FEDERAL AVIATION ADMINISTRATION IMPACT ON MILITARY AIR TRAFFIC CONTROL FORCE PROJECTION

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

ALAN C. DORWARD, MAJ, USAF
B.S., California State University, Fresno, California, 1985

Fort Leavenworth, Kansas
1996

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (*Leave blank*)

2. REPORT DATE
7 June 1996

3. REPORT TYPE AND DATES COVERED
Master's Thesis, 2 Aug 95 - 7 June 1996

4. TITLE AND SUBTITLE

Federal Aviation Administration Impact On Military Air Traffic Control Force Projection.

5. FUNDING NUMBERS

6. AUTHOR(S)

Major Alan C. Dorward, U.S. Air Force

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, Kansas 66027-1352

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

DTIC QUALITY INSPECTED 4

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release, distribution unlimited

12b. DISTRIBUTION CODE

A

13. ABSTRACT (*Maximum 200 words*)

The United States (US) has changed its military strategy to force projection instead of forward basing. Key to the US strategy is the ability to rapidly secure an aerial port of de-embarkation and basing of state-side combat and support aircraft. A key requirement for successful military operations is adequate air traffic control equipment and trained personnel to enable all-weather, around-the-clock, arrival and departure of aircraft. The entire Department of Defense (DOD) air traffic control (ATC) force is trained to Federal Aviation Administration (FAA) standards and controls 25 percent of the aircraft in the US. Military controllers are trained and work at the same level as FAA controllers to deploy for contingencies and war. This study investigates the impact of future changes to air traffic control in the US as a result of the capital investment plan for the national airspace system. This study then looks at the requirements for the deployable military ATC force. This study examines whether the DOD ATC force is adequately prepared to support the national military strategy in light of training to the same standard as the FAA and recommends training and force structure measures to insure that the DOD ATC mission is successfully carried out.

14. SUBJECT TERMS
Federal Aviation Administration Air Traffic Control, Military Air Traffic Control Capabilities, Capital Investment Plan

15. NUMBER OF PAGES
96

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to *stay within the lines* to meet *optical scanning requirements*.

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C	Contract	PR	Project
G	Grant	TA	Task
PE	Program Element	WU	Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

- **DOD** - See DoDD 5230.24, "Distribution Statements on Technical Documents."
- **DOE** - See authorities.
- **NASA** - See Handbook NHB 2200.2.
- **NTIS** - Leave blank.

Block 12b. Distribution Code.

- **DOD** - Leave blank.
- **DOE** - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
- **NASA** - Leave blank.
- **NTIS** - Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

FEDERAL AVIATION ADMINISTRATION IMPACT ON MILITARY AIR TRAFFIC CONTROL FORCE PROJECTION

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

ALAN C. DORWARD, MAJ, USAF
B.S., California State University, Fresno, California, 1985

Fort Leavenworth, Kansas
1996

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: MAJ Alan C. Dorward

Thesis Title: Federal Aviation Administration Impact on Military Air Traffic Control Force Projection

Approved by:

________________________, Thesis Committee Chairman
Robert D. Walz, M.A.

________________________, Member
MAJ Steven F. Miller, M.S.

________________________, Member, Consulting Faculty
LTC James C. McNaughton, Ph.D.

Accepted this 7th day of June 1996 by:

________________________, Director, Graduate Degree Programs
Philip J. Brookes, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

FEDERAL AVIATION ADMINISTRATION IMPACT ON MILITARY AIR TRAFFIC CONTROL FORCE PROJECTION by MAJ Alan C. Dorward, USAF, 96 pages.

The United States (US) has changed its military strategy to force projection instead of forward basing. Key to the US strategy is the ability to rapidly secure an aerial port of de-embarkation and basing of state-side combat and support aircraft. A key requirement for successful military operations is adequate air traffic control equipment and trained personnel to enable all-weather, around-the-clock, arrival and departure of aircraft.

The entire Department of Defense (DOD) air traffic control (ATC) force is trained to Federal Aviation Administration (FAA) standards and controls 25 percent of the aircraft in the US. Military controllers are trained and work at the same level as FAA controllers to deploy for contingencies and war. This study investigates the impact of future changes to air traffic control in the US as a result of the capital investment plan for the national airspace system. This study then looks at the requirements for the deployable military ATC force. This study examines whether the DOD ATC force is adequately prepared to support the national military strategy in light of training to the same standard as the FAA and recommends training and force structure measures to insure that the DOD ATC mission is successfully carried out.

ACKNOWLEDGMENTS

I would like to acknowledge the help and contributions of Major Morris Spence of the Air Force Flight Standards Office for his sponsorship of my research efforts in allowing me to attend the Headquarters USAF Deployable Air Traffic Control and Landing Systems meeting at Fort Monroe, Virginia, on 14 March 1996.

I would like to thank Major Dave Bearden of the Secretary of the Air Force Planning Office for his arrangement of interviews and meetings with key officials at the Pentagon involved in ATC plans and programs.

I would like to thank Major Greg Grove, USMC, at the Marine Corps Headquarters Naval Annex, Washington, D.C. for providing background information on the present and future plans and capabilities of Marine Corps ATC services.

Finally, I would like to thank my lovely bride of nine months, Rita, whose patience was tested by review and rewrites of complete chapters of this thesis.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

In 1990, a rapid series of major world events caused United States (US) political and military leaders to review the nation's National Security Strategy and National Military Strategy. With the Soviet threat removed, the large force structure the United States possessed to defeat or prevent Soviet aggression was viewed with skepticism by a budget conscious civilian government. The military budget and force structure could now be reduced. The National Military Strategy of the United States released in January of 1992 proposed that due to a decreasing world military threat, the United States could reduce some of its force structure but still be prepared to respond to threats throughout the world.

> As we reduce and restructure our armed forces in recognition of the realities of the 1990s, it is important to preserve a core of capability to deter aggression, provide meaningful presence abroad, respond to regional crises, and rebuild a global war fighting capability.[1]

When Les Aspin became Secretary Of Defense in early 1993, one of his first tasks to the Department of Defense (DOD) was to conduct a complete bottom-up review of defense roles, missions, and force structures. He listed four key areas that US defense programs must be prepared to deal with: (1) the dangers of nuclear proliferation; (2) the dangers of regional conflicts; (3) the dangers to democracy; and (4) the dangers of a weak economy.[2]

Secretary Aspin's bottom-up review shifted the US military to a heavier reliance on the concept of power projection as opposed to forward basing US forces permanently overseas. This concept became a theme of the United States Military Strategy.

> With fewer US forces permanently stationed overseas, we must increase our capability to project forces abroad. Credible power projection capability compliments our overseas presence in acting as a deterrent to potential adversaries. Effective power projection capabilities also provide greater flexibility in employing military force. Coupled with overseas forces, the ability to project tailored forces through rapid, strategic mobility gives national leaders additional time for consultation and increased options in response to potential crises and conflicts.
>
> Power projection is essential for performing the required tasks of all components of strategy, however, it is most critical in the deterrence and conflict prevention and warfighting portions of our military strategy.[3]

General Colin Powell, then Chairman of the Joint Chiefs of Staff, noted during his portion of the Defense Department briefing at the Pentagon that the US would "have to focus on being able to project power anywhere in the world rapidly and not just this massive surge of force across the Atlantic."[4]

The military strategy now in place thus relies on US military abilities to respond quickly to major regional conflicts, as was demonstrated in the Gulf War, and to support peace keeping as in Bosnia, peace enforcement as is being conducted by NATO forces in support of the Bosnia peace accord, preventive diplomacy as in Haiti, humanitarian relief as in Rwanda, and disaster relief operations as in Hurricane Andrew. A force projection defense strategy relies heavily on strategic airlift to move combat forces from their bases in the US to the contingency region. These combat forces must be alerted, moved within the US to a port of de-embarkation, and deployed to the area of operations using strategic airlift. Then they must secure a lodgment airbase and build from scratch or augment airbase capabilities so that combat capability can be built at the airbase, and they can then conduct military operations from the airbase.

The use of airports in a contingency area for strategic airlift, air superiority, or aerial bombardment is a key requirement of US military power projection strategy. For these aircraft to be able to operate effectively 24 hours a day, a capable air traffic control system must be placed in the contingency area. United States military forces must continue to have the equipment and trained personnel to provide navigational aids, radar approach control, control tower services and procedures.

Gaining access to a lodgment airbase in a contingency area can be unopposed or encouraged, as occurred during Operation Desert Shield, where US forces entered the contingency theater peacefully with the assistance of the host nation. However, Saudi Arabia and the Persian Gulf region did not possess the mature national airspace systems (NAS) found in the US and Europe. This required large augmentation of equipment and personnel to their NAS in order to handle the large influx of aircraft into their country. This occurred as the US and coalition partners transitioned from power projection force to defend Saudi Arabia to a force in place to expel Iraq from Kuwait. The airbases were the first locations that the United States and coalition partners could rapidly deploy to, and provide a credible military defense for Saudi Arabia. The airbases were also from where the coalition partnership first struck Iraqi forces to end Iraq's occupation of Kuwait.

On the other hand, the establishment of airbases to support military operations in a contingency area can be lethal and violent as occurred during Operation Just Cause. In that operation, the national airspace system of Panama was destroyed to allow US forces to overwhelm the Panamanian Defense Forces. But to sustain the operation, the Panamanian NAS had to be recreated and controlled by US forces within the first hours of the battle to allow captured airfields to be used to support delivery of power projected forces from the United States. In this operation, airbases were used to mass combat power and to quickly overwhelm any Panamanian military force actions.

United States military forces have been providers of air traffic control services in the US and throughout the world as long as aviation has been in existence. The military operated independently from the Government run air traffic control operations. The need for ATC was still considered small even when the <u>Civil Aeronautics Act</u> created the Civil Aeronautics Authority in 1938.[5] The present system traces its real beginnings to the end of the Second World War. This period saw a tremendous growth in the training of pilots and the production of aircraft. At war's end, the idea of commercial aviation replacing bus, rail, or ship transportation of people was a vision seen by many entrepreneurs. Airplanes were no longer a curiosity, but an everyday occurrence. Many World War II soldiers, now civilians, had been transported by air during the war. Additionally, the aviation manufacturing industry felt the transition from producing bomber aircraft to commercial passenger transports could be easily accomplished. The skies were showing signs of overcrowding with civilian and military aircraft that wanted to fly day and night, regardless of the weather.

The Federal Aviation Act of 1958 created the Federal Aviation Agency responsible for ensuring the safe and efficient use of the nation's airspace.[6] In 1967, the act was amended and renamed the Federal Aviation Administration (FAA), placing it under the new Department of Transportation.[7] The FAA administrator was now placed under the Secretary of Transportation, which is a cabinet-level position. Besides being responsible for air traffic control, the transportation secretary was additionally made responsible for creating a climate that encourages continual development of civil aeronautics. The Department of Transportation (DOT) authorizes the FAA and the DOD to provide air navigation services for in-flight navigation, access to the airway system, and guidance in the approach and landing phases of flight.

These tasks are performed in the National Airspace System. The National Airspace System is a network of airports, airways, air navigation facilities, terminal control areas, and enroute air traffic control systems. The network includes surveillance systems, communications, avionics, weather information services, navigation aids, and computer systems. Aeronautical regulations and procedures guide personnel that manage and control the airspace under US jurisdiction.

The armed forces of the United States train, equip, and sustain an air traffic controller force that control 25 percent[8] of the aircraft flown in the US on a daily basis. Additionally, they will be required to respond to a variety of conflicts as well as contingencies because their military response options have shifted from forward basing to force projection. The air traffic controller force must increase its own force projection capability to remote airfields in countries where the ATC infrastructure and NAS are designed to handle limited numbers of commercial and military aircraft. In a matter of weeks, airports that had 50 aircraft takeoff and land daily may be required to handle over 1,000 aircraft. In addition, the FAA expects military air traffic controllers to backfill for striking civilian air traffic controllers as occurred in 1981. The FAA also continues to rely on military ATC equipment and controllers to replace or augment any of their navigation or control facilities if they become unusable.

The FAA continues to computerize and modernize the ATC system in an effort to minimize delay to commercial airliner traffic. The updating of the system attempts to automate the flow of aircraft, thereby increasing the number of individual aircraft a single controller can monitor and reducing the number of air traffic controllers in a given ATC facility. With an automated system, the amount of airspace a single controller is responsible for has increased, and that controller has become dependent on computer-generated information to control the aircraft within that airspace. If the computer in a facility becomes inoperable due to a power failure or natural disaster, the airspace is closed and aircraft are not allowed into or out of the designated airspace.

Military controllers do their initial, advanced, and proficiency training in the United States inside the FAA system. Yet, military controllers must be able to handle similar volumes of aircraft traffic found at Chicago O'Hare or Los Angeles International Airports without the reliance on the automated and integrated computer-based system on which they were trained. Military aircraft do not operate in the same manner as civilian aircraft. The airspace cannot be closed due to equipment failure, especially in a combat environment. Thus, military controllers are trained to control aircraft in their minds and "keep a mental picture" as opposed to having it presented to them through computer graphics.

Since 1981, the FAA has set in motion a plan to enhance the National Airspace System. This system incorporates all airports, airways, radar terminal control areas, and enroute radar control systems in a complex network. Presently, facilities are primarily inter-connected with various computer data interfaces that are heavily reliant on controller input and voice backup to facilitate interior facility connectivity. The Capital Investment Plan and National Airspace Plan calls for modernizing the ATC system. This will require increasing integration of all air traffic control functions into a computer-based complex. This system will place a premium on data interface through several overlapping media that are primarily monitored by controllers for conflicts. The system envisioned will have enough back-up capacity and overlap to ensure that ATC service will not be interrupted. The result is a growing divergence between the FAA and the needs of the military air traffic control system. This leads to the thesis primary research question.

Thesis Question

This thesis investigates whether the Federal Aviation Administration's Capital Investment Plan (formerly the National Airspace Plan) adequately considers military air traffic control training and operational requirements to support force projection operations. The primary thesis question is broken down into four secondary questions. The first of these questions is: How has the airspace system evolved in the US (chapter 2)? The second question is: What are the operational requirements that drive training requirements for military ATC personnel (chapter 3)? The third question is: How has the US deployed ATC assets to support force projection of US military forces (chapter 3)? The final question is: What impact has this evolved system had on the military (chapter 4)?

