint Force Commander's EW Staff (JCEWS), an integral part of the JOC. In a similar fashion, each service has integrated specialized EW staff elements or cells into the basic operations or intelligence elements responsible for the decisionmaking process pertinent to this architecture. The U.S. Army TOC Support Elements (TSE) at corps and division levels provide EW expertise to intelligence and operations elements of the TOC. In the Air Force, electronic combat operations and plan elements of the TACC include EW expertise; moreover, Tactical Air Control Parties (TACPs) provided to the supported ground force are designed to provide advice on U.S. Air Force EW capabilities. U.S. Marine Corps electronic warfare expertise is included in the principal C2 facility at regimental and higher levels. An EW Officer (EWO) is provided at regimental and Ground Combat Element (GCE) (division) and Aviation Combat Element (ACE) (wing) levels, and a Signals Intelligence/Electronic Warfare Coordination Center functions at MEF and MEB levels. Finally, in the U.S. Navy, the CWC will designate an Electronic Warfare Coordinator (EWC), and an EW Module (EW MOD) functions in conjunction with the CIC at each level from task force to task element.

The EW assets of each service component are employed to support its own missions. The direction of joint EW operations emphasizes coordination of EW operations to ensure consistency with the overall joint objectives as well as to facilitate cross-service support.

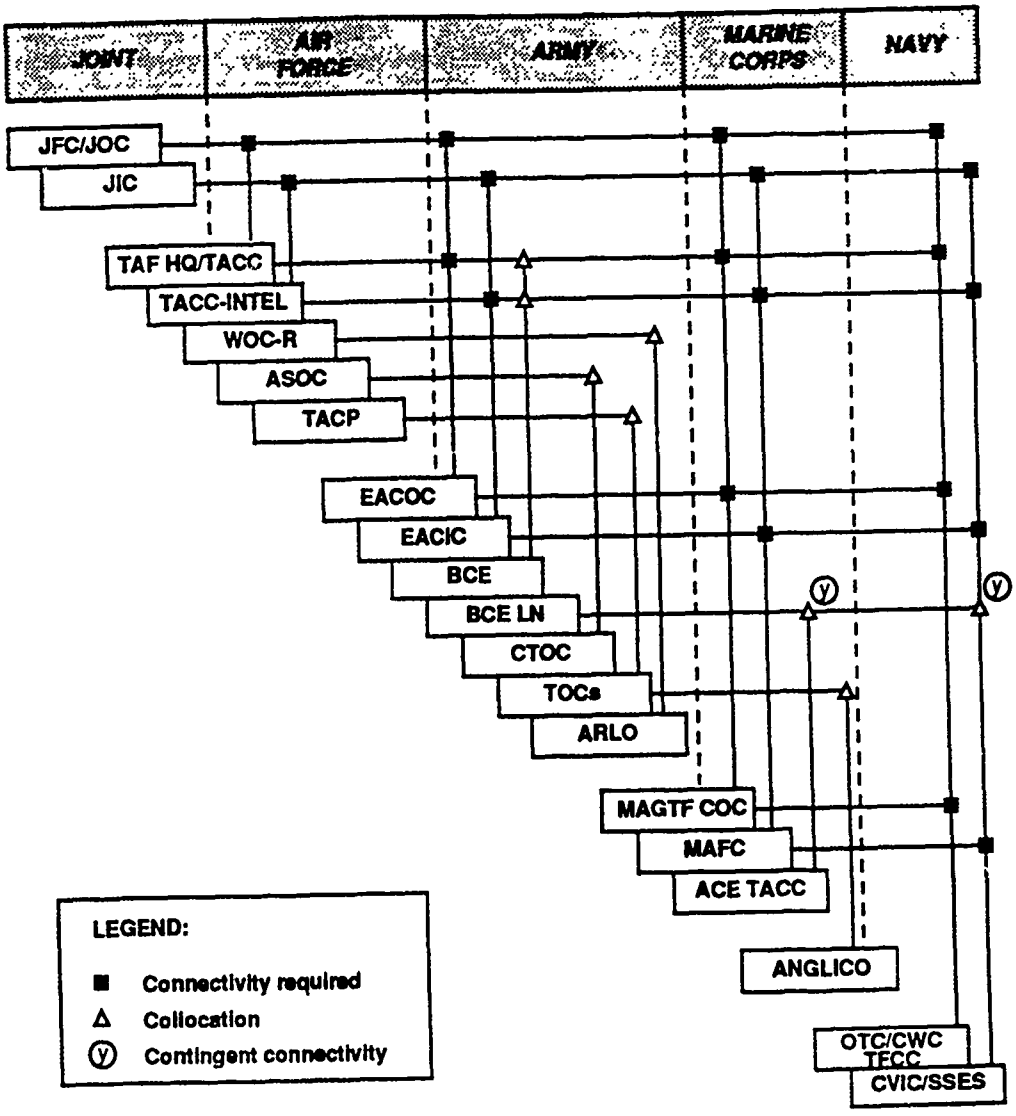


Figure 3-5. Joint C3 Connectivity Requirements for Air Reconnaissance

B. C3 Functions for Joint Electronic Warfare. The joint force commander's JCEWS serves as the focal point for preplanning joint EW support within the joint force. The JCEWS ensures that EW is considered in each phase of the operations plan and identifies areas that overlap. As part of the planning process, each component notifies the JCEWS as to availability of EW assets and aggregate missions assigned. Additionally, components can request cross-service EW support to fulfill requirements exceeding their organic capabilities. Coordination for cross-service support is conducted at the lowest possible level to ensure responsiveness. However, when components are unable to coordinate directly or resolve matters of support, the JCEWS assists in the coordination process. EW support requests forwarded to the JCEWS are coordinated, approved, disapproved, or directed by the joint force commander.

. Standard procedures for joint immediate EW requests have not been established. Joint Pub 3-51, Electronic Warfare Procedures for Joint Tactical Operations, December 1986 (S), provides for such procedures to be developed as part of the overall operations plan. The procedures are to cover requesting, providing, and coordinating EW support as well as establishing or designating communications nets to be used.

C. Joint C3 Interface Requirements for Electronic Warfare. Figure 3-6 depicts the joint C3 connectivity requirements for electronic warfare in air operations.

3-7 JOINT AIRLIFT OPERATIONS

A. General. The objective of airlift operations is the timely movement of personnel, equipment, and supplies to achieve military and national goals. Theater airlift forces provide rapid intertheater mobility for forces, material, and evacuation of casualties. The U.S. Air Force is the principal provider of joint theater airlift support for forces engaged in land, sea, and aerospace projection operations. By virtue of limited intraservice airlift capability, the U.S. Army is the principal service customer for such joint theater airlift. U.S. Air Force theater airlift support also is provided to U.S. Marine Corps and U.S. Navy, and the C2 considerations for these operations are addressed in this architecture as well as airlift support to other services by the U.S. Army, U.S. Marine Corps, and U.S. Navy service components. Aeromedical evacuation is addressed in a separate section.

B. Joint Airlift Support for the U.S. Army. U.S. Army commanders use airlift capabilities to conduct combat support (CS) and combat service support (CSS) air movements. A CS air movement involves the air transport and delivery of combat personnel, equipment, and accompanying supplies to facilitate accomplishment of a tactical mission by a ground force. These movements include joint airborne operations and reinforcement of forces in combat. Joint airborne operations are addressed to the extent that they encompass tactical airlift operations, albeit in a combat support role, and involve delivery of men, equipment, and supplies of another service in an objective area by airlanding, extraction, or airdrop. The G3/S3 is the staff agency responsible for planning and coordinating U.S. Army combat support movements and publishing the air movements portion of appropriate U.S. Army operations plans and orders.

A CSS air movement is the air transport of personnel and cargo in general support of combat operations into areas not immediately threatened by contact with hostile ground forces. The G4/S4 has staff supervision of CSS air movements and produces the air movement portion of appropriate plans and orders.

The key center involved in the direction of joint airlift operations is the JMC. The JMC is the joint force commander's designated agent for airlift operations functions. At the service component level, the air ground operations system for tactical airlift operations comprises generic U.S. Army and U.S. Air Force C2 elements. Execution of Air Force theater airlift missions in support of the U.S. Army involves several joint interfaces in addition to those identified for tasking. Figure 3-7 depicts

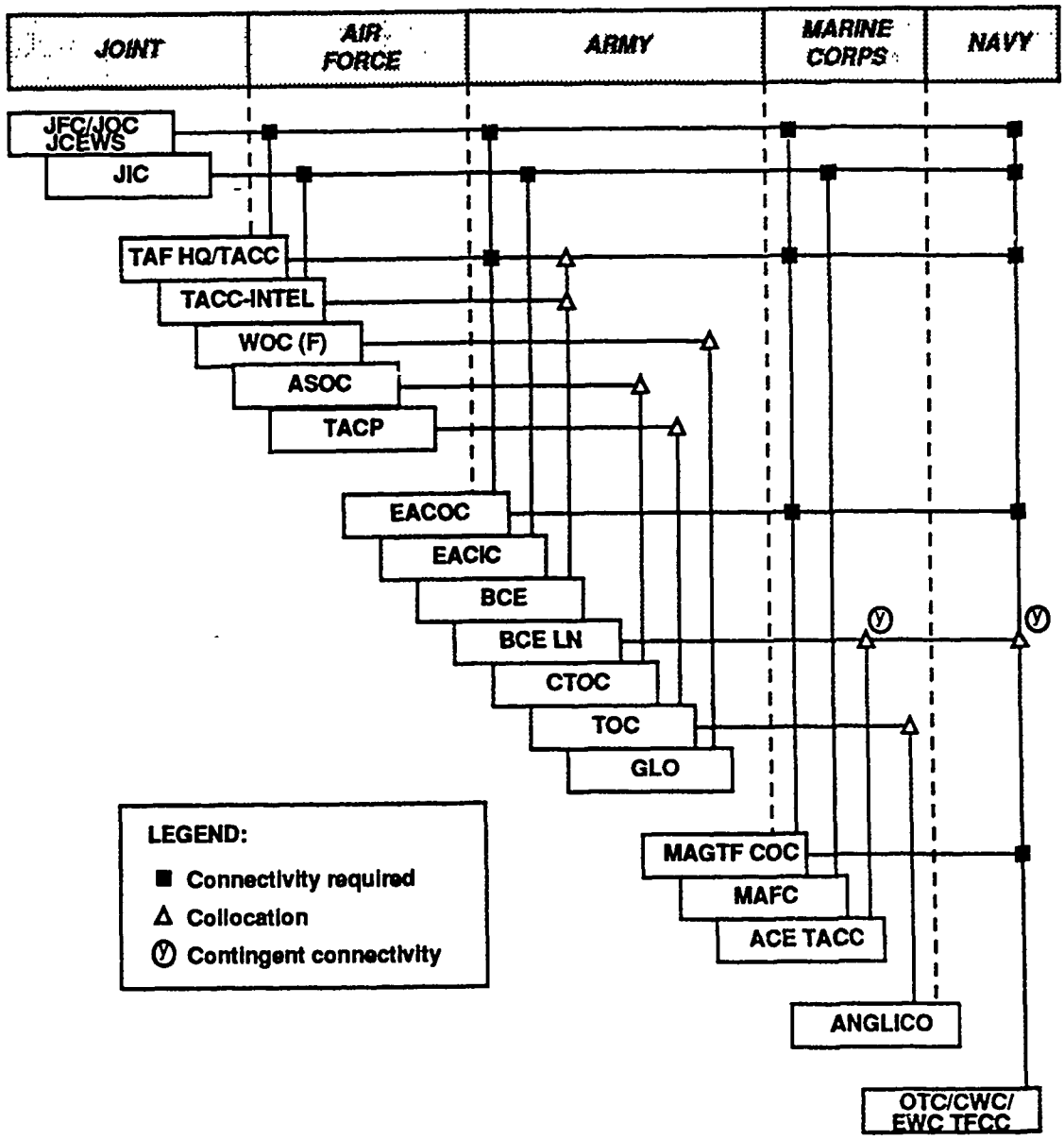


Figure 3-6. Joint C3 Connectivity Requirements for Electronic Warfare

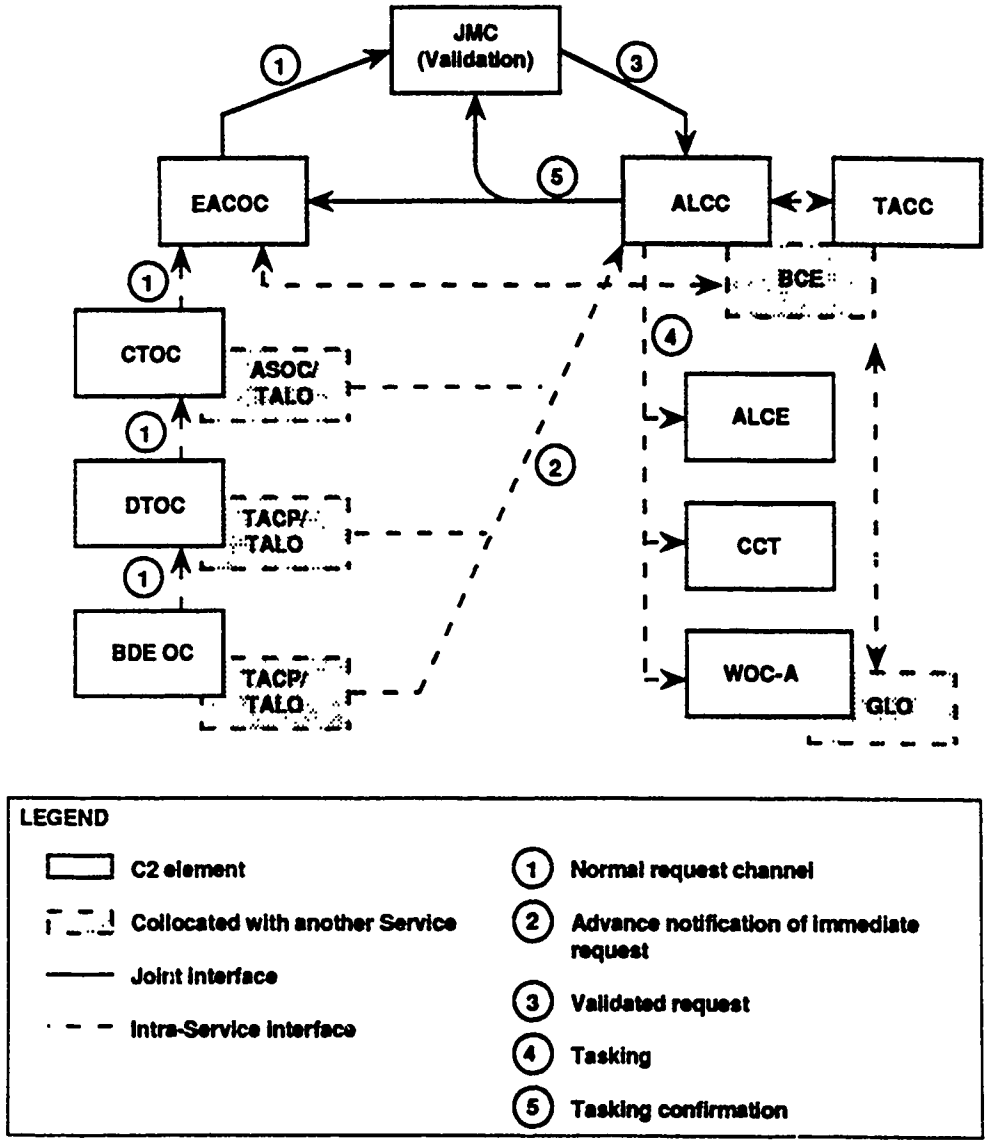


Figure 3-7. Tasking for Theater Airlift for the U.S. Army

C2 elements involved in tasking for U.S. Army theater airlift. As indicated in the description of C2 elements, these interfaces occur at the departure and the arrival airfields, or at a landing zone (LZ), drop zone (DZ), or extraction zone (EZ) on the delivery end of an airlift mission. Figure 3-8 depicts C2 elements involved in execution of theater airlift for the U.S. Army. The C2 elements dedicated to airlift operations and the U.S. Army logistics agencies involved in movement operations are discussed in the following paragraphs.

1. Commander of Airlift Forces (COMALF). COMALF is the senior Military Airlift Command (MAC) commander designated by CINCMAC to manage all airlift resources within a given geographic area; this usually coincides with the supported joint force commander's area of responsibility. He serves on the staff of the Air Force component commander and exercises operational control of airlift forces assigned to the joint force.

2. Airlift Control Center (ALCC). The ALCC is the specialized control center within the TACS that directs and controls the theater airlift effort for the Air Force component commander. COMALF exercises his functions through the ALCC. The ALCC is connected operationally to the TACC to ensure integration of airlift operations with the overall air effort. Liaison officers are positioned in the ALCC to accomplish the necessary coordination for support of their respective components.

3. Airlift Control Element (ALCE). The ALCE is a composite organization to provide MAC airlift support at locations where MAC C2 is nonexistent. The ALCEs primarily support strategic airlift operations, and operational control of these elements is not passed to the theater CINC. The ALCC monitors and manages ALCE operations within their theater, but ALCE taskings are generated at HQ MAC or ALD. The ALCE is responsible for control of aircraft movement, supervision of loading and unloading and coordination of aeromedical evacuation at its operating location. Appropriate representation from the supported unit is positioned with the ALCE.

4. Combat Control Team (CCT). The CCT has the mission to establish assault drop, landing, and extraction zones in austere and nonpermissive environments. This mission includes placing initial en route and terminal navigational aids, controlling air traffic, communications, and removing obstacles. The CCT usually operates under control of the ALCC; however, it may function as part of the ALCE.

