098155

REPORT TO THE CONGRESS

098155

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Information On The Requirement For Strategic Airlift

Department of Defense

Defense officials have not provided sufficient data to the Congress to properly consider the needs for new/alternative airlift programs.

The airlift program goals may not be attainable. It is expensive and can transport only a small portion of total requirements.

The Defense Department should consider the costs of alternatives of airlift, sealift, and prepositioning equipment and identify the airlift requirement.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-162578

June 8, 1976

To the President of the Senate and the
Speaker of the House of Representatives

This report describes Department of the Air Force strategic airlift capabilities, planned increases, and other programs to further expand airlift capability. The budget impact of these airlift improvements is about $13 billion.

The review was made at the request of several congressional committees who were concerned about Department of Defense plans to increase airlift capability.

Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

Because of the immediate interest of committees involved in the authorization and appropriation process, time was not available to obtain written comments from the Department of Defense. However, Air Force representatives did review the draft report and offered oral comments and suggestions. They took no exception to the factual substance of the report, but did indicate some minor differences as to interpretation of facts.

Copies of this report are being sent to the Secretary of Defense and the Director, Office of Management and Budget.

Comptroller General
of the United States

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ABBREVIATIONS

AMST	Advanced Medium Short-take-off-and-landing Transport
AT/CA	Advanced Tanker/Cargo Aircraft
CRAF	Civil Reserve Air Fleet
DOD	Department of Defense
MAC	Military Airlift Command
NATO	North Atlantic Treaty Organization

D I G E S T

Several congressional committees have expressed concern about Air Force and Department of Defense plans to increase strategic airlift capability. GAO reviewed those capabilities, planned increases (airlift enhancement), and other programs to further expand airlift capability, costing about $13 billion.

Current U.S. conventional defense posture is based partly on the need to transport troops and equipment to potential conflict areas throughout the world. National strategic policies pinpoint the European theater as the most critical area of concern.

Specifically, military planners assume that the Warsaw Pact forces, because of certain advantages in geography and conventional capability, would strike first by launching a "blitzkrieg" type attack.

Defense officials consider rapid deployment capability critical in deterring the actual outbreak of hostilities and in limiting initial Warsaw Pact advantages if war should occur. Airlift of additional U.S. forces and equipment would be the initial method of reinforcing forces already in Europe.

REQUIREMENT FOR STRATEGIC AIRLIFT

The Department of Defense has not provided sufficient data to enable the Congress to properly consider the needs for new and/or alternative airlift programs. The pertinent facts are that:

--Defense's airlift "requirement" is, in reality, to move as much as possible in as short a time as possible.

--The current stated "requirement" to move 180,000 tons in 30 days is derived, in GAO's opinion, not from a demonstrable military

need for 180,000 tons of cargo, but from the Air Force estimate of its current airlift capability.

--The Defense Department desires to increase its capability to 370,000 tons. The estimated cost of programs to attain that capability is more than $3.5 billion.

--Other airlift programs being proposed or considered will cost about $9.5 billion.

The Defense Department's airlift program may not be attainable because:

--There is a serious question whether aircraft can operate the number of hours per day projected by the Air Force.

--The number of aircraft estimated by the Air Force to be available may be substantially overstated because modification, overhaul, and maintenance requirements have not been fully considered.

--The availability of sufficient airfields in Europe to accommodate a massive airlift during a conflict situation is open to question.

--It is not clear that there would be sufficient fuel available in Europe to refuel aircraft for the return trip to the U.S. During the last Arab-Israeli war U.S. airlift aircraft took on as much fuel (in pounds) in Israel as the weight of the cargo delivered.

There is a need for U.S. military forces to be able to respond quickly to real or potential conflicts in various parts of the world. Airlift, while providing rapid response, is expensive and can transport only a relatively small portion of total requirements.

The Department of Defense has consistently refused to provide congressional committees or GAO with specific data on airlift requirements on the grounds that such data was too sensitive.

It is essential, however, that a comprehensive study of the alternatives of airlift, vs sealift, vs prepositioning be accomplished and presented to the Congress.

As a minimum, The Department of Defense should identify

--the airlift requirement in terms of specific items and weights and required delivery dates;

--the costs, the advantages and disadvantages of alternatives such as increased prepositioning of supplies and equipment; and

--the timeliness and availability of sealift.