Key Terms

Army Airspace Command and Control (A2C2). The A2C2 system is responsible for promoting the effective and safe, yet flexible, use of airspace within the Army's area of interest on the battlefield.[9]

Airport Traffic Area. Unless otherwise specifically designated, that airspace within a horizontal radius of five statute miles from the geographic center of any airport at which a control tower is operating, extending from the surface up to, but not including an altitude of 2,500 feet above ground level elevation of the airport.[10]

Airspace Control Area. Airspace that is laterally defined by the boundaries of the area of operations, either aircraft or ATC.[11]

Airspace Control Boundary. The lateral limits of an airspace control area.[12]

Air Traffic. Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas. All aircraft in flight or operating on the maneuvering area of an airdrome.[13]

Air Traffic Control (ATC). A service operated by appropriate authority to promote safe, orderly and expeditious flow of air traffic.[14]

Air Traffic Control Service. A service provided for the purpose of:

1. Preventing collisions:

   a. Between aircraft; and

   b. On the maneuvering area between aircraft and obstructions; and

2. Expediting and maintaining an orderly flow of air traffic.[15]

Controlled Airspace. An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.[16]

Ground Controlled Approach. A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR).[17]

Instrument Flight Rules (IFR). A set of rules governing the conduct of flight under instrument meteorological conditions. Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.[18]

Instrument Landing System (ILS). A precision instrument approach system which normally consists of the following electronic components and visual aids, localizer, glideslope, outer marker, middle marker, and approach lights.

Instrument Meteorological Conditions. Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than specified for visual meteorological conditions.[19]

National Airspace System. The common network of US airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.[20]

Terminal Radar Approach Control Facility (TRACON). Refers to the particular facility that contains the approach control and terminal control tower in a single location or building.[21]

Terminal Control Area (TCA) or Terminal Radar Service Area (TRSA). This service provide in addition to basic radar service, sequencing of all IFR and participating VFR aircraft to the primary airport, and separation between all participating VFR aircraft. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the defined area as TCA or TRSA. Participation is mandatory for all VFR aircraft in a Class B TRSA and optional for all VFR aircraft in a Class C TRSA. But a VFR aircraft must still be in radio contact with the facility providing Class C service.[22]

Visual Flight Rules. Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate the type of flight plan.[23]

Visual Meteorological Conditions (VMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.[24]

Purpose and Methodology

Having stated the requirement for military ATC in support of US National Military Strategy of force projection, this thesis investigates the impact of FAA changes in ATC procedures on military air traffic control capabilities in the United States and while deployed in support of US and coalition forces for contingencies such as peace keeping or combat operations.

The method of research used is a comparison of the FAA's vision, needs, and uses of ATC with that of the military's. The two sets of needs and solutions are compared to extract contrasts that impact on military requirements for deployable ATC in support of force projection operations. This comparison will show that the FAA's present uses and future vision for ATC are going in a different direction then the needs and uses for military ATC.

Document research has been combined with interviews of individuals who possess subject matter expertise. The thesis author's own personal experience is added to clarify certain points and aid in topic transitions. These three areas are combined to create this thesis.

Thesis research investigates how the Capital Investment Plan for the national airspace system has, and will continue to affect the training of military ATC personnel in the National Airspace System. This paper will not address elimination of separate and distinct ATC training for each service; that is a separate issue. Discussion will not be included on how the Capital Investment Plan will require military aircraft to be equipped or how new airspace procedures will affect military aircraft operations. The thesis is limited to how it will affect air traffic controllers and how they will perform. This thesis does not consider combat airspace management as a whole, but centers on the defined needs for capable, trained military personnel to provide ATC services in a variety of military deployment contingencies.

This thesis does not include Naval ATC. The United States Navy trains and maintains a controller force for home-station, land-based operations, and carrier sea duty operations. Navy controllers train and operate the same way as FAA controllers, and they maintain and operate land-based tower and radar approach control operations. Navy controllers are uniquely trained to provide ATC services tailored to carrier battle group operations in open ocean, devoid of airways and land mass. The Navy's ATC force does not train to establish an airspace system of terminal areas and airways as does the Army, Marine Corps, and Air Force. Naval ATC equipment is a permanent fixture on the ships from which naval aviation conducts force projection operations.

Literature Review

Research for this thesis is based on documents, publications, and military regulations that address the primary and secondary thesis questions. Few specific publications address the military requirements for training deployable ATC units to operate outside of a nation-wide computer-based ATC complex. This thesis addresses a topic that has yet to be extensively studied.

The purpose of the Capital Investment Plan and the National Airspace Plan is to set forth the FAA's vision on how to upgrade the National Airspace System. These upgrades have significantly changed air traffic control procedures and airspace configuration since 1978. A review of plans dating back to 1970 has shown the emerging ideas, regulations, and equipment trends that the FAA has taken in upgrading equipment, changing ATC staffing, and changing airspace configuration to support the FAA's vision of the anticipated air traffic control workload.

Other FAA published documents have added to or clarified specific points in the National Airspace Plans and the Capital Investment Plan. These documents specifically address topics such as the Proposed System's Effectiveness and Operational Concept, Air Traffic Control and Airspace Management Operational Concept, Airport Movement Area Control Operational Concept, and Airspace System Approach and Departure Sequencing Operational Concept. These documents lay out specific procedures that have become ATC regulations and changed the way aircraft are controlled in the United States. The document research to date has found that the FAA makes changes to ATC procedures without regard to military ATC force projection requirements.

Air traffic control in itself is considered a support function in each of the military services. Each service has its own manuals on training, equipping, and deploying ATC assets and personnel based on FAA operational concepts or ATC support of military force projection operations. The US Air Force has the preponderance of ATC equipment, controllers, and force projection capability. For that reason, the Air Force has been the lead agency for coordinating military ATC integration with the FAA. Studies conducted by the Air Force civilian contractors have only predicted the impacts and costs that military ATC facilities and operations will have to undergo to upgrade the DOD facilities that control 25 percent of all aircraft in the United States.

The United States General Accounting Office (GAO) has conducted several reviews of the FAA's National Airspace Plans and their associated systems. These documents fully investigate the progress the FAA has made in attaining its spelled out goals. These reports have shown that, despite the FAA's best intentions, the technological and system upgrades have not been attainable, practical, or cost effective. FAA ATC regulations have been implemented based on ATC system upgrades that cannot or have not been performed.

Several military and general aviation technology magazines have published a variety of articles dealing with civilian and military ATC, from how ATC training is conducted to proposed regulation changes. Several articles are dedicated to integration of DOD requirements into the capital investment plan.

The airspace in the United States is a national asset that is shared equally by US citizens, businesses, and the military. Since the 1930s, civilian Federal government agencies, in conjunction with the military, have been charged with improving the safety of air travel for the nation's citizenry. In addition, the airspace that is regulated and controlled by the FAA is a major training arena for the US military forces that protect US national interests. The ATC system has evolved in the US to serve civilian and military needs. Changes will be made to the ATC system by the FAA. The potential effects on US military force projection capabilities deserves closer study.

Endnotes

[1]Joint Chiefs of Staff, National Military Strategy of the United States 1992 (Washington, D.C.: Joint Staff, January 1992), 17.

[2]Les Aspin and General Colin Powell, Transcript of Defense Department Briefing on Bottom-Up Review, 1 September 1993, Federal News Service, Washington, D.C., 2.

[3]Joint Chiefs of Staff, National Military Strategy of the United States 1995 (Washington, D.C.: Joint Staff, January 1995), 7.

[4]Les Aspin and General Colin Powell, Transcript of Defense Department Briefing on Bottom-Up Review, 1 September 1993, Federal News Service (Washington, D.C.), 10.

[5]John R. M. Wilson, Turbulence Aloft (Washington: Government Printing Office, 1979), iv.

[6]US General Accounting Office, Report to the Chairman, Subcommittee on Transportation, Committee on Appropriations, House of Representatives, Air Traffic Control, Continued Improvements in FAA's Management of the NAS Plan (Washington: Government Printing Office, 1988), 10.

[7]Alexander T. Wells, Airport Planning and Management (Blue Ridge Summit, PA: Tab Books, 1992), 16.

[8]EER Systems Corporation, Department of Defense, Headquarters, Electronic Systems Division, United States Air Force Systems Command, Air Traffic Control and Airspace Systems Interface with the National Airspace System (Vienna: Virginia, 1989), 1-1.

[9]U.S. Army, FM 100-103-1, ICAC2, Multi Service Procedures for Integrated Combat Airspace Command and Control (Washington D.C.: Department of the Army, October, 1994), A-1.

[10]Federal Aviation Administration, Department of Transportation, Airman's Information Manual (Washington: Government Printing Office, 1996), A-5.

[11]Joint Chiefs of Staff, JCS Pub 1-02, Department of Defense Dictionary of Military and Associated Terms (Washington: Government Printing Office, 1994), 21.

[12]Ibid., 21.

[13] Federal Aviation Administration, Department of Transportation, Airman's Information Manual (Washington: Government Printing Office, 1996), A-6.

[14]Ibid., A-6.

[15]Ibid.

[16]Ibid., C-4.

[17]Ibid., G-2.

[18]Ibid., I-2.

[19]Ibid.

[20]Ibid., N-1.

[21]Ibid., 5-4-1.

[22]Ibid., T-2.

[23]Ibid., V-2.

[24]Ibid., V-3.

CHAPTER 2

EVOLUTION OF THE NATIONAL AIRSPACE SYSTEM

This chapter will address the secondary question of how the United States airspace system has evolved due to the needs of private, civilian, and military requirements. It is important to understand that air traffic control (ATC) as a key part of the national airspace system, is supposed to serve the needs of private, commercial, and military users. Changes to the national airspace system, and particularly ATC, have been in response to public concern or operational requirements based on the needs of one of the three airspace users.

The beginnings of the present air traffic control system and the national airspace system can be traced back to the early fledgling commercial aviation industry. The young aviation businesses lobbied the federal government to come up with federal regulations that would aid the commercial aviation industry in reaching its envisioned fuller potential. The Air Commerce Act of 20 May 1926, charged the Secretary of Commerce with creating a climate which would foster air commerce.[1] The key objectives were to establish, improve, and maintain safety standards that would rid aviation of its barnstorming image. Air traffic rules were issued and enforced, pilots licensed, aircraft certified, and airways established. Aids to aircraft navigation in the form of radio beacons were sited, operated, and maintained along newly established airways and at airports. All of these duties were entrusted to the department's Aeronautics Branch, later renamed the Bureau of Air Commerce.[2]

In 1936, the Department assumed the important new task of air traffic control.[3] These new air traffic controllers used maps, blackboards, and mental calculations to track aircraft traveling along designated airway routes. Controllers communicated with each other between aircraft departure and arrival locations by telephone and telegraph wire stations to ensure safe separation of aircraft between the busiest airports in the United States.[4]

In 1938, the Civil Aeronautics Act transferred the federal government's civil aviation role from the Commerce Department to a new, independent agency, the Civil Aeronautics Authority (CAA).[5] The legislation also expanded federal civil aviation authority by giving the government the power to issue air carrier route certificates and regulate airline fares.[6]

During the first 18 months, a number of organizational differences arose within the CAA.[7] In 1940, President Roosevelt used his authority and split the CAA into two agencies. The Civil Aeronautics Board (CAB) was to have power in safety rulemaking, accident investigation, and economic regulation of commercial airlines.[8] The term CAA was changed to Civil Aeronautics Administration. The new CAA was given responsibility for ATC, airman and aircraft certification, safety enforcement, and airway development.[9]

As America prepared to enter World War II, the CAA began to extend its ATC responsibilities to control of takeoffs and landings at airports. The application of primary radar systems to aid controllers at several of the busiest commercial airports increased the level of flight safety and allowed for more efficient movement of aircraft into and out of terminal airspace.[10]

The postwar years saw a boom in aviation. Coupled with an increase of military aviation to protect the skies over the United States and the federal government plan to aid in the funding of airports, several high level government officials feared that US skies were not being properly managed. The Bureau of the Budget appointed William B. Harding to form a committee to review the projected equipment, personnel, and legislative needs to insure safe skies. The Harding Committee Report was completed in 1955. The report stated that the need to improve air traffic management had already reached critical proportions.[11] The commission recommended that a person be appointed and that this person be directly responsible to the President for developing a program to solve the complex technical and organizational problems facing the government and the aviation industry. President Eisenhower appointed Edward Curtis as his special assistant for aviation facilities planning. Mr. Curtis was tasked to develop a comprehensive plan for meeting the needs identified in the Harding report by the most economical means.[12]

Edward Curtis submitted his plan to the President on 10 May 1957. The Aviation Facilities Planning Report warned of a crisis in the making. The report outlined that the present airspace management system could not cope with the complex pattern of civil and military air traffic that was in the sky. The growing airspace congestion was inhibiting military defense of the nation and slowing the progress of air commerce.[13] The plan concluded that many excellent plans and efforts for improving the national airspace system had failed because the federal agencies responsible for this effort had failed to keep pace with aviation's needs as its usage by the public, military, and private individuals grew.[14] Curtis recommended the establishment of an independent federal aviation agency "into which are consolidated all the essential management functions necessary to support the common needs of the military and civil aviation of the United States."[15]

The report submitted by Mr. Curtis was eagerly anticipated by President Eisenhower. While it was being completed, one of the worst aviation accidents, to that time in the United States, occurred on 10 May 1957. A Trans World Airlines Lockheed Super Constellation and United Airlines Douglas DC-7 collided over the Grand Canyon in Arizona killing 128 people.[16]

Congress was receptive to the ideas contained in the Aviation Facilities Planning Report to resolve the present crisis perceived by the public and businesses alike over crowded skies. The coming of increased commercial jet traffic fanned public concerns. While not fully sold on the idea of creating an independent agency, Congress felt something had to be done immediately.[17]

Congress approved the Airways Modernization Act of 1957 on 14 August 1957, as recommended by the Curtis plan. This act created a board to "provide for the development and modernization of the national system of navigational and air traffic control facilities to serve present and future needs of civil and military aviation."[18] However, the Curtis plan advocated that this board should only be a stopgap measure until an independent government agency could be created. Congress did not anticipate nor appreciate the need for the board to remain in place indefinitely. The Airways Modernization Act had an expiration date of 30 June 1960.[19]

On 20 May 1958, a civilian transport plane and a military jet trainer collided over Brunswick, Maryland, killing 12 people and becoming the third major aviation incident in the skies over the United States in three and one half months.[20] This tragedy spurred the Congress and the rest of the federal government into action to establish a permanent, comprehensive federal aviation agency. Due to the magnitude of public and aviation industry outcry, there was a stampede in Congress to enact legislation.[21] Instead of taking the two or three years to create and establish a separate aviation agency, President Eisenhower signed the Federal Aviation Act of 1958 on 23 August 1958.[22]

This legislation transferred the CAA's functions to a new independent body, the Federal Aviation Agency (FAA). The Civil Aeronautics Board's safety rulemaking and enforcement authority were also transferred to the FAA. But the new FAA was given wider reaching powers to combat aviation hazards it identified. The CAB remained an independent body, retaining its remaining functions, primarily aircraft accident investigation.[23]

The Federal Aviation Act of 1958 contained three major pieces that affected air traffic control and are spelled out in Section 103 of the act. This act is still in effect today and forms the cornerstone of FAA policy formulation.

1. The regulation of air commerce in such a manner as to best promote its development and safety and fulfill the requirements of national defense.

2. The control of the use of navigable airspace of the United States and the regulation of both civil and military operations in such airspace in the interest of the safety and efficiency of both.

