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THE VALUE OF THE CIVIL RESERVE AIR FLEET: HOW MUCH COULD THE DOD SPEND ON INCENTIVES?

THESIS

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Contents

Page

DISCLAIMER ii

LIST OF ILLUSTRATIONS v

LIST OF TABLES vi

ABSTRACT viii

INTRODUCTION 1
- Background 1
- Incentives for Enrollment in the CRAF 3
- Minimizing Risk or Disincentives to Commercial Carriers 4
- Problem Statement 5
- Purpose of the Study 6
- Research Objectives 6
- Scope and Limitations 7
- Significance of Study 8
- Thesis Overview 8

LITERATURE REVIEW 9
- Introduction 9
- The CRAF Program 10
- The Formation of CRAF 12
- The Cold War Years 14
- The Persian Gulf War 16
  - CRAF Volunteers 16
  - CRAF Activation, Stage I 17
  - CRAF Sizing 17
  - CRAF Activation, Stage II 18
- Problems with CRAF 19
- Threats to Future CRAF Participation 20
  - Insurance 20
  - Loss of Market Share 24
- Incentives 27
- Conclusion 29

METHODOLOGY 30
Introduction 30
Research Design 31
The Value of CRAF 32
Costs of Current Incentives 33
Potential Expenditures 34
Insurance 34
Market Share 36
Research Questions 37
Assumptions 38
Summary 38

DATA ANALYSIS 39
The Value of the CRAF 41
Reserve Airlift Capacity 41
Cost of Reserve Airlift Capability 43
The Opportunity Cost of the CRAF 45
Cost of Current Incentives 48
Peacetime Government Business Base 48
CRAF Enhancement Program 51
Commercial Access to Military Installations 52
Wartime Expenditures 53
Potential Expenditures 56
Aviation Insurance and Indemnity Programs 56
Cost of Lost Market Share 71
Summary 76

CONCLUSIONS AND RECOMMENDATIONS 78
Conclusions 78
Limitation in this Study 82
Recommendations for Further Study 82

APPENDIX A: CIVIL AIR CARRIER STATISTICS 84

APPENDIX B: COMMERCIAL AVIATION TRENDS 89

APPENDIX C: CIVIL RESERVE AIR FLEET AND MILITARY FLEET STATISTICS93

APPENDIX D: FAA INSURANCE DATA 103

GLOSSARY 114

BIBLIOGRAPHY 117

Illustrations

Page

Figure 4-1. Reserve Capacity for Emergencies during 1989.....41

Figure 4-2. average annual Total cost per Unit of Reserve Capability, 1961-1990 44

Figure 4-3 . Revenue Available to Participating CRAF Carriers, Fiscal Year 1996.....50

Figure 4-4. Aircraft Hull Values of all FAA Registered Aircraft 57

Figure 4-5. Expected Cost Due to Aircraft Loss or Damage for Varying Incident Rates 66

Figure 4-6. Break-Even Point Where Insurance Costs Equal Costs Due to Loss.....70

Figure B-7. U.S. Scheduled Airlines Cumulative Net Profits, 1980-1994.....90

Figure C-8. Long-Range Cargo Segment and Stage III Requirements 96

Figure C-9. Long-Range Passenger Segment and Stage III Requirements.....97

Figure C-10. Planned Strategic Military Airlift Capability-Cargo Aircraft 100

Figure C-11. AMC HQ Form 312, Civil Reserve Air Fleet Capability summary, Page 1101

Figure C-12. AMC HQ Form 312, Civil Reserve Air Fleet Capability summary, Page 2102

Tables

Page

Table 4-1. Historical Long Range International Participation in the CRAF 45

Table 4-2. The Opportunity Cost of the Long-Range International Segment of CRAF.... 46

Table 4-3. Annual HQ Obligations for International Airlift Services Contract, Fiscal Years 1985-1997 49

Table 4-4. The Average Value of the CRAF and Average Cost of Incentives for Fiscal Years 1985 - 1997, (in $ millions) 54

Table 4-5. The Expected Value of the CRAF and Expected Cost of Incentives for Fiscal Year 1997, (in $ millions)..... 55

Table 4-6. Representative War-Risk Insurance Surcharge Based on the Average Insured Value of the Aircraft Hull (in $)..... 59

Table 4-7. CRAF Cargo Aircraft as Percent of Total CRAF Cargo Fleet 60

Table 4-8. CRAF Passenger Aircraft as Percent of Total CRAF Passenger Fleet 60

Table 4-9. Total CRAF Missions Flown: August 1990 - February 1991..... 61

Table 4-10. Expected Cost of Commercial War-Risk Insurance Surcharge for 5,000 Commercial Missions 62

Table 4-11. Expected Cost of Commercial War-Risk Insurance for Various Levels of Flying Activity..... 63

Table 4-12. Accident Rates for U.S. Airlines, Scheduled and Non-Scheduled Service, 1984-1993 64

Table 4-13. Expected Cost Due to Loss or Damage for Varying Incident Rates 66

Table 4-14. Break-Even Point Where Insurance Costs Equal Costs Due to Loss 69

Table 4-15. Economic Value of Airport Slots..... 73

Table 4-16. Market Share: Analysis of Airport Slots Costs..... 75

Table A-17. Large Certificated Air Carriers, 1992 and 1993 84

Table A-18. Total Capacity Available in all Services by all U.S. Air Carriers1984-1995 (in thousands of ton-miles) 85

Table A-19. Revenue Ton-Miles Flown in all Services by all U.S. Air Carriers1984 - 1995 (Thousands Of Ton-Miles) 86

Table A-20. Available Capacity for U.S. Air Carriers, Cargo and Passenger, 1984-1995 (in millions of ton-miles per day) 86

Table A-21. Revenue Ton-Miles Flown for all U.S. Air Carriers, Cargo and Passenger, 1984 - 1995 (in millions of ton-miles per day) 87

Table A-22. Passenger Capacity for all U.S. Air Carriers, 1984-1995 (in millions of passenger-miles per day) 87

Table B-23. FAA Commercial Aviation Forecasts, Passenger Traffic, 1994-2005 91

Table B-24. Share of World Airlift Capacity as a Percent of Total World Capacity (in millions of ton-miles) 92

Table C-25. Participating CRAF Carriers, as of 1 July 1996 93

Table C-26. Total Number of Aircraft in CRAF by Segment and Stage, as of 1 July 199694

Table C-27. Total Wide-body Equivalents in CRAF by Segment and Stage, as of 1 July 1996 94

Table C-28. Total CRAF Capability in Millions of Ton-Miles per Day and Millions of Passenger Miles per Day, as of 1 July 1996 94

Table C-29. Long-Range International Cargo-Historical CRAF Participation 95

Table C-30. Long-Range International Passenger-Historical CRAF Participation 97

Table C-31. Long-Range International Cargo Carriers as a Percent of Total Fleet, 199698

Table C-32. Long-Range International Passenger and Aeromedical Evacuation Carriers as a Percent of Total Fleet 98

Table C-33. Strategic Military Airlift Capacity, 1996 - 2006 (in MTM/D) 99

Table D-34. Average Insured Value by Make and Model 103

Table D-35. Insured Value of all FAA Registered Aircraft 104

AFIT/GTM/LAL/96S-4

Abstract

This study evaluated the value of the CRAF program to the DOD and explored the amount that could be spent to remove potential obstacles to participation with aviation insurance and lost market share. In comparing the value of the CRAF and the cost of current incentives, it was determined that up to $1.4 million could be spent on additional incentives, annually.

For multiple aircraft losses and liability claims, the Air Force would need to tap into the Defense Business Operating Fund. Therefore, a sensitivity analysis was conducted and found that for low valued aircraft, such as the DC8, the cost due to loss would exceed the cost of commercial insurance at relatively low incident rates. Thus, it may be appropriate for the DOD to absorb the cost of commercial war-risk insurance for certain missions, thereby eliminating the expense resulting from a large claim.

The cost due to lost market share was measured by the minimum cost required to re-enter a city pair market. At highly desirable airports, this cost is approximately $51,200 per month. However, this research found no conclusive evidence that would warrant additional monetary incentives to reduce the risk of lost market share.

Chapter 1

Introduction

Background

Civil airlift has augmented military airlift for over 50 years and has become a necessary part of the Department of Defense's (DOD) airlift strategy. This Civil Reserve Air Fleet (CRAF) grew out of the need for additional airlift during the Korean War and provided the United States with the ability to project military forces in Europe to minimize or counter the Soviet threat of global thermonuclear war. However, the shift in military strategy to smaller, regional conflicts and the activation of CRAF in the Persian Gulf War revealed not only the importance of CRAF, but also several deficiencies in the CRAF program.

The shift in military strategy resulted from the collapse of the Soviet Union affecting airlift requirements for the military and CRAF, significantly. A war in Europe to counter a Soviet threat required a large military force, both pre-positioned and sustaining, with the ability to deliver 66 million ton-miles of supporting personnel and equipment each day. The shift in military strategy to support two near-simultaneous major regional conflicts (MRC) relies on a smaller military force, but with the ability to deploy quickly, over much longer distances. Thus, military strategy has changed from a forward based posture to

that of forward mobility. The airlift requirements for this forward mobile military force were determined in the 1992 Mobility Requirements Study to be approximately 50 million ton-miles per day. With either strategy, however, the Air Force does not have enough capacity to support the airlift requirements with organic (military) airlift, and therefore, relies on the Civil Reserve Air Fleet to fill the shortfall in airlift (Fogleman, Undated).

The shift in military strategy affects not only the amount of airlift required, but also the amount of risk to which commercial aircraft are exposed. During the Cold War, commercial aircraft could operate from airfields far from enemy lines, posing little threat to the CRAF from enemy attack. While the Persian Gulf War may not be predictive of future conflicts, it is reasonable to understand why regional conflicts may pose a greater threat to commercial aircraft. As seen in the Gulf War, airfields may be in the line of fire, posing a higher risk of enemy attack. The threat of a chemical attack at airfields in Saudi Arabia and the region constrained operations because commercial carriers would only land in the region during daylight hours. With a continued requirement to deploy military forces anywhere in the world, airlift, organic and commercial, becomes the primary means of delivering military forces, quickly, to serve as the halting force.

In addition to the increased risk to which commercial carriers were exposed, the Gulf War revealed other deficiencies in the CRAF program: commercial carriers believed the government insurance and indemnity program did not adequately cover their potential losses, large air carriers were reluctant to volunteer additional airframes due to the potential for lost market share, and there was a concern with a declining DOD peacetime business base due to the draw-down in military forces and the withdrawal of troops from overseas locations. As a result, The United States Transportation Command

(USTRANSCOM) began looking for ways to increase the incentives for civil air carriers, while reducing those obstacles which prevent or reduce their participation in the program (Johnson, 1992).

To that end, many changes in the CRAF program have taken place since the Gulf War and several studies have been published. The next two sections will briefly discuss the changes to the CRAF program that the Air Force has implemented and highlight other key issues of importance to the CRAF. A more detailed discussion of these issues can be found in chapter 2 of this report.

Incentives for Enrollment in the CRAF

Enrollment by civil air carriers to the Civil Reserve Air Fleet is based on one primary incentive; the award of contracts for movement of cargo and passengers to participating CRAF carriers. As the United States military continues to down-size, the amount of airlift required for peacetime operations continues to decrease. This, in turn, reduces the amount of airlift available for DOD contracts to these carriers, thereby reducing the incentive for carriers to remain in the CRAF program. However, the reliance on the commercial air carrier industry is still vital to the United States aviation policy in meeting national defense objectives (White House, 1987). Therefore, USTRANSCOM has succeeded in linking other government airlift requirements to CRAF, thereby maintaining a large enough peacetime business base to attract commercial air carrier participation in the CRAF. The first government agency to join the DOD in the use of CRAF carriers is the General Services Administration (GSA). USTRANSCOM would also like to enlist the

United States Postal Service (USPS), which currently contracts their airlift requirements with Emery Worldwide and other carriers (Routh, 1994a; Routh, Undated).

Another change to the incentives offered to participating carriers is not direct monetary compensation, but rather indirect compensation. The Air Force has received legislative approval for commercial air carriers to conduct commercial operations from military airfields, to include alternate weather, technical, and fuel stops. The ability to use military airfields for commercial operations will add greater flexibility to the carrier's scheduling and route planning. The incentive also enables commercial carriers to realize a substantial savings in fuel costs (Routh, 1994b).

Minimizing Risk or Disincentives to Commercial Carriers

To ensure a viable CRAF program for the future it is important that the obstacles which prevent or reduce participation in the CRAF by commercial carriers are minimized or at least balanced with the appropriate incentives. The two disincentives of greatest concern to carriers are an inadequate government insurance and indemnity program and the potential loss of commercial market share during activation of the CRAF. To address problems with the Aviation Insurance Revolving Fund and the ability to expeditiously pay claims, Air Mobility Command is now authorized to use their defense business operating funds (DBOF) to pay for any large claim resulting from the loss or damage to an aircraft. Other risks or disincentives include an increased threat of enemy attack and the declining peacetime business base. To counter a declining peacetime business base, GSA is now using CRAF carriers, as discussed above.

Problem Statement

Many studies have been conducted on the CRAF since the Persian Gulf War. The thesis in these studies fall into two primary categories: lessons learned and issues for the future. The studies which capture the lessons learned from the first activation of CRAF focus, primarily, on the operational problems and successes encountered in the war and include issues, such as mission planning, load planning, communications, the issuance of government insurance, and recall procedures. The other group of studies focus on future issues that threaten the long-term viability of the CRAF. These studies suggest ways to strengthen incentives to commercial carriers. All of the studies contribute to USTRANSCOM's objective of building a stronger, long-term partnership between the Air Force and commercial air carriers in support of the national transportation policies and national defense objectives.

In reviewing the published literature on lessons learned or ways to improve the incentive structure of the CRAF program, the cost to the Air Force, DOD, and commercial carriers receives only a cursory look. The cost analysis in these studies are limited, in that they analyze costs for one specific area only. For example, the cost to replace CRAF with organic, military transports was researched in the 1994 RAND study (Gebman et al., 1994b:40-43). The cost of actual compensation to commercial carriers for missions flown in peacetime and during the Gulf War can be found in several studies (Lund et al., 1993, Chenoweth, 1990, and Chenoweth, 1993). And, the cost to carriers for Title XIII (now Chapter 443) premium and non-premium insurance is found in a 1994 General Accounting Office (GAO) report (GAO, 1994). However, no study attempts to

capture all costs or evaluate the amount the Air Force and the DOD could spend to maintain the reserve airlift capacity in the CRAF.

Purpose of the Study

The objective of this study is to evaluate the value of the CRAF, or the amount it is worth, to the DOD with respect to the overall cost of the program. The value of the CRAF to the DOD can be thought of as an effective ceiling for determining the amount the DOD should be willing to spend on incentives for continued participation in the program. This value is a ceiling because the DOD, or Air Force, should not spend more on incentives than the amount that CRAF is worth. This is analogous to the purchase of a product or service; a consumer would not pay more than the product or service is worth to him or her, including the cost of his or her time and resources. With the total value of the CRAF established, the cost of various incentives or disincentives will be evaluated.

In evaluating the value of CRAF, and therefore, establishing the amount that could be spent on incentives, this study presents an alternate view point for evaluating these incentives than that presented in the current literature. More importantly, however, this study establishes an upper limit for outlays on incentives in the CRAF program. With an upper bound, future incentive programs can be evaluated in terms of their greatest impact to facilitating participation.

Research Objectives

The value of the CRAF with respect to the cost of incentives and disincentives, is evaluated using a three step process. First, the total value of the CRAF program is evaluated from the point of view of the DOD and Air Force. Second, the cost of the

current incentives is quantified. Finally, the cost to compensate carriers in two key areas, insurance coverage and lost market share, is explored. The analysis, contained in chapter 4, annualizes costs to serve as a basis of comparison and answer the following questions.

1. What is the value of CRAF and is this value the amount the DOD should be willing to spend to maintain a viable Civil Reserve Air Fleet?
2. What additional amount, in annual expenditures, should the DOD be willing to invest to adequately compensate civil air carriers?

Scope and Limitations

This study evaluates the value of the CRAF in broad terms, rather than present a detailed cost-benefit analysis for two reasons. First, a detailed cost-benefit analysis is beyond the scope of a single researcher. Second, an exploration of the costs and their magnitude can provide the framework for other researchers to look more closely at the costs and benefits of CRAF, the incentives, and the barriers to participation.

This study explores only the cost of incentives already in use or approved for use in the CRAF program. Additionally, this study does not attempt to analyze the impact that current incentives have on carrier participation. Several studies have analyzed the causal relationship between carrier participation and incentives (Gebman et al., 1994b and Coffey and Frola, 1996).

Finally, the economic and fiscal constraints of the Department of Defense and the United States airline industry are not considered in the analysis of the value or cost of the CRAF. The purpose of this study is to evaluate what the DOD could spend for incentives, rather than what the DOD has the ability to pay for incentives. While these constraints are important and affect the future decisions of the Air Force, the DOD, and commercial

carriers with regard to the CRAF program, their impact are only discussed in the recommendation section of this report.

Significance of Study

The research contained in this report provides a different view on the cost of the CRAF. By establishing a upper bound for expenditures and evaluating the potential costs, this study can help decision makers evaluate future incentives and provide additional information for developing future legislation.

Thesis Overview

This chapter is followed by a literature review which discusses in greater detail the history and formation of the CRAF, an overview of the CRAF and how it works, issues from the Gulf War, incentives, disincentives, and other significant studies. Chapter 3 contains the methodology of this study. The cost analysis for the value of the CRAF and the amount the DOD could spend for incentives are contained in chapter 4. Finally, the concluding remarks and recommendations can be found in chapter 5.

Chapter 2

Literature Review

Introduction

For more than 50 years, civil air carriers have been augmenting military airlift. This joint commitment has been shaped by both economical and political factors throughout its history which continue to influence the military and commercial airlift partnership in the post-cold war era. This partnership, however, suffered some turbulence during and after the Persian Gulf War, in which the CRAF was activated for the first time. Specifically, the risks associated with participation in the CRAF increased, while the incentives to promote participation became less certain.

In order to evaluate the value of the CRAF to the Air Force with respect to the overall cost of the CRAF program, it is important to understand the past influences on the CRAF program, to include the impact of the Persian Gulf War on commercial carriers. Therefore, this chapter reviews the published literature focusing on the structure of the CRAF program, the formation of the CRAF, the Cold War years, the impact of the Persian Gulf War on commercial carriers, and the current problems facing this military and civilian airlift partnership.

The CRAF Program

Participation in the CRAF by commercial carriers is voluntary. However, carriers must meet certain criteria, execute an Air Mobility Command (AMC) contract, and agree to conditions in the AMC/carrier Memorandum of Understanding (MoU). To participate in the CRAF, carriers must (1) offer aircraft for allocation in the various stages of CRAF which can carry military payloads, (2) provide sufficient resources with each aircraft to include air and ground crews, support personnel, and support facilities, (3) allow, once activated, up to 10 hours of use per day until AMC releases the aircraft back to the carrier for normal operations, (4) maintain U.S. registry or control of the aircraft, (5) ensure all cockpit crews are U.S. nationals and eligible for security clearances, and (6) agree to a minimum response time after program activation.

When commercial carriers agree to the requirements of the CRAF program, their aircraft are allocated to one of three segments and one of three stages. The segments of CRAF designate aircraft by mission category, where as the mobilization of the CRAF is tiered into three stages to respond to various levels of threat. Each successive stage of CRAF activation corresponds to increasingly more serious situations. The stages of CRAF are:

1. Stage I of CRAF, *Committed Expansion*, is activated by the Commander-in-Chief, AMC (CINCAMC). This stage is activated when there is an increased requirement for airlift assets beyond military capabilities. In Stage I, commercial aircraft typically furnish long-range airlift and support channel air traffic when military aircraft are deployed elsewhere. Commercial air carriers must have assets and personnel available within 24 hours.
2. Stage II of CRAF, *Defense Airlift Emergency*, is activated by the Secretary of Defense. This stage is activated in defense emergencies just short of full mobilization or the declaration of a national emergency. Stage II of CRAF emphasizes long-range international airlift. Commercial air carriers must have assets and personnel available within 24 hours.

3. Stage III of CRAF, *National Emergency*, is activated by the Secretary of Defense. This stage is the full mobilization of CRAF in support of national defense-related emergencies or war. Commercial air carriers must have assets and personnel available within 48 hours.

Air Mobility Command also assigns aircraft to one of three segments:

1. The *international mission* segment is divided into two sections:
   A. The *long-range international* section is the largest category in CRAF and represents the strategic passenger and cargo airlift capability of the CRAF.
   B. The *short-range international* section supports airlift operations to offshore locations or operations in the Pacific Islands.

2. The *national mission* segment is also divided into two sections:
   A. The *domestic* section supports the domestic airlift service for passenger, cargo, and aircrew movement requirements.
   B. The *Alaskan* section requires cargo aircraft capable of flying in severe northern weather conditions.

3. The *aeromedical evacuation* mission segment supports intertheater medical evacuation operations.

Commercial air carriers receive no direct compensation for offering their resources to the CRAF, rather they are offered incentives to participate in the CRAF program. The primary incentive and the main reason commercial air carriers participate in the CRAF and agree to the requirements set forth in AMC Regulation 55-8 and the AMC/carrier MoU is the guaranteed DOD peacetime passenger and cargo business. In fact, the military is the largest single customer for the airlines (Chenoweth, 1990). The portion of the DOD's peacetime business that a carrier receives is based on the mobilization value (MV) points each aircraft is given. The MV points are calculated by AMC based on payload, volume, block speed, configuration, and special bonuses. Bonus MV points are given to aircraft that offer extra capabilities, are in high demand, or are offered to support Stage I requirements. For example the MD-11 and B-747-400 receive a 20 percent bonus in MV points, a 100 percent bonus is given for the B-767 aircraft when offered to the Stage II

aeromedical evacuation mission segment, and double MV points are given to aircraft offered to Stage I of the CRAF (Reid, Undated).

The CRAF program has not always been structured the way it is today. For example, the concept of staged mobilization was not introduced to the program until 1963 when commercial carriers grew concerned that activation would remove too large of a percentage of their assets from the civil sector (Chenoweth, 1990). Other changes have occurred over the years, particularly with the incentive structure. Some of these changes to the incentive structure of the CRAF program are discussed later in this chapter, and a more detailed review of the recent changes in the CRAF program can be found in a 1996 Logistics Management Institute report entitled, *The Civil Reserve Air Fleet: Trends and Selected Issues* (Coffey and Frola, 1996). The remainder of this chapter discuss the historical significance of the CRAF, the impact of the Persian Gulf War on the CRAF, and current initiatives.

The Formation of CRAF

The augmentation of military airlift with commercial airlift has firm historical roots and much has been written about the formation of CRAF in support of military airlift operations. Two separate studies conducted by the RAND Corporation, the first entitled *Finding the Right Mix of Military and Civil Airlift, Issues and Implications* and the second entitled *The Civil Reserve Air Fleet: An Example of the Use of Commercial Assets to Expand Military Capabilities During Contingencies*, provide a concise historical overview of the CRAF program (Gebman et al., 1994b; Chenoweth, 1990). The CRAF program has its roots in two airlift operations in the 1940's. The first joint military and

commercial venture was the three-year airlift operation over the Burma Hump, beginning in 1942, moving material from India to China. This operation, which led to the loss of 762 crew members and 460 transports, demonstrated an important distinction between military airlift and commercial airlift. Specifically, under adverse conditions and enemy action, the military can order its crews to fly under any conditions if the nation's needs dictate, whereas commercial crews cannot be ordered into harm's way. Thus, the fundamental distinction between military and commercial airlift was the ability of the U.S. government to directly control military airlift (Gebman et al., 1994b:21-23).

The second airlift operation was the Berlin airlift in 1948. The United States and its allies called upon civil carriers to augment military airlift, which did not have enough excess capacity for this sustainment operation. Following the Berlin airlift operation, civil air carriers lobbied Congress to obtain a share of the DOD's peacetime airlift business (Gebman et al., 1994b:21-23). However, it was the Korean War that ultimately led to the formation of the CRAF.

Following World War II, military transport airlift capability languished, while the commercial aviation industry flourished. At the start of the Korean War in 1950, the Air Force had only enough military airlift crews to provide a 2.5 hours-per-day utilization rate. It was, therefore, necessary to call upon the commercial aviation industry to support the surge of personnel and equipment into Korea during the buildup in 1950 and 1951. However, the transfer of commercial aircraft from their normal operations to military control was inefficient and caused delays. Thus, President Truman issued an executive order in December 1951 which called for a formal agreement between the DOD and the commercial airlines for the use of commercial aircraft during military contingencies. The

joint Memorandum of Understanding (MoU) between the DOD and commercial airlines was signed in 1952 and established the Civil Reserve Air Fleet. This MoU allowed the DOD to establish a program and plan for the use of commercial aircraft in support of national defense objectives. Thus, the CRAF program was designed to create a contingency airlift (Chenoweth, 1990).

The Cold War Years

The dependence upon civil air carriers to augment military airlift during national emergencies and war continued throughout the Cold War. As discussed in the RAND study, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications*, reinforcing the North Atlantic Treaty Organization (NATO) against the threat of a Soviet Union attack required an airlift capability which exceeded our military capability. This high demand for airlift to deter or contain a major conflict in Europe made CRAF an economic necessity, such that CRAF became a critical factor in airlift planning in support of our national defense objectives. However, CRAF was never activated during the Cold War and few expected that it ever would be activated (Gebman et al., 1994b:23). This point is also reflected in a U.S. Transportation Command (USTRANSCOM) *White Paper on Incentives for CRAF,* in which General Johnson wrote, "air carriers viewed their participation in the CRAF program as a mechanism to guarantee they received government business without facing much business risk of losing market share" (Johnson, 1992:2).

