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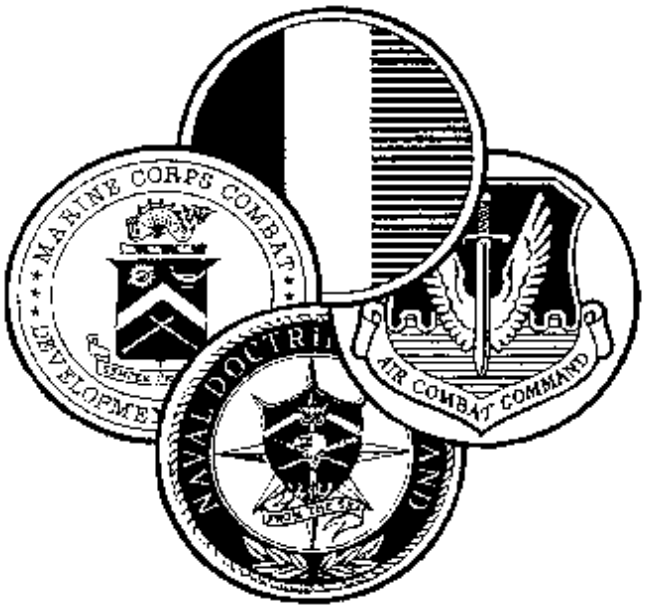

Joint Air Traffic Control

Study

21 February 1997

ALSA Joint Air Traffic Control Study

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EXECUTIVE SUMMARY

- **Provides the purpose and background of the Study**
- **Provides basic information on the Services' air traffic control (ATC) doctrine, forces, capabilities, and equipment**
- **Provides a review of the Services' capability to conduct joint operations within the theater or area of responsibility (AOR)**
- **Recommends that a Multiservice Tactics, Techniques, and Procedures (MTTP) publication be developed to address joint air traffic control (JATC) operations**
- **Concludes that a void exists in joint doctrine and recommends that Joint Tactics, Techniques, and Procedure (JTTP) for JATC be developed in the future**

Purpose and Background

The purpose of this Study is to provide an assessment of each Service's capabilities for initial, follow-on, and sustained JATC operations across the spectrum of joint operations within the theater or AOR (see Glossary for definitions). ALSA was tasked to accomplish an overall ATC assessment, provide recommendations, and (upon completion) forward the Study to the JASC and USAF/XO. The Study was drafted by ALSA and refined in a joint working group (JWG) on 28-29 January 1997. The JWG consisted of subject matter experts from all of the Services. (see **Appendix G, Points of Contact**).

Army, Marine, Naval and Air Force ATC Doctrine, Forces, Capabilities and Equipment

This Study provides basic information on the four Services' ATC doctrine, forces, capabilities and equipment to provide a baseline understanding of the Services' overall capabilities for conducting ATC operations in a joint environment.

Discussion

Service doctrine, forces, capabilities, and equipment were compared and problem areas associated with conducting joint ATC operations were identified. The Study concluded that there is insufficient doctrine and TTP to address initial, follow-on, and sustained ATC operations in a joint environment. The Services' ATC systems should seamlessly interface. In practice however, issues ranging from equipment modernization, doctrinal procedures for handover of ATC services for follow-on forces, to the basic integration and operation of ATC forces from Service to Service have frustrated joint operations.

Recommendation

This Study recommends that a MTTP publication is needed for JATC operations. The Study also concluded that a void exists in joint doctrine and recommends that JTTP for JATC be developed in the future.

Joint Air Traffic Control Study

Air Land Sea Application (ALSA) Center, Langley AFB, VA

21 February 1997

1. PURPOSE AND BACKGROUND

a. Purpose. The purpose of this study is to assess the Services' capabilities for initial, follow-on, and sustained air traffic control (ATC) operations within the theater or area of responsibility (AOR).

b. Background. As a result of an Air Force working group, USAF/XO (see references) requested the ALSA Center, as a joint Department of Defense (DOD) field agency, conduct an objective analysis of each service's capabilities for initial, follow-on, and sustained ATC operations. HQ Air Combat Command (ACC)/CV (see references) requested that ALSA conduct a comparative analysis. With JASC approval, ALSA was tasked to accomplish an overall ATC assessment, provide recommendations, and (upon completion) forward the study to the Joint Action Steering Committee (JASC) and USAF/XO.

2. DOCTRINE, FORCES, CAPABILITIES, AND EQUIPMENT. The following is a discussion of all four services' ATC capabilities to include a snapshot of their doctrine, forces, capabilities, and equipment.

a. Army

1) Doctrine

Army air traffic services (ATS) is an extremely important function in the synchronization of combat power. Deployed ATS tactical units will function as an integral part of joint, multinational, and interagency forces. These units must conduct both opposed and unopposed early entry operations. As a tailored force, ATS supports the Army during all phases of the operational cycle.

ATS is integrated with the theater airspace management structure. ATS tactical units support Army operations at all echelons within the theater. ATS tactical units operate independently of aviation brigades. They support the force commander across the range of military operations and are therefore not designed to support aviation command structures (such as aviation brigades) exclusively. ATS tactical units normally are found in direct support (DS) or general support (GS) organizations. ATS groups are in GS to a theater, ATS battalions are in GS to a corps and ATS companies are in DS to a division and/or GS to a Corps (see **Appendix B, Army ATS Task Organized Elements**).

ATS tactical units augment the G3 and J3 of the Field Army and Land Component Commander with Army Airspace Command and Control (A2C2) liaisons. Their augmentation at

echelons above corps (EAC), corps, division, and brigade A2C2 cells provides the joint, multinational or interagency interface for ATS systems throughout the theater of operations. As part of the A2C2 element, the ATS tactical unit is the Army's primary coordination link to the joint integrated airspace command and control (C2) System.

Airspace integration of Army aviation assets spans the cycle of planning, execution and recovery. ATS tactical units must plan to coordinate airspace requirements, provide an interface for airspace coordination during execution and provide an instrument recovery capability. By performing these services, ATS tactical units help the ground commander seize and maintain the initiative. A2C2 elements enhance initiative through their force protection role by relaying real-time, situational awareness. This information is critical to the survival of all airspace users.

When deployed as part of the initial entry forces, ATS tactical units will establish terminal operations at landing areas/sites as required. In combat operations ATS tactical units must plan to provide:

- terminal services in corps and the theater of operations.
- enroute structure/services throughout the theater of operations.
- tactical aviation control teams (TACT) support throughout the battle area as the ground commander considers appropriate.
- terminal systems to deploy within the division area of operation when landing areas are required.

ATS tactical units must deploy early. These units must be included in the initial planing for the area of operations airspace control plan. ATS personnel must be manifested on the same sorties as other joint airspace planners. This allows Army aviation operational requirements to be included in joint force operations airspace requirements. Early employment of ATS personnel provides the framework for the arrival and deployment of other airlift assets.

ATS tactical units perform airspace control functions based on the airspace control order (ACO). The ACO outlines approved airspace control measures and other active airspace control procedures. The air component commander controls the ACO as he does the air tasking order (ATO). ATS A2C2 personnel coordinate control measures, control functions, and special procedures at all echelons to provide commanders maximum flexibility in employing Army operational assets. The airspace control authority (ACA) authorizes the use of ATS control measures. Therefore, liaison between the ACA and the ATS command and control structure in theater is necessary to ensure that airspace control procedures include ATS procedures.

In military operations other than war (MOOTW), airspace and ATC activities will require close coordination with the host nation's air traffic and airspace control authority for interagency operations. ATS commanders must become involved in the initial planning for airspace and air traffic control. They also must ensure that airspace requirements supporting ATS operations are coordinated with and approved by the proper agency. ATS tactical units support aviation operations during the conduct of Nation Assistance. These units may participate in the development of a host nation airspace infrastructure. This may involve training host nation ATS

personnel or aviators in ATS operations and procedures. ATS personnel provide planning, terminal, airspace information, and forward-area support services to aviation assets conducting Nation Assistance.

2) Forces

The deployment of ATS tactical units in a theater of operations depends on the extent to which Army forces are committed. ATS tactical units and their organic teams are task organized to provide direct support to aviation combat forces of various sizes when they are in the theater of operations or deploy as a separate task force. **Appendix B, Army ATS Task Organized Elements,** contains a list and description of the primary task organized elements.

3) Capabilities

Army ATS tactical units have numerous C2 responsibilities that provide forces with real-time airspace information. ATS units provide many benefits that enhance the synchronization of combat power. ATS at all levels, from brigade to EAC, assist other members of the A2C2 cell and integrate airspace requirements into the joint and multinational environment. ATS capabilities include (1) effective ATS liaison, (2) mobile ATS facilities (3) reliable communications, (4) timely relay of intelligence, (5) support for airspace coordination, and (6) relay of accurate weather information

ATS terminal facilities provide division, corps, and EAC with an instrument recovery airfield capability. Airspace information centers provide airspace guidance and an airspace-management interface. ATS commanders and their staffs that operate with liaison elements in tactical operations centers collect, process, display, issue and coordinate critical C2 information. ATS terminal operations include a full range of services (for fixed wing and rotary aircraft) to support the regulation of landings and takeoffs within concentrated areas of aircraft activity during deep, close and rear operations.

Deep Operations. Tactical aviation control teams (TACTs) will conduct ATS terminal operations in the deep operations area. Using lightweight, man portable equipment, these teams can deploy with airborne, special operations forces (SOF), and long range surveillance (LRS) units to provide navigational assistance to aircraft during deep operations. In the deep battle area, ATS terminal operations include (1) providing weather and A2C2 information, (2) conducting visual surveillance of austere drop zones (DZs), pick up zones (PZs), landing zones (LZs) and airheads, (3) providing procedural control rather than positive control as required, (4) providing situational updates about friendly, unknown, and hostile aircraft, and (5) providing austere DZs, PZs, LZs, and airheads with on-call nonprecision approach navigation aids (NAVAIDS).

Close Operations. During close operations, ATS terminal operations will be limited. As required by the tactical situation, these operations will be set up in areas designated for priority logistics and medical evacuation. They will also be set up in forward arming and refueling points (FARPs) and maneuver force assembly areas. During close operations, ATS terminal operations include (1) providing A2C2 situational update information, (2) providing visual surveillance of

landing areas, (3) providing separation and sequencing of arriving and departing aircraft, (4) providing NAVAIDS for nonprecision approaches for instrument meteorological conditions (IMC) recovery, (5) providing short notice backup support if the battle tempo or the requirements to aid in resupply and reconstitution change, (6) providing positive or procedural control measures as required by environmental factors, the density and complexity of air traffic, and the airspace situation, and (7) coordinating the movement of air traffic with other ATS facilities, A2C2 elements, and joint/multinational service elements to effect an unimpeded flow of aircraft into and out of the close-battle area.

Rear Operations. ATS terminal operations in the rear will be more robust than in the forward areas. They provide main operating bases and satellite airfields and landing areas in the theater, corps, and division areas with all-weather capabilities. Terminal operations include (1) providing enhanced movement of aircraft, (2) providing visual and electronic surveillance, (3) providing traffic pattern separation and sequencing, (4) providing precision or nonprecision approach NAVAIDS, and (5) designing terminal area precision and nonprecision approaches. ATS airspace information centers supporting rear operations will provide on-call demand activated enroute NAVAIDS, dissemination of weather and critical flight data, enroute aircraft separation and deconfliction on designated flight routes, interface with the other joint/multinational, interagency, and host nation airspace management systems, and a transition to the comprehensive enroute airway structure used to support air traffic to and from the rear operations area.

MOOTW. ATS tactical units conduct missions throughout the range of military operations to include MOOTW. ATS tactical units, along with National Airspace System (NAS) resources of other countries, will be used frequently during MOOTW. In this role, ATS tactical units coordinate and integrate Army airspace user requirements into the host nation's airspace system. In host nation internal defense, the ATC system often provides the framework for most of the airspace control functions. The airspace control system must be coordinated and integrated with national procedures. In peace operations, airspace control activities in this environment are mostly air traffic regulation and control. Special identification procedures and air traffic regulations may require that all flight operations be planned and coordinated with the appropriate ATC systems of the nations involved. Measures taken to counter terrorism can impact ATS. They also impact operations at air terminals, aerial ports, and Army airfields and heliports.

ATS tactical units play an important supporting role in counterdrug operations. The two phases of counterdrug operations are interdiction and eradication. In interdiction, ATS tactical units employ as an independent force to conduct radar surveillance operations along US borders. They can be integrated into other systems to locate and track suspected drug traffic along identified air avenues of approach. Along with other federal and military agencies, ATS tactical units can provide information on suspected drug trafficking flights. They also can give radar intercept guidance for friendly counterdrug agency air assets. During eradication operations outside the continental United States (OCONUS), ATS tactical units deploy in much the same way as in other levels of conflict and tactical operations. During these operations, ATS tactical units may employ as part of a joint task force. This task force will provide airspace planning, terminal services, airspace information services, and TACTs at forward areas.

4) Equipment

Army ATC equipment and systems come in a variety of forms. **Appendix C, Air Traffic Control Equipment,** contains a description of some of the Army ATC equipment and systems available. Eighty percent of this equipment is located in CONUS, 10 percent in Europe and 10 percent in the Pacific.

Current ATC systems include the following (detailed descriptions are in **Appendix C, Air Traffic Control Equipment**):

- AN/TSW- 7A, Air Traffic Control Central - provides control tower operations for follow-on and sustained ATC operations.

- AN/TSC-61B, Flight Coordination Central - provides procedural flight following and airspace coordination for follow-on and sustained ATC operations.

- AN/TSQ-71B, Landing Control Central - provides precision approach radar services and limited surveillance radar services for follow-on and sustained ATC operations.

- AN/TSQ-97, Air Traffic Control Facility - provides visual flight rules (VFR) tower services for initial ATC operations.

- AN/TRN-30 (V)1 and (V)2, Radio Beacon Set - provides ADF navigational aid for initial, follow-on and sustained ATC operations.

ATS forces must communicate on the move and maintain and sustain the same communications capabilities as other maneuver forces. Throughout the range of military operations, ATS tactical units must be able to communicate with local airspace authorities and host nation airspace authorities infrastructures using telephones and radios. Radio is the primary means of internal and external communications. ATS tactical units use frequency modulation (FM), high frequency (HF), amplitude modulation (AM) voice, very high frequency (VHF), ultra high frequency (UHF), common-user systems, and internal wire to expedite command and control. The airspace information center requires access to satellite communications (SATCOM) intelligence and weather broadcasts. SATCOM also serves as the non-line of sight backup means of communications. ATS tactical units require dual HF for simultaneous voice and data transmission and reception.

Acquisition Programs. ATS tactical units will continue to emplace enroute and terminal navigation aides until space based systems can satisfy this requirement across the span of the AOR. Modernization equipment programs are underway and are detailed in **Appendix C, Air Traffic Control Equipment**. The following are acquisition programs in the tactical arena and are fully funded within the Army Program Objective Memorandum (POM).

- AN/TSQ-198 Tactical Terminal Control System (TTCS)--(62 systems) for worldwide use--in the production/deployment phase. The AN/TSQ-198 is a replacement for the current TSQ-97 and will address deficiencies in security and maintainability

- Air Traffic Navigation, Integration and Coordination System (ATNAVICS)--(38 systems) for worldwide use. First Unit Equipped (FUE) FY00. ATNAVICS is a replacement for the AN/TSQ-71B and will provide a highly mobile surveillance and precision approach radar system which can be transported with prime mover on a single C-130 and installed in 1 hour.

- Tactical Airspace Integration System (TAIS)--(52 systems) for worldwide use—currently in Low Rate Initial Production (LRIP). TAIS is a replacement for the AN/TSC-61B. TAIS will provide a fully automated capability in support of Army Airspace Command and Control (A2C2) and Airspace Information Services. The TAIS is planned for employment in any theater of operations for any mission where the Army will execute A2C2 and/or ATS functions. Currently, the TAIS will be employed at EACs, corps, and division level. TAIS wartime functions center on A2C2 planning and execution, battlespace synchronization, and ATS support. TAIS MOOTW functions center on the task force mission and include A2C2 planning and execution, expansion of regional civil or host nation ATS/ATC responsibilities, and/or government interagency operations.

- Mobile Tower System (MOTS)--(38 systems) for worldwide use—operations requirements document (ORD) completed. Replaces the AN/TSQ-70A and AN/TSW-7A.

ATS equipment modernization programs support a proactive, streamlined logistics system that can be easily tailored; equipment which is maintainable through standard Army logistics channels; and equipment which is user-friendly for controllers and maintenance personnel. It will provide versatile, highly mobile, and easily tailored systems to support the full spectrum of military operations.

b. <u>USMC</u>

1) <u>Doctrine</u>

Marine Air Traffic Control Detachments (MATCD) Employment. The MATCD can be task organized to meet any number of different contingency operations. The services required at a forward operating base (FOB) will dictate the specific number of personnel and types of equipment necessary to support the mission. While a particular MATCD configuration may normally be associated with a Marine expeditionary force (MEF) or Marine expeditionary unit (MEU), the specific requirements for a given tactical situation will dictate the actual configuration suitable for mission success.