3. The development and operation of a common system of air traffic control and navigation for both military and civil aviation.[24]

In 1966, President Johnson pushed for legislative authority for a new cabinet department that would combine all major federal transportation responsibilities. His move was in response to a general belief by business and industry that a single consolidated organization could meet the nation's need for "integrated systems and policies to facilitate the movement of goods and people."[25] The result was the Department of Transportation (DOT), which began operations on 1 April 1967. The Federal Aviation Agency was downgraded to the Federal Aviation Administration. Although the administrator of the FAA was still appointed by the President, the administrator now had to report to the Secretary of Transportation who headed the DOT. The CAB was dissolved and the National Transportation Safety Board (NTSB), which was created with the DOT legislation, assumed responsibility for investigation of aircraft and ATC incidents.[26]

By the mid-1970s, improvements in air traffic control had progressed at an even pace in the regulated skies. Congestion and delays at airports were due mostly to weather, which today still has not been conquered. Most of the large airports had been integrated into a semi-automated ATC system based on a marriage of secondary radar systems and computer technology. The automation of certain tasks allowed more efficient use of the regulated air traffic on the airway routes. But this system was about to change with the Airline Deregulation Act of 1978.[27] Although the need to upgrade and enhance the national airspace system was recognized, the agency was consumed with responsibilities not originally envisioned by the Federal Aviation Act. The rash of aircraft hijackings involved the agency in the field of aviation security.[28] In 1968, Congress made the FAA responsible for prescribing aircraft noise standards.[29] The Airport and Airway Development Act of 1970 made the FAA responsible for a new airport aid program funded by a special aviation trust funded by a tax on individual airline tickets paid by consumers.[30] The same act put the FAA in the position of determining which airports met minimum FAA safety standards. The FAA would then issue operating certificates to air carrier airports that met their standards.[31] Coupled with frequent changes in leadership, the FAA's focus was not clearly on improving air traffic control equipment, procedures, or hiring enough personnel to meet the anticipated demands of airline deregulation.

The Airline Deregulation Act of 1978 showed that the present national airspace system could not handle the new competitive airline strategies of providing airline service to the most popular locations. Airlines were no longer regulated as to which airports they could fly. The busiest airports saw their aircraft workload double in a matter of months. The immediate impact was the realization that the ATC system could not handle the demand. There were not enough trained and experienced controllers and the ATC equipment was inadequate.[32]

Beginning in 1978, the FAA conducted a national airspace review with the results published in January 1982 as the first National Airspace System (NAS) Plan.[33] But the pace of modernization to the ATC system was competing with other more politically sensitive issues. Feeling that FAA management was unresponsive to the safety, working conditions, and manning concerns expressed by the ATC controllers, the Professional Air Traffic Controllers Organization (PATCO), with over 11,000 controller members, went on strike in August 1981.[34] To keep the airway system open was a challenge. Within hours, military controllers and FAA managers manned the ATC facilities. Special aircraft flow restrictions were put in place to keep the national airspace system operating. The efforts were deemed a success and President Reagan fired all strike participants. The strike effects lasted until the spring of 1984 when enough new controllers were hired and in place so the last of the aircraft flight restrictions could be lifted.[35]

The 1982 National Airspace System Plan called for installing more powerful computers at air route control centers, improving air-to-ground radar surveillance and communications, and revamping terminal and enroute control systems. The plan was to make the improvements over a five-year period. Almost immediately the plan fell behind schedule. The FAA realized that the DOD, which controlled 25 percent of the air traffic in the NAS, had not been included in the original modernization plans.[36] The need for military ATC, air navigation, and airspace management systems to interoperate with the FAA systems was recognized formally in the September 1989 NAS plan update.[37]

This point in the evolution of ATC in the national airspace system carried a significant change in the way the FAA and the DOD would interface on ATC. Until 1989, the FAA and the DOD developed, procured, and installed ATC systems independently of one another. Military controllers operated the equipment to the same FAA regulations and operating procedures. The difference in equipment development and use was based on the different operating requirements of aircraft the ATC systems served. Military systems were not nearly as automated as the FAA systems. Automation equipment was not deemed appropriate for many of the military ATC operating procedures. Military aircraft flight training and aerial maneuvers are not as standardized as civilian aircraft so they do not lend themselves easily to ATC automation. To ensure system interface and commonality of service to any aircraft controlled by military radar approach control or control tower locations, the DOD uses more controllers to provide safe and expeditious ATC services that accommodate military and civilian aircraft.

The 1989 National Airspace System Plan developed by the FAA called for the integration of all ATC systems into the fully computerized system architecture. The DOD was placed in the position of integrating into the future NAS to provide seamless ATC service to all users as the FAA envisioned, or lose much of the airspace it needed to conduct military training and readiness exercises. The DOD agreed to purchase and install equipment and operate it the same way as the FAA. Military ATC facilities will be fully integrated into the fully automated national airspace system architecture.

The programming for improvements for all ATC system upgrades and equipment development was to be completed by 1992. Installation of all components was to be completed throughout the NAS by 1999. But by 1990, the FAA's plan was two-and-one-half years behind schedule and had already spent $12 billion. This amount was twice the original budget. Now the forecast was to spend at least $27 billion.[38]

These costs and delays can be attributed to the FAA's lack of experience in large-scale procurement contracts.[39] This caused the FAA to underestimate the complex technical requirements and the costs associated with those requirements. In 1990, the NAS plan was wrapped into a new Capital Investment Plan. This change in planning and procurement for the automation of the national airspace system was a shift in FAA policy that recognized an airspace system must be continually improved over time as opposed to mass improvements identified in a five-year plan. Since the needs of ATC will always evolve, so will the technology improvements required to meet those needs.[40]

How The National Airspace System Works

The Federal Aviation Act of 1958, as amended (49 U.S.C. 1303, 1348, and 1655, subparagraph c), makes the Secretary of Transportation responsible for ensuring the safe and efficient use of the nation's airspace.[41] The Secretary is additionally responsible for creating a climate that encourages continual development of civil aeronautics. The DOT has authorized the FAA and the DOD to provide air navigation services for in-flight navigation, access to the airway system, and guidance in the approach and landing phases of flight.

These tasks are performed in the national airspace system. The NAS is a complex network of airports, airways, air navigation facilities, terminal control areas, and enroute air traffic control systems. The network includes surveillance systems, communications, avionics, weather information services, navigation aids, and computer systems. Aeronautical regulations and procedures guide personnel that manage and control the airspace under United States jurisdiction.

The control systems come together to interlink different sections or blocks of airspace known as control zones. All control zones are separate and distinct blocks of airspace where procedures are standardized for pilots and aircraft to follow. Positive control of pilots and aircraft is provided by controllers assigned and responsible for the control zone. The control zone has four different styles and sizes that incorporate small or large blocks of airspace: (1) air traffic terminal control area (control tower); (2) ground control approach (GCA); (3) radar approach control (RAPCON/ARAC/RATCF); and (4) enroute radar control centers (referred to individually as "center").

The first and smallest block of airspace is the terminal control area or class D airspace.[42] The area block it encompasses is immediately around the airport itself, typically covering a land radius from the center of an airport out to five miles and up to 2,500 feet above the ground. The control tower has controllers who are responsible for getting an airplane its flight clearance into the airspace system, moving an airplane from its parking spot along taxiways to the runway, and clearing an aircraft for takeoff. A controller is responsible for each distinct and separate phase in the terminal control area. A ground controller is required to clear and monitor an aircraft to and from the runway along taxiways to its parking locations around the terminal. The local controller is responsible for aircraft operating in the control zone airspace to include the runway environment.[43]

Control tower personnel operate by visually seeing the aircraft as it moves around taxiing on the ground. In addition, aircraft are allowed to takeoff and land only when the controller can see that the runway is or will be clear of other aircraft. This block of airspace can only be fully utilized in clear weather, or what is known technically as visual meteorological conditions (VMC). Pilots operate their aircraft under visual flight rules (VFR) while in VMC. Some control towers have an additional block of airspace added to their control zone to provide limited radar approach control capability. This block of airspace is ground control approach (GCA) radar control.[44] This is a radar approach control pattern designed to guide aircraft in from ten miles to the airport. It can be used to provide radar guidance away from the airport as a departure control, but this is rarely used due to the small area in which it can provide radar services.

The next block of airspace uses positive[45] and procedural control to manage aircraft in the control zone airspace. Referred to as radar approach control,[46] it normally extends to a radius of 40 to 60 miles, up to 15,000 feet or as high as 18,000 feet. Its purpose is to provide radar-guided control for aircraft into and out of airports within its control zone block of airspace.[47] Controllers essentially guide aircraft into and out of their block of airspace using radar identification of aircraft operating under instrument flight rules

(IFR). Pilots may be in VMC, but, because of the service provided by the controller, they must follow the more restrictive instrument flight rules as opposed to following visual flight rules. A control tower controller must gain permission from a radar approach controller before an aircraft enters the radar approach control's airspace. This is done by voice communication through a telephone circuit "land line" in a non-automated system. Routinely, this coordination is done by the tower controller before he gives a pilot permission to takeoff. This speeds up the process of the aircraft going directly to his destination. This is especially true of jet aircraft which cannot remain inside tower airspace easily due to their speed and performance. It is possible for an aircraft to leave a radar approach control's airspace and directly enter another radar approach control zone. Called tower enroute control,[48] this happens routinely in large metropolitan areas such as the northeast United States and California where there are large numbers of aircraft that fly below 18,000 feet.[49] If an airplane climbs above 18,000 feet or exits the radar approach control zone, it will move into the enroute center's control zone.

The enroute center is the largest block of controlled airspace. There are twenty-one centers in the United States.[50] Their boundaries tend to incorporate several states and all the airspace from the ground to 60,000 feet. They own that airspace and, through a letter of agreement, assign the boundaries of the control zone that creates the block of airspace for a radar approach control. In turn, the approach control assigns the block of airspace to establish the terminal control zones for the tower/airport. For an aircraft to proceed into the enroute center control zone airspace under IFR, the radar approach control must gain permission from the enroute center to hand the aircraft to them before it enters the enroute center's airspace. This is done by using a land line or using a radar-to-radar handoff. A radar-to-radar handoff is when the computer controlling the approach control's airspace interfaces with the center's computer. The approach controller inputs the request for a handoff through a keyboard at his radar screen position. The alpha-numeric presentation on the radar screen changes to a blinking presentation on his screen and the screen of the enroute center controller. The enroute controller sees the blinking presentation on his radar screen and uses a keyboard entry to make an input accepting the handoff from the approach controller. Once the enroute controller has accepted the handoff, the alpha-numeric presentation stops blinking on both screens and the approach controller knows the enroute controller has accepted the aircraft into enroute center airspace.

Once an aircraft is in the enroute control airspace, it will pass through sectors that divide the enroute airspace.[51] As the aircraft approaches the boundary of each sector, it must be transferred to the next sector as previously described. For the aircraft to land, the enroute controller must effect coordination and transfer control to the person controlling the radar approach control airspace. Then the aircraft must be passed to the control tower operator to execute a landing on the runway he controls.

This is the basis of how aircraft transit from point A to point B using enroute ATC services provided through positive and procedural controls, but it is essentially what must be in place for an aircraft to takeoff, fly to, and land at a distant airport in IMC weather. By the early 1970s, the NAS had grown to incorporate towers, radar approach controls at most busy airports, and enroute centers that covered all airspace used by commercial and military aircraft.

Initially, radar coverage was provided by a primary radar equipment system.[52] Primary radar gave a radar blip return to a controller on a radar screen. Controllers tracked these blips manually and guided them along the airways that criss-crossed the United States.[53] All coordination was done manually between controllers over land line communications and was tracked on hand-written flight progress strips.

In the mid-1960s, a new radar system comprised of three integrated sets of equipment started to come into use. The Air Traffic Control Radar Beacon System (ATCRBS)[54] is commonly referred to as secondary radar.[55] The ground radar unit has an interrogator[56] located at the same position as the primary radar unit. This unit sent out a signal that aircraft equipped with a transponder[57] would reply to. The ground-based receiver would pick up the signal from the aircraft, and through a piece of equipment known as the TPX-42,[58] would collocate a computer-generated symbol on the primary radar return blip presented on the controller's radar scope.[59] The computer-based presentation of the secondary radar can be programmed to display alpha-numeric codes. Individual numeric codes could be assigned to each aircraft, and limited alphabetic information would be presented on the radar scope.

By the mid-1970s, equipment and software upgrades allowed more information to be presented to the controller using a secondary radar system in conjunction with a primary radar system. The FAA had achieved a semi-automated ATC system based on the combination of radar and computer technology. By assigning specific numeric codes to each individual aircraft, these codes could be attached to aircraft flight planning and an aircraft's flight progress tracked automatically by a computer. Each facility along an aircraft's route of flight would get a computer printed flight progress strip that estimated when to expect the aircraft. This allowed all ATC facilities along an aircraft's route of flight to know ahead of time how much traffic they could expect and when.

Through improved software, this computer-based secondary radar system replaced primary radar systems at all enroute centers. The computer-based system has been enhanced to provide not only the aircraft's location, but its type, destination, and in combination with the system on the aircraft called mode C, its altitude. However, all of these secondary radar systems are not interlinked into a central computer. Each control facility, be it an enroute center or an approach control, must have its own system that provides overlap into each other's airspace. This is in order that radar coordination can take place.

In the late 1970s, a national airspace plan outlined and put into affect major changes to the NAS. The FAA felt that flight safety could be increased by integrating secondary radar information into medium to high volume airports. Control towers would be equipped with television presentations on the radar approach screen of the radar approach control zone's block of airspace. The tower controller would be able to see what airplanes would be sequenced to land on the runways he controlled. For this system to work, aircraft had to be equipped with a secondary radar transponder so that the aircraft's information could be tied to its location on the radar screen. With this information, it was possible for a controller to monitor and control more aircraft. But the controller became more reliant on the computer-based radar presentation.

In 1977, with the upcoming deregulation of airline travel, the FAA realized that the present capability of their computer-based system was going to be inadequate to handle the volume of airplanes going into some 22 major airports as the airlines prepared to institute the hub-and-spoke concept of operations. In 1981, the FAA announced its plan to integrate all radar facilities into a large single computer-based system in the United States. The National Airspace System Plan of 1982 was the first attempt to develop and install new equipment that would provide complete data-linkage with every pilot, aircraft, and controller.[60] This plan fully automated ATC with controllers monitoring the computerized aircraft flow. In the future, voice communication between pilots and controllers would only be used to clear up potential conflicts or modify original flight plans.

The improvements in communications and ATC services brought about by the data-link concept are to be phased in and evolve over an undefined time frame. Ground automation systems are to be enhanced, aircraft will be equipped to be able to receive data-link services, and other nations will develop their own transition paths and systems that should be based on the FAA system.[61]

The FAA plans to build communication infrastructures and automation enhancements that will enable two-way data-link communications and access to flight information services contained throughout the NAS. The system of data-link communications is anticipated to have benefits for both pilots and air traffic controllers, and simplify how airspace is managed. A reduction in voice frequency congestion, experienced at some facilities during routine communications, could be reduced to save time and reduce controller workload.