In addition to the risk of activation which could result in lost market share for commercial air carriers, it should also be understood that the physical risk in support of a

major conflict in Europe was low. Military strategy during the cold war relied on large-scale conventional warfare and nuclear might. Thus, commercial aircraft could fly into allied airfields, far from enemy lines, without the risk of tactical enemy attack. Because the perceived risk of activation and the physical risk to carriers were low, the incentive structure for the program changed little over the years.

The change in military strategy following the end of the Cold War affects airlift requirements and CRAF, significantly. First, the scope has changed. A 1993 RAND Report, *The New Calculus: Analyzing Airpower's Changing Role in Joint Theater Campaigns*, evaluated the capabilities of U.S. forces in achieving national defense objectives in future major regional conflicts and described how the scope of military strategy has changed in the post-Cold War era (Bowie et al., 1993). The potential threat facing the U.S. has decreased significantly since the collapse of the Soviet Union. A war in Europe to counter a Soviet threat required a large military force, pre-positioned and sustaining, and the ability to deliver 66 million ton-miles of supporting personnel and equipment each day. The change to support two near simultaneous MRC's relies on a smaller military force, but with the ability to deploy quickly with short warning times, over longer distances. Thus, military strategy has changed from a posture of forward basing to forward mobility, relying heavily upon airpower in the critical initial stages of combat (Bowie et al., 1993). The airlift requirements for this forward, mobile military force were determined in the 1992 Mobility Requirements Study to be approximately 50 million ton-miles per day. With either strategy, however, the Air Force does not have enough capacity to support the airlift requirements with organic (military) airlift, and therefore, the Air Force relies on the Civil Reserve Air Fleet to fill the shortfall in airlift.

Secondly, the shift in military strategy exposes commercial aircraft to a greater threat. During the Cold War, commercial aircraft could operate from airfields far from enemy lines, posing little threat to the CRAF from enemy attack. While the Persian Gulf War may not be predictive of future conflicts, we can assume that regional conflicts may pose a greater threat to commercial aircraft as airlift becomes the primary means of delivering military forces, quickly, to serve as the halting force. As seen in the Gulf War, airfields may be in the line of fire, posing a higher risk to aircraft (Priddy and Holden, 1993:Ch 6, 9-12; Lund et al., 1993:28).

The Persian Gulf War

CRAF Volunteers

The Persian Gulf War was the first test of the CRAF program. An interim report entitled, *A History of The Civil Reserve Air Fleet In Operations DESERT SHIELD, DESERT STORM, and DESERT SORTIE,* written by Ronald Priddy and Raymond Holden, contains a detailed chronology of CRAF operations in the Persian Gulf War and discusses the successes and problems encountered with the activation of the CRAF. When the warning order was first received on August 3, 1990, the Military Airlift Command (MAC) (now Air Mobility Command, AMC) CRAF Office reviewed their emergency procedures, however there was much speculation as to whether CRAF activation would be required. In fact, throughout CRAF's existence, civil air carriers have voluntarily provided the augmented airlift required to support many crises, worldwide. This volunteerism by civil air carriers proved to be critical during this campaign, as well. In the first three days of the deployment phase, 14 civil aircraft were made available to

MAC with more promised. By the end of the first week of the operation, five cargo carriers had volunteered 13 cargo aircraft and six passenger carriers had volunteered 17 passenger aircraft. This represented 60 percent of the CRAF Stage I cargo capability and 50 percent of the Stage I passenger capability. The carriers even submitted schedules to the MAC CRAF Office on when their aircraft would be available. The support from the civil air carrier industry was exceptional and without this volunteer lift, CRAF may have been activated much earlier (Priddy and Holden, 1993:Ch.3, 26).

CRAF Activation, Stage I

The need for passenger airlift increased, yet the volunteered civil airlift, in conjunction with military airlift, did not provide enough capacity. Therefore, CRAF Stage I was activated on August 17, 1990. The activation of CRAF not only doubled the current passenger capability, but also formalized the relationship between MAC and the carriers. Several passenger carriers could not justify to their board of directors committing aircraft to the military without this formal activation (Priddy and Holden, 1993:Ch.3, 26). As the deployment phase progressed, the cargo airlift requirements increased. However, the CRAF commitment in Stage I did not provide enough capability. Even activation of Stage II would not have provided adequate capacity for the cargo requirements. However, this cargo airlift problem was solved through more volunteer airlift from CRAF carriers and several allied airlift programs (Priddy and Holden, 1993:Ch.3, 39-40).

CRAF Sizing

The lack of adequate cargo airlift from both organic and commercial airlift resulted in the realization that CRAF Stage I and Stage II were inappropriately sized for a

contingency outside of Europe. First, CRAF was sized for a U.S. reinforcement of Europe during an extended period of warning, requiring fewer aircraft for the personnel and equipment buildup. Second, Stage I and Stage II of CRAF focused on the passenger capability for the troop buildup to match up with pre-positioned equipment in Europe, particularly Germany. Finally, the flying time to Europe from the east coast of the United States was only eight hours, in which time an aircraft could make one round trip each day. These factors were different in the Persian Gulf War. There were fewer pre-positioned fixed assets in Saudi Arabia, and therefore, there was a larger need for cargo airlift. Additionally, the distance to Saudi Arabia was roughly twice the distance to Europe, impacting the amount of cargo that could be delivered into the region (Priddy and Holden, 1993:Ch.3, 40).

CRAF Activation, Stage II

On November 29, 1990, the United Nations issued UN Resolution 678 which set a January 15, 1991 deadline for the Iraqi withdrawal from Kuwait. This prompted an accelerated passenger and cargo deployment schedule. However, because air carriers continued to provide volunteer air assets over and above their obligation to CRAF, Stage II cargo aircraft were not activated until January 16, 1991, just after the air assaults on Iraq began. The passenger segment of Stage II was activated on March 23, 1991 to meet redeployment requirements. CRAF was activated for more than nine months in support of Operations DESERT SHIELD, DESERT STORM, and DESERT SORTIE, flying 5,188 missions to the Arabian peninsula. CRAF aircraft moved 64 percent of the passengers and 27 percent of the air cargo during the deployment phase. The figures were much higher in the redeployment phase with 84 percent of the passengers and 40 percent of the air cargo

moved via CRAF aircraft. There is no doubt that the success of this extensive airlift operation was in large part due to the dedication and commitment of the civil air carrier industry. In fact, this airlift operation surpasses all major airlift operations in history in terms of ton-miles flown, including the Berlin Airlift, the Korean War, and the Vietnam War (Priddy and Holden, 1993:218-223). While the CRAF program worked, and worked quite well, in support of national defense objectives, the program encountered problems during and after the Gulf War.

Problems with CRAF

As stated earlier, the number and types of aircraft in each stage of CRAF were not necessarily appropriate for an MRC-type operation because Stage I and Stage II of CRAF did not provide enough airlift capacity. The high level of commitment by air carriers to volunteer additional airlift was the main reason Stage III of CRAF was not activated. However, the reliance on volunteer lift in the future became uncertain primarily because major air carriers were reluctant to volunteer airlift above commitment levels and were insistent that Stage III activation would significantly disrupt their airline's competitiveness in the marketplace. Another problem arising from the Gulf War was the inadequacy of government insurance when commercial insurance companies evoked their war-risk exclusion clause on the civil air carriers participating in the war. These issues prompted USTRANSCOM to issue a White Paper on *Incentives for the Civil Reserve Air Fleet*. In this paper, General Johnson stated,

> Problems identified during that activation, coupled with diminishing DOD business brought about by force and budget drawdowns have, in the eyes of the air carrier industry, made CRAF participation less attractive. Carriers have expressed concerns that a more robust incentive program is

needed to ensure continued participation in the CRAF program. (Johnson, 1992)

The White Paper set forth the vision to preserve the voluntary participation in CRAF, as it is key to the commercial/military partnership necessary to meet defense airlift requirements. USTRANSCOM's objective is to establish additional business incentives while eliminating the obstacles that impede CRAF participation (Johnson, 1992). This White Paper prompted several research efforts and working groups aimed at improving the CRAF program. The remainder of this chapter will review the literature in these areas. It should also be noted that were many operational issues and problems arising from the first activation of the CRAF, however these issues are not enumerated here. A closer look at these issues can be found in the publications listed in the bibliography.

Threats to Future CRAF Participation

Insurance

A History of The Civil Reserve Air Fleet In Operations DESERT SHIELD, DESERT STORM, and DESERT SORTIE describes insurance as one of the earliest problems commercial carriers confronted during the Gulf War. Most commercial insurance policies do not cover wartime situations and the implementation of government insurance was not adequate. Specifically, implementation of the government insurance and indemnity program was slow, cumbersome, and did not cover all supporting missions, specifically those outside the Middle East. Additionally, government insurance did not cover many miscellaneous risks typically covered in a commercial policy, such as pre-positioned mission support equipment and spare parts, search and rescue, expenses and lost revenue

due to hijacking or confiscation, and aircrew life insurance, although some of these miscellaneous risks can be indemnified. Finally, the Aviation Insurance Revolving Fund, which is used to pay claims, was not sufficiently funded. During the Gulf War, the fund had accumulated approximately $53 million, however the replacement value of one wide-body aircraft costs in excess of $100 million (Priddy and Holden, 1993:Ch 9).

Insurance and indemnification are necessary parts of the CRAF because commercial insurance may not be available or economically feasible to air carriers when CRAF is activated. A 1994 GAO report entitled, *Aviation Insurance: Federal Insurance Program Needs Improvements to Ensure Success*, described the importance of the government insurance and indemnification and made several recommendations for improvement to the Federal Aviation Administration's (FAA) Aviation Insurance Program (GAO, 1994). Government insurance and indemnification programs are important to the aviation industry because commercial insurance is not always available to carriers. Commercial airlines purchase all-risks insurance to cover losses due to mechanical failure, weather, or pilot error. They also purchase war-risk insurance to cover losses due to terrorism, acts of war, or other hostile acts. However, many commercial insurance policies have a war exclusion clause or a CRAF mission exclusion clause, such that commercial insurers can cancel war-risk coverage upon activation of the CRAF or charge unreasonably high surcharges for the war-risk coverage. To protect commercial air carriers from these types of eventualities and ensure adequate coverage, the Aviation Insurance Program was established in 1951 by Title XIII of the Civil Aeronautics Act of 1938 and later included in the Federal Aviation Act of 1958 (GAO, 1994; Johnson, 1992:5).

The Aviation Insurance Program provides war-risk and all-risk insurance for carriers as outlined in the Federal Aviation Regulation (FAR), Section 198. War-risk insurance is available to air carriers when the operation of an aircraft is necessary to carry out the foreign policy of the U.S. as determined by the President, and the FAA finds that commercial insurance cannot be obtained on reasonable terms and conditions (FAA, 1985:Sec 198.1). The FAA is responsible for the program and issues hull and liability war-risk insurance in two forms: premium and non-premium insurance.

Premium war-risk insurance requires a premium to be paid by the carrier for the coverage based on the risks involved. These premiums are typically higher than the premiums carriers pay for peacetime war-risk coverage, but approximately 30 percent less that what is commercially available (Theiman, 1996). Non-premium insurance requires a one-time registration fee of $200 and can be obtained provided the federal agency with which the air carrier is contracted has an indemnification agreement with the Department of Transportation (DOT). The indemnification agreements, such as the Air Force Indemnification Program authorized by Public Law 85-804, ensures the FAA is reimbursed for any incurred loss or damage (FAA, 1985). Claims on the FAA's Chapter 443 (formerly Title XIII) war-risk insurance is paid from the Aviation Insurance Revolving Fund (the Fund) into which registration fees and premiums are deposited. The Fund is also invests in U.S. Treasury securities, such that the Aviation Insurance Program is self-financed. According the 1994 GAO report, between 1959 and 1993 the Fund had accumulated approximately $56 million in revenues and had only paid out approximately $150,000 in claims. Although there have been no significant claims to date, approximately 17 percent of the aircraft registered for non-premium insurance exceed the Fund's balance,

as shown Figure 4-4. Additionally, liability claims are estimated at approximately $350 million per aircraft incident (GAO, 1994:3-5). For this reason, carriers were concerned about the ability to reach a settlement in a timely manner.

During the Gulf War, supplemental funds to pay claims through the Aviation Insurance Program and the Air Force Indemnification Program would have required congressional appropriation. Commercial insurers typically settle a claim within 30 days, allowing carriers to meet financial obligations (GAO, 1994:6). Congressional appropriation would probably not be accomplished within this 30-day time frame. To address the issue of timely reimbursement on claims, the Air Force has received approval from the Deputy Secretary of Defense for the use of DBOF to indemnify the FAA for any loss incurred. The Air Force would then seek supplemental appropriation to repay the DBOF. As a long-term solution, the DOD has included in the fiscal year 1996 Authorization Bill a provision to allow the Secretary of Defense to reprogram, any fund or appropriation available to the DOD, the amount necessary to reimburse the FAA within 30 days of a claim. This legislation is important because the DOD would not be limited to only operating and maintenance funds (Routh, Undated). Similarly, as recommended in the 1994 GAO report, the FAA has put forth legislation to obtain borrowing authority directly from the U.S. Treasury to allow for timely payment on loss or damages (GAO, 1994; Theiman, 1996). In addition to these solutions for prompt settlement, the FAA and the Air Force have improved the insurance and indemnity programs to more closely match commercial insurance industry practices.

The improvements to Chapter 443 war-risk non-premium insurance include coverage for domestic and positioning portions of a CRAF flight, spare parts and ground

operations, a 50/50 pay out clause, runway foaming, search and rescue, and wreckage removal. Another significant change is the inclusion of aircrew life insurance (Theiman, 1996). Improvements to the Air Force Indemnification Program include extended coverage to indemnify aeromedical flights for all-risk coverage. This coverage is now available because commercial policies do not cover carrier loses resulting from improper government ticketing procedures under the Warsaw Convention/Montreal Agreement (Moore, 1993).

Most air carriers are satisfied with the new policy features and improvements to the Aviation Insurance and the Air Force Indemnification Programs. Carriers are particularly pleased with the legislation to allow greater access to funds necessary for a timely claim settlement (USTRANSCOM, 1994). However, the cost of war-risk insurance is still an expense upon activation of the CRAF. Air carriers will face exorbitant premiums to which the Air Force must evaluate the most cost effective course of action: negotiate to pay the increased cost of war-risk insurance or rely on the Aviation Insurance Program and indemnify the FAA with the potential outlay of a large claim. While this obstacle to CRAF participation, an inadequate war-risk insurance program, has been minimized, there remains another disincentive to CRAF participation—lost market share.

Loss of Market Share

As discussed earlier, volunteer airlift helped delay the activation of Stage I and Stage II of CRAF and was the primary reason Stage III was not activated. However, large carriers responded differently than small carriers in their commitment to the Persian Gulf War. A 1994 RAND study analyzed the participation and level of volunteerism of large and small air carriers. Small charter carriers and small cargo carriers volunteered more

aircraft during the peak month (January 1991) than did the large cargo and passenger carriers, with two exceptions. Both Pan Am and TWA had excess capacity during this time frame due to a decline in demand in their markets. Additionally, both were near bankruptcy. Therefore, these large carriers welcomed the additional government business (Gebman et al., 1994b:50-53).

The RAND study demonstrated a significant correlation between the carrier size and the number of aircraft volunteered beyond CRAF requirements. For example, charter carriers and small cargo carriers specialize in taking advantage of local opportunities. Because these opportunities are their primary revenue generating vehicle, volunteering airframes to support the war did not remove them from their place in the market. On the other hand, large carriers make substantial investment in cultivating a specific market. Thus, large carriers have much more to lose by temporarily exiting a market or even reducing their frequency in a market. Therefore, small carriers were eager for the additional business resulting from the war, while large carriers were reluctant to participate. For example, the Stage I and Stage II commitment from United airlines was 4 airframes from a total fleet of 123 airframes. Their Stage III commitment was 59 airframes. Northwest had even a larger percentage of their fleet committed to Stage III of CRAF, 60 out of 80 total airframes. This is the primary reason large carriers expressed extreme concern over Stage III activation during the war. Whereas, small carriers and carriers which operate primarily in the charter market, such as Tower Air who had 4 out of 4 airframes committed, and World Airways who had 9 out of 11 airframes committed to the war, welcomed the added revenue (Gebman et al., 1994b:50-53).

A study conducted by the Logistics Management Institute (LMI) in 1996 also discussed the issue of the CRAF participation level and lost market share due to activation. The conclusions in this study were similar to those in the previously noted RAND study. For example, United Parcel Service (UPS), a major cargo air carrier offering scheduled domestic and international air service, experienced difficulties in regaining market share lost to foreign carriers and to non-CRAF U.S. air carriers. As a result, UPS reduced its CRAF commitment to minimum levels, 15 percent of UPS' total fleet (Coffey and Frola, 1996:Ch.3, 1-9). To minimize the impact that CRAF activation had on its scheduled air service, UPS downsized domestic and international routes and leased space on approximately 8 B727-100 aircraft. However the cost to lease this space exceeded the revenue UPS received for the wartime missions flown during the war. This resulted in a net loss, particularly considering the leases could not be terminated once AMC released CRAF aircraft back to the carriers (Trietz, 1996).

The concern of lost market share to competitors is also discussed in a Naval War College thesis. Several carriers reevaluated their decision to participate in CRAF following the Gulf War. While the air carriers were paid for the missions they flew, several carriers sustained millions of dollars in lost revenue supporting the war. Some of this lost revenue was the result of foreign competitors stepping in to pick up the domestic and international business (Evans, 1993:24-25). Because private industry operates on profits, the fundamental differences between the level of commitment by small carriers and large carriers suggests that small carriers viewed their support of the Gulf War as a strong opportunity for profit, while the large carriers saw a loss rather than a gain.

Contrary to these views, an official at the National Air Carrier Association stated that there was no direct evidence of market share lost to a foreign competitor as a result of the CRAF activation. There may have been minor adjustments in market share between U.S. competitors, however these adjustments were relatively short term and not permanent (Priddy, 1996 and Kutzke, 1992).

While there are no definitive results to conclude that Stage I and Stage II activation of the CRAF led to a loss of market share for some carriers, it is still a concern to air carriers and affects their decision to participate in the CRAF. To reduce the impact of these disincentives, the Air Force and USTRANSCOM have been working to expand the peacetime business base for participating CRAF carriers and have implemented other non-monetary incentives.

Incentives

Several initiatives have been proposed and adopted to increase incentives and balance the risks to commercial carriers participating in the CRAF. The peacetime business base has been expanded and the DOD has opened military installations for commercial use.

The fundamental incentive to commercial air carriers participation in the CRAF is the guaranteed portion of the DOD's peacetime business. Many anticipated that the military drawdown and budget constraints would reduce the DOD business base, however, according to AMC officials there has not really been a decline in the business base for CRAF. There are two important factors influencing this continued business base. First, in fiscal year 1994 there was a temporary stand-down of the C-141 fleet. Second, there was an unusually high level of overseas deployments (Grier, 1995:53). However, these factors

may not be present in the future. One of the long-term business incentives outlined in the USTRANSCOM White Paper was to capture all government business consistent with the concept of the best service at a reasonable price. In a USTRANSCOM talking paper, *CRAF Incentives*, written by Lt Colonel Routh, a recent addition to the business base is the use of CRAF carriers by the General Services Administration (GSA) for government travel. As of fiscal year 1995, all GSA domestic and international city pair passenger programs are awarded only to CRAF participating carriers. The General Services Administration has also made CRAF participation mandatory for the award of their three domestic small package and freight programs (Routh, 1994). Passenger and cargo business from the GSA is intended to revitalize the CRAF to ensure continued support of our National Airlift Policy objectives.

Another favorable business incentive is the legislative approval allowing CRAF carriers to conduct domestic commercial operations from military airfields. The program was authorized by the Acquisition Streamlining Act and signed into law in October, 1994 with specific statutory authority under Title 10, United States Code Section 9513. In return for additional CRAF commitments, the carrier may negotiate a long-term agreement for non-DOD commercial activities on a military installation within the U.S. Many air carriers anticipate a significant savings in fuel costs alone, given the ability to list a military airfield as an alternate fuel, weather, or technical stop (DOD, January 1995; Routh, 1995).

Conclusion

The Civil Reserve Air Fleet is a critical and necessary part of the DOD's strategic airlift and the first activation of the fleet proved to be crucial to the continued success of the DOD/air carrier partnership. Many problems arose with the activation of CRAF, many problems were solved, and some still remain. The most significant result of the CRAF activation was the realization that activation poses a real threat to the air carrier industry. The carriers must respond to drastic increases in insurance premiums and potentially loss a portion of their market to competitors. United States Transportation Command, the DOD, and the U.S. government responded by bolstering incentives to include an expanded peacetime business, the use of military airfields by commercial carriers, and improvements to the insurance and indemnity programs. As a result, CRAF participation is improving as shown in Appendix C.

The CRAF, however, is continually changing in response to political and economic conditions, and therefore, it is important that the CRAF program continually improve to meet these changing conditions. For this reason, it is necessary to understand the value of the CRAF to the Air Force, the DOD, and the U.S. government. By assessing the amount the CRAF is worth, future decisions for improvements to the CRAF program can better be analyzed.

Chapter 3

Methodology

Introduction

National Airlift Policy provides a formal framework for the interdependence of military and civil airlift in support of national security objectives. This policy is carried out by the contractual partnership between the Air Force and commercial air carriers. As with any contractual agreement, it is assumed that neither party would enter into the contract if the cost of the contractual relationship exceeded the value or benefits derived from the partnership. The benefit of the CRAF program to the Air Force and the DOD is a large airlift capacity in excess of organic capabilities. The benefit to carriers is monetary compensation during a contingency and the guaranteed peacetime DOD business. However, since the Persian Gulf War and military drawdown, the cost of participating in CRAF has been a concern to commercial air carriers. That is, there is a concern that the CRAF program is, perhaps, no longer a mutually beneficial partnership.

It is assumed that the negotiation process between the Air Force and air carriers is a cooperative enterprise driven by our National Airlift Policy. It is a cooperative enterprise, in that both parties are working toward the same goal as defined by U.S. policy. They also rely on each other for support that cannot be found elsewhere. Specifically, the DOD

has no other source of airlift to meet peak demand, while the commercial carriers rely on the United States government's commitment to a strong global airlift capability and, as the airline's largest single customer, commercial carriers rely on the DOD's peacetime business as a source of revenue. Therefore, the Air Force and air carriers must arrive at a mutually beneficial agreement. Additionally, the CRAF program is dynamic and continually changing to meet the changing needs of the DOD and the air carriers. Thus, the negotiation process must adapt, as well, in response to the changing environment.

The premise for the methodology in this thesis is that a fundamental strategy in negotiating a contract in knowing the value each parties places on the terms of the contract. It is important to know the value of the resources the other party brings to the negotiating table, but it is also important to clearly know the value of one's own resources. Therefore, this research explores the value of the CRAF program to the Air Force and DOD and evaluates what the DOD could spend to maintain the reserve airlift capacity in the CRAF.

Research Design

This study evaluates the value of CRAF, or the amount it is worth, to the Air Force and DOD with respect to the overall cost of the program, using a three step process. First, the total value of the CRAF program is evaluated from the point of view of the DOD. Second, the cost of the current incentives is quantified. Finally, the cost to the DOD to compensate carriers in two key areas, insurance coverage and lost market share, is explored. The analysis is contained in Chapter 4.

The Value of CRAF

The 1992 Mobility Requirements Study established a cargo requirement for approximately 50 million ton-miles of airlift capacity per day. However, current organic assets comprise only 65 percent of this requirement. The shortfall in airlift capacity is filled by the CRAF. Therefore, the value of the CRAF is the cost that the DOD has avoided by relying on the capability of the commercial aviation industry to maintain a capability to move 35 percent of the 50 million ton-miles per day (MTM/D), or approximately 17.5 MTM/D. The authors in a 1994 RAND study determined the 30-year average capacity and the 30-year life-cycle cost to the DOD of the reserve capacity of the CRAF and the military fleet. With this information, the cost per unit of reserve capacity was calculated, such that to replace Stage III of CRAF with military-style transports, the cost to the Air Force would have been approximately $3 billion, annually, over the 30-year period (Gebman et al., 1994b:40-44).

The cost analysis used in the RAND study is reviewed for applicability given changes in the military fleet, the CRAF, and the commercial aviation industry since 1990. The only significant change is the increase in Stage III commitments to the CRAF for fiscal year 1997. This results in a lower cost per unit of CRAF capacity, while the unit cost for military capacity remains relatively constant. With the unit cost for military reserve airlift, the opportunity cost of the CRAF is determined for the period of 1985 to 1997, based on the capability of the largest portion of the CRAF, the long-range international passenger and cargo segment. Data for 1997 is based on HQ AMC projected commitments to the CRAF.

