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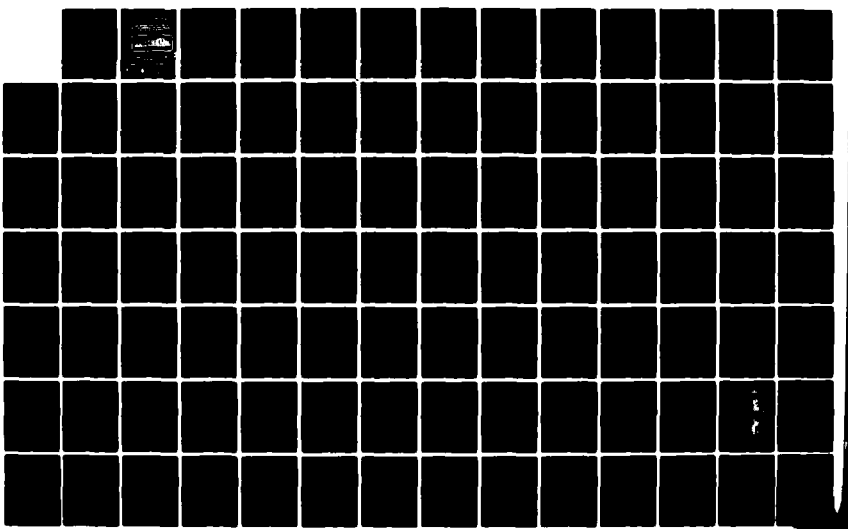

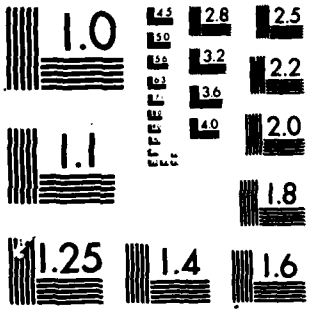

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MOBILIZATION AND DEFENSE MANAGEMENT
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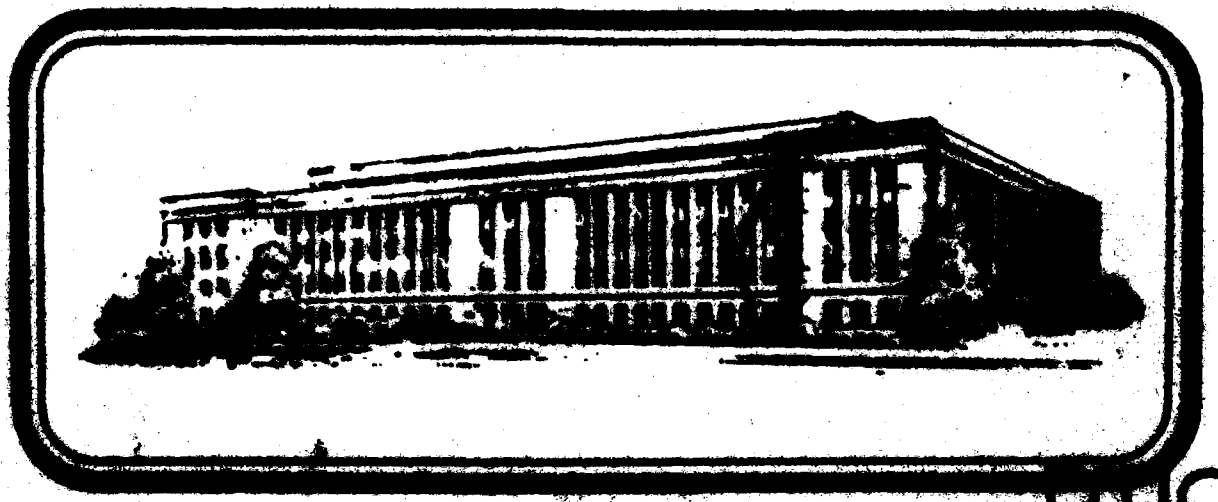
CONTEMPORARY ISSUES AFFECTING THE ABILITY OF COMMERCIAL AIR CARGO CARRIERS TO SUPPORT THE CIVIL AIR RESERVE FLEET



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The national defense strategy of flexible response relies upon the demonstrated ability to rapidly deploy forces in support of our national interests. For this strategy to be credible, the Department of Defense (DOD) must rely upon U.S. commercial air carriers for a significant contribution to our strategic airlift capability. This study addresses the contemporary issues affecting the ability of commercial air cargo carriers to support the Civil Air Reserve Fleet (CRAF).

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NATIONAL DEFENSE UNIVERSITY

MOBILIZATION STUDIES PROGRAM REPORT

CONTEMPORARY ISSUES AFFECTING THE ABILITY OF COMMERCIAL AIR CARGO CARRIERS TO SUPPORT THE CIVIL AIR RESERVE FLEET

by

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IN
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Contemporary Issues Affecting The Ability of Commercial Air Cargo Carriers to Support the Civil Air Reserve Fleet (CRAF)

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Problem Statement

The national defense strategy of flexible response relies upon the demonstrated ability to rapidly deploy forces in support of our national interests. For this strategy to be credible, the Department of Defense (DOD) must rely upon U.S. commercial air carriers for a significant contribution to our strategic airlift capability.

Finding/Conclusions:

1. Three long-term factors--fuel price, noise abatement and airline deregulation--combined with a prolonged business downturn have set into motion forces which will significantly transform the airline industry.
2. No new long-range cargo aircraft are on order by domestic airlines, and none are expected.
3. Without government intervention, the long-range air cargo fleet will continue to shrink. Over the past 7 years, nearly one-third of freighter sales and leases have been to foreign operators and thus lost to the CRAF.
4. Up to forty-percent of the existing CRAF cargo fleet could be lost by 1985, primarily due to noise abatement regulation.
5. The CRAF Enhancement Program--the inclusion or retrofitting of cargo capability into passenger aircraft--is a cost-effective method of obtaining standby cargo capability.
6. The only wide-body aircraft presently on order by domestic airlines is the Boeing B-767. The B-767 offers potential as a cargo aircraft, but cargo capability will not be built into the airframes unless DOD pays the costs.

Recommendations

1. In order to retain the existing CRAF capability, DOD should assist Federal Aviation Administration (FAA) in seeking relief from the noise provisions of the Aviation Safety and Noise Abatement Act of 1979 for cargo cargo capable DC-8s commited to CRAF. The requested relief should be effective through 1990.
2. DOD should proceed with the retrofit of 25 B-747 aircraft as contained in the Air Force FY 84 budget submission.
3. Maximum effort should be expended to include cargo capability in all new commercial wide-body passenger aircraft produced for domestic airlines.
4. DOD should negotiate standby waivers with the FAA to certain Regulatory provisions, such as the two engine 60 minute rule, which would unnecessarily negate the utility of new aircraft to the national strategic airlift needs during a national emergency.

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EXECUTIVE SUMMARY

Our national defense strategy of deterrence relies upon our ability to rapidly deploy forces. For this strategy to be credible, the Department of Defense (DOD) must rely upon commercial air carriers for significant airlift capability.

This study reviews the impact of events acting upon the domestic airline industry and the reaction of commercial air cargo carriers to those events. It reviews generic forces such as fuel prices, environmental regulation, and airline deregulation as well as trends specific to the air cargo sector such as the shift in the types of air cargo shipped and the growth in aircraft lower deck capacity. The impact of these events are interpreted relative to the possible and probable impact they will have on the ability of the commercial air cargo carriers to support the Civil Reserve Air Fleet (CRAF) program through 1990. The study reviews actions taken to date by DOD to increase the domestic air cargo fleet through the Civil Reserve Air Fleet (CRAF) Enhancement Program, and new approaches available in the future. Finally it reviews the capability of the only wide-body aircraft presently on order by domestic airlines, the Boeing B-767, to provide strategic airlift augmentation.

The more significant conclusions of the study are summarized as follows:

1. Three long term factors--fuel price, noise abatement and airline deregulation--combined with a prolonged business downturn have set into motion forces which will significantly transform the airline industry.

2. No new long-range cargo aircraft are on order by domestic airlines, and none are expected.

3. Without government intervention, the long-range air cargo fleet will continue to shrink. Over the past 7 years nearly one-third of freighter sales and leases have been to foreign operators and, thus, lost to the CRAF.

4. Up to forty percent of the existing CRAF cargo fleet could be lost by 1995, primarily due to noise abatement legislation.

5. The CRAF Enhancement Program--the inclusion or retrofittting of cargo capability into passenger aircraft--is a cost-effective method of obtaining standby cargo capability. For the CRAF Enhancement Program to be effective, continuity in funding and political support as well as flexibility in the manner of program execution are required.

6. The only wide-body aircraft presently on order by domestic airlines is the Boeing B-767. The B-767 may offer potential as a cargo aircraft, but cargo capability will not be built into the airframes unless the Department of Defense (DOD) pays for the costs.

CHAPTER I

STUDY BACKGROUND

Introduction

The capability to rapidly deploy military forces magnifies the effectiveness of those forces as a deterrent. Strategic mobility capability has evolved over the years to become a cornerstone of our forward defense strategy. Air transport has evolved as the primary method of deployment for early-moving ground and air forces. The importance of this concept stems from a conscious reappraisal of how the United States would support its NATO and other commitments throughout the world. Since the bulk of military forces are stationed in the United States, rapid transport of early arriving forces to Europe or other world contingency areas is a critical mission which must be undertaken by the Military Airlift Command (MAC) and the other transportation operating agencies.

Since 1975, the Department of Defense (DOD) has documented in seventeen major studies a shortfall in cargo movement capability. The Congressionally Mandated Mobility Study (CMMS) identified a significant cargo airlift shortfall applicable to four separate representative major contingency scenarios. The CMMS recommended immediate action to add 20 million ton miles per day of intertheater cargo airlift above a baseline force capability which included the C-5A wing modification, additional C-141/C-5A spares and crews, the Civil Reserve Air Fleet (CRAF) Enhancement Program, the C-141 stretch program, the SL-7 fast sealift program, six Prepositioned Material Configured to Unit Sets (POMCUS) in Central Europe, additional USAF and USMC

prepositioning in NATO and the Maritime Prepositioning Ship program for a two brigade-sized Marine Air Ground Task Force (MAGTF). Since the baseline force assumed approximately 5 million ton miles per day of additional CRAF capability, the actual deficit in airlift capability is approximately 25 million ton miles per day.[1] The study clearly documents that currently available military and commercial, air and sealift assets are insufficient to react as quickly as necessary to early movement requirements.[2] This paper will concentrate on the capabilities of the commercial airline industry to contribute to strategic mobility.

Civil Reserve Air Fleet (CRAF)

Military resources, alone, are insufficient to meet total cargo airlift requirements. Moreover, it has been determined too costly to maintain a level of organic military capability in peacetime sufficient to satisfy all requirements. For over three decades, therefore, DOD has planned for the commercial airline industry to augment military airlift in emergencies. Recognition that an effective strategic mobility system must be based on agreements between the military and the commercial sector is embodied in the CRAF program. This program establishes a procedure whereby selected commercial airlift capabilities are identified for commitment to DOD during emgencies.

The CRAF program is a partnership between the Government and the airline industry that has existed for three decades. The Secretary of Transportation is currently responsible under Executive Order 11490, as amended, for developing plans to utilize civil air transportation resources to meet civil and military needs during national defense-oriented emergencies. The program

currently operates under the auspices of a revised 7 May 1981 Memorandum of Understanding between DOD and the Department of Transportation.

Under this program, certificated United States civil air carriers enter into annual contracts with DOD and voluntarily commit their United States registered aircraft. DOD determines the number and types of civil air carrier aircraft needed to augment military airlift resources. The Department of Transportation (DOT) establishes priorities and allocates civil air carrier aircraft to DOD. The Secretary of the Air Force, through his designee, the Commander-in-Chief, Military Airlift Command, (CINCMAC), administers the CRAF program for the Air Force. CINCMAC is the operational point of contact for all CRAF program activities, including mission control and policy implementation.

The program is divided into three stages and may be incrementally activated to augment DOD organic airlift capability to meet airlift requirements up to and including the most demanding emergency. The three stage activation procedure provides for efficient utilization of civil airlift resources with minimum disruption to civil commercial services.

The stages of activation are as follows:

Stage I: Long-range aircraft are furnished to DOD to support expanded military airlift requirements. Commander-in-Chief, Military Airlift Command has the authority to activate this stage. Stage I is designed to have minimum disruption on commercial service. This airlift capability is available within 24 hours.

Stage II: The Secretary of Defense, or his designated representative, has the authority to activate this stage in order to provide

additional civil airlift augmentation during an emergency not requiring national mobilization. This stage provides a significant increase in augmentation without resorting to the declaration of national emergency or full mobilization. This capability is also available within 24 hours.

Stage III: These airlift resources are activated by an order from the Secretary of Defense, but only after the President or Congress has declared a national emergency. This airlift is to be available within 48 hours.

The following table shows the composition of the CRAF as of January 1983. The totals will vary slightly from month to month.

TABLE I-1

CRAF COMPOSITION--JANUARY 1983

	Stage I	Stage II	Stage III
Domestic	-	30	30
Alaskan	-	-	11
Short Range Intl	-	-	16
Long Range Intl (PAX)	3	27	215
Long Range Intl (CGO)	47 (25)*	47 (25)*	**115 (73)*
TOTAL	50	104	387

*Number in parenthesis are convertible airframes.

**Represents cumulative totals from Stage I and II.

Source: Hq MAC Monthly CRAF Capability Summary.

This long standing CRAF relationship between DOD and the airline industry has been mutually beneficial. The program provides DOD with a large potential airlift capability for emergency use. For example, the CRAF fleet, when fully activated, accounts for 90% of troop deployment capability and 35% of the air

cargo movement capability available to MAC for NATO contingency.[3] In return, the air carriers, through peacetime participation in DOD contracts, may earn compensatory revenues.

Statement Of The Problem

Despite the close cooperation between DOD and DOT, and the active participation of the air carriers in the CRAF program, the combined capabilities of DOD and the commercial sector fall short of national defense needs. There are several problems in the commercial sector which could aggravate the cargo airlift shortfall and significantly reduce the strategic airlift capability contributed by the air carriers.

The purpose of this paper is to review current airline industry issues which may impact upon the contribution made by the airlines to the CRAF program. In the course of the paper the following will be examined:

1. Current dynamics in the industry to include the impacts of deregulation and other economic factors.

2. The impacts of aircraft sales and leases by CRAF participating airlines which could degrade CRAF availability and capability.

3. Government programs to incentivize airlines to acquire cargo convertible aircraft.

4. The production of new aircraft presently being introduced into the airlines and their potential for inclusion in the CRAF.

Importance Of The Study

As our national defense strategy shifted from massive retaliation to flexible response, with emphasis on rapid deployment of conventional forces,

significant cargo short-falls in our organic military airlift capability were highlighted. With limited defense budgets, military planners were forced to increase their dependence on commercial airlift. Today a significant portion of our total airlift capability, some 400 aircraft, resides in CRAF.

CRAF is currently an integral part of military contingency plans involving massive airlift; however, because of prohibitive cost it has never been fully exercised or implemented. Accordingly, some decisionmakers have questioned whether CRAF assets can be relied upon during a national emergency. Much of this concern has been centered on the availability of aircraft--especially large wide-body long-range cargo freighters.

Given the current turbulence and depressed economic conditions in the airline industry, questions that now arise are: Can the industry continue to maintain its level of participation to the CRAF program? Will the long standing partnership between Defense and the airline industry begin to show signs of strain due to forces within or beyond the control of airlines? This paper will attempt to address these vital questions.

Scope Of Study

Foremost consideration will be given to long-range international cargo type aircraft due to their contribution to strategic deployment.

No consideration will be given to short-range international, the domestic, or the Alaskan segments of CRAF. Aircraft associated with these segments are not capable of worldwide deployment of U.S. forces.

The study is restricted to cargo carrying aircraft and will not address passenger carrying aircraft since there are ample numbers of these aircraft to accomplish planned passenger movements.

Initially the storage of airline aircraft was considered a factor which could affect support to CRAF. A closer examination, however, revealed this was not an issue since few long range aircraft and virtually no cargo aircraft are being stored.

Sources Of Data And Methodology

The information contained in this study is from both primary and other sources. Reports of Air Transport Association of America, Civil Aeronautics Board, Department of Transportation, Headquarters United States Air Force, Military Airlift Command, Military Traffic Management Command, independent financial analysts, and Boeing Aircraft Company are the main sources of information.

The basic methodology employed involves an analysis of the literature, reports, economic st dies, symposiums and panel discussions. Interviews with government and industry representatives were also conducted. Information was received from airline officials, manufacturers, and trade associations. Discussions of methodologies employed for specific portions of this study will be contained in the appropriate chapter.

CHAPTER II

MAJOR FACTORS IMPACTING AIRLINE OPERATIONS

Introduction

United States domestic air carriers must conduct business in an economic, social, and political environment. In many respects, this environment shapes and molds the industry and dictates its final form. Recognizing the significant contribution made by the domestic air carriers to the nation's strategic mobility capability, Department of Defense (DOD) needs periodically to carefully review significant trends and be cognizant of their impact on the airline industry. Without such a review and understanding of these impacts, an assumed Civil Reserve Air Fleet (CRAF) capability could quickly diminish. This chapter addresses three long term factors--fuel price, noise abatement legislation, and deregulation--which are having a profound effect on the airlines operating environment, and will have a significant impact on the shape of the airline industry for the foreseeable future.

Fuel

Almost no business sector has been exempt from the impacts of rapidly rising petroleum prices. The airline industry has been affected more severely than most because fuel makes up such a large portion of the industry's operating costs. According to figures released by the Air Transport Association in 1981, fuel accounted for 30% of total operating expenses. The jet fuel situation and the related cost squeeze has been viewed by many as the most critical problem faced by the U.S. airline industry.[1] The

astronomical rise in fuel costs since 1973 will be the key to the industry's future strength and growth in the decade of the 1980's.

Since the fuel crisis of 1973-1974, the airlines have experienced significant fuel cost increases. The cost of airline fuel was approximately 12 cents per gallon before the increase in price of crude oil decreed in 1973 by the Organization of Petroleum Exporting Countries (OPEC). Since that time, jet fuel prices have risen about 800 percent.[2]

The industry average price per gallon of fuel in 1974 amounted to 24.2 cents, nearly double the price in 1973 (See Table II-1). More increases continued in subsequent years, and in 1979, the price of fuel was again significantly increased.[3]

At the end of 1979, the average cost per gallon had grown to 74 cents for domestic operations and 82 cents for the international operations. The price of jet fuel in December 1979 averaged 75 cents for the overall industry.[4]

TABLE II-1

AVERAGE PRICE PER GALLON OF AIRLINE FUEL

Year*	Domestic	Int'l	Total	Per Cent Increase
1973	12.6	13.6	12.8	11.3
1974	21.8	33.6	24.2	89.1
1975	27.5	35.8	29.1	20.2
1976	30.5	36.7	31.6	8.6
1977	35.3	40.1	36.2	14.6
1978	38.6	42.5	39.2	8.3
1979	56.4	63.4	57.5	47.2

*Beginning of the year.

Source: Air Transport Association of America

In 1980, the industry used 10,643,000 gallons for an average cost of 89.5 cents per gallon and in 1981 consumption dropped to 9,750,000 gallons at a cost of 104.2 cents per gallon. Perhaps the most positive development during 1981 was the slowing of the long, rapid climb in the price of fuel. Although the decontrol of domestic crude prices sparked a sudden surge in fuel prices in the spring of 1981, the oil glut and subsequent price weakening resulted in a standstill and finally a modest reduction in jet fuel prices by mid-year.[6]

In 1982, the easing of fuel cost continued. The glut of oil inventories and the reduced demand from the industry kept the price of fuel in a modestly downward path for most of the year. This resulted in fuel prices being down about 10 cents at the end of 1982.[7]

However, a note of caution has been expressed by government and industry analysts who forecast that economic growth by developing nations is expected to outpace that of industrialized nations of the free world. This growth could reverse the current trend toward flat or declining jet fuel prices and cause increases of more than 7 percent annually in real terms beginning in the middle part of this decade.[8]

The Department of Energy's Energy Information Administration predicts an even greater cumulative impact from economic growth by less developed nations. Their forecast for 1990 shows jet fuel priced at $1.50 per gallon in 1980 dollars. (See Figure II-1) It also predicts an average annual rise in the price of jet fuel of 7.3 percent in 1980 dollars from 1985-1990 and an average of 9.3 percent annually from 1990-1995.[9]

JET FUEL PRICE IN 1980 DOLLARS

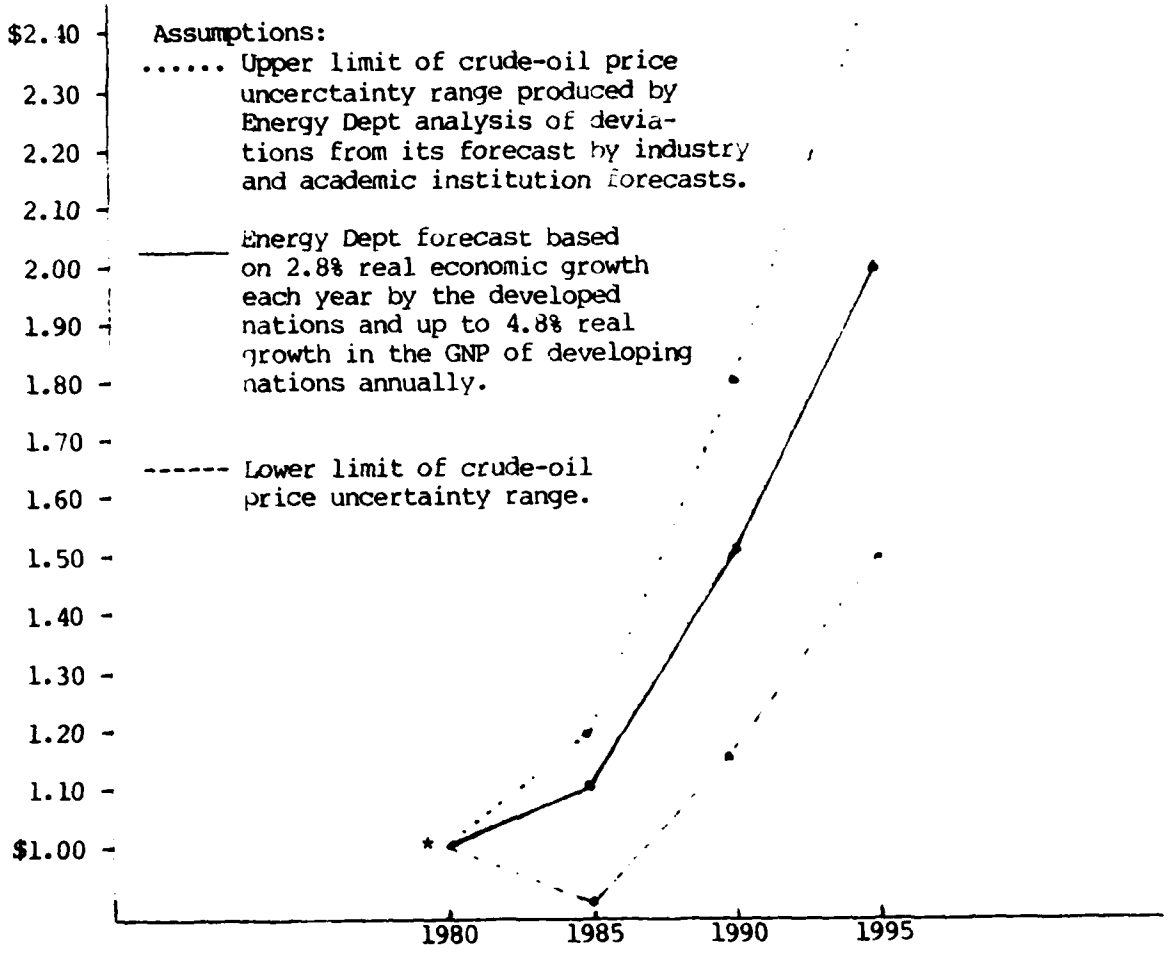


FIGURE II-1

*Average of Monthly Figures for January-November, 1981, Civil Aeronatics Board

Source: Aviation Week and Space Technology

To illustrate the impact of fuel costs, each one cent per gallon increase in the price of jet fuel adds about $110 million to airline industry operating costs. As fuel prices increases they also account for a larger share of airline total operating expenses. Fuel in 1981 accounted for 30.4 percent of airline total operating expenses compared with only 12.6 percent in 1971. Accordingly, high fuel costs have been a significant factor for the eleven carriers making up the major airline group who are likely to report a collective deficit approaching $400 million for their 1982 operations. This will be the third consecutive year of red ink for this group.[10] As a result, the airlines are looking towards more fuel efficient aircraft to modernize their fleets.