The FAA believes that when data-link becomes prolific enough throughout the NAS to be in routine use by airspace management and flight operations, more advanced services requiring significant automation capabilities can be built. This feature of the capital investment plan for the national airspace system will cause major gains in efficiency and economy throughout the aviation industry.[62]

Presently, the FAA is developing four types of data-links: (1) Mode S; (2) VHF digital radio; (3) oceanic and remote-area satellite communications (SATCOM); and (4) domestic SATCOM. All will be combined as a two-way ATC aeronautical telecommunications network (ATN).[63]

Mode S will provide two-way, domestic ATC communications, secondary surveillance radar systems, and a terminal collision avoidance system (TCAS) data-link so that pilots and controllers see the same information. This secondary radar system is expected to be used for air-to-air, air-to-ground, and airport surface needs.[64]

VHF digital radio is an integrated voice and data communications network. The plan is to internationally standardize and implement this system. It is the preferred FAA solution for VHF data-link communications that will provide the link for domestic line-of-sight voice and data transmissions.[65]

In areas where line-of-sight transmitters cannot link with aircraft, SATCOM will be used to cover oceanic and remote areas. Domestic SATCOM is to be used to augment global position system (GPS) transmissions for precision approach and landing, and enroute navigation. The FAA may use SATCOM to replace or augment ground-based transmitters if the cost to operate such a system comes down in the future.[66]

Two-way voice and data communications between aircraft and ground users will traverse the ATN. The FAA touts this system as an "internet" data-link.[67] The system will allow users to freely exchange data messages between the different sub-networks and data-linked systems. All data-linked systems comprise a system architecture that will provide a redundant and reliable computer-based system. The ATN should route voice and data messages through the most appropriate and available data-link to provide positive ATC procedures and critical in-flight information on hazards to flight, such as weather or other aircraft. The information is automatically fed to the aircraft for the pilot to call up from his onboard system. The system is expected to do this automatically, freeing the controller from having to provide the pilot this information over voice communications.[68] The ATC process will be completely automated.

Since the DOD will continue to be an integral player in the NAS and control a large part of the air traffic in the United States, military controller training, equipment, and ATC procedures will continue to mirror, and in most cases use, FAA regulations for CONUS ATC. But, as noted previously, as of 1989, the DOD lost its autonomy to install and operate systems that were compatible with the FAA's and that served the unique operating requirements of military aircraft. Since all CONUS ATC facilities will be inter-linked nation wide, the equipment and procedures used will be tied to what the FAA does. The DOD will no longer be able to develop ATC procedures and find ways to be compatible with the FAA. The FAA will decide on the specifications and the DOD will have to follow.

The major driving force for the FAA's plans are the automated ATC for the anticipated increase in commercial air commerce. At this time, scheduled commercial traffic runs approximately 900,000 flights per month. The projection is for this number to double by 2003.[69] For the most part, military aircraft can operate in this highly restrictive environment that rapidly shuffles United Airlines from Los Angeles to Chicago. But the emphasis on ATC regulations and procedures to accommodate the rise in commercial air traffic through automation has been used to justify a reduction in FAA air traffic controller training and manning of tower and radar facilities. The FAA ATC regulations and operating procedures have been changed to provide faster service to commercial air carriers and have caused a reduction of military training airspace at airbases and training ranges.

The ATC rules and procedures used for commercial aircraft in the FAA system are used in a combat environment. These rules and procedures have been developed jointly between the FAA and the DOD since 1936. But the overall application of the procedures to effect the safe and efficient flow of combat aircraft in a deployed location, void of a highly integrated computer ATC complex, has created a situation where military controllers must be able to operate ATC in two distinctly separate environments. Military controllers deploy in support of force projection operations where the computers are limited in capability or do not exist. Therefore, controllers still must be trained to perform the work that will soon be done by computers.

In answering the first secondary question, the evolution of air national airspace system has keyed on increasing air traffic control efficiency through automation of controller tasks. The national airspace system has evolved, and will continue to evolve, into a computer-based system where controllers monitor parts of the system versus control aircraft with the aid of computers. The FAA's vision for ATC in the national airspace system is summed up best in this opinion, "we have been relying on human controllers to be machines and that is idiotic. Computers can be taught to think like controllers."[70] The next chapter will outline military deployable ATC equipment and capabilities. It will then examine how the deployable ATC services have been used to support force projection operations.

Endnotes

[1]Alexander T. Wells, Airport Planning and Management (Blue Ridge Summit, PA: Tab Books, 1992), 7.

[2]Nick A. Komons, Bonfires to Beacons (Washington, D.C.: Smithsonian Institution Press, 1989), 305.

[3]Ibid., 309.

[4]Ibid., 311.

[5]Airport Planning and Management, 9.

[6]John R. M. Wilson, Turbulence Aloft (Washington, D.C.: Government Printing Office, 1979), 102.

[7]Airport Planning and Management, 9.

[8]Turbulence Aloft, 102.

[9]Ibid., 104.

[10]Ibid., 125.

[11]Airport Planning and Management, 13.

[12]Ibid., 14.

[13]Ibid.

[14]Ibid.

[15]Ibid.

[16]Ibid.

[17]Ibid.

[18]Ibid.

[19]Ibid.

[20]Ibid.

[21]Stuart I. Rochester, Takeoff at Mid Century (Washington, D.C.: Government Printing Office, 1990), 174.

[22]Airport Planning and Management, 14.

[23]Takeoff at Mid Century, 176.

[24]Airport Planning and Management, 15.

[25]Ibid.

[26]Ibid.

[27]Edmund Preston, Troubled Passage (Washington, D.C.: Government Printing Office, 1987), 100.

[28]Ibid., 48.

[29]Richard J. Kent, Jr., Safe, Separated, and Soaring (Washington, D.C.: Government Printing Office, 1980), 165.

[30]Airport Planning and Management, 16.

[31]Ibid., 18.

[32]Ramon Lopez, "Don't Blame Airlines for ATC Delays," Janes Airport Review, 02 (February 1, 1990), 40.

[33]Airport Planning and Management, 22.

[34]Ibid., 23.

[35]Ibid., 25.

[36]EER Systems Corporation, Department of Defense, Headquarters Electronic Systems Division, United States Air Force Systems Command, Air Traffic and Airspace Systems Interface with the National Airspace System (Vienna, Virginia: 1989), 1-1.

[37]Ibid., 1-2.

[38]Robert W. Poole, "Building a Safer and More Effective Air Traffic Control System," Reason Foundation, 126 (February, 1991), 10.

[39]U.S. General Accounting Office, Report to the Chairman, Subcommittee on Transportation, Committee on Appropriations, House of Representatives, Air Traffic Control, Continued Improvements in the FAA's Management of the NAS Plan (Washington, D.C.: Government Printing Office, 1988), 2.

[40]Air Traffic and Airspace Systems Interface with the National Airspace System, 1-1.

[41]Air Traffic Control, Continued Improvements in the FAA's Management of the NAS Plan, 10.

[42]Airmans Information Manual, C-5.

[43]Ibid., 4-1-1.

[44]Ibid., G-2.

[45]Stanley L. Seltzer, "The History of Positive Control," Journal of ATC (December, 1992), 39.

[46]Airmans Information Manual, R-1.

[47]Ibid., C-5.

[48]Ibid., 4-1-11.

[49]Ibid.

[50]AOPA's Aviation USA (Frederick, Maryland: 1995), 1-28.

[51]Airmans Information Manual, 5-3-1.

[52]Ibid., R-1.

[53]Ibid., 5-3-3.

[54]Ibid., 1-2-2.

[55]Ibid., R-1.

[56]Ibid., I-4.

[57]Ibid., 1-2-2.

[58]Ibid., T-3.

[59]Ibid., 1-2-2.

[60]Department of Transportation, Federal Aviation Administration, FAA World (October 1993), 2.

[61]Ibid., 10.

[62]Ibid., 12.

[63]Ibid., 12.

[64]Department of Transportation, Federal Aviation Administration, Data Link (Washington, D.C.: 1995), 3.

[65]Ibid., 4.

[66]Ibid., 5.

[67] FAA World, 12.

[68] Data Link, 12.

[69] Robert Llangreth, "Fail-Safe Skies Coming in the 21st Century?" Popular Science (January 1993), 77.

[70] Ibid., 77.

CHAPTER 3

MILITARY ATC OPERATIONS

To answer the question, does the FAA's capital investment plan support US military force projection ATC requirements, it is necessary to study military ATC requirements. This chapter will address secondary questions two and three: What are the operational requirements that drive training requirements for military ATC personnel?; How has the US military deployed ATC assets to support force projection operations?

Military ATC maintains a force of private contractors, DOD civil servants, and military controllers to man the control towers, ground control approach, and radar approach control facilities operated by the Army, Navy, Marine Corps, and Air Force. The Marine Corps and Army use civil service controllers at their CONUS and foreign bases and can comprise 50 percent or more of the controllers that staff and operate a particular ATC facility.[1] Military personnel trained to operate at each of these facilities during peacetime gives each DOD branch the ability to provide its own brand of tailored ATC services to support each service's unique mission requirements. This ATC service cannot be purchased on the civilian market.

Trained military controllers are used for a variety of contingencies in peacetime and war. As previously noted, they are the backstop for the nation's airspace system when called on to do so. It is imperative that they be trained to continue to provide the nation with this capability. Each service trains to the same standard, independent of each other, using the same operating standard, FAA Regulation 7110.65, Air Traffic Control Procedures. However, military controllers must also train and be ready to deploy anywhere in the world and operate at the same level of efficiency, regardless of the climate or conditions encountered.

The United States possesses the finest airspace system in the world. Military ATC uses basic concepts and procedures of this system when it deploys to project United States military forces. Each service has tailored the ATC services it possesses to the unique requirements of the aircraft each service operates. Each service has specialized areas of ATC it concentrates on, but all ATC missions that military controllers perform fall into four categories: (1) Liaison teams, which involve controllers placed in ATC facilities to aid another nation or another service component to become proficient with the specific operating requirements of aircraft from their service. These liaison controllers will not actively control aircraft, only advise a facility; (2) Facility augmentation, which involves controllers being temporarily assigned to a facility to increase its ATC capability for a specified or indefinite period. This occurred during the 1981 PATCO strike; (3) Tactical ATC, where ground-to-air communications and procedural controls, in conjunction with navigational aids (NAVAIDS), are integrated to establish ATC terminal operations; and (4) Tactical radar ATC operations, where portable tactical radar sets are used to provide positive radar control services in the terminal or enroute environment.

All four of these mission categories can operate independently of one another or be tied together using tactical communications networks, such as TRITAC, or commercial telecommunications, where available.

Military air traffic control is part of a theater area of operations (AOR) and integrated combat airspace control system (ACS).[2] The ACS is the organization, personnel, procedures, and equipment necessary to plan, direct, and control tactical air operations in a conflict or contingency.[3] A combination of control agencies and communications-electronics facilities provide centralized control and decentralized execution for flight operations to all United States services and allied forces that operate in the AOR. The terminal air traffic control elements (TATCE)[4] are the ATC facilities within the AOR. TATCE's are created, augmented, or provided with ATC liaison teams to provide terminal area airspace control. The primary function is to provide safe and expeditious launch and recovery of aircraft involved in the AOR's conflict or contingency. These facilities provide services based on peacetime ATC concepts and procedures, which is desirable, since all aircraft are used to operating that way. However, standard peacetime procedures are usually not flexible enough or sufficiently responsive to the needs of the combat airspace environment.[5] Three elements of ATC in a combat environment frame the difference between civilian ATC operating priorities and military ones. They must be taken into account when establishing military ATC procedures, and are as follows: (1) Even if the airspace system or terminal environment is saturated with aircraft of different types performing various missions, acceptance of tactical offensive/defensive aircraft into the system will not be reduced or denied; (2) There is not recognized, standardized aircraft separation criteria applied by controllers to aircraft. Tactical aircraft missions will continue without delay with the risk of reduced separation accepted as necessary; and (3) Low-priority traffic may be denied access, diverted or delayed when airspace saturation is imminent. The senior flying commander for the airbase will determine aircraft priorities as required.[6]

ATC services are more effectively accomplished under positive control. Radar and electronic navigational aids should be used whenever possible. Recognizing that a radar or electronic signal can also be used by the enemy, combined with environmental and equipment factors, the use of positive control procedures may have to be severely reduced or eliminated. Appropriate procedural means of airspace control for aircraft in a combat environment must be developed in tandem and seamlessly integrated for effective aircraft movement.[7]

Equipment and Capabilities

The United States Army maintains a controller force to support its aviation operations at its fixed-base locations, for exercises, contingencies, and war. Many fixed-based ATC controllers are civilian or contract personnel with the majority of the Air Traffic Services (ATS) military forces being assigned to tactical ATS units. The Army's controller force and deployable ATC equipment are matched to monitor and control a wide range of helicopter and fixed-wing operations. A tactical ATS unit is designed to perform four functions: (1) A2C2 services, where ATS planners and airspace users do the coordination and integration for Army aviation assets at each level of command starting at brigade up to echelons above corps;[8] (2) Airspace information services, which deploy, as the commander desires, to provide airspace information services such as flight following and weather information; (3) Terminal services; and (4) Forward area support teams.

Controllers assigned to the terminal services function and forward area support services will actually perform controller duties.[9] Personnel assigned to A2C2 and airspace information services have an ATC and/or pilot background and are not involved in ATC duties.[10] Terminal services have certified controllers assigned to terminal control towers or GCA.[11] The terminal control tower can be established using portable FM radios or a mobile control tower.[12] A GCA can be established to provide precision approaches with a portable radar set, or nonprecision approaches using a nondirectional beacon (NDB).[13] The Tactical Aviation Control Team (TACT) makes up the forward area support services function. The TACT is responsible for operations at forward support and austere landing locations. The TACT team can be organized in several configurations, consisting of two to four soldiers equipped with manpack data and secure voice communications packages.[14] ATS controllers are trained and equipped to control primarily rotor-wing and smaller fixed-wing traffic in support of the ground element commander.

The United States Marine Corps trains and equips its ATC force for both fixed-base and deployment operations. The Marines train, equip, and operate land-based tower and radar approach control facilities in the CONUS and overseas. The deployment operations are conducted by a Marine Air Traffic Control Squadron (MATCS).[15] The MATCS is organized to employ subordinate elements to meet forward operating base ATC requirements of a Marine Air Group Task Force (MAGTF).[16] MATCS personnel and equipment are organized into two basic elements: four MATCS detachments and eight MATCS mobile teams (MMT).[17]

A MATCS detachment is usually assigned to a main airbase which is supporting a Marine Expeditionary Force, approximately 72 aircraft.[18] Each MATCS detachment has a full range of ATC capabilities to include primary and secondary surveillance radar, automatic carrier landing system radar, NAVAIDS, control tower, voice, radio, and tactical data-links. This equipment gives the detachment the ability to provide radar approach control services for a radius of 60 miles from the airbase,[19] radar final approach control, control tower services, and tactical air navigation (TACAN)[20] service for terminal approach.