The value of CRAF has both tangible and intangible components. The tangible component is the opportunity cost, or the cost avoided by maintaining excess capacity in the CRAF. The intangible component includes the dependability of the CRAF. Dependability of the CRAF could have a significant impact on the overall value of the CRAF program. Specifically, it is generally believed that there is a very high probability that Stage III of CRAF will never be activated. This is due to civil air carrier objections that Stage III activation would remove nearly one-half of their capacity from the private service and adversely affect their position in the commercial market (Gebman et al., 1994a:14-15). Additionally, Stage III activation is in support of national emergencies. The Persian Gulf War was generally not considered a national emergency because the United States and its allies were clearly in control of the war (Priddy and Holden, 1993: Ch 6). Therefore, the greatest amount of airlift that may be expected from the CRAF may only be 12.8 million ton-miles per day and 60.8 million passenger-miles per day, the amount committed to Stages I and II for fiscal year 1997. Because the value of CRAF is based on the cost per million ton-mile per day, the value for Stage II commitments would be less than the value of CRAF for Stage III commitments, significantly impacting the amount the DOD could invest in a viable program.

Costs of Current Incentives

The cost of the CRAF program to the DOD includes implicit and explicit costs. Implicit costs include expenses such as administrative costs, personnel costs, and other overhead expenses for both the DOD and participating carriers. These costs will not be captured. While important, the implicit costs will not significantly impact the overall cost

of the CRAF program. Additionally, the focus of this thesis is to evaluate costs in broad terms, rather than present a detailed cost-benefit analysis.

The explicit costs include peacetime and wartime expenditures for both the DOD and participating carriers. The focus, primarily, will be DOD expenditures. Carrier costs will be discussed as they apply to DOD expenditures, although these costs may not be quantified. The peacetime expenses of the Air Force and DOD included in this study are: (1) the payments to carriers for peacetime airlift for the period 1985-1997, (2) the cost of the CRAF enhancement program, and (3) the cost for other approved incentives, namely the use of military airfields for non-military use. Forecasted data is used for any costs later than fiscal year 1995. The wartime expenses evaluated in this study include the payment to carriers during Operations DESERT SHIELD, STORM, and SORTIE.

Potential Expenditures

The different between the opportunity cost of the CRAF and the cost to the DOD of current incentives represents the dollar amount the DOD could invest in compensatory initiatives and still break even. Of course, a more satisfactory solution would be to realize a net gain on any further investment in the CRAF. In face, many peacetime initiatives implemented by the Air Force and DOD have been at no cost. However, two key areas, insurance and market share loss, may carry high price tags given another activation of the CRAF. These potential costs should be minimized to the greatest extent possible.

Insurance

The annual cost for commercial war-risk insurance is approximately 0.03 to 0.06 percent of the value of the aircraft. Upon activation of the CRAF, commercial insurers

raised the price of war-risk insurance to approximately 0.25 percent of the value of the aircraft per mission (Theiman, 1996). In some instances, the increased cost for commercial war-risk insurance during the Gulf War was paid by HQ AMC rather than have the carriers resort to Chapter 443, war-risk insurance (Moore, 1993). Therefore, the cost of war-risk insurance is explored by determining the point at which the Air Force could pay the increased premiums when compared to the expected cost due to the loss or damage of an aircraft.

The expected cost of the increased commercial war-risk insurance is calculated using a weighted average, as shown in equation (1).

$$I = rate \times value \times fleet \times cat \times m \qquad (1)$$

Where,

I = The expected cost of commercial war - risk insurance.
rate = The commercial war - risk insurance rate (0.25 percent).
value = The average insured value of the aircraft hull.
fleet = The composition of the CRAF fleet by aircraft type, expressed as a percent.
cat = The category of CRAF missions, passenger or cargo, expressed as a percent.
m = The number of CRAF missions.

To apply equation (1), the following assumptions are made:

1. The CRAF is appropriately sized, such that the percent of missions requiring that type aircraft is reflected in the CRAF composition.
2. When an aircraft is replaced by the carrier, it is replaced with a comparable aircraft, such that the capacity remains relatively constant.
3. The replacement value of the hull is reflected in the insured value.
4. The percent of CRAF cargo missions and CRAF passenger missions flown in the Persian Gulf War are representative of the category mix in future contingencies.

The expected cost due to loss or damage is equal to the sum of the expected cost due to loss or damage of an aircraft and the expected liability costs, as shown in equation (2).

$$L = (value \times fleet \times cat \times departures \times probability) + (c \times q) \qquad (2)$$

Where,

L = The expected cost due to aircraft loss or damage.
value = The average insured value of the aircraft hull.
fleet = The composition of the CRAF fleet by aircraft type, expessed as a percent.
cat = The category of CRAF missions, passenger or cargo, expressed as a percent.
departures = The number of departures, 4 x number of CRAF missions.
probability = The probability of loss or damage, incident rate / 10,000 departures.
c = The expected liability cost per incident.
q = The expected number of aircraft lost or damaged, probability x departures.

In addition to the assumptions of equation (1), it is, also, assumed that each CRAF mission would average four departures. These four departures include an intermediate stop between the continental United States and the destination, or area of responsibility. Using equation (2), the expected cost due to the loss or damage for varying probabilities of loss, *probability*, or levels of risk is calculated. Because the expected cost due to the loss or damage varies based on the anticipated rate of incidents or accidents in a crisis, and because the Persian Gulf War may not be predictive of future contingencies, a spectrum of incident rates is presented. To give perspective to anticipated incidents rates in a crisis, the commercial aviation industry accident rates are presented, as well. A sensitivity analysis compares the expected cost of commercial war-risk insurance, *I*, and the expected cost due to the loss or damage for varying levels of risk, *L*, in the aggregate and by aircraft type.

Market Share

CRAF commitments represent a significant portion of participating carrier fleets. Commitments to the CRAF range from approximately 45 to 70 percent of the capacity of

all participating carriers capacity, depending upon segment and stage. Therefore, activation of the CRAF would significantly impact the daily operations of these carriers. As discussed in Chapter 2, many carriers reevaluated their participation in the CRAF following the Gulf War because of lost market share to domestic and foreign competitors.

Review of the literature could find no conclusive evidence of permanent market share loss in the aggregate, although temporarily market share was lost to some competitors (Kutzke, 1992). Thus, market share could be viewed on the margin rather than as an entire industry by exploring the cost to regain access to a city pair market. Access to this market requires the use of airport slots, where an airport slot is a predetermined take-off or landing time window at an airport. The slots at controlled airports are a scarce resource and, therefore, have economic value, measuring the earning potential of the carrier using the slot (DOT, 1995). The value of these slots can capture the cost of lost market share in two ways. First, because a slot holds economic value, the sale or lease price represents the minimum cost to a carrier wanting to re-enter a segment of the market. Second, if a carrier currently owns a slot at a controlled airport, the economic value represents a loss if that carrier does not use the slot once CRAF has been activated. Thus, the minimum cost of lost market share will be explored by analyzing the economic value of slots at various airports.

Research Questions

The data analysis contained in Chapter 4 will attempt to answer the following research questions:

1. What is the value of CRAF and is this value the amount the DOD could be willing to spend to maintain a viable Civil Reserve Air Fleet?

2. What additional amount in annual expenditures could the DOD be willing to invest to adequately compensate civil air carriers?

Assumptions

1. Compensation for actual business is the primary incentive for civil air carrier participation in CRAF. Therefore, it is assumed that a carrier would not chose to commit portions of their fleet to CRAF if the fees they receive for both peacetime business and wartime use were not satisfactory.
2. The value of the CRAF program is the maximum amount the DOD would be willing to spend to ensure continued participation in the CRAF program.
3. There are no budgetary constraints. In reality, the budget is a significant limiting factor. However, budgetary constraints and budgetary decisions are beyond the scope of this thesis. This thesis, focuses on what the DOD could pay in additional compensation, not what the DOD has the ability to pay.

Summary

CRAF is a critical part of military strategic airlift planning and the capability in the CRAF has an inherent value that can be quantified. With this value determined, the objective of this thesis is to determine the amount of money the DOD could invest in the CRAF program to ensure continued participation by commercial carriers. The two key areas that have the greatest impact on the financial stability of a carrier during activation are insurance and market share and will, therefore, receive the greatest attention.

Chapter 4

Data Analysis

The commercial airlift industry is a part of national policy for two primary reasons. First, the United States government has a vested interest in promoting the civil aviation industry for political and economic reasons. A healthy international civil aviation industry fosters trade and investment and serves as a foreign policy tool between nations via bilateral agreements. There is also a strong public interest in ensuring domestic and foreign commerce, to include air freight, mail and parcel delivery, and business or tourist travel. Additionally, regions where aircraft manufacturing is a major industry depend on a healthy and stable aviation industry for its own economic stability. Second, a healthy civil aviation industry is needed in support of our national defense objectives (O'Connor, 1989:13-17). These policy issues were declared in the Federal Aviation Act of 1958 and again in the 1987 National Airlift Policy, National Security Decision Directive 280. In part, the National Airlift Policy states,

> The United States' national airlift capability is provided from military and commercial air carrier resources. The national defense airlift objective is to ensure that military and civil airlift resources will be able to meet defense mobilization and deployment requirements in support of U.S. defense and foreign policies. Military and commercial resources are equally important and interdependent in the fulfillment of this national objective….United States aviation policy, both international and domestic, shall be designed to strengthen the nation's airlift capability and where appropriate promote the global position of the United States aviation industry. (White House, 1987)

Thus, the role of civil aviation in support of national defense has historical significance, as discussed in chapter 2, and political significance. The interdependence of military and commercial aviation in the fulfillment of national defense objectives is the reason the CRAF will continue to be important to the Department of Defense.

In addition to the political significance of the civil aviation industry in public policy, the CRAF is very cost effective method of providing additional airlift to the Department of Defense. It is much less expensive to maintain excess capacity in the CRAF than to invest in organic (military) tankers for the same amount of airlift capacity, as shown in a 1994 RAND study (Gebman et al., 1994b:40). Therefore, it makes sense to invest in the CRAF with time, resources, and money. The cost effectiveness measures used in the aforementioned RAND study is reviewed in the next section, serving as a baseline for determining the value of the CRAF.

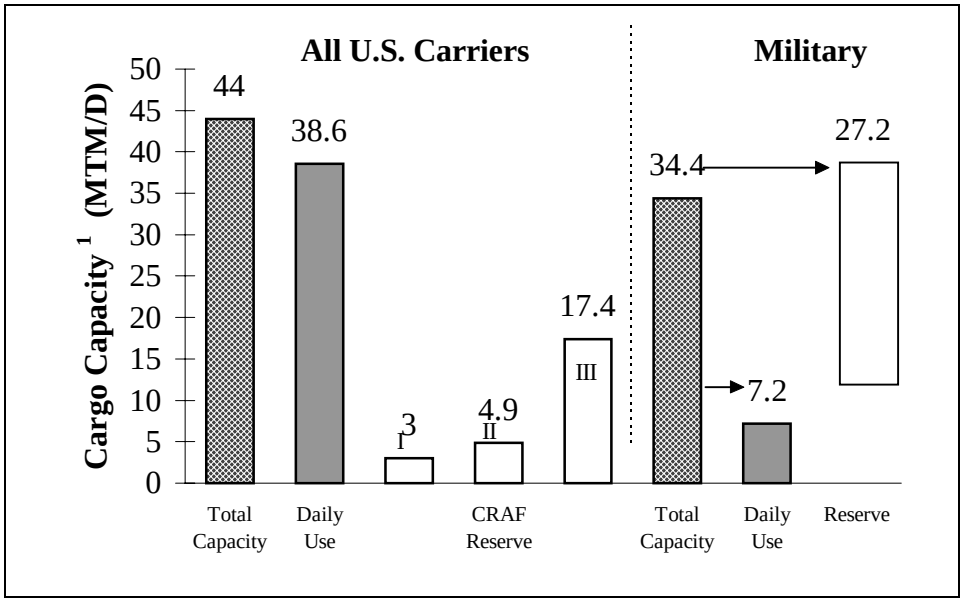
With the value of the CRAF determined, the cost of current CRAF incentives is evaluated. The difference between the value of the CRAF and the cost of current incentives, then, would result in the amount the DOD could spend to ensure the CRAF remains a viable program. The two areas of concern to commercial air carriers that are reviewed in this report are war-risk insurance and loss of market share following the activation of the CRAF. The cost of war-risk insurance and lost market share further represent the amount of money the DOD could spend on additional incentives to ensure future participation in the CRAF is sufficient to support national defense objectives.

The Value of the CRAF

In the 1994 RAND study, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications*, the CRAF was shown to be very cost effective for the government. To evaluate the long-term cost and effectiveness of the CRAF, the RAND study looked at the long-range airlift capacity for the CRAF and the U.S. military and estimated the 30-year life-cycle cost to the government of acquiring and maintaining those two capabilities for the period of 1961 to 1990 (Gebman et al., 1994b:40).

Reserve Airlift Capacity

The 30-year average estimated cargo capacities are shown in Figure 4-1. The study stated that this data appeared to overestimate the average capacity by about 25 percent for both CRAF and military airlift (Gebman et al., 1994b:40).



(Gebman et al., 1994b: 41)
Note 1: Includes long-range aircraft only (excludes 737, C-130, etc.)

Figure 4-1. Reserve Capacity for Emergencies during 1989

More recent data, however, shows only a slight change in the planned long-range cargo airlift capacity for the U.S. military. The total military long-range cargo airlift capacity is approximately 29.5 - 32.2 million ton-miles per day (MTM/D), slightly under the estimate used in the RAND study (Reid, Undated). This long-term planned airlift cargo capacity is illustrated in Appendix C, Figure C-10 and Table C-33.

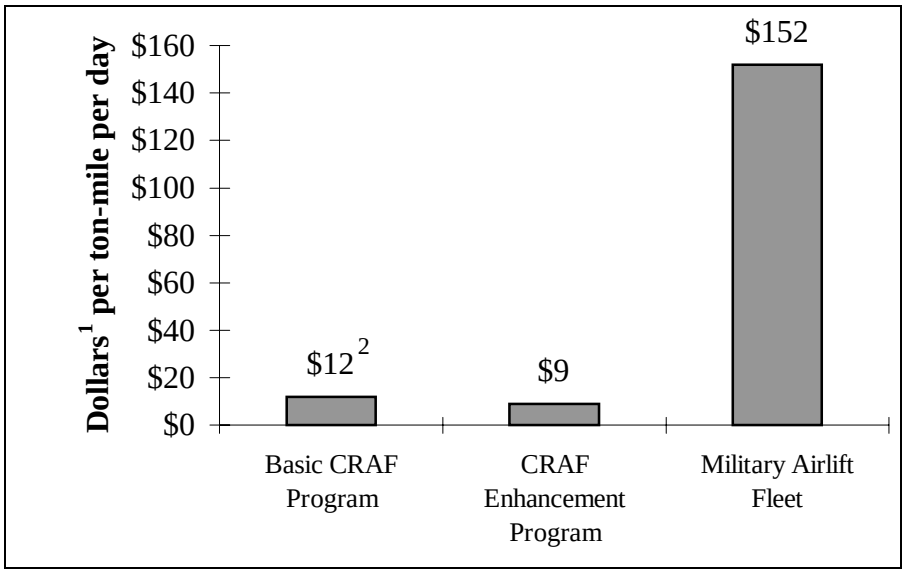
Current data for commercial air cargo capacity reveals a greater variance in the daily use capacity from the data used in the RAND study. The average revenue capacity, or the daily use capacity, for the period of 1984 to 1995, for international cargo was only 20 MTM/D, while the average total capacity for the same period for international cargo was approximately 41 MTM/D, as shown in Appendix A, Tables A-20 and A-21. It should be noted that this current data is based on carrier traffic reports submitted to the Bureau of Transportation Statistics (BTS). Domestic or international traffic is classified based on the origin and destination of the traffic; it is not classified based on the capability of the aircraft. Therefore, there is a portion of domestic cargo capacity that is also suitable of long-range airlift. This portion of the domestic traffic, however, cannot be isolated in the BTS data. Therefore, it should be expected that the long-range cargo capability available for assignment to the international segment of the CRAF is much greater than the average international capacity of 41 MTM/D. This is also consistent with the relatively steady growth in the aviation industry, for cargo and passenger traffic, over the past 12 years, as shown in Appendix A.

The RAND study used the military and commercial capacities to determine a unit cost of airlift, or cost per MTM/D. Military capacity has changed little since the RAND study, as has the life cycle cost of this military capacity and therefore the unit cost of the military

capacity is still applicable. However, as more C-17 aircraft are added to the Air Force inventory and the C-141 aircraft is retired, it would be expected that the unit cost of military airlift would increase due to the higher life cycle costs of the C-17 aircraft. Increases in commercial capacity would result in a lower unit cost, however the commercial airlift unit cost will not be used in this report. Therefore, the estimates used in the RAND study appear to be applicable today and in the near future, particularly as they apply to the cost of the military airlift.

Cost of Reserve Airlift Capability

The RAND study estimated the 30-year life-cycle cost to the government of acquiring and maintaining a reserve airlift capability. The basic CRAF program cost the government an estimated $5 billion in fees and other payments for the entire 30-year period. The CRAF enhancement program (CEP), in which passenger aircraft are modified to carry cargo, was estimated to cost only $1 billion for the same 30-year period. The military reserve capability, however, was shown to be much more expensive, costing $124 billion for the 30-year period. The average annual cost per ton-mile of reserve cargo and passenger capacity is shown in Figure 4-2 (Gebman et al., 1994b:42). As discusses above, the average annual unit cost for the CRAF is potentially lower because the cost to the government for the basic CRAF program and the CEP is unchanged while the commercial capacity has increased.



(Gebman et al., 1994b:42)
Note 1: Stated in 1991 dollars.
Note 2: Combined capacity for cargo and passengers.

Figure 4-2. average annual Total cost per Unit of Reserve Capability, 1961-1990

Figure 4-2 shows the significant difference between the cost of acquiring and maintaining military airlift and the cost of maintaining a reserve capability in CRAF. This large gap is due to the fact that the DOD is not burdened with the expense of purchasing, maintaining, and operating commercial aircraft. Nor is this expense, necessarily, captured in the annual contracts between the Air Force and each participating carrier. The carriers are paid for the movement of cargo and passengers, but the cost to the government of maintaining this large capacity has been virtually nothing. As stated in the RAND study, "…it [the government] did not seem to pay a premium for the right to activate CRAF. It appears that right was obtained as a 'no cost' condition of doing business with the government" (Gebman et al., 1994b:42). Using the average annual cost per unit for the reserve capacity of the military fleet, the study found that the DOD would have spent approximately $3 billion, annually, over the 30-year period to replace the CRAF airlift

capacity with military transports. This is the opportunity cost, or the cost avoided, to the government for maintaining a large reserve airlift capacity in the CRAF.

The Opportunity Cost of the CRAF

The amount that the long-range airlift capacity of the CRAF is worth to the DOD, today, follows the same methodology used in the RAND study. That is, this reserve capacity is worth the amount of money that the DOD has avoided by relying on the capability of the commercial air carriers. By using the unit cost of acquiring and maintain the strategic airlift of the military fleet, the opportunity cost of the CRAF is calculated.

Table 4-1 summarizes the historical participation for the long-range international segment of the CRAF found in Appendix C. The passenger capacity in the CRAF is converted to ton-miles using a standard convention of the aviation industry, see Appendix D, Glossary of Terms. A passenger ton-mile is defined by the Bureau of Transportation Statistics as one ton of passenger weight transported one mile, using a 200 pound standard passenger weight. Given the total capacity of the long-range segment of the CRAF in Table 4-1, the opportunity cost is calculated by multiplying the unit cost of acquiring and maintaining the military fleet by the CRAF capacity. The opportunity cost for Stages II and III of the CRAF is shown in Table 4-2.

Table 4-1. Historical Long Range International Participation in the CRAF

Year	Cargo Capacity (MTM/D)			Passenger Capacity (MPTM/D)		
	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
1985	4.8	5.4	8.9	0.6	1.7	12.7
1986	4.9	4.9	9.5	1.7	4.3	12.7
1987	4.3	5.5	11.1	1.2	4.5	12.8
1988	4.1	5.3	11.6	1.0	4.4	13.2
1989	3.3	5.4	17.6	1.2	4.6	14.3

Table 4-1 Continued

Year	Cargo Capacity (MTM/D)			Passenger Capacity (MPTM/D)		
	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
1990	3.3	5.4	19.3	1.2	4.5	14.6
1991	3.3	5.5	19.9	1.2	4.5	13.9
1992	3.3	5.5	17.1	1.1	4.2	13.4
1993	4.2	9.9	17.3	1.8	4.6	12.7
1994	5.3	12.8	19.0	2.1	5.9	8.0
1995	5.1	12.8	19.4	2.2	6.0	11.3
1996	5.5	13.9	18.9	2.4	6.3	11.6
1997	5.1	12.8	26.7	2.1	6.1	13.5

Note: Total for each Stage is cumulative.

Table 4-2. The Opportunity Cost of the Long-Range International Segment of CRAF

Year	Total CRAF Capacity (MTM/D)			Opportunity Cost (in $ millions[1])	
	Stage I	Stage II	Stage III	Stage II	Stage III
1985	5.4	7.1	21.6	1,079.2	3,283.2
1986	6.6	9.2	22.2	1,398.4	3,374.4
1987	5.5	10.0	23.9	1,520.0	3,632.8
1988	5.1	9.7	24.8	1,474.4	3,769.6
1989	4.5	10.0	31.9	1,520.0	4,848.8
1990	4.5	9.9	33.9	1,504.8	5,152.8
1991	4.5	10.0	33.8	1,520.0	5,137.6
1992	4.4	9.7	30.5	1,474.4	4,636.0
1993	6.0	14.5	30.0	2,204.0	4,560.0
1994	7.4	18.7	27.0	2,842.4	4,104.0
1995	7.3	18.8	30.7	2,857.6	4,666.4
1996	7.9	20.2	30.5	3,070.4	4,636.0
1997	7.2	18.9	40.2	2,872.8	6,110.4
Average	5.9	12.8	29.3	1,945.6	4,453.6

Note 1: 1991 dollars.

Table 4-2 illustrates that as CRAF commitments increase, the opportunity cost increases, as well. The average annual opportunity cost of the CRAF between 1985 and 1997 is nearly $2 billion for the capability in Stage II and $4.5 billion for the capability in

Stage III, annually. If the DOD did not rely on the CRAF, the DOD would have needed to spend approximately $4.5 billion, annually, for military transports to achieve the necessary passenger and cargo capacity to support national defense objectives. Obviously, the DOD has not done this because (1) it is not cost effective (Gebman et al., 1994b) and (2) a healthy commercial aviation industry is an important public policy issue that relies, in part, on the interdependence of the military and the commercial airlines (White House, 1987). Therefore, the DOD avoids the annual expenditure of approximately $4.5 billion by relying heavily on the CRAF. The CRAF currently provides approximately 50 percent of the DOD's total long-range airlift capacity in support of national defense emergencies; approximately 38 percent of the DOD's long-range international cargo capacity and 93 percent of the long-range international passenger capacity is invested in the CRAF for fiscal year 1996 (Spehar, Undated).

With this discussion, it is concluded that the value of CRAF is the opportunity cost of the CRAF capability. That is, an average capability of 29.3 million ton-miles per day in cargo and passenger airlift is worth approximately $4.5 billion, annually. It follows that the DOD could be willing to spend up to this amount in annual incentives to maintain the CRAF airlift capability. It can also be concluded that $4.5 billion in annual expenditures is the break-even point, such that annual outlays in excess of $4.5 billion would not be cost effective and would result in a net loss on the investment in the CRAF.

The probability of a CRAF activation should also be considered. Four billion, five hundred million dollars is the amount that Stage III of CRAF is worth, annually, yet, as discussed in Chapter 2, it is highly unlikely that Stage III of CRAF will ever be activated. Stage II of CRAF has been activated and is probably the highest capability that can be

expected, barring a national defense emergency such as the type planned for during the Cold War. The value of Stage II of CRAF, when averaged over the past 12 years, is $1.9 billion and provides an average capability of 12.8 MTM/D, less that one-half of the Stage III capability.

The next section evaluates the cost of current incentives to include the annual expenditures for the peacetime government guaranteed business, the CRAF enhancement program (CEP), commercial access to military installations, and wartime expenditures. This last item, wartime expenditures, is not a recurring expense, however, it is included to give perspective to the cost of activation of the CRAF.

Cost of Current Incentives

Peacetime Government Business Base

The fundamental incentive to commercial air carriers to participate in the CRAF is the guaranteed peacetime DOD business. Therefore, it is important that the level of business not decline. Following the Gulf War, there was a general concern that the DOD drawdown, the withdrawal of troops from overseas locations, and budget cuts would reduce the peacetime airlift requirements in the annual HQ AMC, Airlift Services Contract. However, this has not been the case, in part, due to a temporary stand-down of the C-141 fleet for structural problems, but also due to a high level overseas deployments in support of peacekeeping and humanitarian operations (Grier, 1995:53). However, there is no guarantee that these situations will continue into the future. Thus, to ensure a stable peacetime business base, HQ AMC and USTRANSCOM solicited the GSA to tie their annual city pair and small package contracts to CRAF participation. Table 4-3 lists

the Air Force's annual outlays to CRAF carriers for the International Airlift Services Contract by fiscal year, exclusive of the Persian Gulf War expenditures.