Noise Abatement

The environmental movement of the 70's produced national concern for a quality of life issue which has had, and will continue to have, a particularly important effect on the airlines. That issue is noise. This concern manifested itself in restriction on aircraft noise levels as legislated in the Aviation Safety and Noise Abatement Act of 1979. The airlines must meet a Department of Transportation timetable for compliance with Federal Aviation Administration (FAA) noise standards outlined in Federal Air Regulations (FAR-36) that set maximum noise levels for takeoffs and landings. Under the compliance schedule, one-quarter of narrow-body, four engine jets had to conform by the end of 1980, one-half must comply by the end of 1983, and the remainder by January 1985. Wide-bodies and two-and three-engine jets must meet a 50% compliance requirement by the end of 1983.

The three methods the airlines can employ to meet the regulations for their complying airframes are: retrofitting engines, replacing engines, or

replacing the aircraft. Nearly all aircraft acquired since 1974 already conform with the noise guidelines. None of the B-707s comply, and some early B-747s and two-and three-engine jets also do not. The B-707s are expected to be replaced by newer models before the 1985 deadline. Some of the stretch DC-8s are being given new engines and some of the older B-727s and B-737s and all of the wide-bodies will be retrofitted with noise-suppressing and sound absorption materials.[11] According to the Federal Aviation Administration nearly 50% of the fleet used by U.S. domestic aircraft operators complied with FAA's 1977 aircraft noise regulations in January 1981 and that number is expected to climb to 73% by 1983. An updated report of the fleet compliance status of U.S. domestic operators published in the Federal Register of 6 August 1981 shows that many four-engine narrow-body models such as the B-707, B-720, and DC-8 will be removed from domestic service by the 1 January 1985 deadline. Exceptions are the 74 stretch DC-8s currently scheduled for reengining.[12] (See Table II-2)

It is clear that compliance with federal anti-noise regulations is playing an important role in fleet planning and replacement. The size and capabilities of the fleet of the future will unquestionably impact on mobilization potential and capacity.

Deregulation

Since the passing of the Airline Deregulation Act in October 1978, the airline industry has been significantly affected. This deregulation gives airlines more flexibility and has resulted in increased route and fare

TABLE II-2
NOISE COMPLIANCE FLEET PROJECTIONS[13]

Airplane	January 1977		April 1980		January 1981		January 1983		January 1985	
	Tot A/C	#Comply	Tot A/C	#Comply	Tot A/C	#Comply	Tot A/C	#Comply	Tot A/C	#Comply
A300	0	0	14	14	19	19	25	25	25	25
BAC 1-11	33	0	44	0	44	0	45	0	43	11
B-707	277	0	190	0	147	0	67	0	0	0
B-720	21	0	12	0	11	0	8	0	0	0
B-727	842	186	1,082	540	1,076	648	1,111	1,106	1,087	1,067
B-737	150	7	224	71	229	82	232	105	231	200
B-747	112	35	141	121	146	132	145	145	148	148
Convair	25	0	8	0	8	0	8	0	0	0
DC-8	224	0	164	0	161	0	143	23	74	74
DC-9	367	32	400	74	405	83	440	150	440	173
DC-10	124	124	146	146	152	152	156	156	159	159
L-1011	81	81	91	91	93	93	114	114	114	114
SE-210	0	0	6	0	6	0	4	0	3	0
B-757	0	0	0	0	0	0	0	0	27	27
B-767	0	0	0	0	0	0	15	15	90	90
Total	2,256	465	2,522	1,067	2,497	1,209	2,513	1,841	2,441	2,108
Percent	20.6		41.9		48.4		73.3		86.3	

Source: Aviation Daily

competition. The orginators of the Deregulation Act had the following objectives for the new law:

a. To make available a variety of economic, efficient, and low-priced services.

b. To place maximum reliance on competitive market forces and on actual potential competition to provide air transportation.

c. To prevent anticompetitive practices and conditions that would allow carriers to increase prices unreasonably, reduce services, or exclude competition.

d. To maintain systems for small communities and isolated areas.

e. To encourage entry into new markets by existing new carriers.[14]

The legislation, which called for the systematic dismantling of the Civil Aeronautics Board (CAB) and the powers entrusted to it, has opened the way for free-market forces to govern routes and pricing. As a result, the route systems of all carriers have been substantially restructured, carriers have far-reaching flexibility in setting rates, and a number of entirely new airline operators have emerged. The new law provided for the gradual phase-out of the CAB's economic regulatory powers as well as the eventual demise of the CAB by the beginning of 1985. However, some residual control over carriers affairs will remain with the government. Areas such as antitrust authority over airline operations and mergers, control over subsidies, consumer affairs matters, and safety and technical matters will be distributed to the Justice Department, Department of Transportation, Federal Trade Commission, and Federal Aviation Administration officers as appropriate.[15]

With deregulation having removed previous barriers to market entry and

pricing flexibility, the industry has become more susceptible to swings in the business cycle. This is especially true in the manner in which fare cutting has been used as a tool to attract traffic. As a result, carrier revenues have been diluted by widespread fare cutting and a decline in revenue yield per passenger-mile is in evidence.[16]

Economic Environment

During the period 1979 through 1981 the airline industry experienced the worst three-year period in its history.[17] According to the December 1982 Standard & Poor's survey of the U.S. Air Transoort Industry, American airline companies are now entering 1983 in a state of considerable financial stress following another year (1982) of great adversity for many carriers. The succession of losses since 1979 has produced a declining cash flow, decreased shareholders equity, damaged liquidity, and substantially increased debt, both long-and short-term. Overall, the financial position of the major airline companies has been seriously weakened.[18] In 1982, Braniff International became the first major carrier to file for bankruptcy in the history of the airline industry. Additionally, four other airlines, Eastern, Pan Amerian, Continental, and Western found it necessary to reach new agreements with creditors when they were unable to comply with the terms of loan agreements.[19]

The passage of the Airline Deregulation Act in October 1978 combined with the rapid fuel price increases, noise abatement regulation, and business recession have set in motion what promises to be a complete transformation of the U.S. airline industry.

Summary

The three long-term factors discussed--fuel price increases, noise abatement, and deregulation--have combined in a synergistic manner causing a profound effect on the environment in which the airline industry must operate. This changing environment has had a more penetrating and immediate impact on the industry because the changes have coincided with a prolonged business downturn.

CHAPTER III

THE EVOLVING AIR CARGO INDUSTRY

Introduction

The previous chapter examined the major factors which are causing rapid changes in the airline industry. This chapter examines the current dynamics of those and other factors within the air cargo sector of the airline industry to determine the impact of current cargo sector trends upon the ability of the industry to provide augmentation to the Civil Reserve Air Fleet (CRAF). In Part One of this chapter trends critical to the cargo sector will be identified and analyzed. These trends are then examined to determine if they support the thesis that the U.S. long-range air cargo fleet is undergoing substantial change that could reduce air cargo movement capability available to the CRAF in an emergency. Part Two examines the results of current industry trends on the composition of the U.S. air cargo fleet to determine if a loss of CRAF cargo capability is occurring and if so, how. Part Three presents conclusions drawn from the analysis.

Part I: Trends

The air cargo industry underwent dramatic change in the decade of the 70s that will continue to reshape its member companies and their capital equipment requirements throughout the '80s. Three trends predominated which individually and in combination have proved to be a significant detriment to the major airline's ability to provide augmentation to the long-range cargo portion of the CRAF. First, a trend which has profoundly affected the industry over the past

decade is the large-scale withdrawal of the major airlines from all-cargo service. Secondly, the air cargo business is becoming segmented into two distinct markets--the time-sensitive, small package market and the heavy (over 70 pounds) bulk shipment market. Finally, the competitive environment is changing significantly with the entrance of aggressive, efficient newcomers requiring primarily smaller, non-CRAF capable aircraft.

Withdrawal Of The Major Airlines

An understanding of the position occupied by the air cargo business within the airline industry is needed to fully appreciate the major airlines reduced presence in this market. For most airlines, the air cargo business is largely ancilliary to their main business of moving passengers. While freight operations provided an average of 6.6% of 1981 total revenues, they represent only about 2.2% of the total revenue miles flown[1] and have an erratic record of profitability.[2] The trend toward reduced major airline presence was started in 1972-73 by Delta and Eastern Airlines when they cancelled their DC-8 and Hercules cargo service. Trans World Airlines followed a short time later by grounding their 12 B-707 freighters. By late 1982, only American, Northwest, Pan American and United among the major airlines were operating freighter aircraft.[3] The total number of freighters operated by the major airlines had shrunk to just 35 by 1 January 1983. On February 22, 1983, Pan American further reduced its participation in the all-cargo business to a single airframe when it swapped four of its five remaining B-747 freighters for three of Flying Tigers passenger versions of the same aircraft. The overall effect has been a decline in all cargo airframe mileage flown by the

major airlines of some 48% in the past ten years.[4] In our opinion, this trend toward a reduced presence in the all-cargo market is largely the result of the three factors previously discussed in Chapter II -- deregulation of the airline industry by the Carter Administration 1978, the eightfold increase in aviation fuel costs between 1973 and 1985 and federal airport noise restrictions --plus the increased volume of belly cargo capacity available in today's wide-body airline fleet.

Deregulation

Prior to deregulation, government imposed operating restrictions effectively stifled competition within the air cargo market allowing the scheduled airlines to dominate. Potential competitors were limited to operation of aircraft whose cargo capacity did not exceed 7500 pounds.[6] Since deregulation, however, substantially increased competition has developed from new, efficient and expanding operators who can now fly any type of cargo aircraft they so choose, with great pricing flexibility and over a much wider route structure than ever before. The decontrol of pricing allows these smaller operators to take advantage of lower overhead and labor costs and places the major airlines at a competitive disadvantage in many markets. Decontrolling the route structure also allows every operator an equal opportunity to service major cargo destinations that had once been the province of the industry giants alone. Failing to recognize, in a timely manner, the consequences of deregulation, many of the major airlines lost market share rapidly.

Fuel Costs

The dramatic rise in jet fuel prices from an average of $.13 per gallon in 1973 to $1.04 per gallon in 1981 has been a major factor in the withdrawal from the all-cargo market by the major air carriers. As a percentage of total operating expenses, fuel has risen from 12.6% in 1971 to 30.4% in 1981.[7] Combined with leveling demand, excess capacity, increasingly expensive financing and growing competitive pressures, fuel costs have forced the airlines to cut back in marginal areas. As a result, most of the major carriers have abandoned the all-cargo sector to the more efficient freight operators and have sold or leased their cargo aircraft.

Due to current world economic conditions and the failure of the Organization of Petroleum Exporting Countries (OPEC) to agree on production quotas and stable pricing policies, there has been a steady retrenchment in oil prices in recent months. As rising prices were detrimental to airline participation in CRAF cargo operations, conversely, a significant reduction in jet fuel price could now augur well for CRAF cargo capability. When the airport noise reduction regulations were originally established in 1978, operators of the older, high-noise B-707 and DC-8 freighters knew it would mean expensive re-engining or the end of service for the majority of the narrow body cargo fleet by January 1, 1985. Most believed that in light of then steadily rising fuel costs, these relatively inefficient aircraft would be operationally uneconomical and thus grounded or sold long before that date. The recent reversal in the trend of fuel prices, and forecasts for further reductions, could enable these older aircraft to again become economically competitive. If the re-born viability of these aircraft leads to

enough industry pressure to extend the 1985 deadline, to modify the requirements or to provide waivers, the CRAF may yet retain a significant portion of the narrow body cargo fleet until improved economic conditions permit a permanent solution such as re-engining or replacement by a new aircraft. In any case, the fluctuating price of fuel will continue to be a major factor in airline industry participation in the all-cargo sector and in availability of such equipment for the CRAF.

Belly Cargo Capacity

The introduction of wide-body aircraft with their spacious cargo holds provided the airline industry with substantially increased bulk cargo carrying capability and flexibility. As a result, much of the cargo traffic still carried by the major airlines has been shifted from freighter decks to the belly compartments of regularly scheduled passenger flights.[8] This allows the airlines to increase aircraft load factors, spread operational costs over a broader base and carry small cargo lots on a marginal cost basis much as special fares are used to fill unsold passenger seats. Indeed, the belly capacity now available exceeds the total commercial bulk cargo space requirement to such an extent that an estimated 50-60% of existing cargo hold capacity travels empty.[9] Available belly capacity, combined with the leveling off of large item, long-range cargo shipments, resulted in underutilization of freighter deck space and thus contributed to the subsequent reduction in freighter operations by the major airlines. This significant unused bulk capacity will have to be used before industry interest, if any, will turn to acquisition of additional new freighters. It could take a number of years at the currently projected rate of cargo volume growth for this to happen.

Industry Segmentation

The composition of the air cargo market has also been changing rapidly in recent years. After years of relatively stable operations moving high-volume bulk cargo, the high-tech information revolution hit the air cargo market with smaller, lighter packages that required extra-fast handling.

The Small Package Sector

The big story in the air cargo revolution has been the rapid growth of the time-sensitive, small package market while overall growth of air cargo shipments has been sluggish. Frederick W. Smith, Chairman and Chief Executive Officer of Federal Express Corporation, cites six basic reasons for the rapid growth of the time-sensitive, small package market and for high expectations for its further growth. First, breakdowns of microprocessors upon which many of today's high technology machines are dependent, are so costly in terms of lost productivity that the value of moving spare parts to repair them far exceeds the cost of the transportation to move them. Second, air cargo systems have inherently less "friction" in them than the more traditional transport systems. Third, the continued profusion of U.S. industrial plants favors rapid and indiscriminate distribution of goods moving in high priority transportation systems. Fourth, managers, in recognition of the high costs of technological obsolescence, are striving to minimize high technology inventories. Fifth, the shift from an industrial to a service-based society will continue to increase the demand for movement of time-certain, time-sensitive items. And sixth, nothing can replace the ability of time-sensitive cargo delivery systems to give the industrial sector of our

society the flexibility needed to meet changing conditions.[10] Ninety-five percent of all items moving in the time-sensitive, small package market are individual pieces. While the top weight in this sector is 70 pounds the average shipment is less than five pounds and consists of paper products moving in support of the "white collar revolution."[11] The overnight delivery sector is by far the fastest growing portion of this market, currently growing at a rate of approximately 20% annually.[12] Meeting the demands of this market has proven to be a task for which the major scheduled airlines are ill-equipped. Since most of their capacity is concentrated during daytime hours, the prerequisite promise of overnight delivery service is largely unachievable.

Large Item Sector Stagnation

Substantial growth in sectors of the air cargo industry, other than the time-sensitive, small package sector, is not expected. In fact, although the total freight market grew at an average rate of 6% during the 1970s, overall cargo ton-miles have been declining over the past three years due in large part to poor economic conditions. Ton-miles flown for 1980 and 1981 declined 3.8% and 1.2% respectively, with a further drop of 4-5% projected for 1982.[13] FAA estimates of future U.S. air cargo traffic (Revenue Cargo ton-milies) for the period 1983-1993 reflect slow growth at an average annual rate ranging from approximately 3 1/2% to 7%.[14] Our survey and discussions with executives of airlines currently participating in the CRAF program confirmed expectations of a relatively level, or at best slowly growing, overall air cargo market in the near term.

The Changing Competitive Environment

The withdrawal of major airlines and increasing market segmentation have opened the air cargo industry to unprecedented competitive pressures. The industry members are changing and with them the equipment used. The result is clearly not compatible with providing the long range cargo airlift needed in the CRAF program.

New Market Entrants

The rapid development of the time-sensitive, small package market and its attendant requirments, coupled with the retrenchment of the scheduled airlines from the all-cargo market, has induced many of the major freight forwarders to acquire or contract for their own cargo fleets and to conduct line haul operations themselves. John Emery, Vice President of Emery Worldwide, estimates that four years ago eighty percent of Emery's cargo still flew on scheduled U.S. carriers. Today, more than ninety percent moves in company planes.[15] As could be expected, the entry of the freight forwarders into line haul operations has meant the loss of a substantial amount of both freight and belly cargo business formerly provided by the freight forwarders and increased competition in the existing market. The increasing numbers of regional air carriers also adds additional cargo hold space which is being aggressively filled at the expense of other transportation modes and air cargo carriers. This capacity is a by-product of deregulation and represents a capability that will further reduce the demand for freighter airframes and thus the U.S. long-range cargo capability needed in the CRAF.

Smaller Aircraft Demanded

The limited projected growth in the large shipment sector combined with the rapid growth of the time-sensitive, small package sector has fundamentally altered the type of aircraft being employed in the air cargo market. The time-sensitive, small package sector dictates the purchase primarily of small, efficient aircraft up to and including the B-727 for use in hub and spoke operations. In this regard, John Emery notes: "In terms of the Emery cargo plane requirement, we are basically dealing here with a business that involves 30 to 40,000 pound leg segments every day. It's not a New York-Los Angeles business. It's Endicott, New York to Amarillo, Texas. It's a variety of different loop combinations in which, really, a 747 is not the answer to what we are looking for."[16] In this regard, it is also significant that no new large freighter aircraft are on order and none are currently in aircraft manufacturer's production plans. Further, this situation exists despite the fact that, as previously mentioned, existing B-707 and DC-8 freighter aircraft must be removed from service by January 1, 1985 unless they are re-engined to meet new federal noise standards. Presently there are no plans by operators to re-engine any of the existing B-707 freighter fleet. Estimates of DC-8 re-engining plans vary from 74 to 120 airframes, but to-date only eight have actually been re-engined.[17] With the industry needing smaller, shorter-range, more efficient aircraft to support future domestic cargo operations and faced with the potential loss of most of the present narrow-body freighter fleet, the serious implications for the cargo capability need in the CRAF are apparent.

Summary

From the foregoing it can be seen that the nature of the air cargo industry is undergoing significant change that does not augur well for the long range cargo capability needed in the CRAF. The substantial withdrawal of the major airlines from participation in the air cargo business, the shift in the composition of freight being hauled, and the significantly increased competition in the market all point to a reduced CRAF capability in the future.

Part II: Air Cargo Fleet Analysis

Methodology

The trends already highlighted indicate that substantial change should be occuring in the the composition of the air fleets of the airline industry. This section of the analysis examines the changes in the long-range, cargo carrying air fleet and its impact on the CRAF program.

The composition of the CRAF fleet, as reflected in MAC HQ Forms 0-312, was examined over the period 1977-1982. Two data points, 1 January and 1 July, within each year were selected for analysis. Data was arrayed to provide a historical picture for each airline participating in the CRAF program by type aircraft committed (See Appendix A). Data points where a reduction in the number of aircraft committed to the CRAF program occurred were highlighted for further investigation. Operating and financial data reported by the airlines to the Civil Aeronautics Board (CAB), the Federal Aviation Agency (FAA),and other organizations such as the Air Transport Association (ATA) were analyzed to determine the cause for these reductions. The reductions were subsequently categorized as sales to domestic purchasers, sales to foreign purchasers, leases to domestic lessees, leases to foreign lessees, still owned, crashed, or unknown (anomoly in reported data, data not reported, airline no longer in business, etc.).

1977 Versus 1983

A useful beginning point is an examination of the long-range air cargo fleet composition at the beginning and end points of the period, i.e., January 1, 1977, and January 1, 1983 (See Table III-1). Currently, seventeen

airlines have committed long-range cargo aircraft to the CRAF program. This number has varied from fourteen to eighteen over the period examined with changes primarily the result of bankruptcies and mergers. Table III-2 provides a summary of the numbers, types, and capabilities of aircraft committed to the program on January 1, 1977, and January 1, 1983. It reflects a trend toward modernization in the long-range air cargo fleets. B-707s and DC-8s have declined numerically by 76% and 18%, respectively, while B-747s and DC-10s have shown 143% and 55% increases. Overall, it can be seen that there has been a net reduction of 14% (18) in the number of airframes committed to the CRAF. While the number of aircraft committed to the program has decreased, the larger capacity of the newer wide-bodied aircraft has more than offset the loss of cargo capacity experienced. In fact, cargo hauling capacity of the remaining fleet is now some 21% higher than it was in 1977. However, the increased capacity does not come without some potential costs. The reduced number of airframes increases the penalty of combat losses and reduces, to a certain extent, the scheduling flexibility of the fleet. It should also be noted that since the airlines are not purchasing new freighter aircraft, this beneficial tradeoff will not be occurring in the future. Any further reductions will represent a net loss of capability available to CRAF.

Analysis Of CRAF Reductions

Table III-3 provides a summary of the reductions in commitments to the CRAF program during the period 1977-1982 categorized by the reasons for those reductions. One hundred-thirteen reductions were noted during the period. Fifteen, or 13% were anomalies in the data or their causes were not

identified. From the remaining data, the airline industry's historical propensities when airframes are removed from the CRAF can be determined. Fifty-one percent are sold, fourteen percent are leased, nineteen percent are still owned by the airline (some retained in a non operational status), and three percent were destroyed in accidents. To ascertain the impact of these reductions on CRAF capability, however, the data must be classified with respect to the purchaser or lessee of those airframes. Sales and leases to domestic purchasers or lessees remain within or potentially available to the CRAF whereas sales and leases to foreign purchasers or lessees result in their loss to the program albeit sometimes only temporarily in the case of a lease. Viewed in this manner, it can be seen that 34% of the reductions resulted in sales or leases to domestic customers whereas 31% were sold or leased to foreign firms.