The MATCS MMT is usually tasked to provide all-weather ATC service to aircraft of a Marine Expeditionary Unit (MEU), usually about 20 aircraft.[21] An MMT can provide tactical control tower, and non-radar approach control service using NAVAIDS and procedural controls, for a radius of 40 miles from the airbase.[22] Manning of an MMT usually consists of an ATC officer, three tower personnel, and three non-radar approach personnel.[23] Marine controllers are trained and equipped to support fighter-bomber aircraft in support of the Marine ground force commander.

The United States Air Force (USAF) trains, equips, and maintains the largest part of DOD ATC assets and personnel. Unlike the Army, the Air Force has very few civilian or contract controllers in its facilities. These facilities vary from small tower operations to enroute center operations, fully staffed and operated by military controllers. The Air Force maintains deployable ATC equipment to cover all spectrums of ATC services including a tactical tower in a terminal environment or temporary assault strip, radar/non-radar approach control, and radar/non-radar enroute center control services.

Air Force deployable assets are found in three different units. The first is Special Tactics Squadrons (STS). This organization is manned by Combat Control Team (CCT) members and Para-Rescue Combat Medics (PJs). This organization is used by the Special Operations community to provide a variety of services to all Special Operations Forces (SOF). Combat Control Team members are certified air traffic controllers in tower and non-radar approach control duties. Their ATC equipment is limited to tactical radio sets and manpack TACANs. Special Tactics Squadrons will soon be equipped with mobile microwave landing systems that can be used by specially equipped aircraft. In most cases, they will be the first on the scene to establish ATC operations, whether or not they are invited to the airfield. Special Tactics Squadrons are the ATC element of special operations airfield seizure operations.

The largest deployable ATC personnel and equipment assets belong to Combat Communications Groups within the Air Force. These personnel usually deploy in flights using tactical towers in conjunction with TACANs. If required, a terminal/approach control radar may also deploy to the same location, or to an airbase where tower operations already exist to provide day and night, all-weather, capability for airport users. The terminal/approach control radar has the capability to use its full six radar scope capacity as an enroute center, when required.

Combat ATC personnel may be assigned to backfill STS personnel in ATC duties only, as they are not trained to carry out the many missions STS personnel must execute. Combat ATC personnel are the main ATC group deployed in the liaison and augmentation mission categories for exercises and contingencies. Until 1992, combat ATC flights were fully staffed with up to 70 controllers per unit as a standing, dedicated force prepared to support any Air Force or Joint Chiefs of Staff mission on a worldwide basis. An ATC officer and an in-garrison staff of fifteen experienced senior noncommissioned officers (NCOs) were part of a Combat Communications Squadron that maintained the ATC equipment. This core staff commanded, trained, and managed their assigned dispersed controllers and the deployable equipment, in addition to conducting all the necessary exercise and contingency planning. The 55 dispersed controllers were stationed at the busiest ATC facilities in the Air Force to build and maintain ATC experience. The dispersed controllers would be recalled for an exercise or contingency to where the in-garrison staff was stationed, prepare for deployment, and then execute their mission. This capability was lost due to budget considerations and the Air Force assumed the risk that a standing combat ATC capability was not required. The decision was made to have a smaller in-garrison staff in a Combat Communications Group and have controllers from fixed facilities meet the tactical ATC equipment at the deployment location. The in-garrison controllers deploy to set up the equipment, then turn it over to a controller force that has never seen the equipment, been trained in tactical ATC procedures, or ever been on a deployment.

The last deployable asset is ATC personnel identified to deploy from fixed-base facilities. Referred to as mobility controllers, this is where the largest contingency of DOD controllers will come from to link up with the combat ATC flights. This is also where most of the DOD controller force came from during the PATCO strike. During that strike, Air Force ATC facilities were reduced to the minimum manning level required for safe operations and all available controllers were sent to FAA facilities. As part of normal operations, a percentage of fixed facility controllers are kept on deployable "mobility" status as backfill for combat ATC units, and liaison and augmentation missions.

The Air Force will deploy in support of any combatant commander, joint task force commander, or civilian agency's ATC needs. The Air Force is the prime force projection ATC force in the United States inventory.

Having defined what ATC equipment and what personnel are available to support force projection operations, it is now possible to look at the importance of deployable ATC services. Two operations will be reviewed, as they are representative of the types of major regional contingencies in which United States forces are likely to participate.

Operation Just Cause

This was the first combat operation in which I was ever involved. My staff and I planned and executed two separate ATC missions in support of Operation Just Cause. These included a liaison team and a tactical ATC flight that were assembled and deployed. Operation Just Cause involved 13,000 military personnel deployed in advance, and approximately 9,500 troops flown from the United States during the operation.[24] Air traffic control force projection was an integral part of the entire operation in that additional controllers were sent to augment Howard Air Force Base's (AFB) ATC operations during the increased air flow. Rio Hato Airfield and Torrijos/Toucmen Airport were designated for opposed entry operations. Both of these airfields were assaulted and secured by the 75th Ranger Regiment.[25] As the airfields were secured, ATC services were restored and provided by Air Force Special Tactics Units augmented with equipment and personnel from Air Force combat ATC flights.

A key oversight was detected within the first 24 hours of mission execution. Fixed ATC unit controllers that augmented the combat ATC flight, were selected for the mission based on their ability to speak Spanish. Military planners dictated that 50 percent of the controllers sent be fluent. Since the universal language of ATC is English, tasked units assumed United States controllers would be utilized in a liaison capacity to augment Panamanian Nationals operating their ATC radar equipment. United States controllers that had not operated in a control tower since initial training, found themselves trying to conduct control tower operations with portable radios while under fire. Most of the rated tactical control tower personnel could not speak Spanish and had to be brought in from CONUS after the airfields were secured.

The two airfields were developed tactically (Rio Hato and Torrijos/Toucmen) by US Air Force Special Tactics Units and a Combat ATC Flight. Howard AFB was augmented with ten additional controllers from the 33d Combat ATC Flight. The three airports handled twenty-two C-130s, seventy-one C-141s, and twelve C-5s that moved invasion troops from the United States to Panama on the first night of the operation.[26]

Howard AFB was used primarily as a landing airport for C-141s and C-5s. The airfield was considered secure and became the primary supply drop-off and casualty evacuation point.[27] Rio Hato and Torrijos/Toucmen airports were considered to be protected by artillery and surface-to-air missiles. The airports were attacked and rendered ineffective prior to forced-entry operations that included all air-to-ground communications and navigational aid capabilities. Air traffic controllers had to re-establish air-to-ground and navigational aid capability before the main air drop of the 82nd Airborne into Torrijos/Toucmen Airport could take place. Air traffic control services had to be re-established at Rio Hato Airfield before air-land operations could proceed to reinforce troops already on the ground.[28] Air Force Special Tactics and Combat ATC Flight controllers and equipment stayed in Panama at these locations until the operation was successfully completed.

Desert Shield/Desert Storm

In August 1990, United States forces deployed to Saudi Arabia. Air traffic control forces were initially deployed to the Gulf region as liaison controllers to the existing ATC facilities in the region where coalition aircraft would be based. But by February of 1991, ATC services had deployed to 24 different locations, across six countries, where over 500 Army, Marine Corps, and Air Force controllers were charged with managing over 350,000 square miles of airspace.[29] Controllers served in all mission categories to create an airspace system in the Gulf region that had not been seen in size and scope since the Second World War.[30]

When the Desert Shield deployment began, it was quickly realized that the Saudi Arabian ATC system was not geared to handle the volume of traffic generated by the operation.[31] Air traffic control systems throughout the Gulf ranged from antiquated, primary radar facilities, such as Khamis Mushait, Taif, and Tabuk, to very modern ones at Jeddah Center and Bahrain Center.[32] But there was no inter-connectivity between them except over telephone voice lines. Most of the region had very little radar coverage except around the busiest cities. The area was controlled through the use of non-radar enroute control between major terminal approach controls. But even the radio coverage was sparse. Since most of the air traffic was civilian, only VHF radio repeater sites were placed along airways, so military aircraft would go for long periods without ground-based radio contact.

The air traffic in the Gulf consisted of air carrier flights that maintained precise schedules, routes, and procedures. They were accustomed to working a few hundred civilian airliners per day at a slow regular pace with no sense of urgency. Within days, the level of activity increased tenfold.[33] The system was not designed for the levels of traffic during the Gulf conflict, and ATC controllers from the region did not have the level of skills required to safely and expeditiously control the high volumes of aircraft.

When their confidence and pride was shaken, and things beyond their abilities, the Saudi Arabian controllers would not ask for help, but fall back on the philosophy of "En Shalah", which translates to "the will of God."[34] Initial United States liaison teams had to tread lightly as they were, in many cases, unwelcome visitors to the once serene ATC facilities. Liaison teams were specifically told they could not work aircraft or were banned from facilities after pointing out potential aircraft conflicts. For example, aircraft would repeatedly call the tower to be radar identified and given positive control after just crossing 500 miles of unfamiliar desert without radio communications. But if there was a conflict with another aircraft, the controller would not respond until the two aircraft resolved the problem themselves..."En Shalah."[35] In another case, if a controller was working an aircraft and saw a conflict, he would discontinue positive control rather than resolve the conflict, let the conflict resolve itself through a mid-air crash or near miss between the two aircraft and then re-establish positive radar control..."En Shalah."[36]

This situation was becoming a hindrance to initial force deployments and the decision to tie up precious airlift with ATC equipment and personnel was made out of necessity on 12 August 1990.[37] On that day, I was rerouted from my initial tasking of going to Thumrait, Oman, as head of a liaison team, to an airport that did not exist on any map.

Initially, Iraqi forces were expected to proceed into the eastern province of Saudi Arabia. Our original military aircraft basing options were at airfields south, east, and west of Riyadh. For whatever reason, Iraqi forces chose to remain in Kuwait long enough for Central Tactical Air Forces (CENTAF) to base aircraft in the eastern province of Saudi Arabia. Initially, the 1st Fighter Wing from Langley AFB, Virginia, deployed to Dhahran to establish air defense protection for forces that would be moved up to the Kuwait border.[38] CENTAF also decided to establish a new airfield at the new international airport for the eastern province that was under construction. The airfield's two large runways, associated taxiways, and aircraft parking ramps were complete. However, the airfield communications and ATC equipment had not been installed, although the air traffic control tower structure had been completed. This airfield was King Fahad International Airport (KFIA).

Although originally deployed in-country to head up liaison teams, ATC personnel were stripped from the liaison teams already in-country and given the task of preparing the airport to handle coalition aircraft. Keep in mind, few air traffic controllers had been deployed into theater by 15 August and there was no ATC equipment in-country at that time. Tasks broke down into three areas: (1) establishing ATC tower operations; (2) installing aircraft navigational aids (NAVAIDS); and (3) developing the associated approach procedures and airport operation procedures.

As described in chapter two, an airport or approach control derives the airspace it will control through a letter on agreement. An international letter of agreement with the Saudi Arabian Presidency of Civil Aviation had to be developed, negotiated, and implemented before the new airport could be activated. My staff and I accomplished this with the help of the Dhahran ATC facility manager.

An additional problem encountered, was the lack of ATC personnel to staff the facility for 24 hour per day operations. While the small three-man staff originally sent to KFIA could achieve all the tasks required to get the airport operational within 48 hours, few fully qualified air traffic controllers could be reassigned from those already in-country.

The solution was to procure Army ATS controllers and CCT personnel. These controllers possessed basic ATC skills that allowed them to control limited numbers of aircraft at small temporary landing fields. They were given a crash upgrade program to enable them to control aircraft in a more complex ATC environment. Air traffic control tower communications were made possible through the use of three single channel UHF/VHF portable radios: two for air-to-ground communications (one for each runway), and one used as a consolidated aircraft ground movement frequency.

Initially, as of 29 August 1990, forty CENTAF aircraft, fifteen Special Operations Command (SOCCENT) aircraft, and the initial elements of the 101st Airborne Division (Air Assault) (ARCENT) aircraft called KFIA home. Additionally, Mobility Airlift Command (MAC) and the civilian air reserve fleet (CRAF) aircraft were using KFIA as an air mobility port of entry for coalition troops and equipment. Aircraft that used KFIA initially totaled 250 sorties a day.

By 15 November 1990, KFIA was now home-base for over 1,200 aircraft. The MAC and CRAF aircraft sorties, in addition to base-assigned aircraft, totaled over 2,000 sorties per day. As of that date, KFIA was the busiest airport in the world. The number of aircraft exceeded the capacity of any airport complex to date. This level of activity continued throughout Operation Desert Storm and into Operation Southern Watch until the airport was deactivated and turned back to the Saudi Arabian government and Saudi Arabian Bechtel Company for them to complete airport construction.

Fully qualified controllers were eventually assigned to KFIA and, due to the winter season, a tactical ATC radar system was made operational on 22 December 1990, to provide true all-weather capability. But these systems were stand alone and integrated only through the use of telephone lines, not through a computer-based system. All integration and coordination between KFIA and other ATC facilities was done by controllers through voice communication via telephone or two-way radio (FM).

Thanks to the skill of all controllers involved, ARCENT ATS, SOCCENT CCT, and CENTAF ATC, not one aircraft experienced an incident where flight safety was compromised due to ATC operations at KFIA during the entire period the facility operated.

Other airports that were fully equipped and manned by CENTAF personnel included Al Kharj, Al Jawf, and King Kalid Military City. Airports augmented by CENTAF ATC controllers included Riyadh, Taif, Dhahran, Bahrain Center, Jeddah Center, and the Marine Corps Central Command (MARCENT) airbase at Shaikh Isa. The US Air Force deployed four radar approach controls, six towers, eight tactical air navigation systems, and 350 controllers.

MARCENT initially operated two airfields at Shaikh Isa, Bahrain, and Al Jubyial, Saudi Arabia. Then established ATC facilities in Kuwait City after its liberation. The Marine Corps deployed a full MATCS.[39]

ARCENT ATS units augmented forces at KKMC and KFIA airports in addition to providing ATC services to numerous forward area refueling points and forward operating locations for ARCENT rotary-wing operations. The Army deployed an ATS battalion in support of the XVIII Airborne Corps.

Summary

ATC force projection operations are heavily dependent on well-trained ATC personnel who can use rugged, tactical, air traffic control landing system equipment and radar. To deploy a radar system, tower, navigation aid, and personnel that replace an STS squadron at an airfield requires three C-5 aircraft loads. When airlift is a premium, ATC personnel and facilities have shown they must be one of the first priorities in order that a comprehensive airspace system in the area of operations can be ensured in support of United States force projection operations.