5. Tactical Airlift Liaison Officers (TALOs). TALOs are airlift officer aircrew members assigned with TACPs supporting U.S. Army units down through brigade level. Their principal function is to advise the ground commander on the capabilities, limitations, and employment of MAC airlift resources. They also assist the ground commander in preparation of airlift requests and coordinating airlift requirements with the ALCC. The TALO communicates with the ALCC, aircrews on missions in his area, and ALCEs/air units/CCTs supporting these missions.

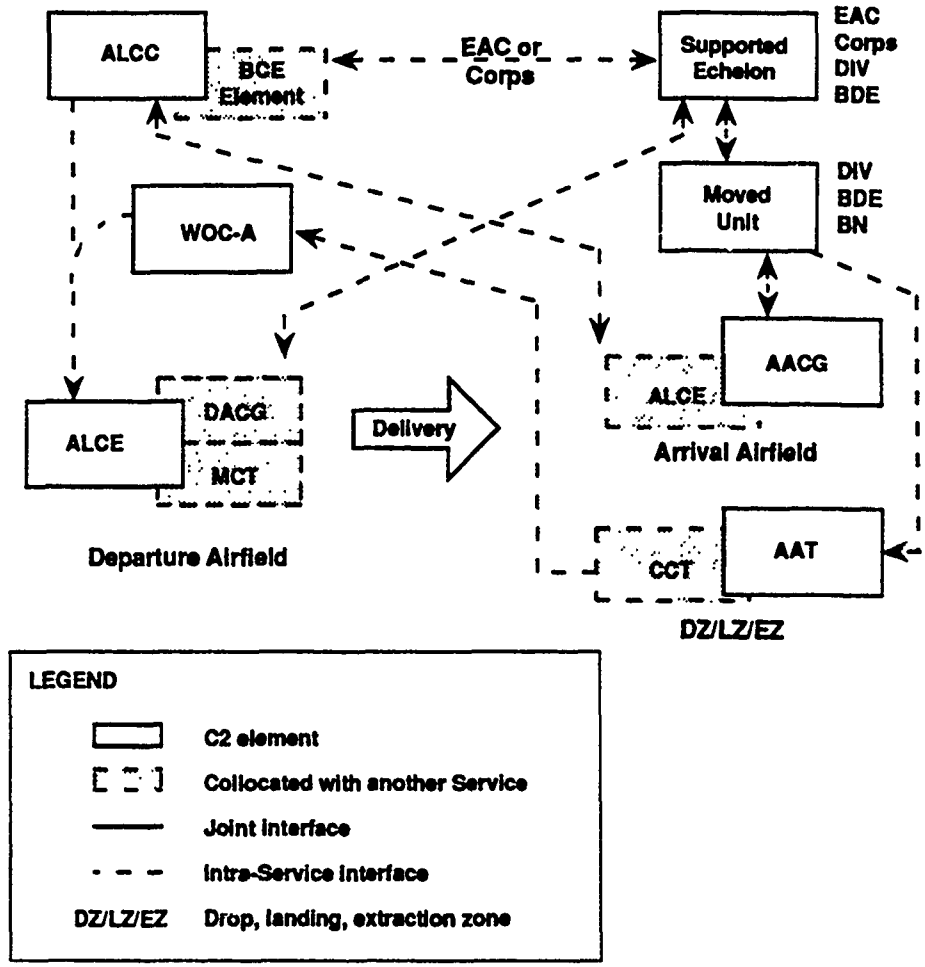


Figure 3-8. Execution of Theater Airlift for the U.S. Army

6. Departure Airfield Control Group/Arrival Airfield Control Group (DACG/AACG). These are provisional elements organized to coordinate and control loading and offloading of personnel, equipment, and supplies into and from Air Force aircraft. The major commander of the service component whose units are being supported is responsible for providing a DACG. The forces commander involved in the air movement provides the AACG. The DACG/AACG is the transported force's primary point of contact for coordination with the Air Force ALCE. TALOs can be used at both arrival and departure airfields to assist the coordination with the supported force.

7. Movement Control Teams (MCTs). The U.S. Army movement control agency provides coordination and movement control functions related to transport of U.S. Army cargo on U.S. Air Force aircraft. They provide an interface with the Air Force for terminal transfer units and aerial delivery units from theater U.S. Army who transload cargo and prepare it for air delivery.

8. U.S. Army Assault Team (AAT). AAT is an infantry team task organized to provide security and protection for U.S. Air Force CCT and to assist U.S. Army units in rapid assembly and reorganization. When CCT is joined by an AAT, the combined team is designated the Joint Airborne Advance Party (JAAP). CCT and AAT are unique to joint airborne operations.

C. Joint Airlift Support for the U.S. Marine Corps/U.S. Navy. When requirements for theater airlift exceed the capabilities of U.S. Marine Corps forces operating as part of a joint force, the U.S. Marine Corps may request joint theater airlift support. The organization for direction of such support involves the senior U.S. Marine Corps command element, the MAGTF CE, as well as the same U.S. Air Force elements discussed in case of airlift support for the U.S. Army.

The tasking cycle for theater airlift missions for the U.S. Marine Corps is similar to that described for the U.S. Army. The process is initiated by the MAGTF with an airlift request's being transmitted to the JMC for validation and to the ALCC for information. The process is illustrated in figure 3-9.

In the execution phase of U.S. Air Force theater airlift support to the U.S. Marine Corps, the major commanders whose units are being supported, or whose forces are involved in the air movement are responsible, respectively, for providing a DACG and a AACG. When collocation of these elements is achieved, the functions and joint connectivity with the U.S. Air Force ALCE at departure and arrival airfields is the same as described for Air Force airlift for support to the U.S. Army.

No direct joint interfaces need to be established between the OTC/CWC and other agencies for airlift support. The OTC/CWC makes his needs known within U.S. Navy channels. A shore-based Fleet Port Representative coordinates intra-theater airlift requirements with the ALCC or an ALCE, and arranges for transfer of cargo delivered by MAC to afloat forces via organic Navy assets.

D. Joint Airlift Support for the U.S. Air Force. U.S. Air Force component requirements for airlift and the satisfaction of those requirements are also subject to validation by the JMC and the priorities established by the JFC. The tasking process described above for theater airlift missions for the U.S. Marine Corps component is applicable, and the Tactical Air Force Headquarters (TAF HQ) will initiate the cycle with a request to JMC.

E. Joint U.S. Army and U.S. Marine Corps Helicopter Airlift Operations. U.S. Army aviation and U.S. Marine Corps helicopter assets are employed as units by their respective service commanders as part of the combined arms team. However, the tactical situation can call for U.S. Army/U.S. Marine Corps helicopter lift support to other services. In such cases, the appropriate unit(s) are tasked to support another service. The air tasking processes, such as those described for airlift, are not used for helicopter operations.

To obtain U.S. Army/U.S. Marine Corps helicopter air movement support, the requesting service component forwards its requirements to the JOC. After validation of the request and coordination with the providing services to determine availability and capability to support the request, the joint force commander will task the U.S. Army or the U.S. Marine Corps to perform the mission and authorize direct coordination between the requester and the provider.

The joint connectivity requirements to support this process are satisfied by the basic connectivity shown previously in figure 3-7, when augmented by standard U.S. Army aviation or U.S. Marine Corps liaison to the supported unit.

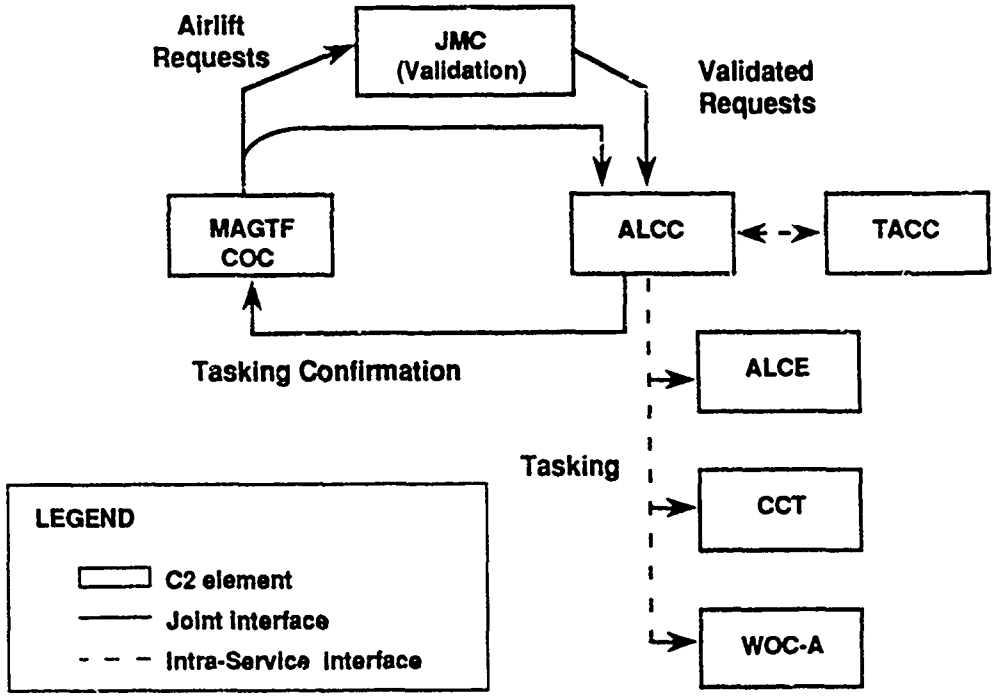


Figure 3-9. Tasking for Theater Airlift for the Marine Corps

F. Airlift Tasking Procedures. Airlift tasking and associated request or validation procedures must be responsive and flexible to accommodate deliberate and rapidly changing situations. The JCS have established standard tasking procedures for preplanned, or deliberate, airlift missions; special provisions are made for requesting immediate missions.

The tasking phase for theater airlift missions begins with a service component request and proceeds through joint validation and tasking. The request, usually starting as a request for transportation or resupply, may originate at anylevel in the supported service. In the U.S. Army, interface with airlift C2 begins at brigade (BDE) level through the TALO and is found at each higher level. Each level considers satisfying the request with U.S. Army transportation assets; if that is not possible, request for tactical airlift support is forwarded to the next higher level. A request reaching the U.S. Army component level is transmitted to the JMC for validation and to the ALCC for information. In light of joint force commander's priorities and available airlift assets, the request either is validated by the JMC and passed to the ALCC as an airlift requirement, or is denied, and the ALCC and the requester are informed. If approved, the ALCC sends an Airlift Mission Schedule to the requesting service component indicating the aircraft that will perform the mission and the scheduled times. That message is sent to the tasked organization as an intraservice tasking order and also is used by the ALCC to inform the JMC and the requester if assets should be unavailable for the mission.

G. Joint C3 Interface Requirements for Airlift Operations. Figure 3-10 depicts the joint C3 connectivity for airlift operations, exclusive of aeromedical operations addressed in a subsequent section of this architecture.

3-8 JOINT AEROMEDICAL EVACUATION OPERATIONS

A. General. Aeromedical evacuation (AE) is one of the principal uses for theater airlift. Since AE involves a number of unique C2 elements as well as additional procedures, it is treated separately. The organization and process for joint AE support provided by the U.S. Air Force, cross-force AE support between the U.S. Army, U.S. Navy, and U.S. Marine Corps, and associated joint C3 connectivity are addressed in turn.

B. C2 Structure for Joint Aeromedical Evacuation Operations. In addition to the C2 elements identified previously for direction of joint theater airlift, key elements involved in direction of AE are the Joint Medical Regulating Office (JMRO) at joint force level and elements of the Air Force Theater Aeromedical Evacuation System (TAES). The medical regulating system coordinating and controlling movement of patients to medical facilities best able to provide the required medical care extends from the JMRO into each of the service components and functions under supervision of the respective command surgeons. Responsibilities of the JMRO include arranging cross-service medical support, establishing priorities, and coordinating use of rear area medical treatment facilities (MTFs) and air transportation. The TAES is a highly mobile system designed to deploy or redeploy on short notice to any airfield. It functions as a total system to provide interim medical care and expedite evacuation of the sick and injured. The principal elements of the TAES are described in the following paragraphs.

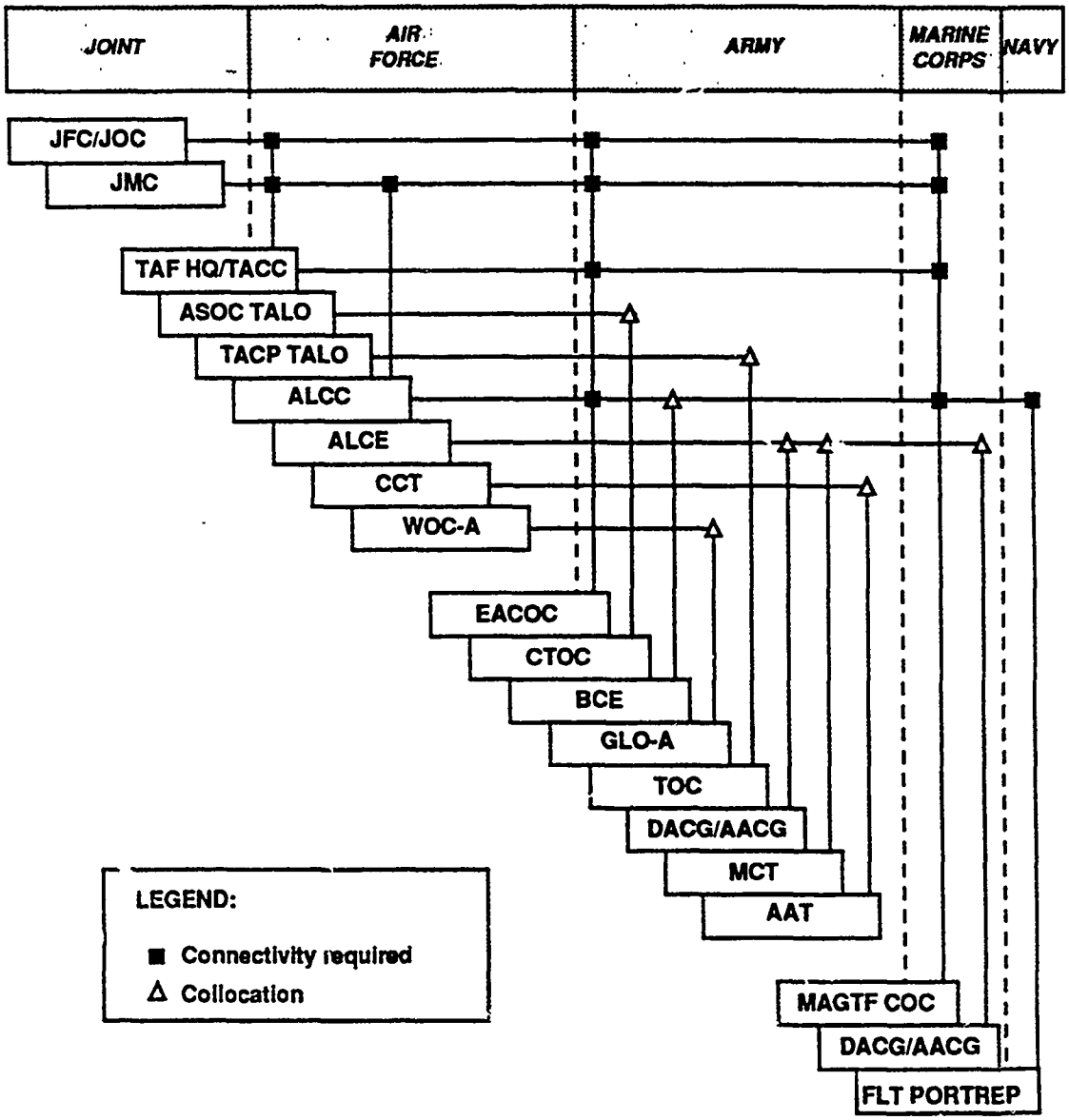


Figure 3-10. Joint C3 Connectivity Requirements for Theater Airlift

1. The Aeromedical Evacuation Control Center (AECC). The AECC is the command and control element of the TAES. It receives requests from the Aeromedical Evacuation Liaison Team (described below) to evacuate patients aeromedically and works with the ALCC to obtain airlift.

2. The Aeromedical Evacuation Liaison Team (AELT). This team is located with or near the forward MTF of the supported service(s) and is the first aeromedical evacuation element contacted by the service. The AELT coordinates with the medical regulating officer (MRO) of the forward MTF, the AECC, and the Mobile Aeromedical Staging Facility to ensure a smooth and rapid flow of patients within the system.

3. The Mobile Aeromedical Staging Facility (MASF). The MASF provides short-term holding and supportive treatment for patients to be evacuated. It deploys to forward airfields and receives patients from service MTF and prepares them for flight.