Table III-4 summarizes the reductions in CRAF commitments by type of aircraft. Here it can be seen that sales and leases of the older B-707 and DC-8 aircraft predominate. Only two of the twelve reductions in CRAF commitments of B-747 and DC-10 aircraft have been attributable to a sale or lease to a foreign customer. Sales and leases of B-707 airframes, on the other hand, are heavily wighted toward foreign customers. Twenty-four of thirty-four sales or leases (71%) were to foreign customers. This undoubtedly reflects the early decision by the airlines that re-engining of the B-707s to meet 1 January 1985 federal noise standards was not economically feasible. Of the twenty-five sales or leases of DC-8 aircraft, sixteen (64%) were to domestic firms and nine (36%) to foreign firms. This also tends to reflect an earlier airline decision that re-engining of the DC-8 would make economic

sense. With re-engining a DC-8 currently costing approximately $15-17 million and in light of the current oil glut and consequent drop in fuel prices, the economic feasibility of DC-8 re-engining may have to be re-evaluated. Should such a re-evaluation be unfavorable to re-engining, it can be expected that, as in the case of the B-707s, sales and leases of DC-8s will become heavily weighted toward foreign purchasers and lessees. Analysis to Table III-5, which portrays the status of all U.S. owned cargo capable aircraft leased out at the end of 1981, portrays much the same general pattern.

Summary

The changes occurring in the composition of the airline industry fleets as shown in the accompanying table's foretell a decline in U.S. long range cargo carrying capability. Existing trends indicate that all B-707s will be eliminated from the U.S. fleet by 1 January 1985 and that a substantial portion of the DC-8 fleet may also be lost. Further, since no new long range freighters are being bought and since sales or leases of these aircraft will undoubtedly be to foreign customers, future reductions in airframes committed to the CRAF will not be compensated for and thus represent a net loss of capability.

Part III: Conclusions

A number of conclusions can be drawn from this analysis of the air cargo industry. (1) All-cargo operations will continue to represent a relatively small segment of the major airlines business. (2) The small package sector of the market will probably continue to grow rapidly for the foreseeable future

while the heavy shipment sector will remain relatively stable or at best growing only slowly. (3) The entry of freight fowarders and regional air carriers into line haul operations, as a result of deregulation, will continue to increase competitive pressure on the major airlines' all-cargo operations, perhaps resulting in further reductions or withdrawals from the market. (4) Until excess belly capacity is more fully used, few, if any, additional long-range cargo aircraft will be purchased in the foreseeable future. (5) Future requirements for new cargo aircraft will be predominantly for small, highly efficient, non-CRAF capable airframes for use in hub and spoke operations. (6) When airlines dispose of cargo airframes approximately 31% can be expected to go to foreign operators and be lost to the CRAF. A much higher percentage is possible if the airlines decide not to re-engine their DC-8s. (7) The number of aircraft committed to the long-range cargo portion of the CRAF can be expected to decline further as B-707s are removed from service by 1985. This decline could become quite precipitous if decisions are made not to re-engine DC-8 aircraft and waivers to the 1985 noise standard regulations are not granted. Up to forty-six DC-8s representing 40% of the airframes and 30% of the cargo capacity now in the CRAF program could be lost. (8) Future losses of cargo aircraft will be more damaging to the CRAF than past reductions since no new long range cargo aircraft are entering the fleet to provide offsetting capacity.

CHAPTER IV

CRAF ENHANCEMENT

Introduction

As discussed in Chapter One, the need for additional airlift capability has been demonstrated in many mobility studies. The most recent, the Congressionally Mandated Mobility Study (CMMS) and SABER CHALLENGE-LIFT, were used as the basis for the Air force airlift acquisition program. CMMS recommended an airlift increase of 20 million ton-miles/day while assuming a 5 million ton-miles/day CRAF enhancement. However, CMMS also stated that the 25 million ton-miles/day fails to provide the rapid deployment necessary to implement the strategies outlined by the Joint Chiefs of Staff in the study scenarios. The airlift acquisition program announced in January 1982 proposed 44 additional KC-10As and 50 C-5Bs. But even the addition of these aircraft will not meet the 25 million ton-mile per day requirements as described in CMMS. SABER CHALLENGE--LIFT determined that is is more cost-effective to satisfy some of the oversize/bulk requirements using CRAF aircraft than owning and operating a force of commercially available aircraft.

It is recognized in both CMMS and SABER CHALLENGE-LIFT that if the 25 million ton-mile/day increase in capability recommended by CMMS is to be achieved, the commercial air carriers, through the CRAF Program, must make a significantly increased contribution to lift capability. However, as described in Chapter Three, the cargo CRAF fleet will, at best, stay the same, and at worst could lose 40% of its airframes and 30% of its cargo carrying capability between now and 1985 unless government intervenes. It is clear

that if DOD wishes to increase the contribution made by the commercial air carriers to strategic cargo airlift capability, the ability to carry cargo must either be retrofitted into existing passenger airframes or incorporated during airframe manufacture. The DOD program in which cargo-carrying capability is incorporated into commercial passenger aircraft in order to provide cargo capability during a CRAF activation is called the "CRAF Enhancement Program." This chapter reviews the background, objectives and progress of the CRAF Enhancement Program and discusses alternative incentives that could increase its effectiveness in encouraging airlines' participation.

Background

The basic objective of the CRAF Enhancement Program is to increase the oversize cargo capability of civil transport aircraft in the CRAF. Modifications to enhance the oversize cargo capability of existing wide-body passenger aircraft were first formally proposed to civil carriers in December 1974. Basically, the modifications included in the request for proposal would incorporate a cargo door, strengthen the floor and add a cargo roller system to wide-body passenger aircraft, making these aircraft convertible to a cargo configuration. Costs for these modifications and associated operating and maintenance expenses would be paid for by the government. In return, the Air Force would receive a 16 year commitment for the aircraft. The money paid to the carrier would be refunded if the aircraft were withdrawn from the CRAF Program. Initial carrier response offered 87 aircraft, mostly B-747s, for participation in the program. However, enabling legislation and funds approriation were not approved by the Congress.[1] Subsequent attempts to

obtain Congressional approval for the program have achieved only limited results. To date, only one DC-10-10 has been modified.[2]

Current Status

During the FY 83 budget cycle, CRAF enhancement obtained increased emphasis from the Defense Resources Board (DRB) and funding was increased and accelerated from FY 87 to FY 84. Additionally, Congress expects the Air Force to request further acceleration of the implementation of the CRAF Enhancement Program in the FY 83 Authorization Bill. To support these decisions, HQ MAC is studying the CRAF program to determine how best to ensure a successful future program to modify wide-body civil aircraft into cargo-capable aircraft.

A number of factors have combined to reduce the attractiveness of the CRAF Enhancement Program to the carriers, not the least of which is the instability of the program in the legislative and funding cycles. The perception regarding lack of support for the program within the Congress and the Administration has prompted the carriers to adopt a wait and see attitude. The carriers have gone to considerable expense several times in the past to prepare cost proposals and responses to Request For Proposals (RFP's) that have yet to result in firm contracts.

The current budget proposal provides $1,079.9 million for the total program (FY 84-FY 88) starting with $151.7 million in FY 84. This would provide funding for 19 aircraft, 6 short of the 25 aircraft desired.[3] Table IV-1 outlines the total obligational authority in the proposed budget, the funding necessary to provide for 25 aircraft, and a schedule for delivery.

TABLE IV-1

CRAF ENHANCEMENT FUNDING PROFILE[4]

	Fiscal Year						
	84	85	86	87	88	89	Total
TOA ($M)	151.7	179.4	228.9	254.2	265.7	0	1079.0
Funds Needed ($M)	192.8	256.5	273.5	291.0	372.0	0	1375.8
DELTA ($M)	+41.1	+77.1	+44.6	+36.8	+106.3	0	+305.9
ACFT Procured	4	5	5	5	6	0	25.
ACFT Delivered	0	4	5	5	5	6	25.

Source: HQMAC (XPW)

The figures above are based on an acquisition cost of $13.7M and operating and support costs of $28.1M per aircraft for a 16 year life.

Alternative Considerations

Recognizing that the CRAF Enhancement Program as structured has not received the desired results, the Air Panel of the 1982 Conference on National Strategic Mobility recommended that the Air Force revise the program.[5] Discussions at the conference paralleled those of the 1981 conference which called for solutions involving creative financing and innovations that are attractive to industry and government.[6]

Projections show no new wide-bodied cargo aircraft being added to the inventories of U.S. carriers. If the shortfalls in U.S. strategic cargo airlift are to be reduced, equitable incentives to preserve and enhance existing capabilities must be provided to U.S. carriers. Possible new incentives for participation in the CRAF Enhancement Program are leasing

options, government guaranteed loans, removal of the restrictions on the commercial use of added cargo capability, preferential assignment of government cargo to participating airlines, and some consideration for the reduced value of the aircraft at the end of its service life.

The CRAF Enhancement Modification Program also results in certain inefficiencies such as decreased payload and increased fuel consumption. The Enhancement Program should also consider the funding of additional modifications to offset these losses. Charles "Pete" Conrad, Senior Vice President for Marketing, Douglas Aircraft Company, has suggested modifications such as fuel savings probes, computers and winglets. He states that winglets alone could improve fuel consumption by more than 3%.[7]

Another area deserving consideration for funding under the CRAF Enhancement Program is the re-engining of the DC-8s now in the CRAF. As pointed out in Chapter 3, noise reduction regulations require the re-engining to be completed by January 1, 1985. The downward trend in fuel prices may make it uneconomical for the airlines to re-engine these aircraft, which include 30% of the CRAF cargo-carrying capability. If waivers to extend this deadline are not granted, the airlines will most likely require financial assistance to preserve this capability.

The CRAF Enhancement Program can only be successful by ensuring proper compensation and reward to participating carriers. In order to accomplish this, the government must guarantee a fair economic return to offset the costs caused by the addition of CRAF enhancement modification to the carrier aircraft.

Retrofit Of Used VS. New Aircraft

Another problem that has delayed implementation of the CRAF Enhancement Program is the disagreement concerning the wisdom of retrofitting older existing aircraft. Some in industry and the government believe it to be more sound to incorporate the enhancements in new wide-body aircraft only.[8] However, Attorney-at-Law John Wilson Perry, of Perry & Perry, Washington, D.C., writing in the Defense Transportation Journal, argues that the program should include the flexibility to include both new and existing aircraft. He points out the long lead time required for programming and obtaining government appropriation. He further states that carriers acquire new equipment based on current operations and that neither government nor industry can project the availability of new aircraft by the time funds for the program would finally be available. He also outlines the advantages of being able to modify either or both new and existing aircraft depending on their availability.[9] Because of the uncertainty of new aircraft purchases by the airlines, it is logical to have the option to modify either new or existing aircraft depending on which proves most efficient to meet national needs.

Ideally, all new wide-body aircraft would include features making them adaptable to military needs in time of national emergencies. Legislation, including fair compensation, could be enacted to require this. However, projections show the industry is looking primarily for smaller, shorter-range, more efficient aircraft for cargo use. With no new wide-body B-747 or DC-10 aircraft coming into domestic service in the near future, modification of existing aircraft with enough years of useful life remaining is the only way to achieve increased capability.

Recognizing that cargo aircraft capability is absolutely essential for strategic mobility and the national defense, and the fact that new wide-bodied cargo aircraft are not coming into the inventories of the U.S. carriers, there is a pressing need to preserve and enhance the existing capabilities. There are a number of problems, perceptions and expressed objections to many of the proposed solutions. The questions to be resolved are centered around the attractiveness of options for commercial airlines to participate in the CRAF Enhancement Program, the legislation required to implement and sustain such a program, funding, and industry reaction to such proposals.

The cargo-carrying airlines participating in the CRAF program have all cited funding, return on investment, and added tax or operating benefits as the primary incentives for their voluntary participation in the program. Of somewhat lesser emphasis, but nonetheless a valid perceptual problem, is the lack of consistency and high-level administration support for CRAF enhancement. The airlines are also concerned that the modification of older aircraft (i.e., B-747 and DC-10's) is not in the best interests of national defense when newer models are already in the inventory. The latest model aircraft currently flying should be the primary target for enhancement. However, if the newer models are not in service, nor being produced, the question is moot.

Leasing Options

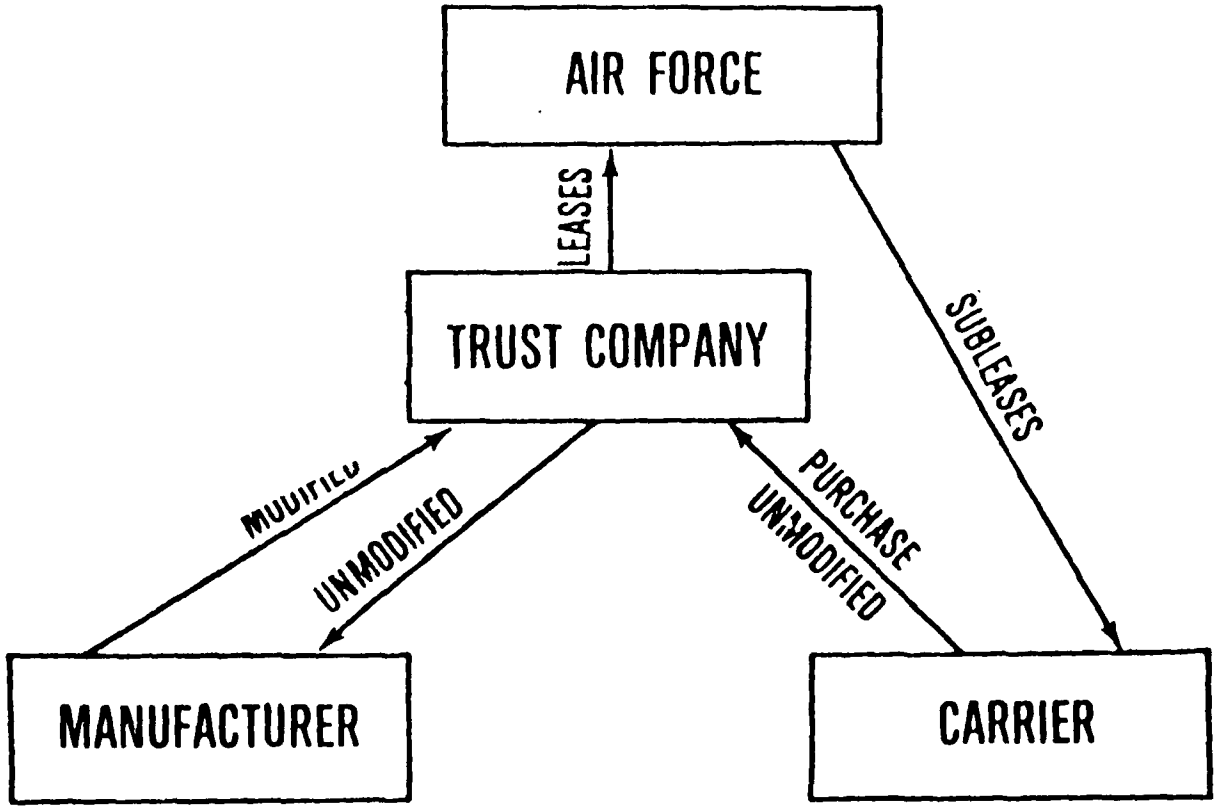
The traditional CRAF Enhancement Program covers the direct costs of conversion, loss of use of the aircraft during conversion and added operating costs after conversion, but offers no additional incentives beyond those

available to other CRAF participants. The development of options centered around leasing of aircraft through the government appears to hold the most promise for a near-term solution. A series of alternatives has been explored by MAC that considerably reduces the total cost to the U.S. Government. The new alternatives being examined include leverage leasing, a service contract scheme and a purchase lease-back arrangement. (All options assume a fixed purchase price of $22.5M per B-747 aircraft; estimated modification cost of $13.7M per aircraft; a 12-year contract; and lease payments placed in a new industrial fund designed to reduce costs of the program, or to return money to the general treasury.)[10]

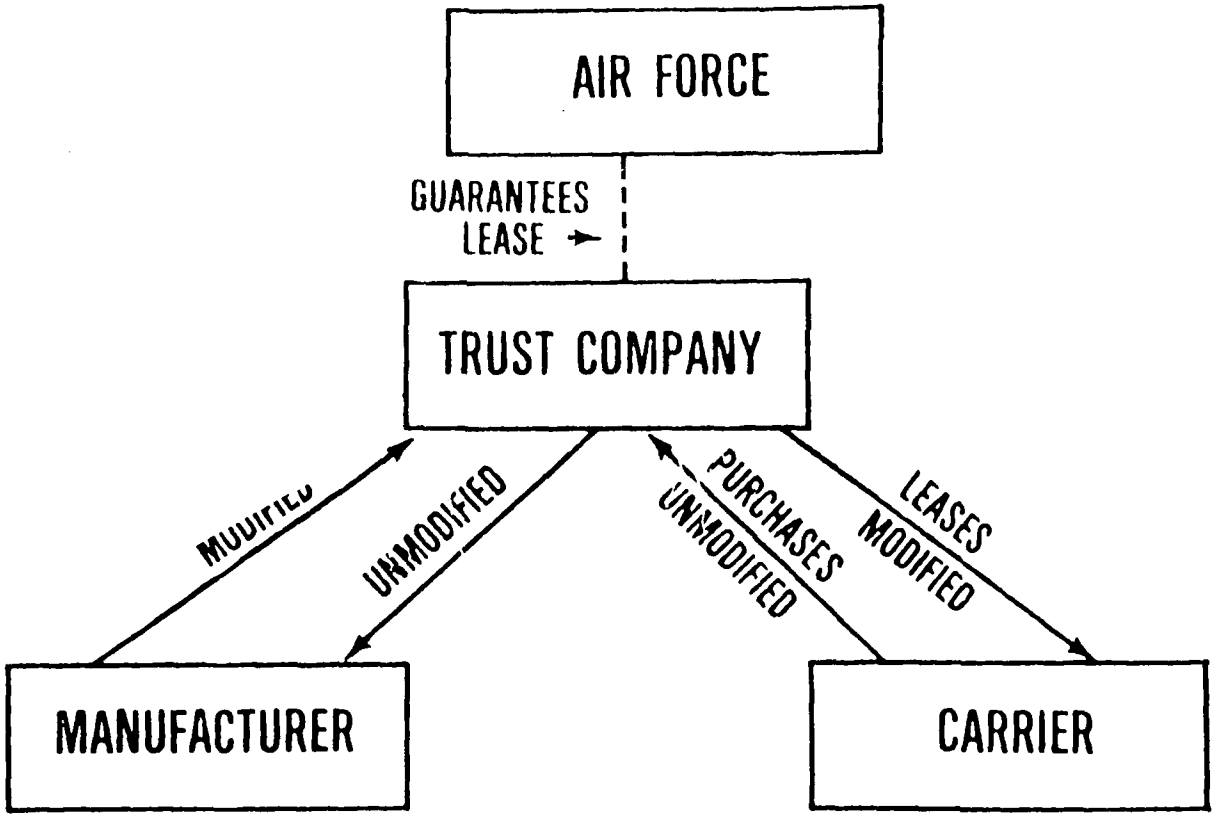
Leverage leasing involves the purchase of unmodified aircraft from the carrier by a trust company who sends the aircraft to the manufacturer for modification. The trust company then leases the aircraft to the Air Force who, in turn, subleases it to the carrier. The trust company pays all acquisition costs. The Air Force pays the trust company lease payments (operating and support costs) over the 12-year contract, and collects an equal amount of lease payments from the carriers through the sublease.[11] (See Figure IV-1)

The service contract scheme is similar to Leverage Leasing. The trust company purchases the unmodified aircraft from the carrier and has the manufacturer perform the necessary modifications. The trust company then leases the aircraft directly back to the carrier, and the Air Force guarantees the lease to the trust company. The trust company pays all acquisition costs. The carrier pays all operating and support costs through the lease. The Air Force could owe the trust company the lease payments (O&M costs) over

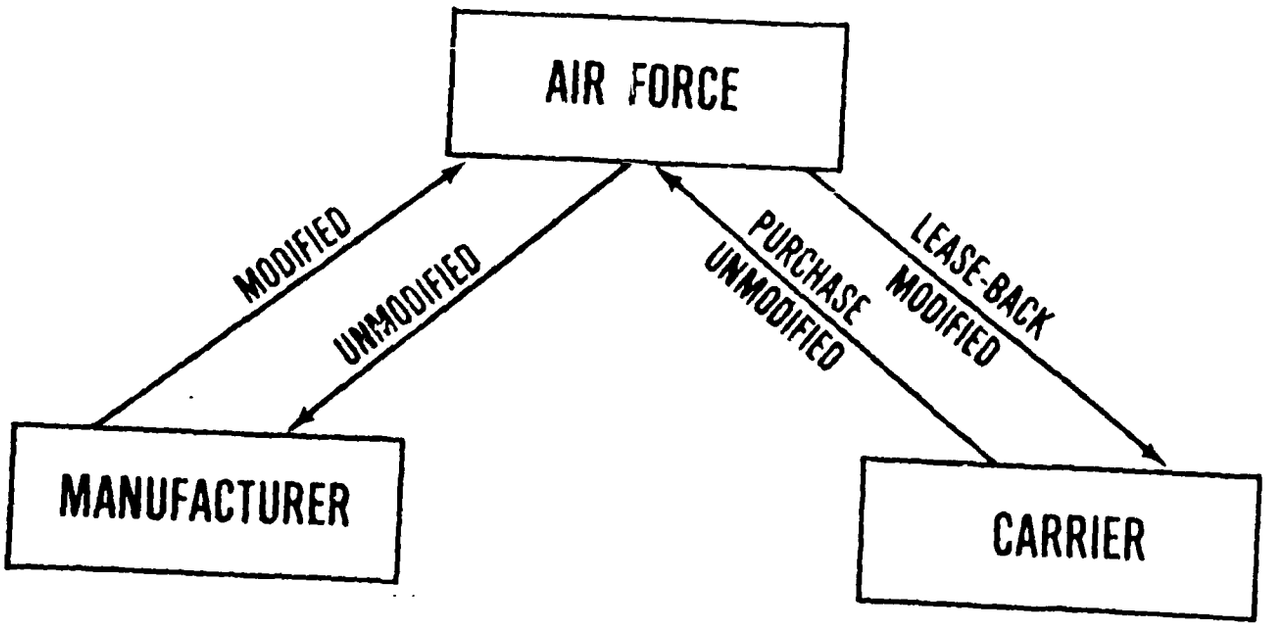
LEVERAGE LEASING



SERVICE CONTRACT SCHEME



PURCHASE LEASE BACK



the 12-year contract if the carrier defaults and no replacement can be found. (This situation could also occur in the leverage leasing option.) The service contract option is favored by the industry because of the additional investment tax credits available for the modification costs. This results in lower lease payments for the carrier, but also results in a net decrease in tax revenues for the U.S. Government.[12] (See Figure IV-2)

Purchase-lease-back involves the Air Force purchase of the unmodified aircraft directly from the carrier, payment to the manufacturer to modify each aircraft, and leasing of the aircraft back to the carrier. The Air Force pays all acquisition and modification costs; and the carrier pays, through the lease, all operating and support costs. The lease payments would be deposited in a new industrial fund to provide a revolving fund for continuation of the program.[13] (See Figure IV-3)

Any of these CRAF enhancement strategies would provide an additional 4.8 million ton miles per day capability at a significant savings over organically owned and operated aircraft. The traditional CRAF Enhancement Program is the most expensive in terms of budget outlay, but offers the lowest risks and the best acceptability to the various Congressional committees and trade associations. The leverage leasing and service contract approach would cost the Air Force nothing if all aircraft remain leased at a rate high enough to cover the cost of acquisition and modification, but does result in a decrease in general tax revenue. The purchase-lease-back option would provide a positive cash flow, but requires money up front for initial acquisition and ultimately could put the U.S. Government in a profit-making position.[17]

All of the lease options require the purchase of aircraft from the carrier. This provides a substantial cash infusion to those carriers at a

time when it is vitally needed, and but may be viewed by competing carriers as subsidization and unfair competition. The case for leasing of aircraft and subsequent leasing back to the carriers can be made, however, on the basis of national defense and should eventually be sustained, but it will likely involve lengthy legal and congressional proceedings.