The MATCD is organized and equipped to provide continuous all-weather ATC services to an independent and geographically separated main air base/facility and one remote air site or point. Each MATCD is capable of providing the full range of terminal ATC services. Primary employment options may include, but are not limited to the following:

- **Full Service ATC Detachment.** The full service ATC detachment is designed to support continuous all weather ATC services at a main air base. Services provided by the full service ATC detachments typically include: control tower, TACAN, radar approach and arrival/departure control, precision/non-precision and instrument approaches.

- **Tower and TACAN Detachment.** The tower and TACAN detachment capabilities focus on providing all weather ATC services at a designated site. Services provided by the tower and TACAN detachments include control tower and TACAN instrument approaches and departures.

- **MATC Mobile Team (MMT).** A MMT can provide non-radar ATC services up to 40 NM from a tactical landing zone (TLZ) using a portable NAVAID and non-radar procedures. The MMT's relatively small logistics footprint requires fewer transportation assets than the larger MATCD option and is conducive to rapid site establishment and retrogrades.

MMT Employment. The MMT has a 72 hour capability without resupply or augmentation. The MMT is capable of supporting a variety of ATC missions as an independent unit or as part of a larger force in joint/multinational operations. The MMT is specifically designed to be inserted into remote locations to support Marine air-ground task force (MAGTF) air operations. Common methods of insertion are:

- **Tactical Vehicle**. Tactical vehicle insertion is the primary method of deploying a MMT to its air point. To facilitate movement of personnel and equipment to the air point, each MMT is equipped with a HMMWV. Normally, all MMT personnel and equipment will fit within the HMMWV.

- **Air Insert**. Air insert operations deliver the MMT to their assigned air point by fixed/rotary-wing aircraft. During these operations, the MMT is typically inserted with the first air element into the objective area. The early establishment of ATC services at the air point ensures that all succeeding aviation elements have ATC and navigational guidance available, thus enhancing the safe and expeditious flow of air traffic into and out of the air point and surrounding airspace.

As a stand alone unit distinctive from the MATCD, the MMT is typically task organized to provide ATC services for airfield seizures, noncombatant evacuation operations (NEO), Humanitarian/Civil Assistance operations and other MEU [special operations capable (SOC)] operations. The MMT is specifically trained and task-organized to:

- recommend/assist in TLZ and helicopter landing zone (HLZ) site selection.
- conduct TLZ/HLZ surveys.
- mark TLZ/HLZ.
- provide ATC services at designated TLZs/HLZs.
- coordinate with civil and military control agencies.

The MMT supports the MAGTF by performing the following tasks:

- Formulating and issuing air traffic control clearances, instructions and advisories to effect safe, orderly and expeditious movement of air traffic in their assigned airspace.
- Surveying air sites to determine each site's operational suitability for both numbers and type of aircraft.
- Marking TLZs/HLZs as the mission dictates.
- Establishing a control point from which to exercise air traffic control.
- Establishing a terminal control area (TCA) around each TLZ and controlling all air traffic within this area under VFR and instrument flight rules (IFR) conditions. This task may be extended to include non-radar approach control services.
- Developing terminal instrument procedures for TLZs/HLZs.
- Providing and operating NAVAIDS.
- Providing limited weather observations and information.
- Assisting in the selection of sites for TLZ/HLZ operations.
- Establishing communications for ATC and ATC coordination within the TCA and for MMT connectivity with the Marine air command and control system (MACCS)/MAGTF.

Marine ATC is a valuable asset in the FOB concept for MAGTF aviation operations. With the forward edge of the battle area (FEBA) moving further away from the rear area at an ever increasing rate, the final measurement for the success of MAGTF aviation must be its ability to support and respond with a high degree of flexibility to the MAGTF's requirements. Depending on the scope of MAGTF operations, it is necessary to establish ATC services at not only a main air base, air facility and air site, but also at FARPs, rapid ground refueling (RGR) points, and lagger points; usually supported by a MMT.

Coordination of MAGTF air operations during MEF-sized operations requires a considerable amount of ATC support, and will typically be based on the number of FOBs from which Marine aircraft is operating. Normally, four full MATCDs will deploy in support of a MEF to provide continuous, all-weather ATC services at up to four main airbases. The four detachments can also field four MMTs to provide limited ATC services at air facilities or air sites as required. A forward element of a MEF is normally supported by two MATCDs. The two detachments can provide continuous, fully capable ATC services at up to two main airbases and two MMTs for ATC support at two air facilities or air sites. Limited ATC services are typically provided to the MEU by one MMT. The MMT's mission and tasks are situationally dependent.

The MAGTF commander uses MAGTF aviation to assist efforts in support of the commander, amphibious task force (CATF), the naval expeditionary force (NEF) commander, or the joint force commander (JFC) in preparing and defending the battlespace. In its most common employment, the MATCD will operate in support of expeditionary operations ashore. Each MATCD has the capability of supporting one main airbase and one remote air site or point. The detachment has a full range of ATC capabilities to include (1) air surveillance radar, (2) identification, friend or foe (IFF), (3) automatic carrier landing system (ACLS) radar, (4) communications, (5) NAVAIDS, and (6) a control tower. This equipment provides a MATCD with positive airspace control capabilities that encompass airspace extending out to 60 NM from a main air base using radar control procedures and out to 100 NM using non-radar procedures.

Elements of the MATCD, notably the MMT and liaison officers, are typically among the first MACCS air control capabilities introduced ashore. MMTs used in either a stand-alone role or as a precursor for a build-up for a larger MATCD, are initially established to coincide with initiation of FOB air operations. As airfields are secured, additional ATC capabilities may be phased into the amphibious objective area (AOA)/ area of operation (AO) to provide additional, continuous ATC services for USMC, joint, and allied Service aircraft operating from AOA/AO airfields. In situations where MAGTF aviation elements are forward based at an allied nation's airfield located in proximity to the AOA/AO, MATCD personnel may be assigned as liaisons to the host nation's ATC administration. With the introduction of ATC radars into the MAGTF's AO, the MATCD will coordinate for the requisite voice and data links necessary to contribute to the force's IADS through the Marine sector antiair warfare coordinator (SAAWC) or Navy sector air warfare coordinator (SAWC) or the air warfare commander.

Joint/Multinational Operations. The *Marine Air Traffic Control Detachment Handbook* (MCRP 3-2.5.9 final draft) addresses joint/multinational planning considerations. The MAGTF must ensure its operations are integrated and coordinated with joint or multinational forces. To ensure integration and coordination, a MAGTF representative must be included during the joint operation planning (i.e., development of joint air operation plan, airspace control plan (ACP), air defense plan, etc.). The aviation combat element (ACE) commander, his staff, and the Marine air control squadron (MACS) will provide joint or multinational force planners with the MAGTF's requirements. They will also identify MAGTF capabilities and requirements relative to airspace control and air defense operations. Specifically, their joint and multinational operational plans must

- integrate with and complement the joint force's mission.
- ensure the interoperability of equipment and personnel.
- ensure the common use and understanding of terminology.
- allow responsiveness and the massing of firepower whenever and wherever needed.
- identify the proper liaison and staff/agency representation between joint force components.
- outline procedures for airspace control and air defense degradation.
- facilitate transition from peacetime conditions to hostilities.

In joint and multinational operations, the MATCD's role differs little from amphibious/ expeditionary operations; the MATCD will support MAGTF air operations and integrate with the joint/multinational force. MAGTF ATC coordination with the ACA for the promulgation of airspace control measures and airfield operating procedures are a high priority for MACCS operations. Of equal significance is the role MATCD controllers play as liaisons to allied ATC facilities to facilitate coordinating MAGTF airspace. Further, MATCD personnel may be functioning from airfields used by both joint and allied Service aircraft. In circumstances such as this, versatility, familiarity, and experience in joint/multinational ATC and airfield operating procedures are paramount to enhancing aircrew safety and success.

2) Forces

The MATCD is the principal terminal air traffic control organization within the MACCS. Two MATCDs are structured to operate as subordinate elements of the MACS. **Appendix A, Air Traffic Control Force Structure,** depicts the MACS units and their detachments.

Each MATCD is organized and equipped to provide continuous all-weather ATC services to an independent and geographically separated main air base or air facility and one remote air site or point. The MATCD also functions as an integral part of a MAGTF integrated air defense system (IADS). Marine ATC equipment is maintained by the MATCD and supported by the Naval Air (NAVAIR) Systems Command.

MATCD Organization. The MATCD's assigned mission and supporting task organization will determine the ATC elements' exact crew requirements. For example, each detachment is organized to provide the MAGTF with one MMT. MATCD crews are typically operationally organized into command, radar control, and tower control sections--described as follows:

- The **command section** supervises and coordinates each MATCD's activities. The command section is composed of a ATC watch officer, a radar supervisor and a tower supervisor.

- The **radar control section** is responsible for management of assigned/designated airspace and is composed of an approach controller, an arrival/departure controller, a final controller and a data link coordinator. The radar control section transmits information via data link or voice crosstell to other air control agencies, supervises MATCD execution of the emission control (EMCON) conditions set by the Marine tactical air command center (TACC), and employs electronic protection (EP) measures as appropriate.

- The **tower control section** is responsible for the control of friendly aircraft operating within the tower's assigned airspace. This airspace is typically limited to an area that can be visually observed and surveyed from the tower; approximately a five mile radius from the airport up to an altitude of 2500 feet above ground level. The tower control section is also responsible for air and vehicular traffic operating on runways, taxiways and other designated areas of the airfield. The tower control section is composed of a local controller, a ground controller and a flight data operator.

- The **MATC mobile team (MMT)** is a task organized sub-element of the MATCD. Normally the lead element in establishing initial ATC service, the MMT is responsible for rapidly establishing and controlling TLZs for fixed-wing aircraft and HLZs for rotary-wing and vertical/short take-off and landing (V/STOL) aircraft in remote locations under both visual meteorological conditions (VMC) and IMC. The MMTs typically deploy with a MEU (SOC).

3) Capabilities

The MATCD is capable of deploying and operating independent of the MAGTF, joint force, or joint task force to provide ATC support for various types of operations. Examples of this type of ATC support include: (1) providing ATC services to assist humanitarian efforts (MOOTW), (2) assisting other joint/allied Services, and (3) supporting inter-governmental ATC requirements.

The MATCD functions as an integral part of the MAGTF's airspace management and air defense networks. In the accomplishment of its mission, the MATCD will

- provide control tower, radar and non-radar approach/departure control services within its assigned airspace.
- provide precision and non-precision NAVAIDS.
- provide automatic landing system approach and landing services under all-weather conditions.
- display and disseminate appropriate air and ground situation information to designated higher and adjacent air C2 agencies to include the : Marine TACC, tactical air operations center (TAOC), direct air support center (DASC), HAWK engagement section, and low altitude air defense battalion (LAAD Bn) while functioning as an integral element of the MACCS.
- serve as the operational liaison between the MAGTF and national/international ATC agencies.
- coordinate the activation of the airfield base defense zone (BDZ).
- provide airspace control, management, and surveillance within its designated airspace sector.
- provide navigational assistance to friendly aircraft, to include itinerant ATC services.
- interface with the MACCS, other military air control agencies, and/or civilian agencies/authorities as necessary.
- provide required ATC services in support of MAGTF operations.
- provide personnel to the survey liaison reconnaissance party (SLRP) team to ensure MATCD siting criteria and terminal instrument procedures (TERPs) are considered and addressed during the site survey.

4) Equipment

The MATCD equipment consists of the Marine air traffic control and landing system (MATCALS), NAVAIDS, air traffic control towers, mobile electric power (MEP), and maintenance shelters. The MATCALS shares various characteristics with the Air Force's deployable air traffic control and landing system (DATCALS) which is discussed later in this Study. MATCD equipment is designed to be deployed by conventional ground, rail, air and sealift means. Additionally, all MATCD equipment can be transported by USMC CH-53E helicopters. All MATCD radars and communications-electronics shelters are considered oversized cargo. A principal concern when deploying the MATCD is ensuring that adequate transportation and materials handling equipment (MHE) are available to support the carriers loading and offloading, movement to the site, and equipment emplacement.

The MATCALS provides continuous radar approach, arrival/departure, and enroute ATC capabilities. MATCALS collects, evaluates and displays air track data and disseminates information to other air control agencies. MATCALS consists of three subsystems: (1) AN/TPS-

73 air traffic control subsystem (ATCS), (2) AN/TPN-22 all-weather landing subsystem (ALS), and (3) the AN/TSQ-131 control and communications subsystem (CCS). A description of these systems and a variety of other MATCD systems and equipment are contained in **Appendix C, Air Traffic Control Equipment.**

Acquisition Programs. Planned improvements to Marine ATC equipment included the remote landing site tower (RLST) and the common aviation command and control system (CAC2S)--described below.

- The **RLST** is intended as a replacement for the AN/TRC-195 control central. The RLST will provide the means for rapid emplacement, establishment, and withdrawal of communication and other related capabilities required for VFR ATC services at remote landing sites. The RLST will consist of an extendible roof S-250 shelter containing the equipment required for ATC services at remote sites. The system will include a high mobility trailer to carry antennas, generators, and communications equipment. The RLST will be capable of operating in a HMMWV-mounted configuration or in a stand-alone configuration. The RLST system will include six radios and has the capability to introduce up to six land lines into its communication sub-system.

- The **CAC2S** and its communications suite may replace the AN/TSQ-131 upon the end of its service life. The CAC2S initiative will provide a common equipment suite within the MACCS, thus enhancing interoperability and reducing logistics requirements. CAC2S's standardized hardware suite will be equipped with a MACCS-common complement of servers, workstations, processors, etc. CAC2S's software will consist of standardized common components with agency specific (TACC, TAOC, DASC, etc.) applications. Each system will be modular in design and configured to meet each agency's mission requirements.

c. NAVY

1) Doctrine

There are basically three levels of operations for the tactical air control group, squadron, or detachments. They are identified as MEU, MEF (FWD), or MEF level operations. MEUs comprise the landing force for an amphibious ready group. tactical air control groups (TACGRU)/ tactical air control squadron (TACRON) support for MEU level operations will normally consist of a detachment. MEFs, as part of an amphibious task force, are much larger and often have special support requirements and TACGRU/TACRON support for these levels of operations will be necessary to successfully complete the mission.

Typically, a TACRON deploys as one of numerous embarked elements of an amphibious squadron. The detachment OIC is normally assigned as the amphibious Commander's air officer. The amphibious squadron Commander is operationally in command of the amphibious ready group (ARG). The ARG may consist of a variety of ships to include the following ships:

- general purpose amphibious assault ship (LHA)

- general purpose amphibious assault ship (with transport dock)--(LHD)
- amphibious assault ship, landing platform helicopter (LPH)
- landing ship, dock (LSD)
- amphibious transport dock (LPD)

The ARG also has a MEU assigned, which consists of approximately 3000 Marines in ground, air, and support elements. An ARG is capable of landing and supporting combat troops from both the air and sea.

After an amphibious operation has been outlined and an AOA or AOR has been delineated (including all of its control points), the TACRON becomes responsible for the control/monitoring of all fixed-wing assets entering, exiting, or operating within the assigned area. Control of helicopters is generally retained by the ship's air operations control center (AOCC)/Helicopter Direction center (HDC). All aircraft will check-in with the TACRON prior to entering assigned airspace in order to receive control instructions, traffic deconfliction, mission information (including mission assignment and/or mission brief), and transfer to subsequent controlling agency (ies). Follow-on control may be a function of another individual within the TACRON or it may be an outside agency. Following mission completion, aircraft will check-out of the area via the TACRON in order to ensure any additionally required information is passed to affected aircrews.

2) Forces

Forces available for Naval ATC operations are derived from two TACGRU as depicted in **Appendix A, Air Traffic Control Force Structure**. TACGRUs or TACRONs will deploy aboard amphibious flag or amphibious command ships for operations in direct support of amphibious task force operations when directed. They are responsible for providing centralized command, control, planning coordination of all air support and airspace required for amphibious operations for numbered fleet Commanders. When the TACGRU/TACRON deploys, it will be composed of elements of, or the entire group staff and each TACRON.

Typically a TACRON has approximately 18 officers and 60-70 enlisted personnel assigned. Officer manning is comprised of Naval aviators and Naval flight officers of nearly every warfare specialty and Marine aviators. Enlisted manning consists primarily of Air Traffic Controllers (AC) and Operations Specialists (OS), but squadrons also have personnel assigned to provide operational and administrative support**.** Some of the positions of greatest importance in the TACRON and its detachments are described in **Appendix D, Navy Tactical Air Control Squadron Duty Positions**.

Ashore, the TACRON is typically organized like any other command with administrative operations, training and other supporting departments. Detachment composition while deployed generally is as follows: officer-in-charge (OIC) (0-5) and 4-5 other officers, and 18-22 enlisted personnel. Manning will vary somewhat, dependent upon ship embarked.