Military operations completed to date and the present US operations tempo has demonstrated the need for deployable equipment and qualified controllers who can work like an automated system where one does not exist. The FAA capital investment plan will turn ATC controllers into ATC monitors, reliant on a computer automated and operated system. This will have an effect on the ability of the military to train deployable ATC services to support the US force projection military strategy. Having framed the FAA's plans and described how military ATC is set up to support contingencies and conflicts, the next chapter will analyze what changes have occurred and will occur to widen the divergence between ATC in the United States national airspace system and military ATC for preparation to support force projection.

Endnotes

[1]Interview, Major Greg Grove, Headquarters USMC, Naval Annex, Washington, D.C., 15 March 1996.

[2]Joint Chiefs of Staff, JCS Pub 3-52, Doctrine for Joint Airspace Control in the Combat Zone (Washington, D.C.: Government Printing Office, 1994), I-5.

[3]Ibid., I-2.

[4]Joint Chiefs of Staff, JCS Pub 1-02, Department of Defense Dictionary of Military and Associated Terms (Washington, D.C.: Government Printing Office, 1994), I-3.

[5]Joint Pub 3-52, I-5.

[6]Joint Pub 1-02, I-4.

[7]Joint Pub 3-52, I-5.

[8]U.S. Army, FM 1-303, Army Air Traffic Services Contingency and Combat Zone Operations (Washington, D.C.: Department of the Army, September, 1995), 8-4.

[9]Ibid., 8-5.

[10]Ibid., 8-3.

[11]Ibid., 8-3.

[12]U.S. Army, TC 1-225, Air Traffic Control Platoon Drills (Washington, D.C.: Department of the Army, October, 1985), 3-97.

[13]Ibid., 3-68.

[14]FM 1-303, 8-3.

[15]U.S. Marine Corps, FMFM 5-60, Control of Aircraft and Missiles, (Washington, D.C.: Department of the Navy, June, 1993), 7-1.

[16]Ibid., 7-1.

[17]Ibid.

[18]Ibid., 7-2.

[19]Ibid., 7-3.

[20]Ibid.

[21]Ibid., 7-2.

[22]Ibid.

[23]Ibid.

[24]Major Rowayne A. Schatz Jr., USAF, Airborne Forcible Entry Operations: USAF Airlift Requirements (Thesis, U.S. Army Command and General Staff College, 1994), 50.

[25]Ibid.

[26]Ibid., 51.

[27]Ibid.

[28]Ibid., 56.

[29]Headquarters United States Central Command Air Forces, The Desert Shield/Desert Storm Comm Story (Riyadh, Saudi Arabia: March 1991), 161.

[30]Ibid.

[31]Ibid., 45.

[32]Ibid.

[33]Ibid., 46.

[34]Ibid.

[35]Ibid.

[36]Ibid.

[37]Ibid., 7.

[38]Ibid., 8.

[39]Interview, Major Greg Grove, USMC.

CHAPTER 4

ANALYSIS

This chapter will explore the fourth secondary question of how the evolution of the national airspace system has impacted the uses of air traffic control for the military. Analyses will highlight impacts, to date and in the future, and potential problems for deployable ATC.

At this time, the direction for improvements to the national airspace system and the air traffic architecture and facilities in the system, is to increase efficiency in the handling of civilian commercial aircraft. This is not a new approach, as shown previously. The FAA and former government organizations responsible for the national airspace system have based their technological improvements on increasing efficiency for civilian commercial aircraft. This is in keeping with their charter to promote air commerce. The trend has been the same since 1938: the federal government has promoted technological improvements to increase air traffic control efficiency and has paid for it with a reduction in civilian controller personnel. Stated differently, the FAA and its former namesakes have proposed and implemented expensive technologies that attempt to increase efficiency and eliminate manpower.

Military uses of the national airspace system and its air traffic control capabilities are different. Military ATC exists to support military aircrew training in a variety of aircraft that fulfills divergent military requirements and then deploys to support those aircraft for contingency or conflict. Military deployable ATC services have retained and improved the simplest equipment that can be used in the widest variety of situations. The key factor to deployable ATC is a highly trained controller force. Reducing manpower through technological updates has never been an accepted or preferred method of operating.

The evolution of the national airspace system, and the upgrades and changes to air traffic control regulations and procedures, have had the common goal of providing safe and expeditious movement of aircraft. As was explained in chapter two, ATC in the national airspace system will continue to evolve into a fully automated system. The same number, or a reduced number, of controllers will be able to monitor more aircraft. The envisioned computerized system of the future will automatically provide control instructions through the data-link digital communications system. Controllers will monitor air traffic and provide control instructions only when a conflict between aircraft is detected by the system or controller. The military ATC system and its controllers must upgrade and be trained to provide the same levels of service that the capital investment plan requires.

Chapter three demonstrated that the military force projection requirements for ATC are significantly different from civilian uses. Military controllers deploy from the automated national airspace system to locations where a radar and communications infrastructure have never existed, or were put out of action. They must quickly create a rudimentary ATC system to handle the rapid increase of aircraft that overwhelms another nation's national airspace system. The newly created system must be simple, efficient, and heavily reliant on the controller to perform all the functions that are now, or scheduled to be, performed by computers. As the capital investment plan continues to automate ATC, the divergence that now exists between military and civilian uses of ATC will continue to grow.

Manpower Versus Technology

The two different approaches on how to operate and to train to provide air traffic control can be seen as far back as 1938. Since that time, the two approaches, manpower versus technology, have been evident. The FAA has relied on technology to try and increase the effectiveness of air traffic control and reduce controller manpower. This is opposed to the military system which puts a premium on a large controller force because it is interested in the simplest system for pilots and aircraft.

In 1919, government agencies had began work on an instrument landing system (ILS) that would enable properly equipped aircraft to land at an airport with minimum visibility.[1] By 1931, the Bureau of Standards had tested a working system and established the three basic elements of an ILS.[2] The system provided precision landing guidance to aircraft equipped to receive electronic approach glide path and runway position guidance. In conjunction with high-power runway approach lights and beacons that marked the segments of the approach, a pilot could perform bad weather approaches without radar or controller guidance. But the CAA was never able to field the system at the nation's airports. This was due to the other developmental partners, the Army and the Navy. The military services were never satisfied with the limited capabilities offered by the system the CAA backed and refused to aid in the funding or purchase of it.[3] The military preferred to wait until the technology advances promised by competing ILS developers were fielded and tested. The airline industry also contributed to the problem by not installing the necessary airborne equipment on their aircraft which showed a lack of endorsement for the CAA's precision approach system of choice.[4]

During W.W.II, the military introduced a ground control approach (GCA) radar system that had been developed by Dr. Luis Alvarez at the Massachusetts Institute of Technology.[5] This system was a relatively simple one where the pilot was talked down a glide path to the runway to land in lower runway visibility than the CAA's ILS. Aircraft required no new equipment onboard and pilots could quickly and easily be trained to do GCA approaches.[6]

The two avenues of development and fielding equipment for bad weather landing capability were far apart. The CAA system was highly dependent on equipment to eliminate the need for controllers. This system, at the end of W.W.II, was still not fully developed, but was touted and maintained as the standard for precision approaches to all airports within the United States by the CAA. A series of tests conducted up through 1948 demonstrated that the GCA system out-performed the ILS system.[7] Despite a rash of incidents where commercial aircraft had to make emergency landings because the ILS system was not adequately developed, and therefore not fielded, permission was granted for commercial aircraft to land at military GCA-equipped airfields if requested by the aircraft. The CAA contended that the ILS system's lower installation and operating costs were the reason to continue its development and not procure GCA systems. A GCA unit was more expensive to install and operate because of the manpower requirements, however the CAA figure did not also factor in further development that the ILS system required.[8] The CAA refused to buy GCA units and continued to promote the ILS system until 1950 when Congressional hearings forced the CAA to admit that the ILS was not as capable as the GCA system at that time. The CAA ordered GCA units for the busiest airports as an interim measure until the promised ILS system with the same level of approach capabilities could be fielded. Today, the military still uses proven GCA technology for deployable precision approach capability. In essence, the CAA placed its faith in unproved technology rather than go with a system that works because of the manpower requirements. The CAA preferred to continue to spend large sums of money on developing a system that could eventually show a savings in manpower costs. Whereas the military placed its faith in simple reliable equipment that cost more initially to install and operate, but did not require additional money to develop. The military would eventually procure ILS, but only after the system lived up to the claimed performance.

In the late 1950s, the FAA realized the need to attempt to automate with computers and planned ATC radar coverage for the entire United States.[9] The coming of jet aircraft had spurred the installation of additional radar and joint-use agreements with the military to put jet aircraft operating in the United States under a radar umbrella. All 48 states were to be brought under the watchful eye of the FAA. The FAA's planning, procurement, and fielding of equipment would be to provide for 100% positive control to all aircraft, especially jet aircraft. By 1965, all airspace in the CONUS above 24,000 feet was under radar control. The FAA's first priority was development of the NAS-Beacon system to provide positive control of jet aircraft. This system, based on secondary radar equipment, was prioritized first for the enroute centers. Dubbed NAS Stage A, this system installation was given priority over the terminal approach control radar. Manpower considerations were a key factor in this decision and the FAA felt the enroute environment would be the easiest to automate since mostly commercial airliners were the majority of the air traffic and the airlines were the most willing to equip with secondary radar equipment. The requirement for manpower to staff the many new enroute centers was high. The FAA budget was shrinking steadily. To find the money to develop the system they held controller hiring and training below full manning levels. In the FAA's original justifications for the automation program, the FAA had convinced the Bureau of Budget and Congress that the system would pay off in increased productivity of controllers and a more efficient ATC system.[10] But technical delays and the mounting costs used most of the procurement dollars. The FAA reduced controller training and absorbed higher workloads for each controller before the new equipment was installed.[11] By 1967, controller workload and aircraft traffic had increased with basically the same manpower and equipment levels since 1960.[12] Additionally, restrictions and new equipment requirements for pilots, controllers, and aircraft had already been enacted.

The key to the FAA's ability to reduce manpower and increase automation was the requirement for all aircraft to be equipped with secondary radar capability and the establishment of mandatory terminal control airspace (TCA) procedures at high and medium air traffic density airports. The regulation made it mandatory that all aircraft that flew in the TCA be under positive control through the use of secondary radar. Reduced controller manning levels based on the expected efficiency of automation by computers, severely crippled ATC ability to identify and track aircraft by primary radar. Even though the NAS-Beacon system may not have been installed at a particular terminal approach control, the FAA automated manning levels were enforced. Aircraft had to be equipped, pilots had to comply, and controllers had to provide air traffic services as though all FAA facilities were upgraded to the anticipated computer automated standard. Even reductions in the maintenance staff for the old equipment took place because reductions in manpower could not be delayed until the new equipment was on-line.[13] The FAA's quest to reduce manpower through automation increased controller workload and reduced ATC system reliability until the mid-1970s, when the system envisioned to be in place by 1965, finally came on-line.

As has already been discussed in chapter two, the <u>National Airspace Plan</u> released in 1982 was started in 1977, just after the final phase-in of the 1960 NAS-Beacon plan was completed. The same pattern of mistakes had been repeated. Projected controller manning levels were adopted to take advantage of system enhancements promised, even though the equipment was not installed. Regulation changes for pilots, controllers, and aircraft were instituted, even though the national airspace system equipment has not been upgraded. As occurred with the NAS-Beacon plan, the FAA has reduced service to military aircraft and reduced military airspace that provides for training of pilots and controllers. The justification for these actions is that the military has not upgraded ATC equipment to be compatible with the FAA systems.[14] But neither has the FAA upgraded. The revision of the original 1982 plan in 1989, that then changed into the Capital Investment Plan in 1994, has still not provided the automated system that the FAA has justified reductions in controller work force and consequently, ATC services. In actuality, the regulations and automation plans have reduced military training capabilities for aircraft and controllers.

The military has not reduced its facility manpower levels, and in many instances, are more able to provide ATC services because they have the manpower with which to provide the service. The DOD will upgrade, modernize, and reduce manpower levels eventually as automation makes this possible. But, as with the installation of ILS, procurement and installation of equipment to provide all of the FAA's envisioned improvements through automation will occur only when the systems are developed and proven to provide the level of performance promised.

Problems With Automation

As controllers in the national airspace system become monitors reliant on an automated ATC system, the regulations, procedures, and uses of ATC have evolved to satisfy different requirements. The ATC procedures used for civilian commercial aircraft have already taken precedence over military training requirements.

As has been described previously, aircraft in the enroute phase of flight have automated flight-following capability. This is accomplished through the use of the automated flight progress system. This system has assigned a unique beacon code to each aircraft when it requests flight plan routing. This code appears on radar scopes and on a flight progress strip that each controlling facility along the aircraft's route of flight receives. This same system passes the same information to the terminal radar approach control facility that services the airport where the aircraft will land.

To provide for a more rapid sequencing of arriving aircraft and to aid in the coordination from approach control to control tower, a video presentation of the approach control radar screen has been placed in the control tower. On the video screen, the tower controller will see a real-time picture of all alpha-numeric presentations tied to aircraft radar identification position indicators. To simplify, the tower controller sees the radar scope blips and associated aircraft information. This system is ideally suited to commercial aircraft that make one approach and land, and with aircraft that are of a similar approach speed. This system does not simplify the coordination between tower and approach control for military aircraft doing multiple approaches to maintain aircraft proficiency, nor does it work well with the variety of military aircraft that use the same runway and ATC facilities, such as helicopters, fighter aircraft, and airlift aircraft. Military tower controllers still must learn to sequence each aircraft for takeoff and landing without the benefit of the radar picture presentation. This is because, after an aircraft is passed to the tower and it completes its approach, the approach control will not maintain the alpha-numeric display for that aircraft. As the aircraft nears the airport, the aircraft will go below radar coverage and the approach control computer deletes the aircraft's secondary radar track.

In the mid-1970s, FAA ATC regulations were changed to take advantage of the approach control video in control towers. The approach controller would type in or tag an aircraft's type of approach and landing and it would be displayed as an alpha-numeric code. The approach controller no longer had to call the tower controller and tell him the type of approach, all the tower controller had to do was read the information off the screen. To fully automate the process, regulations were changed so that the approach controller was not required to ask for permission to send the aircraft into the control tower airspace. The approach controller would ensure that the aircraft had proper separation with other arriving aircraft and tower controllers just monitored their arrival. Two skills that controllers used to develop were now done by a computer. Voice communication was eliminated between radar and tower personnel and the tower controller no longer had to keep a mental picture of where aircraft were in relation to the runway or other aircraft in the tower control airspace zone. The video presentation did both for them. The main drawback to this form of ATC automation was that for the system to work, the aircraft had to be equipped with the secondary radar encoder unit so that each aircraft could be given its own code, the computer would recognize it and display alpha-numeric information for each separate coded aircraft. The solution was to make secondary radar equipment mandatory for all aircraft.