The Merchant Marine Act of 1970 attempted to solve similar problems in the shipbuilding industry. Its basic flaw was the omission of long-range consistent funding to achieve its stated mandates of subsidization and contruction support ceilings to build 300 ships over a 10-year period.[18] The use of a leasing program to finance airlift cargo convertibility would minimize the need for federal funding. The leasing program does have some drawbacks, however. The government must guarantee the lease and would, therefore, be liable should a carrier, like Braniff, go bankrupt and break its lease.

Commercial Use Of Enhanced Capability

Another possible incentive to the airlines to encourage participation would be provision for the use of the enhancement capability in its commercial ventures. This could take at least two forms: (1) the use of the cargo capability for commercial purposes, and (2) an increase in the amount of government cargo to the CRAF participating airlines. Increased airlift of household goods overseas could provide additional sources of revenue to the carrier. However, such a shift of cargo modes can expect to cost considerably more and to meet considerable opposition from those modes which would lose shipment of the cargo.

A number of corollary factors must be addressed if we are to consider such a shift of cargo to commercial aircraft. The acquisition of additional C-5B aircraft requires a specified level of crew proficiency training in long-range cargo flights to assure maximum efficiency of organic airlift. The reduction of available cargoes from MAC channels could decrease the opportunities for proficiency training, as well as have a significant impact on the Airlift Services Industrial Fund (ASIF). Further, the shift of overseas household goods transportation to the enhanced CRAF fleet would decrease the volume of cargo currently supporting similarly enhanced sealift capability in the Military Sealift Command (MSC) as well as increase the DOD Transportation Bill.

The resolution of these considerations must begin with a national resolve or commitment to the need for a combined (organic and commercial) airlift and sealift program. Once that has been established, existing industrial fund criteria could be changed to accept (or waive) a level of underutilized peacetime airlift capability so that it does not reflect in inflated airlift rates. Missions flown solely for training purposes could be funded separately, outside of the ASIF. An equitable distribution of all available cargo loads between sealift and airlift could be developed as an incentive for commercial participation. These DOD and national policies, as well as others that may be necessary, can be accomplished once the commitment is made.

Summary And Conclusions

Previous efforts to obtain Administration and Congressional support for CRAF enhancement have not been successful. The airlines have lost interest in the program due primarily to the lack of consistent support and their

financial difficulties. To correct this, new and innovative approaches to financing, legislation and incentives must be pursued, along with development of a national commitment to the need for developing and maintaining an airlift capability as part of a national defense program. Lessons learned in the attempt to resolve the problems in sealift capability through the Merchant Marine Act of 1970 should be adapted to the similar problems in airlift. The designation of airlift as a national defense need, with the acceptance of some form of government financial assistance to the air carrier industry, is imperative if we are to regain the requisite strategic mobility base. As a national defense need, legislation is necessary to require military strategic mobility capabilities to be built into every aircraft as a condition for being licensed, as well as comprehensive legislation and funding for CRAF augmentation. If strategic mobility is truly a defense need, then U.S. industry and its productive innovation must be motivated to pursue courses of action compatible with that need.

Considerable time will be required to enact the legislation necessary to pursue an "Airlift Capabilities Act" and the legislation will undoubtedly encounter some strong opposition and lengthy Congressional hearings. In the near term, the most feasible options are (1) to take maximum advantage of all forms of financing available to industry and the government for the enhancement of civil aircraft, (2) to develop a means for the air carriers to use all or a portion of the enhanced cargo capability for non-defense or commercial business, and (3) to re-direct additional government cargo to airlines and enhanced aircraft participating in the CRAF and CRAF Enhancement Program.

Our research shows that the most feasible and attractive financing option to the industry is the sale of candidate aircraft from the carrier to a trust or holding company, which would have the cargo convertibility modifications accomplished and who would then lease back the airframe to the airlines. This has been defined as the service contract scheme by Military Airlift Command. The government's role is to guarantee the lease, and must pick up the lease if one of the airlines should default. The attractiveness to the air carrier is the cash infusion at a financially difficult time and the negotiation of a lease that would be comparable with the increased weight and operating costs of the enhanced aircraft, which provides a considerably lower expense than principal and interest in owned aircraft. The appeal to the trust company is the increased tax benefits, return on investment, and reduced risk.

As a means of assuring the continued operation of the civil carrier, an option to use the enhanced cargo capability of each participating airline should be developed. A proposal to be able to use the enhanced capability on a routine commercial basis, coupled with a re-direction of additional government cargo to those airliners, would also provide a means to better use the capability.

Further, the Government should consider providing financial support to the carriers to re-engine the cargo capable DC-8s in the CRAF. Every effort should be made to preserve this important segment of our cargo-carrying capability.

CHAPTER V

STRATEGIC AIRLIFT POTENTIAL OF THE BOEING B-767 AIRCRAFT

Introduction

Previous chapters have described the forces impacting on the domestic airlines and some of the results of those forces. As previously described, the United States is losing a portion of its long-range commercial airframes through sales to foreign carriers. Recognition of these losses raises the question of whether or not replacement airframes being purchased by the airlines have strategic mobility capability and potential utility to the CRAF.

Our review of the market indicates that two aircraft have the potential for replacing any DC-8, B-707, B-747 or DC-10 airframes which have been sold or will be sold. The first, the Airbus A 300/A-310 manufactured in Europe has enjoyed very limited success in the U.S. with only 30 airframes being sold in the domestic U.S. market--all to Eastern Airlines. No additional U.S. orders are pending. We believe these airframes, while successful in the foreign market, will not significantly penetrate the U.S. market, and therefore their potential to CRAF will not be discussed here.

The second airframe is the Boeing B-767. (Figure V-1) As of January 1983, Boeing had delivered 17 B-767s to domestic airlines and has 88 additional announced orders and 68 options to U.S. airlines. Because of the potentially large number of B-767 airframes in the domestic fleet, this chapter will concentrate on the potential of the B-767 to serve as a strategic mobility airlift asset. For the purposes of this examination, the following criteria have been established. To qualify as a strategic airlifter the airframe must:

Have non-refueled range of at least 3500 miles (the standard range capability for Long Range International CRAF)1

Must carry a payload of at least 208 passengers or 45,000 lbs. of cargo (equivalent to a minimum Maximum Takeoff Weight (MTOW) stretch DC-8).

Without these minimum capabilities, the aircraft would have only limited value as a strategic airlift,

Methodology

To develop an understanding of the capabilities of the B-767 all available literature on the aircraft was reviewed. On November 19, 1982, a letter (Appendix C) from the study team was sent to the Boeing Company requesting specific information which would expand and clarify data available in the literature. After receipt by Boeing of the request for information, two study team members traveled to Boeing headquarters in Seattle, Washington to further develop a detailed understanding of the aircraft's capabilities and potential to the CRAF program. Data contained in the Boeing response dated March 11, 1983 as well as other Boeing publications provided the source of most information used in this chapter. Other sources will be appropriately footnoted.

The Boeing B-767

Aircraft Specifications

In physical dimensions, the B-767 has approximately the same wingspan and length as a B-707 but has a wide-body cabin and only two engines. (Figure V-2) The wide-body cabin is designed to seat seven abreast divided by two

aisles. A variety of seating configuations are available depending upon the desires of the purchasing airlines (Figure V-3). Airplanes delivered to U.S. airlines to date are configured as follows:

TABLE V-1

SEATING CONFIGURATIONS OF ON ORDER AIRCRAFT

Airline	First Class/Tourist
United	24 / 173
American	24 / 180
Delta	24 / 186

Source: Boeing

The airframe is presently offered in four maximum takeoff weights (MTOW); 282,000 (reduced gross weight), 300,000 (standard gross weight), 315,000 (increased gross weight) and 345,000 (extended range). To date, U.S. airlines have placed 105 firm orders and hold 68 options as follows:

TABLE V-2

ON ORDER BOEING B-767s

Airlines	Firm Orders	Options	MTOW
United	39	30	300,000
American	30	0	315,000*
Delta	20	22	315,000*
TWA	10	10	315,000*
Western	6	6	315,000*

*For deliveries after September 83

Source: Boeing

The four different MTOWs are achieved without major change to the aircraft and represent expected normal growth capability. Only a few minor changes are made to some systems such as landing gear, tires, etc., to obtain the growth. As a result, the cost to achieve the increased MTOW is relatively minor. The growth is also obtained with a minimum increase in the airframe's operating empty weight (OEW).

TABLE V-3

ESTIMATED PRICES OF BOEING B-767s

B-767-200 MTOW	Operating Empty Weight* (LBS)	Increase Over Base	Price Est ($M)*	Increase Over Base
282,000	178,810	-210	$41.109	0
300,000	179,020	Base	$41.109	Base
315,000	179,020	0	$41.619	$ .510
345,000	180,400	+1380	$44.122	$3.013

*Approximate weight and price. These will vary somewhat depending on make of engine and selection of customer options. Prices are FY 82 dollars.

Source: Boeing

Since the increase in MTOW is gained with little operating empty weight penalty, the additional takeoff weight can be utilized either to extend range by carrying more fuel, or for carring heavier payloads. Figure V-4 demonstrates the trade-off between payload and range for the various models. With this basic understanding of aircraft size, range, and payload, we can now examine what its capabilities are in specific mission areas.

Passenger Capabilities

To determine the ability of the B-767 to serve as a strategic airlift

passenger carrying aircraft, we examined the capabilities of the various models to carry people 3500 miles. Passenger weights to be used for this examination will be 300 lbs. each for combat troops and 225 for non-combat individuals.[2]

TABLE V-4

TROOP CARRYING CAPABILITY OF THE B-767

	Combat Troops		Noncombat	
	# transport 3500 miles	Distance 208 Transported	# transport 3500 miles	Distance 208 transported
282,000	50	1000	67	1800
300,000	107	1750	142	2700
315,000	156	2500	208	3500
345,000	223	3700	298*	4700

*Cabin cannot be configured for that size passenger load. The unused weight could be used to carry bulk cargo in the lower deck.

Source: Boeing

As can be seen, the minimum MTOW in the B-767 which should be considered for passenger airlift is the 315,000 lb. version with the 345,000 lb. version preferred. These takeoff weights allow it to perform at least the previously defined minimum mission.

In defining the scope of this review in Chapter I, it was stated that only cargo CRAF capabilities were to be reviewed. This short discussion of the passenger capability of the B-767 is included because of the possibility that 25 B-747 passenger aircraft will be changed to cargo convertible models through the CRAF Enhancement Program. Although there is no passenger aircraft

shortfall at the present time, the loss of 25 of the 115** domestic passenger B-747s, (and most B-707 and DC-8s) from the passenger CRAF program by 1985 may cause a passenger shortfall. In such a case, the B-767 in MTOW's is greater than or equal to 315,000 lbs. offers a possible replacement capability. In addition, strategic airlift movement planners may prefer the use of the B-767 to the shorter ranged DC 10-10s currently in the CRAF. Although the B-767 carries a smaller passenger load, the ability to transit most critical legs without refueling may offer sufficient advantage to displace the larger load DC 10-10s that must make an enroute stop.

Cargo Capability

The discussion of the potential cargo carrying capability of the B-767 is more complex than the rather straightforward assessment of its passenger capability for two reasons. First, at the present time, there is no cargo version of the B-767 and none is planned until 1986 at the earliest. Further, the probability of a cargo version of the B-767 being developed and commercially sold is diminished by the slow growth in long range, over 70 lb. per package air freight market and the sizeable growth in belly cargo capacity as described in Chapter III. These trends significantly diminish the probability of sufficient domestic commercial demand developing for a cargo version to warrant the research and development expenditure. Without actual

**149	Total B-747s in operation with domestic airlines[3]
- 34	Total B-747s committed to cargo CRAF[4]
115	Passenger B-747s potentially available to CRAF
-110	Passenger B-747s committed to CRAF[5]
5	Domestic B-747s in use but not committed to CRAF

hardware to examine, discussions of capabilities, weights, ranges, carrying capacities, costs, etc., are bounded by a degree of uncertainty. Further, the manufacturer, Boeing, is the sole source for performance data and cost estimates.

The second element which complicates the examination of the cargo capabilities of the B-767 is the number of variables involved. To simplify the examination of the B-767 as a potential CRAF cargo aircraft, two alternatives will be considered. The first alternative will examine the costs associated with incorporating the minimum enhancements which will allow the aircraft to meet the predefined minimum requirement--to carry 45,000 lbs. 3500 miles. We will call this the "minimum capable configuration." The second alternative to be examined will be a "fully capable" convertible freighter which maximizes the available capabilities of the airframe. (Both alternatives examined are adding cargo capability to a passenger aircraft. If the B-767 was bought as a freighter, the freight hauling capability would be greater than the "fully capable" (convertible.)

Since there is only a small probability of significant numbers of freighter versions of the B-767 entering service with domestic air carriers, if the military wishes to exploit the cargo capabilities of the B-767, it will have to be, in all probability, through some form of enhancement program. As discussed in Chapter IV, DOD would pay for the inclusion of features which would allow a passenger airplane to be converted quickly to a cargo airplane when required. Therefore, the potential costs to DOD, as well as capabilities, will be discussed. All costs will be stated in constant FY 82 dollars.

Modifications and additions to a passenger plane to provide cargo capability usually are broken down into the following four categories:

1. Cargo floor structure including strengthened body frames and floor beams.

2. A 134 inch cargo door and door surrounding structure.

3. Cargo handling system hardware, usually in a kit form, which will be installed on the aircraft floor after removal of passenger peculiar equipment such as seats, galley, and lavatories.

4. Convertible passenger accommodations and miscellaneous conversion provisions such as revised control cable routing, revised decompression venting, providing cargo compartment lighting, and revised passenger accommodations from fixed to convertible configuration.

An aircraft equipped with these features would be able to fly with a commercial airline during peacetime in a passenger configuration. During a CRAF activation, the passenger features would be removed and the cargo handling kit would be installed. The main deck cargo floor of the [illegible] to handle palletized cargo in two configurations; either two pallets abreast or a single row of pallets. (Figures V-5 & V-6) For simplification, all further discussions of pallet loads will assume the single row of pallets with the 108 inch dimension across the fuselage. Although this is a less efficient configuration for utilizing the available cube of the main deck, it offers an operational advantage of requiring minimum contouring of the built-in pallet [illegible].

Each of these additions entails an acquisition cost. Each addition also adds operating weight to the aircraft when in passenger service. This added weight increases fuel consumption and therefore operating costs. Based on information furnished by Boeing, we can estimate the acquisition costs, weight and added operating costs for 16 years of operation associated with each of these categories. Because of uncertainty, a high/low range has been developed:

TABLE V-5

WEIGHTS AND COSTS OF CARGO PROVISIONS

Category	Acquisition Cost($M) High	Low	Weight (LBS) High	Low	Operating Cost($M) High	Low
Cargo Floor	.700	.556	3040	2280	1.014	.760
Cargo Door	1.401	1.113	3120	2340	1.040	.780
Cargo Handling System	.832	.661*	1200	900*	.400	.300
Convertibility	1.445	1.148	640	480	.213	.160
Total	4.378	3.478	8000	6000	2.667	2.000

*The weight estimate includes only those components which remain in the airplane at all times. The price estimate also includes the cargo handling hardware which is removable and stored in kit form.

Minimum Capable Configuration

The minimum capable configuration would begin with the 300,000 MTOW. To this model would be added the cargo door, the cargo handling system and all the convertible conversion provisions. As can be seen by Figure V-7, the aircraft is limited by MTOW and not floor capacity. Therefore, the floor would not need to be strengthened. The existing passenger floor which is built to support 53 lbs. per running inch could be used since the passenger floor design would allow a maximum load of 64,000 lbs. on the main deck which exceeds the 45,000 lb. payload the aircraft can carry 3500 miles. Light vehicles such as the M-151, M-880 series, Commercial Utility Cargo Vehicle (CUCV) and the High Mobility Multipurpose Wheeled Vehicle (HMMWV) could be carried if a flooring of pallets were laid to spread and distribute the load

evenly. (Figure V-8 & V-9) One significant limitation should be noted. None of the 14 463L pallets could be loaded to more than 4600 lbs. and could average only 3200 lbs. The "Saber Thrust"[6] study determined that the expected average weight of a loaded cargo pallet during a contingency is 4500 lbs. Therefore, approximately 50% of expected pallet loads could not be carried in this configuration B-767 because of weight.

The DOD would be responsible for the following costs associated with converting a passenger aircraft to this minimum capable convertible cargo configuration:

TABLE V-6

COST OF MINIMUM CAPABLE CONFIGURATION

	High	Low
Cost Over Base for MPOW	0	0
Cargo Floor	0	0
Cargo Door	1.401	1.113
Cargo Handling System	.832	.661
Convertible Accommodations	1.445	1.148
Increased Operating Costs*	1.653	1.240
Lost Airline Revenues*	2.500+	2.000+
Total	7.831+	6.162+

*Estimates based on typical airline operation.

The cargo convertible features will add 4000 to 6000 lbs. to the empty operating weight of the passenger aircraft. This additional weight not only increases operating costs for fuel, but may displace revenue producing passengers or cargo. As Figure V-7 shows, the potential lost revenue is applicable throughout the operating profile.

This configuration meets or exceeds the minimum criteria established. It will carry 45,000 lbs. 3500 miles, loaded on 14 pallets to a maximum weight of 4600 lbs. each. The major advantage of this configuration is that it minimizes the cost to the government. Major disadvantages are:

1. Provides little flexibility in loading of pallets since no pallet position can weigh more than 4600 lbs.

2. Does not take advantage of the full inherent capability in the B-767 airframe.

3. Would be applicable to DOD only, and would have little commercial cargo usefulness. As such, it may encounter airline opposition.

4. Most if not all of the weight carrying capacity would be consumed on the main decks thereby wasting the considerable cube available in the lower deck. (Figure V-10)

Fully Capable Convertible Freighter

In this alternative, we will increase the MTOW to 345,000 lbs. and incorporate a fully capable cargo floor. The cargo floor will be designed to 146 lbs. per running inch. Costs associated with this alternative are estimated as follows: (Operating costs are estimated for a 16 year period.)

TABLE V-7

COSTS OF FULLY CAPABLE CONVERTIBLE

	High	Low
Cost Over Base for MTOW	3.013	3.0113
Cargo Floor	.700	.556
Cargo Door	1.401	1.113
Cargo Handling System	.832	.661
Convertible Accommodations	1.445	1.148
Increased Operating Costs*	2.667	2.000
Lost Airline Revenues*	0	0
Total	10.058	8.491

*Estimates based on typical airline operation.

As can be seen Figure V-11, this configuration will be capable of transporting 75,000 lbs 3500 miles on 14 main deck pallets loaded to an average of 5360 lbs., but up to 12,000 lbs. per pallet position. (The 88x108 463L pallet is designed to carry up to 10,000 lbs. Although it is doubtful that a 463L pallet would be loaded to a weight in excess of 10,000 lbs. some 8ft x 8ft x 10ft commercial containers may exceed 10,000 lbs., since their design weight limitation is 15,000 lbs.) It should be noted that the 5360 lbs. average pallet weight is not considered a limitation. This configuration's capability to average 5360 lbs. per pallet is significantly above the 4500 average pounds per pallet predicted by the "Saber Thrust" study.[7]

No cost is anticipated for "Lost Airline Revenues" associated with the increased operating empty weight since the revenue generating payload capacity of the 345,000 lb. version with convertible modifications while operating in a passenger configuration is approximately equal to the 300,000 and 315,000 lb. version without modification. In fact, on longer trips the modified 345,000

lb. version exceeds the other two versions and could be exploited by the owning airlines. (See Figure V-12)

Comparison Of Two Alternatives

The two alternatives can be compared in a variety of ways such as pounds moved 3500 miles, miles able to move 45,000 lbs., and cost per pound moved. The following table compares the two alternatives in a variety of ways. Comparisons are based upon the high cost estimates.

TABLE V-8

COMPARISON OF 300K and 345K MTOW ALTERNATIVES

	Minimum Capable (300,000)	Fully Capable (345,000)
Pounds Moved 3500 Miles	45,000	75,000
Miles Able to Move 45,000 lbs.	3,500	5,300
Cost Per lb. Moved 3500 Miles	$174	$134

Source: Boeing Airplane Company.

This comparison indicates that the fully capable aircraft provides more cost effective airlift capability. Not only is it cheaper on a "per pound basis" than the minimum capable configuration, but it also provides important advantages in the event of a non-NATO contingency. In the Pacific, a 345,000 lb. B-767 can fly non-stop from McCord AFB, Washington to Kimpo, Korea with over 45,000 lbs. of cargo. In a Middle Eastern crisis, such an aircraft can fly nonstop from McGuire AFB to Cairo Egypt with almost 50,000 lbs. of cargo. In the NATO scenario, the 345,000 lb. convertible would allow the

loading of 14 463L pallets on the main deck to an average of 2.3 tons per pallet (MAC estimate of average bulk cargo weight per pallet)[8] and still carry over 10,000 lbs. of cargo in the lower lobe.

Does The B-767 Fill A DOD Need?

If the fully capable B-767 is the proper alternative to select, one still must address whether any B-767 is a proper selection to enhance for strategic airlift cargo carrying duty. Said simply, "Is the fully capable B-767 a proper choice compared to other airframe alternatives, and can it contribute to reducing the airlift shortfall?"

First, let us examine the first part of the question by comparing the capabilities of the B-767 to the C-141B and then to a B-747-100 which has been modified through retrofit to a convertible at a MTOW of 750,000 lbs.

TABLE V-9

COMPARISON OF THE C-141B TO THE B-767

	C-141B	B-767
# of Main Deck 463L Pallets	13	14
Weight Carried Dover to Ramstein	50,000	75,000
Main Deck Cube Ft	7,024	7,330
Lower Lobe Cube Ft	0	3,070
Total Cube Ft	7,024	10,400
Carry Bulk	Yes	Yes
Carry Oversize	Yes	Some
Max Container Size	8x8x40	8x8x10
Largest Wheeled Vehicle	5 ton	1 1/4 ton

Source: C-141B, USAF Reg: 76-2
B767, Boeing

As can be seen, the B-767 compares favorably with the C-141B. The main constraint for the B-767 is the 134 inch cargo door which restricts the size of cargo which can enter. The comparison of a B-747-100 convertible to the B-767 convertible follows:

TABLE V-10

COMPARISON OF THE B-747 TO THE B-767

	B-747-100	B-767
# Main Deck 463L Pallets	33	14
Weight Carried McGuire to RheinMain	200,000	81,000
Main Deck Cube Ft	20,770	7,330
Lower Lobe Cube Ft	5,990	3,070
Total Cube Ft	26,760	10,400
Carry Bulk	Yes	Yes
Carry Oversize	Yes	Some
Max Container Size	8x8x20	8x8x10
Largest Wheeled Vehicle	5 Ton	1 1/4 Ton
Cost to DOD (Mil$)	41.80[9]	10.05
Cost Per Pound Moved	$209	$ 124
Cost Per Cubic Ft Moved	$1562	$1035

This analysis indicates that on a "cost per pound moved" or on a "cost per cubic foot of cargo space" the B-767 compares favorably with the B-747-100. It should be noted that the B-747 "Cost to CRAF" includes the revenues lost to the owning airline while the aircraft is out of service being retrofitted.