The commanding officer of a TACRON will deploy in support of Amphibious Group Commanders as the tactical air officer (TAO). The TACRON will man and operate a TACC to

provide centralized planning, control, coordination, and integration of all air operations in support of amphibious operations, training and transits. Each squadron is currently capable of providing two detachments a year with a projected cycle of six months deployed and twelve months in port as directed by the Chief of Naval Operations (CNO). Detachments are required continuously.

The **Tactical Air Control Squadron Detachments**, as operational units of a TACRON, will deploy in support of amphibious squadron commanders. The detachment OIC shall serve as the Tactical Air Officer (TAO). The detachment will staff and operate the TACC to provide centralized planning control coordination, and integration of all air operations in support of amphibious operations, training and transits. A detachment will be tailored to meet the tasking and will reflect the ship type assigned for the deployment. TACC is divided into the following five functional areas (sections):

- **Helicopter Coordination Section (HCS).** Responsible for the coordination of all helicopter operations conducted by helicopter direction centers (HDCs) and other subordinate control agencies within the amphibious ready group and the operational control of specific helo missions when required.

- **Air Traffic Control Section (ATCS).** Responsible for the operational control of all air traffic entering, operating within, or traversing the AOA or assigned operating area, and for coordination of search and rescue (SAR) operations.

- **Air Support Control Section (ASCS).** Responsible for the operational control of all fixed wing and rotary wing aircraft assigned to close and deep air support missions.

- **Air Warfare Section (AWS).** Responsible for coordinating and evaluating all air warning reports and the operational control of all air warfare assets including fighter aircraft, anti-aircraft missiles and guns, and electronic countermeasures assigned. Supervises qualified TACRON, flagship, and staff personnel that are integrated into the AWS.

- **Plans and Support Section (PSS).** Responsible for all communications support, conducts current and future planning, and assembles and distributes current air operations data and reports.

3) Capabilities

The TACRONs operate in and as part of a joint or unified force. They are capable of operating as a component of the joint force air component commander (JFACC), providing air control and planning in a unified or multinational theater of operations. Helicopters are employed in the moving of troops and material ashore while fixed wing aircraft provide close air support (CAS) for friendly ground forces and ensure air superiority by employing combat air patrols (CAP). They are capable of performing all assigned primary missions simultaneously while maintaining continuous readiness conditions I, IA, III (wartime/deployment/cruising readiness) or IV (peacetime steaming) at sea, and V (in port). **Appendix E, Squadron (TACRON) Required Operations Capabilities (ROC),** contains detailed information on their primary missions and

capabilities. In addition, the TACRONs maintain the capability to temporarily staff and operate an existing ATC facility ashore or augment with personnel a remote facility ashore to control air traffic in support of emergency or disaster relief operations.

4) Equipment

With the exception of PRC-113s, TACRONs do not own any air traffic control equipment. Amphibious ATC equipment is installed on LHA-1 (*Tarawa*-San Diego), LHA-2 (*Saipan*-Norfolk), LHA-3 (*Belleau Wood*-Japan), LHA-4 (*Nassau*-Norfolk), LHA-5 (*Peleliu*-San Diego), LHD-1 (*Wasp*-Norfolk), LHD-2 (*Essex*-San Diego), LHD-3 (*Kearsarge*-Norfolk), LHD-4 (*Boxer*-San Diego), LHD-5 (*Bataan*-Norfolk), LHD-6 (*Bon Homme Richard*-San Diego). **Appendix C, Air Traffic Control Equipment,** provides additional details on Navy ATC equipment.

Acquisition Programs. Current displays are undergoing updating on several ships. Some updating has been completed.

d. USAF

1) Doctrine

USAF provides ATC services to support theater tactical combat operations and combat airspace management similar in nature to what Service's fixed-base facilities provide in CONUS and overseas. The USAF ATC is involved in a multitude of missions from combat to MOOTW. Reserve components play such a key role in their operations, that in some cases they could be tasked instead of active duty forces. However, currently there is no specific Air Force doctrine directing the execution of air traffic control and the transition from initial to follow-on and subsequently sustained operations.

2) Forces

Special Tactics. Special Tactics (ST) forces are ground combat forces assigned to Air Force Special Operations Command (AFSOC). Special Tactics forces consist of combat control, pararescue, and combat weather personnel who are organized, trained and equipped to establish and control the air-ground interface and provide airmenship skills in the objective area. Team sizes vary according to taskings. Specific ST units are listed in **Appendix A, Air Traffic Control Force Structure**. ST personnel are routinely committed to support various joint service and allied commanders and government agencies in a wide range of contingencies during joint exercises and training, and Foreign Internal Defense (FID) operations. In the tactical sense, the ST forces provide the theater Commander the ability to positively control the objective area aviation environment and efficiently manage all joint air, ground, and maritime operations within his assigned AOR across the continuum of warfare. To permit the positive command and control of forward operations, ST forces are attached as staff and tactical liaisons to supported ground force units at the company, battalion, and regimental level, and to the Joint/Multinational Task Force level.

Combat Communications Support. Limited numbers of active duty air traffic controllers are imbedded with DATCALS at two CONUS-based ACC Combat Communications Groups (CCG). ATC augmentees must be sourced from Major Command (MAJCOM) unit type codes (UTC)-tasked fixed base assets to operate in a deployed environment. (see **Appendix A, Air Traffic Control Force Structure**) Maintenance personnel are contained in CCG equipment packages from CCG assigned assets. Conversely, Air National Guard (ANG) ATC units contain both air traffic controllers and maintainers in largely autonomous package with their associated DATCALS.

Fixed Base ATC Support. The preponderance of controllers are located at CONUS fixed--base locations and assigned to facility-specific UTCs designed to support a wide range of ATC taskings. Fixed base controllers are identified and trained to support control tower, radar approach control (RAPCON), as well as ATC liaison requirements. Limited VFR control tower services may be provided using AN/MRC-144 assets assigned to select ACC wing initial comm package (WIC-Ps) using available wing ATC assets.

3) Capabilities

Special Tactics. Special Tactics forces are the USAF initial ATC capability and execute missions for both SOF and conventional forces/operations. They are deployable within 12 hours of notification and provide ATC service after a tactical insertion. Follow-on equipment must be air landed within 24 hours to provide 14 days of ATC service. Services can be extended with resupply until relieved by another ATC organization. They deploy with air and joint ground forces , by all infiltration methods via land, sea or air, in the execution of Direct Action, Counterterrorism, Foreign Internal Defense, Humanitarian Assistance, and Special Reconnaissance missions. Special Tactics Teams (STT) of the STS are rapidly deployable, highly mobile forces capable of providing VMC/limited IMC air traffic control and limited airfield operations for austere, expeditionary airfields. They can provide VFR and limited IFR ATC services at the airhead in the objective area using a variety of equipment to include UHF SATCOM, UHF/VHF, VHF/FM, AN/MRC-144, AN/TRN-41(TACAN), and AN/TRN-45 Mobile Microwave Landing System (MMLS). They are capable of conducting tactical assault zone surveys, and positioning and monitoring terminal NAVAIDS. They also provide combat search and rescue, personnel recovery, combat trauma care, long range secure command and control communications, and remove obstacles with demolitions, gathering and reporting ground intelligence and providing local weather observations. ST forces can plan and conduct military operations to include:

- Austere Airfield Control
- Personnel Rescue and Recovery
- Assault Zone Assessment
- Battlefield Trauma Care
- Terminal Attack Control
- Combat Weather Forecasting

General Purpose Air Traffic Controllers. Air traffic controllers assigned to CCGs are generally equipped but do not usually provide initial bare base ATC services. These capabilities consist of a HMMWV with radios (MRC-144 package) to provide basic VFR terminal services. Select ACC WIC-Ps also contain MRC-144 assets and could provide VFR-tower services using controller assets from the wing they are supporting.

DATCALS provide ATC service and positive control capabilities in the combat zone to both the Air and Land Component Commanders. DATCALS (ANG and active duty) deployment characteristics are such that they deploy with organic maintenance and logistic support, which contributes to their deployability, flexibility, and responsiveness. Both personnel and equipment require airlift or surface transportation for deployment.

4) Equipment

Appendix C, Air Traffic Control Equipment, contains a list and description of the most commonly used Air Force ATC equipment which includes the following:

- Six AN/TPN-19 RAPCON
- Six AN/TRN-26 TACAN (or programmed IFR certifiable TRN-41s)
- Six AN/TSW-7 mobile control tower (programmed to be replaced by AN/MSN-7 tower restoral vehicle)
- AN/MRC-144 mobile communications vehicle in CCG and WIC-P packages may be used to provide limited VFR ATC with controller augmentation
- One AN/TPN-19 RAPCON (equipment and maintenance personnel only), 3 ea. AN/TRN 26s, 1 AN/TSW 7 and 4 AN/TRN-45 are assigned to USAFE for theater operations. USAFE requires air traffic controller manning support to operate its TPN-19.
- Twenty AN/TRN-45 MMLS (7 installed semi-permanently at CONUS locations for training)

ANG sustainment DATCALS packages consist of the following:

- Ten AN/MPN-14K Mobile RAPCON
- Ten AN/TRN-26 TACANs (or IFR certifiable TRN-41s)
- Ten AN/TSW-7 (programmed to be replaced by AN/MSN-7)
- Nine AN/TRN-45 MMLS

Special Tactics Equipment. The equipment assigned to special tactics forces are either manpackable or contained within the MRC-144 communications system. The equipment available can be deployed to mark and control runways and includes portable airfield lighting, UHF/VHF/HF/SATCOM/FM communications, TACAN, and portable beacons. The MMLS will be deployable in Nov 97.

The size and composition of the ST forces will vary depending on the mission tasking. The team size can be as few as two to three and up to forty. The standard (core) UTC package is 18/24 personnel and is then increased as required. The standard UTC package can provide ATC services for up to 14 days and includes three MRC-144's, All Terrain Vehicles, NAVAIDS,

portable radios, survey equipment, and portable airfield lighting. Resupply of consumable items is required if operations are extended past 14 days. This UTC can be deployed on one C-141. The personnel breakout is two ST officers, 16 ST controllers, and six pararescuemen.

Acquisition Programs. The current deployable ATC systems are composed of numerous electronic components, several produced in the 1950's. Key elements of the Air Force air traffic control inventory, justified to support current war plans, include: mobile control towers, radar approach controls, navigational aids, communications equipment and airfield lighting, to operate a fully integrated ATC system. These systems are becoming technologically obsolete and expensive to maintain as they near the end of their projected service life. Programmed modifications may extend that service life, but do not adequately address modernization to meet current/future ATC needs. For example, modification plans for the TPN-19 will only maintain its current operational capability and operability but does not address the need to be compatible with Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO) long-term efforts.

USAF is in the testing stage of procurement of tower restoral vehicles (AN/MSN-7) designed to replace active duty and ANG AN/TSW-7 assets. Thirty-seven MMLS have been procured and thirty-three are now being fielded. USAF is coordinating an ORD to define a replacement for existing mobile radar systems.

The FAA, along with the ICAO, is currently implementing plans that will revolutionize the world's communications, navigation, and surveillance system. The entire worldwide air traffic system will evolve from a ground-based to space-based system (e.g., ground-based NAVAIDS like the tactical air navigation system will be replaced with the global positioning system (GPS), and ground-based control centers will transmit ATC instructions to and receive aircraft position information from the space-based system) driving changes in both avionics and ground equipment requirements. The Air Force sees the number one priority in ATC as the need to continue to provide the same service as the FAA and host nations, updating or replacing outdated and hard to maintain systems as needed. This need must be addressed in parallel with FAA and ICAO planned upgrades starting in 1997 and continuing through 2010. The need to sustain current DATCALS while transitioning to the new architecture will allow for a smooth transfer of function without degrading existing ATC and navigation services until all US military aircraft have completed appropriate avionics upgrade.

Mobile components should be configurable and sized for deployment so as to minimize airlift requirements. However, the system must provide air traffic controllers with at least the functionality of today's systems.

To provide the capability for fixed-base and mobile operations into the next century, the system must accept multiple sensor input (ground-based, airborne, and space-based) and be fully interoperable with existing and forecasted DOD command, control, communications, and computer systems. Additionally, it must be capable of interfacing with airfield defense (data and voice) and NAS facilities (analog and digital data). Due to operations in foreign countries, the new fixed and mobile system must be fully interoperable with FAA, ICAO, and NATO current and developing ATC systems. As is the case for the Army, the Air Force has numerous ATC

systems which are outdated and expensive to maintain. While upgrades offer improvements to the system, they fall short of the goal of providing the same level of technological service as the FAA and host nations.

3. DISCUSSION

This section contains a comparison and discussion of each Service's ATC doctrine, forces, capabilities, and equipment. The discussion includes a brief overview of the problem areas associated with joint ATC operations in a theater or AOR specifically related to two criteria: interoperability and commonality.

a. ATC Doctrine

ATC supports worldwide military, or other assigned operations at Theater Command/CINC directed locations. Task organized tailored force packages normally support their Service's mission by providing ATC services to all military and friendly aircraft. ATC operations begin with initial establishment of ATC operations for the type of airfield. Facilities and procedures are enhanced with follow-on forces and the formal establishment of an airspace infrastructure. During the sustainment phase, ATC facilities continue to operate until relieved. During all phases of the operation ATC liaison personnel establish ATC coordination for communications, radar, C2, and other procedure development as appropriate with adjacent ATC units and airspace control authorities. Each Service is capable of providing expert airspace management personnel to an Airspace Control Authority. Currently, joint doctrine does not support interservice ATC responsibilities in a joint environment.

Service doctrine basically states that becoming familiar, versatile and experienced in joint/multinational ATC is paramount. What is missing is the "how to" of becoming versatile, familiar and experienced in joint ATC and airfield procedures. For example, an area that needs addressing is the handover, both planning and execution, of ATC services in the progression from initial, follow-on to sustained operations. Within the Air Force, a void exists from the conclusion of the mission of the STT combat controllers to the introduction of follow-on ATC forces. Air Force combat deployable airfield operations and landing systems consist of active duty and ANG controllers and DATCALS. The difference in organizations and commands to which they answer may contribute to handover problems currently ongoing in the Air Force. Services wide there is a lack of guidance for the handover of ATC services from one service to another. The only guidance provided is for each Service to consider the coordination and integration of air traffic services with other services. In short, there are no tactics, techniques and procedures to plan the actual handover.

b. ATC Forces

Each Service plans, fights, and force protects their aviation/airspace required forces and systems. As such, similarities or duplication will exist in force structure as ATS service organizations are designed to support initial, follow-on, and sustained operations. The Army maintains light, highly mobile systems and forces for early entry and close battle survivability. The Marines are self-sustaining, highly mobile and organized to execute their primary mission, supporting MAGTF operations, and are also capable of supporting joint operations. The Navy is robust and fleet based. The Air Force has an initial first entry tactical ATC and maintains robust, airfield-based systems. Historically, in larger scale MOOTW through major regional conflict, Air Force or Army ATC enters the AOR first and establishes initial ATC operations. Depending on the scenario the Marines might also be the first and only service landbased to establish initial ATC operations. In any case, the follow-on forces are not clearly defined. The Air Force provides the sustaining ATC services as the AOR matures.

An area of concern is the planning and execution of the transition from initial to follow-on and then sustainment forces. During MOOTW and contingencies, the theater Commander determines the priority of personnel and equipment that is required in the AOR. The immediate requirement may be artillery and security forces. This impacts the arrival of follow-on and sustained ATC forces as they compete for deployment airlift assets. The paradox is that is initial tactical ATC is capable of providing VFR and limited IFR capabilities for an airlift force requiring IFR capability.

c. ATC Capabilities

The Army, Marine Corps, and Air Force all possess mobile, quick-reaction type ATC packages. The Army has the most readily deployable ATC packages for follow-on and sustained operations in the deep and close battle area. Army tactical terminal ATS systems are designed for quick emplacement and maneuver. As such, total capabilities in range and robustness are traded for mobility. The Marines are capable of providing continuous all weather ATC services (initial, follow-on, and sustained operations) within the MAGTFs AOR and the FOB concept. The Air Force possesses an initial tactical capability, with the Special Tactics Teams, however requires greater time and support for their robust sustainment systems and ultimately provides excellent theater-level support. Subsequently, USAF doctrine does not identify internal follow-on forces. The Navy does not have the capability nor equipment for inserting small, independent teams for establishing initial ATC ashore. However, they do have the capability for follow-on and sustained augmentation at existing or expeditionary airfields. While all Services have the capability to support internal (Service specific) operations, joint operations require interoperability of equipment and procedures. Currently, joint procedures do not support a smooth inter-service handover of ATC responsibilities from initial to follow-on and subsequently sustained operations. To allow for greater Service ATC interoperability, each ATC school must incorporate a discussion of other Services tactics and equipment as part of their syllabus.