C. C3 Procedures for Joint Aeromedical Evacuation Operations. The joint aspects of the process for requesting, tasking, and conducting intratheater aeromedical evacuation are depicted in figure 3-11. The MRO at the originating service MTF originates the process by reporting patients for evacuation to the JMRO. After receiving identification and location of the destination hospital, the MTF submits a patient movement request to the servicing AELT. The AELT then requests

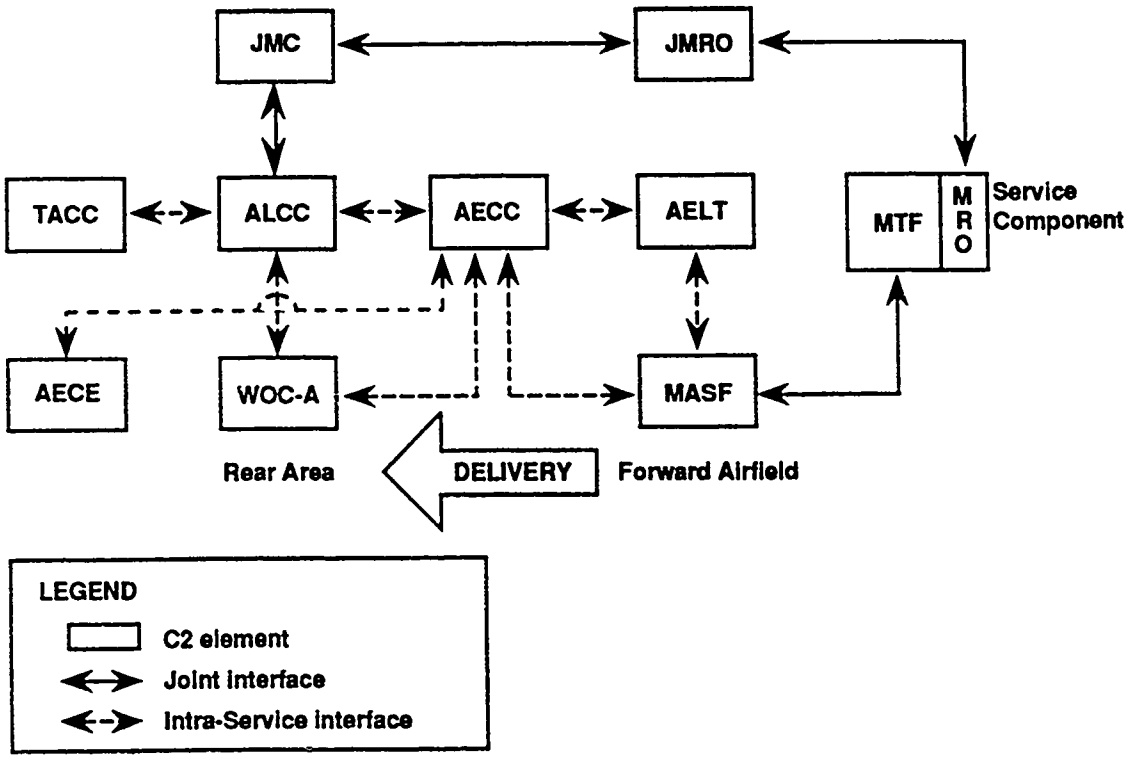


Figure 3-11. Joint Process for Management of Aeromedical Evacuation

AE support from the AECC. The AECC checks medical validation and prioritizes the request with other requests. If the request is validated on a medical basis and of appropriate priority, the AECC requests necessary airlift through the ALCC, who works with the JMC to establish it as an airlift requirement. Upon JMC validation, the ALCC tasks the airlift requirement to the WOC-A, as described for other airlift missions. The mission tasking information also is sent to the AECC, where the missions are coordinated with the AELT and originating MTF, the MASF at the forward operating location, and the destination medical facility in the rear area. The AELT coordinates the timely movement of patients from the MTF to the MASF for the AE mission.

AE support by the U.S. Army, the U.S. Navy, and the U.S. Marine Corps may become expedient or necessary. A service may have been designated or tasked to provide support to another service, or the components had agreed upon support arrangements, if direct coordination has been authorized by the JFC. This type of support is more likely to involve operations close to the casualty-producing scene, in contrast to the Air Force AE, where between-treatment facilities are reasonably removed from close combat areas.

AE support among the U.S. Army, the U.S. Navy, and the U.S. Marine Corps may engage the liaison capabilities of the ANGLICO teams provided to U.S. Army division, brigades, and battalions when those services are being employed jointly. On-the-scene connectivity between the supporting AE unit or AE flight or aircraft and the supported unit will be facilitated by the ANGLICO through necessary exchange of CEOI data and establishment of other communications arrangements. A standard medevac request format does not exist, although the information required by both services is the same.

D. Joint C3 Interface Requirements for Aeromedical Evacuation Operations. Figure 3-12 depicts the joint C3 connectivity requirements for aeromedical evacuation operations.

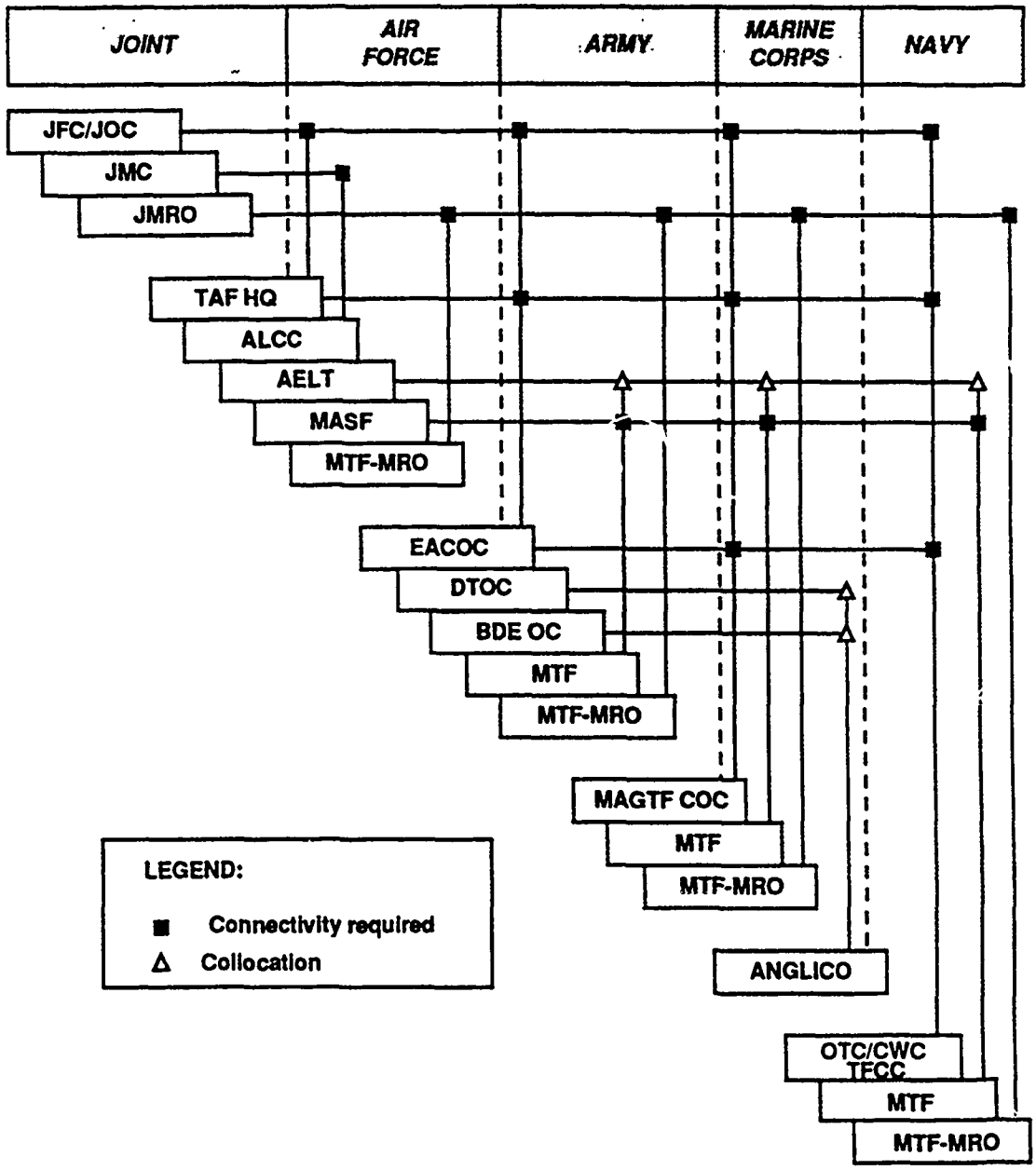


Figure 3-12. Joint C3 Connectivity Requirements for Aeromedical Evacuation

3-9 JOINT COMBAT SEARCH AND RESCUE OPERATIONS

A. General. The objective of Combat Search and Rescue (CSAR) is to employ available resources effectively to recover distressed personnel in wartime or in a contingency environment. The JCS have tasked U.S. overseas unified commanders to provide rescue support for U.S. forces operating within their areas of responsibility. These commanders are tasked specifically to develop wartime CSAR procedures, establish Joint Rescue Coordination Centers (JRCCs) to direct and coordinate CSAR operations, and exercise control of CSAR forces committed to an incident. The Joint Force Commander (JFC) usually, but not always, designates the AFCC as the area CSAR coordinator, who, in turn, delegates authority to the Commander of Combat Rescue Forces (COMCRF) or the Deputy for Operations in the TAF HQ.

Each component in the joint force will provide CSAR services and resources to support its own forces, usually will designate a CSAR controller to coordinate those forces, and may establish a component RCC to carry out the required direction and coordination. The U.S. Air Force will establish an RCC that usually will serve as the JRCC and be an element of the TAF HQ staff. The Air Force's COMCRF usually is the JFC's senior CSAR coordinator and directs the JRCC; however, the senior CSAR coordinator may be a member of any service. The JRCC is staffed by all participating services to coordinate interservice CSAR requirements. This architecture assumes that the U.S. Air Force RCC is serving as the JRCC and that the U.S. Air Force COMCRF is serving as the senior CSAR coordinator for the JFC.

The JRCC interfaces with U.S. Air Force elements for requesting, tasking, and coordinating CSAR forces, and the other service representatives in the JRCC communicate with elements of their respective services. Typically, the JRCC will be in contact with the senior headquarters in the theater for each component as well as the SOC HQ. In addition, the JRCC typically will establish communications with an appropriate U.S. Army aviation brigade operations center, the U.S. Marine Corps TACC, and the U.S. Navy Rescue Coordination Team (RCT) under the Strike Warfare Commander.

Each service should notify the JRCC of any internal CSAR operations to prevent duplication of effort, to ensure that other services are aware of the effort, and possibly to combine efforts. If the service needs additional support to perform a recovery, it sends a request to the JRCC, who may use dedicated CSAR assets or attempt to obtain nondedicated assets from other services. In general, the Air Force is the only service that provides dedicated assets for CSAR; the other services generally use nondedicated assets for CSAR and will support the JRCC requests for assets on a not-to-interfere basis. Since CSAR is an inherent capability of most SOF assets, the JRCC may request use of SOF assets through the Commander Special Operations Command (COMSOC). If the AFSOF units are under the operational control of the U.S. Air Force component commander, the appropriate SOF assets will be requested through U.S. Air Force channels.

The JRCC coordinates preplanned and immediate CSAR requirements. General divisions of responsibility guide the JRCC in determining appropriate forces to prosecute CSAR missions. Air Force assets are preferred for aircrew recovery missions in an overland environment; ground CSAR, other than aircrew recovery,

usually will be associated with U.S. Army or U.S. Marine Corps operations, and maritime CSAR incidents are prosecuted most effectively by U.S. Navy forces.

The C3 aspects of a CSAR mission are crucial, since resources from different forces within the Air Force, from the SOF, and from other services probably will need to be orchestrated. In addition, C3 requirements must be considered in terms of interfaces with the airspace control system for the forward area and with the distressed personnel during the recovery phase.

Major elements that may be involved in the terminal phase of a CSAR operation include the airborne mission commander (AMC), the on-scene commander (OSC), and the pararescue elements (PJ). The PJ teams are specially trained to provide emergency medical treatment and assist distressed or isolated personnel in recovery.

B. C3 Procedures for Joint Combat Search and Rescue Operations. CSAR forces may employ any one of a variety of procedures to recover distressed personnel, the objective of combat rescue (OCR). The specific method of recovery will be dictated by the threat, survivor condition, and types of CSAR forces available. In general, the CSAR process involves phases for preplanning, for immediate requesting and tasking forces in response to a specific CSAR incident, and for executing recovery of the OCR.

Figure 3-13 illustrates the typical process of preplanning and of immediate requesting and tasking forces in response to a specific CSAR incident. The preplanned cycle begins with the JRCC's preparing requests to have various forces available to accomplish CSAR mission objectives for the next tasking day. Each component determines how it will satisfy the CSAR tasking, then sends confirmation to the JRCC.

Typical C3 connectivity for the elements of a CRTF in the area of the OCR to be recovered may involve the various C2 aircraft and facilities, recovery aircraft, escort aircraft, CAP aircraft, pararescue elements (PJ), and the OCR. Many of these interfaces could be joint.

C. Joint C3 Interface Requirements for Combat Search and Rescue Operations. Figure 3-14 depicts joint C3 connectivity requirements for combat rescue operations.

3-10 JOINT AERIAL REFUELING OPERATIONS

A. General. U.S. Air Force, U.S. Marine Corps, and U.S. Navy aircraft involved in conventional theater air operations may need to be serviced by tankers. The only U.S. Army aircraft currently capable of aerial refueling are associated primarily with special operations. The U.S. Marine Corps and U.S. Navy have tankers or refuelers organic to their respective forces; whereas, the U.S. Air Force tactical forces are supported by SAC tankers.

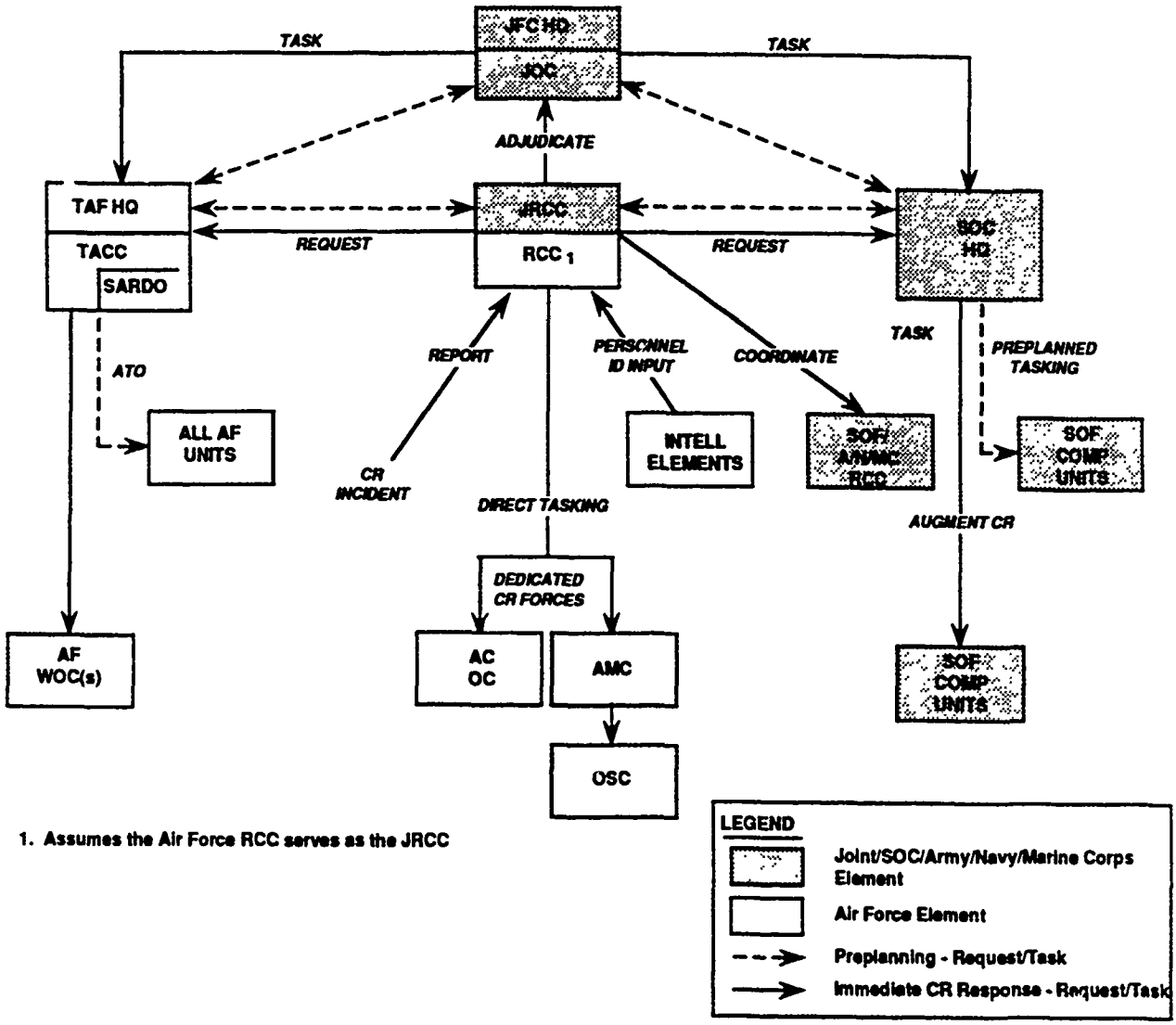


Figure 3-13. Typical Joint Planning and Tasking Process for Combat Search and Rescue