To this point, the analysis of the B-767 has examined only the capability of a B-767 convertible freighter, and the cost effectiveness to DOD of buying that capability through the CRAF Enhancement Program. From the analysis, the reader can see that the B-767 is a very capable airplane, has longer legs, greater cube and greater weight carrying capacity than an unrefueled C-141-B.

In addition, it is cheaper to add capability to the CRAF by including convertible provisions during the manufacture of B-767's than by retrofitting B-747's when measured on a cost per pound delivered or cost per cubic foot of cargo space available. To this point, the question that has not been asked is "Is the type of cargo capability available through the use of the B-767 what DOD needs?" The answer to this question is clearly "Yes." The B-767 appears to offer great potential as a very efficient bulk cargo carrier with some oversize capability.

The shortfall in outsize capability is being addressed and partially rectified with the proposed purchase of an additional 50 C-5Bs. Assuming the completion of the C-5B purchase, a recent USAF/SA study estimates that 100 B-747 cargo equivalents could be added to the CRAF before the outsize capability becomes the limiting factor in unit closure dates.[10] As described in Chapter Four, the DOD POM presently contains an initiative to retrofit 25 B-747's to a cargo convertible configuration. This initiative will provide 25% of the bulk/oversize capability needed to complement the new C-5 buy. The B-767 convertible offers significant capability to fill the remaining 75%. It should be understood that the B-767 is not a substitute for the B-747. The B-747 is capable of carrying oversize items which cannot be carried in a B-767, but just as the B-747 complements the C-5B by allowing it to concentrate on outsized cargo, so will the B-767 complement the B-747 by allowing it to concentrate on oversize cargo.

Other Potential Limiting Factors

There are two remaining factors which could potentially limit the utility of the B-767 to the CRAF fleet. The first factor is that most B-767s are being

bought with a cabin configured for a two man crew. Federal Air Regulation (FAR) 121.385, Composition Of Flight Crew, states that "no certificate holder may operate an aircraft with less than the minimum flight crew in the airworthiness certificate of the aircraft flight manual approved for that type aircraft; and required by this part for the kind of operation being conducted." FAR 121.389, Flight Navigator and Specialized Navigation Equipment, states that "no certificate holder may operate an airplane outside the 48 contiguous states and the District of Columbia, when its position cannot be reliably fixed for a period of more than one hour, without:

(1) A flight crewmember who holds a current flight navigator certificate;

(2) Specialized means of navigation approved in accordance with 121.355 which enables a reliable determination to be made of the position of the aircraft by each pilot seated at his duty station."

The B-767 has the specialized navigational equipment required to comply with FAR 121.389 and therefore crewmember requirements should not be a factor.

The second factor that must be considered if the B-767 is to be used in a passenger CRAF role is that it has only two engines. FAR 121.161 states "Unless otherwise authorized by the Administration, based on the character of the terrain, the kind of operator, or the performance of the airplane to be used, no domestic or flag air carrier may operate in any operations, and no supplemental air carrier or commercial operator may operate in passenger-carrying operations, a two-engine or three-engine airplane (except a three-engine turbine-powered airplane) over a route that contains a point farther than one hour's flying time (in still air at normal cruising speed with one engine inoperative) from an adequate airport." This FAR paragraph

stems from the old Civil Aviation Rules which were drawn up in the 1940s. The text was revised again in 1953 and became Part 121.161 of the FAR, which is still in force. Another regulation, Paragraph 4.1.1 of Annex 6 to the International Civil Aviation Organization Regulation prevents those operators who do not fall under U.S. jurisdiction from flying the big twin jets on routes which are more than 90 minutes from an alternate airfield.

These limitations, both national and international, came into being at a time when the reliability of engines during cruise was not what it is today, and the rules are now difficult to justify. According to very conservative estimates produced by Airbus Industries based on the current operating statistics of the GE CF6-50 and Pratt and Whitney JT9D-59A, the probability of losing both engines while at cruise is less than 5.7×10^{-10}. To put that into perspective, the probability of an in-flight shutdown of 10^{-9} per flying hour corresponds to one shutdown in 200 years of U.S. domestic operations.[11]

Recognizing this low risk, a certain flexibility of interpretation has been given to the FAR by the FAA. Eastern Airlines, for example, has benefitted from an exemption since 1977 which allows it to operate its Airbus A300 between New York and San Juan in Puerto Rico--the 60 minute limitation has been increased by special FAA authorization to 75 minutes. Air Florida obtained a similar authorization in 1980 to operate Boeing 737s between New York and Porto Plata in the Dominican Republic. However, further relaxation of the 60 minute rule for commercial passenger air carriers is not expected soon. In a February 4, 1983 speech, Mr. J. Lynn Helms, Director of the Federal Aviation Administration, indicated a reluctance to ease the 60 minute rule.[12]

Although the 60/90 minute rule is a factor during current day operations, it is felt that during a mobilization or CRAF activation, a waiver would be justified. Therefore, the 60 minute rule should not be a limiting factor in using the B-767 to supplement the CRAF passenger capability.

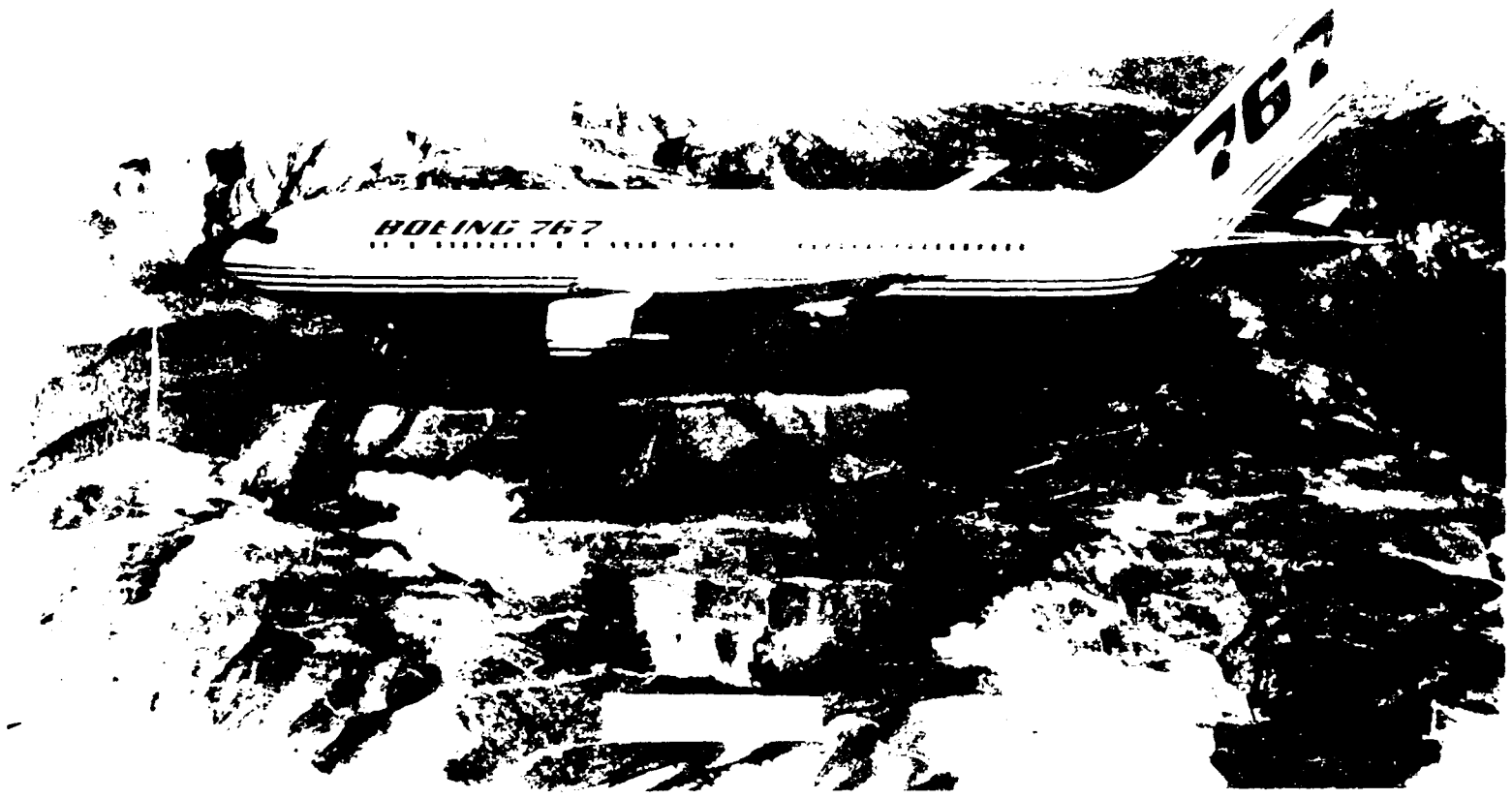
Conclusions

This chapter has provided a discussion of the present and future capabilities of the Boeing B-767 aircraft to support strategic airlift requirements. Presently, the aircraft scheduled to be delivered in the 315,000 MTOW configuration can contribute meaningfully to strategic passenger airlift. However, to take advantage of this capacity, a standby waiver from FAA to exempt CRAF aircraft from the 60 minute rule when operating during a contingency should be sought by DOD.

In the longer term, the B-767 promises to be very efficient and cost effective bulk cargo hauler with some oversize cargo capability. If the acquisition of the C-5-B aircraft proceeds as planned, and complementary bulk and oversized hauling capability is required, the B-767 should be recognized as a very attractive source for that capability. It should be noted, however, that it is unlikely that a significant number of cargo or convertible B-767s will be sold to the domestic air carriers. Therefore, to take advantage of the inherent capability in the airframes will require the DOD to enhance passenger B-767s to a convertible configuration.

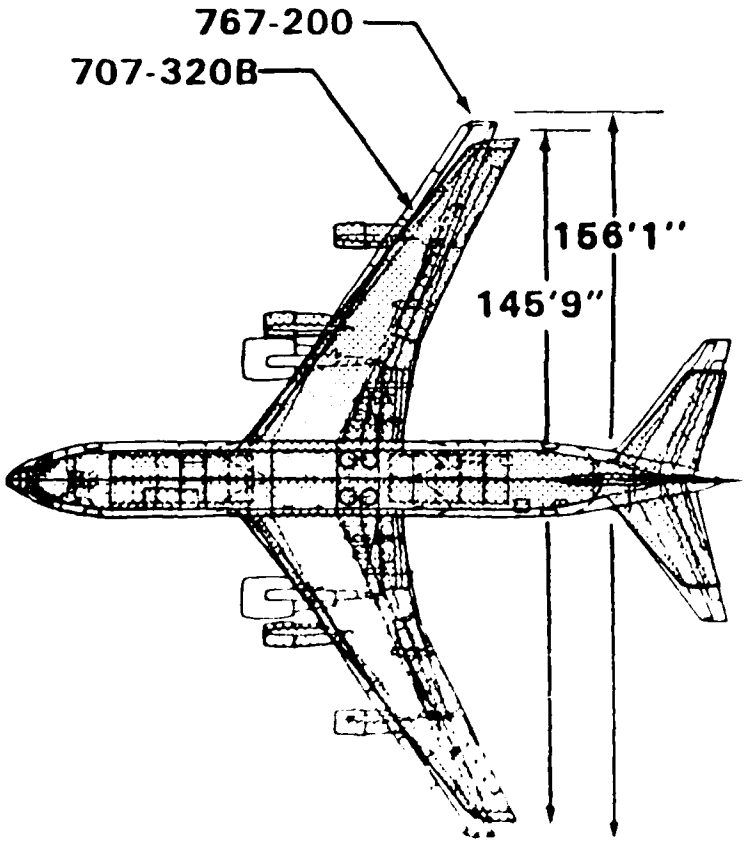
The least costly time to incorporate the convertible features into the airframe is when the aircraft is being built. In that way the government avoids paying "downtime costs," which is the loss of revenue to the airline

while the aircraft is out of service being modified. These costs can be substantial. Budget planning and programming should begin now so that airframes scheduled for production in 1986 can be modified during assembly. Prior budgeting also allows the government to minimize "delay costs,"--costs to the airline resulting from delays in production while cargo convertible features are incorporated into the airframe. Advanced budgeting will allow the government to conclude negotiations in time to permit the early ordering of convertible unique components and thereby minimize production delays. These costs can be a significant portion of contract costs. For example, the "Delay Costs" paid for the DC-10-10 recently modified under the CRAF enhancement program ran $5.7 million, 36% of the total enhancement contract cost of $15.9 million.[13] If "delay cost" and "downtime costs" are to be minimized, a continuing commitment to CRAF Enhancement funding, and advanced budgeting will be necessary.


BOEING 767
767

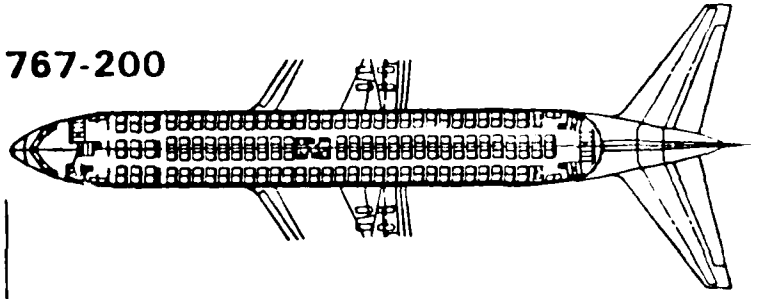
SIZE COMPARISON

767-200/707-320B

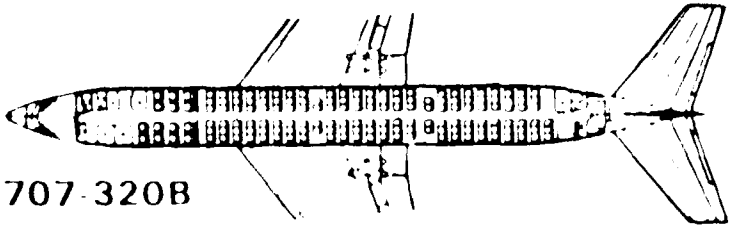


- 767-200 HAS 29% MORE PASSENGERS

767-200



APPROX SAME AIRPLANE LENGTH

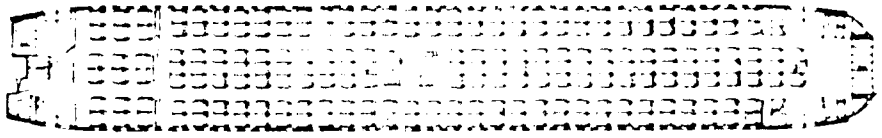


707-320B

INTERIOR ARRANGEMENTS

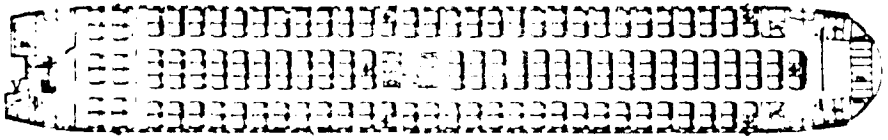
787-200

FIRST CLASS VARIATIONS

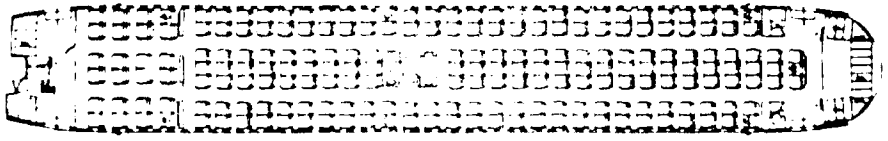


BASIC

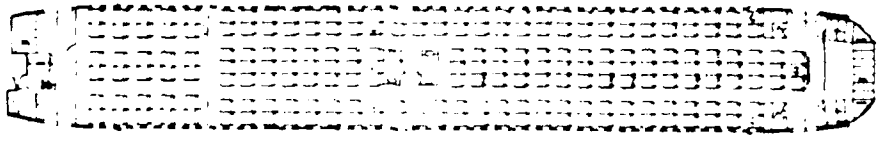
18 FIRST CLASS - 38 IN. PITCH 193 TOURIST - 34 IN. PITCH
211 PASSENGERS



12 FIRST CLASS - 38 IN. PITCH 200 TOURIST 34/33 IN. PITCH
212 PASSENGERS



24 FIRST CLASS - 38 IN. PITCH 186 TOURIST - 34/33 IN. PITCH
210 PASSENGERS



30 FIRST CLASS - 38 IN. PITCH 177 TOURIST - 34/33 IN. PITCH
207 PASSENGERS

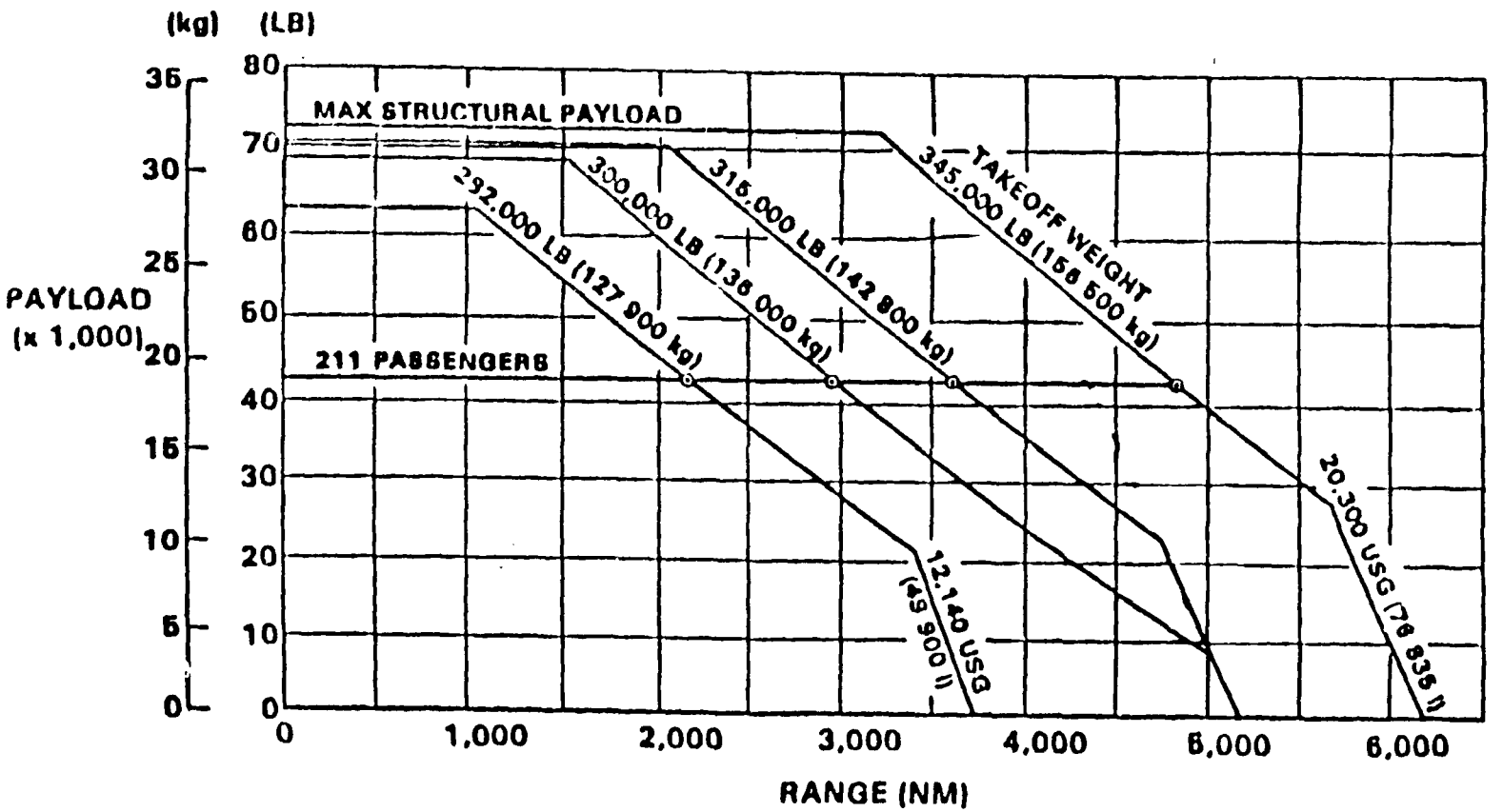
FIGURE V - 3

FIGURE V-4

PAYLOAD - RANGE (JT9D-7R4D/E ENGINES)

ATA DOMESTIC RULES, MIXED CLASS

- NOMINAL PERFORMANCE
- CRUISE .80M AT 35-39,000 FT

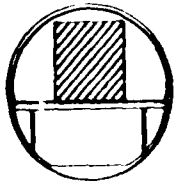


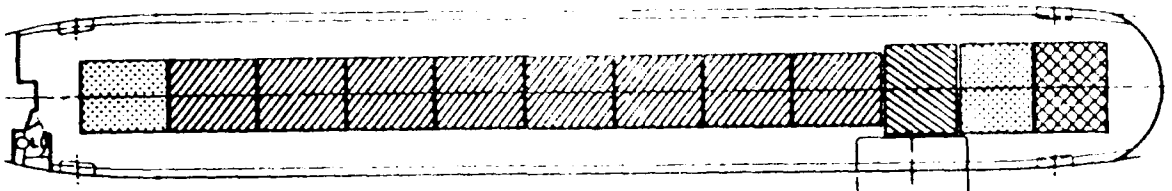
MAIN DECK PAYLOADS

767-200C, AFT MAIN DECK DOOR

PRODUCT DEVELOPMENT STUDY

RECTANGULAR PALLETS



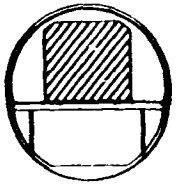


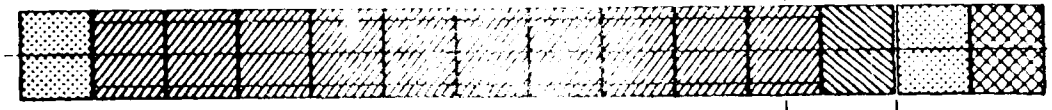
(8) 88" x 108" x 96" = 3,920 FT³
(2) 88" x 108" x 78" = 780 FT³
(1) 88" x 108" x 88" = 440 FT³
(1) 88" x 108" x 74" = 370 FT³