Table 4-3. Annual HQ Obligations for International Airlift Services Contract, Fiscal Years 1985-1997

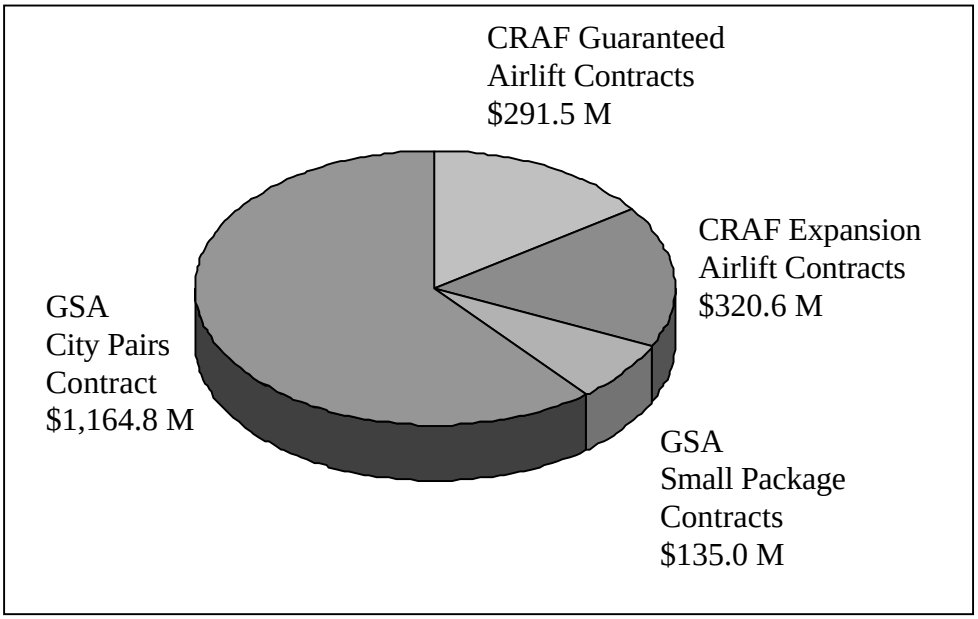
Year	Obligations (in $ millions)
1985	435
1986	462
1987	561
1988	524
1989	466
1990	659
1991[1]	511
1992	584
1993	572
1994	726
1995	607
1996[2]	612
1997[3]	618
Average	564

(Koch, 1996; Reid, Undated)

Note 1: Excludes expenses for Operations DESERT SHIELD, DESERT STORM, and DESERT SORTIE.
Note 2: Represents projected outlays for fiscal year. As of 28 June 1996, $533 million had been obligated.
Note 3: HQ AMC projection of Fixed Airlift Services Contract and Expanded Contracts.

As of fiscal year 1995, all GSA domestic and international city pair passenger programs are awarded only to CRAF participating carriers. This significantly expands the government's business base for participating carriers with additional revenues for CRAF carriers of nearly $1.2 billion. This increase in available revenue provided the necessary leverage for the DOD to encourage the return of United Airlines and American Airlines to the CRAF in fiscal year 1995 after a one year absence from the program (Routh, 1994b). The GSA Small Package contracts require a 15 percent or a 5 percent increase in CRAF

commitments, depending on the size of the actual contract. The first GSA Small Package Express contract was awarded on 14 May 1996 to Federal Express. This contract award provided an annual incentive of $58 million in revenues for the one-year contract, with four option-years, in return for an additional 15 percent minimum commitment. Two other GSA Small Package contracts have yet to be awarded, however, the total GSA freight contracts will add $135 million to the peacetime business base. In addition, GSA anticipates $23 million in annual savings due to a substantial improvement in delivery and service (Spehar, 1995). Figure 4-3 illustrates the revenue available to participating CRAF carriers from the government's peacetime business base. It should be noted that the GSA city pair contract includes the movement of DOD personnel, which accounts for approximately $800 million of the total GSA city pair program.



(USTRANSCOM, 1996)

Figure 4-3 . Revenue Available to Participating CRAF Carriers, Fiscal Year 1996

While the GSA contracts significantly increase the revenue available to CRAF carriers, there are no additional costs incurred by the DOD by implementing the GSA

contracts into the CRAF incentive package. The requirement to move U.S. government employees and packages via commercial air carriers has not changed, nor has the cost of the GSA contract. Therefore, while the GSA contracts are a net gain in CRAF incentives, there is no net increase in DOD expenditures.

It may be argued, however, that the new CRAF requirement in the GSA contracts actually decrease the cost of the CRAF to the DOD. Specifically, without the GSA contracts, the DOD may have had to incur additional costs to solicit the necessary commitments from carriers to meet strategic airlift goals. Thus, the DOD realizes a cost savings by enlisting a non-DOD, governmental agency to use a CRAF-only incentive program. Thus, there is a marginal cost associated with the increase in CRAF participation due to the GSA CRAF-only contracts. However, it cannot be assumed that the increase in CRAF commitments for 1997 is due solely to the GSA CRAF-only requirement. Rather, the increase in CRAF participation is due to a combination of all incentives, including the commercial use of military installations.

CRAF Enhancement Program

In the late 1970's and 1980's, the CRAF program lacked the necessary cargo capability to meet the DOD's long-range needs. Therefore, the CRAF Enhancement Program (CEP) was started in the 1970's under the National Defense Features Program to recruit long-range cargo airlift capability from the commercial aviation sector by offering incentives to incorporate cargo convertible features into their new or existing passenger aircraft. The CEP compensated carriers to reinforce floors, install rails and rollers, and add additional cargo doors. United, PanAm, Federal Express, and Evergreen have all participated in the CEP. The entire CEP cost approximately $635 million with the average

conversion cost of $32 million per aircraft. A total of 19 aircraft have been modified under the CEP (Chenoweth, 1993; VanHorn, 1996).

However, as shown in Appendix C, Figure C-9, long-range international cargo airlift commitments has risen in recent years. Therefore, a CEP is no longer needed as an incentive and the program is no longer aggressively pursued by HQ AMC (VanHorn, 1996). The investment in these converted aircraft, however, is not lost. Of the 19 CEP aircraft, 16 of the aircraft are in the CRAF program and fully converted to cargo aircraft, one CEP aircraft was lost in the terrorist bombing over Lockerbie, Scotland, and two CEP aircraft are in storage. In addition, HQ AMC still has a few conversion kits which they have offered to sell to air carriers. However, few carriers want to purchase the kits, even though, additional cargo capacity is in demand (see Appendix B, Commercial Aviation Trends). Therefore, HQ AMC has offered these extra conversion kits to carriers without charge in exchange for enrollment of that aircraft in the CRAF. More carriers have selected this option (Chenoweth, 1993; VanHorn, 1996).

Because the CEP is no longer an active incentive program, none of the costs of the program are included in the final analysis of this report. Additionally, the cost of the remaining kits is not included in the final analysis because the cost of these kits represent a sunk cost rather than a recurring expenditure.

Commercial Access to Military Installations

Department of Defense Instruction 4500.55 outlines the policy and guidelines for Commercial Access to Military Installations (CAMI). The DOD policy is to permit CRAF carriers access to military airfields where it is operationally feasible. Acceptable use of the military airfield by a CRAF carrier includes (1) weather alternative stops, (2) technical

stops, and (3) enplaning or deplaning of domestic commercial cargo or passengers (DOD, October 1995:Section C). In return for additional CRAF commitments, the carrier may negotiate a long term agreement for non-DOD commercial activities on a military installation within the U.S. The CAMI program is designed to allow CRAF carrier access to the installation at no cost to the Air Force. Therefore, carriers are expected to be self-supporting, although services and supplies may be provided by the installation at predetermined rates. Funds collected from the air carriers for services, landing fees, facility usage, or supplies are retained by the military installation (DOD, October 1995:Section E).

While the CAMI program will cost the Air Force nothing in annual outlays, CRAF carriers anticipate substantial savings in operating costs. For example, TWA estimates that use of Scott Air Force Base, Illinois as a weather alternative to Lambert Field in St. Louis, Illinois would save over the company approximately $200 million per year just in fuel costs. Similar savings are estimated by other carriers (Routh, 1994b).

Wartime Expenditures

Because the CRAF has only been activated once since its inception, there is nothing with which to compare the cost of the CRAF in an actual national emergency. The CRAF activation in support of Operations DESERT SHIELD and DESERT STORM cost $1.35 billion (Reid, Undated). Recall that the cost of establishing and maintain a reserve capability with commercial airlift is relatively inexpensive when compare to building and maintaining a military fleet, $12 per MTM/D compared to $152 per MTM/D. However, this is not the case when the CRAF was actually used for its intended purpose. A RAND study analyzed the marginal cost of using civil and military airlift in support of the

deployment phase of the Gulf War and found that the cost of commercial airlift was more than 4 times the cost of military airlift (Gebman et al, 1994b:44-45). While the CRAF is much more expensive to use than it is to maintain, it is hoped that activation of the CRAF is a rare event. If this was not believed, the DOD would be justified in building a military fleet capable of the 50 MTM/D requirement established in the Mobility Requirements Study.

This chapter began with the valuation of the CRAF for Stages II and III. The value of the CRAF is the actual dollar amount that this reserve capability is worth to the DOD. Based on the analysis done in the 1994 RAND study, the unit cost of military-style transports was used to determine the value of CRAF to the DOD. This assumes that, in the absence of a CRAF, the DOD would find it necessary to build up the military fleet to meet national defense objectives. Thus, the value of the CRAF is amount of money the DOD would have spent to build this additional military capacity.

The cost of current incentives was also discussed to include the peacetime business base, the CEP, commercial use of military airfields, and CRAF activation. Table 4-4 summarizes the average value of the CRAF, the applicable cost of incentives, and returns the net gain on the investment in the CRAF. Table 4-5 summarizes the value of the CRAF and costs for fiscal year 1997.

Table 4-4. The Average Value of the CRAF and Average Cost of Incentives for Fiscal Years 1985 - 1997, (in $ millions)

	Stage II	Stage III
Average Value of CRAF	1,945.60	4,453.60
Average Annual Outlays:		
Annual Cost of Airlift Service Contract	575.00	575.00
Cost of GSA City Pair Program	0.00	0.00

Table 4-4 Continued

	Stage II	Stage III
Cost of GSA Small Package Contracts	0.00	0.00
CEP	0.00	0.00
CAMI	0.00	0.00
Total Average Annual Outlays	575.00	575.00
Average Net Gain on Investment in CRAF	1,370.60	3,878.60
Average Annual Rate of Return	238%	675%

Table 4-5. The Expected Value of the CRAF and Expected Cost of Incentives for Fiscal Year 1997, (in $ millions)

	Stage II	Stage III
Value of CRAF	2,872.80	6,110.40
Annual Outlays:		
Annual Cost of Airlift Service Contract	618.00	618.00
Cost of GSA City Pair Program	0.00	0.00
Cost of GSA Small Package Contracts	0.00	0.00
CEP	0.00	0.00
CAMI	0.00	0.00
Total Annual Outlays	618.00	618.00
Net Gain on investment in CRAF	2,254.80	5,492.40
1997 Rate of Return	365%	889%

The average net gain on the investment in Stage III of the CRAF is approximately $3.9 million, as shown in Table 4-4. Therefore, the DOD could spend up to this amount on incentives and still realize a cost advantage with the CRAF. Similarly, if Stage II of the CRAF is the most capability that is expected, then the DOD could spend up to $1.4 million on incentives.

Peacetime incentives are not the only way to encourage participation. As became a priority following the Gulf War, reducing disincentives is equally important (Johnson, 1992). One such disincentive was the imbalance of coverage between commercial aviation insurance and the Aviation Insurance and Air Force Indemnification Programs. The genuine concern of a lengthy payment process on a claim resulting from the loss or

damage of an aircraft has been resolved with approval for the use of DBOF funds to indemnify the FAA and the submission of legislation as discussed in chapter 2 (Routh, Undated). Additionally, the FAA insurance and Air Force indemnification now provide extended coverage for air crew life insurance, the domestic portion of a CRAF mission, ground operations, and other items previously excluded. However, payment on a claim or reimbursement to the FAA remains a potential expenditure upon activation of the CRAF. The next section will review ways in which the DOD can minimize this expenditure. The minimum cost of lost market share is also evaluated based on the marginal cost of adding an additional flight at highly desirable airports.

Potential Expenditures

Aviation Insurance and Indemnity Programs

As discussed in the literature review of this report, all CRAF aircraft are registered with the Federal Aviation Administration for non-premium war-risk insurance in the event that commercial insurance is not economically feasible during a national emergency or other similar crisis. A $200.00, one-time, registration fee is assessed for each aircraft. Because the U.S. government does not insure a carrier for amounts greater than the carrier's commercial insurance, the terms of the commercial insurance policy are disclosed to the FAA. A portion of this database was provided by the FAA, Office of Aviation Policy and Plans and was used in this analysis (FAA, 1996). Appendix D, Table D-35 contains the database, listing each registered aircraft by aircraft make and model and the insured value of the hull. There are currently 832 aircraft registered by tail number with the FAA. While there are only 595 aircraft committed to the CRAF, once activated,

carriers may substitute aircraft with similar range and capacity (see Appendix C, Table C-26). Therefore, airlines typically register more aircraft than they have committed to the CRAF to allow for substitution of an airframe which is still eligible for FAA insurance and Air Force indemnification.

One of the major air carrier concerns is the level of financial protection offered by the aviation insurance and indemnity programs. The Aviation Insurance Revolving Fund (the Fund) is the primary source used to pay a claim. The Fund is, then, reimbursed by the contracting agency, in this case, HQ AMC. Currently, the Fund has accumulated approximately $63 million (Theiman, 1996). As shown in Figure 4-4, however, only 17 percent of the aircraft registered with the FAA for non-premium insurance have aircraft hull values in excess of $63 million.

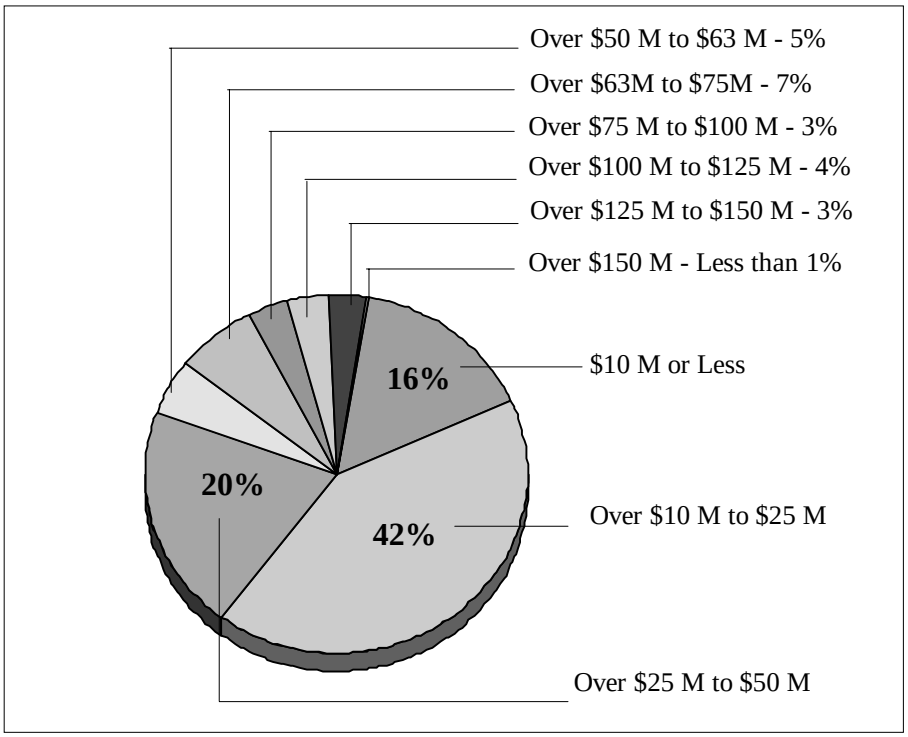


Figure 4-4. Aircraft Hull Values of all FAA Registered Aircraft

While the Fund has adequate resources to cover a single hull loss for the majority of the aircraft registered, there are not enough resources to pay for multiple losses or cover liability claims. The FAA estimates that average liability per incident for each registered aircraft is approximately $350 million (GAO, 1994). Therefore, the loss of even one aircraft would require the DOD to tap into the defense business operating fund in order to satisfy the claim. There is a level of risk associated with the loss of an aircraft which should be balanced with the cost of a claim and the cost of commercial aviation insurance.

According to the FAA, it is desirable that the carriers remain commercially insured whenever possible (Theiman, 1996). Carriers would prefer to remain commercially insured because of quick reimbursement on claims, and the government would prefer that carriers remain commercially insured because the potential for a claim and subsequent outlay of funds is eliminated. Therefore, it may be advantageous for AMC to pay for commercial insurance when rates begin to escalate. In fact, AMC has negotiated with air carriers in advance to pay increased premiums rather than resort to Chapter 443 insurance (Moore, 1993). It would be advantageous for AMC to pay the increased premiums when the expected cost of the war-risk insurance is less than the expected cost due to the loss of an aircraft. To explore the expected cost of war-risk insurance, the experiences from the Gulf War are used.

In the Gulf War, the surcharge for commercial war-risk insurance increased as the risk of loss increased. Airlines typically pay between 0.03 and 0.06 percent of the value of the aircraft hull, annually, for commercial war-risk insurance during peacetime. However, when the CRAF was activated, the surcharge for commercial war-risk insurance increased and became economically unfeasible for carriers. Once hostilities began, commercial war-

risk insurance surcharges were, again, increased. The FAA estimates that the cost of the commercial war-risk insurance surcharge increased to approximately 0.25 percent of the value of the aircraft hull, per mission. It should be noted that commercial war-risk insurance rates did fluctuate throughout the war, based on the perceived risk (Theiman, 1996). Table 4-6 shows the extreme difference in the annual peacetime rate and the per mission wartime rate.

Table 4-6. Representative War-Risk Insurance Surcharge Based on the Average Insured Value of the Aircraft Hull (in $)

		Peacetime War-Risk Surcharge		Wartime War-Risk Surcharge
		Expected Annual Cost		Expected Per Mission Cost
Make-Model	Average Insured Value	0.03%	0.06%	0.25%
Passenger Aircraft:				
DC8-50/54/55	5,031,250	1,509	3,019	12,578
B757-200ER/2Q8ER	58,107,750	17,432	34,865	145,269
A300-B4	26,275,000	7,883	15,765	65,688
B747-100	22,467,391	6,740	13,480	56,168
B747-200	46,187,500	13,856	27,713	115,469
B747-400	143,404,063	43,021	86,042	358,510
B767-200ER/300ER	59,783,478	17,935	35,870	149,459
DC10-10/30/40	27,213,031	8,164	16,328	68,033
MD-11	109,352,754	32,806	65,612	273,382
L1011-50/100/150/250/500	16,211,596	4,863	9,727	40,529
Cargo Aircraft:				
DC8-50/54F/55F	5,031,250	1,509	3,019	12,578
DC8-61C/61F/62F/63F/Combi	9,632,439	2,890	5,779	24,081
DC8-71F/73CF/73F	23,097,574	6,929	13,859	57,744
B747-100F	33,743,750	10,123	20,246	84,359
B747-200F	87,200,000	26,160	52,320	218,000
DC10-10F/30CF/30F	59,460,526	17,838	35,676	148,651
MD-11F	120,000,000	36,000	72,000	300,000
L1011	16,211,596	4,863	9,727	40,529

The average insured value for each aircraft type was calculated from the FAA insurance database of CRAF registered aircraft. Appendix D, Table D-34 contains the summary of all aircraft registered with the FAA. Table 4-6 contains only those aircraft

currently committed to the CRAF, as of 1 July 1996. Given that the wartime war-risk insurance surcharge is a per-mission rate, as the number of AMC missions contracted in support of a contingency increases, the wartime commercial insurance costs escalate.

The expected cost of the commercial war-risk insurance, equation (1), is based on the weighted average by aircraft type (i.e., B747 or DC8), the category (i.e., passenger or cargo), and the number of CRAF missions flown. The weight factor for the aircraft type was determined from the current composition of the CRAF, as shown in Tables 4-7 and 4-8. For example, if Stage II of CRAF was activated, the B747-100F would fly approximately 16 out of 100 missions.

Table 4-7. CRAF Cargo Aircraft as Percent of Total CRAF Cargo Fleet

Aircraft Type	Number of Aircraft in Stage II	Percent of Fleet	Number of Aircraft in Stage III	Percent of Feet
DC8-51F	10	8.55	16	9.20
DC8-61F	32	27.35	44	25.29
DC8-71F	13	11.11	22	12.64
B747-100F	19	16.24	30	17.24
B747-200F	16	13.68	20	11.49
DC10-30F	22	18.80	35	20.11
L1011-200F	2	1.71	4	2.30
MD11-F	3	2.56	3	1.72
Total	117	100.00	174	100.00

Table 4-8. CRAF Passenger Aircraft as Percent of Total CRAF Passenger Fleet

Aircraft Type	Number of Aircraft in Stage II	Percent of Fleet	Number of Aircraft in Stage III	Percent of Fleet
B767	11	9.24	24	9.34
DC10	22	18.49	81	31.52
L1011	23	19.33	39	15.18
B757	5	4.20	28	10.89
B747-100	15	12.61	32	12.45
B747-200	34	28.57	41	15.95
A300	2	1.68	5	1.95
MD11	4	3.36	4	1.56

Table 4-8 Continued

Aircraft Type	Number of Aircraft in Stage II	Percent of Fleet	Number of Aircraft in Stage III	Percent of Fleet
DC8	3	2.52	3	1.17
Total	119	100.00	257	100.00

The weight factor for aircraft category, passenger or cargo, was determine using number of passenger and cargo missions flown by CRAF during the height of the Gulf War. Commercial carriers flew over 5,000 CRAF missions in Operations DESERT STORM/SHIELD/SORTIE, approximately 20 percent of the total missions flew (Reid, Undated). Of the CRAF missions flown, approximately 40 percent were passenger missions and 60 percent were cargo mission as illustrated in Table 4-9 (Lund et al., 1993:Ch2, 9).

Table 4-9. Total CRAF Missions Flown: August 1990 - February 1991

	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Total
Cargo	81	179	96	162	266	489	625	1,898
Passenger	91	130	153	53	292	286	156	1,161
CRAF Total	172	309	249	215	558	775	781	3,059
Percent Cargo								62%
Percent Passenger								38%

(Lund et al., 1993:Ch2, 9)

With these weight factors, the expected cost of commercial war-risk insurance is calculated using equation (1), where the aircraft insured values are given in Appendix D.

$$I = rate \times value \times fleet \times cat \times m \qquad (1)$$

Where,

I = The expected cost of commercial war - risk insurance.

rate = The commercial war - risk insurance rate (0.25 percent).

value = The average insured value of the aircraft hull.

fleet = The composition of the CRAF fleet by aircraft type, expressed as a percent.

cat = The category of CRAF missions, passenger or cargo, expressed as a percent.

m = The number of CRAF missions.

To apply equation (1), the following assumptions are made:

1. The CRAF is appropriately sized, such that the percent of missions requiring that type aircraft is reflected in the CRAF composition.
2. When an aircraft is replaced by the carrier, it is replaced with a comparable aircraft, such that the capacity remains relatively constant.
3. The replacement value of the hull is reflected in the insured value.
4. Approximately 40 percent of the CRAF missions flown will be passenger aircraft and 60 percent of the missions flown will be cargo aircraft.
5. The commercial war-risk insurance surcharge is approximately 0.25 percent of the value of the aircraft hull, regardless of the stage of CRAF activation. It may be expected, however, that a Stage III activation could result in a higher insurance surcharge rate, given the higher level of threat.

The cost of the commercial war-risk insurance surcharge is calculated for each aircraft type using equation (1), as shown in Table 4-10. The table illustrates that the expected cost of commercial war-risk insurance for a contingency requiring 5,000 commercial missions under a Stage III activation is approximately $447.4 million. Table 4-11 shows the expected cost of commercial war-risk insurance for varying levels of commercial flying activity for CRAF Stage II and Stage III activation.

Table 4-10. Expected Cost of Commercial War-Risk Insurance Surcharge for 5,000 Commercial Missions

Make-Model	Average Insured Value (in $ million)	Percent in Stage III by Aircraft Type	Commercial War-Risk Surcharge(in $ millions)
Passenger Aircraft:			
DC8-50/54/55	5.03	1	0.3
B757-200ER/2Q8ER	58.10	11	31.7
A300-B4	26.27	2	2.6
B747-100	22.46	12	14.0
B747-200	46.18	16	36.8

Table 4-10 Continued

Make-Model	Average Insured Value (in $ million)	Percent in Stage III by Aircraft Type	Commercial War-Risk Surcharge(in $ millions)
B747-400	143.40	0	0.0
B767-200ER/300ER	59.78	9	27.9
DC10-10/30/40	27.21	32	42.9
MD-11	109.35	2	8.5
L1011-50/100/150/250/500	16.21	15	12.3
Cargo Aircraft:			
DC8-50/54F/55F	5.03	9	3.5
DC8-61C/61F/62F/63F/Combi	9.63	25	18.3
DC8-71F/73CF/73F	23.09	13	21.9
B747-100F	33.74	17	43.6
B747-200F	87.20	11	75.2
Make-Model	Average Insured Value (in $ million)	Percent in Stage III by Aircraft Type	Commercial War-Risk Surcharge(in $ millions)
Cargo Aircraft:			
DC10-10F/30CF/30F	59.46	20	89.7
MD-11F	120.00	2	15.5
L1011	16.21	2	2.8
Total			447.4

Table 4-11. Expected Cost of Commercial War-Risk Insurance for Various Levels of Flying Activity

Number of CRAF Missions	Expected Cost of War-Risk Insurance (in $ millions)	
	Stage II	Stage III
2,500	232	224
5,000	464	447
7,500	696	671
10,000	928	895
12,500	1,160	1,119

To determine if AMC should negotiate the cost of commercial war-risk insurance into the contract upon a CRAF activation, the expected cost due to loss or damage, equation (2), must be considered. The expected cost due to loss or damaged is based on the expected rate of incident of loss or damage. In general, airlift is a very safe mode of transportation. Between 1984 and 1993, U.S. scheduled airlines averaged 0.33 accidents per 100,000 departures. The fatality rate was even lower at 0.06 fatal accidents per

100,000 departures. Table 4-12 shows the accident rate extracted from the Federal Aviation Administration Statistical Handbook Of Aviation, 1995 (BTS, 1996). If it were assumed that the incident rate in a contingency were similar to peacetime aviation incident rates, then the expected accident rate for a crisis would be approximately 0.03 per 10,000 departures.