Initially, as part of the NAS-Beacon system, the FAA proposed the idea that military towers would be equipped with the same style of approach control video monitors and an input system that would allow tower controllers to "retag" military aircraft for multiple approach work. However, the computer system that would allow the interface between civilian approach controls (TRACONs) and military towers did not materialize. TRACONs had their manpower reduced on the assumption of one airplane, one approach, and one landing. While the radar equipment could still perform as it had in the past, enhanced with secondary radar capabilities, FAA radar facilities did not maintain the level of manpower necessary to identify and track a primary radar presentation of an aircraft. As previously mentioned, military aircraft perform multiple approaches for aircrew training. With the reduction in manpower at the TRACONs, the FAA used this as a reason to limit multiple approach training for military aircraft that had to return to FAA approach control airspace. The reductions in manpower the FAA used to justify the expense and development of automated ATC now affect military aircrew and ATC tower personnel training.

The FAA capital investment plan for the national airspace system has built in to it overlapping redundancy in the system so that if one component of communications or radar coverage fails, the ATC duties of the failed system will be automatically assumed by the overlapping coverage provided by other TRACONs or enroute centers. Now, and in the future, controllers will be trained and become completely dependent on the automated system. The FAA will not train its controllers to work without the benefit of the automated system due to the additional expense from the increase in training time to initially qualify and then keep controllers current in non-automated ATC operations. This policy decision is not consistent with other FAA aviation regulations, specifically in the area of flight crew training. Pilot training includes initial, recurring, and annual flight proficiency checks in how to safely operate aircraft with instrumentation and navigational aid failures. Pilots are expected to be able to safely operate aircraft with or without instrumentation that automates the piloting process, even in the age of fully automated flight controls.

Since 1975, it has been known that an automated system leads controllers to be dependent on that system. Rather than controlling aircraft with automation as an aid, they wait for the computer to detect a problem. A National Transportation Safety Board (NTSB) investigation of an ATC incident involving two airliners that almost collided over Michigan in December of 1975, concluded that automatic features breed complacency and reduce cooperation between pilots and controllers.[15] The technical advances lead to mistakes as controllers wait for the automated system to notify them of a problem rather than the controller issuing control instructions to prevent a possible conflict between two aircraft. As already described, the purpose of the capital investment plan is to enhance and implement more computer automation to reduce the number of controllers and make ATC more efficient to serve the needs of the continued growth of aviation. This continued growth is expected to be part of the civilian commercial aviation sector. The FAA has placed the military in the position of upgrading to provide the same level of ATC computer-based service as the FAA will provide, or be excluded from receiving ATC services in preference to commercial aviation. The net effect of the FAA's capital investment plan is that it has placed military requirements for ATC in the CONUS behind commercial aviation. With conscious and deliberate effort, the FAA has reduced or eliminated training opportunities for military aircraft and military ATC services in the United States for the non-automated environment military controllers will face at deployment locations. Now, and in the future, this will hamper force projection operations that are dependent on CONUS trained ATC personnel that must upgrade the ATC services at the deployed location lodgment bases.

Since 1965, the FAA has changed procedures and upgraded equipment for the benefit of civilian aviation. The military always has, and will continue to train its controllers to the FAA standard for ATC licensing. In other words, before a military controller can train to work aircraft as a controller, he or she will be certified to the FAA standard. Specific military ATC training and operational requirements for contingency or wartime operations will be the responsibility of the DOD. Controllers will train to work in a computerized ATC system that will not exist in a contingency or wartime environment. When a military controller deploys from their fixed computerized facility, they will not be trained to control aircraft. They will have been trained to monitor a computerized operation and intervene with this automated ATC operation only when a computer informs them there might be a conflict between aircraft. It will be the service's responsibility to train controllers to work in austere environments that do not have, and cannot afford, to install the ATC system that allows controllers to be monitors. Controllers will still be required to train to do the computer's work.

For the military controller force, technology and equipment upgrades will allow some enhanced ATC automation capabilities to be built into stand alone facilities. However, in a combat or contingency environment, radar equipment may never be used, or will have to remain turned off due to the electronic radiation pattern that makes any radar a lucrative enemy target. In a combat or contingency, ATC will provide terminal and approach control services and, in some cases, enroute center services. Without comprehensive enroute radar coverage, military aircraft will rapidly move out of ATC radar coverage, but still be in radio contact and request non-radar ATC services. This divergence between a fully automated system and providing ATC services without automation, is a training process in its own right and each of the services has taken a slightly different approach based on the ATC needs of the military aircraft that a particular service has.

As described in chapter three, military ATC has four different mission categories of ATC services: liaison teams; facility augmentation teams; tactical non-radar; and tactical radar approach control. Liaison teams, which advise an existing facility's controllers on aircraft characteristics, require no special training other than having performed ATC services with the particular type of aircraft that has deployed.

Augmentation of a facility with CONUS-based controllers has already shown some problems. Military pilots have noted that they can tell the difference between United States controllers who deploy from CONUS to support an exercise, and those native controllers who are trained in a non-automated environment. There is a significant learning period until the deployed controller acquires the skills to perform ATC without computer automation.

For tactical ATC, which provide for control tower and non-radar approach control, the Air Force Special Tactics Squadrons (STS) will always be the first on the scene. If the airfield they deploy to will be an Army or Marine Corps aviation facility, deployable ATC services from the Army or Marine Corps will relieve STS. Since the Air Force no longer has a standing controller force trained and available for contingencies to provide tactical tower and non-radar approach control, STS has been placed in the position of continuing to run the ATC operations past the level for which they are designed and equipped to provide.

Curiously, the Army and Marine Corps believe that the Air Force still has this capability to establish aerial ports of embarkation and provide the ATC services for Air Mobility Command (AMC) strategic airlift in support of peace keeping, peace enforcement, and humanitarian relief operations. The deployable ATC equipment is owned by Air Combat Command, Combat Communications Squadrons that no longer have the controllers to man the equipment. Air Mobility Command must provide controllers that have never worked with deployable ATC equipment to support a deployment. The few ATC personnel that are assigned to the

Combat Communications Squadron, must set up the equipment, survey the airfield, and design the approaches that will serve the airport. Once the area is established, these same personnel must train the incoming controllers on how to work in an non-automated ATC environment while familiarizing the non-combat communications controllers with the deployable ATC equipment and operating procedures. Another problem with this mobility controller system is that the CONUS ATC facility where the controllers are taken from still has to provide the same level of ATC service to the aircraft that use the approach or terminal services at that facility. That CONUS facility is now short controllers which may impact its ability to provide ATC services. For a major regional conflict, reducing ATC services at CONUS facilities is acceptable, however, not for contingencies. The majority of force projection operations military ATC must support are contingencies. Without a trained, deployable ATC force, the Air Force is not able to adequately support force projection operations for tactical tower and non-radar approach control services unless Air Force special operations Special Tactics Squadrons are used.

The problems associated with providing controllers for tactical tower ATC to support a contingency become greater for providing tactical radar ATC. Tactical radar ATC provides approach control or enroute services for large numbers of aircraft. The Air Force is still the DOD force provider for any deployable contingency that requires this level of ATC service, despite not having a standing controller force that is trained to operate in remote locations serving moderate to heavy air traffic workloads. If a location is identified, controllers that have never worked without computer automation will deploy to man deployed ATC equipment. The same problem occurs as with augmenting an existing host nation facility, the controllers need time to train to work without computer automation. But, unlike deploying to a host nation ATC facility, there is no native controller force from which to learn.

While the Marine Corps and Army have capable controllers, they also require substantial training to provide the level of ATC service for moderate to high air traffic workloads. This is required because Marine Corps and Army controllers train to the low air traffic workload associated with their service's deployed aircraft deployment schemes, not because of a reliance on automation.[16]

Of the three services studied, the Army and Marine Corps have decided not to attempt to have fully qualified CONUS-based controllers that can function in the stateside facilities. They will concentrate their efforts on fielding a controller force that is split. One half of the controllers will be civilian, DOD employees that will never deploy in force projection operations and staff each service's tower and approach control operations full-time. The other 50 percent of the controller force will primarily be military members who will spend the bulk of their time assigned to tactical units after they have completed initial FAA qualification training. They will not go on to fixed facilities and increase and enhance their controlling skills. In these units, controllers will wait to deploy. The controlling skills learned at the basic ATC course is the bulk of the ATC training they receive. Unlike the Air Force, the Army and Marine Corps do not assign their new controllers to fixed facilities to increase and build an ATC experience level. Experience will come through support of exercises and/or deployments and, if possible, familiarization training at a fixed facility.

The Air Force will continue to train their controllers initially and then assign them as purely air traffic controllers in fixed facilities, which under the capital investment plan, will become fully automated. The Air Force maintains that it has the capability to support any size of force projection operations with ATC services. The present concept of no longer having a standing force trained in deployable ATC operations has left a large gap in force projection capability. Special Tactics Squadrons have already warned that they are over-tasked to provide ATC services for which they are not trained and not equipped to perform as a stopgap measure. This is due to the inability of the Air Force to relieve STS and bring in qualified ATC personnel and equipment to support Air Force aircraft deployments in the low, medium, or high air traffic workload contingencies. The idea of taking controllers from a fixed automated facility without any training in deployment ATC operations has been recognized as a failure since the concept was put in place in 1991.[17] Several ideas on how to remedy the problem have been discussed. But to date, only Air Combat Command has begun to provide one week of equipment familiarization for its fixed facility controllers who may be deployed. The few controllers that are assigned to combat communications squadrons are over-tasked and unable to relieve STS personnel to provide ATC services.

Summary

In this chapter, analysis was performed on the research material that compared how the FAA has developed ATC in the national airspace system, to how the military developed ATC in the national airspace system to support military requirements. The research shows a pattern of the FAA and its predecessors attempting to increase ATC efficiency in the national airspace system by developing technological solutions that reduce or eliminate manpower. In all cases, manpower and ATC services have been reduced to pay for technological developments.

The military has also invested in technology to enhance the ability of air traffic controllers to provide ATC services, but has not invested in technology as heavily, and has relied on trained controllers to make up for the lack of automated systems. This is especially true for deployable ATC services where computerized radar systems may not be used and the controller must provide safe and expeditious ATC service for large numbers of aircraft with highly developed ATC skills and a radio.

The automated ATC systems of the FAA have degraded the ability of controllers to acquire the non-automated ATC skills while working at CONUS-based fixed facilities. It falls on the military to train controllers to provide ATC services that support force projection operations. The military has recognized the need for controllers to be able to provide ATC services in a non-automated environment. The Army, Marine Corps, and Air Force all possess the ability to support low air traffic terminal and approach control operations. However, with the demise of deployable ATC service capabilities in the medium to high air traffic operations due to budget priorities, a major regional conflict scenario, such as Desert Storm, cannot be supported in the present environment.

Endnotes

[1]Turbulence Aloft, 127.

[2]Ibid., 128.

[3]Ibid., 129.

[4]Ibid.

[5]Ibid., 218.

[6]Ibid., 219.

[7]Turbulence Aloft, 220.

[8]Ibid., 222.

[9]Safe, Separated and Soaring, 204.

[10]Ibid., 208.

[11]Ibid.

[12]Ibid., 209.

[13]Ibid.

[14]EER Systems, 3-5.

[15]Troubled Passage, 209.

[16]The Desert Shield/Desert Storm Comm Story, 141.

[17]United States Air Force, Deployed Air Traffic Control and Landing Systems (DATCALS) Working Group Meeting, Fort Monroe, Virginia, 14 and 15 March, 1996.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Today, United States military strategy relies on force projection instead of forward basing of military forces. This strategy places an emphasis on the ability to respond quickly by air to major regional conflicts, to support peace keeping missions and peace enforcement operations, as well as humanitarian relief, and disaster relief operations. The overnight surge of airlift and other aircraft to any place on the globe calls for the ability to conduct around-the-clock, all-weather operations.

Key to the concept of around-the-clock, all-weather operations for an aircraft is air traffic control equipment and controllers who can provide air traffic services to support all varieties of military force projection operations. Each service has a deployable air traffic control service element. These service elements reestablish, or install for the first time, ATC services that are not in-country. These ATC services are provided by military personnel who train to the same procedural and operating standards as FAA air traffic controllers. In fact, all United States military controllers are licensed by the FAA. Since all military controllers train to operate in a similar fashion to FAA controllers, future plans by the FAA for air traffic control equipment, procedures, and personnel training will impact military ATC. The military operates, and will continue to operate, in the national airspace system and provide as much as 25 percent of the air traffic control services in the US. The reason the US has a military ATC force is to support military aircrew training and then to support these aircrews during combat or contingencies.

This thesis has investigated whether the FAA's plans to modernize the national airspace system for ATC in the United States through the capital investment plan take into account the military's requirements and uses for ATC. This review shows that civilian commercial and military aircraft all have a need for services to aid in enroute navigation and provide bad weather landing capabilities. The entire system of air traffic control and the facilities and equipment to support aviation requirements grew into what is now known as the national airspace system. The FAA has been spurred over time to enhance the national airspace system because of commercial aviation needs. The FAA has always chosen to reduce manpower and upgrade ATC efficiency through technology, regardless if ATC service suffers because the technology is not proven. The military has held on to manpower to provide ATC services until technology has shown that manpower is no longer required. The military has paid a price for this approach in that the FAA has reduced valuable training opportunities for military aircrews and controllers through a reduction in the airspace and FAA ATC service provided to military aircraft.

The changes that the FAA has made in air traffic control and equipment to provide safe and expeditious ATC services to commercial airliners has placed increased reliance on automation of controller tasks with computerized radar systems. Without the computerized system, the FAA does not posses the manpower or have the procedures in place to operate in a non-automated environment. For the CONUS ATC facilities that train controllers to go to war, the FAA is forcing the military into the same type of automated computer-based ATC that is designed to best serve civilian commercial air traffic. This thesis has shown that the ATC services required to support combat or contingencies are different.

Because the FAA's capital investment plan does not consider air traffic control for combat nor contingencies, it will fall completely on the military to train their personnel for both automated and non-automated air traffic control services. In this time of reductions in military operating budgets, training of air traffic controllers for deployment has been significantly reduced. This thesis has highlighted a large gap in deployable ATC equipment and trained personnel that, prior to 1991, was filled by standing deployable Air Force controller personnel. A budget decision has created a shortage in ATC capability for the US military's present contingency operations. It is acknowledged that the ability to support an operation the size of Desert Shield/Desert Storm cannot occur without significant lead time to train ATC personnel.

Recommendations

Within the DOD, the mechanisms already exist to resolve the gap between the direction of the FAA and its capital investment plan, and the needs of the military for air traffic services to support force projection operations. The key is to provide training to the controller force within the present and future confines of the national airspace system to meet the requirements of deployable ATC services. For the controller will have to do the work of a computer in a combat or contingency environment.