MAIN DECK VOLUME, FT³

5,510

CONTOURED PALLETS

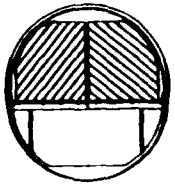


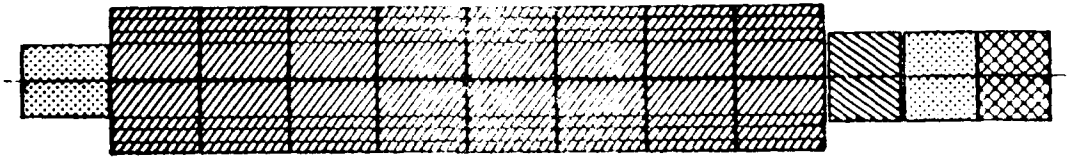


(10) 88" x 108" x 96" = 4,800 FT³
(2) 88" x 108" x 78" = 780 FT³
(1) 88" x 108" x 88" = 440 FT³
(1) 88" x 108" x 74" = 370 FT³

6,390

CONTOURED PALLETS





(16) 88" x 108" x 96" = 6,960 FT³
(2) 88" x 108" x 78" = 780 FT³
(1) 88" x 108" x 88" = 440 FT³
(1) 88" x 108" x 74" = 370 FT³

8,550

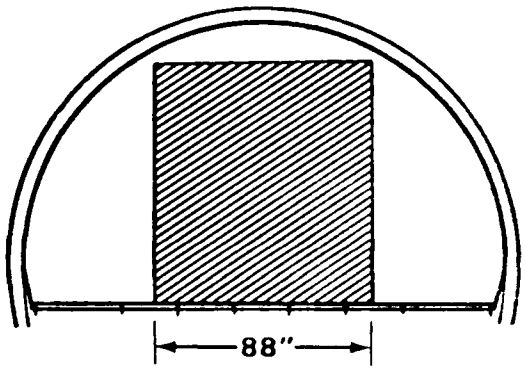
FIGURE V-5

CROSS - SECTION

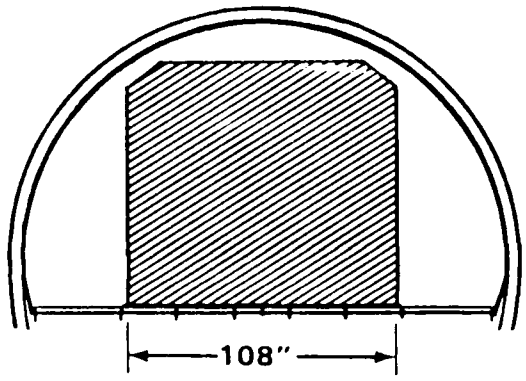
767-200C/F, WITH TYPE 463L PALLETS

PRODUCT DEVELOPMENT STUDY

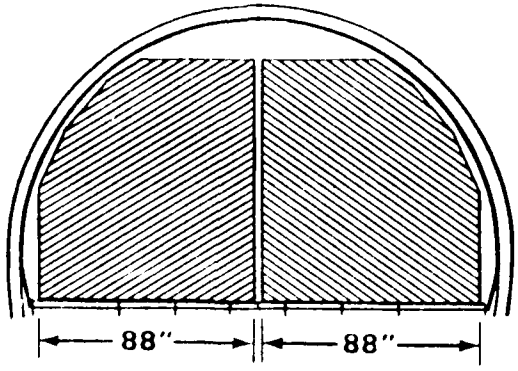
88" x 108" PALLET (96" HIGH)
490 FT³



88" x 108" PALLET (96" HIGH)
480 FT³



88" x 108" PALLET (96" HIGH)
435 FT³



NOTE: INTERNAL PALLET VOLUME SHOWN

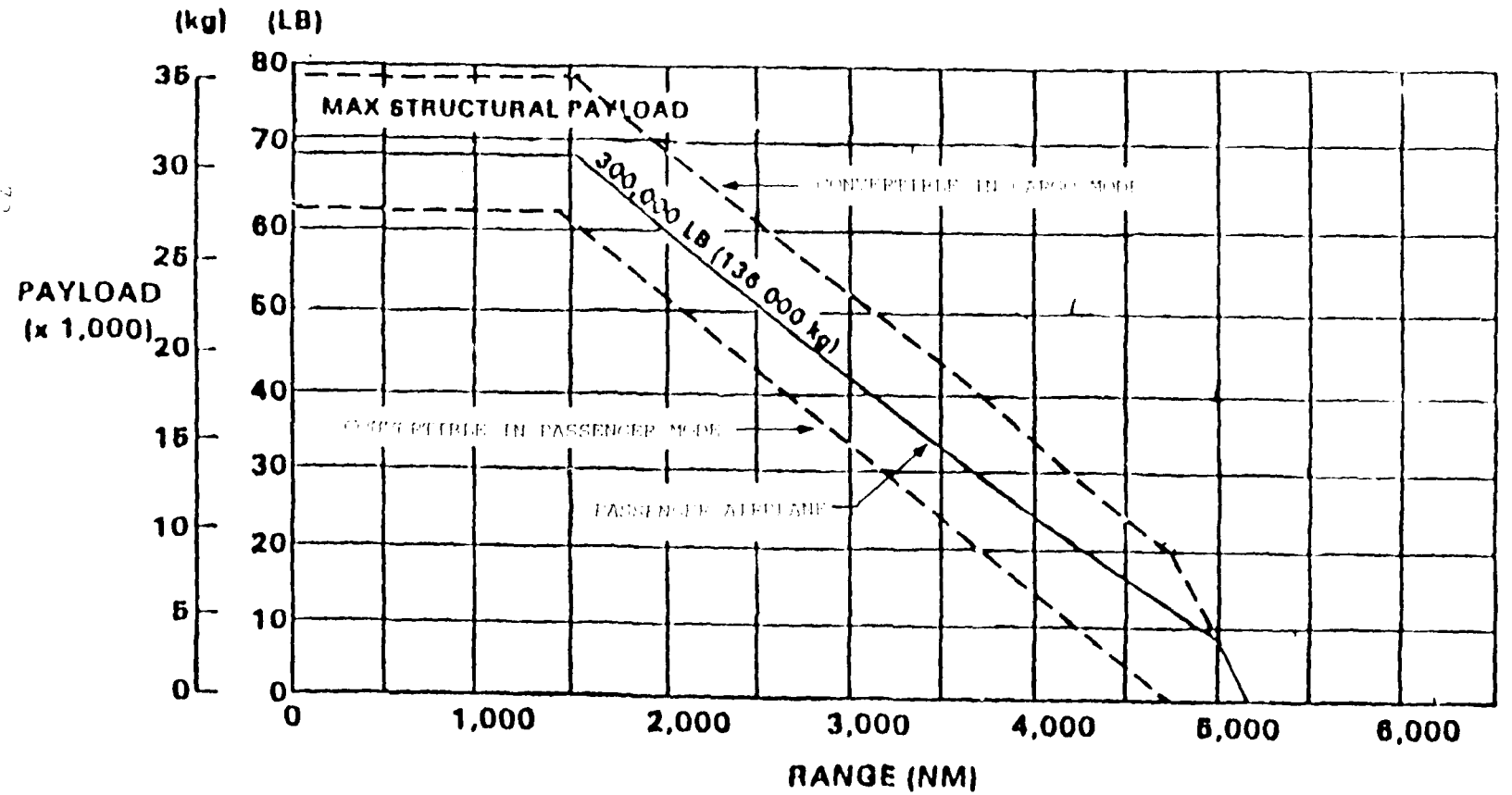
FIGURE V-6

FIGURE V-7

PAYLOAD - RANGE (JT9D-7R4D/E ENGINES)

ATA DOMESTIC RULES, MIXED CLASS

IMPACT OF ADDING CARGO CONVERTIBILITY
TO 767 PASSENGER AIRPLANE WITH
300 K MTOW



MAIN DECK PAYLOADS

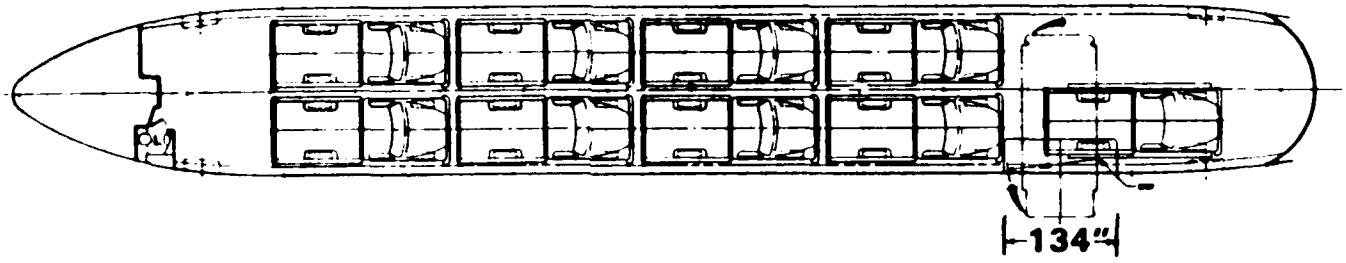
767-200C/F WITH MILITARY VEHICLES

PRODUCT DEVELOPMENT STUDY

TOTAL WT. OF VEHICLES (LB) (INCLUDING TARE)

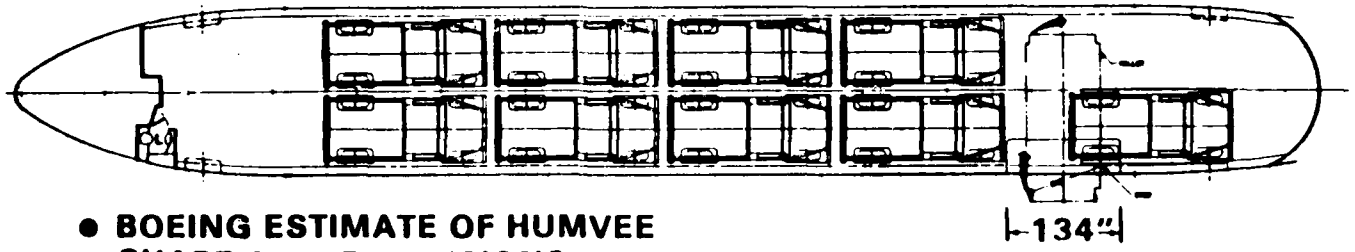
WITH 1¼ TON TRUCKS

47,900 (EMPTY)
70,400 (LOADED)



47,800 (EMPTY)
70,300 (LOADED)

WITH 1¼ TON HIGH MOBILITY MULTI-PURPOSE VEHICLES



- **BOEING ESTIMATE OF HUMVEE SHAPE AND DIMENSIONS**

FIGURE V-8

MAIN DECK PAYLOADS

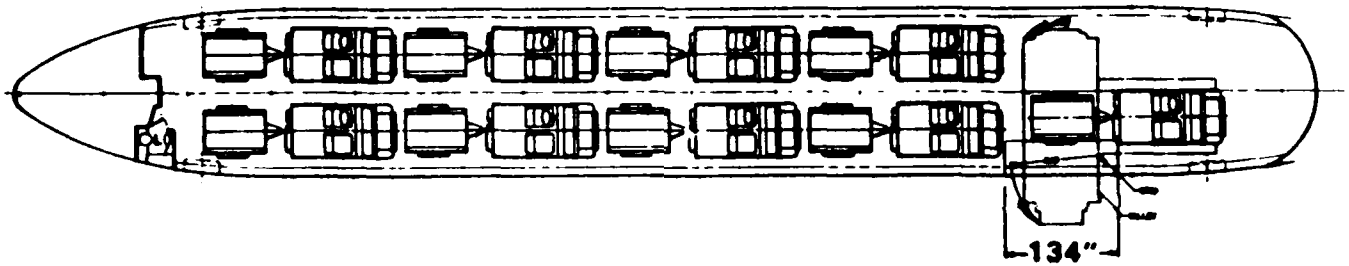
767-200C/F WITH MILITARY TRUCKS

PRODUCT DEVELOPMENT STUDY

TOTAL WT. OF VEHICLES (LB) (INCLUDING TARE)

WITH ¼ TON TRUCKS AND ¼ TON TRAILERS

32,500 (EMPTY)
37,000 (LOADED)



WITH ¾ TON TRUCKS

31,200 (EMPTY)
38,700 (LOADED)

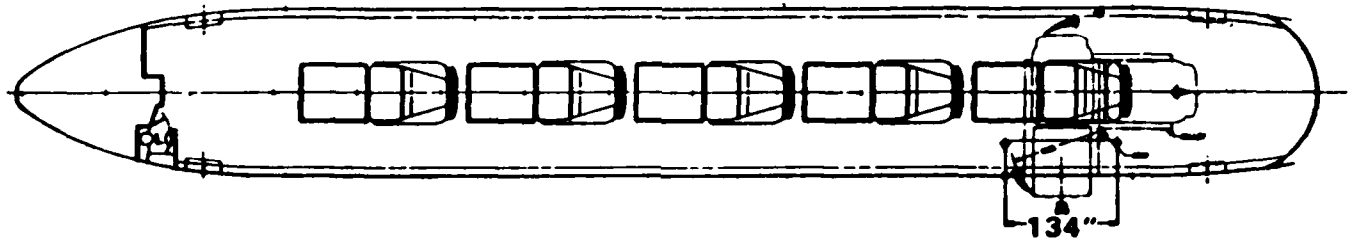
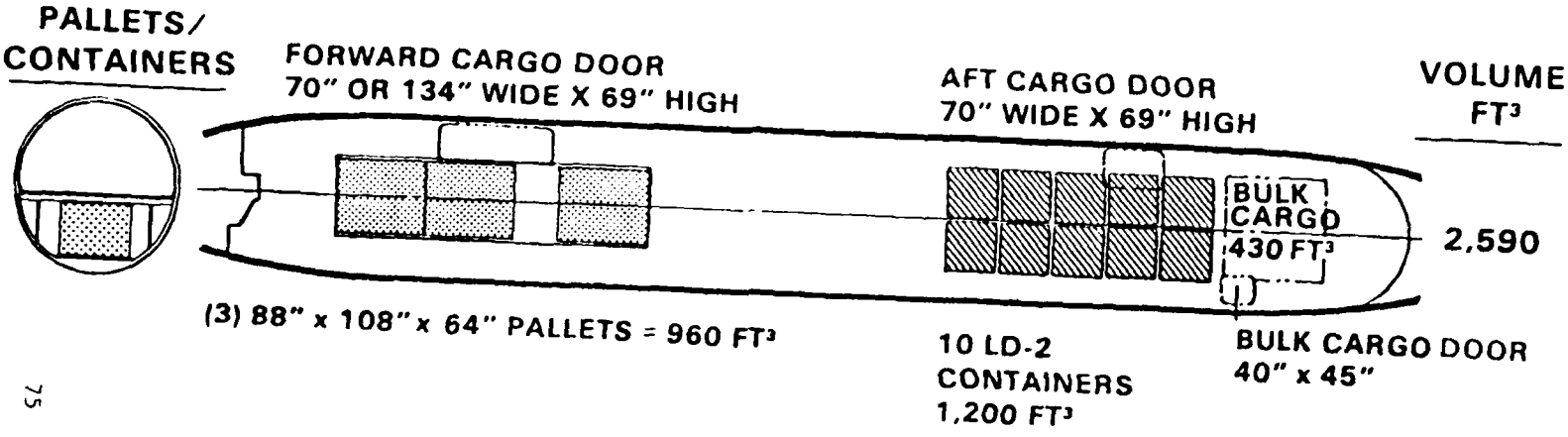


FIGURE V - 9

LOWER DECK PAYLOADS

767-200

PRODUCT DEVELOPMENT STUDY



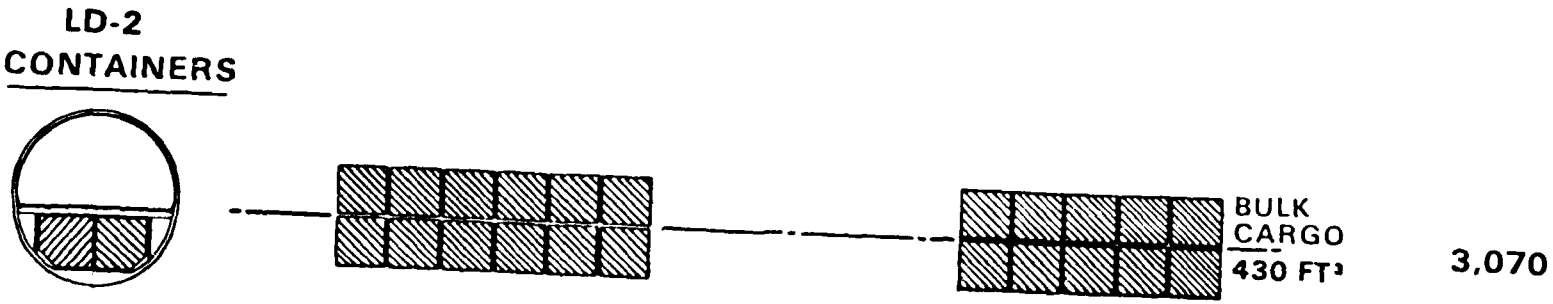


FIGURE V-10

PAYLOAD - RANGE (JT9D-7R4D/E ENGINES)

ATA DOMESTIC RULES, MIXED CLASS

IMPACT OF ADDING CARGO CONVERTIBILITY
TO A 767 PASSENGER AIRPLANE WITH
345K MTOW

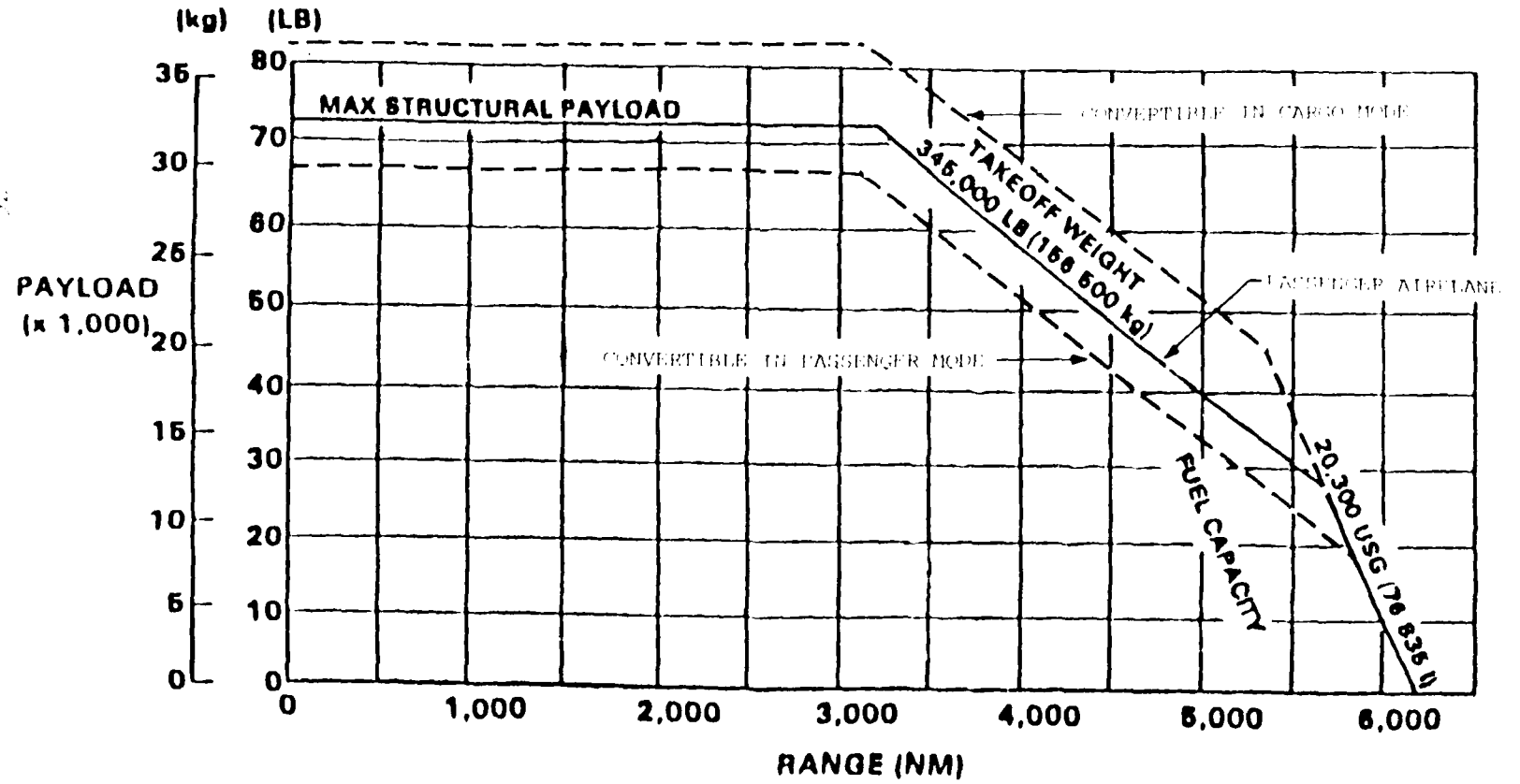


FIGURE 11

PAYLOAD - RANGE (JT9D-7R4D/E ENGINES)

ATA DOMESTIC RULES, MIXED CLASS

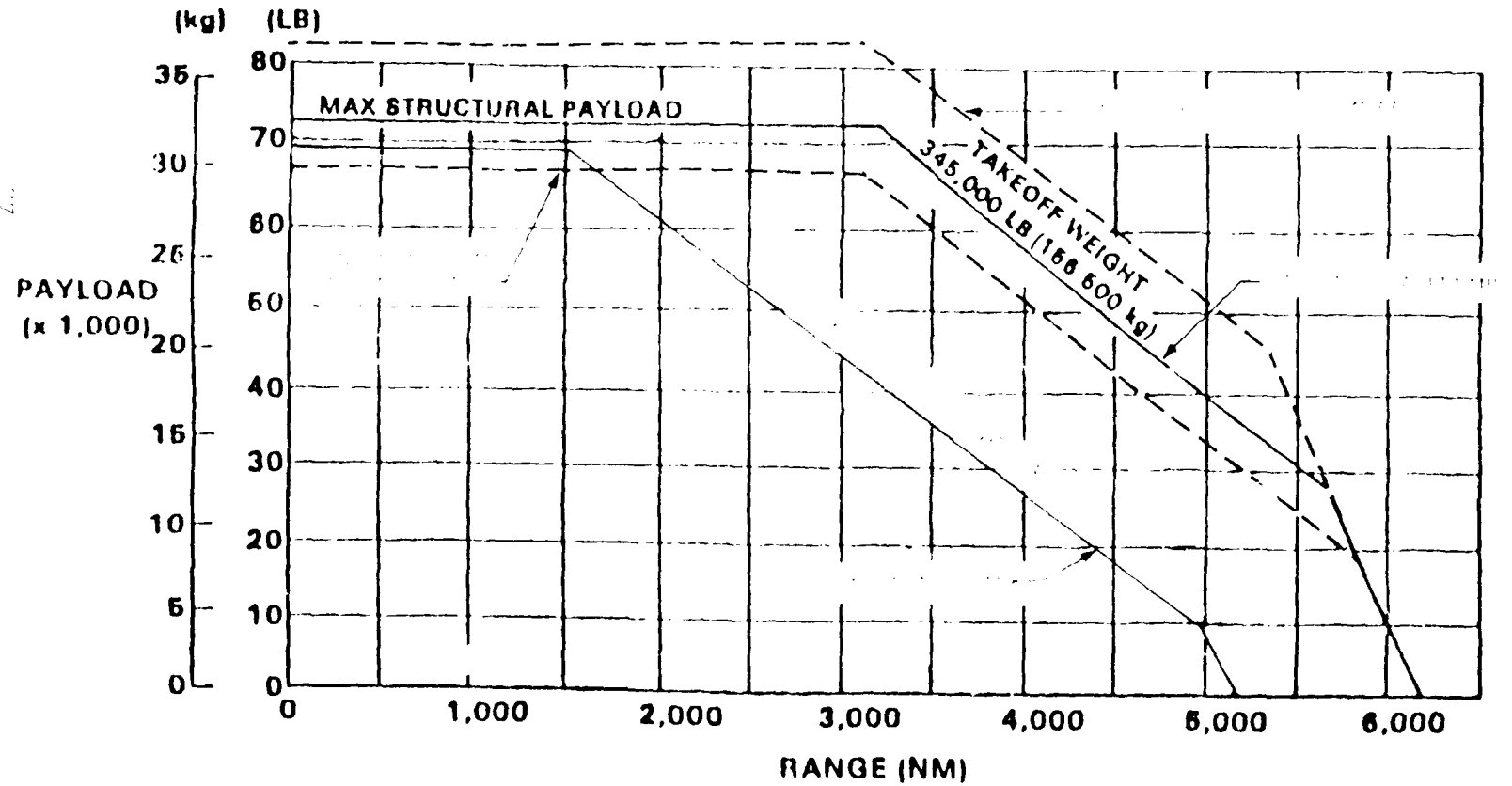


FIGURE 12

CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The national defense strategy of flexible response relies upon the demonstrated ability to rapidly deploy forces in support of our national interests. For this strategy to be credible the Department of Defense must rely upon U.S. commercial air carriers for a significant contribution to our strategic airlift capability.