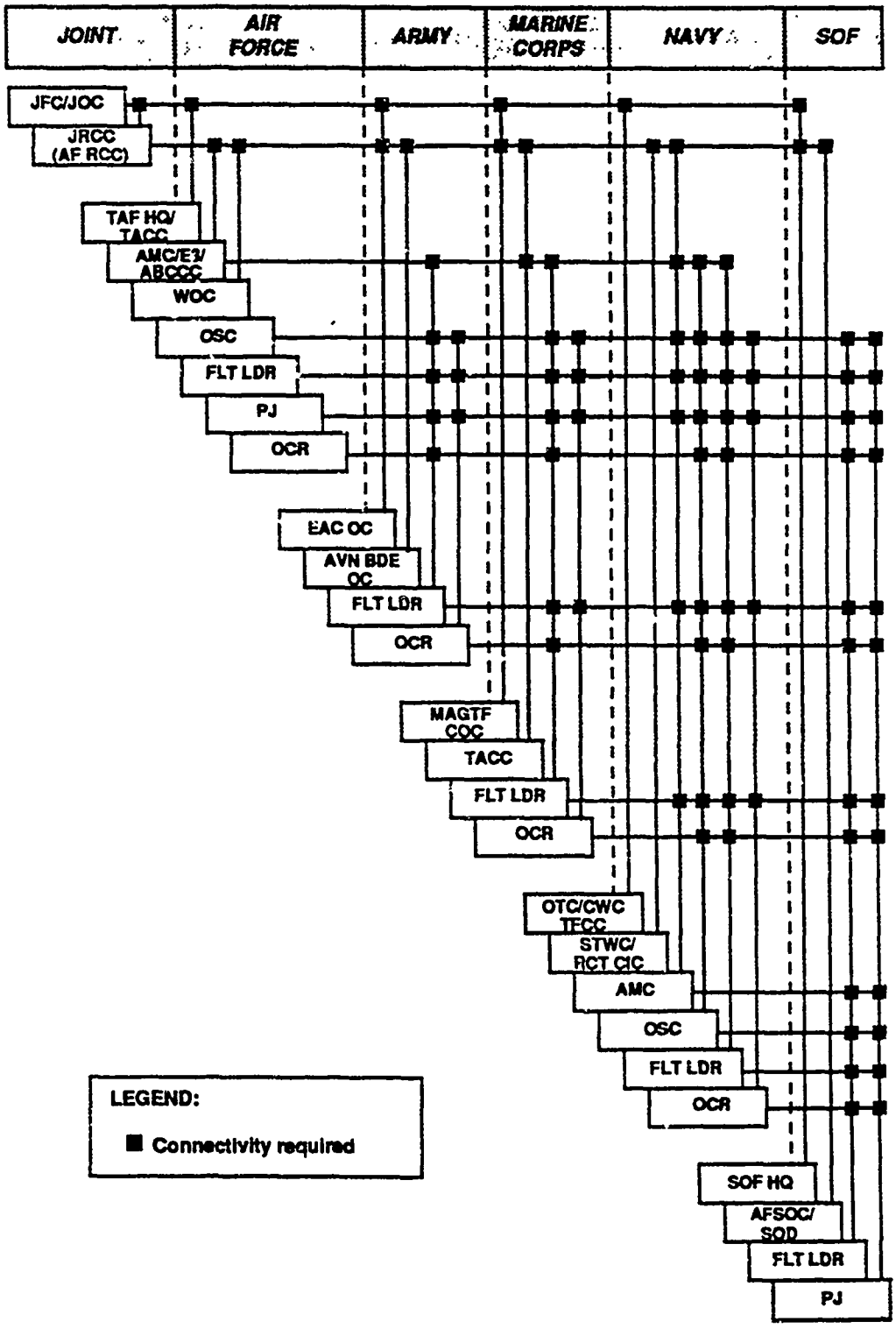


Figure 3-14. Joint C3 Connectivity Requirements for Combat Search and Rescue Operations

SAC tankers are made available to the theater Air Force component commander at the strategic direction of the JCS. CINCSAC retains operational command of the SAC tankers to ensure that they can be reintegrated quickly into the higher priority strategic missions. During tactical air operations, tanker aircraft will be under tactical control of the Air Force component commander. To assist him in effectively employing SAC forces in tactical air operations, CINCSAC may establish a SAC strategic forces (STRATFOR) liaison element. This echelon interfaces with the Air Force TACC and is responsive to the TACC director for planning, preparing the ATO, and executing tasks assigned to supporting strategic forces. Tactical control is provided through subordinate elements of the TACS or the appropriate control system for the area in which the operations are conducted. Detailed control arrangements are coordinated with the STRATFOR commander.

Preplanned aerial refueling would be used primarily to support tactical missions. Tanker support would be included in each service's air planning process, similar in principle to those described for other missions. The refueling operation typically may be coordinated or monitored by a radar facility such as a U.S. Air Force CRC/CRP, U.S. Marine Corps TAOC, or U.S. Navy E-2, who probably would be in radio contact with the tanker and the tactical aircraft to be refueled.

B. C3 Procedures for Joint Aerial Refueling Operations. The most likely joint refueling scenario would have the U.S. Air Force providing tanker support to either the U.S. Marine Corps or the U.S. Navy. The preplanned air tasking cycle would involve typicalinterfaces among the JFACC, the U.S. Air Force TACC, and the MAGTF CE COC/MAGTF TACC of the U.S. Marine Corps forces or the OTC/CWC of the U.S. Navy, or both, depending on the service being provided tanker support. The U.S. Air Force would provide tanker support in the ATO developed at the TACC. Tankers would be included in the planned air tasking of the Marine or Navy tactical aircraft to be supported.

Another joint refueling operation may involve either the U.S. Navy or U.S. Marine component providing tanker support to the other. Inclusion of this tanker support in the preplanned air tasking cycle would be similar in principle to that described earlier for other cases. The execution phase of the process is monitored by either U.S. Marine Corps or U.S. Navy facilities as appropriate.

C. Joint C3 Interface Requirements for Aerial Refueling Operations. Figure 3-15 depicts the joint C3 connectivity requirements for aerial refueling operations.

3-11 JOINT WEATHER SERVICE OPERATIONS

A. General. The U.S. Air Force Air Weather Service (AWS), under MAC, is responsible for providing weather support to the U.S. Air Force, U.S. Army, specified commands, and some unified commands. The primary weather service units are weather forecasting and weather observing elements placed within the theater. In addition, the Air Force Global Weather Central (AFGWC) at Offut AFB, Nebraska,

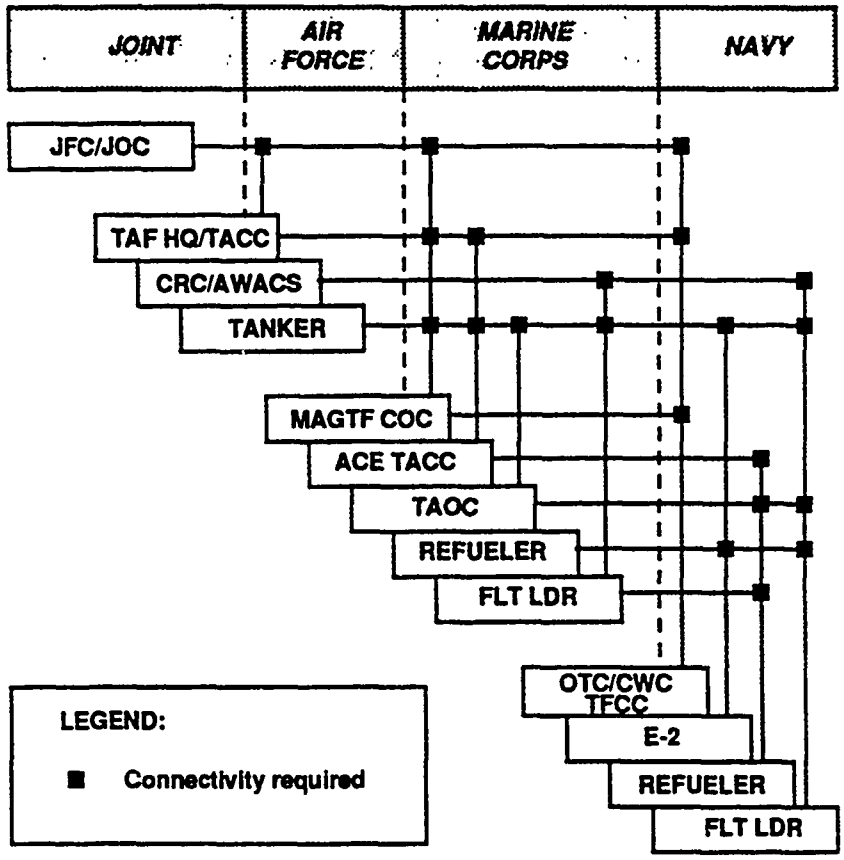


Figure 3-15. Joint C3 Connectivity Requirements for Aerial Refueling Operations

also serves the theater. It receives raw weather data concerning the theater and produces tailored weather data that supports long-range planning and mission planning. Other service elements may provide local weather observations to the AWS units. U.S. Navy and U.S. Marine Corps components of a joint operation receive environmental support from organic weather resources that are not usually part of the AWS weather support force.

B. C3 Procedures for Joint Weather Service Operations. Weather Teams (WETMs) are the basic U.S. Air Force weather support unit for U.S. Army and U.S. Air Force forces in the tactical theater at multiple U.S. Army echelons and various U.S. Air Force locations. WETMs vary in size and capability to meet the requirements of the supported tactical unit. WETMs provide three categories of services: Staff Weather Officer (SWO) advisory services, forecasting, and observing support. The U.S. Air Force provides Special Operations Weather Teams (SOWTs) to the U.S. Army and U.S. Air Force Special Operations Forces as shown in figure 3-16. Tactical Elements (TEs) provide a unique capability to train untrained personnel to take

limited observations for Air Force Special Forces. Each U.S. Army division has a Mobile Observing Team (MOT) within the division WETM to take weather observations at tactical locations that meet the unique requirements of the mission or terrain in the area of operations.

Figure 3-16 depicts the location of primary AWS support teams deployed throughout a typical joint operations area. As indicated in the figure, a Tactical Forecast Unit (TFU) will be established at the joint force level to provide centralized weather products to components in the theater. If the joint force commander is either U.S. Army or U.S. Air Force, this information may be passed to U.S. Navy and U.S. Marine Corps component HQs. When the joint force is commanded by a Navy officer, the senior weather officer may be a Navy officer. In this case, the senior AWS staff weather officer providing support to a U.S. Army or U.S. Air Force component is responsible for coordinating with the U.S. Navy.

For the U.S. Army component, U.S. Air Force WETM support is provided to the senior U.S. Army Component Commander, as well as each corps, division, corps and division aviation brigades, separate brigade, and armored cavalry regiment (ACR) as shown. These WETMs tailor the weather product provided from the joint level for U.S. Army needs.

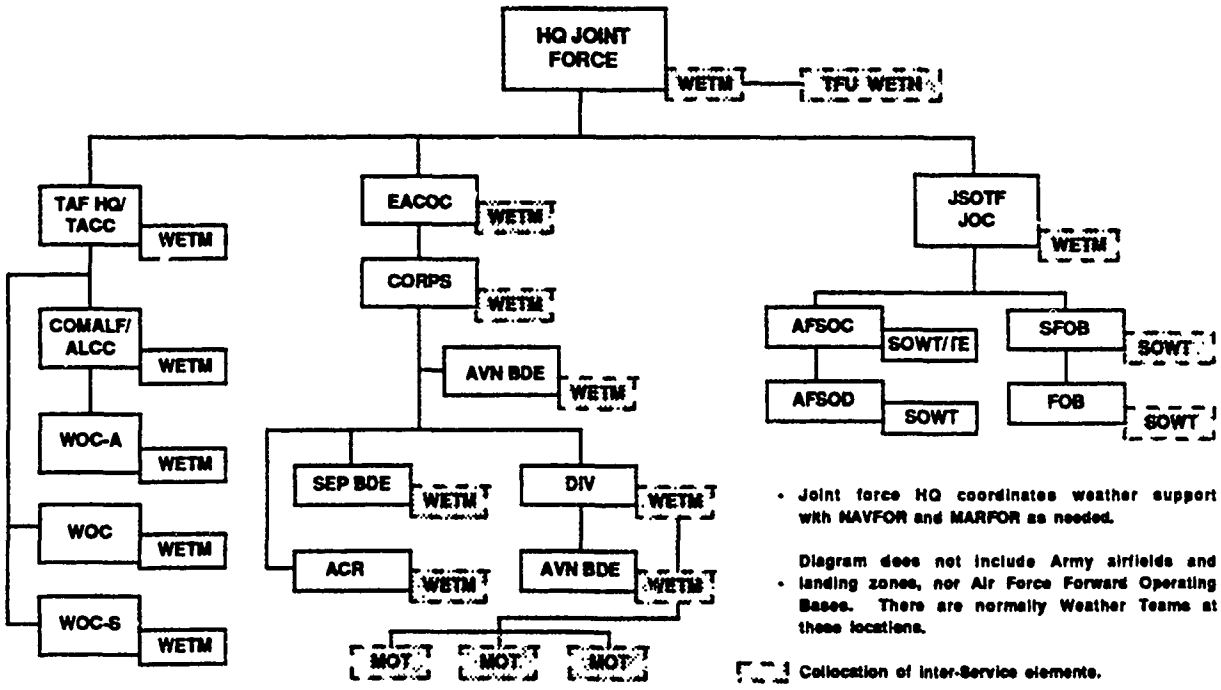


Figure 3-16. Joint Operational Weather Support Structure

The WETM at the SOC HQ is responsible for interfacing and coordination with the joint force level WETMs and for producing various forecasts for special operations. SOWT support to the Naval Special Warfare Task Group (NSWTG) or its subordinate units, is provided by U.S. Navy forces or by other sources, if necessary, to respond to the requirements established by COMSOC.

When U.S. Army units are attached to or under the operational control of U.S. Marine Corps forces, the U.S. Army retains its attached USAF WETM at the division level, with its communication links to the corps WETM. U.S. Army units below divisional level require finished product weather support from the supported USMC unit or headquarters. When U.S. Marine Corps units are attached to or under the operational control of U.S. Army forces, the U.S. Marine Corps is responsible for providing logistic and communication support.

The WETMs and SOWTs shown in the connectivity matrix are collocated with all the elements for which connectivity is indicated. A number of the other connectivities shown among elements are implemented by the WETMs (or SOWTs) at the respective elements. U.S. Air Force, U.S. Army, and U.S. Navy special operations units are shown in the chart as part of a SOF component in the joint force. The Joint Forecast Unit (JFU) refers to the Tactical Forecast Unit previously discussed.

C. Joint C3 Interface Requirements for Weather Operations. Figure 3-17 depicts the joint C3 connectivity requirements for weather service operations.

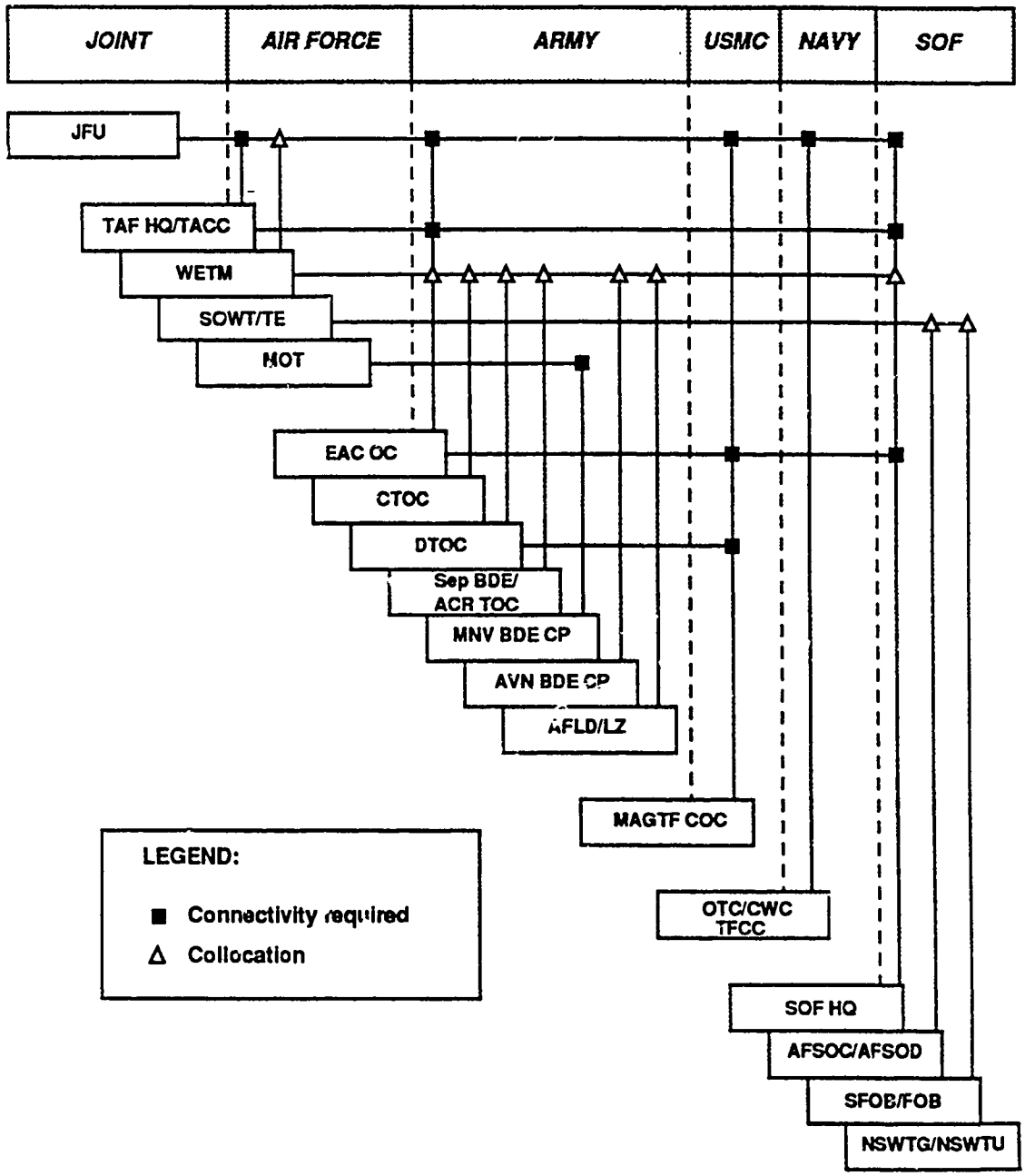


Figure 3-17. Joint C3 Connectivity Requirements for Weather Service Operations

CHAPTER 4

FUNCTIONAL C3 INTEROPERABILITY ARCHITECTURE FOR AIR OPERATIONS

4-1 JOINT TACTICAL C3 INTERFACES FOR AIR OPERATIONS

A. General. The objective of this chapter is to give a cohesive portrayal of the joint C3 connectivity requirements for various missions and tasks identified for inclusion in the functional C3 interoperability architecture for air operations. Chapter 3 discussed individual operations that fall within the scope of this architectural development and interfaces needed for effective conduct of those operations. This chapter consolidates the connectivity requirements into a comprehensive representation.