To accomplish specific Service force protection and warfighting missions, controllers must be able to control large volume, high density, and/or fast moving air traffic. In peacetime, each Service's fixed-base infra-structure provides the only opportunity for controllers to gain and maintain ATC skills. There is cross-service duplication of initial ATC training with minimal coordination between the Service's ATC schools. Each trains to Federal Aviation Administration

standards and produces knowledgeable, technically competent graduates capable of transitioning from apprentice to full-performance level air traffic controllers. These basic skills are then honed to a higher level, consistent with the level of air traffic serviced. All Service controllers start out with the same basic skills, but specific mission requirements will dictate the experience level and special skills necessary to meet mission requirements during specific deployments. Although each Service's advanced and sustainment ATC training and professional development is different, the universal peacetime requirement is to develop the skills required on the battlefield to safely control live traffic.

d. ATC Equipment

A review of fielded ATS systems identified both similarities and differences in currently fielded equipment, though function remained constant. ATC equipment is designed to provide command and control, airspace information services, terminal airfield services under visual flight rules (ATC towers), terminal airfield services under instrument flight rules (area search and precision approach radars), and navigational aid support (nondirectional beacon (NDB), tactical air control and navigation (TACAN). Currently, each ATC organization is equipped to meet its Service specific requirements. Commonality and interoperability between the Service's are continual challenges. The Marine Corps and Air Force utilize TACAN as a tactical navigational/approach aids. The majority of the Army's aviation fleet is not equipped to use this equipment and instead uses the NDB as its tactical navigational aid. Interoperability problems surface in joint operations where aircraft of one Service operate into locations operated by another Services ATC. Flight crews find NAVAIDs and landing systems that they are not accustomed to flying during their Service specific training and operations. Technology is driving all Services to space-based navigational systems such as the global positioning system. Several current DOD initiatives are forcing the Services to align procurement programs in order to gain fiscal efficiency, commonality, and interoperability, as exemplified by the on-going joint precision and approach landing system (JPALS) initiative.

All Services have initial ATC radio communications capability. Initial landing systems are even more limited being matched to very specific aircraft systems such as the Marines ARA-63 airborne radar or USAF MMLS. In most cases, airfield lighting must be coordinated with another unit within the Services. The exception is USAF STT which have manpackable airfield lighting systems organic to their units allowing them to provide the most complete initial airfield operating package.

The Army and Marines both have good follow-on capability with their more mobile and less airlift intensive radar systems, mobile towers and communication systems. USAF follow-on capability is limited to enhancements of capabilities provided by the initial package such as generator powered airfield lighting, increased range TACAN and mobile tower assets. Navy shipboard systems are limited to the coverage provided from their offshore location.

All Services can provide sustained capability for both VFR and IFR service to all Service aircraft through mobile control towers, radar systems, and communications connectivity. The Army and Marine's systems are only limited by the extent they can be resupplied/maintained.

Navy shipboard systems are only limited by the ability of the ship to remain on station and maintain its systems operational. Air Force sustaining equipment is extremely robust and requires extensive airlift to deploy, but provides complete ATC service to support a theater airbase mission.

Equipment requirement planners for joint/multinational operations need to explore the ATC requirements of each operating location in terms of speed of deployment, level of immediate operational capability, and ultimate level of capability and duration of employment.

e. Joint Operations

ATC operations are not thought of in a total joint perspective. Individual services must be prepared to operate within the framework of the Service they are supporting. Numerous reports and lessons learned have indicated that the lack of a mutual understanding of each service's equipment, procedures, and capabilities has resulted in needless duplication of effort, disruption of service, and delay of missions, which creates potential safety hazards.

The formal training which Services provide for ATC personnel to operate in a joint environment is not sufficient. However, a near term solution would be to increase ATC participation in Joint Service Training Exercises (JSTE). JSTE scenarios have been developed to support joint training for probable contingency operations worldwide. These scenarios could provide integrated systems training that incorporates the challenges of integrating joint ATC services in the joint arena.

It is imperative that ATC units and personnel be trained to integrate with joint forces for all future operations. They also must be capable of providing services for joint aviation assets. ATC systems employed in multinational operations must support the full spectrum of equipment capability consistent with the nature of ATC required. Addressing these shortcomings would enhance the ability of each service to better perform its mission.

The FAA, along with the ICAO, is currently implementing plans that will revolutionize the world's communications, navigation, and surveillance system. The entire worldwide air traffic system will evolve from a ground-based to space-based system (e.g., ground-based NAVAIDS like the tactical air navigation system will be replaced with the global positioning system (GPS), and ground-based control centers will transmit ATC instructions to and receive aircraft position information from the space-based system) driving changes in both avionics and ground equipment requirements.

The future fixed system must fit into existing facilities and occupy no more space than existing equipment. Mobile components shall be configurable and sized for deployment so as to minimize airlift requirements. However, the system must not provide air traffic controllers less functionality than exists in today's systems.

In summary, basic ATC operations throughout the Services share some commonalties. Service unique requirements can cause operational problems if not anticipated. Commonality and

interoperability problems in joint ATC operations can be resolved through education, development of joint doctrine, joint training and exercises, and a focus on commonality of equipment.

4. RECOMMENDATION

Recommend that approval be granted to develop a MTTP publication on JATC operations.

A MTTP publication is needed because joint operations require extensive ATC integration and coordination. A MTTP publication on joint ATC operations will help to ensure joint interoperability of ATC systems, equipment, and personnel and commonality by providing common TTP. Additionally, recommend that JTTP for JATC be developed in the future to address voids which currently exist in joint doctrine.

Air Traffic Control Force Structure

This appendix outlines the deployable air traffic control force structure in the Services.

1. **Army Air Traffic Services (ATS).**

For active duty ATS tactical units, 45 percent ~~%~~ of their strength is in CONUS, 27.5 percent~~%~~ of the strength is in Europe and another 27.5 percent~~%~~ is in the Pacific. The following table outlines the Army ATS tactical units.

UNIT	TYPE	SUPPORTING	ALIGN	LOCATION
29th ATS Gp (NG)	EAC Gp	3d Army/USAREUR	SWA	Glen Arm, MD
164th ATS Gp	EAC Gp	8th Army	NEA	Seoul, KOR
1-58th Bn	Corps Bn	XVIII Corps	XVIII Corps	Ft Bragg, NC
A/1-58 ATS	Corps Co	XVIII Corps	XVIII Corps	Ft Bragg, NC
B/1-58 ATS	Abn Div Co	82 Abn Div	XVIII Corps	Ft Bragg, NC
C/1-58 ATS	AAslt Div Co	101st AA Div	XVIII Corps	Ft Campbell, KY
D/1-58 ATS	Div Co	3 MX Div	XVIII Corps	Ft Stewart, GA
E/1-58 ATS	Div Co	10th LID	XVIII Corps	Ft Drum, NY
F/1-58 ATS	Div Co	1st Cav Div	XVIII Corps	Ft Hood, TX
3-58th Bn	Corps Bn	V Corps/USAREUR	V Corps	Wiesbaden, GE
E/58 ATS	EAC Co	USAREUR	NATO	Sandhofen, GE
C/3-58 ATS	Corps Co	3-58th Bn	V Corps	Wiesbaden, GE
A/3-58 ATS	Div Co	1st Arm Div	V Corps	Hanau, GE
B/3-58 ATS	Div Co	1st MX Div	V Corps	Ansbach, GE
2-114 Bn (NG)	Corps Bn	III Corps	III Corps	Little Rock, AR
E/111 ATS (NG)	EAC Co	3d Army	SWA	Jacksonville, FL
D/114 ATS (NG)	Corps Co	2-114 Bn (NG)	III Corps	Little Rock, AR
232 ATS (NG)	Div Co	III Corps	4th MX Div	Jackson, MS
1-103 Bn (NG)	Corps Bn	I Corps	I Corps	Ft Lewis, WA
B/4-58 ATS	EAC Co	8th Army	NEA	Uijonbu, KOR
145 ATS (NG)	Corps Co	I Corps	I Corps	Lexington, OK
A/4-58 ATS	Div Co	2d MX Div	I Corps	Cp Casey, KOR
G/58 ATS	Div Co	25th ID	I Corps	Schofield Bks, HI
H/104 ATS (NG)	Div Co	28th Arm Div	I Corps	Harrisburg, PA
G/238 ATS (NG)	Div Co	38th MX Div	I Corps	Shelbyville, IN
49 ATS (NG)	Div Co	49th Arm Div	I Corps	San Antonio, TX
129 ATS (NG)	Div Co	29th Inf Div	I Corps	Edgewood, MD
181 ATS (NG)	Div Co	34th Div	I Corps	Bangor, MN
416 ATS (NG)	Div Co	40th MX Div	I Corps	Phoenix, AZ
426 ATS (NG)	Div Co	42d Div	I Corps	Cp Edward, MA
670 ATS (NG)	Div Co	35th Div	I Corps	Smyrna, TN
F/58th ATS	Maintenance	All ATS units	Worldwide	Ft. Rucker, AL

2. **Marine Air Control Squadrons (MACS).**

There are five active duty and one reserve Marine Air Control Squadrons (MACS). The MACSs are located in the following areas:

- MCAS Cherry Point, NC
- MCAS Beaufort, SC
- MCAS Yuma, AZ
- MCB Camp Pendleton, CA,
- MCAS Futenma, Okinawa JA.

The reserve MACS is based out of Damneck, VA with a detachment in Aurora, CO. Each MACS has one tactical air operations center (TAOC) and two Marine air traffic control detachments (MATCDs). The MATCDs are spread throughout CONUS and Western Pacific (WESTPAC).

The detachments (Det) of each MACS are located in the following areas:

- MACS-1 ATC Det A: Marine Corps Air Station (MCAS) Camp Pendleton, CA
- MACS-1 ATC Det B: MCAS Tustin, CA
- MACS-2 ATC Det A: MCAS Beaufort, SC
- MACS-2 ATC Det B: MCAS New River, NC
- MACS-4 ATC Det A: MCAS Futenma, Okinawa, JA
- MACS-4 ATC Det B: MCAS Iwakuni, JA
- MACS-6 ATC Det A: Marine Corps Auxiliary Landing Field, Bogue, NC
- MACS-6 ATC Det B: Marine Corps Auxiliary Landing Field, Bogue, NC
- MACS-7 ATC Det A: MCAS Yuma, AZ
- MACS-7 ATC Det B: MCAS El Toro, CA
- MACS-24 ATC Det A: Naval Air Station (NAS) Joint Reserve Base, Fort Worth, TX (Reserve)
- MACS-24 ATC Det B: NAS Joint Reserve Base, Willow Grove, PA (Reserve)

3. **Navy Tactical Air Control Groups (TACGRU).**

- **Tactical Air Control Group 1** is located at Naval Amphibious Base Coronado, California. Its subordinate units are Tactical Air Control Squadrons (TACRONs). TACRONs Eleven and Twelve are squadrons under Group 1. The TACRONs deploy as detachments throughout the Pacific Fleet AOR to provide centralized planning, control, and integration of all air operations in support of amphibious operations.

- **Tactical Air Control Group 2** is located at Naval Amphibious Base Little Creek, Virginia. Its subordinate units are Tactical Air Control Squadrons (TACRONs). TACRONs Twenty-one and Twenty-two are squadrons under Group 2. The TACRONs deploy as detachments

throughout the Atlantic Fleet AOR to provide centralized planning, control, and integration of all air operations in support of amphibious operations.

4. **Air Force ATC Providers.** Air Force ATC personnel are dispersed across various units, to include AFSOC special tactics squadrons, active duty/ANG combat ATC units, and augmentees from CONUS-based MAJCOM operations support squadrons. Specific MAJCOM allocations are listed in table below:

Table 1 Air Force ATC Providers

MAJCOM	AIR TRAFFIC CONTROLLERS
AIR COMBAT COMMAND (ACC)	325 (NOTE 1 and 2)
AIR MOBILITY COMMAND (AMC)	68
AIR FORCE MATERIEL COMMAND (AFMC)	59
AIR EDUCATION & TRAINING COMMAND (AETC)	26
AIR FORCE SPECIAL OPERATIONS COMMAND (AFSOC)	435 (NOTE 3)
AIR NATIONAL GUARD (ANG)	240 (NOTE 4)

NOTES:

1. **Combat Communications Groups (CCGs).** Includes air traffic controllers imbedded in DATCALS packages at two combat communications groups (3rd CCG at Tinker AFB, OK and 5th CCG at Robins AFB, GA)

2. **ACC Wing Initial Communications Packages (WIC-Ps).** These packages are associated with ACC combat-coded fighter and composite wings and can provide minimum VFR control tower services with air traffic control augmentation.

3. **Special Tactics Teams (STTs).** The special tactics structure is organized into the 720th Group located at Hurlburt Field, Florida. Under the 720th Group are the 21st STS located at Pope AFB; the 22rd STS located at McChord AFB; the 23rd STS located at Hurlburt Field; the 24th STS located at Ft Bragg; the 320th STS located at Kadena, Japan (OPCON to the 353 SOG); the 321st STS located at Mildenhall, England (OPCON to 352 Special Operations Group (SOG)d) with elements located in Germany; the 10th Weather located at Hurlburt Field with detachments at Ft Lewis, Ft Campbell, Ft Carson, Ft Benning, and Ft Bragg; and an OL-A with LNO's at HQ Air Mobility Command (AMC), Scott AFB.

4. **Air National Guard (ANG).** Approximate controller number based on reduction to ten ATC squadrons with assigned DATCALS located in CONUS and Hawaii.

Army ATS Task Organized Elements

This appendix lists and describes the primary task organized elements in Army ATS.

- **Tactical aviation control teams (TACT)** are employed at auxiliary areas and remote locations. TACTs can provide Army aviation units with on-the-spot control and advisory capabilities in any environment. The TACT provides terminal control and advisory services at any location where Army aviation requires coordinated movement of aircraft. They can be organized in several configurations using a manpack secure data/voice communications package. TACTs are task organized to support specific missions in the forward areas. The focus is always on providing support to aviation; the goal is to ensure coordinated aviation operations at austere landing areas. With its secure, long range communications, the TACT is ideal for providing terminal area services at remote, austere landing areas. TACT operations will provide portable, lightweight NAVAIDS for passage points and landing site designation and integration. The mobility of the TACT allows the commander flexibility during all stages of force projection. The TACT can perform short-term independent operations. Most tailored force packages using aviation assets should include TACTs.

- **Tower teams** are normally employed at main operating bases where high density air traffic exists. This team provides tower services similar to those that are conducted in a fixed-base environment. Tower teams control air traffic that is transitioning, landing, or departing main operating bases or tactical landing sites. The tower team is the primary ATS organization for regulating and integrating ATS terminal services at the main operating base. It also establishes the nonprecision approach capability for the terminal area of operations. All aircraft movements at the airfield or tactical landing site that the aviation operations section or appropriate A2C2 element initiates should be coordinated with the tower team. Tower teams and TACTs can use night vision devices (NVDs) to detect threat air and ground forces during offensive or defensive operations.

- The **ground-controlled approach team** normally employs with the tower team at main operating bases. This team provides a near all-weather, precision, and nonprecision approach and recovery capability. It also provides surveillance vectoring and precision/nonprecision approach guidance to arriving and departing aircraft operating in the terminal area.

- Airspace management doctrine requires that **A2C2 liaison elements** be assigned at all echelons from brigade to EAC. The A2C2 liaison team furnishes the personnel for the A2C2 elements at each echelon. It provides A2C2, airspace information, and air traffic services integration. The liaison teams are the primary players in helping A2C2 cells provide synchronization, regulation, identification, and deconfliction of all airspace users. These teams must be robust enough to afford 24-hour services yet mobile enough to move rapidly as combat operations develop.

- The **communications zone (COMMZ) support company** can provide teams to support terminal area operations at up to four designated airfield locations or austere landing sites in the theater. These locations are expected to be used for sustainment operations where joint

and combined forces aircraft conduct landings and takeoffs. The company can move rapidly using its internal TACTs in a terminal configuration.

- The **corps support company** provides a terminal team to support terminal area operations at each designated airfield or austere landing site. It also provides airspace information services in the corps area of operations. The company can move rapidly using its internal TACTs in a terminal configuration.

- The **division support company** provides (1) two TACTs, (2) airspace information services in the division area of operations, (3) the division maneuver brigade's A2C2 elements with A2C2 liaison personnel, (4) terminal area services at each designated airfield location or austere landing site, and (5) the division airspace information center, which is organic to the division support company and collocated with the division A2C2 cell.

- The **assault division support company** is the same as the division support company except for the number of TACTs. The company provides (1) six TACTs, (2) airspace information services in the division area of operations, (3) the assault division maneuver brigade's A2C2 elements with A2C2 liaison personnel, (4) terminal area services at each designated airfield location or austere landing site, and (5) the division airspace information center, which is organic to the assault division support company.

- The **corps airspace information center (CAIC)** is the primary ATS facility that provides A2C2 services, airspace information services, and coordination of Army, joint, and multinational air traffic operating in the rear operations areas. It is also the primary interface with the joint and multinational airspace management system concerning the coordination of flights conducted within the LCC AOR. The CAIC provides updates that include hostile aircraft intrusion warnings, on-call demand activated navigation aids (NAVAIDS), dissemination of terminal airfield status, flight following and navigational assistance, aircraft sequencing on designated flight routes, assistance in defensive and offensive operations, dissemination of current and forecasted aviation weather information, search and rescue assistance to aircraft performing combat search and rescue (CSAR) operations and the collection, processing, displaying, and dissemination of critical A2C2 information.