Table 4-12. Accident Rates for U.S. Airlines, Scheduled and Non-Scheduled Service, 1984-1993

	Accident Rate Per 100,000 Departures	
Year	Total	Fatal
1984	0.29	0.02
1985	0.35	0.11
1986	0.32	0.03
1987	0.46	0.05
1988	0.36	0.03
1989	0.37	0.14
1990	0.29	0.07
1991	0.33	0.05
1992	0.22	0.05
1993	0.29	0.01
Average	0.33	0.06

(BTS, 1996)

However, it may be expected that the accident rate during a contingency or national emergency would be higher given the increased threat. In fact, airfields in the Gulf region were subject to attack by SCUD missiles which resulted in a refusal of CRAF carriers to land in the region at night (Priddy and Holden, 1993:Ch 6, 6-29; Lund et al., 1993:28). During a contingency or crisis, all operations, military and civilian, may be subject to sabotage, enemy attack, terrorist attack, or other dangers. However, even with the increased risk of loss or damage, there was not a single incident in the Persian Gulf War

which resulted in a claim by commercial carriers (GAO, 1994). However, it cannot be assumed that the peacetime incident rate is applicable during a contingency, nor will the incident rate, necessarily, be the same for every contingency. Therefore, the expected cost resulting from a claim due to loss or damage of an aircraft varies depending on the expected incident rate for that crisis.

The expected cost due to the loss or damage is equal to the sum of the expected cost due to loss or damage of an aircraft and the expected liability costs, as shown in equation (2)

$$L = (value \times fleet \times cat \times departures \times probability) + (c \times q) \qquad (2)$$

Where,

L = The expected cost due to aircraft loss or damage.
value = The average insured value of the aircraft hull.
fleet = The composition of the CRAF fleet by aircraft type, expessed as a percent.
cat = The category of CRAF missions, passenger or cargo, expressed as a percent.
departures = The number of departures, 4 x number of CRAF missions.
probability = The probability of loss or damage, incident rate / 10,000 departures.
c = The expected liability cost per incident.
q = The expected number of aircraft lost or damaged, probability x departures.

In addition to the assumptions of equation (1), it is, also, assumed that each CRAF mission would average four departures. These four departures include an intermediate stop between the continental United States and the destination, or area of responsibility. With equation (2), the expected cost due to the loss or damage of an aircraft for varying levels of risk is shown in Figure 4-5 and Table 4-13. Appendix D, Table D-35 contains the complete sensitivity analysis for the expected cost due to loss or damage for 5,000

CRAF missions. Analysis tables were constructed for the other levels of commercial flying activity, however only the total costs are included, as shown in Table 4-13.

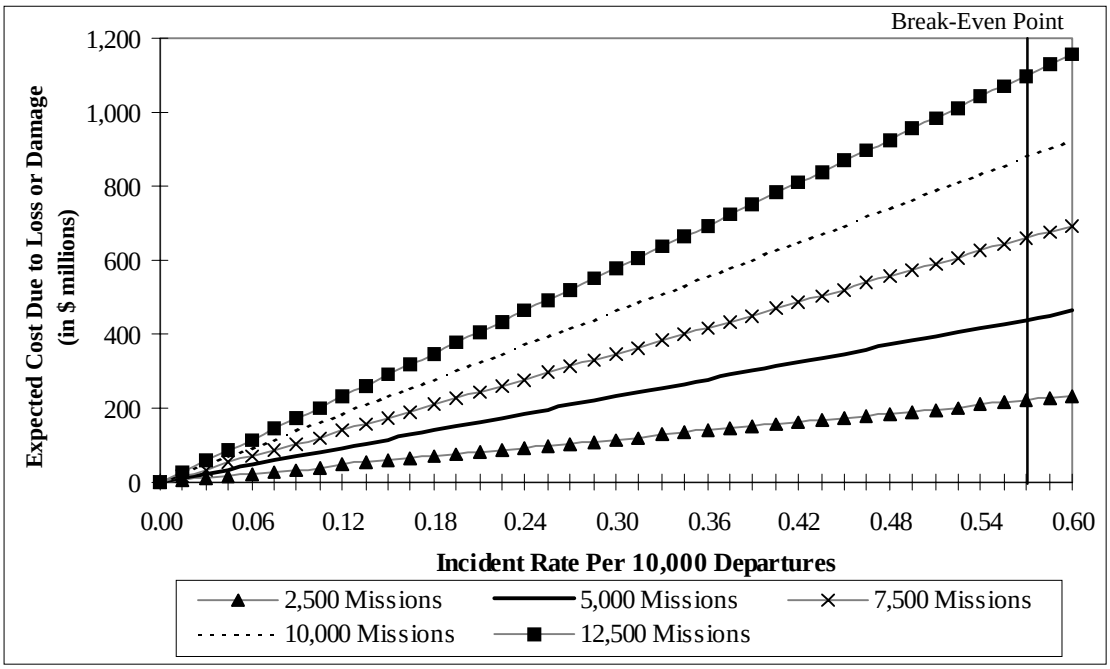


Figure 4-5. Expected Cost Due to Aircraft Loss or Damage for Varying Incident Rates

Table 4-13. Expected Cost Due to Loss or Damage for Varying Incident Rates

	Number of CRAF Missions				
	2,500	5,000	7,500	10,000	12,500
Incident Rate Per 10,000 Departures	Expected Cost Due to Loss or Damage (in $ millions)				
0.015	5.79	11.57	17.36	23.15	28.93
0.030	11.57	23.15	34.72	46.29	57.86
0.045	17.36	34.72	52.08	69.44	86.80
0.060	23.15	46.29	69.44	92.58	115.73
0.075	28.93	57.86	86.80	115.73	144.66
0.090	34.72	69.44	104.16	138.87	173.59
0.105	40.50	81.01	121.51	162.02	202.52
0.120	46.29	92.58	138.87	185.17	231.46
0.135	52.08	104.16	156.23	208.31	260.39
0.150	57.86	115.73	173.59	231.46	289.32
0.165	63.65	127.30	190.95	254.60	318.25
0.180	69.44	138.87	208.31	277.75	347.19
0.195	75.22	150.45	225.67	300.89	376.12
0.210	81.01	162.02	243.03	324.04	405.05
0.225	86.80	173.59	260.39	347.19	433.98

Table 4-13 Continued

	Number of CRAF Missions				
	2,500	5,000	7,500	10,000	12,500
Incident Rate Per 10,000 Departures	Expected Cost Due to Loss or Damage (in $ millions)				
0.240	92.58	185.17	277.75	370.33	462.91
0.255	98.37	196.74	295.11	393.48	491.85
0.270	104.16	208.31	312.47	416.62	520.78
0.285	109.94	219.88	329.83	439.77	549.71
0.300	115.73	231.46	347.19	462.91	578.64
0.315	121.51	243.03	364.54	486.06	607.57
0.330	127.30	254.60	381.90	509.21	636.51
0.345	133.09	266.18	399.26	532.35	665.44
0.360	138.87	277.75	416.62	555.50	694.37
0.375	144.66	289.32	433.98	578.64	723.30
0.390	150.45	300.89	451.34	601.79	752.23
0.405	156.23	312.47	468.70	624.93	781.17
0.420	162.02	324.04	486.06	648.08	810.10
0.435	167.81	335.61	503.42	671.22	839.03
0.450	173.59	347.19	520.78	694.37	867.96
0.465	179.38	358.76	538.14	717.52	896.90
0.480	185.17	370.33	555.50	740.66	925.83
0.495	190.95	381.90	572.86	763.81	954.76
0.510	196.74	393.48	590.22	786.95	983.69
0.525	202.52	405.05	607.57	810.10	1,012.62
0.540	208.31	416.62	624.93	833.24	1,041.56
0.555	214.10	428.20	642.29	856.39	1,070.49
0.570	219.88	439.77	659.65	879.54	1,099.42
0.585	225.67	451.34	677.01	902.68	1,128.35
0.600	231.46	462.91	694.37	925.83	1,157.28

In comparing the expected cost of the commercial war-risk insurance, *I*, and the expected cost resulting from loss or damage, *L*, the incident rate in a crisis would have to be approximately 0.58 per 10,000 departures for these two costs to equal. It should be noted that the analysis for the expected cost due to loss or damage for the CRAF fleet composition in Stage II showed similar results. For the fleet composition in Stage II, the incident rate where *I* and *L* equal is approximately 0.60 per 10,000 departures. This means that the Air Force would have to anticipate a relatively high incident rate before it would be economical to pay the increased surcharges for all CRAF missions. Therefore,

in the aggregate, it appears that it would not be advantageous for HQ AMC to absorb the cost of commercial war-risk insurance upon activation of the CRAF. However, it may not be unreasonable to view the benefits and costs on an individual basis.

Currently the CRAF is composed, primarily, of low valued aircraft, such as the DC-8, B747-100, or DC-10. These aircraft, presumably, would fly more of the CRAF missions in a contingency than higher valued aircraft. It is also reasonable to assume that the expected incident rate will vary depending on the phase of the crisis (i.e., deployment, sustainment, redeployment) and operating location in the area of responsibility. Thus, certain CRAF missions may be at higher risk than others, at any point in time. It is, therefore, appropriate to look at each aircraft type, separately.

Table 4-14 illustrates the rate of incident per 10,000 departures, by aircraft type, at which point the cost of commercial war-risk insurance, *I*, equals the cost due to the loss of that aircraft. For example, the DC-8 aircraft would have to fly over 28,000 missions before the cost of the commercial war-risk insurance (based on 0.25 percent of the hull value per mission) would exceed the cost of the loss from one aircraft. The expected cost due to loss is the sum of the replacement cost and the estimated liability costs, where the replacement costs is assumed to equal the insured value of the hull. Applying equation 2 and solving for *prob*, the resulting incident rate for 28,226 missions, such that the expected cost due to loss or damage equals cost of the war-risk insurance is 0.089 per 10,000 departures.

Table 4-14. Break-Even Point Where Insurance Costs Equal Costs Due to Loss

Make-Model	Average Insured Value	Estimated Liability Cost per Loss	Expected Cost due to Loss of one Aircraft	Wartime War-Risk Surcharge per Mission	Number of Missions Break-Even Point	Resulting Incident Rate per 10,000 Departures
Passenger Aircraft:	(in $ millions)					
DC8-50/54/55	5.03	350	355.03	0.01	28,226	0.089
B757-200ER/2Q8ER	58.11	350	408.11	0.15	2,809	0.890
A300-B4	26.28	350	376.28	0.07	5,728	0.436
B747-100	22.47	350	372.47	0.06	6,631	0.377
B747-200	46.19	350	396.19	0.12	3,431	0.729
B747-400	143.40	350	493.40	0.36	1,376	1.817
B767-200ER/300ER	59.78	350	409.78	0.15	2,742	0.912
DC10-10/30/40	27.21	350	377.21	0.07	5,545	0.451
MD-11	109.35	350	459.35	0.27	1,680	1.488
L1011-50/100/150/250/500	16.21	350	366.21	0.04	9,036	0.277
Cargo Aircraft:	(in $ millions)					
DC8-50/54F/55F	5.03	350	355.03	0.01	28,226	0.089
DC8-61F/62F/63F/Combi	9.63	350	359.63	0.02	14,934	0.167
DC8-71F/73CF/73F	23.10	350	373.10	0.06	6,461	0.387
B747-100F	33.74	350	383.74	0.08	4,549	0.550
B747-200F	87.20	350	437.20	0.22	2,006	1.247
DC10-10F/30CF/30F	59.46	350	409.46	0.15	2,755	0.908
MD-11F	120.00	350	470.00	0.30	1,567	1.596
L1011	16.21	350	366.21	0.04	9,036	0.277

This information could, then, be used as a decision tool. For example, if the DC-8 aircraft was expected to fly fewer than 28,000 mission, but the anticipated accident rate was greater than 0.089, then it would be cost effective to pay the cost of commercial war-risk insurance for those missions because the cost resulting from a loss would be greater than the cost of commercial insurance. Similarly, the expected incident rate for the missions flown by the MD-11 aircraft would have to be greater than 1.49 per 10,000 departures before it would be cost effective to include the cost of commercial war-risk insurance in the AMC contract. Figure 4-6 illustrates the break-even point for each type of aircraft. Each point on the graph is discrete and independent of other points on the graph. Any combination of missions and incident rates above or to the right of the break-

even point indicate that it would be more cost effective for AMC to absorb the cost of commercial war-risk insurance.

It may be reasonable to expect incident rates as high as 0.2 to 0.4 per 10,000 departures at certain locations or phases of a contingency. At these times it would be cost effective for HQ AMC to absorb the cost of the higher war-risk insurance surcharges for low valued aircraft, such as the DC8, at any level of flying activity. However, given the same level of risk, it would be more cost effective to rely on the FAA non-premium insurance for high valued aircraft, such as the MD-11 or B747-200, as illustrated in Figure 4-6.

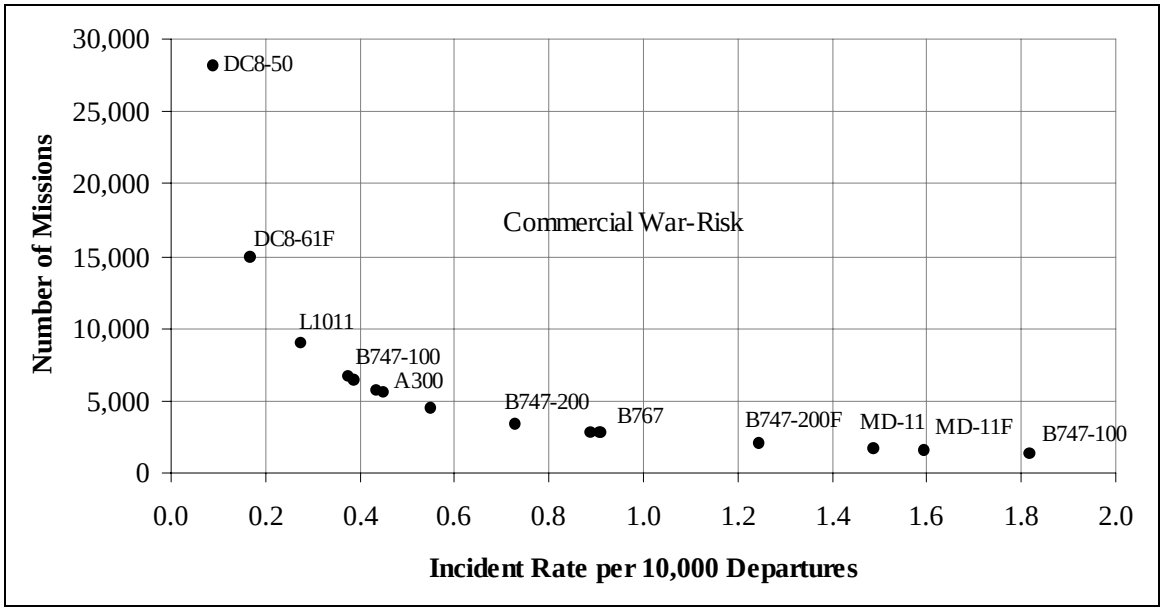


Figure 4-6. Break-Even Point Where Insurance Costs Equal Costs Due to Loss

The second disincentive explored in this paper is the risk of lost market share upon activation of the CRAF. While the cost effectiveness of commercial war-risk insurance appears to be carrier independent, market share is not.

Cost of Lost Market Share

The cost of lost market share varies among carriers. This is due to a wide range of variables that determine market share and market share profitability. Competition, customer demand, cost structure, and many other variables affect how successful a carrier is in cultivating a market or expanding into new markets. Similarly, the risk associated with lost market share varies between carriers depending upon many of these same factors. Therefore, the risk of lost market share upon activation of the CRAF may not be felt by all carriers or may affect each carrier differently. Carriers that primarily offer unscheduled service are less affected by a CRAF activation than carriers that provide scheduled service between an established city pair market (Gebman et al., 1994b:48-55). For these reasons, the cost to regain market share will vary among carriers. Because a common cost cannot be applied consistently to all carriers, it is appropriate to identify the minimum cost that is representative of lost market share. This minimum cost could provided a basis for determining if the risk of lost market share should be compensated via monetary or non-monetary incentives.

Given that a carrier has withdrawn from a city pair market due a CRAF activation, the cost to re-enter that market can be measured by the cost to add one flight. Many cost components are necessary to add a flight or enter a market. First, the carrier must have rights to the city pair route. Second, the carrier must have adequate resources, such as aircraft and crews. Third, the carrier must generate customer demand. And finally, the carrier must be able to operate from an airport that will generate adequate revenues. It is assumed that route ownership and resources are not lost upon activation of the CRAF and is, therefore, not a cost consideration. Additionally, the cost to generate customer

demand via discount fares and advertising will not be considered. Advertising and discount fare costs are highly variable and are costs incurred by carriers in their daily operations, with or without CRAF activation. Therefore, only airport operations will be considered.

The FAA imposes limits on the operation at four major U.S. airports: Kennedy, LaGuardia, Chicago O'Hare, and Washington National. The regulation, known as the High Density Rule (HDR), was implemented in 1969 to allocate capacity to carriers at these highly congested airports. With the HDR, capacity is allocated to carriers via take-off and landing slots. Because a carrier cannot operate a flight without a slot, the HDR acts as a barrier to service at these restricted airports. While the slots are not, necessarily, the property of the holders, the slots can be bought, sold, leased, traded, and held as collateral. Thus, the slots have inherent value (DOT, 1995).

Slots have value because they are a scarce resource and enable carriers to earn financial returns. In a DOT study on the HDR, four measures of value were identified. First, the slots have economic value. The economic value is the discounted present value of the future earnings resulting from the use of that slot. Second, the slots have a sale or lease value. The sale or lease value varies depending upon the number of slots involved, the time period for which they can be used, the airport, earning power, and other economic factors. Third, the slots have collateral value and, finally, slots can be carried on a balance sheet as an asset. While slots may be bought and sold on the free market, they must also be used. Domestic slots must be used at least 80 percent of the time over a 2-month period, while international slots must be returned for subsequent re-allocation if they are not used for more than 2 weeks (DOT, 1995:17-30). Because the ownership of a

slot has a fair market value and allows a carrier to operate in a city pair market, slot value can be used to represent the minimum cost to gain market share. Slot value can represent this cost in two ways. First, the sale or lease price represents the minimum cost to a carrier wanting to re-enter a segment of the market. Second, if a carrier currently owns a slot at a controlled airport, the economic value represents the carrier's loss if that slot is not used once CRAF has been activated. Thus, the minimum cost of lost market share will be explored by analyzing the economic value of slots at various airports.

The DOT study measured the economic value of slots based on the difference between individual carrier yields and costs with and without the High Density Rule, assuming that the slots would have no economic value if the HDR was removed. The DOT measured the loss in fare premiums, or loss in earning potential, of carriers at three of the four airports, assuming airport slots were no longer a barrier to entry at these locations. The DOT study results are shown in Table 4-15.

Table 4-15. Economic Value of Airport Slots

	Chicago O'Hare	LaGuardia	Washington National
Increase in slots per day without the HDR	221	70	191
Loss in fare premiums ($/year)	$181,000,000.00	$56,000,000.00	$48,000,000.00
Loss in fare premiums ($/day)	$495,890.00	$153,425.00	$131,507.00
Value per slot per day	$2,243.85	$2,191.78	$688.52
Value per slot per month	$67,315.44	$65,753.42	$20,655.53
Value per slot per year	$819,004.52	$800,000.00	$251,308.90

(DOT, 1995)

A review of various transactions in the early 1990's indicate similar valuation of slots at these airports. For example, in 1992 United Airlines won a bid to lease 16 slots from Trans World Airlines at Chicago O'Hare for $66,000 per month per slot (United, 1992);

bankrupt Eastern Airlines sold 67 slots at Washington National for $530,000 each and 7 slots at LaGuardia for $500,000 each (O'Brian, 1991); and USAir purchased 12 slots at LaGuardia and 10 slots at Washington National from Midway for $760,000 each (USAir, 1991). Many of the slot purchases in the early 1990's were the result of bankruptcies or downsizing due to the severe financial problems of the entire airline industry. In fact, a 1990 GAO study suggested that slot sales were falling, while the trend for short-term slot leases was increasing (GAO, 1990:25).

Using the results in the DOT study, the earning potential of airport take-off and landing slots is approximately $51,200 per month. Given the ability to negotiate a lease, the minimum cost to re-enter a market at highly desirable airports is approximately $51,200 per month per flight. Therefore, the minimum cost of lost market share, for some carriers, may be substantial depending on the length of the CRAF activation and current market conditions, as shown in Table 4-16. For example, if one or more carriers lost an average of 10 daily flights per month, the cost to the carriers would be at least $0.5 million for each month that CRAF is activated. This cost is significant for two reasons. First, because slot value at slot controlled airports is directly related to the earning potential of the carrier, the costs shown in Table 4-16 represent lost revenue by carriers based on the degree to which their operations are downsized due to a CRAF activation. Second, some carriers may not only experience lost revenue due to activation of the CRAF, but may also incur a cost to re-enter a market that was lost during the activation. The cost for these carriers would approximately double.

Table 4-16. Market Share: Analysis of Airport Slots Costs

Daily Flights per Month	Cost per Month (in $ millions)
1	0.05
10	0.51
25	1.28
50	2.56
75	3.84
100	5.12
150	7.68
200	10.24

Given the minimum cost to re-enter a market which is representative of the cost of lost market share, several options can be explored. First, AMC could capture the cost of lost market share in the wartime airlift rates or as a separate item within the wartime negotiated contracts. However, such a position would tend to favor carriers who offer primarily nonscheduled service or are unlikely to experience a high risk of lost market share. Additionally, AMC could negotiate a separate rate structure for those carriers most susceptible to lost market share. While this option favors major air carriers, such a position may encourage greater participation in Stages I and II of the CRAF. Second, the FAA could revise the HDR to ensure carriers do not lose slots due to non-use during a CRAF activation. While such a change would eliminate the risk of losing a slot due to non-use, the change would not protect carriers from lost customers and lost revenue. This is particularly true at non-slot controlled airports, where market share may shift due to higher passenger load factors or greater flight frequency of competing airlines. Finally, AMC could focus on non-monetary compensation in the form of stronger incentive programs, rather than direct monetary compensation. The long-term initiatives envisioned by USTRANSCOM, such as greater U.S. government use of CRAF carriers for a larger

peacetime business base and more scheduled service for CRAF members, may provide enough leverage to outweigh the risk of lost market share.

Because the impact of a CRAF activation on market share is dynamic and carrier dependent, this last option is perhaps the most effective way to address this issue, in the short run, particularly since there is little empirical evidence of the cause and affect relationships between a CRAF activation and market share. As discussed in Chapter 2, there is no conclusive evidence that market share was or was not lost during the first CRAF activation. However, if market share is lost by some carriers, the cost to these carriers can be substantial and should be compensated.

Summary

The opportunity cost for the long-range international segment of the CRAF is approximately $4.5 billion and $1.9 billion, annually, for 29.3 million and 12.8 million ton-miles per day of cargo and passenger capacity, respectively. In reviewing the cost of current incentives, the only significant cost incurred by the DOD is the cost of the annual Airlift Services Contract. The GSA annual contracts and CAMI, while significant incentives, result in no additional expenditures for the DOD. It was concluded that the net gain on the investment in the CRAF is valued at approximately $1.4 million for Stage II capacity and $3.8 million for Stage III capacity, annually. From this point of view, the DOD could spend more for incentives or the removal of disincentives, if necessary, to stimulate greater participation and ensure the future viability of the CRAF program.

This report explored two areas where potential expenditures could reduce the disincentives of aviation insurance and lost market share. While the Aviation Insurance

and Air Force Indemnity Programs have been significantly improved since the Persian Gulf War, the cost for commercial war-risk insurance or the expense due to a claim is still a real war-time expenditure. This study found that the Air Force could minimize outlays by including the cost of commercial war-risk insurance for low-valued aircraft, thereby eliminating the costs due to a claim for the loss or damage of these aircraft. The sensitivity analysis showed that the cost due to loss or damage at relatively low rates of incident could exceed the cost of the commercial insurance.

The second disincentive explored in this research was the risk of lost market share due to the activation of the CRAF. The cost associated with this loss is not consistent among carriers because market share is a function of the type of service offered, cost structure, and other economic factors. Therefore, the fair market value of an airport slot was used to measure the minimum cost to enter a city pair market.

The next chapter reviews the analysis contained in this chapter within the larger context of the CRAF program as a public policy issue.