B. Selection of C2 Elements and Interfaces for the Architecture. The general criteria and other factors considered in identifying the C2 elements and connectivities that make up the architecture are discussed in the following paragraphs.

1. An interface is included in the architecture if it has been established in joint doctrine or documents on tactics, techniques, and procedures. Interfaces that are essential extensions of doctrinal requirements also are established in the architecture.

2. Connectivities that analysis identified as inherent in current, well established, operational practices. but not specifically directed by doctrine, are included in the architecture when they clearly impact on joint air operations.

3. Interface requirements also were identified for specified evolving functions or operations judged to be imminent requirements. These interfaces have been discussed in this report and, in more detail, in the supporting analysis.

4. Some interfaces were based on their having been established for two of the services, suggesting interfaces for analogous functions between other pairs of services where appropriate. For example, coordinating groups at departure and arrival airfields are explicit only for the U.S. Army when the U.S. Air Force is providing airlift support. Similar functions need to be served when U.S. Air Force airlift is supporting the U.S. Marine Corps or the U.S. Navy.

5. Connectivity requirements in this architecture are based on joint air operations conducted by the generic joint task force established as the baseline for this architecture. As explained in chapter 1 of this report, the size of the component forces making up the joint task force may impact upon the complexity of required interfaces. However, it does not significantly alter the generic connectivity requirements depicted.

6. No specific provisions have been made for continuity of operations except for the inherent capability to transfer selected responsibilities from one element to another either laterally or vertically.

7. A number of connectivities in figure 4-1 are labeled as being contingent. This category of interface is identified for circumstances in which operations may be conducted in the absence of a C2 element. For example, if the Air Force is not present to support the U.S. Army in a joint operation, the latter may depend directly on naval aviation for air support. To reflect those circumstances, the architecture has identified a contingency requirement for an Army liaison element, functionally similar to the BCE, but limited in size and connectivity, at the ACE TACC or at the Navy TACC during amphibious operations. During other maritime operations when a TACC is not designated, the BCE LN element may be located with the Strike Warfare commander (STWC) or another C2 element mutually agreed upon by the commanders involved. Such an element is labeled BCE LN, and its presence is marked as contingent. This category of interface also applies to C2 elements that may provide useful but nonessential support to specified operations. For example, the matrix indicates connectivity among the CRC or AWACS aircraft and flight leaders for offensive counterair operations. This connectivity is contingent on the CRC or AWACS's being able to provide warning advisory and vectoring services to mission aircraft over or near enemy territory during OCA or refueling operations. While these services provide significant support, the mission can be executed without it.

8. Most of the C2 elements in the architecture were identified on the basis of their primary role in requesting, planning, controlling, coordinating, and executing air operations. However, other elements were included because they are the means by which the primary interfaces between these elements are implemented. These include the liaison or coordination teams embedded in a larger organization. For example, the BCE implements the interface between the Army component TOC and the Air Force TACC. Similar relationships exist between the Marine Corps ANGLICO teams and the Army TOCs they support.

9. The connectivity of C2 elements associated primarily with air defense and airspace control (CRC, AWACS, TAOC, and E-2) does not reflect the entire contribution of these elements to the conduct of joint air operations. This architecture portrays only their specific role in execution of the applicable missions included in this architecture, which are offensive counterair and aerial refueling operations.

4-2 ORGANIZATION AND FORMAT OF THE ARCHITECTURE

The joint interface requirements of the architecture are displayed in this chapter in three forms: matrices, tables, and organizational relationships or wiring diagrams. A matrix condenses all of the applicable joint connectivity in a highly accessible format. A table provides amplifying information about the purpose for this interface. The organizational relationships diagram contains the same basic information as a matrix or a table, but it also conveys a sense of how the connectivity fits into a hierarchical command and control structure.

Interfaces shown on the matrix also are presented in table format. Tables 4-1 and 4-2 include joint connectivity among the four services and the joint force headquarters taken two at a time. The tables list the operational function or information exchange the connectivity supports.

The C2 elements and tactical functions in the architecture are too numerous to be depicted in a single set of graphics that would be comprehended easily by the reader. For this reason, the architecture is depicted in two sets of figures and tables. No analytical basis exists for inclusion of tactical functions in either of the sections. They are grouped for ease of display and readability, so that, when presented graphically, each section contains, as nearly as possible, the same number of C2 elements.

1. The first set of graphics depict the C2 elements and interface requirements for six of the nine tactical functions that make up the architecture. These functions are offensive counterair, air interdiction, air reconnaissance and surveillance, electronic warfare, theater airlift, and aerial refueling.

2. The second set of graphics depict the C2 elements and interface requirements for combat rescue, theater aeromedical evacuation, and weather service support. This matrix and set of tables also includes selected elements of the special forces component, largely for their potential interface requirements during combat rescue operations. An organizational relationship or wiring diagram is not provided for functions 7 through 9 because no lateral connectivity requirements exist among the C2 elements involved in combat rescue, aeromedical evacuation, and weather service operations.

The meaning of the symbology used in the figures is found on the legend of each graphic.

3. Tables 4-1 through 4-3 depict the purpose of the interfaces identified in the architecture and the mode, or type of connectivity, necessary to satisfy the interface. The requirement is expressed in the alphabetic codes described in the following paragraphs.

a. Code "V" represents a requirement for voice connectivity to exchange information orally over wire or radio circuits.

b. Code "R" represents a requirement for record traffic passed in accordance with established procedures for AUTODIN and teletype traffic. This mode uses a keyboard, printer, and type perforation or reading equipment to exchange information over cable or radio between message centers or other appropriate transmitter or terminal sites.

c. Code "D" indicates a requirement for data exchange. This mode employs modems and protocols to process, transmit, and convert analog and digital signals into human processable format.

d. Code "F" indicates information exchange between facsimile terminals. This mode of information exchange involves the process by which graphic and photographic material is converted to electronic signals that may be transmitted over a telecommunications system. This report notes that facsimile differs from the video mode of information exchange that involves conversion of transit visual images into electric signals that can be transmitted by radio or wire and reconverted at a receiver to the original images. Another mode of information exchange,

differentiated from facsimile, is imagery. Requirements for this mode are unique to the intelligence functional area.

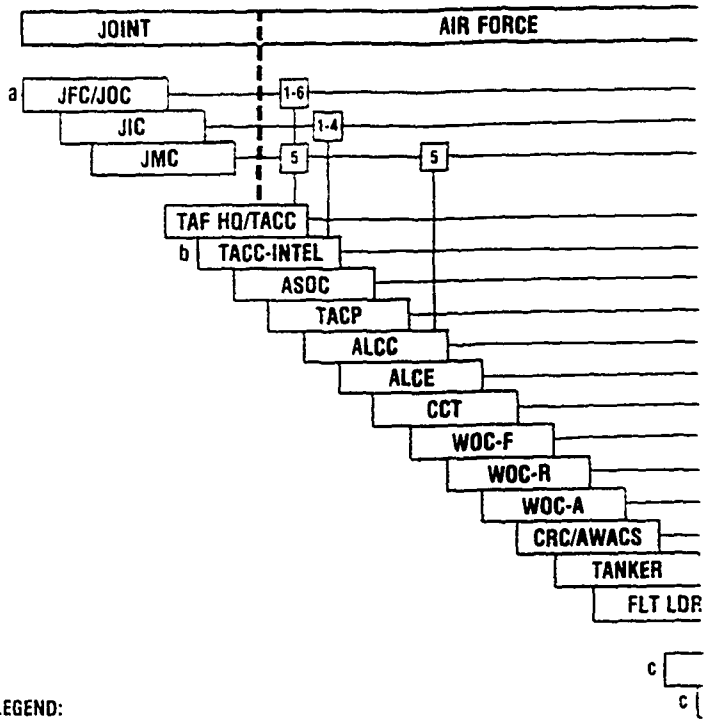
4-3 THE ARCHITECTURE

The matrices, tables, and organizational relationship graphics on the remaining pages of this chapter make up the Functional C3 Interoperability Architecture for Air Operations.

Figures 4-1 and 4-2 and table 4-1 depict the joint C3 connectivity requirements for the tactical functions of offensive counterair, air interdiction, air reconnaissance and surveillance, electronic warfare, theater airlift, and aerial refueling.

Figure 4-3 and tables 4-2 and 4-3 depict the joint C3 connectivity requirements for the tactical functions of combat search and rescue, theater aeromedical evacuation, and weather service support.

JOINT
SUPPO



LEGEND:

- JOINT CONNECTIVITY BETWEEN THE C2 ELEMENTS INDICATED
- CONNECTIVITY IMPLEMENTED BY COLLOCATION OF C2 ELEMENTS
- [x] or (x) A NUMBER x INDICATES THE FUNCTION THAT THE CONNECTIVITY PRIMARILY SUPPORTS

x =
1 - OFFENSIVE COUNTER AIR OPERATIONS
2 - AIR INTERDICTION
3 - AIR RECONNAISSANCE AND SURVEILLANCE
4 - ELECTRONIC WARFARE
5 - THEATER AIRLIFT
6 - AERIAL REFUELING

- (Y) CONTINGENT CONNECTIVITY (See Text)

NOTES:

a JOC represents CJTF for purposes of connectivity and subsumes specialized respons such as JFACC, JTCB, and JCEWS.

b TAC-INTEL represents the intelligence divisio[illegible] the ACC.

c If the highest Army echelon is a corps, then E[illegible] connectivities devolve to the CTC case. BCE and BCE LN are CTOC liaison elements, and F [illegible] becomes the corps intellige

d TOC represents Army echelons below corps. Specific connectivity depends on C2 ele involved. It may extend from division to company levels.

e DACG/AACG are added as Marine C2

f ANGLICO is a USMC organization manned by both the Navy and the Marines to provic when these Services are supporting Army operations.

1-27-88-4

Figure 4-1. J
Support

JOINT CONNECTIVITY FOR SIX COMBAT AND SUPPORTING FUNCTIONS IN AIR OPERATIONS

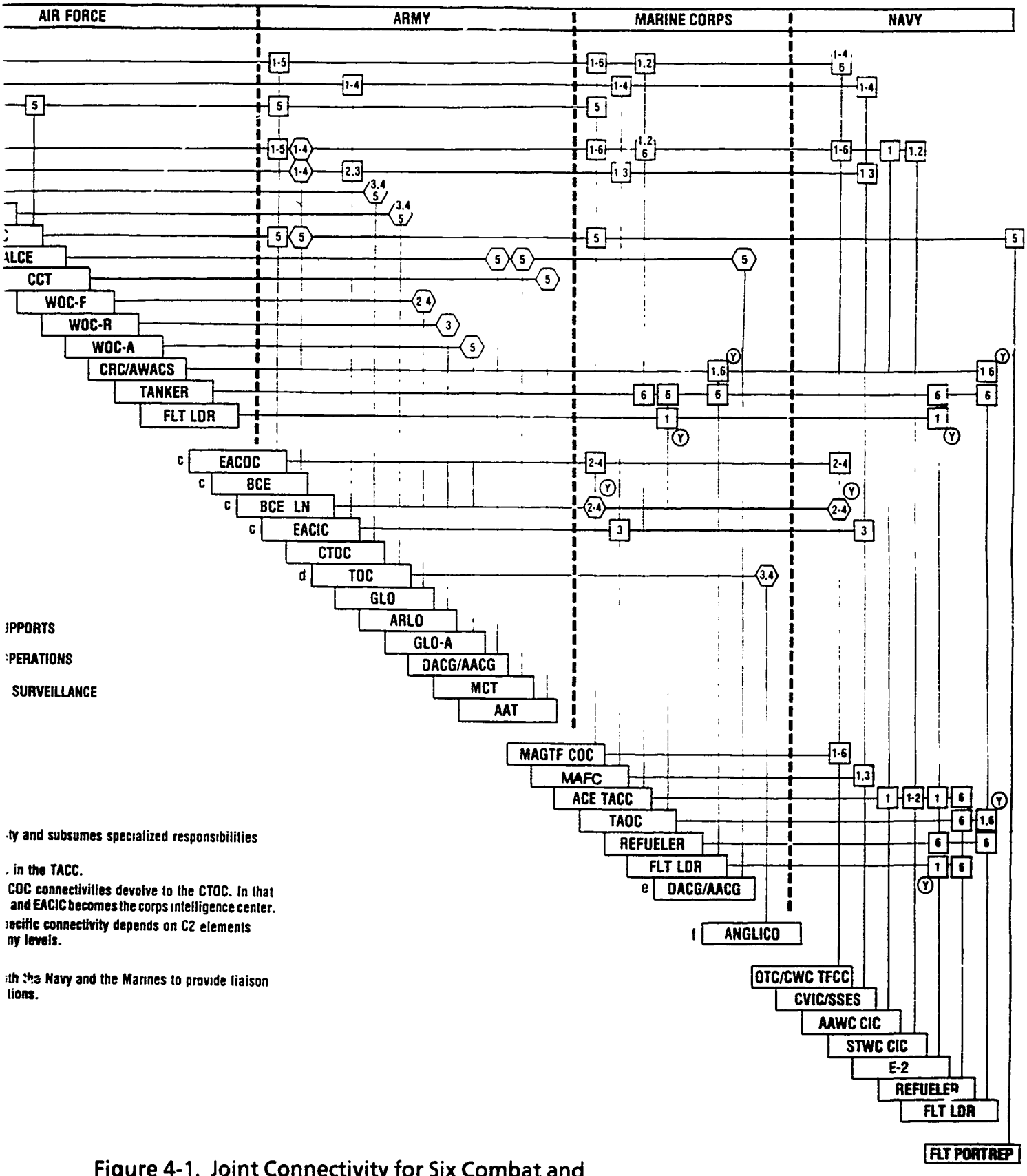
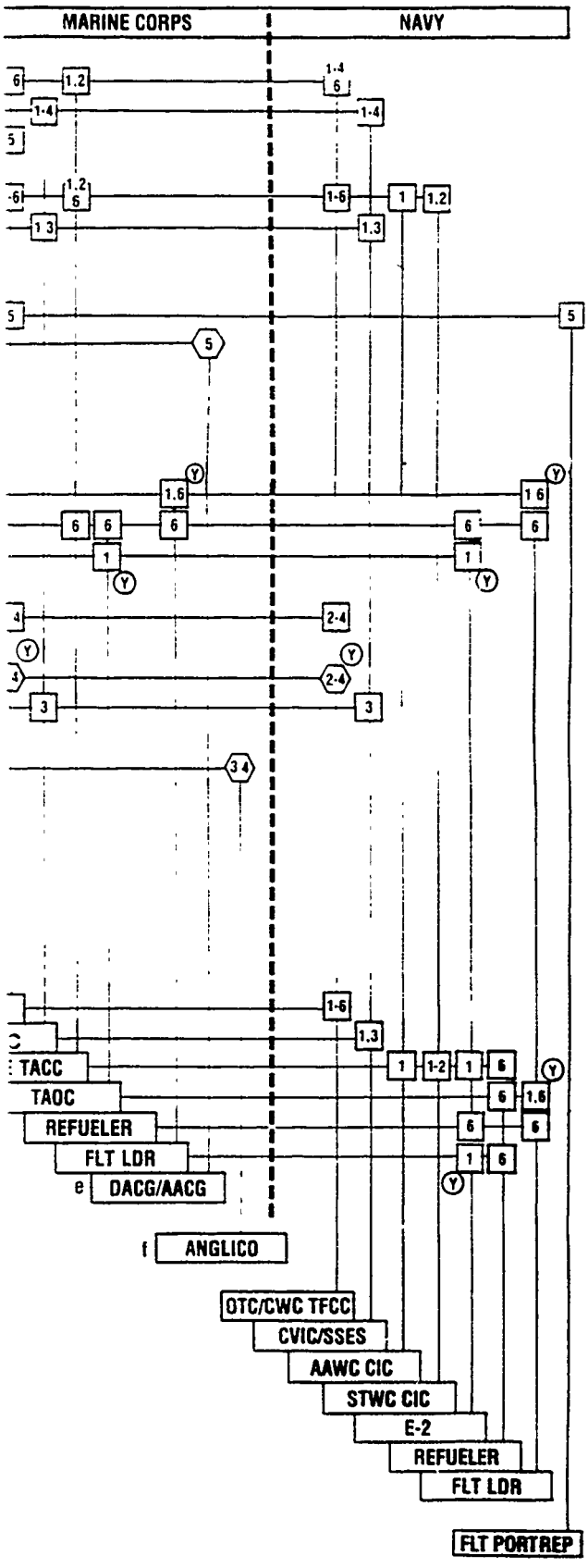


Figure 4-1. Joint Connectivity for Six Combat and Supporting Functions in Air Operations