- The **division airspace information center (DAIC)** provides A2C2 information and is employed in the division area of operations. The DAIC supports the CAIC with its coordination activities. The DAIC also can provide real-time air picture situational updates as required. The DAIC relays current and forecasted weather information and is the primary coordination link between the brigade A2C2 and division A2C2 cells. Although located at different echelons, all AICs perform essentially the same function and have the same tactical equipment. When the CAIC is inoperative or moving, the ATS commander will designate another AIC to serve as the main AIC. The redesignated AIC operates and employs the same as the original CAIC. This link ensures continuity in the flow of information required for air defense and air traffic management operations.

Air Traffic Control Equipment

This appendix contains a list and description of the most common ATC equipment used by the Services.

1. **Army ATC Equipment.**

- **Air Traffic Control Facility - AN/TSQ-97**

1. **Description.** The AN/TSQ-97 is a portable Air Traffic Control Facility for control of air traffic at landing zones in forward areas. It can also be used at any landing zone where VFR control is required. Included in the facility are the following radio communication capabilities: one UHF radio, one - VHF radio, and one FM radio.

This equipment is not actually installed as such, but is set-up for (temporary) use where needed. When used at an airfield, it is only utilized temporarily until larger and more capable facilities are installed. The facility can be set up and in operation in about 10 minutes.

The AN/TSQ-97 can be operated in the normal manner during periods of rain if suitable waterproof covering is used to shield the facility from direct drenching however, this facility will not be operated during electrical storms. When battery has been cycled under moderate to warm climatic conditions, it should not be used in extreme cold as cells may crack. When relocating to cold environments, new batteries should be used. Three air traffic controllers are required for the AN/TSQ-97.

2. **Interface.** The AN/TSQ-97 can interface with other deployed communications facilities via field phones or UHF/VHF/FM radio. Cables are supplied to interface security equipment for X-mode (secure) communications. The AN/TSQ-97 has no integral landline communications console. Note: The TSQ-97 uses analog equipment for communications and requires special consideration when interfacing with digital equipment.

3. **Transportation Requirements.** The facility with batteries weighs about 200 pounds and is intended to be personnel-transportable for short distances.

By Ground: 4 Soldiers
By Road: Any cargo carrying vehicle
By Air: Any utility helicopter and above

4. **Minimal Mission Capability And Set-Up Timing.** Three Air Traffic Controllers will set up the AN/TSQ-97 and provide VFR Air Traffic Services utilizing UHF/VHF/FM secure communications, provide wind direction, wind speed, and density altitude. The team of 3 will install the AN/TSQ-97 to an operational status within 20 minutes and with an additional 10 minutes be camouflaged.

- **Tactical Terminal Control System - AN/TSQ-198**

1. **Description.** The AN/TSQ-198 is a new mobile Air Traffic Control Facility, which when fully fielded will replace the AN/TSQ-97. The AN/TSQ-198 will provide VFR control of air traffic at landing zones, drop zones, pick-up zones and temporary helicopter operating areas. It can also be used at any landing zone where Visual Flight Rule control is required. NOTE: The AN/TSQ-198 communications system can also be converted to a portable battery-operated manpack (jump) configuration. Major communications components of the AN/TSQ-198 include VHF/UHF-AM Radio sets, and one FM radio (SINCGARS), one HF radio. When the AN/TSQ-198 is used at an airfield, it is only utilized temporarily until larger and more capable facilities are installed. Three air traffic controllers are required for the AN/TSQ-198.

The AN/TSQ-198 can be operated on a 24-hour-a-day basis. It can move 4 times in a 24 hour period with a total distance of 80 km during the four moves with an estimated travel time of two hours each move. The AN/TSQ-198 is capable of operations, transportation, and storage in hot, basic, cold, and severe cold climates, it has secure voice communication interface and commonality with other services. It can be operated by individuals in MOPP IV attire, and the system has been hardened to the effects of NBC contamination and decontamination agents. It is compatible with standard night vision goggle devices and has been hardened to the effects of high-altitude electromagnetic pulse.

2. **Interface.** The AN/TSQ-198 can interface with other deployed communications facilities via field phones or radios utilizing:

a. VHF/HF radios with jam resistant capability.
b. UHF,VHF and HF radios with COMSEC capability.
c. Automatic link establishment for HF.
d. Data transfer over HF, UHF, and VHF radios.
e. MSRT.

The AN/TSQ-198 supports standardization and interoperability with other US military radio systems, allied and NATO forces, and with host nation ATS Systems. The AN/TSQ-198 is interoperable with the U. S. Air Forces “Pacer Speak” series of radio systems.

3. **Transportation Requirements.**

By Road: HMMWV, M-998
By Air: Sling load, single helicopter capable. C-130 single aircraft minimum requirement.

NOTE: The AN/TSQ-198 communications system can also be converted to a portable battery-operated manpack (jump) configuration.

4. **Minimal Mission Capability And Set-Up Timing.** Three air traffic controllers will set up the AN/TSQ-198 and provide air traffic services utilizing UHF/VHF/FM/HF secure communications. This service includes arrival/departure information, weather, wind direction and speed information, and sequencing instructions. The team of three will install the AN/TSQ-198 to an operational status within (time to be determined - estimate 15-30 minutes including camouflage).

- **Aircraft Control Central - AN/TSQ-70A**

1. **Description.** Aircraft Control Central AN/TSQ-70A is an air and ground transportable unit that provides facilities for air traffic control within and about an airfield. The AN/TSQ-70A facilitates visual sighting and communication with aircraft to provide in-flight and on-ground assistance and control. It may be operated from controls inside the shelter or by portable consoles remotely located within 100-foot radius of the shelter. The AN/TSQ-70A is used at an airfield to provide air traffic regulation, aircraft separation, in-flight assistance, landing and takeoff control, and ground control. Its major components include three UHF radios, three VHF radios, two FM radios and one HF radio. Six air traffic controllers are required for the AN/TSQ-70A.

2. **Interface Capability.** The AN/TSQ-70A can interface with other facilities via landline or VHF/UHF/FM/HF radios. Note: The TSQ-70A uses analog equipment for communications and requires special consideration when interfacing with digital equipment.

3. **Transportation Requirements.** Air and Ground transportable - Normally this piece of equipment is ground transportable by M-35 (duece and a half); sling loaded minus vehicle; mounted configuration - C141 or larger/dismounted configuration C130 or larger.

4**. Minimal Mission Capability And Set-Up Timing.** After arrival at the required location, the system set-up (position, unpack, and assemble) time is within 1 hour. Required tasks include mounting radio antennas, connecting to the required power source, and performing communications checks.

- **Air Traffic Control Central - AN/TSW-7A**

1. **Description.** The active duty operated AN/TSW-7A (Air Traffic Control Central) provides ground-to-aircraft radio communications and surface communications in a tactical field environment. It is a transportable facility that can be employed at airstrips for airborne and ground control of aircraft. This facility may be installed to replace permanent control towers in emergency conditions. The ATC Central provides the same functions as a stationery air traffic control tower. It contains all the equipment needed to control aircraft under VFR conditions.

The Air Traffic Control Central provides ground-to-aircraft, aircraft-to-ground, airborne-to-airborne and surface communications within a designated airport tactical area or airfield. Two-way radio communications to aircraft within radio line-of-sight, weather reporting pilot-

to-forecaster service, and flight data. Military operations message relaying is an additional feature. Major components of the AN/TSW-7A include three UHF radios, three VHF radios, three very high frequency (FM/AM) radios, and one high frequency (HF) radio. Three air traffic controllers are required for the AN/TSW-7A. Four air traffic control specialists are required for installation of the facility.

2. **Interface Capability.** The AN/TSW-7A can interface with other ATC facilities or operations centers via landline [WD-1 or private branch exchange (PBX)], FM, VHF, UHF and HF radio frequencies. A dual filtered light gun is provided for none verbal signaling.

3**. Transportation Requirements.**

By Air: 1 each C-17 (on pallets), C-5 (heavy lift type)
By Road: 2 each M-35 (2 1/2 ton motor vehicle) loaded with baggage and towing MJQ-18 generators.

4. **Minimal Mission Capability And Set-Up Timing.** The AN/TSW-7A is capable of two continuous hours of limited operation on battery power. Full service operations on generated power are capable within the limits of equipment maintenance or nonoperability. The team will properly position, unpack, and assemble the AN/TSW-7A within 20 minutes (Emergency Mode), 30 minutes (Limited Duration Mode), or 60 minutes (Extended Duration Mode).

- **Landing Control Central - AN/TSQ-71B**

1. **Description**. The ground-controlled approach (GCA) radar is a precision radar set providing courseline and glidepath tracking of aircraft to within 20 feet (altitude) and 1.3° runway alignment of a predetermined landing point (touchdown). Aircraft position, as determined by the GCA radar is relayed to the aircraft pilot using the radio communications facilities provided with the AN/TSQ-71B. An airport surveillance radar (ASR) capability may be provided when the maximum radar range is 40 nautical miles. Normally, the search mode is used to vector aircraft into the approach sector. The operating modes, selected by the MODE switch, are: Search Mode, Precision Approach (NORMAL) Mode, Height Finder Mode, Simultaneous Mode (this mode allows tracking targets outside the approach sector while providing GCA (precision approach) for landing aircraft), and IFF Interrogation Mode. Major components of the AN/TSQ-71B include the shelter, the AS-1905/TPX-44 - IFF interrogator Antenna, the AN/MJQ-15 Power generation set, and the AN/TPN-18 Radar Set (GCA). Radio communications include three UHF radios, three VHF radios, and two FM radios. Seven air traffic controllers are required for the AN/TSQ-71B.

2. **Interface Capability.** AN/TSQ-71B can interface with other facilities via landline or VHF/UHF/FM/HF radios. Normally, the only facility the AN/TSQ-71B will be required to interface with is the tower facility on the same airfield/landing area. Note: The TSQ-71B uses analog equipment for communications and requires special consideration when interfacing with digital equipment.

3. **Transportation Requirements.** Air and Ground transportable - Normally this piece of equipment is ground transportable by 2 1/2 ton M-35; sling loaded minus vehicle; mounted configuration - C-141 or larger/dismounted configuration C-130 or larger. NOTE: This system is not Rail transportable.

4. **Minimal Mission Capability And Set-Up Timing.** After arrival at the designated location, the GCA team, 7 air traffic controllers, will install the AN/TSQ-71B to an operational status and camouflage it within 7 hours.

- **Flight Coordination Central - AN/TSC-61B**

1. **Description.** Flight Coordination Central, AN/TSC-61B is a transportable unit that provides facilities for air traffic coordination, warning air defense identification, and in-flight assistance within an assigned zone of responsibility on a continuous basis. Altitude, time, and distance flight plan data for airborne aircraft can also be coordinated in the FCC (now called an Airspace Information Center).

The AIC is the main air traffic control facility for the en route structure. It provides facilities to establish air-to-ground radio communications with FM equipment (tactical FM) in the VHF range and with AM equipment (pilot command control) in the UHF, VHF, and HF ranges. Facilities are also included for telephone, and ground-to-ground radio communications with associated airfields and ground installations, as well as adjacent air traffic control facilities. Eight air traffic controllers are required for the AN/TSC-61B. The AN/TSC-61B, Flight Coordination Central, provides the following radio/landline communications capabilities; three UHF radios, three VHF radios, three FM radios, one high frequency (HF) radio, and 15 each - landline capabilities.

2. **Interface Capability.** The AN/TSC-61B can interface with other facilities via landline or VHF/UHF/FM/HF radios. Note: The TSC-61B uses analog equipment for communications and requires special consideration when interfacing with digital equipment.

3. **Transportation Requirements.** Air and Ground transportable - Normally this piece of equipment is ground transportable by 2 1/2 ton M-35 or M-211; sling loaded by utility helicopter when air transported minus the vehicle; in mounted configuration - C141 or larger; in dismounted configuration C130 or larger.

4. **Minimal Mission Capability And Set-Up Timing.** After arrival at its tactical location, the flight coordination central, AN/TSC-61B, will be installed and in operational status with camouflage within one hour. Add 45 minutes for installation of Mast AB-577/GRC (telescoping antenna mast used to raise an array of two antennas (one FM and one UVU) to a height of approximately 50 feet). Allow an additional 15 minutes for installation of Extension Kit, Mast MK-806/GRC.

- **Beacon Set, Radio - AN/TRN-30(v)1/(v)2**

1. **Description.** The radio beacon set transmits a homing signal which is used in Airborne Direction Finding (ADF) Sets AN/ARN-59 and AN/ARN-83 installed in helicopters and fixed-wing aircraft. The radio beacon set provides an amplitude-modulated (am) radio frequency (rf) signal on any one of 964 channels in the frequency ranges from 200 to 535.5 kHz and 1605 to 1750.5 kHz in tunable increments of 500 Hz. The rf output is modulated by a 1020-Hz tone which is automatically keyed to form Morse code characters in four-letter groups, as selected by the operator or manually keyed as desired. The transmission of the radio beacon set is as follows: - Ranges:

AN/TRN-30(V)1 - 28 KM (16 Nautical Miles) with 16-foot antenna
46 KM (26 Nautical Miles) with 30-foot antenna

AN/TRN-30(V)2 - 93 KM (60 Nautical Miles) Tactical Mode
186 KM (100 Nautical Miles) Semifixed Mode

The radio beacon set is used to provide a nonprecision approach at a tactical/semifixed airfield/landing area in two configurations:

Pathfinder mode - **AN/TRN-30(V)1**
Tactical & Semifixed mode - **AN/TRN-30(V)2**

No air traffic controllers are required for this equipment. It is a support NAVAID piece of equipment included for use with other ATC facilities.

2. **Interface Capability.** N/A

3. **Transportation Requirements (AN/TRN-30 (V)1 and (V) 2).** Air or Ground transportable - Normally these pieces of equipment are ground transportable by the vehicle/facility using the NAVAID.

4. **Minimal Mission Capability And Set-Up Timing.** The air traffic control team responsible for siting the radio beacon set has been deployed to a predetermined site and provided with a beacon frequency and code they will:

- Pathfinder Mode: install to an operational status, the AN/TRN-30(V)1 (15 foot antenna) within 20 minutes or (30 foot antenna) within 30 minutes of arrival at desired location.

- Tactical & semifixed Mode: install to an operational status, the AN/TRN-30(V)2 (tactical and semifixed mode) within 90 minutes of arrival at desired location.

Acquisition Programs
Future ATC/ATS Systems which are currently funded

- **Tower System (Future) - Mobile Tower System (MOTS)**

The MOTS replaces the AN/TSQ-70A and the AN/TSW-7A, Aircraft Control Central (Towers).

Description. The MOTS is a mobile air traffic control (ATC) tower. Mounted on a High Mobility Multi-purpose Wheeled Vehicle (HMMWV) it will self deploy or be air lifted by C-130 aircraft or UH-60 or larger helicopter to the aircraft landing area and rapidly begin operation. The MOTS will provide terminal ATC services for selected high traffic landing areas in the echelon above corps (EAC), corps, and division areas. The ATC services will include the necessary coordination permitting instrument meteorological conditions recovery and landing with Army precision radar. The MOTS will have digital air/ground communication and digital linkage (MSE, HAVEQUICK, SINCGARS, etc.) into A2C2, air traffic services, and local command nets. The MOTS will have space for two air traffic control operators and one supervisor.

- **Radar System (Future) - Air Traffic Navigation, Integration, and Coordination System (ATNAVICS)**

The ATNAVICS replaces the AN/TSQ-71B, Landing Control Central (RADAR).

Description. The ATNAVICS is a vehicular-mounted, survivable radar system that will provide continuous near all weather landing precision assistance, departure recovery capability at Army tactical airfields and landing areas. Additionally, the ATNAVICS will provide area surveillance and aircraft identification capability for a minimum of a 25 nautical mile radius of all sites where employed. The ATNAVICS is designed for employment at division, corps, and echelon above corps. The system consists of three integrated radars: area surveillance radar, precision approach radar (PAR), and secondary surveillance radar. The fixed-base PAR is being combined with ATNAVICS for commonality and standardization within the acquisition process.

- **A^2C^2 System (Future) - Tactical Airspace Integration System (TAIS)**

The TAIS replaces the AN/TSC-61B Flight Operations/Coordination Center (FOC/FCC), and additionally assumes the Army A^2C^2 mission.

Description. The TAIS will be a mobile communications and digitized battlefield automated system for airspace management. FM 100-13, Battlefield Coordination Detachment (BCD), states the TAIS is planned for employment in any theater of operations and will be the Army system to meet both Army Airspace Command and Control (A^2C^2) and air traffic services (ATS) requirements. A^2C^2 is a combined arms requirement, not just an Aviation requirement. The TAIS, as a piece of equipment in the A^2C^2 element, will be directly responsive to the

command level G-3 organization (usually the G-3 Air). The TAIS, will collocate with the command level A^2C^2 element at the main tactical operations center (echelon above corps, Corps Tactical Operations Center (CTOC), Division Tactical Operations Center (DTOC)), as appropriate. The TAIS will provide the digitized battlefield with automated A^2C^2 planning, enhanced A^2C^2 execution, improved theater and intra- and inter-Corps/Division ATS support in war, and military operations other than war.