CHAPTER 1

INTRODUCTION

Current United States conventional defense posture is based on the perceived necessity for a U.S. capability to transport troops and equipment to potential conflict sources throughout the world.

The primary possibility which the Department of Defense (DOD) uses as a basis for its mobility force structure is a full-scale conventional war in the North Atlantic Treaty Organization (NATO) theater. More specifically, it is assumed that the Warsaw Pact forces, because of certain advantages in geography and conventional capability, would strike first by launching a "blitzkrieg" type attack. This would give it the advantage of initiative, crucial time, and perhaps even territory during the period it would take the United States to fully mobilize. This perception has led to the conclusion that the first priority in the current mobility force structure is to provide a capacity to transport masses of troops and equipment during the critical first few weeks of a mobilization period. DOD officials consider a rapid deployment capability critical in preventing initial Warsaw Pact advantages, and especially in deterring the actual outbreak of hostilities.

We reviewed Air Force strategic airlift capabilities, planned increases in them (airlift enhancement) and other programs to further expand them. Appendix I shows their budget impact.

THE REQUIREMENT FOR AIRLIFT

The Joint Chiefs of Staff, the Air Force, and the Military Airlift Command (MAC) have studied the requirement to support NATO forces in Western Europe during a conventional conflict with Warsaw Pact forces. That requirement would be met with prepositioned forces, supplemented in the early stages by deployment of forces first by air and later by sea. We attempted to ascertain the overall magnitude of the requirement for airlift, as well as the priorities established for airlifting equipment to Europe.

Officials of the Joint Chiefs of Staff testified before the House Armed Services Committee, indicating that war plans are based on existing capabilities; thus the airlift requirement, as it relates to war plans, is the same as the existing capability. Further testimony indicated that prepositioned equipment coupled with existing airlift capabilities leave the Warsaw Pact forces a considerable advantage in the first

weeks in terms of equivalent forces. The Air Force has estimated that doubling airlift capabilities would reduce the Warsaw Pact advantage in the early weeks of an invasion by 50 percent.

The Joint Chiefs, the Air Force, and the Army denied us access to detailed backup information concerning the requirements for airlift, and we therefore could not make an evaluation of either the origin or the reasonableness of the requirement for material to be moved by airlift. We were not permitted to review the Joint Chiefs' contingency plans, but we understand that they are predicated on the Air Force estimate of current airlift capability. Representatives of the Joint Chiefs confirmed that the airlift requirement was to "transport as much as possible as soon as possible." This definition of airlift requirements results in a "capability equals requirements" situation.

SCOPE OF REVIEW

We reviewed Air Force documents showing capability of strategic airlift, enhanced airlift, and increased capability. We reviewed Air Force studies of airlift and Air Force and Joint Chiefs of Staff briefing documents regarding airlift. We discussed various aspects of airlift with Air Force, Army, and Joint Chiefs officials. We visited contractors with capability to build airlift-type aircraft or to modify existing aircraft. We discussed various aspects of airlift with contractor officials. The primary locations visited during our review included:

--MAC Headquarters, Scott Air Force Base, Illinois

--Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio

--Air Force Headquarters and Joint Chiefs of Staff, Pentagon

CHAPTER 2

CURRENT STRATEGIC AIRLIFT CAPABILITY

The Military Airlift Command (MAC) is responsible for fulfilling strategic airlift requirements. The equipment available to MAC in October 1975 included 70 C-5A aircraft, 234 C-141 aircraft and a varying number of aircraft owned by commercial carriers that are committed to the Civil Reserve Air Fleet (CRAF).

The Air Force used the following factors in a study to determine strategic airlift capability:

--the number and type of aircraft,

--the average payload,

--the average speed for the trip,

--the average daily use of the aircraft,

--the number of days to accomplish the mission, and

--the round trip distance from the center of the United States.

Using these factors, the Air Force estimated that 180,000 tons of cargo can be airlifted to Europe in 30 days.

The 180,000 tons of cargo includes 50,400 tons of outsize cargo, 108,000 tons of oversize cargo, and 21,600 tons of bulk cargo. Outsize cargo exceeds 828 inches long, 117 inches wide or 105 inches high and cannot be carried by the C-141 aircraft. Oversize cargo is all rolling stock that does not meet the outsize description and any other cargo that is too large to be attached to a standard pallet (104 inches long and 84 inches wide). Oversize cargo can be loaded on the C-5A, C-141, C-130, Boeing 747, and DC-10 freighters and some Boeing 747 passenger aircraft which are convertible to cargo aircraft. Bulk cargo can be attached to a standard pallet, and can be transported by most aircraft.