FC

AND
IONS



3

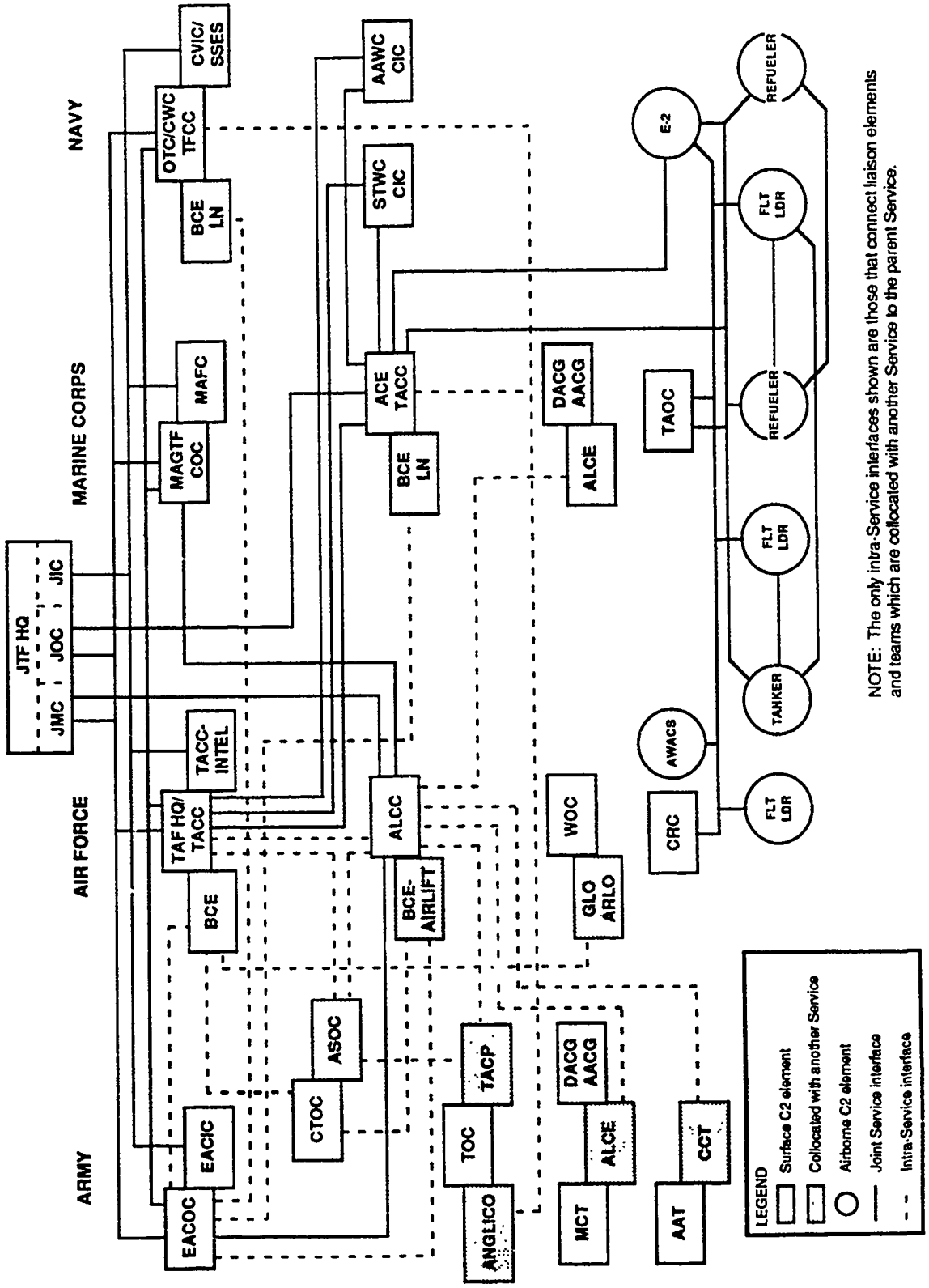


Figure 4-2. Joint Connectivity for Offensive Counterair Operations, Air Interdiction, Air Reconnaissance and Surveillance, EW, Theater Airlift, and Aerial Refueling

Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6)

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE **
JOINT	COMPONENT		
JFC	TAF HQ/TACC	Command coordination/apportionment, allocation, and tasking of air sorties	V,R,D,F
JFC	EACOC	Command coordination/apportionment recommendations, preplanned air support requests, air sorties tasking	V,R,D,F
JFC	MAGTF COC	Command coordination/apportionment, allocation, and tasking of air sorties	V,R,D,F
JFC	ACE TACC	Detailed tasking of air sorties	V,R,D,F
JFC	OTC/CWC TFCC	Command coordination/apportionment, allocation, and tasking of air sorties	V,R,D
JIC	TACC-INTEL EACIC MAFC CVIC/SSES	Exchange of intelligence information	V,R,D,F
JMC	TAF HQ/TACC EACOC MAGTF COC OTC/CWC TFCC	Request/validation of airlift support	V,R,F
JMC	ALCC	Execution tasking for validated airlift requests	V,R,F

* 1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE
2 - AIR INTERDICTION
3 - AIR RECONNAISSANCE AND SURVEILLANCE
4 - ELECTRONIC WARFARE
5 - AIR LIFT
6 - AERIAL REFUELING

** SEE SECTION 4-2 FOR DISCUSSION OF VOICE (V), RECORD (R), DATA (D), FACSIMILE (F) AND COLLOCATION (C).

Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
AIR FORCE	ARMY		
TAF HQ/TACC	EACOC	Command and force employment coordination	V,R,F
TAF HQ/TACC	BCE	Liaison to coordinate air support; collocated with TACC	C
TACC-INTEL	EACIC	Exchange of intelligence information	V,R,F
ASOC ASOC/TALO	CTOC	Liaison to assist with air reconnaissance, airlift, and EW support; collocated with CTOC	C
TACP TACP/TALO	Other TOCs	Liaison to assist with air reconnaissance, airlift, and EW support; collocated with TOC	C
ALCC	EACOC	Coordination of airlift support, usually through the BCE	V,R
ALCC	BCE	Liaison to coordinate airlift support; collocated with ALCC	C
ALCE	DACG/AACG	Coordination and control of airlift loading/unloading at departure/arrival airfields	V,R
ALCE	MCT	Coordination of terminal transfer and aerial delivery services	V,R
CCT	AAT	Coordination for ground control of precise delivery at DZs, LZs, and EZs in airborne/airlift operations	V
WOC-F	GLO	Liaison for OCA, AI, and EW operations	C
WOC-R	ARLO	Liaison for reconnaissance operations and product development	C
WOC-A	GLO-AL	Liaison for airlift operations	C

*1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE
2 - AIR INTERDICTION
3 - AIR RECONNAISSANCE AND SURVEILLANCE
4 - ELECTRONIC WARFARE
5 - AIR LIFT
6 - AERIAL REFUELING

Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
AIR FORCE	MARINE CORPS		
TAF HQ/TACC	MAGTF COC	Command and force employment coordination	V,R,D,F
TAF HQ/TACC	ACE TACC	Coordination of air operations	V,R,D
TACC-INTEL	MAFC	Exchange of intelligence information	V,R,F
ALCC	MAGTF COC	Coordination of airlift support operations	V,R
ALCE	DACG/AACG	Coordination and control of airlift loading/unloading at departure/arrival airfields	V,R
CRC/AWACS	FLT LDR	Assistance to air crews during OCA execution or for aerial refueling	V
TANKER	ACE TACC	Coordination for execution of aerial refueling	V
TANKER	TAOC	Coordination of participants in executing aerial refueling	V
TANKER	FLT LDR	Coordination during aerial refueling	V
FLT LDR	TAOC	Assistance to air crews during OCA execution (contingenct connvctivity) or for aerial refueling	V
AIR FORCE	NAVY	PURPOSE OF THE INTERFACE	
TAF HQ/TACC	OTC/CWC TFCC	Coordination of air operations	V,R
TAF HQ/TACC	AAWC CIC	Detailed coordination of OCA operations	V,R,D
TAF HQ/TACC	STWC CIC	Detailed coordination of air interdiction or air-to-surface OCA operations	V,R
TAC-INTEL	CVIC/SSES	Exchange of intelligence information	V,R,F
ALCC	FLT PORTREP	Coordination of airlift support operations	V,R
CRC/AWACS	FLT LDR	Assistance to air crews during OCA execution or for aerial refueling	V
TANKER	E-2	Coordination of participants in executing aerial refueling	V
TANKER	FLT LDR	Coordination during aerial refueling	V

* 1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE
2 - AIR INTERDICTION
3 - AIR RECONNAISSANCE AND SURVEILLANCE
4 - ELECTRONIC WARFARE
5 - AIR LIFT
6 - AERIAL REFUELING

Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6) - continued

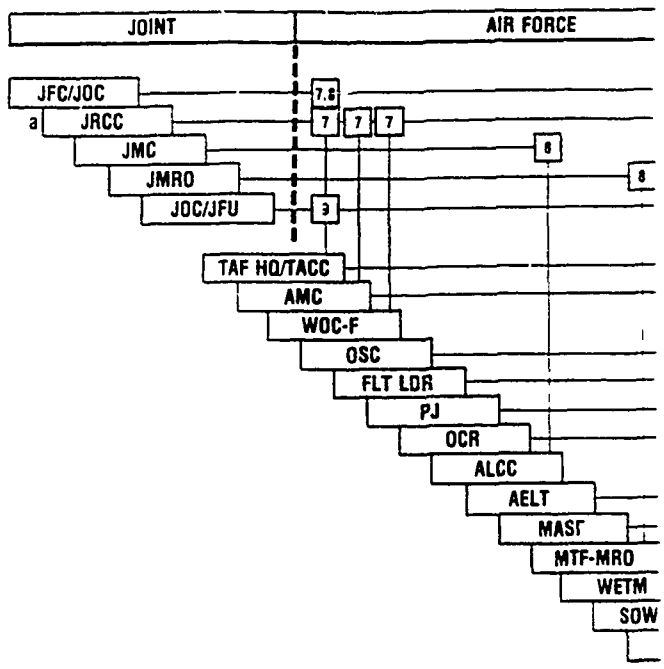
C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
ARMY	MARINE CORPS		
EACOC	MAGTF COC	Command and force employment coordination	V,R,F
BCE LN	MAGTF COC	Liaison to coordinate air support in the absence of Air Force TACC; collocated with MAGTF COC (Contingent connectivity)	C
EACIC	MAFC	Exchange of intelligence information	V,R,F
TOC/CP	ANGLICO	Liaison to coordinate naval air support; collocated with Army units from company to division levels	V
ARMY	NAVY	PURPOSE OF THE INTERFACE	
EACOC	OTC/CWC TFCC	Command and force employment coordination	V,R
BCE LN	OTC/CWC TFCC	Liaison to coordinate air support in the absence of Air Force TACC; collocated with OTC/CWC TFCC (Contingent connectivity)	C
EACIC	CVIC/SSES	Exchange of intelligence information	V,R,F

*
1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE
2 - AIR INTERDICTION
3 - AIR RECONNAISSANCE AND SURVEILLANCE
4 - ELECTRONIC WARFARE
5 - AIR LIFT
6 - AERIAL REFUELING

Table 4-1. Joint Interfaces for Air Operations (Functions 1 through 6) - concluded

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
MARINE CORPS	NAVY		
MAGTF COC	OTC/CWC TFCC	Command and force employment coordination	V,R,F
MAFC	CVIC/SSES	Exchange of intelligence information	V,R,F
ACE TACC	AAWC CIC	Detailed coordination of AAW operations	V,R,D
ACE TACC	STWC CIC	Detailed coordination of air interdiction or air-to-surface OCA operations	V,R,D
ACE TACC	REFUELER	Coordination for execution of aerial refueling	V
ACE TACC	E-2	Air picture for monitoring of offensive AAW operations	V
TAOC	REFUELER	Assistance to air crews for areial refueling	V
TAOC	FLT LDR	Assistance to air crews during OCA execution (contingent connectivity) or for aerial refueling	V
REFUELER	E-2	Coordination of participants in executing aerial refueling	V
REFUELER	FLT LDR	Coordination during aerial refueling	V
FLT LDR	E-2	Assistance to air crews during OCA execution (contingent connectivity) or for aerial refueling	V
FLT LDR	REFUELER	Coordination during aerial refueling	V

*
1 - OFFENSIVE COUNTERAIR/ANTIAIR WARFARE
2 - AIR INTERDICTION
3 - AIR RECONNAISSANCE AND SURVEILLANCE
4 - ELECTRONIC WARFARE
5 - AIR LIFT
6 - AERIAL REFUELING



LEGEND

- JOINT CONNECTIVITY BETWEEN THE C2 ELEMENTS INDICATED
- CONNECTIVITY IMPLEMENTED BY COLLOCATION OF C2 ELEMENTS
- [x] OR (x) A NUMBER x INDICATES THE FUNCTION THAT THE CONNECTIVITY PRIMARILY SUPPORTS

x = { 7 - COMBAT SAR; 8 - THEATER AEROMEDICAL EVACUATION; 9 - WEATHER SUPPORT }

NOTES:

[a] Air Force RCC usually serves as JRCC; the interfaces in this diagram such arrangement.

[b] If the highest Army echelon is a corps, then EACOC connectivities

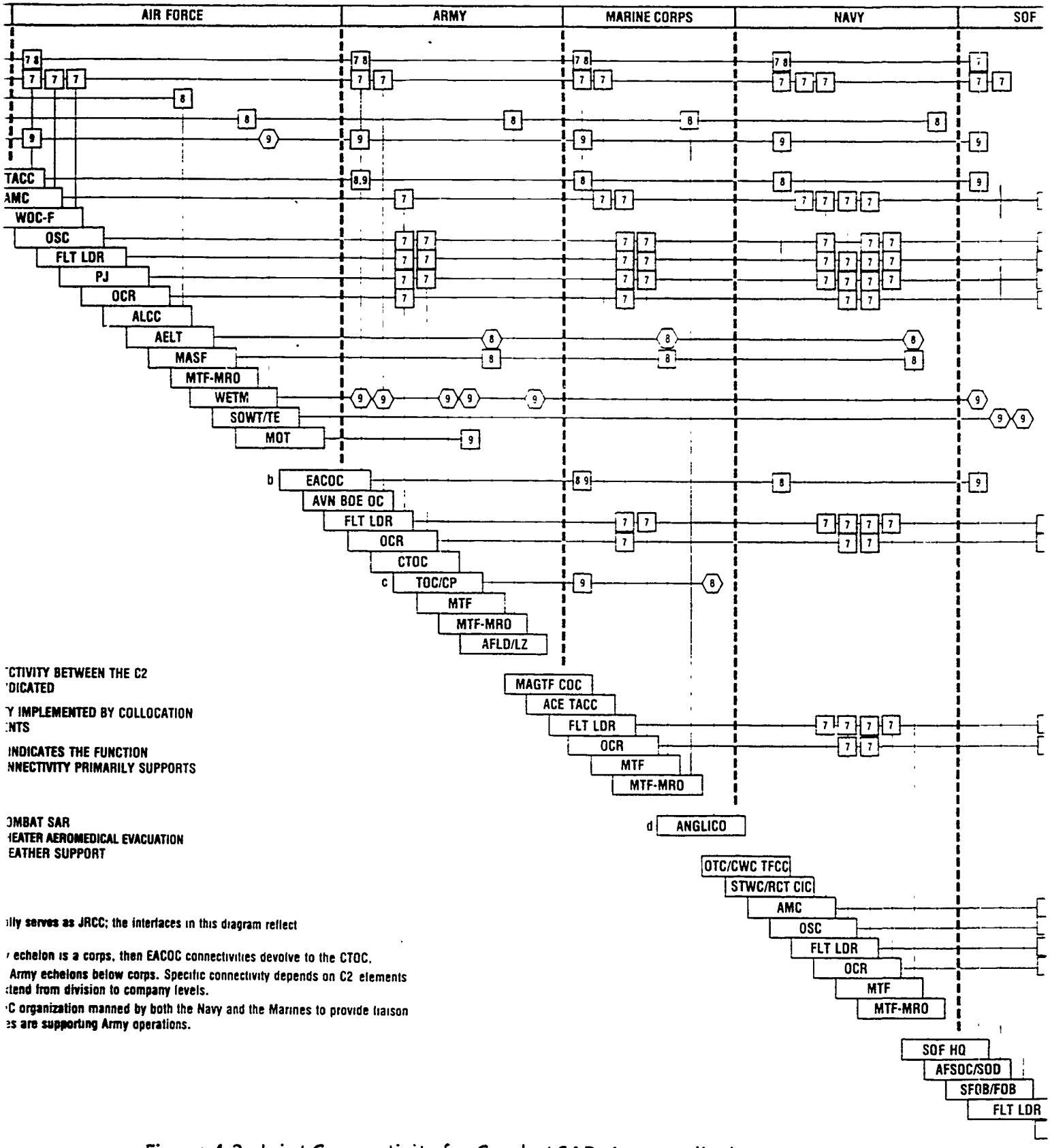
[c] TOC/CP represents Army echelons below corps. Specific connectivi involved. It may extend from division to company levels.

[d] ANGLICO is a USMC organization manned by both the Navy and the when these Services are supporting Army operations.