2. **Marine ATC Equipment.**

- **AN/TPS-73 Air Traffic Control Subsystem (ATCS)**

Description. The AN/TPS-73 is a two dimensional, transportable tactical airport surveillance radar system operating in the E band (2705-2895 Mhz). This non-linear radar is capable of a 60 nm surveillance range for its primary radar, 120 nm search range for its secondary radar IFF), and is capable of detecting airborne targets up to an altitude of 60,000 feet. The AN/TPS-73 ATCS is capable of interrogating IFF modes I, II, III, IV, and C. Radar and IFF information from the ATCS are processed within the CCS and can be forwarded to other agencies via data link and/or voice communications. The AN/TPS-73 ATCS can simultaneously detect and track up to 600 air targets.

- **AN/TPN-22 All-Weather Landing Subsystem (ALS)**

Description. The AN/TPN-22 is an I band (9000-9200 Mhz), three dimensional, track-while-search, transportable phased array radar which provides the MATCD with tactical precision approach capabilities. The AN/TPN-22 ALS's pencil beam radar has a 10 nm range and an 8 degree (-1 to +7 degree) angular coverage in elevation. The AN/TPN-22 ALS provides ACLS Mode I/IA, Mode II and Mode III approach services via TADIL C for all-weather landings. The AN/TPN-22 ALS is capable of automatic tracking for up to six aircraft simultaneously.

- **AN/TSQ-131 Control and Communications Subsystem (CCS)**

Description. The AN/TSQ-131 is the heart of MATCALS. It functions as a collection point for radar data produced by the ATCS and the ALS. The CCS consists of two International Standards Organization (ISO) shelters which allow its employment in either a single or dual shelter configuration. Each shelter provides four processor display system (PDS) consoles which serve as operational workstations for crew members. Each PDS has its own communications capability. In addition to intercommunications and switchboard circuits, the CCS provide access to one HF, three VHF amplitude modulation (AM), one VHF frequency modulation (FM), and eight UHF radios. One UHF radio is reserved for Tactical Digital Information Link (TADIL)-C. In addition to accessing single channel radios, the CCS provides access to 10 external telephone lines. The CCS has the capability to automatically exchange certain elements of command, tactical intelligence and situation data with other MATCDs, TAOCs, and the TACC via TADIL-B. The AN/TSQ-131 is capable of encrypted communications.

- **AN/TSQ-120A/B Air Traffic Control Central (ATC Tower)**

Description. The AN/TSQ-120 is a transportable ATC tower facility which provides operators with 360 degree visual observance of aircraft, both on the ground and in the air, operating within a designated control zone and visual control over ground vehicles operating in the vicinity of the runway. The ATC tower can be erected to heights of 8, 16, or 24 feet. The ATC tower provides three operator positions from where aircraft and airfield control is effected through the use of radio communications and visual aids. The ATC tower provides operators with access to one HF, three VHF/AM, one VHF/FM, and five UHF single channel radios and up to 10 telephone lines. The AN/TSQ-120B model is capable of encrypted communications. All audio communications are recorded.

- **AN/TRC-195 Control Central**

Description. The AN/TRC-195 provides a limited tower capability for remote site operations. Typically employed in the rear section of a HMMWV, the AN/TRC-195 provides up to two controllers with communications access to four 20 hertz (Hz) telephone lines and one HF/VHF FM, one VHF AM, and two UHF single channel radios.

- **AN/TRN-44 Tactical Aid to Navigation (TACAN)**

Description. The AN/TRN-44 set is a transportable, dual-channel navigational aid which operates in the D band (962-1213 MHz) and provides up to 100 TACAN equipped aircraft with range, bearing and station identification information within an effective radius coverage of 200 miles. It is used for both enroute navigation guidance and as an instrument approach aid.

- **AN/TPN-30 Marine Remote Area Approach and Landing System (MRAALS)**

Description. The AN/TPN-30 is a two person, portable, all-weather instrument landing system. It transmits azimuth, distance, and elevation data in the J-band (15.412-15.680 GHz) and distance measuring equipment (DME)/Station Identification Data in the D-band (962-1213 MHz). It provides forty degree azimuth and twenty degrees elevation guidance out to ten nm on final approach to aircraft equipped with the ARA-63 airborne radar system. It also provides 360 degree DME and station identification information out to 40 nm.

- **AN/TSM-170 Maintenance Repair Group**

Description. The AN/TSM-170 consists of four shelters which contains workbenches, test equipment, cabinets, tools and other equipment necessary for maintenance of ATC equipment.

Appendix C

3. **Navy ATC Equipment. Table 1 - Amphibious ATC Equipment -** equipment and displays are being updated on several ships which are depicted.

HULL	SHIP	CURRENT DISPLAY	FUTURE DISPLAY	DLVR DATE	CDC SYSTEM	COM SUITE	HEAD SETS	JACKBOX FOOTKEY	SPN-46 PAR	SPN-41 ILS	NAV SRCR	RADARS
LHA-1	TARAWA (SAN DIEGO)	NTDS UYA-4	TPX-42V-13 V-XX ADS	1st QTR 99	NTDS ACDS BLK 1 I-99	LS537	(10)	(8) (7)				SPN43C,52,40,67 SPN-35 PAR/ASR
LHA-2	SAIPAN (NORFOLK)	TPX-42V-12 V002 OD-201		Done	NTDS ACDS BO/L10 3-97	LS537	(10)	(8) (7)			SRN-25 KCMX	SPN43C, 48E, 40, 67 SPN-35 PAR/ASR
LHA-3	BELLEAU WOOD (JAPAN)	TPX-42V-13 V002 OD-201		Done	NTDS ACDS BO/L10 3-98	LS537	(10)	(8) (7)			SRN-25 KCMX	SPN43B, 48E, 40, 67 SPN-35 PAR/ASR
LHA-4	NASSAU (NORFOLK	NTDS UYA-4	TPX-42V-13 V-XX ADS	1st QTR 98	NTDS ACDS BO/L 10 8-97	LS537	(10)	(8) (7)				SPN43C,52,40,67 SPN-35 PAR/ASR
LHA-5	PELELIU (SAN DIEGO)	NTDS UYA-4	TPX-42V-13 V002 OD-201	July 96	NTDS ACDS BLK 1 9-98	LS537	(10)	(8) (7)			SRN-25 KCMX	SPN43C, 52, 40, 67 SPN-35 PAR/ASR
LHD-1	WASP (NORFOLK)	TPX-42V-12 V001 OD-201		Mar 97	ACDS BLK 0/L 8 BLK 1 3-97	LS654	(10)	(8) (7)		DONE	SDMS KCMX	SPN43C, 49, 48E, 67 SPN-35 PAR/ASR
LHD-2	ESSEX (SAN DIEGO)	TPX-42V-12 V002OD-201		DONE	ACDS BLK 0/L 9	LS654	(10)	(8) (7)	FY 97	FY97	SDMS KCMX	SPN43C, 49, 48E, 67 SPN-35 PAR/ASR
LHD-3	KEARSARGE (NORFOLK)	TPX-42V-12 V002 OD-201		DONE	ACDS BLK 0/L 10	LS654	(10)	(8) (7)			SDMS KCMX	SPN43C, 49, 48E, 67 SPN-35 PAR/ASR
LHD-4	BOXER (SAN DIEGO)	TPX-42V-12 V002 OD-201		DONE	ACDS BLK 0/L 9	LS654	(10)	(8) (7)			SDMS KCMX	SPN43B, 49, 48E, 67 SPN-35 PAR/ASR
LHD-5	BATAAN (NORFOLK)	TPX-42V-13 V002 OD-201		DONE	ACDS BLK 0/L 10	IVN ICT	(10)	(8) (7)		DONE	SDMS KCMX	SPN43C, 49, 48E, 67 SPN-35 PAR/ASR
LHD-6	BON HOMME RICHARD (SAN DIEGO)	TPX-42V-13 V002 OD-201		DONE	ACDS BLK 0/L 10	IVN PICT	(10)	(8) (7)	DONE	DONE	SDMS KCMX	SPN43C, 49, 48E, 67
LHD-7			TPX-42V-13 V-XX ADS		ACDS BLK O/L 10		(10)	(8) (7)	DONE	DONE	SDMS KCMX	SPN43C, 49, 48E, 67
MSC-12	INCHON INGALSIDE,TX	SPA-25G RPTR	N/A		LINK 14	TA970	5	4			GYRO	SPN43C SPN35 PAR/ASR
TCRN 11/12	SAN DIEGO						4					
TCRN 12 Det	SASEBO, JA						2					
TCRN 21/22	NORFOLK						4					

4. **Air Force ATC Equipment**.

a) **Special Tactics Squadrons (STS).** In addition to the AN/MRC-144, AN/TRN-41 TACAN and the AN/TRN-45 Mobile Microwave Landing System (MMLS), the STS possess the following equipment:

- **VHF/UHF Manpack Radios**

1. AN/PRC-113 Transceiver - secure and non secure voice mode/can be used for Have-Quick operations/has whisper mode operation.
2. PRC-117D (C) Transceiver - simplex/half duplex operations/frequency hopping mode/built in communication security (COMSEC) module/SATCOM mode of operation.
3. LST-5C Lightweight Satellite Transceiver - self contained 1200/2400 Baud modem/FM and AM scan and beacon modes.
4. HST-4A Satellite Transceiver - AM Scan and beacon mode/built in 1200/2400 Baud modem/secure mode of operation in AM/FM modes.

- **HF Manpack Radios**

1. AN/PRC-132 HF Transceiver - operates in single sideband mode (SSB)/100 programmable TX and RX channels/half duplex mode.
2. AN/PRC-138 Manpack Tactical HF radio - operates SB/LSB/USB, and FSK/frequency hopping mode of operation/half duplex mode.

- **Handheld Radios**

1. AN/PRC-112 Survival Radio - provides 121.5 and 243 Mhz beacon/allows interrogation by personal locator system (PLS) avionics system/has 2 programmable channels in UHF range.
2. AN/PRC-126/8 VHF Radio Set - has 10 programmable channels/watertight up to 10 feet/secure capable with KYV-2A/FM operation in simplex or half-duplex modes.
3. AN/PRC-139 VHF/UHF FM Transceiver - has 14 programmable channels/provides Vinson/Fascinator interoperability.
4. Saber II and Saber III portable radios - 12 programmable channels/optional secure capability with Fascinator/field programmable.

- **Communications Systems**

AN/MRC-144 Mobile Communications System - HF SSB operation/VHF AM/FM operation/UHF AM operation/contains additional mount for AN/PSN-11 GPS plugger equipment.

- **Beacons and Transponders**

1. PRD-7880 Selectable Strike Beacon (TEMIG) - used with the ASD-5 Black Crow system

on AC-130 H Gunship/provides target ID, range, azimuth, and beacon ID/idea; for use in a "no communications" environment.
2. SST-124 Transponder (GARI) - used to mark drop, landing, and FULTON recovery zones for MC-130E Combat Talon One/receives on one frequency while transmitting up to 16 different code combinations on another.
3. SST-181 Transponder - used as a radar reference point in marking assault landing and drop zones/marks friendly positions during AC-130H/U Gunship call-for-fire missions.
4. AN/PPN-19 Multi-band transponder - used as a radar reference point in offset beacon bombing, naval gunfire, and to ID friendly positions/compatible with most radar equipped aircraft including AC-130H/U and MC-130E/H.

- **Laser Equipment**

1. GCP-1 Ground Commander's Pointer - contains a safety switch which prevents accidental laser emissions/has a laser output lens to adjust the beams intensity.
2. GCP-1A Ground Commanders Pointer - remote switch is an additional function/safety cover must be in the armed position before the GCP-1A can be activated with the on/off switch.

b) **General Purpose USAF ATC Equipment.**

- **Landing Control Central - AN/TPN-19**

1. **Description.** The active duty operated and maintained AN/TPN-19 Landing Control Central (Radar Set) can be configured as a complete RAPCON with RFC, RAPCON with ASR only, or a GCA only facility. The radar unit is used by air traffic controllers to locate and identify arriving and departing aircraft and provide final approach guidance. These services can be provided in all types of weather.

The radar unit is capable of identifying aircraft using secondary radar within a 200 nautical miles (NM) radius, ***SFC - 60,000'***, and primary radar coverage to 60 NM, ***SFC - 40,000'.*** The PAR portion provides both azimuth and elevation information from 20 NM to touchdown. The unit has six display indicators that are capable of providing both ASR and PAR displays in the operations shelter.

With all these indicators and communications equipment installed, the unit is capable of taking over ATC operations at bust airports. Since the PAR antenna may be rotated and locked into numerous positions, the unit is capable of providing approaches to four runways.

Air traffic control personnel required include two air traffic controllers from CCG and 18 air traffic controllers (UTC-tasked from fixed base assets).

2. **Interface.** The AN/TPN-19 can interface with other facilities via landline or UHF/VHF radio. These facilities include other ATC facilities and wing operations centers. Note: The

TPN-19 uses analog equipment for communications, and requires special consideration when interfacing with digital equipment.

3. **Transportation Requirements.** Transportation Requirements for the AN/TPN-19 consist of the following:

By Air:	7 C-130s or 3 C-141s or 1 C-5 (36 pallet positions without self-propelled vehicles)
By Road:	M-923 loaded with MRSP towing PAR shelter
	M-923 loaded with MRSP towing ASR shelter
	M-923 loaded with support towing Ops A shelter
	M-923 loaded with support towing Ops B shelter
	M-35 loaded with power support towing ASR/OPS Pallet
	M-35 towing S530A shelter
	M-35 loaded with MRSP, towing S530B shelter or 280 shelter
	M-35 loaded with life support, towing the PAR pallet
	M-35 loaded with fuel drums, towing MEP 005
	M-35 loaded with fuel drums, towing MEP 005
	M-35 loaded with baggage, towing MEP 005
	M-35 loaded with support towing MEP 005
	M-35 loaded with support towing MEP 006
	M-35 loaded with support towing MEP 006

4. **Minimal Mission Capability and Setup Timing.** Ten maintenance personnel should be able to install the AN/TPN-19 with one operational PAR scope, two operational ASR scopes, secondary radar, four UHF and two VHF radios within 26 hours. Prior to being declared mission capable the AN/TPN-19 must receive a flight inspection. NOTE: Under combat limited situations with no augmentees assigned, the standard time is 36 hours.

- **Landing Control Central - AN/MPN-14K**

1. **Description.** The ANG operated and maintained AN/MPN-14K Landing Control Central (Instrument Landing Aid) can be configured as a complete RAPCON with RFC, RAPCON with ASR only, or a GCA only facility. The system can deploy autonomously configured as a GCA only facility providing limited final approach guidance. The radar unit is used by air traffic controllers to locate and identify arriving and departing aircraft and provide final approach guidance. These services can be provided in all types of weather.

The radar unit is capable of providing 60 NM primary radar coverage and 200 NM secondary Identification Friend or Foe/Selective Identification Feature IFF/SIF sweep coverage. The PAR portion provides both azimuth and elevation information from 15 NM to touchdown. The unit has three ASR indicators and one PAR indicator in the operations shelter. The unit is capable of ATC operations at busy airports with single runway operations.

Air traffic control personnel required are one air traffic control officer, 16 air traffic controllers and one TERPS specialist

2. **Interface.** The AN/MPN-14K is capable of interface with the AN/TSW-7 mobile control tower and other facilities via landline, radio (UHF/VHF) and microwave link. The system uses analog equipment for communications and requires special consideration when interfacing with digital equipment.

3. **Transportation Requirements.** Transportation requirements for the AN/MPN-14K consist of the following:

By Air:	Three C130s or One C-5
By Road:	M-923 loaded with MSRP towing Ops shelter
	M-923 loaded with support towing maint shelter
	M-35 loaded with fuel drums, towing MEP 006 generator
	M-35 loaded with support towing MEP 006 generator
	M-35 loaded with support cables

4. **Minimal Mission Capability and Setup Timing.** Eleven maintenance and ten air traffic control personnel are required to install the AN/MPN-14K with one operational PAR scope, two operational ASR scopes, four UHF and two VHF radios within 18 hours. Prior to being declared mission capable the AN/MPN-14K must receive a flight inspection after set-up. NOTE: Under combat limited situations with no augmentees assigned, the standard time is 36 hours.

- **Air Traffic Control Central - AN/TSW-7**

1. **Description.** The AN/TSW-7 is a Mobile Control Tower, operated and maintained by both active duty and ANG personnel, used to provide ATC capabilities where no operational control tower exists (bare base operations). The AN/TSW-7 has limited capabilities, however, it provides controllers with the minimum items necessary to do the job.

The AN/TSW-7 provides air traffic controllers landlines, UHF/VHF radios, crash phone, emergency warning and evacuation alarm signal, barometer, tape recorders, binoculars, NAVAID monitor, light guns, and wind measuring equipment.