These carriers must conduct business in one existing economic, social, and political environment. In many respects this environment shapes and molds the industry and dictates it final form. Three long term factors--fuel price, noise regulation, and competitive deregulation--combined with a prolonged business downturn have set into motion forces which promise to transform the airline industry.

These factors plus a substantial withdrawal of the major airlines from air cargo competition, a shift in the type of air freight hauled, and changing aircraft requirements all point to a reduced civil aviation long range cargo capability. One result may be the loss of a substantial portion of the narrow body cargo fleet through sales and leases to foreign operators by 1985 unless government action is taken to intervene. Since no replacement cargo aircraft are being purchased, the CRAF long range cargo component faces a steepening decline in aircraft numbers with a corresponding loss of net lift capability.

Conclusions

As a result of the airline's reactions to current industy trends, the Department of Defense can expect a reduced capability from civil airline operators to provide long range cargo augmentation. Economic and competitive pressures have driven most of the large airlines out of freighter operations. In addition, the military requirement for outsized and oversized cargo aircraft is not compatible with current civil sector requirements for a highly efficient, short range, essentially bulk carrier. Further, due to an overabundance of belly cargo space in passenger aircraft, the demand for new freighter aircraft has been reduced to near zero.

The U.S. long range commercial air cargo fleet will continue to shrink unless measures are taken. Our analysis shows that one-third of freighter sales and leases will be to foreign operators and thus lost to the CRAF. Up to 40% of the present CRAF freighters could be lost by 1985. The remaining CRAF cargo capability would then be concentrated in a fewer number of wide-body aircraft creating higher risks, utilization and scheduling problems.

Previous efforts at CRAF enhancement, in terms of retrofitting existing or forthcoming aircraft to provide additional cargo capability, have not been successful. This lack of success can be attributed to the following: (1) the lack of a firm and consistent program, (2) failure to consider a means to preserve existing narrow body (DC-8, B-707) cargo capability, (3) increased competitiveness due to deregulation, (4) rapid rise in fuel costs, and (5) general financial condition of the air cargo industry.

New, innovative approaches to building and maintaining a strategic airlift cargo capability must be developed and implemented if the U.S. is to possess a

credible rapid response capability. Prior to the development of the mechanisms to achieve the capability, there must be a national commitment to the legislative and funding support required. The DOD cannot expect commercial air carriers to cooperate in a program until DOD and Congress have demonstrated their support through necessary legislative and funding actions. With a national commitment to a CRAF program that allows flexible use of financial devices such as leasing programs, investment tax credits and financial incentives to the air cargo and financial communities, these private sectors will be encouraged toward maximum particpation in this vital national defense need.

Recommendations

In order for the CRAF to contribute meaningfully to the achievement of the goals of the CMMS study, a three part approach is recommended: (1) preserve the existing commercial cargo fleet, (2) add to the fleet by providing existing passenger aircraft with a convertible features, (3) add capability by including cargo capability in future production wide-body airframes.

Without such a comprehensive program, cargo capability available to CRAF will decline further aggravating the shortfall. To implement this three part plan and insure the viability and increased capability of the CRAF, DOD should accomplish the following:

a. In order to retain the existing CRAF capability, DOD should assist FAA in seeking relief from the noise provisions of the Aviation Safety and Noise Abatement Act of 1979 for cargo capable DC-8s committed to CRAF. The requested relief should be effective through 1990. Without such relief,

thirty percent of CRAF's current cargo capability could be lost [illegible]. If legislative relief cannot be obtained, then DOD should request [illegible] assist the carriers in re-enjining the DC-8s as part of the [illegible] Program.

b. DOD should proceed with the retrofit of 25 B-747 aircraft [illegible] in the Air Force FY 84 POM. The success of a program this size not only will add considerable cost effective airlift, but also demonstrate DOD and Congressional support for the program. To insure the success of the CRAF Enhancement Program, DOD should abandon the "traditional" approach and adopt the service contract approach.

c. Maximum effort should be expended to include cargo capability in all new commercial wide-body passenger aircraft produced for domestic airlines. Without such a continuing program, CRAF cargo capability could be subject to wide fluctuations depending upon the health and vitality of the air cargo industry.

d. DOD should negotiate standby waivers with the FAA to FAR provisions, such as the two engine 60 minute rule, which would unnecessarily negate the utility of new aircraft to the national strategic airlift needs during a national emergency.

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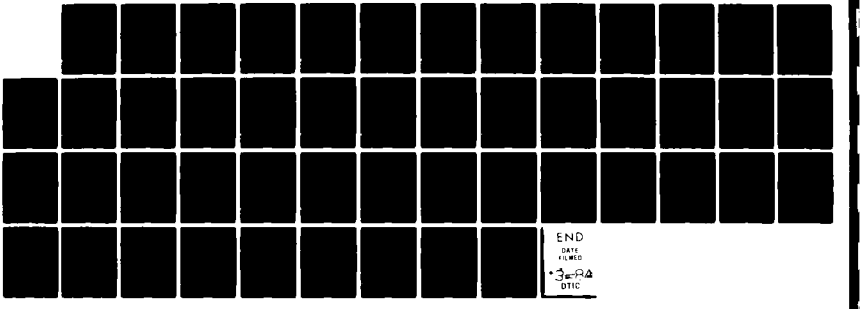
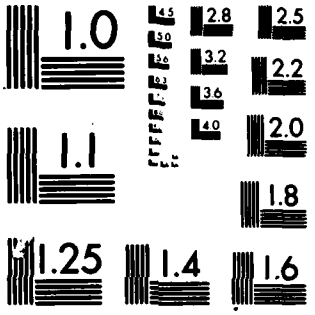




APPENDIX A

CRAF COMMITMENTS BY AIRLINE

AIRLIFT INTERNATIONAL

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F	2	2	3	3	5	4[1]	4	4	2[3]	1[4]	0[7]		
DC-8-50F	2	2	2	2	2	3	1[2]	1	1	1	1	1	2
DC-8-50CF							3	3	3	3	1[5]	1	0[8]
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F	3	3	3	3	3	3	3	3	3	3	1[6]	1	0[9]
DC-10-10CF													
DC-10-30CF													
TOTALS	7	7	8	8	10	10	11	11	9	8	3	3	2

NOTES:

1. Sale (D). 09/30/80 N8215 DC-8-33F to United Aircraft Leasing.
2. Sale (D). 06/30/80 1041W DC-8-54F to FBA Corporation.
3. Unknown.
4. Unknown.
5. Unknown.
6. Sale (D). DC-8-63F/73F to MacDonald Douglas (Resold to World Airways).
   Sale (D). DC-8-63F/73F to Bach Air (Resold to Arrow Airways).
7. Unknown.
8. Unknown.
9. Unknown.

Source: CAB Form 42; MAC Hq Form 0-31[illegible]; Conversations with Airline Executives

AMERICAN AIRLINES

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F B-707-300C	9	9	4[1]	5	5	5	5	5	5	2[2]	0[3]		
B-747-100F B-747-200F B-747-200C	3	3	3	3	3	3	3	3	3	6	6	6	6
DC-8-33F DC-8-50F DC-8-50CF DC-8-61CF DC-8-62CF DC-8-63F DC-8-63F/73F													
DC-10-10CF DC-10-30CF													
TOTALS	11	12	7	8	8	8	8	8	8	8	6	6	6

NOTES:

1. Sale (F). 03/02/78 N7555 B-707-300F to Trade Winds Airways.
   Still owned. 4 B-707-300F.
2. Lease (D). 04/22/81 N8417 B-707-300C to Global International Airways.
   Still owned. 6 B-707-300F
3. Lease (D). N8415 B-707-323CC to Global International Airways.
   Still owned. 3 B-707-300F in storage at Waco, Texas (Telecon with Mike Strange).
   Sold to USAF. 5 B-707-300F.

Source: CAB Form 41; MAC Hq Form 0-312

ARROW AIRWAYS

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C											7	8	8
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF											2	2	2
DC-8-61CF													
DC-8-62CF													1
DC-8-63F													
DC-8-63F/73F												1	2
DC-10-10CF													
DC-10-30CF													
TOTALS											9	11	13

NOTES:

Source: C. B Form 41; MAC Hq Form 0-312

BRANIFF INTERNATIONAL

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF	1	1	1	1	1	1	1	0[1]					
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS	1	1	1	1	1	1	1						

NOTES:

1. Still owned. Bankruptcy.

Source: CAB Form 41; MAC Hq Form 0-312

CAPITOL AIR

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F	2	2	2	2	2	2	2	2	2	2	5	4[1]	3[2]
DC-10-10CF													
DC-10-30CF													
TOTALS	2	2	2	2	2	2	2	2	2	2	5	4	3

NOTES:

1. Sale (D). 04/13/82 N911CL DC-8-61 to International Air Leases.
2. Lease (F). 08/31/82 N907CL DC-8-63F to Flugeider H.F.

Source: CAB Form 41; MAC Hq Form 0-312

CONTINENTAL AIRLINES

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F B-707-300C													
B-747-100F B-747-200F B-747-200C													
DC-8-33F DC-8-50F DC-8-50CF DC-8-61CF DC-8-62CF DC-8-63F DC-8-63F/73F													
DC-10-10CF DC-10-30CF	8	8	8	8	8	8	8	6[1]	5[2]	4[3]	4	4	4
TOTALS	8	8	8	8	8	8	8	6	5	4	4	4	4

NOTES:

1. Sale (D). 03/24/80 N68054 DC-10-10CF to Federal Express.
   Sale (D). 05/14/80 N68055 DC-10-10CF to Federal Express.
2. Sale (D). 09/15/80 N68050 DC-10-10CF to Federal Express.
3. Sale (D). 05/21/81 N68049 DC-10-10CF to Federal Express.

Source: CAB Form 41; MAC Hq Form 0-312

EVERGREEN INTERNATIONAL

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F	2	2	0[1]										
DC-8-50F													
DC-8-50CF													
DC-8-61CF						1	1	1	1	1	1	1	1
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F									1	1	1	1	1
DC-10-10CF													
DC-10-30CF													
TOTALS	2	2				1	1	1	2	2	2	2	2

NOTES:

1. Sale (D). To Rosenbaum Aviation.
   Sale (D). To Rosenbaum Aviation.

Source: CAB Form 41; MAC Hq Form 0-312

FLYING TIGER LINE[4]

TYPE AIRCRAFT	1977 JAN	1977 JUL	1978 JAN	1978 JUL	1979 JAN	1979 JUL	1980 JAN	1980 JUL	1981 JAN	1981 JUL	1982 JAN	1982 JUL	1983 JAN
B-707-300F													
B-707-300C													
B-747-100F	3	3	6	6	6	6	6	6	6	3[2]	3	3	3
B-747-200F							2	2	10	10	10	10	10
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF			2	2	2	2	2	2	2	2	2	2	2
DC-8-62CF													
DC-8-63F	6	6	6	6	6	6	6	6	6	6	6	6	6
DC-8-63F/73F	10	10	9[1]	10	10	10	10	10	13	11[3]	11	11	13
DC-10-10CF													
DC-10-30CF									1	1	1	1	1
TOTALS	19	19	23	24	24	24	26	26	38	33	33	33	35

NOTES:

1. Sale (F). 06/30/77 N70Ft DC-8-63F to Interlease Luxembourg Ltd.
2. Sale (D). 03/31/81 N801Ft B-747-100F to American Airlines.
   Sale (D). 05/03/81 N800Ft B-747-100F to American Airlines.
   Sale (D). B-747-100F to American Airlines.
3. Lease (F). DC-8-63F/73F to Air India.
   Lease (F). DC-8-63F/73F to Air India.
4. Company has signed contract to re-enging 18 DC-8-60 Aircraft with GE CFM 56 Engines ($268M). 1982-1984.

Source: CAB Form 41; MAC Hq Form 0-312

GLOBAL INTERNATIONAL AIRWAYS

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F B-707-300C										1	2	2	2
B-747-100F B-747-200F B-747-200C													
DC-8-33F DC-8-50F DC-8-50CF DC-8-61CF DC-8-62CF DC-8-63F DC-8-63F/73F													
DC-10-10CF DC-10-30CF													
TOTALS										1	2	2	2

NOTES:

Source: CAB Form 41; MAC Hq Form 0-312

NORTHWEST AIRLINES

TYPE AIRCRAFT	1977 JAN	1977 JUL	1978 JAN	1978 JUL	1979 JAN	1979 JUL	1980 JAN	1980 JUL	1981 JAN	1981 JUL	1982 JAN	1982 JUL	1983 JAN
B-707-300F													
B-707-300C	3	3[1]	2	2	0[2]								
B-747-100F													
B-747-200F	3	4	4	4	4	4	4	5	5	5	5	5	5
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS	6	6	6	6	4	4	4	5	5	5	5	5	5

NOTES:

1. Sale (F). 03/31/77 N386US B-707-300C to Alyemda, Democratic Yemen Airlines.
2. Sale (F). 08/21/78 N384US B-707-300C to Arab Organization for Industrialization.
   Sale (F). 08/29/78 N385US B-707-300C to Bangladesh Biman Corporation.

Source: CAB Form 41; MAC Hq Form 0-312

OVERSEAS NATIONAL AIRWAYS

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F													1
DC-8-50CF													1
DC-8-61CF	2	2	0[1]										
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F	3	3	0[2]	1									1
DC-10-10CF													
DC-10-30CF		2	2	2									
TOTALS	5	7	2	3									3

NOTES:

1. Sale (D). 12/16/77 867 DC-8-61 to Flying Tiger Lines.
   Sale (D). 12/21/77 868 DC-8-61 to Flying Tiger Lines.
2. Sale (D). 10/16/77 865 DC-8-63F/73F to Seaboard World.
   Sale (D). 12/18/77 864 DC-8-63F/73F to Seaboard World.
   Sale (D). 12/29/77 866 DC-8-63F/73F to Seaboard World.

Source: CAB Form 41; MAC Hq Form 0-312

PAN AMERICAN WORLD

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F	10	7[1]	2[3]	2	1[5]	0[7]							
B-707-300C	4	3[2]	2[4]	2	1[6]	0[8]							
B-747-100F	2	4	4	4	4	4	4	4	4	4	4	4	4
B-747-200F							2	2	2	2	2	2	1[9]
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS	16	14	8	8	6	4	6	6	6	6	6	6	5

NOTES:

1. Sale (F). 03/08/77 N459PA B-707-321F to ATASCO.
   Sale (F). 06/12/77 N449PA B-707-321F to ATASCO.
   Sale (F). 06/29/77 N447PA B-707-321F to ATASCO.
2. Sale (F). 09/30/77 N790PA B-707-321C to ATASCO.
3. Sale (F). 06/29/77 N452PA B-707-321F to Trans Mediterranean Airways.
   Sale (F). 10/20/77 N448PA B-707-321F to ATASCO.
   Sale (F). 06/28/78 N457PA B-707-321F to ATASCO.
   Sale (F). 10/23/79 N473PA B-707-321F to RONAIR.
   Unknown.
4. Lease (F). 03/30/78 N791PA B-707-321C to Maufrick International
5. Unknown.
6. Sale (F). 02/26/79 N791PA B-707-321C to ATASCO.
7. Unknown.
8. Sale (P). 03/13/79 N793PA B-707-321C to ATASCO.
9. Sale (P). B-747-200F to Japan Airlines.

Source: CAB Form 41; MAC Hq Form 0-312

RICH INTERNATIONAL AIRWAYS

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													1
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS													1

NOTES:

Source: CAB Form 41; MAC Hq Form 0-312

TYPE AIRCRAFT	1977 JAN	1977 JUL	1978 JAN	1978 JUL	1979 JAN	1979 JUL	1980 JAN	1980 JUL	1981 JAN	1981 JUL	1982 JAN	1982 JUL	1983 JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F	2	2	2	2	2	2	3	3	0[5]				
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F	6	4[1]	6	4[2]	5	4[3]	4	3[4]	0[5]				
DC-10-10CF													
DC-10-30CF								1	0[5]				
TOTALS	8	6	8	6	7	6	8	8					

NOTES:

1. Crashed. 03/31/77 N8635 DC-8-63F Destroyed in Niger.
   Leased (F). Various DC-8-63F to Saudi, ONA, Icelandic, Thai, IACC.
2. Leased (F). DC-8-63F to Air India.
   Leased (F). DC-8-63F to Icelandic.
3. Sale (UNK). 04/30/79 N8639 DC-8-63F to (Not Reported).
4. Leased (F). DC-8-63F to Saudi.
5. Airline Merged with Flying Tigers.

Source: CAB Form 41; MAC Hq Form 0-312

TRANSAMERICA AIRLINES

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C							1	2	2	3	3	3	3
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF	3	2[1]	2	3	3	5	5	5	5	5	5	5	5
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F	6	6	6	6	6	7	7	7	7	7	7	7	7
DC-10-10CF													
DC-10-30CF	3	3	3	3	3	3	3	3	3	3	3	3	3
TOTALS	12	11	11	12	12	15	16	17	17	18	18	18	18

NOTES:

1. Lease (D). 02/01/78 N8955U DC-8-62CF to Flying Tigers Line.

Source: CAB Form 41; MAC Hq Form 0-312

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F	12	12	12	9[1]	0[2]								
B-707-300C	3	3	3	3	3	3	3	1[3]	0[4]				
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS	15	15	15	12	3	3	3	1					

NOTES:

1. Sale (F). 03/01/78 N5773T B-707-300C to Trans Mediterranean Airways.
   Sale (D). 07/03/78 N15713 B-707-300C to Global International Airways.
   Sale (F). 08/29/78 N5772T B-707-300C to Guinness Peat Aviation.
2. Sale (F). 11/15/78 N5774T B-707-300C to Fast Air Carrier LTDA.
   Sale (D). 03/26/79 N1471 B-707-300C to Air Cargo Equipment Corp.
   Lease (F). 04/01/79 N1571 B-707-300C to Guinness Peat Aviation.
   Lease (D). 04/28/79 N791TW B-707-300C to Global International Airways.
   Lease (F). 05/15/79 N15711 B-707-300C to Guinness Peat Aviation.
   Sale (F). 02/18/82 786TW B-707-300C to Guinness Peat Aviation.
   Sale (F). 02/27/81 789TW B-707-300C to Aeronautics and Aeronautics Services (Panama).
   Still Owned 788TW B-707-300C.
   Sale (F). 792TW B-707-300C to Foreign Airline (Unk)(Mr. William Hatch).
3. Still owned 789TW B-707-300C.
   Still owned 1793T B-707-300C
4. Still owned 794TW B-707-300C.

Source: CAB Form 41; MAC Hq Form 0-312

UNITED AIRLINES

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F	15	15	14[1]	14	14	14	14	0[2]					
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													1
TOTALS	15	15	14	14	14	14	14						1

NOTES:

1. Crashed. 12/18/77 N8047 Destroyed at Salt Lake City.
2. Still own and operate 14 DC-8-54F Airframes.

Source: CAB Form 41; MAC Hq Form 0-312

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C	1	1	1	1	1	1	1	0[1]					
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS	1	1	1	1	1	1	1						

NOTES:

1. Sale (F). 05/16/80 N1504W B-707-347C to Middle East Airlines.

Source: CAB Form 41; MAC Hq Form 0-312

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C		1	1	1	1	0[1]							
B-747-100F				1	1	1	1	1	1	1	1	1	0[5]
B-747-200F													
B-747-200C	2	2	2	2	2	3	3	3	3	3	2[3]	2	2
DC-8-33F													
DC-8-50F													
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F	5	5	5	5	5	5	5	4[2]	4	4	4	4	4
DC-10-10CF													
DC-10-30CF				2	3	6	6	9	9	9	9	8[4]	8
TOTALS	7	8	8	11	12	15	15	17	17	17	16	15	14

NOTES:

1. Unknown. Airline did not own or lease B-707-300C according to CAB Forms Dated 12/31/78.
2. Sale (F). 05/27/80 N803WA DC-8-63F/73F to Sultan of Oman.
3. Still Owned. N748WA B-747-273C.
4. Crashed. 01/23/82 47821 DC-10-30CF Destroyed in Accident.
5. Lease (F). B-747-100F to Foreign Lessee (Unknown).