Chapter 5

Conclusions and Recommendations

Conclusions

This study evaluated the value of the Civil Reserve Air Fleet, or the amount it is worth, to the Air Force and the DOD with respect to the overall cost of the program and attempted to answer the following research questions (1) what is the value of CRAF and is this value the amount the DOD could be willing to spend to maintain a viable Civil Reserve Air Fleet? and (2) what additional amount in annual expenditures could the DOD be willing to invest to adequately compensate civil air carriers?

The value of the CRAF was measured as the opportunity cost to the DOD for the commercial capacity necessary to meet strategic airlift requirements. The average value for the long-range international segment of Stage II of the CRAF is $1.9 million, annually, while the average value for Stage III of the CRAF is $4.5 million, annually. The amount that Stages II and III are worth to the Air Force and DOD should be differentiated because the relative reliability, given current military airlift objectives, of these stages is not the same.

Current military airlift objectives focus on the capacity necessary to support smaller regional conflicts. The threat of a large-scale war in Europe, requiring the full

mobilization of the CRAF, is no longer present. Additionally, as seen in the Gulf War, commercial air carriers may be reluctant to commit to the Stage III activation of the CRAF and remove a significant portion of their fleet from the civil sector. Therefore, the capacity in Stage II of the CRAF may be the most that can be expected in future conflicts, even though the Air Force depends on the CRAF for at least 50 percent of their strategic airlift. For these reasons, only the value of Stage II is relevant when evaluating what the DOD could spend for future CRAF incentives.

In reviewing the cost of current incentives, the only significant cost incurred by the DOD is the cost of the annual Airlift Services Contract. The GSA annual contracts and CAMI, while significant incentives, result in no additional expenditures for the DOD. It was concluded that the net gain on the investment in the CRAF is valued at approximately $1.4 million, annually, for the capacity in Stage II. Thus, the DOD has a substantial airlift capability in the CRAF, while saving approximately $1.4 million, annually. The premise for this research was to determine the amount the DOD could spend to retain a viable CRAF program. Given that current investments in the CRAF are substantially less that what the CRAF capacity is worth, it is concluded that the DOD could spend up to $1.4 million for additional incentives or the removal of disincentives. However, this conclusion is made outside of DOD fiscal constraints. An increase in annual outlays for incentives may only increase the cost incurred by AMC customers. However, the Air Force and DOD may consider the cost of reducing wartime disincentives as a means to achieve greater commitment to the CRAF, particularly in Stage II.

This report explored two areas where potential expenditures may reduce the disincentives associated with aviation insurance and lost market share. While the Aviation

Insurance and Air Force Indemnity Programs have been significantly improved since the Persian Gulf War, the cost for commercial war-risk insurance or the expense due to a claim is still a real war-time expenditure. The Aviation Insurance Revolving Fund has approximately $63 million to satisfy a claim, therefore, the Air Force would need to tap into the DBOF in order to satisfy multiple losses or liability claims. Additionally, it is desirable for CRAF carriers to remain commercially insured, whenever possible. Therefore, it is appropriate to determine when AMC should absorb the cost of higher commercial insurance premiums rather than rely on the FAA non-premium insurance.

This study found that the Air Force could minimize outlays by absorbing the cost of commercial war-risk insurance for low-valued aircraft, thereby eliminating the costs due to a claim for the loss or damage of these aircraft. The sensitivity analysis showed that the cost due to loss or damage, even at relatively low rates of incident, could exceed the cost of the commercial insurance for low valued aircraft, such as the DC8, B747-100, and DC-10. However, it is not cost effective to incur the higher commercial war-risk insurance surcharges for high valued aircraft unless the expected incident rate for these aircraft were extremely high. If AMC adopted a position, such that the cost of commercial war-risk insurance for certain CRAF missions was included in the AMC contract, some lingering carrier concerns may be eliminated. However, such a position may also act as a disincentive for carriers to commit higher valued aircraft to the CRAF.

The second disincentive explored in this research was the risk of lost market share due to the activation of the CRAF. The cost associated with this loss is not consistent among carriers because market share is a function of type of service offered, cost structure, and other economic factors. Therefore, the fair market value of an airport slot

was used to measure the minimum cost to enter a city pair market, and therefore, represent the cost of lost market share upon activation. The minimum cost to re-enter a city pair market was found to be approximately $51,200 per month. The logic would follow that carriers should be compensated this monthly amount during a CRAF activation. But, is this the role of public policy, and is the risk of lost market share a significant barrier to CRAF participation?

The CRAF program, as a public policy instrument, cannot protect every carrier from potentially adverse situations and still be equally beneficial and equitable to all. However, the analysis contained in Chapter 4 showed that even a relatively small loss of 10 daily flights could cost carriers at least $0.5 million per month. Yet, without more conclusive evidence that lost market share is the result of a CRAF activation, it is premature to conclude that market share should be monetarily compensated. Additionally, the impact of a CRAF activation on market share is dynamic and carrier dependent. Therefore, it is concluded that market share loss is an inherent risk that cannot be overcome with direct monetary compensation, but can only be reduced by positive incentives, at least in the short run. The initiatives envisioned by USTRANSCOM, such as greater U.S. government use of CRAF carriers for a larger peacetime business base and more scheduled service for CRAF members, may provide enough leverage to outweigh the risk of lost market share.

Through this research, the author believes that the CRAF program is strong and vital. Many serious issues have been resolved in the few years that have past since CRAF's first activation. Carrier participation is at an all-time high and, in general, carriers are satisfied with the CRAF program. However, changing domestic and global, political and economic

climates can affect the military and the air carrier industry in very significant ways. Thus, the CRAF is a very dynamic part of public policy.

Limitation in this Study

Several factors limited this study. While it is not believed that these factors affect the magnitude of costs in this study, they may improve the precision of the cost analysis. First, the unit cost of the military fleet is based on the average cost of operations and maintenance, personnel, fuel, facilities, and supplies. Given that the C-17 aircraft is replacing the C-141 aircraft, the unit cost may be affected as the fleet composition changes. Second, the liability cost used to estimate the cost due to an aircraft loss was the same for each type of aircraft. The liability cost, however, is variable. Finally, the method for determining lost market share did not capture the complexity of the variables involved in market share. Thus, a more accurate picture of the costs was not presented due, in part, to the lack of supporting research of the causal relationships.

Recommendations for Further Study

In this research effort, many areas of interest to the CRAF program were not pursued due to the limited resources of the researcher. It is believed that further research may be beneficial to the DOD in the continuing effort to promote the interdependence of military and commercial aviation in the fulfillment of national defense objectives. While several research projects have been conducted on the CRAF, none have solely addressed the issue of lost market share. A thorough study of the impact of a CRAF activation on market share would be beneficial in determining what, if any, action would promote a stronger commitment to the program. Similarly, a study of the motivational factors relating to

CRAF participation may reveal areas for continued improvement in the DOD/air carrier partnership.

Appendix A

Civil Air Carrier Statistics

Table A-17 lists those carriers which are issued a Certificate of Public Convenience and Necessity by the Department of Transportation (DOT).

Table A-17. Large Certificated Air Carriers, 1992 and 1993

MAJORS	NATIONALS (Cont.)	MEDIUM REGIONALS
America West	Tower	Aerial
American	US Air Shuttle	Airmark
Continental	Westair	Atlas Air
Delta	World	AV Atlantic
Federal Express		Buffalo
Northwest	LARGE REGIONALS	Casino Express
Southwest	Air Transport Int'l	Continental Micronesia
Trans World	American Int'l	Eagle Airlines
United	Amerijet	Empire
United Parcel	Arrow	Fine Airlines
USAir	Braniff Int'l	Great Americans
	Carnival	Int'l. Cargo Xpress
NATIONALS	Challenge Air Cargo	Jet Fleet
Air Wisconsin	Executive Airlines	Miami Air
Air Wisconsin Corp.	Express One	Million
Alaska	Florida West	North American
Aloha	Key	Patriot
American Trans Air	Kiwi	Ryan International
Atlantic Southeast	MGM GRAND	Sierra Pacific
Business Express	Morris	Spirit Air
DHL Airways	Northern Air	Trans American Charter
Emery	Private Jet	Trans Air Link
Evergreen	Reeve	Ultrair
Hawaiian	Reno	Wilbur's
Horizon Air	Rich	Worldwide

Table A-17 Continued

MAJORS	NATIONALS (Cont.)	MEDIUM REGIONALS
Markair	Simmons	Wrangler
Midwest Express	Trans Continental	
Southern Air	Trans States	
Sun Country	UFS, Inc.	
	Zantop	

(BTS, 1996)

Table A-18 describes the total capacity in thousands of ton-miles for all large air carriers and includes passenger and cargo traffic. For simplicity, *all large certificated air carriers* are referred to throughout this thesis as *all U.S. air carriers*. However, it should be noted that small air carriers or private aircraft are not included in any data, nor do small air carriers or private aircraft participate in the CRAF.

Table A-18. Total Capacity Available in all Services by all U.S. Air Carriers1984-1995 (in thousands of ton-miles)

Year	Total[1]	Domestic Operations	International Operations
1984	76,298,288	58,942,974	17,355,314
1985	80,565,182	61,337,807	19,227,375
1986	90,243,958	69,771,737	20,472,221
1987	99,152,795	75,741,397	23,411,398
1988	105,272,555	78,264,976	27,107,579
1989	109,397,126	78,955,003	30,442,123
1990	117,112,475	83,354,510	33,757,965
1991	116,374,506	80,879,199	35,495,307
1992	122,282,214	84,041,325	38,240,889
1993	126,329,589	86,387,719	39,941,869
1994	133,898,444	91,741,724	42,156,719
1995	139,843,236	95,327,862	44,515,374

(BTS, 1996)
Note 1: Categories may not add to total due to rounding

Table A-19 describes the revenue traffic in thousands of ton-miles for all U.S. air carriers, including passenger and cargo service. Again, this data does not include small or private aircraft. A revenue ton-mile is one ton of revenue traffic transported one mile. Revenue ton-miles flown can be thought of as the actual capacity used by all U.S. air carriers.

Table A-19. Revenue Ton-Miles Flown in all Services by all U.S. Air Carriers1984 - 1995 (Thousands Of Ton-Miles)

Year	Total [1]	Domestic Operations	International Operations
1984	41,277,948	30,561,436	10,716,512
1985	44,154,779	32,939,216	11,215,563
1986	48,883,854	37,148,059	11,735,795
1987	54,917,632	40,509,782	14,407,850
1988	58,397,186	41,598,662	16,798,524
1989	61,095,371	42,475,761	18,619,610
1990	63,627,077	43,651,162	19,975,915
1991	62,479,347	42,668,249	19,811,099
1992	66,683,729	45,300,540	21,383,188
1993	69,682,263	46,897,800	22,784,462
1994	75,511,379	50,631,587	24,879,792
1995	79,097,777	52,822,228	26,275,549

(BTS, 1996)

Note 1: Categories may not add to total due to rounding

Table A-20. Available Capacity for U.S. Air Carriers, Cargo and Passenger, 1984-1995 (in millions of ton-miles per day)

Year	System	Domestic		International		Total
		Pax	Cargo	Passenger	Cargo	Cargo
1984	209	116	46	25	23	69
1985	221	122	46	28	25	71
1986	247	136	55	30	26	81
1987	272	144	63	33	31	94
1988	288	147	67	38	36	103
1989	300	145	71	42	41	112

Table A-20 Continued

Year	System	Domestic		International		Total
		Pax	Cargo	Passenger	Cargo	Cargo
1990	321	154	74	47	45	119
1991	319	151	73	51	46	119
1992	335	155	74	56	48	122
1993	346	159	77	58	51	128
1994	367	163	87	58	58	148
1995	383	168	92	59	63	155
Average	301	147	69	44	41	110

Table A-21. Revenue Ton-Miles Flown for all U.S. Air Carriers, Cargo and Passenger, 1984 - 1995 (in millions of ton-miles per day)

Year	System	Domestic		International		Total
		Passenger	Cargo	Passenger	Cargo	Cargo
1984	113	67	17	17	13	30
1985	121	74	16	18	13	29
1986	134	83	19	18	14	33
1987	150	89	22	22	18	40
1988	160	90	24	26	20	44
1989	167	90	26	28	23	49
1990	174	93	26	32	22	48
1991	171	93	20	34	19	39
1992	183	97	22	38	19	41
1993	191	99	24	39	22	46
1994	207	106	27	41	26	53
1995	217	110	29	42	28	57
Average	166	91	23	30	20	42

Table A-22. Passenger Capacity for all U.S. Air Carriers, 1984-1995 (in millions of passenger-miles per day)

Year	Total Passenger System		Domestic		International	
	Available	Revenue	Available	Revenue	Available	Revenue
1984	1412	836	1158	668	254	168
1985	1501	922	1221	741	279	180
1986	1664	1004	1364	828	300	177
1987	1777	1108	1444	889	334	219
1988	1854	1160	1470	902	384	258
1989	1875	1186	1452	904	423	281
1990	2009	1255	1543	932	467	322

Table A-22 Continued

Year	Total Passenger System		Domestic		International	
	Available	Revenue	Available	Revenue	Available	Revenue
1991	2022	1269	1511	926	511	343
1992	2117	1353	1554	972	564	381
1993	2175	1386	1595	992	580	394
1994	2217	1473	1639	1064	578	408
1995	2277	1529	1687	1105	590	424

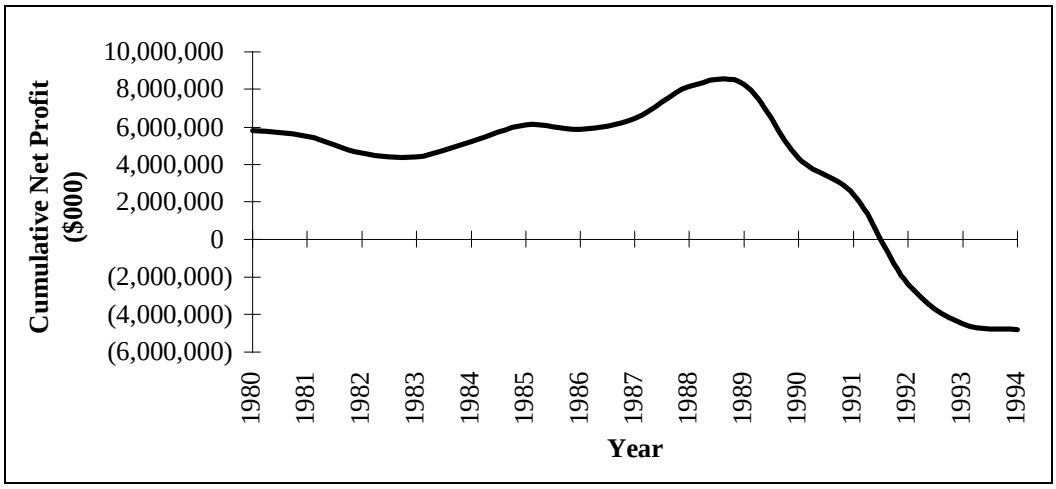
(BTS, 1996)

Appendix B

Commercial Aviation Trends

Aviation Industry Losses

The commercial aviation industry has grown over the past few decades, however, the industry has not always been profitable. In the 1980's, the industry enjoyed consistent profits, however, this was not true for the 1990's. The airline industry as a whole experienced severe financial problems due to recessionary pressures, rising fuel and labor costs, heavy debt load, and intense price competition. A decline in tourist traffic and a 230 percent increase in the price of jet fuel during the Persian Gulf War compounded the industry's financial problems. The industry lost $4 billion in 1990, $1.9 billion in 1991, nearly $5 billion in 1992, and $2 billion in 1993. These four years were, financially, the worst in the history of commercial aviation and is illustrated in Figure B-23. In fact, the commercial aviation industry lost more in these three years than their cumulative profits to date (ATA, WWWeb; Lieb, 1994:145-149).



(ATA, WWWeb)

Figure B-7. U.S. Scheduled Airlines Cumulative Net Profits, 1980-1994

Recovery

The record losses in the early 1990's prompted many airlines to make dramatic changes in their long-term operating and capital plans and begin focusing on improved yield management techniques. Many airlines delayed or canceled new aircraft orders to minimize further capital expenditures, however capital investment, interest, depreciation, and amortization represents only 20 percent of an airline's total cost. Variable costs, on the other hand, represent nearly 80 percent of the industry's total cost, of which fuel and labor account for 55 percent. Therefore, airlines trimmed operations to curtail capacity growth and reduced or eliminated unprofitable routes and hub operations (Lieb, 1994: 146-149).

As a result of these cost cutting measures and a stronger economy, the industry rebounded in 1994 and 1995. Industry losses were minimal in 1994, approximately $279 million, and the 1995 year-end net profits for the airlines were over $2.375 billion (BTS, 1996). This financial health of the industry is anticipated to continue into the 21st century with continued growth in passenger and cargo traffic for U.S. air carriers. The FAA

forecasts a steady increase in new aircraft procurements to replace the aging U.S. commercial fleet and allow carriers to keep pace with increased passenger traffic demands as shown in Table B-23. In fact, airlift capacity world-wide is expected to grow by over 300 percent by the year 2014 as shown in Table B-24. While the U.S. aviation industry is expected to grow, the U.S. share of the world market is expected to decline. The U.S. share of world cargo ton-miles is expected to decline from 32% in 1994 to 29% in 2014, although total ton-miles will result in a net increase. The growth in the international market is expected to outpace domestic growth, exceeding 80 percent of the total ton-miles by 2014 (Boeing, 1996). These forecasts suggest a stronger global industry with an increased long-range capacity.

Table B-23. FAA Commercial Aviation Forecasts, Passenger Traffic, 1994-2005

Year	Revenue Passenger Miles (in billions)	Number of Jet Aircraft
1994	499.8	4,363
1995	525.6	4,396
1996	552.1	4,519
1997	581.1	4,722
1998	609.5	4,876
1999	638.6	4,981
2000	667.2	5,069
2001	695.8	5,253
2002	725.0	5,447
2003	755.0	5,644
2004	785.5	5,858
2005	817.0	6,063

(BTS, 1996)

Table B-24. Share of World Airlift Capacity as a Percent of Total World Capacity (in millions of ton-miles)

	1994		2014	
	Percent	Available Ton-Miles	Percent	Available Ton-Miles
Passenger	58%	193,645	59%	651,855
Freighter	35%	116,855	39%	430,887
Combi	7%	23,371	2%	22,097
Total		333,871		1,104,839

(Boeing, 1995)

Appendix C

Civil Reserve Air Fleet and Military Fleet Statistics

Table C-25. Participating CRAF Carriers, as of 1 July 1996

MAJORS	NATIONALS	LARGE REGIONALS
America West	Airborn Express	Air Transport International
American Airlines	Alaska Airlines	Carnival Airlines
Continental	American Trans Air	North American
Delta Air Lines	American International	Omni Air Express
Federal Express	DHL Airways	Reno Air
Northwest	Emery Worldwide Airlines	Rich International Airways
Southwest Airlines	Evergreen Int'l Airlines	Trans Continental Airlines
Trans World	Southern Air Transport	
United Airlines	Sun Country	MEDIUM REGIONAL
UPS	Tower Air	Atlas Air
USAir	USAir Shuttle	Burlington
	World Airways	Fine Airlines
		Miami Air
		North American Airlines
		Polar
		Zantop Int'l Airlines

(HQ AMC, 1996)

Table C-26. Total Number of Aircraft in CRAF by Segment and Stage, as of 1 July 1996

Segment	Number of Aircraft		
	Stage I	Stage II	Stage III
Passenger			
Long-Range International	49	119	257
Short-Range International		13	76
Domestic Services			49
Cargo			
Long-Range International	43	117	174
Short-Range International		14	14
Domestic Services			
Alaskan		6	6
Aeromedical Evacuation		19	19
Total	92	288	595

(HQ AMC, 1996)

Table C-27. Total Wide-body Equivalents in CRAF by Segment and Stage, as of 1 July 1996

Segment	Wide-Body Equivalents		
	Stage I	Stage II	Stage III
Passenger Long-Range International	32.71	88.8	162.97
Cargo Long-Range International	32.45	82.02	111.01
Aeromedical Evacuation		10.64	10.64
Total	65.16	181.46	284.62

(HQ AMC, 1996)

Table C-28. Total CRAF Capability in Millions of Ton-Miles per Day and Millions of Passenger Miles per Day, as of 1 July 1996

Segment	MTM or MPM per day		
	Stage I	Stage II	Stage III
Passenger (MPM/D)			
Long-Range International	23.24	63.07	115.75
Short-Range International		1.97	11.51
Domestic Services			7.93

Table C-28 Continued

Segment	MTM or MPM per day		
	Stage I	Stage II	Stage III
Cargo (MTM/D)			
Long-Range International	5.53	13.98	18.92
Short-Range International		0.45	0.45
Domestic Services			
Alaskan		0.34	0.34
Aeromedical Evacuation		7.56	7.56

(HQ AMC, 1996)

Table C-29 lists the historical participation for the long-range cargo segment of the CRAF. Prior to 1993, CRAF requirements were defined by number of aircraft. In 1993, a conversion methods based on the B747-100 aircraft was implemented to standardize the method of reporting and allow comparison between carriers. The CRAF commitments for 1997 show a significant increase in Stage III cargo capability.

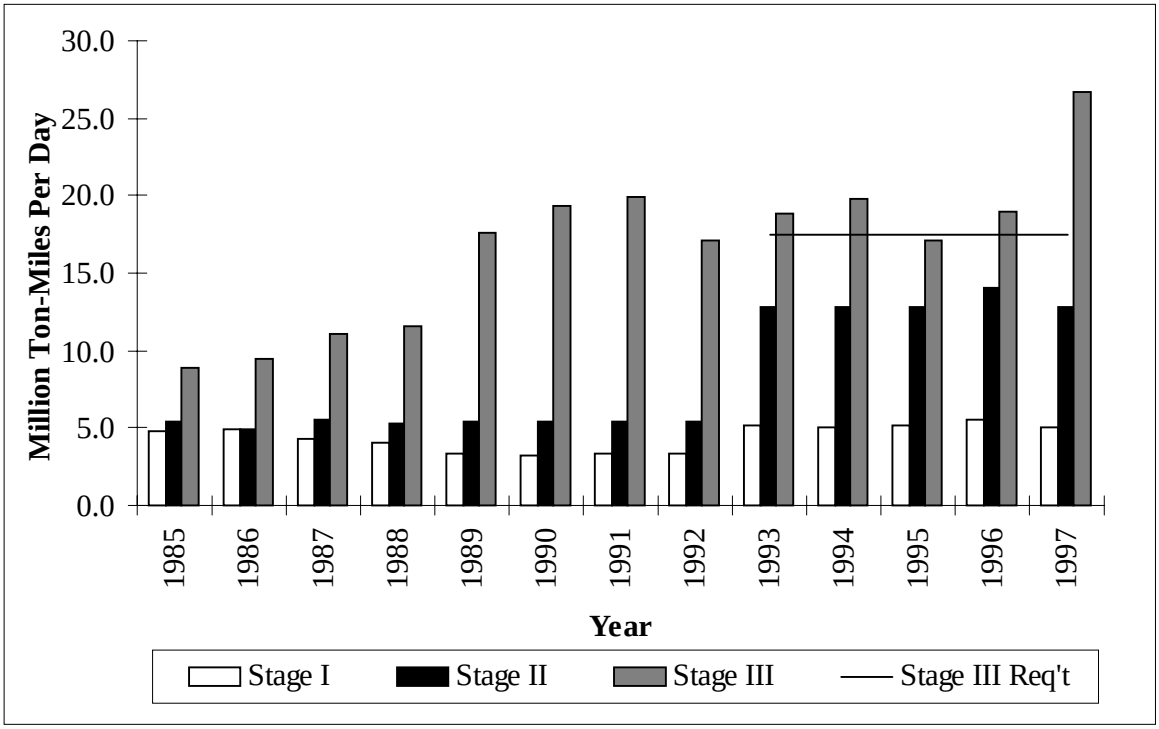
Table C-29. Long-Range International Cargo-Historical CRAF Participation

	Wide-Body Equivalents				Million Ton-Miles Per Day			
Year	Stage I	Stage II	Stage III	Stage III Req't	Stage I	Stage II	Stage III	Stage III Req't
1985	28	32	52		4.8	5.4	8.9	
1986	29	29	56		4.9	4.9	9.5	
1987	25	32	65		4.3	5.5	11.1	
1988	24	31	68		4.1	5.3	11.6	
1989	20	32	103		3.3	5.4	17.6	
1990	19	32	113		3.3	5.4	19.3	
1991	20	32	117		3.3	5.5	19.9	
1992	20	32	100		3.3	5.5	17.1	
1993	25	58	101	120	4.2	9.9	17.3	17.5
1994	31	75	112	120	5.3	12.8	19.0	17.5

Table C-29 Continued

	Wide-Body Equivalents				Million Ton-Miles Per Day			
Year	Stage I	Stage II	Stage III	Stage III Req't	Stage I	Stage II	Stage III	Stage III Req't
1995	30	75	114	120	5.1	12.8	19.4	17.5
1996	32	82	111	120	5.5	13.9	18.9	17.5
1997	30	75	156	120	5.1	12.8	26.7	17.5

(Reid, Undated; VanHorn, 1996; HQ AMC, 1996)



(Reid, Undated; VanHorn, 1996)

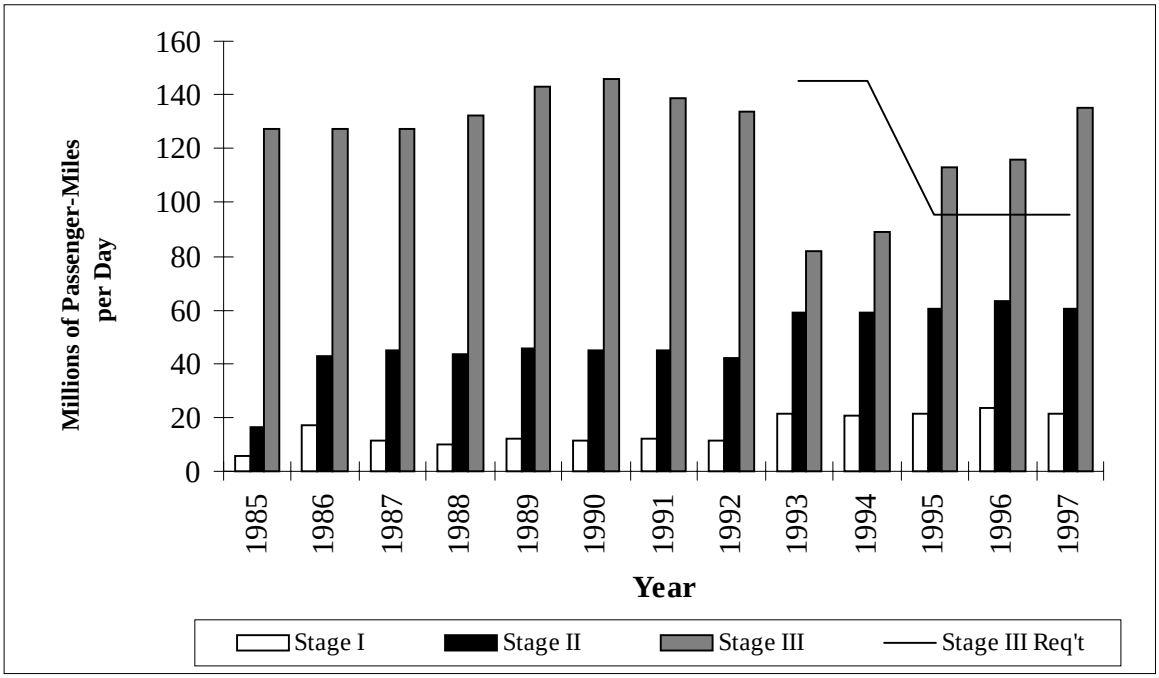
Figure C-8. Long-Range Cargo Segment and Stage III Requirements

Table C-30 enumerates the historical CRAF participation for long-range international passenger airlift. As a follow on the 1992 Mobility Requirements Study, Bottoms Up Review Update (MRS BURU), long-range international passenger requirements were reduced to 136 wide body equivalents. The CRAF commitments for 1997 show a significant increase in Stage III passenger capability

Table C-30. Long-Range International Passenger-Historical CRAF Participation

	Wide-Body Equivalents				Million Passenger-Miles per Day			
Year	Stage I	Stage II	Stage III	Stage III Req't	Stage I	Stage II	Stage III	Stage III Req't
1985	9	24	183		6.0	16.6	127.1	
1986	25	62	184		17.0	42.7	127.4	
1987	17	65	184		11.7	45.0	127.6	
1988	15	63	191		10.0	43.7	132.0	
1989	17	66	207		12.1	45.5	143.2	
1990	17	65	210		11.5	45.0	145.5	
1991	17	65	200		11.9	45.1	138.8	
1992	16	61	193		11.1	42.0	133.6	
1993	25	66	183	210	17.6	45.7	126.8	145.0
1994	31	85	115	210	21.2	59.1	79.5	145.0
1995	31	87	163	136	21.5	60.3	113.2	95.0
1996	33	89	163	136	23.5	63.1	115.8	95.0
1997	30	86	190	136	21.3	60.8	135.2	95.0

(Reid, Undated; VanHorn, 1996; HQ AMC, 1996)
Note: Totals are cumulative, not incremental, for each stage.