The following table shows how the Air Force used these factors to determine strategic airlift capability for 30 days.

Strategic Airlift Capability In a 30-day Deployment to Europe (9,516 Miles Roundtrip)

Aircraft	Number of aircraft	Average payload per aircraft (tons)	Average speed (nautical miles per hour)	Hours of use per day	30-day capability (tons)
Military Airlift Command					
C-5A	70 a/	77.0	410	10	69,700
C-141	234 a/	23.5	410	10	71,000
Civil Reserve Air Fleet (note b)					
Boeing 747	11	104.0	460	10	16,600
Douglas DC-10	7	52.71	460	10	5,400
Douglas DC-8 & Boeing 707	129				17,300
Total	451				180,000

a/These are with aircrews, maintenance personnel, and spares expected to be available.

b/The inventory includes two Boeing 747 and three Douglas DC-10 aircraft provided by NATO countries but not a part of CRAF.

The Air Force calculation of a 30 day capability assumes that all the equipment (outsize, oversize, and bulk) of each designated Army and Air Force unit is delivered at about the same time in order to maintain the integrity and combat capability of those units (a balanced deployment). C-5A loads would include some oversize cargo and C-141 loads would include some bulk cargo, in order to maximize weight capabilities. The mixes are as follows:

Aircraft	30-day capability (tons)			
	Outsize	Oversize	Bulk	Total
C-5A	50,400	19,300		69,700
C-141		66,700	4,300	71,000
CRAF 747		16,600		16,600
CRAF DC-10		5,400		5,400
CRAF DC-8 and B707			17,300	17,300
	50,400	108,000	21,600	180,000

OBSERVATIONS CONCERNING EXISTING AIRLIFT CAPABILITY

In computing the existing airlift capability the Air Force assumed that 70 C-5A and 234 C-141 aircraft would be used an average of 10 hours a day during the entire 30-day airlift. These assumptions, however, are questionable, for the reasons discussed below.

Aircraft available for operations

On an average day during 1975, only 43 C-5As and 178 C-141s were flyable. MAC officials said some of the aircraft in a nonflyable status were undergoing minor maintenance and could have been returned to a flyable status quickly. During December 1975 and January 1976, an average of 33 C-5As were in flyable status and eight more (a total of 41) could have been made available within 48 hours. MAC officials indicated that it would have taken 60 days to make as many as 52 C-5As available for operations.

Operation at a rate of 10-hours-a-day

The C-5As and C-141s could not have operated at a rate of 10-hours-a-day during 1975 because of an inadequate supply of spare parts, delays in repairing components, and an insufficient number of trained maintenance and flight crews. Air Force officials told us that funding is available to increase spare parts; however, they still have delays in deliveries and in getting components repaired. Thus, in a short-term emergency situation, it is not likely that the aircraft could operate 10 hours a day for a 30-day period.

Conclusions

Because the number of aircraft available in an emergency is less than estimated by the Air Force and the capability to operate those aircraft at 10-hours-a-day is questionable, we believe existing airlift capability is considerably less than the 180,000 tons projected for a 30-day period. If the Joint Chiefs' plans are predicated and dependent on the capabilities as expressed by the Air Force, the contingency plans may be unattainable. The inability to provide the 180,000 tons of airlift could, in the extreme, adversely affect the outcome of any confrontation in Europe with Warsaw Pact forces.

CHAPTER 3

AIRLIFT ENHANCEMENT

The Air Force has embarked on a number of programs which are intended to more than double strategic airlift capability. In terms of cargo capability, the objective of the programs is to permit airlift of the 180,000 tons of cargo to Europe in 15 rather than 30 days or to increase the 30-day airlift capability to 370,000 tons.

Since a balanced deployment is necessary to maintain an effective force and the extent of the deployment is limited by the C-5A movement of outsize cargo, the airlift programs are designed to increase the C-5A outsize capability to the maximum level and procure added oversize capability. The various increases result in an outsize capability of about 95,700 tons and oversize capability of about 230,000 tons.