Source: CAB Form 41; MAC Hq Form 0-312

ZANTOP INTERNATIONAL AIRLINES

TYPE AIRCRAFT	1977		1978		1979		1980		1981		1982		1983
	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN	JUL	JAN
B-707-300F													
B-707-300C													
B-747-100F													
B-747-200F													
B-747-200C													
DC-8-33F													
DC-8-50F								1	1	1	0[1]	1	1
DC-8-50CF													
DC-8-61CF													
DC-8-62CF													
DC-8-63F													
DC-8-63F/73F													
DC-10-10CF													
DC-10-30CF													
TOTALS								1	1	1		1	1

NOTES:

1. Still Owned. Temporarily Aberrated.

Source: CAB Form 41; MAC Hq Form 0-312

TABLE III-1

NUMBER OF AIRCRAFT IN CRAF
BY TYPE
(1973-1983)

TYPE AIRCRAFT	1977 Jan	1977 Jul	1978 Jan	1978 Jul	1979 Jan	1979 Jul	1980 Jan	1980 Jul	1981 Jan	1981 Jul	1982 Jan	1982 Jul	1983 Jan	NET
B-707-300F	31	28	18	16	6	5	5	5	5	3	2	2	2	-29
B-707-300C	11	10	9	9	6	4	4	1	0	0	7	8	8	-3
B-474-100F	7	10	13	14	14	14	14	14	14	14	14	14	13	+6
B-474-200F	5	6	6	6	6	6	12	13	17	17	17	17	16	+11
B-474-200C	2	2	2	2	2	3	4	5	5	6	5	5	5	+3
DC-8-33F	2	4	5	3	5	4	4	4	2	1	0	0	1	-1
DC-8-50F	15	15	14	14	14	14	15	2	2	2	1	2	4	-11
DC-8-50CF	2	2	2	2	2	3	3	3	3	3	3	3	3	+1
DC-8-61CF	5	4	4	5	6	8	8	8	8	8	8	8	8	+3
DC-8-62CF	1	1	1	1	1	1	1	0	0	0	0	0	1	NC
DC-8-63F	6	6	6	6	6	6	6	6	6	6	6	6	6	NC
DC-8-63F/73F	35	33	31	31	31	31	31	30	30	28	29	29	31	-4
DC-10-10CF	8	8	8	8	8	8	8	6	5	4	4	4	5	-3
DC-10-30CF	3	5	5	7	6	9	9	13	13	13	13	12	12	+9
TOTAL	133	134	124	124	113	116	124	110	110	105	109	110	115	-18

TABLE III-2
SUMMARY OF CHANGES
CRAF CARGO AIRCRAFT COMPOSITION
1 JAN 1977 VS. 1 JAN 1983

TYPE AIRCRAFT	1977	1983	CHANGE
B 707	42	10	-76%
B-747	14	34	+143%
DC-8	66	54	-18%
DC-10	11	17	+55%
TOTAL	133	115	-14%
WIDE-BODY LOWER LOBE CAPACITY	1.713	2.225	+30%
NARRO-BODY CARGO CAPACITY	7.610	4.964	-35%
WIDE-BODY MAIN DECK CARGO CAPACITY	4.135	9.152	+121%
TOTAL	13.458	16.341	+21%

TABLE III-3
SUMMARY
CRAF DELETIONS BY AIRLINE 1977-1982

AIRLINE	Total Deletions	Sales to Domestic Purchaser	Sales to Foreign Purchaser	Leases to Domestic Lessor	Leases to Foreign Lessor	Still Owned	Destroyed In Crash	Disposition Unknown/ Anomoly
AIRLIFT	13	4						9
AMERICAN	10	5	1	2		1		1
ARROW	0							
BRANIFF	1					1		
CAPITOL	2	1			1			
CONTINENTAL	4	4						
EVERGREEN	2	2						
FLYING TIGERS	6	3	1		2			
GLOBAL	0							
NORTHWEST	3		3					
OVERSEAS NATIONAL	5	5						
PAN AMERICAN	15		11		1			3
RICH INTER-NATIONAL	0							
SEABOARD WORLD	14	8			4		1	1
TRAMSAMERICA INTERNATIONAL	1		1					
TWA	15	2	6	1	2	4		
UNITED AIRLINES	15					14		
WESTERN AIRLINES	1		1					
WORLD	5		1		1	1	1	1
ZANTOP	1					1		
TOTAL	113	34 (30%)	24 (21%)	11 (4%)	11 (10%)	22 (19%)	3 (3%)	15 (13%)

TABLE III-4
SUMMARY
CRAF DELETIONS BY TYPE AIRCRAFT
1977-1982

AIRLINE	Trans-actions	Sales to Domestic Purchaser	Sales to Foreign Purchaser	Leases to Domestic Lessor	Leases to Foreign Lessor	Still Owned	Destroyed In Crash
B-707-300F	19	5	8			6	
B-707-300C	21	2	13	3	3		
B-747-100F	4	3			1		
B-747-200F	6	4	1			1	
B-747-200C	0						
DC-8-33F	3	3					
DC-8-50F	17	1				15	1
DC-8-50CF	0	3					
DC-8-61CF	4	3		1			
DC0-8-62CF	0						
DC-8-63F	7	1			5		1
DC-8-63/73F	11	8	1		2		
DC-10-10CF	4	4					
DC-10-30CF	2	1					1
TOTAL	98	34	24	4	11	22	3

SUMMARY

Type Aircraft	Sale/Lease Domestic	Sale/Lease Foreign	Total
B-707	10	24	34
B-747	7	2	9
DC-8	16	9	25
DC-10	5	0	5
Total	38	35	73

TABLE III-5
CARGO AIRCRAFT LEASED OUT BY AIRLINES YEAR END 1981

Lessor	Lessee	No. of Aircraft	Type Aircraft
American	Global (D)	1	B-707-320C
	Global-Subleased to Saudia (F)	1	B-707-320C
Capitol	UTA(F)	1	DC-8-50C
Evergreen	ONA-Subleased to Saudia (F)	1	DC-8-61C
Fying Tigers	Air India (F)	2	DC-8-63C
	Challenge (D)	1	DC-8-50C
	ONA-Subleased to Saudia (F)	1	DC-8-63C
	ONA (D)	2	DC-8-63C
	Transamerica (D)	2	DC-8-63C
Overseas National	Elan Air (D)	1	DC-8-50C
	Fying Tigers (D)	2	DC-8-63C
	Flying Tigers Subleased to Metro Int'l (D)	1	DC-8-63C
	Saudia (F)	1	B-707-320C
	Wein Air Alaska (D)	1	DC-8-63C
Rosenbaum Aviation	Zantop (D)	1	DC-8-20F
	Zantop (D)	1	DC-8-30F
Southern A.T.	Aero Leon (F)	1	DC-8-20F
Transamerica	Air Florida (D)	3	DC-10-30C
	Flying Tigers (D)	5	DC-8-61C
	Saudia (F)	1	B-747-200C
TWA	Guinness Peat Sub-leased to Faucett (F)	3	B707-320C
	Guinness Peat Sub-leased to Air Haiti	1	B-707-320C
	Guinness Peat (F)	1	B-707-320C
World	Viasa (F)	1	B-747-200C

Source: World Jet Airplane Inventory at year end 1981,. Boeing Commercial Airplane Co., Seattle, Washington, June 1982.

TABLE III-5 (cont'd)
CARGO AIRCRAFT LEASED OUT BY AIRLINES
YEAR END 1981

1. SUMMARY:

Type Aircraft	Total Number Leased	Domestic Lessees	Foreign Lessees
B-707-320C	8	1	7
B-747-200C	2	0	2
DC-8-20F	2	1	1
DC-8-30F	2	2	0
DC-8-50C	3	2	1
DC-8-61C	6	5	1
DC-8-63C	11	8	3
DC-10-30C	3	3	0
Total	37	22	15

2. SUMMARY:

Type Aircraft	Total Number Leased	Domestic Lessees	Foreign Lessees
B-707	8	1 (13%)	7 (87%)
B-747	2	0 (0%)	2 (100%)
DC-8	24	18 (75%)	6 (25%)
DC-10	3	3 (100%)	0 (0%)
	37	22 (59%)	15 (41%)

APPENDIX B

AIRLINE QUESTIONNAIRE

ICFA-MSM

9 DEC 1982

Mr. Stanley Seltzer
Mobilization Representative
American Airlines, Inc.
Dallas/Ft. Worth Airport
Ft. Worth, TX 75261

Dear Sir,

A major research effort of the Industrial College of the Armed Forces, a component of the National Defense University, involves examining the impact of current economic trends on national mobilization capability. I am a member of a research group examining economic pressures on the ability of the airline industry to support the Civil Reserve Air Fleet (CRAF). Specifically, our concern is with the changing composition and the future projections for the long-range air cargo fleet. We have examined data from the FAA, CAB and ATA to determine if trends exist to support the thesis that the U.S. long-range air cargo fleet is undergoing significant change through sales and long-term leases that would reduce CRAF air cargo capability in a mobilization scenario.

We have found the available data fragmented and incomplete. In order to compile an accurate and timely analysis, it is apparent that input from the airline industry is needed. In other words, we need your help. You will find attached a list of questions pertaining primarily to your present and future air cargo fleet. Answers to these questions will provide much needed data and be invaluable to our efforts. We recognize that your future plans may be incomplete and your ability to disclose them constrained. However, any information you can provide, or suggested sources for the information, will be indeed welcome and sincerely appreciated.

Thanks in advance for your cooperation. Your input will be most beneficial and timely. If you have any questions, I can be reached at: Industrial College of the Armed Forces, Fort McNair, Washington, D.C., 20319, Tel. 202-693-8184.

Sincerely,

1 Encl
Ques.

GARY C. ROSS
Lieutenant Colonel, USAF

Questions

1. What is your current inventory (as of December 1982) of long-range cargo aircraft (B-707, B-747, DC-8, DC-10)? If possible, please identify airframe license number, aircraft type/series, status (owned, leased, NOA) and include both cargo only and convertible airframes.

2. What is your company's current forecast of future requirements for long-range cargo configured aircraft (expanding, contracting, level)?

3. Does your company have any plans to sell currently owned long-range cargo aircraft if a buyer(s) can be found? If so, please indicate number, type and buyer(s) (if known).

4. Does your company have any plans to lease currently owned long-range cargo aircraft to others? If so, please indicate number, type and lessee(s) (if known).

5. Does your company plan to add long-range cargo aircraft to its fleet? If so, please indicate number, type of aircraft and method (purchase or lease).

6. Does your company plan to replace currently owned long-range cargo aircraft with newer aircraft? If so, please indicate type aircraft to be replaced and type aircraft to be obtained as replacement.

7. What is your airline's policy regarding underutilized aircraft? Are they put into storage? Sold? Leased? Flown, but at lower utilization rates?

8. If long-range cargo aircraft are stored, under what conditions (maintenance) are they stored? What would be the minimum time required to place them back in service? If cannibalization is permitted, how are such cannibalizations recorded/tracked? Is the Military Airlift Command notified when a CRAF committed aircraft is placed in storage?

9. If the Department of Defense should decide to adopt a CRAF enhancement program, i.e., the modification of passenger aircraft to make them convertible to cargo aircraft, what incentives would be most attractive to or necessary for your company's participation in the program?

Attachment 1

APPENDIX C

QUESTIONS SENT TO BOEING COMMERCIAL AIRPLANE COMPANY

NATIONAL DEFENSE UNIVERSITY
INDUSTRIAL COLLEGE OF THE ARMED FORCES
WASHINGTON, D.C. 20319

REPLY TO
ATTENTION OF:
ICAF

19 November 1982

Mr. Henry Van Gieson
Boeing Military Airplane Company
1700 North Moore Street, 20th Floor
Rosslyn, Virginia 22209

Dear Mr. Van Gieson,

We greatly appreciate the time and information you have provided us to date. As we promised in our last meeting, a written request for additional information not contained in previously provided material, would be forthcoming.

A primary function of the Industrial College of the Armed Forces (ICAF) is to explore, from an academic as well as a pragmatic point of view, the ability of our country to mobilize its industrial base. Our nation's global strategy requires an ability to project forces. The ability to respond rapidly requires long range passenger and cargo airlift. For three decades, the Civil Reserve Air Fleet (CRAF) has provided the mechanism through which commercial aircraft could be mobilized. As you are aware, even with the CRAF program, DOD still lacks adequate cargo airlift capability. This recognition has given rise to the CRAF Enhancement Program.

Presently, only the 747 and DC-10 are included in the CRAF Enhancement Program. The B-767, which appears to have potential as a CRAF carrier, is not presently included despite the fact that a large number of the air frames will be entering domestic service in the near term. Therefore, our ICAF Mobilization Research Project includes a review of the capability of the 767 to fill a CRAF role.

Information provided by Boeing to date has been most helpful. The purpose of this letter is to request additional information which will round out data previously provided, and assist in our formulation of recommendations. The information request is framed in terms of seven questions. The first two questions are aimed at exploring the usefulness/costs of the 767 as a CRAF passenger asset. Questions three through seven explore costs of the 767 as a CRAF cargo carrier. In all discussions of the cargo floor, it is assumed that a floor system similar to the convertible 747 would be used except the floor would be non-powered.

ICAF
Mr. Henry Van Gieson

19 November 1982

In addition to the data requested in the attached questions, your thoughts on how to make the CRAF Enhancement Program more attractive to U.S. airlines would be of great benefit.

Your continuing assistance in this matter is greatly appreciated.

Sincerely,

FRANK J. COLSON
Student Research Group Leader

1 Encl
Questions

CF:
BGEN John Griffith
HQ USAF/LET
The Pentagon
Washington, D.C. 22030

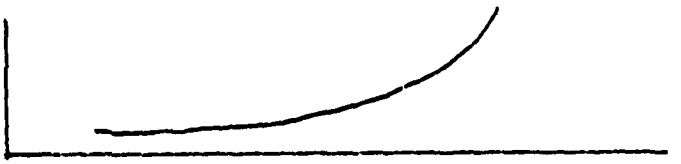
COL Clarence Lindsey, Jr.
HQ MAC/TR
Scott AFB, IL 62225

QUESTION ONE: Graph Ad82-124 charts payload range of the 330,000 lb VS the 360,000 lb MTOW air frame. Is there a 345,000 lb version? If so, how does it compare?

QUESTION TWO: What is the acquisition price differential between the 285,000 lb version and the 310,000 lb, 330,000 lb, 345,000 lb, and the 360,000 lb? Is there a difference in fuel or operating costs?

The preceding two questions are intended to provide information necessary to judge the acceptability/advisability of using the 767 in a CRAF passenger role. The following questions are intended to explore the costs/advisability of adapting the 767 to a CRAF cargo role.

QUESTION THREE: It is assumed that there is a relationship between the weight carrying capacity of a cargo floor and the cost to design and install the floor; that is, the higher the floor loading capacity, the more expensive the floor. Please provide your estimate of the cost to capability relationship.



Cost of Floor
(Design & Install)
$

Load Capacity Per 463L Pallet
Position (LBS)

QUESTION FOUR: It is also assumed that the handling of rolling stock presents a unique series of floor design problems, since the weight of the vehicle is concentrated in a small area; the contact area of the tires. Please provide your estimate of the relationship between floor cost (design and install) and the per axle load carrying capability of the floor.

Floor Cost
(Design & Install)
$

Load Capacity Per Axle
(LBS)

QUESTION FIVE: Question two addresses the costs associated with providing adequate MTOW in the air frame. Questions four and five address the cost of a cargo floor at various design capacities. What is your estimated cost to incorporate the other modifications necessary to make the air frame a convertible freighter?

QUESTION SIX: Chart 282-90 RTN-2-26 indicates a 3% increase in ¢/ASM for a convertible VS a standard air frame. From your knowledge of the industry, what does this equate to in expected increased operating costs over a 16-year air frame life?

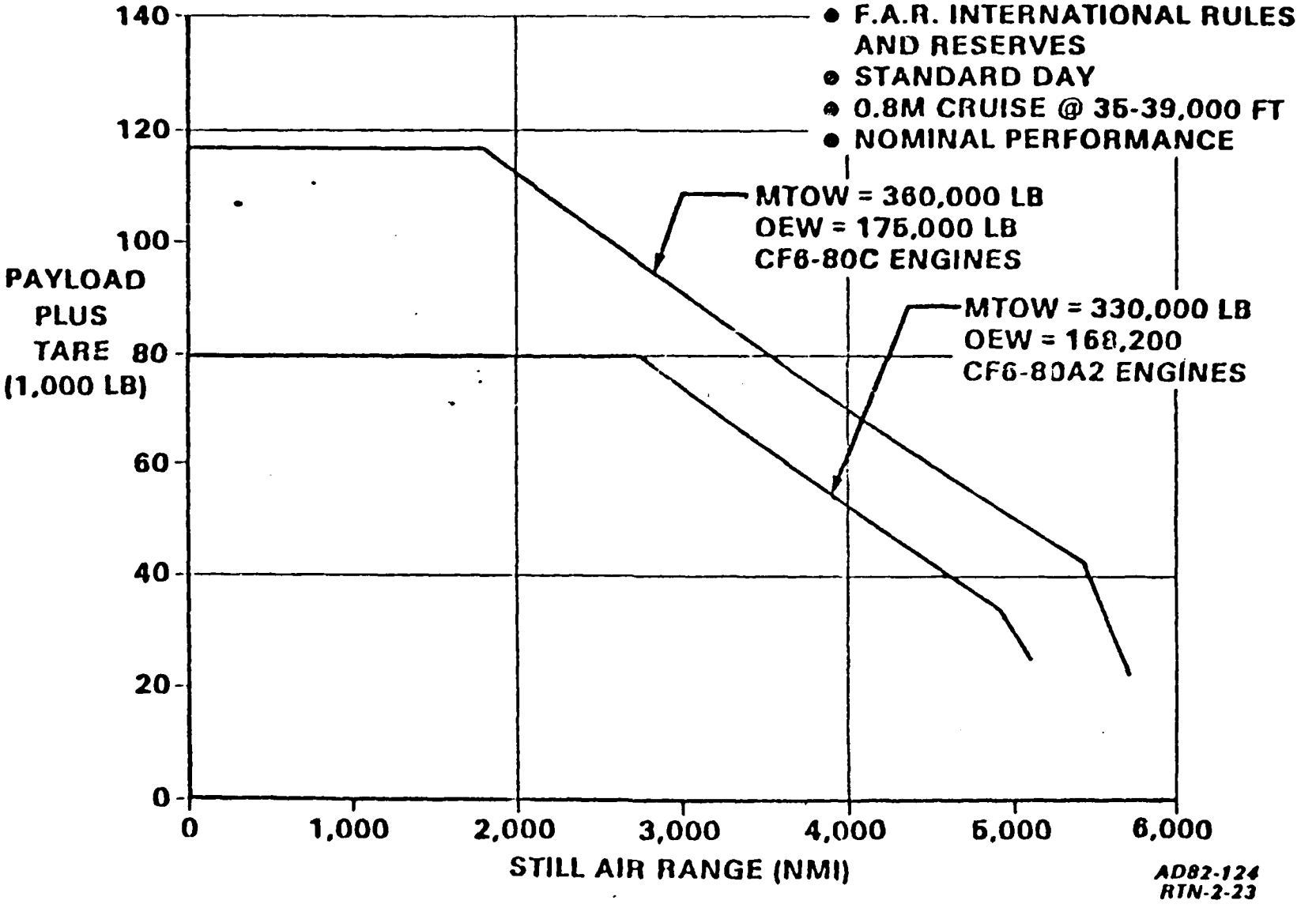
QUESTION SEVEN: It is assumed that the 3% increase is based upon increased weight attributable to the convertible modifications. It is also assumed that the weight increase was based on incorporating into the 767 the same types of additional structural materials used in the 747 modification. Is there a relationship between using more expensive materials to strengthen the floor and the decrease in life cycle operating costs associated with the decreased weight. Said simply, would we be better off investing on the front end in a "high technology floor structure" and, as a result, save operating costs for the next 16 years through lower weight?

Increased Operating Costs for 16 Years
Attributable to the Floor

PAYLOAD - RANGE COMPARISON

767-200C WITH CARGO, 330,000 LB VS 360,000 LB MTOW

PRODUCT DEVELOPMENT STUDY



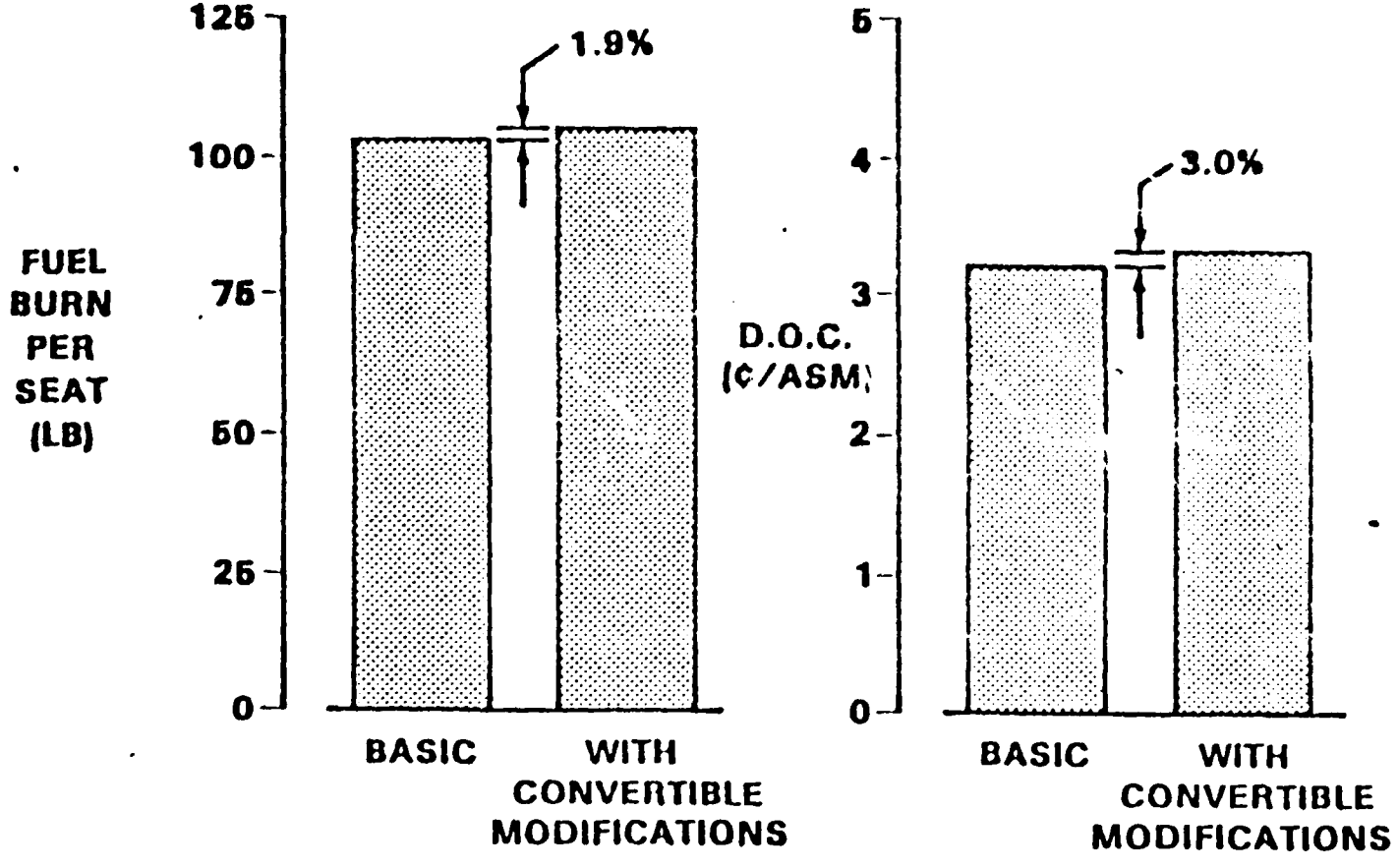
AD82-124
RTN-2-23

EFFECT OF CONVERTIBLE MODIFICATIONS

767-200, 1,000 NMI, U.S. DOMESTIC RULES

PRODUCT DEVELOPMENT STUDY

- 230 PASSENGERS
- MTOW = 310,000 LB



C82-90
RTN-2-26

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[2]Memorandum from Secretary of the Air Force, "Airlift Enhancement Program," to Secretary of the Army, 5 February 1982, p. 1.

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[4]Ibid., p. 6.

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[3]Standard and Poor's Industry Surveys, Air Transport Analysis. December 16, 1982, p. A73.

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[5]Ibid., pp. A73, A78.

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[4]Briefing by Captain Steven Roser (USAF), Military Airlift Command, XPW, "Alternative Strategies for CRAF Enhancement," 25 January 1983.

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DATE:
ILME