1-27-88-6

Figure 4-3. J

JOINT CONNECTIVITY FOR COMBAT SAR, AEROMEDICAL EVACUATION, AND WEATHER SUPPORT



'CTIVITY BETWEEN THE C2
'DICATED

'Y IMPLEMENTED BY COLLOCATION
:NTS

INDICATES THE FUNCTION
NNECTIVITY PRIMARILY SUPPORTS

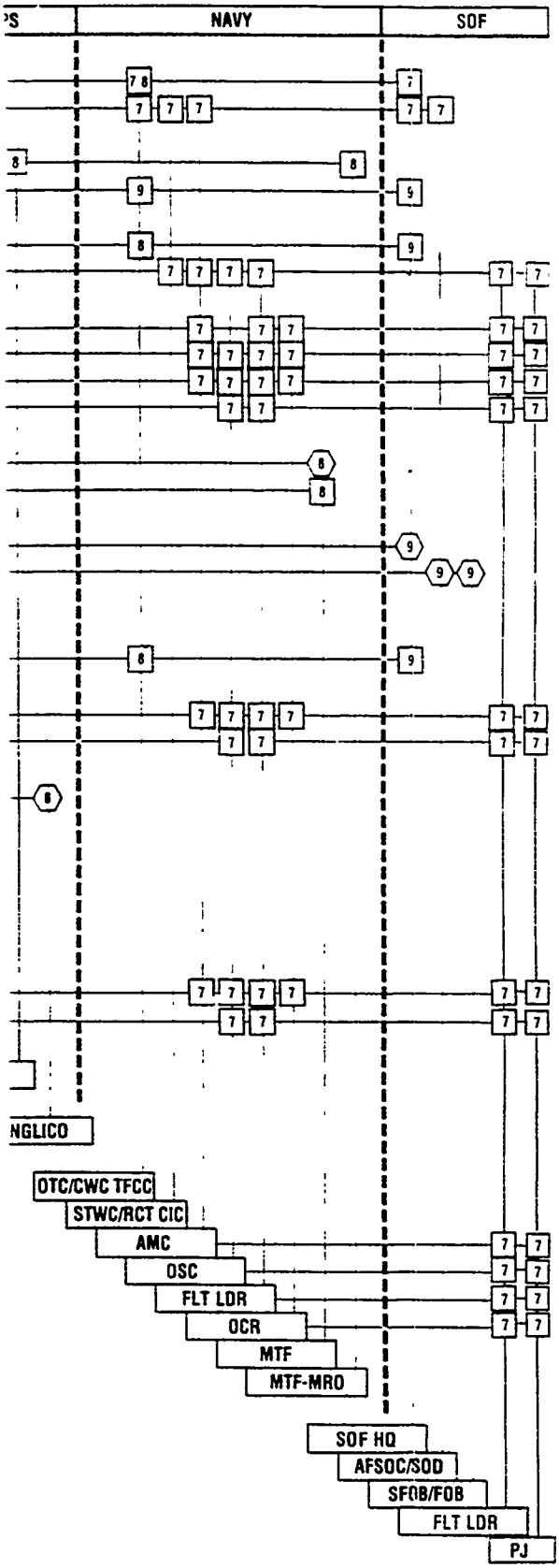
OMBAT SAR
IEATER AEROMEDICAL EVACUATION
EATHER SUPPORT

ılly serves as JRCC; the interfaces in this diagram reflect

r echelon is a corps, then EACOC connectivities devolve to the CTOC.
Army echelons below corps. Specific connectivity depends on C2 elements
:tend from division to company levels.
'C organization manned by both the Navy and the Marines to provide liaison
:s are supporting Army operations.

Figure 4-3. Joint Connectivity for Combat SAR, Aeromedical Evacuation, and Weather Support

)RT



:dical

4-13/14

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9)

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
JOINT	COMPONENT		
JFC/JOC	TAF HQ/TACC EACOC MAGTF COC OTC/CWC TFCC	Command coordination	V,R,D,F
JFC/JOC	SOF HQ	Command coordination for combat search and rescue	V,R
JOC/JRCC	TAF HQ/TACC	Coordination of combat search rescue operations	V,R,D
JOC/JRCC	AMC	Coordination and tasking for combat search and rescue mission	V,R
JOC/JRCC	WOC-F	Tasking for combat search and rescue mission	V,R
JOR/JRCC	EACOC	Coordination of requests for rescue search and resources; Army requests for combat search rescue support	V,R
JOC/JRCC	AVN BDE OC	Tasking for combat search rescue mission	V,R
JOC/JRCC	MAGTF COC	Coordination of requests for combat search and rescue resources; Marine requests for combat search and rescue support	V,R
JOC/JRCC	ACE TACC	Tasking of assigned combat search and rescue assets; coordination of combat search and rescue operations	V,R
JOC/JRCC	OTC/CWC TFCC	Coordination of requests for combat search and rescue resources; Navy requests for combat search and rescue support	V,R
JOC/JRCC	STWC/RCT	Coordination of combat search and rescue operations	V,R
JOC/JRCC	AMC	Coordination and tasking for combat search and rescue mission	V,R
JOC/JRCC	SOF HQ	Coordination of requests for combat search and rescue resources	V,R
JOC/JRCC	AFSOC/AFSOD	Tasking for combat search and rescue mission	V,R
JMC	ALCC	Tasking for aeromedical evacuation airlift	V,R

*FUNCTION 7 - COMBAT SEARCH AND RESCUE
FUNCTION 8 - AEROMEDICAL EVACUATION
FUNCTION 9 - WEATHER SUPPORT

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
JOINT	COMPONENT		
JMRO	MTF-MRO (at each comp)	Determination of destination hospital for patients	V,R
JOC/JFU	TAF HQ/TACC EACOC MAGTF COC OTC/CWC TFCC SOF HQ	Coordination for weather support	V,R,F
JOC/JFU	WETM	Weather support team; collocated with JFU	C
AIR FORCE	ARMY	PURPOSE OF THE INTERFACE	
TAF HQ/TACC	EACOC	Coordination of aeromedical evacuation and weather support	V,R,F
AELT	MTF	Coordination of (1) requests for aeromedical evacuation support and (2) patient movement from MTF to MASF	V,R
MASF	MTF	Coordination of patient reception and processing at MASF	V,R
WETM	EACOC	Weather support team; collocated with EACOC	C
WETM	AVN BDE CP	Weather support team; collocated with AVN BDE	C
WETM	CTOC	Weather support team; collocated with CTOC	C
WETM	TOC/CP	Weather support teams; collocated with Army units	C
WETM	AFLD/LZ	Weather support teams; collocated at Army airfields and landing zones	C
MOT	TOC/CP	Weather data from mobile observation teams	V,R,F
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			

*
FUNCTION 7 - COMBAT SEARCH AND RESCUE
FUNCTION 8 - AEROMEDICAL EVACUATION
FUNCTION 9 - WEATHER SUPPORT

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9) - continued

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
AIR FORCE	MARINE CORPS		
TAF HQ/TACC	MAGTF COC	Coordination of aeromedical evacuation support	V,R
AMC	ACE TACC	Coordination of combat search and rescue missions	V,R
AELT	MTF	Coordination of (1) requests for aeromedical evacuation support and (2) patient movement from MTF to MASF	V,R
MASF	MTF	Coordination of patient reception and processing at MASF	V,R
	(For connectivity associated with execution of combat search and rescue, see Table 4-3)		
AIR FORCE	NAVY	PURPOSE OF THE INTERFACE	
TAF HQ/TACC	OTC/CWC	Coordination of aeromedical evacuation support	V,R
AMC	STWC/RCT	Coordination of combat search and rescue operations	V,R
AELT	MTF	Coordination of (1) requests for aeromedical evacuation support and (2) patient movement from MTF to MASF	V,R
MASF	MTF	Coordination of patient reception and processing at MASF	V,R
	(For connectivity associated with execution of combat search and rescue, see Table 4-3)		
AIR FORCE	SOF	PURPOSE OF THE INTERFACE	
HQ TAF/TACC	SOF HQ	Coordination of weather support	V,R
WETM	SOF HQ	Weather support team; collocated at SOF HQ	V,R,F
SOWT/TE	AFSOC/AFSOD	Weather support teams; collocated at AFSOC/SOD	V,R,F
SOWT/TE	SFOB/FOB	Weather support teams; collocated at SFOBs/FOBs	V,R,F
	(For connectivity associated with execution of combat search and rescue, see Table 4-3)		

*
FUNCTION 7 - COMBAT SEARCH AND RESCUE
FUNCTION 8 - AEROMEDICAL EVACUATION
FUNCTION 9 - WEATHER SUPPORT

Table 4-2. Joint Interfaces for Air Operations (Functions 7 through 9) - concluded

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
ARMY	MARINE CORPS		
EACOC	MAGTF COC	Coordination of aeromedical evacuation support operations	V,R
TOC/CP	MAGTF COC	Coordination of weather support for cross-attached units	V,R,F
TOC/CP	ANGLICO	Coordination of aeromedical evacuation support	C
(For connectivity associated with execution of combat search and rescue see Table 4-3)			
ARMY	NAVY	PURPOSE OF THE INTERFACE	
EACOC	OTC/CWC TFCC	Coordination of aeromedical evacuation support operations	V,R
(For connectivity associated with execution of combat search and rescue. see Table 4-3)			
ARMY	SOF	PURPOSE OF THE INTERFACE	
EACOC	SOF HQ	Coordination of weather support	V,R,F
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
MARINE CORPS	NAVY	PURPOSE OF THE INTERFACE	
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
MARINE CORPS	SOF	PURPOSE OF THE INTERFACE	
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			
NAVY	SOF	PURPOSE OF THE INTERFACE	
(For connectivity associated with execution of combat search and rescue, see Table 4-3)			

*
FUNCTION 7 - COMBAT SEARCH AND RESCUE
FUNCTION 8 - AEROMEDICAL EVACUATION
FUNCTION 9 - WEATHER SUPPORT

Table 4-3. Joint Interfaces in the Execution of Combat Search and Rescue Missions

C2 ELEMENTS CONNECTED		PURPOSE OF THE INTERFACE	MODE
COMPONENT [a]			
AMC	AMC	Coordination in executing combat search and rescue mission	V
AMC	OSC		
AMC	FLT LDR		
AMC	PJ		
OSC	FLT LDR		
FLT LDR	FLTLDR		
FLT LDR	PJ		
PJ	PJ		
OSC	OCR	Coordination between rescue team and object of rescue	V
FLT LDR	OCR		
PJ	OCR		

[a] The C2 elements may be affiliated with Service Components as follows:

	AIR FORCE	ARMY	MARINE CORPS	NAVY	SOF
AMC	●			●	
OSC	●			●	
FLT LDR	●	●	●	●	●
PJ	●				●
OCR	●	●	●	●	

This Page Intentionally Left Blank.

CHAPTER 5

INTEROPERABILITY FINDINGS

5-1 GENERAL

The joint C3 interface requirements established in the preceding chapter are based on the analyses contained in the Institute for Defense Analysis (IDA) Report 348, Supporting Analysis: Functional C3 Interoperability Architecture for Air Operations, August; 1990 (S). The interoperability findings summarized in this chapter are based on the assessments contained in the same report.

The findings relate to the capability of existing doctrine, training, operating procedures, and C2 systems and communications equipment of U.S. forces to satisfy the joint interface requirements established in this architecture. The findings identify C3 deficiencies that are, or have the potential to be, impediments to joint interoperability during air operations.

The findings in this chapter are divided into four categories: planning and tasking; joint doctrine and joint tactics, techniques, and procedures; joint information exchange; and joint training. The last section of the chapter addresses other matters having an impact on joint interoperability that require continuing attention.

5-2 FINDINGS

A. Planning and Tasking in Joint Air Operations. Recurring themes regarding real or perceived shortcomings associated with the air tasking process represent a mixture of views: tasking takes too long to prepare; requests for some types of air missions must be made unrealistically early; tasking is too detailed; it takes too long to disseminate; it does not ameliorate differences among service practices in employing air assets.

Some aspects of the problems underlying these views are straightforward and readily amenable to technical and administrative improvements. Others reflect a more fundamental and enduring conflict between the need for an orderly process in employing air assets and the demands for responsiveness in supporting the forces on the battlefield. Finding solutions is more difficult.

The responsiveness of the formal planning, tasking preparation, and dissemination processes can be improved by use of automated planning aids and information exchange systems to provide the current status of resources and disseminate tasking and execution instructions. Networking automation systems should be considered to tie appropriate C2 nodes together to make more efficient use of the available communications capacity and increase the capability to operate in an environment degraded by C3 countermeasures.

At a minimum, the tasking processes must accommodate the following activities:

1. Complex planning process at the senior C2 levels in orchestrating various functional activities; for example, apportionment, targeting, and force packaging.

2. Preparation of aircraft for assigned missions; for example, arming and fueling by the operating air units.

3. Detailed mission planning by aircrews.

Clearly, planning lead times cannot be reduced below certain minimums dictated by aircraft and aircrew preparation times. The objective is to refine the planning and procedural process to reduce lead times while providing for aircraft and aircrew preparation.

Measures to improve combat responsiveness within the overall planning cycle have been developed, and new approaches continue to evolve. Examples include increased use of aircraft in attacks against time-sensitive targets, and new planning initiatives for creating force packages that can react on short notice to penetrate enemy airspace in attacks against interdiction targets. Taking advantage of new surveillance systems capable of producing targeting-quality data in near-real time will require even more responsive forces. Technological advances in the form of high accuracy navigation systems such as GPS and data communications systems such as JTIDS to distribute information/instructions to airborne platforms could help implement responsive employment of air forces.

B. Joint Doctrine and Joint Tactics, Techniques, and Procedures (JTTP). The interfaces in this architecture are based on numerous doctrinal publications. Some of the connectivity is derived explicitly; the remainder is based on the best judgments of the study team due to the rather broad guidance provided in joint doctrine. Taken in its entirety, the available body of doctrine appears to be comprehensive and well-developed for most of the operational tasks in air operations. Some of the doctrine in test form is yet to be proven in joint exercises. However, most areas for improvement appear to be more a matter of applying existing doctrine to establish JTTP than a lack of such doctrine.

Specific concerns with joint doctrine and procedures are discussed in the following paragraphs.

1. The introduction of longer range fire support weapons such as the Army Tactical Missile System (ATACMS) along with longer range target acquisition means have lead to requirements for better coordination of air, ground, and naval fires to avoid duplicative targeting, reduce fratricide, and increase efficiency in use of the weapons. The services have been moving towards cooperative fire support planning and targeting strategies. Currently, attacks against surface targets short of the Fire Support Coordination Line (FSCL) must be coordinated with the appropriate

ground force commander. Increasingly, this level of coordination for fires beyond the FSCL needs to be considered.

2. The joint tasking procedure often cannot process excess sorties from an air-capable service component sufficiently early to be included in the detailed planning for air tasking if such tasking includes participation in a force package.

3. Improving the effectiveness of joint combat rescue (CR) operations may require that doctrine be revised or clarified, and procedures be better developed. Doctrinally, no agency or service is responsible for joint CR program development, implementation, or conduct. While some services have their own CR procedures, no detailed joint CR manual exists, and the current National Search and Rescue Manual (AFM 64-2) is considered too broad and general. In an effort to correct this void, Joint Pub 3-50.2, Doctrine for Joint Combat Search and Rescue, is being developed and is planned for release as a test publication in 1991.

C. Joint Information Exchange. Joint information exchange requires procedures, standards, and compatible equipment to assure transfer of information over the links connecting various C2 information exchange elements. The equipment encompasses communications and data processing systems that may be located at C2 nodes and at communications facilities linking them.

In most cases, communications systems are adequate for the information flow needed to support the operational tasks included in this architecture. Maintaining connectivity and capacity during high-intensity conflict and in a moderate to severe countermeasures environment will depend on efficient and skilled use of limited assets.

Specific observations are explained in the following paragraphs.

1. Automation, or other responsive techniques are required to generate or update Joint Communications Electronics Operating Instructions (JCEOIs).

2. Low-level (nap-of-the-earth or terrain-following) tactics and extended range air operations tend to exceed the limits of LOS radios. Communications needed to support the full depth of air operations depend on SATCOM, HF radios, and airborne radio relays. HF radios are being upgraded with improved frequency selection techniques and antenna systems for better transmission reliability. Airborne radio relays are used to extend the effective range of LOS radios, often with manned aircraft as a platform. A UAV is a logical candidate for this task, and developmental work to adapt LOS relays is underway. Fielding of improved HF radios and radio relay UAV systems and airborne pods must be supported to augment limited SATCOM assets for beyond LOS communications.

3. The crew of an airlift aircraft may need to communicate with numerous C2 elements along its flight path in the course of a single extended mission. The C2 elements may use several communications networks secured by

different cryptonet systems. The current method of manual operation is labor intensive and inefficient. U.S. airlift forces require the capability to transition rapidly from one COMSEC system to another.

4. Maintaining communications with Navy forces afloat can be a problem due to limited communications equipment aboard ships, use of incompatible encryption gear, and the practice of emissions control (EMCON). These factors can be particularly important in a joint task force if its JOC is afloat.

D. Joint Training. The previously developed C2 interface architectures on air defense/airspace control and fire support emphasized the need for joint training as a means of ensuring effective joint interactions and personnel proficiency in using C3 systems and procedures. Reports that document the lessons learned during joint exercises continually indicate the need for more joint training within the mission areas covered in the architecture.

E. Other Matters Requiring Continued Attention

1. Joint Surveillance Target Attack Radar System (Joint STARS). This system was developed in a joint U.S. Army and U.S. Air Force program. The system provides high resolution, large-area scrutiny of the battlefield and produces an accurate picture of the tactical situation directly to the commander and the control structure. The two major C2 elements of the system are the airborne multimode radar and the Ground Station Module (GSM). Developmental Joint STARS systems have been operated in a combat environment, and joint C3 interface requirements are evolving. Multiservice, if not joint doctrine, and JTTP that document existing interfaces and can be used to identify others, need to be developed.

2. The U.S. Army BCE positioned at an Air Force TACC lacks automation support. The Army's projected fielding of a BCE Automated Support System (BASS) in the 1989-1992 period should fill this void. The type of interface that BASS should have with the Air Force automation support at the TACC, either computer-to-computer or "swivel chair," has not been determined.

3. A concept for direct delivery of cargo by the C-17, or other advanced transport aircraft, from strategic distances to forward tactical locations is being developed. The concept calls for delivery of outsize combat equipment and cargo into austere airfields, usually operated by nonairlift units, and onto marked or unmarked drop zones in medium-threat environments. Such deliveries could be made as far forward as battalion or company areas. The direct delivery concept requires a high degree of C3 to respond to the dynamic changes in the battlefield situation.

4. Increasing use of sophisticated weapons systems whose delivery accuracies depend on weather conditions has increased the need for accurate short-term forecasts in hostile areas. A system of improved observations and forecasts is needed to provide a timely assessment of weather effects on various weapon systems in specific battle situations.

5. The pending introduction to the battlefield of potentially large numbers of unmanned aerial vehicles with joint and service component roles appears to present significant command and control challenges that should be addressed expeditiously.

This Page Intentionally Left Blank.