(Reid, Undated; VanHorn, 1996)

Figure C-9. Long-Range Passenger Segment and Stage III Requirements

Table C-31. Long-Range International Cargo Carriers as a Percent of Total Fleet, 1996

	Capacity Offered to CRAF	Percent of Fleet Offered to CRAF	Total Capacity of Private Fleet	Total Capacity of Private Fleet
Participating CRAF Carrier	WBE	Percent	WBE	MTM/D
Federal Express	19.87	0.44	45.16	7.7
American Int'l/Burlington	15.47	1.00	15.47	2.6
Emery Worldwide Airlines	13.71	1.00	13.71	2.3
Evergreen Int'l Airlines	11.81	1.00	11.81	2.0
Polar Air Cargo	11.1	1.00	11.10	1.9
Northwest	8.76	1.00	8.76	1.5
Southern Air Transport	6.77	1.00	6.77	1.2
World Airways	6.56	1.00	6.56	1.1
Air Transport Int'l	5.13	1.00	5.13	0.9
United Parcel Service	4.76	0.15	31.73	5.4
Altas Air	2.51	0.15	16.73	2.9
Tower Air	1.64	1.00	1.64	0.3
Buffalo	1.01	0.75	1.35	0.2
Zantop Int'l Airlines	0.87	0.67	1.30	0.2
DHL Awys	0.41	0.20	2.05	0.3
Airborne Express	0.4	0.15	2.67	0.5
Rich International	0.28	1.00	0.28	0.0
Total	111.06		182.22	31.06

(Reid, Undated)

Note: Wide-body equivalents may differ from the 1 July 1996 CRAF capability summary because data was extracted at different points in time

Table C-32. Long-Range International Passenger and Aeromedical Evacuation Carriers as a Percent of Total Fleet

	Capacity Offered to CRAF	Percent of Fleet Offered to CRAF	Total Capacity of Private Fleet	Total Capacity of Private Fleet
Participating CRAF Carrier	WBE	Percent	WBE	MTM/D
Northwest Airlines	41.87	0.63	66.46	46.0
United Airlines	31.07	0.30	103.57	71.8
American Airlines	18.54	0.30	61.80	42.8
Continental Airlines	16.84	0.81	20.79	14.4
Delta Air Lines	15.99	0.30	53.30	36.9

Table C-32 Continued

	Capacity Offered to CRAF	Percent of Fleet Offered to CRAF	Total Capacity of Private Fleet	Total Capacity of Private Fleet
Tower Air	15.32	0.88	17.41	12.1
American Trans Air	11	1.00	11.00	7.6
Trans World Airlines	10.03	0.53	18.92	13.1
World Airways	4.67	1.00	4.67	3.2
Rich Int'l Airlines	3.68	1.00	3.68	2.5
Sun Country Airlines	1.74	0.68	2.56	1.8
USAir	1.51	0.33	4.58	3.2
Carnival Air Lines	1.35	1.00	1.35	0.9
North American Airlines	0.67	1.00	0.67	0.5
Total	174.28		370.76	256.9

(Reid, Undated)

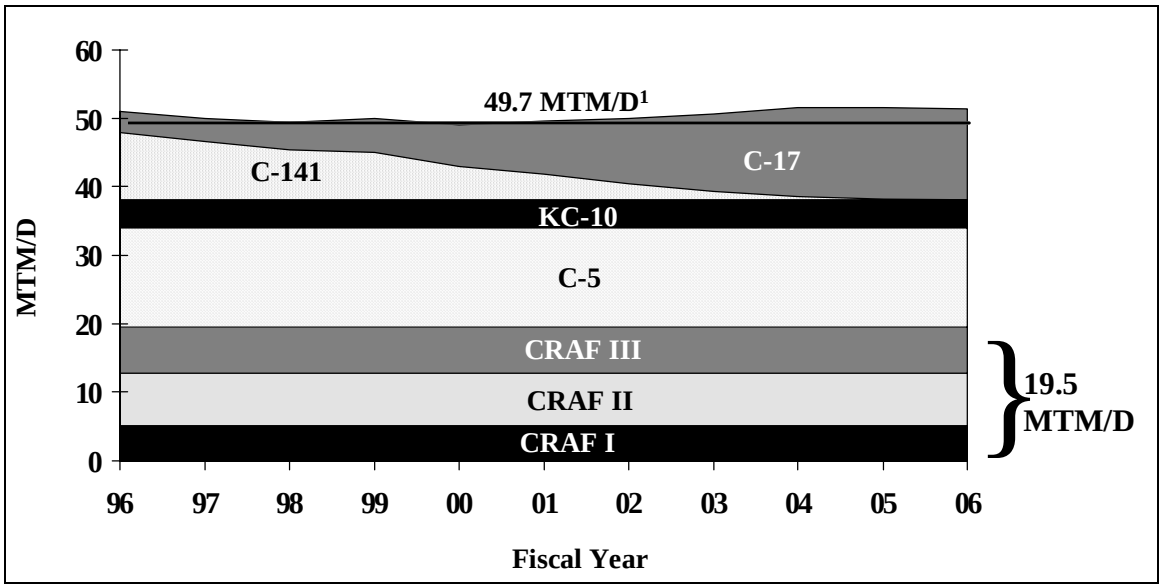
Note: Wide-body equivalents may differ from the 1 July 1996 CRAF capability summary because data was extracted at different points in time

Table C-33. Strategic Military Airlift Capacity, 1996 - 2006 (in MTM/D)

	Forecast Year										
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
C-5	14.61	14.61	14.61	14.61	14.61	14.61	14.61	14.61	14.61	14.61	14.61
KC-10	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
C-141	10.03	8.74	7.47	7.02	4.98	3.96	2.43	1.37	0.55	0.27	0.27
C-17	3.02	3.15	3.94	4.86	6.04	7.62	9.46	11.3	13.01	13.4	13.4
Total	31.53	30.37	29.89	30.36	29.5	30.06	30.37	31.15	32.04	32.15	32.15

(Moken, Undated)

Figure C-10 depicts the long-term cargo airlift capacity of military and civil airlift. The CRAF accounts for approximately 35% of the planned cargo capability. The Mobility Requirements Study Bottoms Up Review Update (MRS BURU) recommended a range of 49.4 - 51.8 MTM/D of cargo airlift capacity depending upon the levels of pre-positioning and regeneration for the conflict.



(Reid, Undated)

Note 1: Joint Chiefs of Staff approved point solution for MRS BURU

Figure C-10. Planned Strategic Military Airlift Capability-Cargo Aircraft

CIVIL RESERVE AIR FLEET (CRAF) CAPABILITY SUMMARY

SOURCE: HQ AMC/DOF — AS OF: 1 JULY 1996

INTERNATIONAL SEGMENT -- LONG-RANGE SECTION

PASSENGER

AIRLINE AND CRAF STAGE	American Airlines (AAL)			Delta Air Lines (DAL)			North American Airlines (NAO)			Sun Country Airlines (SCX)			Trans World Airlines (TWA)			United Airlines (UAL)			American Trans Air (AMT) TA-2								
AIRCRAFT TYPE	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
DC8-62/63																											
B757-200ER								1	2										4	4	11						
A300-B4																											
B747-100														3	7	1	(7)	(17)									
B747-200													1	1	1		5	9									
B747-400																											
B767-200ER/300ER		11	24																								
DC10-10/15/30/40	1	4	15							1	2	4					(4)	(13)									
MD-11																											
L1011-1/50/100/250/500				1	7	14								1	2				9	9	15						
TOTALS	**1**	**15**	**39**	**1**	**7**	**14**		**1**	**2**	**1**	**2**	**4**	**1**	**5**	**10**	**1**	**16**	**39**	**13**	**13**	**26**						

CARGO

AIRLINE AND CRAF STAGE	Airborne Express (ABX)			Atlas Air (GTI)			Fine Airlines (FBF)			DHL Awys / UPS Airlines (DHL) / (UPS)			Trans Continental Airlines (TCN)			Zantop Int'l Airlines (ZAN)			Air Transport Int'l (ATN) TA-2			Federal Express Airlines (FDX) TA-2			Southern Air Transport (SJM) TA-2		
AIRCRAFT TYPE	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
DC8-31F/32F/54F/55F							(2)	(2)	(3)				(1)	(2)	(3)	1	1	2									
DC8-61F/62F/63F		1	1					(1)	(2)				(1)	(1)	(1)				3	7	8						
DC8-71F/73F											1	1														4	4
DC8-62 COMBI																				1	4						
B747-100F										1	3	5															
B747-200F				1	1	2																			2	3	3
DC10-10F																							3	13			
DC10-30F/C																						7	17	17			
MD-11F																											
L1011-200F																											
TOTALS		**1**	**1**	**1**	**1**	**2**	**2**	**3**	**5**	**1**	**4**	**6**	**2**	**3**	**4**	**1**	**1**	**2**	**3**	**8**	**12**	**7**	**20**	**30**	**2**	**7**	**7**

PASSENGER

AIRLINE AND CRAF STAGE	Carnival Air Lines (CAA) TA-3			Tower Air (TOW) TA-3						Continental Airlines (COA) TA-1			Northwest Airlines (NWA) TA-1			Rich Int'l Airways (RIA) TA-1			World Airways (WOA) TA-1			CONFIG-URATION	TOTAL EACH STAGE		
AIRCRAFT TYPE	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		I	II	III
DC8-62/63																3	3	3				PN	3	3	3
B757-200ER												15										PN	4	5	28
A300-B4	1	2	5																			PW	1	2	5
B747-100				5	5	5									3							PW	6	15	52
B747-200				9	9	9				1	2	2	1	17	20							PW	12	34	41
B747-400																						PW			
B767-200ER/300ER																						PW		11	24
DC10-10/15/30/40											8	19		5	29				1	1	1	PW	3	22	85
MD-11																			4	4	4	PW	4	4	4
L1011-1/50/100/250/500																6	6	8				PW	16	23	39
TOTALS	**1**	**2**	**5**	**14**	**14**	**14**				**1**	**10**	**36**	**1**	**20**	**52**	**9**	**9**	**11**	**5**	**5**	**5**		**49**	**119**	**257**

CARGO

AIRLINE AND CRAF STAGE	American Int'l/Burlington (CKS/BAX) TA-3			Tower Air (TOW) TA-3			Polar Air Cargo (PAC) TA-3			Emery Worldwide Airlines (EWW) TA-1			Evergreen Int'l Airlines (EIA) TA-1			Northwest / Rich Int'l (NWA/RIA) TA-1			World Airways (WOA) TA-1			CONFIG-URATION	TOTAL EACH STAGE		
AIRCRAFT TYPE	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III		I	II	III
DC8-31F/32F/54F/55F		5	8																			FN	4	10	16
DC8-61F/62F/63F		(5)	(10)								14	17	○	○	○							FN	4	30	39
DC8-71F/73F										7	8	17										FN	7	13	22
DC8-62 COMBI																1	1	1				COMBI N	1	2	3
B747-100F	1	2	3	1	1	2	3	8	12					5	8							FW	6	18	30
B747-200F	2	2	3										3	4	4	2	6	8				FW	10	16	20
DC10-10F																						FW		3	13
DC10-30F/C																				2	5	FW/CW	7	18	22
MD-11F																			3	3	3	FW	3	3	3
L1011-200F	1	2	4																			FW	1	2	4
TOTALS	**4**	**17**	**28**	**1**	**1**	**2**	**3**	**8**	**12**	**7**	**22**	**34**	**3**	**9**	**12**	**3**	**7**	**9**	**3**	**5**	**8**		**43**	**117**	**174**

AMC HQ FORM 312, NOV 93 (EF) PREVIOUS EDITION IS OBSOLETE

LONG-RANGE INTERNATIONAL GRAND TOTALS	92	236	431

Figure C-11. AMC HQ Form 312, Civil Reserve Air Fleet Capability summary, Page 1

INTERNATIONAL SEGMENT -- SHORT-RANGE SECTION

AIRLINE AND CRAF STAGE	AlaskaAirlines (ASA)		Am Trans Air (AMT) TA-2		Carnival Airln (CAA) TA-3		Continental (COA) TA-1		Miami Air Intl (BSK) TA-1		North Ameron (NAC)		Sun Country (SCX)		USAir Shuttle (USS)						DHL Airways (DHL)		Evergreen Intl (ELA) TA-1		Omni Air Exp (OAE)		So Air Transp (SJM) TA-2				TOTAL EACH STAGE	
AIRCRAFT TYPE	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III	II	III
L100-20 / 30																											7	7			7	7
B727-100F / 200F																					2	2			2	2					4	4
DC9-33F																							3	3							3	3
B727-100																																
B727-200			3	19	1	2	5	24	1	5				1		3															10	54
B737-200						1																										1
B737-400		2				2																										4
MD-80 / 88	3	16										1																			3	17
TOTALS	3	18	3	19	1	5	5	24	1	5		1		1		3					2	2	3	3	2	2	7	7			27	90

AEROMEDICAL EVACUATION SEGMENT

AIRLINE AND CRAF STAGE	Delta AirLines (DAL)		Trans World (TWA)		USAir (USA)				TOTAL EACH STAGE	
AIRCRAFT TYPE	II	III	II	III	II	III	II	III	II	III
B767-200ER			4	4	3	3			7	7
B767-300ER	12	12							12	12
TOTALS	12	12	4	4	3	3			19	19

NATIONAL SEGMENT

DOMESTIC SERVICES SECTION

AIRLINE AND CRAF STAGE	America West (AWE)		Reno Air (ROA)		Southwest Airl (SWA)				TOTAL EACH STAGE	
AIRCRAFT TYPE	II	III	II	III	II	III	II	III	II	III
DC-6										
L100-20										
L100-30										
B727-100F										
B737-200C										
B727-100 / 200										
B737-200 / 300 / 400 / 500		13				32				45
MD-80 / 83				4						4
TOTALS		13		4		32				49

ALASKAN SECTION

AIRLINE AND CRAF STAGE	AlaskaAirlines (ASA)		So Air Transp (SJM)				TOTAL EACH STAGE	
AIRCRAFT TYPE	II	III	II	III	II	III	II	III
L100-30			2	2			2	2
B737-200C	4	4					4	4
TOTALS	4	4	2	2			6	6

CAPABILITY (MTM/MPM)	STAGES I	STAGES II	STAGES III
DOMESTIC SERVICES CARGO (MTM)			
DOMESTIC SERVICES PAX (MPM)		0.00	7.93
ALASKAN (MTM)		0.34	0.34
SHORT-RANGE INTERNATIONAL CARGO (MTM)		0.45	0.45
SHORT-RANGE INTERNATIONAL PAX (MPM)		1.97	11.51
AEROMEDICAL EVACUATION (MPM)		7.56	7.56
LONG-RANGE INTERNATIONAL PAX (MPM)	23.24	63.07	115.75
NARROW BODY CARGO (MTM)	1.28	3.83	5.23
WIDE BODY CARGO OVERSIZE (MTM)	1.90	4.48	6.30
WIDE BODY CARGO BULK & OVERSIZE (MTM)	4.25	10.15	13.69
LONG-RANGE INTERNATIONAL CARGO (MTM)	5.53	13.98	18.92

AIRCRAFT SUMMARY	STAGES I	STAGES II	STAGES III
DOMESTIC SERVICES CARGO			
DOMESTIC SERVICES PAX		0	49
ALASKAN		6	6
SHORT-RANGE INTERNATIONAL PAX		13	76
SHORT-RANGE INTERNATIONAL CARGO		14	14
AEROMEDICAL EVACUATION		19	19
LONG-RANGE INTERNATIONAL PAX	49	119	257
LONG-RANGE INTERNATIONAL CARGO	43	117	174
TOTAL CRAF	92	288	595
B747-100 EQUIVALENTS			
AEROMEDICAL EVACUATION		10.64	10.64
LONG-RANGE INTERNATIONAL PAX	32.71	88.80	162.97
LONG-RANGE INTERNATIONAL CARGO	32.45	82.02	111.01
B747-100 EQUIVALENTS TOTALS	65.16	181.46	284.62

NOTES:

CONFIGURATION:
C -- CONVERTIBLE
F -- FREIGHTER
P -- PASSENGER
W -- WIDE BODY
N -- NARROW BODY

CAPABILITY REFLECTED IN MILLIONS OF TON OR PASSENGER MILES (MTM OR MPM) PER DAY.

CARGO CAPABILITY BASED ON COMBINATION OF BULK AND OVERSIZE.

◯ -- INDICATES CHANGES SINCE FREVIOUS CAPABILITY SUMMARY

REMARKS:

Buffalo Airways - In temporary non-use. Aircraft removed from the CRAF program.

Fine Airlines - New CRAF carrier.

Trans Cont'l Airlines - New CRAF carrier.

American Int'l/Burlington - Removed 2 DC-8 aircraft due to an accident and a business related decision.

Evergreen Int'l Airlines - Removed DC-8 aircraft which is in storage.

United Airlines - Dropped 1 B747-100 and replaced it with 1 DC10-10.

AMC HQ FORM 312, NOV 93 (EF) (REVERSE)

Figure C-12. AMC HQ Form 312, Civil Reserve Air Fleet Capability summary, Page 2

Appendix D

FAA Insurance Data

Table D-34 summarizes the average insured value by aircraft make and model of all aircraft registered with the FAA. The original data is listed in Table D-35 and was extracted from a database provided by the FAA, Office of Policy and Plans (FAA, 1996).

Table D-34. Average Insured Value by Make and Model

Make-Model	Average Insured Value	Make-Model	Average Insured Value
A300-B4	$26,275,000	B747-SP	$21,300,000
A310-203/300	$75,310,030	B757-200/212/23A	$39,411,765
B707-320CH/Cargo	$5,964,286	B757-200ER/2Q8ER	$58,107,750
B727-100	$4,766,667	B767-200/200ER/300ER/332ER	$59,783,478
B727-100F	$3,750,000	CL-44	$3,500,000
B727-200	$10,572,940	DC10-10/30/40	$27,213,031
B727-200-ADV	$15,666,667	DC10-10F/30CF/30F	$59,460,526
B727-200B	$14,049,923	DC10-30CF/30F	$69,580,000
B727-208 to B727-2Q6-ADV	$9,240,323	DC8-50/54/55/54F/55F	$5,031,250
B737-200/200A/247	$12,241,176	DC8-61C/61F/62F/63F/Combi	$9,632,439
B737-300	$18,722,222	DC8-71F/73CF/73F	$23,097,574
B737-400	$29,550,000	DHC-7	$6,000,000
B737-500	$23,750,000	L100-20/30	$13,666,667
B747-100	$22,467,391	L1011-50/100/150/250/500	$16,211,596
B747-100F/100SR/121/123BF	$33,743,750	L188	$2,200,000
B747-132/135/151	$22,400,000	Lockheed Electra	$1,500,000
B747-200	$46,187,500	MCHX93	$18,000,000
B747-200F/200C/203BE	$87,200,000	MD-11	$109,352,754
B747-212/227B	$65,000,000	MD-11F	$120,000,000
B747-228F/245F/249F	$78,333,333	MD-80/83/87	$27,829,630
B747-251B	$56,214,655		
B747-251F/2J9F/2R7SF	$72,148,084		
B747-400	$143,404,063		

Table D-35 is the entire database used in the analysis contained in this report. The database was provided by the FAA, Office of Policy and Plans and was sanitized to remove reference of air carrier, registration number, or tail number (FAA, 1996). The database contained 834 registered aircraft, however, 2 entries were duplicate aircraft. These duplicate entries were removed, and therefore, the final database contains 832 individual aircraft. The insured value is the amount each carrier has insured the aircraft hull with their commercial insurance underwriter.