There are three controller positions: local control (controls airborne aircraft and runway traffic), ground control (controls all other ground movements, aircraft and vehicles), and flight data (handles administrative coordination).

Air traffic control personnel required include two air traffic controllers (from active duty CCG or ANG UTC-tasked) and eight air traffic controllers (ANG or active duty fixed base UTC-tasked)

2. **Interface.** The AN/TSW-7 can interface with other facilities via landline or radio (UHF/VHF). Other facilities include the AN/MPN-14K or AN/TPN-19 as well as on-base fixed facilities or off-base radar approach/center facilities. The AN/TSW-7 is also capable of monitoring the AN/TRN-26 mobile TACAN.

3. **Transportation Requirements.** Transportation requirements for the AN/TSW-7 consist of the following:

By Air: 2 C-130s or 1 C-141 (11 pallet positions, without self-propelled vehicles)
By Road: M-35 loaded with MRSP/field support, AN/TSW-7 on M-720 mobilizers
M-35 loaded with MRSP/field support, towing *support pallet* on M-720 mobilizers.
M-35 loaded with baggage, towing MEP-005A/M-200 trailer.
M-35 towing MEP-005A/M-200 trailer.

4. **Minimal Mission Capability and Setup Timing.** Seven maintenance personnel should have the mobile tower operational with three UHF radios plus a 243.0 UHF guard receiver, two VHF radios plus 121.5 VHF guard receiver, and one light gun within 16 hours. After the unit is fully operational the number of maintenance personnel required decreases.

- **Tower Restoral Vehicle (TRV) - AN/MSN-7**

1. **Description.** The AN/MSN-7 is currently in the final field testing phases and is programmed to replace the AN/TSW-7 in both the active duty and ANG inventories. The system consists of a vehicle-mounted shelter containing air traffic control equipment and space for three air traffic controller personnel to perform aircraft launch and recovery operations. Transported to the theater of operations by air, it can be driven to its final operating location, be set up quickly, and be capable of self-sustained operation in a bare-base environment. If necessary, the system can be quickly torn down and moved to a new operating location. The system's communications capabilities are robust to allow the AN/MSN-7 to temporarily replace existing air traffic control tower facilities while they are being repaired or refurbished.

The AN/MSN-7's mission to supply ATC service in bare-base locations may make the system a primary target for damage caused by surface-to-surface and air-to-surface munitions. Although the AN/MSN-7 may be located in vulnerable areas during an attack against the airfield, the system's high mobility and relatively small size will allow its crew to react quickly and move the system to a sheltered area. A threat also exists from hostile special operations forces. Due to its small size and weight, the AN/MSN-7 is easily damaged by small arms fire and lightweight explosives. A secondary threat is present due to the AN/MSN-7's close proximity to other primary targets on the airfield. The system could suffer collateral damage if it is near one of these targets during an airfield attack. Survivability may be aided by camouflage and the fact that emissions from the AN/MSN-7 need be present only during aircraft launch and recovery operations. Electronic warfare and electronic countermeasures will be a partial jamming threat to communications used by the system. The use of HAVE

QUICK capable radios will give anti-jam protection to ultrahigh frequency (UHF) communications.

During wartime, the AN/MSN-7 is capable of being quickly deployed and operating in a bare base environment. Forward operating locations demand that the system be self-supporting. If hostile airfields are captured, the AN/MSN-7 is capable of rapid redeployment to the captured area in order to exploit these resources and render ATC service to friendly forces.

The system will remain mostly in a non-operational state (in storage) during peacetime. The storage requirements allow storage almost anywhere space is available. The system will be rapidly readied and transported to locations where ATC service has been lost due to natural disaster. Once there, the system will supply temporary service until repairs are made to fixed tower assets.

Temperature ranges represent those which may be encountered during worldwide deployment of tactical systems. The system is designed to be set up and operational under all expected environmental conditions.

(Proposed) Air traffic control personnel required include two air traffic controllers (from active duty CCG or ANG UTC-tasked) and eight air traffic controllers (ANG or active duty fixed base UTC-tasked).

2. **Interface.** The AN/MSN-7 is inter-operable with the host wing command and control (C2) structure for fixed base operations. The AN/MSN-7 does not require a Wing Command and Control System workstation. Any communications with Theater Air Control or the Airlift Control System will take place via radio or landline. Frequency allocations for ground-to-air radios are such that operation of the AN/MSN-7 is transparent to aircraft supported by ATC operations conducted from the AN/MSN-7 within the constraints of the system's intended mission. Frequency allocations for the LMRs ensure interoperability with other base functions such as communications squadrons and base operations. Since the AN/MSN-7 operates in foreign countries, interface and interoperability considerations with existing and potential allied ATC and C_2 systems are integrated.

3. **Transportation Requirements.** A single AN/MSN-7 system must be transportable without disassembly by one C-1 30 aircraft. This requirement is limited to the prime mover and support vehicle, it does not include manpower nor all the necessary sustainment equipment detailed in the unit type code (UTC). The AN/MSN-7 can be driven to its operating location using either unimproved roads or, if necessary, by crossing moderately rough open terrain. The ability to travel at a 50 mph cruising speed on paved roads enables the AN/MSN-7 to be driven reasonable distances from its storage location to embarkation point, or from its debarkation point to its operating location. This capability conserves airlift capabilities so they may be employed elsewhere.

4. **Minimal Mission Capability and Setup Timing.** The AN/MSN-7 is capable of being made fully operational within 1.5 hours nominal, after arrival on site by a maximum of four trained personnel. AN/MSN-7 setup time will be no more than 2 hours when these personnel are wearing chemical, biological, and radiological (CBR) or arctic weather gear. The same time and personnel constraints apply to the system when dismantling and packing for storage or redeployment.

- **Tactical Air Navigation (TACAN) - AN/TRN-26**

1. **Description.** The active duty and ANG operated/maintained AN/TRN-26 is designed for use at remote landing strips and forward operating areas. The system provides radio navigation information (azimuth or bearing, identification, and distance) to as many as 100 aircraft simultaneously. Due to the UHF carrier, the transmitted information is limited to LOS.

The system has an acquisition range (lock on) of 35 nautical miles NM at 1500' above unobstructed terrain and a maximum reception range of 100 NM. Associated monitoring equipment provides a continuous check of all significant TACAN parameters and shuts the TACAN off when a fault occurs. The AN/TRN26A is not suitable for deployments longer than 30 days, or to areas likely to experience extreme weather conditions, without environmental control provisions. The S-600 shelter is available to house the AN/TRN26B for environmental control provisions and is more suitable for long term deployment, or to severe climates.

2. **Interface.** The AN/TRN-26 does not require interface with other facilities. However, it normally has a monitor connected to the RAPCON or tower to allow 24 hour monitoring.

3. **Transportation Requirements.** Transportation requirements for the AN/TRN-26 consist of the following:

By Air:	1 C-130 or 1 C-141 (AN/TRN26A 2 pallet positions, AN/TRN26B 3 pallet positions without self-propelled vehicle)
By Road:	AN/TRN26A: M-923 loaded with MRSP & AN/TRN-26A TACAN M-35 loaded with , 2 MEP-003A
By Road:	AN/TRN26B: M-923 loaded with MRSP/ECU & towing AN/TRN-26B TACAN M-35 loaded with 2 MEP-003A

4. **Minimal Mission Capability and Setup Timing.** All assigned maintenance personnel should have the TACAN operational within four hours. At least one integral monitor and one receiver/transmitter with 63 channel capability identification, and at least 360W output power are required before the TACAN can be declared operational. Prior to being declared mission capable the AN/TRN26 must receive a flight inspection.

- **Tactical Air Navigation (TACAN) - AN/TRN-41**

1. **Description.** The AN/TRN-41 is a portable, lightweight, air droppable, unmanned TACAN designed to provide bearing, facility identification, and distance information. The ground equipment consists of a transponder with associated antenna system and the aircraft is equipped with an interrogator. The TACAN transmits continuous bearing information to an unlimited number of aircraft and provides slant range distance information to as many as 100 aircraft simultaneously. Due to the UHF carrier, the transmitted information is limited to LOS use only with a range of 75 nautical miles. This TACAN does not possess external azimuth monitoring device as required by AFMAN 11-225 and therefore it is not currently certified for IFR use. A programmed modification to this system will make this system IFR-capable in the future.

2. **Interface.** The AN/TRN-41 does not require any other type of equipment to be operational.

3. **Transportation Requirements.** Transportation requirements for the AN/TRN-41 consist of the following:

By Air: One C-130 or One C-141 (1 pallet position, without self-propelled vehicle)
By Road: One M-35 with AN/TRN-41 TACAN/Generator /Generator MRSP/support

4. **Minimal Mission Capability and Setup Timing.** Three METNAV technicians should have 63 channels with identification and at least 100 W output of power in 4 hours.

- **Mobile HF/UHF/VHF Radio System - AN/MRC-144**

1. **Description.** The AN/MRC-144 is a mobile HF/VHF/UHF communications facility with an AN/GRC-206 package mounted in a M-998 HMMWV. It provides single sideband (SSB) HF, VHF/FM, VHF/AM, and UHF communications, with a full compliment of portable backup radios. This system can be remoted up to two kilometers and all radios have secure voice capability. When used in an ATC capacity, air traffic controllers must be tasked separately.

Air traffic control personnel required are four air traffic controllers (modified UTC from fixed base assets).

2. **Interface.** The AN/MRC-144 can communicate with any radio in the UHF/VHF AM, VHF FM, and HF range. Also, it can communicate with any UHF AM radio that has been modified with HAVE QUICK II.

3. **Transportation Requirements.** Transportation requirements for the AN/MRC-144 consist of the following:

By Air: One C-130 or One C-141 (5 pallet positions, includes one self-propelled vehicle [M-998])
By Road: M-998 HMMWV, and towing M-101 trailer

4. **Minimal Mission Capability and Setup Timing.** One radio technician and one radio operator should have HF/SSB, VHF/FM, UHF/AM, and VHF/AM radios available over 90% of the tuning range in 45 minutes.

- **VHF/UHF-AM Radio Set - AN/TRC-176**

1. **Description.** The AN/TRC-176 is a portable UHF/VHF radio set operating in the 116.0 to 149.975 or 225.0 to 399.975 MHz frequency bands. It can provide one channel of either UHF or VHF voice communications (both UHF and VHF cannot be operated simultaneously) and can be secured with TSEC/KY-57 and operate in the HAVE QUICK mode to prevent enemy jamming. This system, although not a part of DATCALS, acts as an important back-up ATC communications capability in the event of degraded operations from the ATC deployable systems.

Air-to-ground radio operations encompass the majority of missions for this system, although it can be used for local command and control and engineering nets. The operational range for local area ground-to-ground communications is less than 35 miles with minimal obstructions between communications points. For air-to-ground the operational range is up to 200 miles line-of-sight.

2. **Interface.** The AN/TRC-176 can interface with all VHF/UHF radio systems that operate in the 116-149.95 or 225-400 MHz range and have a 25 kHz or higher separation between channels. Note that some older UHF systems can only select channels at 50 kHz increments so these systems may not tune to all the frequencies available on the AN/TRC-176.

3. **Transportation Requirements.** Transportation requirements for the AN/TRC-176 consist of the following:

By Air: One C-130 or One C-141 (1 pallet position, without self-propelled vehicles)
By Road: M-35 loaded with MRSP, radios, *and* antennas,

4. **Minimal Mission Capability and Setup Timing.** One ground radio technician should have 8 W of power over 90% of the VHF and UHF tuning ranges within 4 hours.

- **Mobile Microwave Landing System - AN/TRN-45**

1. **Description.** The MMLS provides precision navigation guidance for exact aircraft alignment and descent of aircraft on approach to a selected runway by providing three-dimensional navigation guidance. It integrates azimuth, elevation angle, and range (DME) information to provide precise aircraft positioning. The components of an MMLS are similar

to an ILS. There is a glideslope antenna known as an elevation station, and a localizer antenna known as an azimuth station.

The MMLS can fulfill a variety of needs in the transition, approach, landing, missed approach and departure phases of flight. Some additional capabilities associated with MMLS include curved and segmented approaches, selectable glideslope angles, accurate three-dimensional positioning of the aircraft in space, and the establishment of boundaries to ensure clearance from obstructions in the terminal area. The azimuth coverage extends laterally to allow for proportional coverage or clearance signal to at least ±400 on either side of the runway. In elevation, coverage extends from the horizon (00) up to an angle of 150 and up to at least 20,000 feet, and in range to a maximum of 15 NM. The elevation station transmits its guidance signals on the same carrier frequency as the azimuth station. The single frequency is time-shared between angle and data function. Coverage extends to a distance of at least 15 NM. MMLS has 200 discrete channels.

The system has low susceptibility to interference from weather conditions and airport ground traffic, but has a high susceptibility to television signals.

2. **Interface.** MMLS is normally installed in a configuration quite similar to ILS; however, it is possible, if necessary because of limited space, to install all of the components together. In a standard airfield installation, the MMLS azimuth transmitter is usually located between 1,000 and 1,500 feet beyond the departure end of the runway along the runway centerline. The elevation transmitter is normally located 400 feet from the runway centerline near the approach threshold.

3. **Transportation Requirements.**

By Air: One C-130
By Road: One M-35/M-923

4. **Minimal Mission Capability and Setup Timing.** The system requires four personnel. Currently, there is no manpower assigned to the system. Special Operations Command uses Combat Controllers (operations) to install the system, and the Air Guard has embedded the system into the TACAN UTC (maintenance). Operational within 1.5 hours.

Appendix D

Navy Tactical Air Control Squadron (TACRON) Duty Positions

This appendix describes the duties of the primary air operations positions within the TACRON and its detachments.

- **Tactical Air Controller (TAC)** - The senior officer in the TACC. He is responsible for management and execution of air operations within and around the AOA. Except in very large operations, most detachment OIC will fill both TAO and TAC billets. He receives notification of and initiates SAR missions, notifying the amphibious squadron (PHIBRON) staff of fixed and rotary wing assets available. He determines the need for rescue combat air patrol (RESCAP). He also coordinates the use of airspace coordination areas. For underway operations, the TAC has overall responsibility for TACRON operations. There are three main areas that are managed by the TAC and his subordinates: helicopter coordination, air warfare and close air support (CAS). Each of these three areas is headed by a coordinator to ensure safety and mission accomplishment and are all functions of the TACC.

- **Air Support Coordinator (ASC)** - Supervises the Air Support Control Section (ASCS). Advises supporting arms coordinator (SAC) on the use of close air support aircraft.

- **Assistant Air Support Coordinator (AASC)** - Responsible to ASC. Exercises supervision and direction over all aircraft assigned to the CAS section. Monitors performance, fuel, and weaponry of CAS aircraft and recommends to ASC which units are best suited to carry out assigned missions. Assigns aircraft for strike and support missions. Advises ASC on the execution status of air support missions. Directs orbiting, air refueling, and/or return to base (RTB). Aids ASC in coordination and use of airspace coordination area (s).

- **Tactical Air Control Center Supervisor (TACC SUP)** - Ensures all air traffic services provided are safe, orderly and expeditious. Monitors all air operations and services provided in the AOA. The TACC Supervisor is qualified at all positions in the Air Traffic Control Section and has overall responsibility for the safe and expeditious handling of all aircraft operating within the AOA. The tactical air control section is normally supervised by a senior AC (TACC SUP) who has responsibility over tactical air traffic controllers (TATCs) and tactical air direction controllers. The TACC SUP is responsible for keeping the TAC and TACC watch officers informed regarding all aspects of TACC operations, from helicopter coordination to SAR operations. The TATC section is responsible for tactical air traffic control and for the dissemination of all tactical information to aircraft that check into the AOA. The TATC will pass control over to the TAD.

- **Tactical Air Traffic Controller (TATC)** - TATC is responsible for separation and coordination of air traffic during approach to, operations within, and retirement from the AOA/AOR. This function is performed normally under radar/positive airspace management conditions. The TATC, with the concurrence of TACC Supervisor, will assign entry/holding/exit points for all aircraft. He identifies and checks-in all aircraft entering the AOA, and passes the following; weather, divert, deconfliction information, changes to the expected route, altitude information, and traffic. He separates and controls all inbound and

outbound aircraft and effects handover to the tactical air director (TAD), air intercept controller (AIC), Air warfare coordinator (AWC), or to a point clear of the AOA. He coordinates with AWC all combat air patrol (CAP) arrival/departure missions. He also coordinates airspace usage for mission deconfliction and route and altitude for safety, separation, deconfliction, and efficiency.

- **Tactical Air Director (TAD)** - The TAD coordinates with the TATC as required to ensure the safe, efficient, and orderly control of tactical air traffic. TACRONs normally plan for manning of two TAD positions in operations of any size. These controllers are assigned and report to AASC, but the actual operation of coordinating the movement of strike aircraft is TATC-to-TAD direct. His duties include providing separation and direction of aircraft assigned; coordinating and deconflicting traffic situations as required; and coordinating and directing assistance during SAR and emergency operations. Passes control of CAS mission flights to the TACP for individual tasks. The TAD responds directly to tasking provided by the ASC. The ASC ensures that aircraft carrying the proper ordnance are assigned appropriate targets. This requires a thorough knowledge of the different types and uses of ordnance and also air delivery methods. The ASC passes the target location to the TAD who directs the aircraft to their assigned targets. Upon completion of the aircraft mission, the aircraft checks in with the TAD who receives the battle damage assessment (BDA) and passes this information to the ASC to determine if additional aircraft are needed to ensure target destruction.