The airlift enhancement programs involve:

--Increased use of existing aircraft. (See p. 8.)

--Modification of C-141 aircraft. (See p. 11.)

--Modification of commercial aircraft. (See p. 14.)

The chart on the following page is a summary of the estimated cost and impact of the programs presented by the Air Force.

Airlift Enhancement Programs Proposed by the Air Force to Increase Strategic Airlift Capability

	Increase in 30-day capability (tons) Air Force estimate	Estimated 10-year cost (millions of 1976 dollars)
Increased or changed use of existing aircraft:		
Increase C-5A spare parts and crews	17,700	$ 584.3
Increase C-141 spare parts and crews	14,800	472.7
Train crews in C-5A aerial refueling	5,800	—
Use C-130 for strategic airlift	11,400	—
Use additional CRAF bulk capability	30,000	—
Modification of C-141 aircraft:		
Stretch C-141 fuselages	16,500	504.0
Add refueling receptacle, etc., to C-141s	3,100	46.0
Modification of commercial aircraft:		
Modifications to aircraft assigned to the civil reserve air fleet	91,000	a/550.0
Total	190,300	$2,157.0

a/ Depending on the type of modification, the cost ranges from $450 to $650 million. For purposes of this chart, we used $550 million, the midpoint.

LIMITS TO INCREASING AIRLIFT CAPABILITY

The number of aircraft missions required to transport 370,000 tons of cargo could saturate offload bases in the European theater. In order to airlift 370,000 tons in 30 days, about 330 airlift aircraft would arrive daily at their destinations, or about 9,900 sorties in 30 days. In addition to the cargo aircraft, passenger, fighter and tactical airlift aircraft from the United States and NATO countries would also be using the NATO airfields.

Another factor which could limit airlift capability is the availability of adequate fuel at offload points to accommodate all aircraft. For example, during the last Arab-Israeli war, U.S. airlift aircraft took on as much fuel (in pounds) in Israel as the weight of the cargo delivered.

Conclusions

We believe that the Air Force projections that the enhancement programs will double airlift capabilities may be optimistic. Studies of airlift programs have not included adequate consideration of factors such as saturation of offload bases and availability of adequate fuel, which may limit the maximum airlift capability.

INCREASED EMERGENCY USE OF C-5A AND C-141 AIRCRAFT

Existing plans anticipate that C-5A and C-141 aircraft forces will fly a limited number of hours for peacetime training, will be able to "surge" in an emergency for 45 days, and will maintain a sustained maximum use rate after 45 days as follows.

	Hours a day planned use	
	C-5A	C-141
Peacetime	2.5	3.5
Emergency surge	10.0	10.0
Sustained rate	8.0	8.0

The number of flight and maintenance crews and the supply of spare parts are limiting factors in the Air Force capability to meet the planned use rates. During 1975 neither the C-5A nor the C-141 aircraft would have been capable of meeting the surge or sustained rates of operation (see p. 5.)

The airlift enhancement programs also include plans to increase the C-5A and C-141 flying hour programs to a 12.5-hour-a-day surge rate for 45 days, with a sustained 10-hour-a-day rate after 45 days.

To reach the proposed capabilities, the Air Force estimates that a total of 280 C-5A and 936 C-141 flight crews will be required (four crews per aircraft). As of September 1975, only 179 C-5A and 713 C-141 flight crews were qualified. The Air Force also needs additional maintenance personnel to maintain the higher use rates. The Air Force plans to reach the necessary crew levels primarily by expanding reserve units (trained crews without aircraft assigned).

In addition to costs for crew and maintenance personnel, war reserve spare parts and other supplies would have to be increased to support operations, at a cost of over $350 million between 1976 and 1980.

During House Armed Services Committee hearings a MAC official indicated that it may not be possible to achieve an average daily use of 12.5 hours with the C-5 and C-141. He stated that it is probably only safe to plan on doubling the peacetime use rates of aircraft for an emergency. If this is true, it would not be reasonable to estimate capabilities based on a 12.5-hour-a-day use rate.

If the program to modify C-5A wings is approved, an average of 10 aircraft per month will be out of service from November 1980 through January 1986. Some other aircraft, probably 6 or more, would be undergoing routine depot maintenance at any one time. Thus, until modernization of the C-5A fleet is completed in 1986, something less than 280 crews (four each for 70 aircraft) would be necessary. The lower number of aircraft operating would not require the quantity of war reserve materials that would be procured for the total fleet of 70 aircraft.