Table D-35. Insured Value of all FAA Registered Aircraft

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
A300	$30,550,000	B727-100	$3,000,000
A300	$30,550,000	B727-100	$9,000,000
A300	$19,000,000	B727-100F	$3,000,000
A300-B4	$25,000,000	B727-100F	$4,500,000
A310-203	$65,000,000	B727-200	$0
A310-300	$83,839,274	B727-200	$0
A310-300	$70,818,073	B727-200	$0
A310-300	$74,001,671	B727-200	$0
A310-300	$71,195,526	B727-200	$0
A310-300	$72,857,232	B727-200	$0
A310-300	$72,714,007	B727-200	$0
A310-300	$79,016,137	B727-200	$0
A310-300	$82,073,333	B727-200	$0
A310-300	$81,585,042	B727-200	$0
B707	$6,000,000	B727-200	$5,500,000
B707	$6,000,000	B727-200	$0
B707	$6,000,000	B727-200	$0
B707	$4,000,000	B727-200	$0
B707-320CH/Cargo	$6,500,000	B727-200	$11,500,000
B707-320CH/Cargo	$6,750,000	B727-200	$0
B707-320CH/Cargo	$6,500,000	B727-200	$0
B727-100	$2,300,000	B727-200	$0
B727-200	$0	B727-227A	$14,000,000
B727-200	$0	B727-227A	$14,000,000
B727-200	$0	B727-227A	$14,000,000
B727-200	$10,000,000	B727-227A	$7,000,000
B727-200	$10,000,000	B727-227A	$6,500,000
B727-200	$10,000,000	B727-227A	$12,000,000
B727-200	$0	B727-227A	$12,000,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
B727-200	$0	B727-22C	$4,200,000
B727-200	$0	B727-22C	$4,200,000
B727-200	$10,000,000	B727-231A	$9,000,000
B727-200	$10,000,000	B727-264A	$14,000,000
B727-200	$7,500,000	B727-264A	$14,000,000
B727-200	$0	B727-264A	$14,000,000
B727-200	$0	B727-290A	$12,000,000
B727-200-ADV	$17,000,000	B727-290A	$7,400,000
B727-200-ADV	$15,000,000	B727-2B7-ADV	$7,000,000
B727-200-ADV	$12,000,000	B727-2B7-ADV	$7,000,000
B727-200-ADV	$12,000,000	B727-2B7A	$14,000,000
B727-200-ADV	$19,000,000	B727-2Q6-ADV	$4,400,000
B727-200-ADV	$19,000,000	B737-200	$3,500,000
B727-200B	$16,397,000	B737-200	$22,000,000
B727-200B	$15,713,000	B737-200	$22,000,000
B727-200B	$11,609,000	B737-200	$22,000,000
B727-200B	$12,939,000	B737-200	$22,000,000
B727-200B	$13,181,000	B737-200	$10,600,000
B727-200B	$11,944,000	B737-200A	$21,000,000
B727-200B	$14,386,000	B737-200A	$8,000,000
B727-200B	$14,355,000	B737-200A	$8,000,000
B727-200B	$14,743,000	B737-200A	$8,500,000
B727-200B	$14,392,000	B737-200A	$8,500,000
B727-200B	$14,355,000	B737-200A	$9,000,000
B727-200B	$13,980,000	B737-200A	$9,000,000
B727-200B	$14,655,000	B737-200A	$9,000,000
B727-208	$9,500,000	B737-200A	$9,000,000
B727-212	$8,000,000	B737-247	$8,000,000
B727-212	$8,000,000	B737-247	$8,000,000
B727-221	$3,250,000	B737-300	$16,500,000
B727-221	$4,000,000	B737-300	$16,500,000
B727-221	$4,000,000	B737-300	$16,500,000
B727-221	$4,000,000	B737-300	$17,500,000
B727-221RE	$14,000,000	B737-300	$17,500,000
B727-221RE	$14,000,000	B737-300	$21,000,000
B727-225	$6,000,000	B737-300	$21,000,000
B727-225ADV	$7,000,000	B737-300	$21,000,000
B727-227A	$14,000,000	B737-300	$21,000,000
B737-400	$31,500,000	B747-100	$30,000,000
B737-400	$31,500,000	B747-100	$30,000,000
B737-490	$27,600,000	B747-100	$25,000,000
B737-490	$27,600,000	B747-100	$30,000,000
B737-500	$23,000,000	B747-100	$20,000,000
B737-500	$23,000,000	B747-100	$20,000,000
B737-500	$23,000,000	B747-100	$7,500,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
B737-500	$23,000,000	B747-100	$21,000,000
B737-500	$23,000,000	B747-100	$21,000,000
B737-500	$24,500,000	B747-100	$21,000,000
B737-500	$24,500,000	B747-100	$21,000,000
B737-500	$24,500,000	B747-100	$21,000,000
B737-500	$24,500,000	B747-100	$21,000,000
B737-500	$24,500,000	B747-100	$25,000,000
B747-100	$21,000,000	B747-100	$21,000,000
B747-100	$21,000,000	B747-100F	$34,500,000
B747-100	$24,000,000	B747-100SR	$40,000,000
B747-100	$24,000,000	B747-121	$40,000,000
B747-100	$24,000,000	B747-121	$40,000,000
B747-100	$24,000,000	B747-121	$40,000,000
B747-100	$24,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$25,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$25,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$24,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$24,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$14,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$14,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$15,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$15,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$15,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$16,000,000	B747-123BF-Cargo	$31,400,000
B747-100	$16,000,000	B747-132	$40,000,000
B747-100	$16,000,000	B747-132	$40,000,000
B747-100	$17,000,000	B747-135	$18,000,000
B747-100	$17,000,000	B747-135	$18,000,000
B747-100	$40,000,000	B747-151	$18,000,000
B747-100	$17,000,000	B747-151	$18,000,000
B747-100	$17,000,000	B747-151	$18,000,000
B747-100	$40,000,000	B747-151	$18,000,000
B747-100	$35,000,000	B747-151	$18,000,000
B747-100	$21,000,000	B747-151	$18,000,000
B747-100	$24,000,000	B747-200	$73,000,000
B747-100	$30,000,000	B747-200	$73,000,000
B747-100	$30,000,000	B747-200	$45,000,000
B747-100	$30,000,000	B747-200	$40,000,000
B747-200	$40,000,000	B747-251-B	$80,000,000
B747-200	$48,000,000	B747-251-B	$80,000,000
B747-200	$42,000,000	B747-251-B	$0
B747-200	$45,000,000	B747-251-B	$0
B747-200	$60,000,000	B747-251-B	$0
B747-200	$45,000,000	B747-251-F	$70,000,000
B747-200	$35,000,000	B747-251-F	$70,000,000
B747-200	$35,000,000	B747-251-F	$70,000,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
B747-200	$50,000,000	B747-251-F	$72,000,000
B747-200	$18,000,000	B747-251-F	$75,000,000
B747-200	$45,000,000	B747-251-F	$0
B747-200	$45,000,000	B747-251-F	$0
B747-200C	$150,000,000	B747-2J9F	$80,000,000
B747-200C	$150,000,000	B747-2R7SF	$85,000,000
B747-200F	$52,000,000	B747-400	$163,700,000
B747-200F	$75,000,000	B747-400	$150,700,000
B747-200F	$25,000,000	B747-400	$144,200,000
B747-200F	$55,000,000	B747-400	$149,700,000
B747-200F	$65,000,000	B747-400	$143,700,000
B747-200F	$75,000,000	B747-400	$144,600,000
B747-200F	$160,000,000	B747-400	$141,900,000
B747-203BE	$65,000,000	B747-400	$142,100,000
B747-212	$40,000,000	B747-400	$143,500,000
B747-212	$60,000,000	B747-400	$144,000,000
B747-227-B	$80,000,000	B747-400	$144,900,000
B747-227-B	$80,000,000	B747-400	$125,000,000
B747-227-B	$65,000,000	B747-400	$135,700,000
B747-228F	$45,000,000	B747-400	$137,100,000
B747-245F	$85,000,000	B747-400	$135,900,000
B747-245F	$85,000,000	B747-400	$0
B747-245F	$85,000,000	B747-400	$0
B747-245F	$85,000,000	B747-400	$0
B747-249F	$85,000,000	B747-400	$0
B747-251-B	$29,350,000	B747-400	$0
B747-251-B	$29,350,000	B747-400	$0
B747-251-B	$29,350,000	B747-400	$0
B747-251-B	$29,350,000	B747-400	$0
B747-251-B	$32,250,000	B747-400	$147,765,000
B747-251-B	$65,000,000	B747-400	$0
B747-251-B	$65,000,000	B747-SP	$20,100,000
B747-251-B	$65,000,000	B747-SP	$20,100,000
B747-251-B	$65,000,000	B747-SP	$20,100,000
B747-251-B	$65,000,000	B747-SP	$20,100,000
B747-251-B	$65,000,000	B747-SP	$20,100,000
B747-251-B	$65,000,000	B747-SP	$21,000,000
B747-SP	$22,600,000	B767-300ER	$56,137,705
B747-SP	$24,900,000	B767-300ER	$57,240,407
B747-SP	$22,000,000	B767-300ER	$57,822,671
B747-SP	$22,000,000	B767-300ER	$60,209,213
B757-200	$0	B767-300ER	$61,383,875
B757-200	$0	B767-300ER	$61,737,073
B757-200	$0	B767-300ER	$95,000,000
B757-200	$0	B767-300ER	$95,000,000
B757-200	$0	B767-300ER	$118,000,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
B757-200	$0	B767-300ER	$116,000,000
B757-200	$0	B767-300ER	$115,000,000
B757-200	$0	B767-323ER	$56,627,000
B757-200	$0	B767-323ER	$57,118,000
B757-200	$0	B767-323ER	$57,681,000
B757-200	$0	B767-323ER	$62,773,000
B757-200	$0	B767-332ER	$51,500,000
B757-200ER	$67,300,000	B767-332ER	$51,500,000
B757-212	$38,500,000	B767-332ER	$51,500,000
B757-212	$38,500,000	B767-332ER	$51,500,000
B757-212	$38,500,000	B767-332ER	$51,500,000
B757-212	$38,500,000	B767-332ER	$99,274,324
B757-23A	$54,000,000	B767-332ER	$95,901,650
B757-2Q8-ER	$50,400,000	B767-332ER	$83,869,188
B757-2Q8-ER	$50,400,000	B767-332ER	$92,300,378
B757-2Q8-ER	$64,331,000	B767-332ER	$84,171,860
B767-200	$62,400,000	B767-332ER	$82,945,585
B767-200	$64,100,000	B767-332ER	$81,406,543
B767-200	$53,600,000	B767-332ER	$51,500,000
B767-200	$56,600,000	B767-332ER	$51,500,000
B767-200	$53,800,000	B767ER	$48,337,000
B767-200	$56,200,000	B767ER	$48,319,000
B767-200	$54,800,000	B767ER	$40,729,000
B767-200	$55,200,000	B767ER	$38,833,000
B767-200	$54,850,000	B767ER	$44,030,000
B767-200	$55,200,000	B767ER	$52,060,000
B767-200	$44,000,000	B767ER	$55,431,000
B767-200ER	$24,141,080	B767ER	$48,781,000
B767-200ER	$24,346,412	B767ER	$48,780,000
B767-200ER	$27,810,170	B767ER	$50,141,000
B767-200ER	$28,338,253	B767ER	$46,666,000
B767-200ER	$29,192,181	B767ER	$46,606,000
B767-210ER	$65,000,000	B767ER	$54,548,000
B767-210ER	$65,000,000	B767ER	$59,017,000
B767-300	$57,681,000	B767ER	$58,702,000
B767-300ER	$47,447,994	B767ER	$58,766,000
B767ER	$58,157,000	DC10-10	$21,000,000
CL-44	$3,500,000	DC10-10	$21,000,000
DC10-10	$9,766,000	DC10-10	$21,000,000
DC10-10	$9,745,000	DC10-10	$21,000,000
DC10-10	$9,702,000	DC10-10	$21,000,000
DC10-10	$10,029,000	DC10-10F	$40,000,000
DC10-10	$10,008,000	DC10-10F	$40,000,000
DC10-10	$9,801,000	DC10-10F	$40,000,000
DC10-10	$9,762,000	DC10-10F	$40,000,000
DC10-10	$20,473,000	DC10-10F	$40,000,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
DC10-10	$20,447,000	DC10-10F	$40,000,000
DC10-10	$20,423,000	DC10-10F	$40,000,000
DC10-10	$16,258,000	DC10-10F	$40,000,000
DC10-10	$16,342,000	DC10-10F	$40,000,000
DC10-10	$16,476,000	DC10-10F	$40,000,000
DC10-10	$18,428,000	DC10-10F	$40,000,000
DC10-10	$18,792,000	DC10-10F	$40,000,000
DC10-10	$18,676,000	DC10-10F	$40,000,000
DC10-10	$19,556,000	DC10-30	$32,500,000
DC10-10	$21,882,000	DC10-30	$45,000,000
DC10-10	$21,676,000	DC10-30	$45,000,000
DC10-10	$21,728,000	DC10-30	$45,000,000
DC10-10	$10,191,470	DC10-30	$40,000,000
DC10-10	$15,900,000	DC10-30	$17,771,000
DC10-10	$15,900,000	DC10-30	$23,683,000
DC10-10	$15,900,000	DC10-30	$45,000,000
DC10-10	$15,900,000	DC10-30	$45,000,000
DC10-10	$14,500,000	DC10-30	$19,153,000
DC10-10	$14,500,000	DC10-30	$19,158,000
DC10-10	$14,800,000	DC10-30	$19,211,000
DC10-10	$14,800,000	DC10-30	$23,205,000
DC10-10	$38,000,000	DC10-30	$23,369,000
DC10-10	$38,100,000	DC10-30	$0
DC10-10	$18,000,000	DC10-30	$24,559,000
DC10-10	$38,200,000	DC10-30	$34,720,000
DC10-10	$39,600,000	DC10-30	$27,300,000
DC10-10	$46,700,000	DC10-30	$31,000,000
DC10-10	$38,800,000	DC10-30	$31,000,000
DC10-10	$21,800,000	DC10-30	$76,700,000
DC10-10	$47,200,000	DC10-30	$32,100,000
DC10-10	$19,300,000	DC10-30	$32,100,000
DC10-10	$35,000,000	DC10-30	$32,100,000
DC10-10	$35,000,000	DC10-30	$34,700,000
DC10-10	$21,000,000	DC10-30	$45,000,000
DC10-10	$21,000,000	DC10-30	$40,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$41,500,000	DC10-40	$21,000,000
DC10-30	$40,000,000	DC10-40	$21,000,000
DC10-30	$45,000,000	DC10-40	$21,000,000
DC10-30	$45,000,000	DC10-40	$21,000,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
DC10-30	$0	DC10-40	$21,000,000
DC10-30	$0	DC10-40	$21,000,000
DC10-30	$45,000,000	DC10-40	$21,000,000
DC10-30	$29,000,000	DC10-40	$21,000,000
DC10-30	$35,000,000	DC10-40	$21,000,000
DC10-30CF	$54,500,000	DC10-40	$21,000,000
DC10-30CF	$45,000,000	DC8COMBI	$9,000,000
DC10-30CF	$50,000,000	DC8	$17,000,000
DC10-30F	$70,000,000	DC8-50	$3,000,000
DC10-30F	$70,000,000	DC8-51	$3,000,000
DC10-30F	$70,000,000	DC8-51	$3,000,000
DC10-30F	$70,000,000	DC8-54	$3,500,000
DC10-30F	$70,000,000	DC8-54	$3,500,000
DC10-30F	$70,000,000	DC8-54F	$4,500,000
DC10-30F	$70,000,000	DC8-54F	$4,500,000
DC10-30F	$70,000,000	DC8-55	$6,000,000
DC10-30F	$70,000,000	DC8-55	$6,000,000
DC10-30F	$70,000,000	DC8-55	$3,500,000
DC10-30F	$70,000,000	DC8-55F	$3,000,000
DC10-30F	$70,000,000	DC8-55F	$7,500,000
DC10-30F	$75,000,000	DC8F-54	$4,500,000
DC10-30F	$75,000,000	DC8F-55	$3,500,000
DC10-30F	$75,000,000	DC8F-55	$4,500,000
DC10-30F	$75,000,000	DC8-61	$5,000,000
DC10-30F	$75,000,000	DC8-61C	$5,000,000
DC10-30F	$75,000,000	DC8-61F	$8,000,000
DC10-30F	$75,000,000	DC8-61F	$4,500,000
DC10-30F	$75,000,000	DC8-61F	$4,500,000
DC10-30F	$75,000,000	DC8-61F	$4,500,000
DC10-30F	$75,000,000	DC8-61F	$4,500,000
DC10-40	$21,000,000	DC8-62	$8,000,000
DC10-40	$21,000,000	DC8-62	$10,450,000
DC10-40	$21,000,000	DC8-62	$8,000,000
DC10-40	$21,000,000	DC8-62	$11,000,000
DC8-62	$10,000,000	DC8-71F	$23,000,000
DC8-62	$10,000,000	DC8-71F	$23,107,000
DC8-62	$5,000,000	DC8-71F	$23,000,000
DC8-62	$10,000,000	DC8-71F	$23,000,000
DC8-62	$11,000,000	DC8-71F	$23,000,000
DC8-62	$8,000,000	DC8-71F	$23,000,000
DC8-62	$8,000,000	DC8-71F	$23,000,000
DC8-62 Combi	$9,000,000	DC8-71F	$23,000,000
DC8-62 Combi	$9,000,000	DC8-71F	$30,000,000
DC8-62C	$9,750,000	DC8-73CF-Cargo	$22,400,000
DC8-62CB	$9,000,000	DC8-73CF-Cargo	$22,400,000
DC8-62CB	$9,000,000	DC8-73CF-Cargo	$22,400,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
DC8-62CB	$8,500,000	DC8-73CF-Cargo	$22,400,000
DC8-62CB	$8,500,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$8,500,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$8,962,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$8,962,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$9,044,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$9,000,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$8,953,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$10,062,000	DC8-73CF-Cargo	$22,400,000
DC8-62F	$8,962,000	DC8-73CF-Cargo	$22,400,000
DC8-63	$16,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63	$13,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63	$16,500,000	DC8-73CF-Cargo	$22,400,000
DC8-63	$10,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$13,500,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$13,500,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$12,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$15,030,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$14,687,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$10,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$9,586,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$13,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$12,000,000	DC8-73CF-Cargo	$22,400,000
DC8-63F	$12,000,000	DC8-73F	$23,000,000
DC8-63F	$10,500,000	DC8-73F	$21,653,000
DC8-63F	$9,677,000	DC8-73F	$21,355,000
DC8-63F	$10,835,000	DC8-73F	$23,077,000
DC8-63F	$8,374,000	DC8-73F	$21,070,000
DC8-63F	$8,900,000	DC8-73F	$21,889,000
DC8-63F	$10,743,000	DC8-73F	$23,500,000
DC8-63F	$10,266,000	DC8-73F	$23,171,000
DC8-63F	$10,326,000	DC8-73F	$33,000,000
DC8-63F	$8,980,000	DC8-73F	$28,000,000
DC8-73F	$28,000,000	L1011-100	$20,200,000
DC8-73F	$21,364,000	L1011-150	$15,000,000
DHC-7	$6,000,000	L1011-150	$12,500,000
DHC-7	$6,000,000	L1011-250	$14,035,890
L100-20	$12,000,000	L1011-250	$14,035,890
L100-30	$12,000,000	L1011-250	$14,035,890
L100-30	$12,000,000	L1011-250	$14,035,890
L100-30	$14,000,000	L1011-250	$14,035,890
L100-30	$14,000,000	L1011-250	$14,035,890
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$12,500,000
L100-30	$14,000,000	L1011-50	$18,000,000
L100-30	$14,000,000	L1011-50	$18,000,000
L100-30	$14,000,000	L1011-50	$18,750,000
L1011	$10,000,000	L1011-50	$15,000,000
L1011	$10,000,000	L1011-50	$15,000,000
L1011	$6,000,000	L1011-50	$15,000,000
L1011	$10,000,000	L1011-50	$15,000,000
L1011	$10,000,000	L1011-500	$14,200,000
L1011	$10,000,000	L1011-500	$14,200,000
L1011	$7,000,000	L1011-500	$14,200,000
L1011-100	$7,500,000	L1011-500	$14,200,000
L1011-100	$18,000,000	L1011-500	$14,200,000
L1011-100	$18,000,000	L1011-500	$14,200,000
L1011-100	$17,600,000	L1011-500	$14,200,000
L1011-100	$20,000,000	L1011-500	$14,200,000
L1011-100	$20,200,000	L1011-500	$14,200,000
L1011-100	$20,000,000	L1011-500	$14,200,000
L1011-100	$38,800,000	L1011-500	$14,200,000
L1011-100	$39,300,000	L1011-500	$14,200,000
L1011-100	$17,600,000	L1011-500	$14,200,000
L1011-100	$47,000,000	L1011-500	$14,200,000
L1011-100	$29,600,000	L1011-500	$14,200,000
L1011-100	$42,300,000	L1011-500	$14,200,000
L1011-100	$20,200,000	L1011-500	$14,200,000
L1011-100	$20,200,000	L188	$2,200,000
L1011-100	$17,600,000	L188	$2,200,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-11F	$120,000,000
L188	$2,200,000	MD-80	$25,000,000
Lockheed Electra	$1,500,000	MD-80	$25,000,000
Lockheed Electra	$1,500,000	MD-80	$27,000,000
MCHX93	$18,000,000	MD-80	$27,000,000
MD-11	$106,500,000	MD-82	$15,400,000
MD-11	$107,000,000	MD-82	$15,400,000
MD-11	$107,500,000	MD-83	$25,400,000

Table D-35 Continued

Make-Model	FAA Insured Value	Make-Model	FAA Insured Value
MD-11	$115,000,000	MD-83	$29,500,000
MD-11	$124,500,000	MD-83	$29,500,000
MD-11	$125,000,000	MD-83	$29,500,000
MD-11	$115,255,612	MD-83	$25,700,000
MD-11	$114,187,612	MD-83	$25,700,000
MD-11	$114,536,468	MD-83	$14,800,000
MD-11	$113,945,918	MD-83	$14,700,000
MD-11	$95,000,000	MD-83	$35,200,000
MD-11	$113,004,125	MD-83	$35,200,000
MD-11	$114,296,616	MD-83	$35,100,000
MD-11	$95,000,000	MD-83	$36,800,000
MD-11	$95,000,000	MD-83	$34,500,000
MD-11	$95,000,000	MD-83	$34,500,000
MD-11	$108,270,462	MD-83	$24,500,000
MD-11F	$120,000,000	MD-83	$24,300,000
MD-11F	$120,000,000	MD-83	$33,600,000
MD-11F	$120,000,000	MD-83	$33,600,000
MD-11F	$120,000,000	MD-83	$33,600,000
MD-11F	$120,000,000	MD-83	$33,400,000
MD-11F	$120,000,000	MD-87	$27,500,000

Glossary

Air Carrier	The commercial system of air transportation consisting of certified air carriers, air taxis (including commuters), supplemental air carriers, and commercial operators of large aircraft
AMC	Air Mobility Command
Block Speed (BS)	Wide body (B747-100) equivalent block speed is 465 knots.
BTS	Bureau of Transportation Statistics
CAMI	Commercial Access to Military Installations
CEP	CRAF Enhancement Program
Certificate Of Public Convenience And Necessity	A certificate issued to an air carrier under Section 401 of the Federal Aviation Act, by the Department of Transportation, authorizing the carrier to engage in air transportation.
Certificated Air Carrier	An air carrier holding a Certificate of Public Convenience and Necessity issued by the U.S. Department of Transportation (DOT) to conduct scheduled services interstate. Nonscheduled or charter operations may also be conducted by these carriers. These carriers operate large (30 seats or more for a maximum load of 7,500 pounds or more) in accordance with FAR Part 121.
Channel Airlift	Common-user airlift service provided on a scheduled basis.
CRAF	Civil Reserve Air Fleet
CRAF	Civil Reserve Air Fleet. A fleet of civil aircraft with crews that is allocated by the Department of Transportation to the DOD in peacetime for use in times of crisis in international and domestic service. This predetermined fleet of passenger and cargo aircraft may be unilaterally tasked for national security reasons. Upon activation of the CRAF, the military exercises *mission* control, while operational control remains with the individual commercial carrier.
DBOF	Defense Business Operating Fund
DOD	Department of Defense
DOT	Department of Transportation
FAA	Federal Aviation Administration
GAO	General Accounting Office
GSA	General Service Administration
Large Regionals	Carrier groups with annual operating revenues between $10,000,000 and $100,000,000.

MAC	Mobility Airlift Command
Majors	Carrier groups with annual operating revenues exceeding $1,000,000,000.
Medium Regionals	Carrier groups with annual operating revenues less than $10,000,000 or that operate only aircraft with 60 seats or less (or 18,000 lbs. maximum payload).
MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
MPM/D	Million passenger miles per day.
MTM/D	Million ton miles per day
MV	Mobilization Value. Used to determine the carrier's "fair share" of the DOD business based on CRAF contribution. The MV also allows comparison of various types of aircraft. The MV = WBE Factor x 10
National Emergency	A condition declared by the president or the Congress by virtue of powers previously vested in them, which authorizes certain emergency actions to be undertaken in the national interest. Actions to be taken may include partial or total mobilization of national resources.
Nationals	Carrier groups with annual operating revenues between $100,000,000 and $1,000,000,000.
Passenger-Mile	One passenger transported one mile. Total passenger-miles are computed by summation of the products of the aircraft miles flown on each inter-airport flight stage multiplied by the number of passengers carried on that flight stage.
Payload (PL)	Wide body (B747-100) equivalent payload is 78 tons or 320 passengers over a standard distance of 3500 nautical miles.
Pre-positioning	Stockpiling of equipment and supplies at or near the point of planned use or at a designated location to reduce reaction time and to ensure timely support of a specific force during initial phases of an operation.
Productive Utilization Rate (UR)	Wide body (B747-100) equivalent daily productive utilization rate.
Revenue Passenger Ton-Mile	One ton of revenue passenger weight (including all baggage) transported one mile. The passenger weight standard for both "Domestic" and "International" operations is 200 pounds.
Revenue Passenger-Mile	One revenue passenger transported one mile in revenue service. Revenue passenger-miles are computed by summation of the products of the revenue aircraft-miles flown on a flight stage, multiplied by the number of revenue passengers carried on that flight stage.
Revenue Ton-Mile	One ton (2000 pounds) of revenue traffic transported one statute mile (5,280 feet).

Revenue Ton-Mile Of Freight	One short ton of freight transported one mile. Ton-miles are computed by summation of the products of the aircraft miles flown on each inter-airport flight stage multiplied by the number of tons carried on that flight stage.
Scheduled Service	Transport service operated pursuant to published flight schedules, including extra sections and related non-revenue flights.
U.S. Flag Carrier Or American Flag Carrier	One of a class of air carriers holding a Certificate of Public Convenience and Necessity issued by the DOT, approved by the President, authorizing scheduled operations over specified routes between the U.S. (and/or its territories) and one or more foreign countries. 14 CFR 121: Revenue operations of air carriers, commercial operators and deregulated all cargo carriers, using large aircraft. 14 CFR 135: Commuter air carriers (scheduled) and on-demand air taxi operators (unscheduled) revenue operations, using small aircraft.
USTRANSCOM	U.S. Transportation Command
Wide Body Equivalent (WBE)	CRAF commitments are converted to B747-100 equivalents for standardization and comparison.
Wide Body Equivalent (WBE) Factor	The WBE factor is the MTM or MPM divided by the B747 MTM or MPM .

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