- **Helicopter Coordinator (HC)** - A typical amphibious assault will employ multiple waves of helicopters. The HC is responsible for the coordination of all helicopter traffic within the assigned AOA. The HC passes direction to the HDC/AOCC) who provides direct radar control of the assault force helicopters. HDC/AOCC is a function of every LHA/LHD and LPH within the US Navy and provides air traffic control to the helicopters. The HC utilizes the console for monitoring the progress of the aircraft ashore. It is also the HC's function to prepare and ensure the air tasking order (ATO) is carried out and disseminated.

- **Air Warfare Coordinator (AWC)** - The air warfare section is manned by an AWC Coordinator whose responsibility it is to ensure every air contact within the area is positively identified. In the event of a hostile contact, it is the AWC's function to destroy the threat with all the assets that are available. Directly under the AWC is the air intercept control supervisor (AICS) who assists the AWC in the employment of fighter aircraft and surface to air systems through use of a senior OS who is assigned to the position of AW console operator.

Appendix E

Tactical Air Control Squadron (TACRON) Required Operational Capabilities(ROC)

This appendix contains detailed information on the required operational capabilities of the TACRONs.

Air Warfare (AW)*

1. Provide air defense in cooperation with other forces
   - Coordinate air defense planning as AW Commander (AWC) for Battle Group convoy amphibious operations
2. Provide air defense of a geographic area (zone) in cooperation with other forces.
3. Engage air targets during battle group operations in cooperation with other forces.
4. Control combat air patrol.
   - Support/conduct air intercept missions against multiple aircraft and subsurface, surface or air launched missiles
   - Provide continuous multiple air intercept control capability.
5. Coordinate the overall conduct of AW operations with all other warfare requirements of the amphibious task force (ATF) commander. Allocate air assets as required to counter threats to the ATF.

*Note: Group 2 TACRONs are not manned to support the AW Commander.

Amphibious Warfare (AMW)

1. In Amphibious Warfare provide air control and coordination of air operations in an AOA and in transit.
   - Provide air traffic control, control all air support aircraft, and coordinate helicopter operations in an AOA and in transit.
   - Provide coordination of AW, SUW and USW air assets for protection of the force in an AOA.
   - Control air search and rescue operations in AOA. Coordinate air assets in the AOA with supporting arms to provide safe, coordinated action.
2. Provide for air operations in support of amphibious operations.
   - Control aircraft under all conditions of active jamming.
   - Provide air strike control to direct or assist attack aircraft.
3. Conduct tactical recovery of aircraft and personnel (TRAP).

Surface Warfare (SUW)

1. Support surface ship defense of geographical area in cooperation with other forces.
2. Provide for air operations in support of surface attack operations.
   - Provide air strike control to direct or assist attack aircraft.
3. Perform duties of aircraft control unit (ACU) for aircraft involved in SUW operations.

Under Sea Warfare (USW)

Provide for USW defense in support of amphibious operations.

Command Control Communications (C3)

Coordinate and control the operations of the task organization or functional force to carry out assigned missions.

- Coordinate the reconnaissance of multiple surface, subsurface and/or air contacts.
- Function as AWC for force or sector.
- Function as on-scene commander for a search and rescue (SAR) operation.
- Establish a TACC and/or TADC as appropriate to support the TAO. TACC will control and/or coordinate all fixed wing air assets within the AOA and in transit.
- Establish a Helicopter Coordination Section (HCS) to support the TAO. HCS will coordinate helicopter operations within the AOA and in transit during multi-deck operations.
- Control close air support aircraft in support of amphibious operations. Control function will include coordination with other supporting arms.
- Coordinate and control air SAR operations in the AOA.
- Function as one or more of the following coordinators for force or sector: Air Element Coordinator/LAMPS Element Coordinator (LEC).
- Assist in the planning of AW, SUW and USW for the coordination of air operations in the AOA and transit.

Fleet Support Operations (FSO)

Support/conduct search and rescue operations in a combat/noncombat environment.

- Support/conduct combat/noncombat SAR operations by fixed or rotary wing aircraft.
- Acquire and display distress data.
- Report situation assessment.
- Coordinate SAR operations.
- Conduct multi-unit SAR operations.

Intelligence (INT)

1. Support/conduct unarmed reconnaissance (weather, visual, BDA, etc.)
2. Support the processing of surveillance and reconnaissance information.
3. Support the dissemination of surveillance and reconnaissance information.
4. Operate a contingency planning cell to support fleet commanders.

Mobility (MOB)

1. Operate from a ship with a helicopter platform.
2. Operate from a ship capable of supporting air control activities in support of amphibious operations.
3. Conduct operations ashore in climatic extremes ranging from cold weather to tropical to desert environments.

Noncombat Operation (NCO)

1. Under Noncombat operations provide disaster assistance and evacuation.
   - Man air traffic control facilities ashore.
2. Support/provide for the evacuation of noncombatant personnel in areas of civil or international crisis.
   - Support/conduct helicopter/boat evacuation of noncombatant personnel as directed by higher authority from areas of civil or international crisis.
   - Support/conduct day/night rotary wing aircraft operations.
   - Support/conduct rotary wing aircraft flight operations during all EMCON conditions.
3. Conduct counter narcotic and other law enforcement support operations in conjunction with other forces.
   - Conduct operations with Coast Guard Units.
4. Detect and monitor suspect air contacts.

Strike Warfare (STW)

1. Support and conduct air strikes by supporting/participating in conventional air strike operations or major air strike operations under all conditions of readiness.
2. Provide for air operations in support of air strike operations by providing control of all aircraft enroute to and returning from assigned missions.

Special Tactics Squadron (STS) Mission Tasks

This appendix contains a comprehensive list of the mission tasks that ST forces are required to perform.

- Conduct on-site assessments of as many potential target sites, assault zones, ISB/FSB/FOB locations as possible in the area of interest.
- Collect, collate and provide sufficient assault zone and airfield survey data to support timely mission planning requirements.
- Develop and provide precise, to scale computer enhanced target/assault zone/airfield diagrams, photographs and other survey products as necessary to support mission planning requirements.
- Establish and control assault zones or conduct turnover operations without interruption of terminal guidance services, at times and locations established in the mission operation order (OPORD).
- Conduct fire support and/or laser target designation operations as required in support of R&S Team and/or follow-on forces movements/operations.
- Conduct and relay limited weather observations as required to support detailed mission planning and follow-on forces requirements.
- conduct demolition operations to clear obstacles from assault zones required to support follow-on forces movements/operations.
- Provide real time intelligence/information on assault zone (s).
- Define operational parameters of assault zone (s) based on number/type of aircraft, procedures, ground plans, physical and environmental characteristics of target zone (s).
- Formulate aircraft/ground movement and parking plan in concert with ground forces commander (GFC) tactical requirements.
- Determine requirements for NAVAIDS, Beacons, portable radar equipment and assault zone lighting to assist aircraft operations in a VMC/limited IMC operational environment.
- Provide continuous tactical interface with ground forces command elements to coordinate air movement, provide timely assessments, and monitor ground movement to ensure the safe and expeditious flow of air traffic in concert with the ground tactical plan.
- Conduct SAR Security Team operations with identified ground force security element using available rotary wing assets IAW applicable SOPs and mission CSAR plan.
- Provide on-scene extrication, triage, emergency medical treatment, and enroute medical treatment during extraction IAW established medical protocols and SOPs.
- Utilize identified combat search and rescue (CSAR) platforms and plans to locate, authenticate, and recover distressed personnel as quickly as the tactical situation and safety of flight considerations permit.
- Control fixed/rotary wing CAS operations, to include AC-130 gunship operations, using pre-briefed procedures and appropriate SOPs while minimizing collateral damage to friendly personnel or structures.

Points of Contact

This appendix contains a list of the agencies that attended the JATC joint working group held at Langley AFB, VA from 28-29 January 1997.

Army

- DCSOPS Aviation - Pentagon
- HQ TRADOC - Ft Monroe, VA
- US Aeronautical Services Agency - Ft Belvoir, VA
- The US Army Air Traffic Control Activity - Ft Rucker, AL
- 29th ATS Group National Guard - Aberdeen Proving Ground, MD

USMC

- MAWTS-1 - Yuma, AZ

Navy

- COMTACGRU TWO - Little Creek, VA

USAF

- USAF/XOOS - Pentagon
- USAF Flight Standards Agency - Andrews Air Force Base, MD
- HQ ACC DOF/DOFR - Langley AFB, VA
- AFSOC/DOOF - Hurlburt Fld, FL
- 720th Special Tactics Group - Hurlburt Field, Fl

GLOSSARY

PART 1 - ABBREVIATIONS AND ACRONYMS

A2C2	Army Airspace Command and Control
AAGS	Army Air Ground System
AASLT	Air Assault
ABCS	Army battle command system
Abn	Airborne
ACA	airspace control authority
ACC	Air Combat Command; aircraft control unit
ACE	aviation combat element
ACLS	automatic carrier landing system
ACO	airspace control order
ACP	airspace control order
AFCC	Air Force component commander
AFSOC	Air Force special operations component
AIC	air intercept controller
AICS	air intercept control supervisor
ALB	airland battle
ALSA	Air Land Sea Application Center
AM	amplitude modulating
AM	amplitude modulation
AMW	Amphibious Warfare
ANG	Air National Guard
ANGLICO	air/naval gunfire liaison company
AO	area of operations
AOA	amphibious objective area
AOC	air operations center
AOCC	air operations control center
AOR	area of responsibility
ARFOR	Army forces
ARG	amphibious ready group
ASC	air support coordinator
ASR	Area Surveillance Radar
ATC	air traffic control
ATCS	air traffic control subsystem
ATF	amphibious task force
ATNAVICS	air traffic navigation, integration and coordination system
ATO	air tasking order
ATS	Air Traffic Services
AW	air warfare
AWC	air warfare coordinator
AWS	air warfare section
BAS	battlefield automated systems

BCD	battlefield coordination detachment
BDA	battle damage assessment
BDZ	base defense zone
Bn	Battalion
C2	command and control
C3	command, control, and communications
C4	command, control, communication, and computers
CAC2S	common aviation command and control system
CAIC	corps airspace information center
CAP	combat air control
CAS	close air support
CATF	commander, amphibious task force
CCG	combat communications groups
CNO	Chief of Naval Operations
COMSEC	communication security
CONUS	continental United States
CRT	cathode ray tube
CTAPS	contingency theater air control system automated planning system
DASC	direct air support center
DATCALS	Deployable Air Traffic Control and Landing Systems
Det	Detachment
Div	Division
DME	distance measuring equipment
DOD	Department of Defense
DS	direct support
DZ	drop zones
EAC	echelons above corps
EMCON	emission control
EP	electronic protection
ETVS	enhanced terminal voice switch
FAA	Federal Aviation Administration
FARP	forward arming and refueling points
FCC	flight coordination central
FEBA	forward edge of the battle area
FID	foreign internal defense
FM	frequency modulating
FM	frequency modulation
FOB	forward operating base
FSB	forward staging base, forward support battalion
FSC	fire support coordinator
FSO	fleet support operations
G3	Army or Marine Corps component operations staff officer (Army division or higher staff, Marine Corps brigade or higher staff)
GCA	ground control approach
GFC	ground forces commander

GP	Group
GPS	global positioning system
GS	general support
HC	helicopter coordinator
HCS	helicopter coordination section
HDC	helicopter direction center
HF	high frequency
HLZ	helicopter landing zones
HMMWV	high mobility mullti-wheeled vehicle
IADS	integrated air defense system
IAW	in accordance with
ICAO	International Civil Aviation Organization
IFF	identification, friend, or foe
IFR	instrument flight rules
ILS	instrument landing system
IMC	instrument meteorological conditions
INT	intelligence
ISB	intermediate staging base
IVCSS	integrate voice communication switching system
J3	Operations Directorate of a joint staff
JASC	Joint Actions Steering Committee
JATC	joint air traffic control
JCS	Joint Chiefs of Staff
JFACC	joint force air component commander
JFC	joint force commander
JMCIS	joint maritime command information system
JPALS	joint precision approach and landing system
JSOACC	Joint Special Operations Air Component Commander
JSTE	joint service training exercises
JTTP	joint tactics, techniques, and procedures
JWG	joint working group
LEC	LAMPS Element Coordinator
LHA	general purpose amphibious assault ship
LHD	general purpose amphibious assault ship (with internal dock)
LID	Light Infantry Division
LNO	liaison officer
LPD	amphibious transport dock
LPH	amphibious assault ship, landing platform helicopter
LRS	long range surveillance
LSD	landing ship, dock
LTD	laser target designators
MACCS	Marine air command and control system
MACOM	Major Command (Army)
MACS	Marine air control squadron
MAGTF	Marine air-ground task force

MAJCOM	Major Command (Air Force)
MATCALS	Marine air traffic control and landing system
MATCD	Marine air traffic control detachments
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MEF	Marine expeditionary force
MEU	Marine expeditionary unit
MEU(SOC)	Marine expeditionary (special operations capable)
MHE	materials handling equipment
MMLS	mobile microwave landing system
MMT	mobile team
MOB	mobility
MOOTW	military operations other than war
MOTS	Mobile Tower System
MRAALS	Marine remote area approach and landing system
MTTP	multiservice tactics, techniques, and procedures
NAS	Naval Air Station; National Airspace System
NATC	Navy Tactical Air Control System
NATO	North Atlantic Treaty Organization
NAVAIDS	navigational aids
NAVAIR	Naval air
NCA	National Command Authority
NCO	noncombat operation
NDB	non-directional beacon
NEA	Northeast Asia
NEF	naval expeditionary force
NEO	noncombatant evacuation
NG	National Guard
NGF	night naval gunfire
NOE	nap of the earth
NOTAM	notice-to-airmen
NVD	night vision devices
OCONUS	outside the continental United States
OIC	officer-in-charge
OPCON	operational control
OPORD	operation order
OS	operations specialist; operation system:
PHIBRON	amphibious squadron
PJ	pararescue
PSS	plans and support section
R&S	reconnaissance and surveillance
RAM	reliability, availability, and maintainability
RAPCON	radar approach control
RESCAP	rescue combat air patrol
RFC	radar final control

RGR	rapid ground refueling
RLST	remote landing site tower
ROC	required operational capabilities
RTB	return to base
SAAWC	sector antiair warfare coordinator
SAC	supporting arms coordinator
SAR	search and rescue
SATCOM	satellite communication
SAWC	sector air warfare coordinator
SINCGARS	single channel ground and airborne radio system
SLRP	Survey liaison reconnaissance party
SOF	special operations forces
SOP	standing operating procedures
SSB	single sideband mode
ST	Special Tactics
STG	special tactics group
STS	special tactics squadrons
STT	special tactics teams
STW	Strike Warfare
SUW	Surface Warfare
SWA	Southwest Asia
TAB	theater air base
TAC	Theater Air Control System
TACAN	tactical aid to navigation
TACC	tactical air operations center
TACGRU	tactical air control groups
TACRON	tactical air control squadron
TACS	theater air control system
TACT	tactical aviation control team
TAD	tactical air direction
TAGS	Theater Air/Ground System
TAIS	Tactical Airspace Integration System
TAO	tactical air officer
TAOC	tactical air operations center
TATC	tactical air traffic controllers
TCA	terminal control area
TERPES	Tactical Electronic Reconnaissance Processing and Evaluation System
TERPS	terminal instrument procedures
TLZ	tactical landing zone
TRAP	tactical recovery of aircraft and personnel
TRV	tower restoral vehicle
TTCS	tactical terminal control system
UHF	ultra high frequency
UIC	unit identification code (Army)

USAREUR	United States Army Europe
UTC	unit type code (Air Force)
V/STOL	vertical/short take-off and landing
VFR	visual flight rues
VHF	very high frequency
VIDS	video information display system
VMC	visual meteorological conditions
WESTPAC	Western Pacific
WIC-P	wing initial comm package

PART II - TERMS AND DEFINITIONS

Deployment Phases.

a. **Initial deployment.** Initial deployment begins with securing and establishing an airdrome to receive aircraft using small, lightweight communications and marking equipment. Initial services will include visual flight rules ATC services up limited instrument flight rules services using man-portable NAVAIDs equipment (ex. TRN-41 TACAN)

b. **Follow-on deployment.** Follow-on deployment begins within 5 to 15 days with the arrival of ATCALS packages that provide the communications capability necessary to interface and or establish a capability to support squadron flying operations. The package augments initial communications package s to expand the capability to operate bare base until permanent communications are installed

c. **Sustaining deployment.** Sustaining deployment requires ATCALS packages that provide required IFR capability up to and including dual runway precision approach capability. These packages also ensure a stable theater ATC system to support wing flying operations.

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