The Army and Marine Corps have correctly identified the need for separate deployable ATC units. They have tailored ATC equipment and controller training to support their aircraft deployments. The controllers who man these facilities are trained to handle low air traffic workloads and man stand-alone GCA and control tower units that can provide all-weather operations. At this time, the Army and Marine Corps will only deploy to support their service's aircraft on an airfield that is considered an Army or Marine airfield.

The Air Force has the bulk of the deployable equipment and controller personnel to support any size contingency. Prior to 1992, a dedicated contingency dispersed controller program, backed by the mobility controller program, made supporting contingencies and major regional conflicts possible. Highly skilled controllers with a minimum of six years experience in stateside, FAA-style military facilities, trained, exercised, and deployed to contingencies and war in support of any size ATC mission. However, even the dispersed controller program, before it was eliminated, was not fully supported by the Air Force. Manning levels for controllers rarely climbed above 60 percent. Those who were assigned to combat ATC units had more than their share of temporary duty deployments in an effort to make up for the manning shortage that the Air Force Manpower Center could never make up. Eliminating the dispersed controller program and deploying straight from a fixed stateside unit was thought to be the best solution. But, time and this thesis have shown that providing ATC services without automated, integrated ATC environment of the national airspace system is a separate mission that requires specialized training in non-automated ATC operations. The Air Force should follow the example of the Army and Marine Corps in recognizing this requirement and establish separate ATC deployable units with a well trained ATC force taken from the already highly trained stateside fixed ATC force. These units should be located at military facilities where the deployable equipment can be set up and operated to maintain currency. The controllers assigned to the deployable unit should also be qualified in the fixed facility control tower and approach control.

In the area of controller training, the Air Force has the best system whereby a controller gains and maintains ATC proficiency while assigned to a fixed air traffic control facility. It is only after gaining several years of experience that an Air Force controller is assigned to support deployable ATC. The Army and Marine Corps should adopt the same method of training. As stated above, it is recognized that the Army and Marine Corps anticipate only supporting their own deployed aircraft. However, in today's environment of joint operations, and limited runway space available at deployed locations, it is unlikely that Army and Marine Corps controllers will only work Army or Marine Corps aircraft.

In recognition that all services operate in a joint environment, consideration should be given to establishing joint tours for mid-level and senior-grade noncommissioned officers in each service's fixed facilities. Emphasis should be placed on getting Army and Marine Corps controllers into busy Air Force facilities where they can decidedly enhance their ATC skills and take those skills back to their own service. Air Force personnel, in turn, could be given a joint assignment to the Army and Marine Corps deployable ATC units. A small cadre of experienced mid-level and senior-grade noncommissioned officers would provide an excellent training resource, instead of waiting for a deployment such as Desert Shield to force the training requirement.

Given today's operation tempo, it would be advantageous to develop a joint service air traffic control element similar to the joint services communications element already in operation. The ATC equipment that each service operates is very similar, and so is the controller training since all DOD controllers train and maintain to the FAA standard. A unit that possesses radar and non-radar approach control, GCA, navigational aids, mobile control tower, the maintenance personnel along with experienced controllers, would immediately solve the problem of who is going to support any contingency or deployment and relieve an STS unit that is usually first on the scene.

This thesis has looked at the relationship between the FAA and its predecessors in relation to the military as both organizations provide ATC. The purpose was to determine whether the actions taken by the FAA support military ATC requirements. First, the evolution of how ATC started and became the largest, most comprehensive national airspace system in the world was investigated. Chapter two showed that military and civilian ATC both evolved in parallel, and at times demonstrating that the military requirements produced better solutions in providing ATC services. In 1958, the relationship was formally put into law by the Federal Aviation Act. An area for further research would be to investigate the exchange between the FAA and the DOD as to what or how the decisions were made to upgrade equipment capabilities and change ATC regulations. While absolute blame cannot be pinpointed, a distinctive lack of any reference to military membership in the decisions on how best to upgrade ATC equipment and procedures is evident in this thesis research material. The overall impression is that the FAA makes the decision and the military must comply. Was this the intent of the 1958 act?

After describing what the national airspace system is and how the ATC equipment is used by controllers, chapter three described what equipment is used by deployable military ATC units to create a limited or fully capable airspace system. The deployable ATC units use FAA training and experience to provide safe and expeditious ATC service to all sizes of contingencies and in war. The different styles of ATC support missions were explained and how each service was equipped to cover all or some of the possible ATC mission taskings. Two real world examples of deployable ATC services showed the unique operational requirements that military controllers must fill. A topic for further research is the ATC support provided for the many diverse military missions the US and its allies have undertaken since Desert Storm. This is especially true for Bosnia and Rwanda, where airlift was a key factor in the success of the initial rapid deployment of coalition forces.

Analysis in chapter four highlighted several interesting points. First, that the FAA has always attempted to use technology to solve a perceived lack of efficiency in the ATC services it provides, regardless of the costs to make the technology work. Those costs have included large expenditures of taxpayer dollars on systems that do not work, reductions in ATC services to pay for the cost overruns, and reductions in military training opportunities for aircrews and controllers alike. While this thesis touched on possible reasons for the FAA's consistently bad decisions, this research and findings are a by-product of determining whether future modernization by the FAA would help or hurt military ATC. A more thorough study of the FAA's preference for automation technology over trained controller manpower might help enlighten as to why these dollars have been wasted to date.

This thesis has shown that the FAA's capital investment plan for national airspace system does not consider military air traffic control capabilities to support United States military force projection operations. It will be up to the military to resolve the requirements for air traffic services to support military force projection operations. Now, more than ever, the world relies on US military airpower and the airpower relies on controllers to ensure safe and expeditious flight operations.

BIBLIOGRAPHY

Books

Kent, Richard J., Jr. Safe, Separated and Soaring. Washington, D.C.: Government Printing Office, 1980.

Komons, Nick A. Bonfires to Beacons. Washington, D.C.: Smithsonian Institution Press, 1989.

Preston, Edmund. Troubled Passage. Washington, D.C.: Government Printing Office, 1987.

Rochester, Stuart I. Takeoff at Mid-Century. Washington, D.C.: Government Printing Office, 1986.

Wells, Alexander T. Airport Planning and Management. Blue Ridge Summit, PA: Tab Books, 1992.

Wilson, John R. M. Turbulence Aloft. Washington, D.C.: Government Printing Office, 1979.

Periodicals and Articles

Chao, Elaine L. "DOT Plans for ATC Modernization." Journal of ATC (January/March 1990): 35-37.

Fischer, Frank W. "Do We Really Need Air Traffic Control?" Interavia (October-December 1987): 359-368.

Lopez, Ramon. "Don't Blame Airlines for ATC Delays." Jane's Airport Review, 2, No. 2 (1 February 1990): 40.

McLaurin, Hugh, and Mary Minnix. "Data Link Communications: Key to Future Air Traffic Services." FAA World (October 1993): 10-13.

Oliveri, Frank. "When the LZ is Hot." Air Force Magazine, 77, No. 2 (February 1994): 26-34.

Philips, Edward H., et. al. "Special Report: ATC Revolution Brewing." Aviation Week & Space Technology (16 May 1994): 3-16.

Poole, Robert W., Jr. "Building a Safer and More Effective Air Traffic Control System." Policy Insight: Reason Foundation, No. 126 (February 1991): 3.

Seltzer, Stanley L. "The History of Positive Control." Journal of ATC (October/December 1992): 38-40.

Walker, Charles. "World Survey of ATC Schemes." Jane's Airport Review, 2, No. 1 (1 January 1990): 15.

Government Documents

Burton, John L. FAA's Plan to Improve the Air Traffic Control System: A Step in the Right Direction But Improvements and Better Coordination are Needed. Washington, D.C.: Government Printing Office, February 1983.

Iadeluca, Joseph P. National Airspace System Approach and Departure Sequencing Operational Concept. Washington, D.C.: Government Printing Office, 1989.

Peach, J. Dexter. Air Traffic Control: Continued Improvements Needed in the FAA's Management of the NAS Plan. Washington, D.C.: Government Printing Office, November 1988.

Powell; Colin L. National Military Strategy of the United States of America. Washington, D.C.: Government Printing Office, 1992.

Shalikashvili, John M. National Military Strategy of the United States of America. Washington, D.C.: Government Printing Office, 1995.

Trent, William. National Airspace Operational Concepts. Washington, D.C.: Government Printing Office, 1992.

United States. Federal Aviation Administration. Airman's Information Manual. Washington, D.C.: Government Printing Office, 1995.

United States. Federal Aviation Administration. Aviation system capital investment plan report of the Federal Aviation Administration to the US Congress pursuant to Section 504(b)(1) of the Airport and Airway Improvement Act of 1982 (Title V, P.L. 97-248). 1990.

United States. General Accounting Office. Air traffic control continued improvements needed in FAA's management of the NAS plan: Report to the chairman, Subcommittee on Transportation, Committee on Appropriations, House of Representatives. 1988.

Joint Chiefs of Staff: Joint Pub 1-02, Department of Defense Dictionary of Military and Associated Terms. Washington, D.C. : Government Printing Office, March 1994.

Joint Chiefs of Staff: Joint Pub 3-52, Doctrine for Joint Airspace Control in the Combat Environment. Washington, D.C. : Government Printing Office, December 1994.

U.S. Army. FM 1-120, Army Air traffic Services Contingency and Combat Zone Operations. Washington, D.C.: Department of the Army, May 1995.

U.S. Army. FM 1-303, Air Traffic Control Facility Operations and Training. Washington, D.C.: Department of the Army, April 1993.

U.S. Marine Corps. FMFM 5-60, Control of Aircraft and Missiles. Washington, D.C.: Department of the Navy, June 1993.

Unpublished Materials

Bridewell, Alex, Tom Pickerel, and Kent Simmons. "Department of Defense Air Traffic Control and Airspace Systems Interface with the National Airspace System." EER Systems Corporation, Vienna, Virginia, March, 1990.

Schatz, Rowayne A., Jr. "Airborne Forcible Entry Operations: USAF Airlift Requirements." Master of Military Art and Science Thesis, U.S. Army Command and General Staff College, 1994.

Scherbinske, Donald A. "Strategic Airlift Limitations in a Changing World Environment." Master of Military Art and Science Thesis, U.S. Army Command and General Staff College, 1991.

Transcript of Department of Defense Press Conference, September, 1993.
Les Aspin
General Colin L. Powell

Witt, Randy. "Air Force Tactical Communications in War, the Desert Shield/Desert Storm Comm Story." Riyadh, Saudi Arabia, Headquarters United States Central Command Air Forces, March, 1991.

INITIAL DISTRIBUTION LIST

1. Combined Arms Research Library
   U.S. Army Command and General Staff College
   1 Reynolds Avenue
   Fort Leavenworth, KS 66027-1352

2. Defense Technical Information Center
   Cameron Station
   Alexandria, VA 22314

3. Air University Library
   Maxwell Air Force Base
   AL 36112

4. Mr. Robert Walz
   DJCO
   USACGSC
   1 Reynolds Avenue
   Fort Leavenworth, KS 66027-1352

5. MAJ Steven F. Miller
   DJCO
   1 Reynolds Avenue
   Fort Leavenworth, KS 66027-1352

6. LTC James C. McNaughton
   5344 Soquel Drive
   Soquel, CA 95073

7. Headquarters Air Combat Command/DOF
   205 Dodd Boulevard, Suite 101
   Langley AFB, VA 23655

8. MAJ William Bassett
   CSI
   1 Reynolds Avenue
   Fort Leavenworth, KS 66027-1352

CERTIFICATION FOR MMAS DISTRIBUTION STATEMENT

1. Certification Date: 5 / May / 96

2. Thesis Author: Major Alan C. Dorward, USAF

3. Thesis Title: Federal Aviation Administration Impact on Military Air Traffic Control Force Projection

4. Thesis Committee Members Signatures:

5. Distribution Statement: See distribution statements A-X on reverse, then circle appropriate distribution statement letter code below:

(A) B C D E F X SEE EXPLANATION OF CODES ON REVERSE

If your thesis does not fit into any of the above categories or is classified, you must coordinate with the classified section at CARL.

6. Justification: Justification is required for any distribution other than described in Distribution Statement A. All or part of a thesis may justify distribution limitation. See limitation justification statements 1-10 on reverse, then list, below, the statement(s) that applies (apply) to your thesis and corresponding chapters/sections and pages. Follow sample format shown below:

S-----------SAMPLE---------SAMPLE---------SAMPLE----------SAMPLE-------S

	Limitation Justification Statement	/	Chapter/Section	/	Page(s)	
A						A
M						M
P	Direct Military Support (10)	/	Chapter 3	/	12	P
L	Critical Technology (3)	/	Sect. 4	/	31	L
E	Administrative Operational Use (7)	/	Chapter 2	/	13-32	E

----------SAMPLE---------SAMPLE----------SAMPLE----------SAMPLE-------

Fill in limitation justification for your thesis below:

Limitation Justification Statement	/	Chapter/Section	/	Page(s)
	/		/	
	/		/	
	/		/	
	/		/	
	/		/	

7. MMAS Thesis Author's Signature: Alan C Dorward

STATEMENT A: Approved for public release; distribution is unlimited. (Documents with this statement may be made available or sold to the general public and foreign nationals.)

STATEMENT B: Distribution authorized to U.S. Government agencies only (insert reason and date ON REVERSE OF THIS FORM). Currently used reasons for imposing this statement include the following:

1. Foreign Government Information. Protection of foreign information.

2. Proprietary Information. Protection of proprietary information not owned by the U.S. Government.

3. Critical Technology. Protection and control of critical technology including technical data with potential military application.

4. Test and Evaluation. Protection of test and evaluation of commercial production or military hardware.

5. Contractor Performance Evaluation. Protection of information involving contractor performance evaluation.

6. Premature Dissemination. Protection of information involving systems or hardware from premature dissemination.

7. Administrative/Operational Use. Protection of information restricted to official use or for administrative or operational purposes.

8. Software Documentation. Protection of software documentation--release only in accordance with the provisions of DoD Instruction 7930.2.

9. Specific Authority. Protection of information required by a specific authority.

10. Direct Military Support. To protect export-controlled technical data of such military significance that release for purposes other than direct support of DoD-approved activities may jeopardize a U.S. military advantage.

STATEMENT C: Distribution authorized to U.S. Government agencies and their contractors: (REASON AND DATE). Currently most used reasons are 1, 3, 7, 8, and 9 above.

STATEMENT D: Distribution authorized to DoD and U.S. DoD contractors only: (REASON AND DATE). Currently most used reasons are 1, 3, 7, 8, and 9 above.

STATEMENT E: Distribution authorized to DoD only; (REASON AND DATE). Currently most used reasons are 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

STATEMENT F: Further dissemination only as directed by (controlling DoD office and date), or higher DoD authority. Used when the DoD originator determines that information is subject to special dissemination limitation specified by paragraph 4-505, DoD 5200.1-R.

STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals of enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25; (date). Controlling DoD office is (insert).