APPENDIX A

GLOSSARY

A2C2	Army Airspace Command and Control
AACG	Arrival Airfield Control Group
AADC	Area Air Defense Commander
AAGS	Army Air-Ground System
AAT	Army Assault Team
AATFC	Air Assault Task Force Commander
AAW	Antiair Warfare
AAWC	Antiair Warfare Commander
ABCCC	Airborne Battlefield Command and Control Center
AC	Airborne Platform/Aircraft
ACA	Airspace Control Authority
ACC	Air Component Commander
AFCC	Air Force Component Commander
ACE	Aviation Combat Element
ACP	Automatic Communications Processor
ACR	Armored Cavalry Regiment
AD	Air Defense
ADA	Air Defense Artillery
ADCOORD	Air Defense Coordinator
ADDS	Army Data Distribution System
ADF	Automatic Direction Finder
ADVON	SAC Advanced Echelon
AECC	Aeromedical Evacuation Control Center
AELT	Aeromedical Evacuation Liaison Team
AFATDS	Advanced Field Artillery Tactical Data System
AFCC	Air Force Component Commander
AFGWC	Air Force Global Weather Center
AFSOB	Air Force Special Operations Base
AFSOC	Air Force Special Operations Command
AFSOCC	Air Force Special Operations Control Center
AFSOD	Air Force Special Operations Detachment
AFSOE	Air Force Special Operations Element
AGOS	Air-Ground Operations System
AH	Attack Helicopter
AHIP	Army Helicopter Improvement Program
AI	Air Interdiction
AIR AMB	Air Ambulance
AIR CAV	Air Calvary
AIR CAV TRP	Air Calvary Troop
AL	Airlift
ALCC	Airlift Control Center
ALCE	Airlift Control Element

ALD	Airlift Division
ALMSNSCD	Airlift Mission Schedule (Message Format)
ALS	All-Weather Landing System
AMC	Airborne Mission Commander
AMG	Amphibious Group
ANGLICO	Air and Naval Gunfire Liaison Company
APES	Automated Patient Evacuation System
ARBS	Angle Rate Bombing System
AREC	Air Resources Element Coordinator
ARLO	Air Reconnaissance Liaison Officer
ARRS	Air Force Aerospace Rescue and Recovery Service
ARSP	Airborne Reconnaissance Support Program
AS	Aerial Surveillance
ASAS	All Source Analysis System
ASD/C3I	Assistant Secretary of Defense for C3I
ASF	Air Staging Facility
ASLT	Assault
ASMD	Anti-ship Missile Defense
ASMRO	Armed Services Medical Regulating Office
ASOC	Air Support Operations Center
ASRT	Air Support Radar Team
ASUW	Anti-Surface Warfare
ASUWC	Anti-Surface Warfare Commander
ASW	Anti-Submarine Warfare
ASWC	Anti-Submarine Warfare Commander
ATACC	Advanced Tactical Air Command Center
ATACMS	Army Tactical Missile System
ATARS	Advanced Tactical Air Reconnaissance System
ATCCS	Army Tactical Command and Control System
ATCS	Air Traffic Control System
ATDS	Airborne Tactical Data System
ATF	Amphibious Task Force
ATHS	Airborne Target Handoff System
ATO	Air Tasking Order
ATOCONF	Air Tasking/Confirmation
ATS	Air Traffic Services
AVN	Aviation
AWACS	Airborne Warning and Control System
AWADS	Adverse Weather Aerial Delivery System
AWAPS	Advanced Weather Analysis and Prediction System
AWN	Automatic Weather Network
AWS	Air Force Air Weather Service
B	Bomber (SAC)
BAI	Battlefield Air Interdiction
BCC	Battery Control Central
BCE	Battlefield Coordination Element
BCP	Battery Command Post

BDE	Brigade
BF/BG	Battle Force/Battle Group
BIC	Battery Information Center
BN	Battalion
C of S	Chief of Staff
CATCC	Carrier Air Traffic Control Center
C2	Command and Control
C2E	Command and Control Element
C2IPS	C2 Information Processing System
C3I	Command, Control, Communications, and Intelligence
C3CM	Command, Control, and Communication Countermeasures
CAP	Combat Air Patrol
CARGRU	Carrier Group
CAS	Close Air Support
CAS	Crisis Action System
CATF	Commander, Amphibious Task Force
CCE	Combat-Communications Elements
CCS	Control and Communications Subsystem
CCS2	Command, Control, and Subordinate Systems
CCT	Combat Control Team
CDS	Combat Direction System
CEWI	Combat Electronic Warfare and Intelligence
CG/CGN	Guided Missile Cruisers
CIC	Combat Information Center
CID	Combat Intelligence Division
CIFS	Close In Fire Support
CINCSAC	Commander in Chief, SAC
CJCS	Chairman, Joint Chiefs of Staff
CLF	Commander Landing Force
CMD BN	Command Aviation Battalion
CMD CO	Command Aviation Company
CNI	Communication, Navigation and Identification
COC	Combat Operations Center
COMALF	Commander of Airlift Forces
COMARRF	Commander of Aerospace Rescue and Recovery Forces
COMEDS	CONUS Meteorological Dissemination System
COMINT	Communications Intelligence
COMJTF	Commander, JTF
COMP	Component
COMSOC	Commander Special Operations Command
CP	Command Post
CR	Combat Rescue
CRC	Control and Reporting Center
CRP	Control and Reporting Post
CRTF	Combat Rescue Task Force
CS	Combat Support

CSAR	Combat Search and Rescue
CSS	Combat Service Support
CSSCS	Combat Service Support Control System
CSSE	Combat Service Support Element
CTF	Carrier Task Force
CTAPS	Contingency TACS Automated Planning System
CTOC	Corps Tactical Operations Center
CV/ASWM	Carrier Antisubmarine Warfare Module
CV/CVN	Aircraft Carriers
CVBG	Carrier Battle Group
CVIC/SSES	Navy Carrier Intelligence Center/Ship Signals Exploitation Space
CVSD	Continuous Variable Slope Delta (modulation)
CWC	Composite Warfare Commander
DA AALPS	Department of the Army Automated Air-Land Planning System
DACG	Departure Airfield Control Group
DARS	Daily Aerial Reconnaissance and Surveillance
DASC	Direct Air Support Center
DCA	Defensive Counter Air
DCT	Digital Communications Terminal
DDN	Digital Data Network
DET	Detachment
DI	Deputy for Intelligence
DIV ARTY	Division Artillery
DIV	Division
DO	Deputy for Operations
DMSP	Defense Meteorological Satellite Program
DOC	Command and Control Division
DOX	Combat Operations Division
DS/CR	Display Control/Storage and Retrieval
DSN	Digital Switched Network
DZ	Drop Zone
EAC	Echelons Above Corps
EACIC	Army Echelons Above Corps Intelligence Center
EACOC	Echelons Above Corps COC
EC	Electronic Combat
ECCM	Electronic Counter-Countermeasures
ECM	Electronic Countermeasures
EDAC	Error Detection and Correction
EHF	Extremely High Frequency
ELINT	Electronic Intelligence
EM	Electromagnetic
EMCON	Emissions Control
ENSCD	Enemy Situation Correlation Division
ENSCE	Enemy Situation Correlation Element

EOB	Electronic Order of Battle
EPLRS	Enhanced Position Location Reporting System
ESM	Electronic Support Measures
ETAC	Enlisted Tactical Attack Controller
EVAC	Evacuation
EW	Electronic Warfare
EW MOD	Electronic Warfare Module
EWC	Electronic Warfare Coordinator
EWO	Electronic Warfare Officer
EXCOM	Executive Committee
EZ	Extraction Zone
F	Fighter
FAAD C2I	Forward Area Air Defense Command, Control and Intelligence
FAC	Forward Air Controller
FAC(A)	Forward Air Controller (Airborne)
FACP	Forward Air Control Post
FASCO	Forward Area Support Coordinating Officer
FDDS	Flag Data Display System
FLIR	Forward Looking Infra-Red
FLOT	Forward Line of Own Troops
FLT LDR	Flight Leader
FLTCINC	Fleet Commander in Chief
FMF	Fleet Marine Forces
FMF-EUCE	Fleet Marine Force-End User Computing Equipment
FOB	Forward Operating Base
FOFA	Follow-On Force Attack
FOL	Forward Operating Location
FLTPORTREP	Fleet Port Representative
FRAG	Air Operations Fragmentary Order
FSCL	Fire Support Coordination Line
FSCOORD	Fire Support Coordinator
FSE	Fire Support Element
FTAO	Force Tactical Action Officer
FTI	Fixed Target Indicator
FW	Fixed Wing (Aircraft)
GCE	Ground Combat Element
GCI	Ground Control Intercept
GCS	Ground Control Station
GDSS	Global Decision Support System
GLO	Ground Liaison Officer
GPS	Global Positioning System
GS	Ground Station
GSM	Ground Station Module

HC(A)	Helicopter Coordinator (Airborne)
HEC	Helicopter Element Coordinator
HDC	Helicopter Direction Center
HF	High Frequency
HML/A	Marine Light/Attack Helicopter
HMM	Marine Medium Assault Helicopter
HQ	HAVE QUICK
HST	Helicopter Support Team
IA	Army Imagery Analysis
IC	Intelligence Center
ICC	Information Coordination Central
IEW	Intelligence/Electronic Warfare
IFF	Identification Friend or Foe
IHFR	Improved High Frequency Radio
INS	Inertial Navigation System
IPC	Air Force Imagery Processing Center
ISOPREP	Isolated Personnel Report
J-CSAR	Joint Combat Search and Rescue
JAAT	Joint Air Attack Team
JACC/CP	Joint Airborne Communication Center/Command Post
JCEWS	Joint Force Commander's Electronic Warfare Staff
JCSE	Joint Communications Support Element
JFACC	Joint Force Air Component Commander
JFC	Joint Force Commander
JFU	Joint Forecast Unit
JIC	Joint Intelligence Center
JMC	Joint Movement Center
JMRO	Joint Medical Regulating Office
JMSWG	JTIDS Message Standards Working Group
Joint STARS	Joint Surveillance Target Attack Radar System
JOP	Joint Operations Procedure
JPO	Joint Program Office
JR	Jam Resistance
JRCC	Joint Rescue Coordination Center
JSIPS	Joint Service Imagery Processing System
JSOTF	Joint Special Operations Task Force
JTACMS	Joint Tactical Missile System
JTAO	Joint Tactical Air Operations
JTC	Joint Technology Center
JTCB	Joint Targeting Coordination Board
JTF	Joint Task Force
JTIDS	Joint Tactical Information Distribution System
JTL	Joint Target List
JTTP	Joint Tactical Techniques and Procedures
JUSMAG	Joint U.S. Military Advisory Group

LAAD	Light Antiair Defense
LAAM BN	Light Antiair Missile Battalion
LAN	Local Area Network
LANA	Low-Altitude Night Attack
LAPES	Low Altitude Parachute Extraction System
LCC	Land Component Commander
LCC	Amphibious Flagship (Ship Type)
LENSCE	Limited Enemy Situation Correlation Element
LHX	Light Attack Helicopter
LO	Liaison Officer
LOCE	Linked Operational/Intelligence Centers
LOH	Light Observation Helicopter
LOI	Letter of Instruction
LOS	Tactical Line of Sight
LOT/SC	Laser Detector Tracker/Strike Camera
LZ	Landing Zone
LZCT	LZ Control Team
MAC	Military Airlift Command
MACCS	Marine Air Command and Control System
MAFC	MAGTF All-Source Fusion Center
MAG	Marine Aircraft Group
MAGTF	Marine Air Ground Task Force
MARC	MAC ALCE Reaction Communications System
MARRES	Manual Radar Reconnaissance Exploitation System
MASF	Mobile Aeromedical Staging Facility
MATCALS	Marine Air Traffic Control and Landing System
MATCS	Marine Air Traffic Control Squadron
MCC	Movement Control Center
MCO	Movement Control Officer
MCS	Maneuver Control System
MCT	Movement Control Team
MDM BN	Medium Lift Battalion
MEB	Marine Expeditionary Brigade
MED BDE	Medical Brigade
MED	Medical
MEDEVAC	Medical Evacuation
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MI BDE	Military Intelligence Brigade
MI	Military Intelligence
MMC	Materiel Management Center
MOT	Mobile Observing Team
MPA	Maritime Patrol Air
MPS	Mission Planning System
MRCC	Navy Medical Regulating Center
MRO	Medical Regulating Officer
MSE	Mobile Subscriber Equipment

MTE	Medical Treatment Element
MTF	Joint Message Text Format
MTF	Medical Treatment Facilities
MTI	Moving Target Indicator
NAF	Numbered Air Force
NAO	Naval Aviation Observer
NCCS	Navy Command and Control System
NFO	Naval Flight Officer
NOE	Nap-of-the-Earth
NSWTG	Naval Special Warfare Task Group
NSWTU	Naval Special Warfare Task Unit
NTDS	Naval Tactical Data System
O&C	Operations and Control
OAAW	Offensive Antiair Warfare
OC	Operations Center
OCA	Offensive Counter Air
OCR	Object of Combat Rescue
OICWSF	Officer-in-Charge, Weather Support Force
OPCON	Operational Control
OPGEN	General Operation
OPLAN	Operation Plan
OPORD	Operation Order
OPV	Optionally Piloted Vehicle
OSC	On Scene Commander
OTC	Officer in Tactical Command
OTH	Over-the-Horizon
PCS	Portable Control Station
PJ	Pararescue Element
PLI	Position Location Information
PORTREP	Port Representative
PRESSURS	Pre-Strike Surveillance/Reconn System
PRT	Pararescue Team
QRCP	Quick Reaction Communications Package
QRCT	Quick Reaction Communications Terminal
RCC	Rescue Coordination Center
RCT	Rescue Coordination Team
RECCE	Reconnaissance
REC	Radio Electronic Capability
REQCONF	Request Confirmation
RESCAP	Rescue Combat Air Patrol
RESCORT	Rescue Escort
ROE	Rules of Engagement
RPV	Remotely Piloted Vehicle

RRS	Remote Receiving Station
RTF	Return to Force
RW	Rotary Wing (Aircraft)
S/EWCC	Signals Intelligence Electronic Warfare Coordination Center
SALT	Battalion Supporting Arms Liaison Team
SAR	Search and Rescue
SARDO	Search and Rescue Duty Officer
SARSAT	Search and Rescue Satellite Aided Tracking
SC	Screen Commander
SCDL	Army Surveillance and Control Data Link
SCOTT	Single Channel Objective Tactical Terminal
SEAD	Suppression of Enemy Air Defenses
SEAL	Sea-Air-Land
SEMA	Special Electronic Mission Aircraft
SERER	Survival, Evasion, Resistance, Escape and Recovery
SFOB	Special Forces Operations Base
SFOD	Special Forces Operations Detachment
SGN	Surgeon
SINCGARS	Single Channel Ground and Airborne Radio System
SKE	Station Keeping Equipment
SO	Special Operations
SOC	Special Operations Capable
SOF	Special Operations Forces
SOW	Special Operations Wing
SOWT	Special Operations Weather Team
SRIG	Surveillance, Reconnaissance and Intelligence Group
SSB	Single Sideband
SSES	Ships Signal Exploitation Space
STRATFOR	Strategic Forces Liaison Element
STW	Strike Warfare
STWC	Strike Warfare Commander
SURG	Surgeon
SWO	Staff Weather Officer
TA CO	Target Acquisition and Reconnaissance Company
TA PLAT	TA Platoon
TABWS	Tactical Air Base Weather Station
TAC CP	Tactical Command Post
TAC(A)	Tactical Air Coordinator (Airborne)
TACAIR	Tactical Air
TACC	Tactical Air Control Center (Air Force)
TACC	Tactical Air Command Center (Marine)
TACC-INTEL	Air Force Tactical Air Control Center Intelligence Divisions
TACFIRE	Tactical Fire Direction System
TACP	Tactical Air Control Party
TACS	Tactical Air Control System

TACSATCOM	Tactical Satellite Communications
TADC	Tactical Air Direction Center
TADIL	Tactical Data Information Link
TAES	Tactical (Intratheater) Aeromedical Evacuation System
TALO	Tactical Airlift Liaison Officer
TAMCA	Theater Army Movement Control Agency
TAMS	Theater Airlift Management System
TAOC	Tactical Air Operations Center
TAOM	Tactical Air Operations Module
TDA	Tactical Decision Aid
TDS	Tactical Data Station
TE	Tactical Element
TEP	Tactical ELINT Processor
TERPES	Tactical Electronic Reconnaissance Processing System
TESS	Tactical Environmental Support System
TF	Task Force
TFCC	Tactical Flag Command Center
TFU	Tactical Forecast Unit
THTR AVN BN	Theater Army Aviation Battalion
TIDS	Tactical Imagery Display Satellite
TKR	Tanker
TOC	Tactical Operation Center
TOT	Time-on-Target
TREDS	Tactical Reconnaissance Exploitation Demonstration System
TRI-TAC	Tri-Services Tactical Communications
TRIGS	TR-1 Ground Station
TRT	TEREC Remote Terminal
TSE	Army TOC Support Element
TSE	TOC Support Element
TTY	Teletypewriter
TU	Tracking Unit
TUOC	Tactical Unit Operations Center
TWAC	Tactical Weather Analysis Center
UARS	Unmanned Air Reconnaissance System
UAV	Unmanned Aerial Vehicle
UNAAF	Unified Action Armed Forces (Joint Pub 0-2)
URG	Underway Replenishment Group
USTS	UHF Satellite Terminal System
VAK	Carrier-Based Tanker Aircraft
VAL	Navy Light Attack Forces
VERTREP	Navy Vertical Replenishment
VFA	Strike Fighters
VMAQ	Marine Corps EW/ Reconnaissance Squadron
VMFA	Marine Fighter/Attack (squadron)
VMGR	Marine Land-Based Tanker Aircraft

VOD	Vertical On-Board Delivery
VSTOL	Vertical/Short Takeoff and Landing
WETM	Weather Team
WOC	Wing Operations Center
WOC-A	WOC Airlift
WOC-F	WOC Fighter
WOC-R	WOC Reconnaissance
WSF	Weather Support Force

This Page Intentionally Left Blank.