The practicality of achieving increased operating rates for 234 C-141s may be similarly affected by the C-141 modification, if carried out. Based on the estimated schedule there will be 34 C-141s undergoing the stretch modification at any one time from the first quarter of fiscal year 1980 through the first quarter of fiscal year 1982. In addition, another 11 C-141s are programed to be out of service for routine depot maintenance.

Conclusions

Considering the operational history of the C-5A and reliability of components, the number of modifications planned, and the unavailability of aircraft undergoing modifications, we have serious reservations whether the Air Force will ever be able to achieve a 12.5-hour-a-day use rate for all C-5A and C-141 aircraft. Air Force experts have indicated that the highest use rates achievable might be only twice the daily peacetime flying rate (2.5 hours for the C-5A and 3.5 hours for the C-141).

Failure to achieve a 12.5-hour use rate for MAC aircraft in an emergency would degrade full-scale reaction to a contingency in Europe and would create a shortfall of cargo scheduled to be airlifted. The ability of the C-5A to deliver outsize cargo appears to be a key factor in Air Force goals to maintain a balanced deployment.

The Air Force's funding plan for increasing crews and war reserve material is aimed at providing the increased use rates for 70 C-5As and 234 C-141s by fiscal year 1980, even though not that many aircraft could be operational if the planned modifications are performed.

In view of the uncertainty as to whether a goal of a 12.5-hour-a-day surge rate for either the C-5A or C-141 aircraft could realistically be achieved, the Air Force should reevaluate its plans and funding requirements.

C-5A AIR REFUELING TRAINING

United States airlift operations in the 1973 Middle East war demonstrated a potential for a substantial increase in strategic airlift capabilities from in-flight refueling. As a result, the Air Force trained 77 C-5A flight crews in air refueling techniques.

The Air Force estimates that air refueling of C-5As will increase the average payload by 4-percent and provide an additional 4-percent gain in range by avoiding enroute landing for refueling. The total effect of these changes is an increase of about 5,800 tons of outsize cargo in 30 days. Aerial refueling would also be critical on longer missions, such as in the Middle East, where a lack of enroute ground refueling locations could make an effective airlift impossible.

AUGMENTATION OF STRATEGIC AIRLIFT WITH C-130s

Both tactical and strategic airlift responsibilities have been consolidated under MAC to enable MAC to employ forces more efficiently by augmenting a strategic deployment with the tactical airlift C-130 aircraft. The Air Force plans to use the C-130s in a strategic role during the early stages of the airlift before the C-130s are needed for intra-theater tactical airlift.

By 1980, a total of 31 squadrons of C-130 aircraft are programed to be in the active and reserve forces with about 234 aircraft available to assist in a strategic deployment. The other squadrons will (1) support deployment operations within the United States, (2) satisfy Alaskan requirements and (3) fulfill in-place NATO commitments.

The Air Force projects that the use of C-130 aircraft will permit the delivery of an additional 11,400 tons of oversize cargo to Europe. This capability can be achieved at no extra cost in either manpower or other operational and maintenance expenditures.

The actual increase in strategic airlift capability achieved by using the C-130s will depend on the length of time they are available in the strategic role which in turn will depend on the advanced warning received concerning an impending conflict in Europe.

USE OF ADDITIONAL BULK CARGO CAPABILITY AVAILABLE THROUGH CRAF

The bulk cargo capability of CRAF assigned aircraft exceeds Air Force needs in reacting to a European contingency. During a balanced deployment the Air Force proposed to transport 17,300 tons of bulk cargo. Under the airlift enhancement program the Air Force plans to increase the use of bulk cargo capability to transport 47,300 tons of cargo.

MODIFICATION OF THE C-141

The C-141 normally cannot be loaded to its weight capacity with oversize equipment because the equipment fills the cargo space before the aircraft reaches maximum weight limitations. To increase the capability to transport oversize equipment, the Air Force plans to stretch the C-141 fuselage by about 23 feet. This will increase the empty weight of the aircraft by about

10,000 pounds. The Air Force also plans to add aerial refueling hardware to the C-141s to reduce dependence on enroute support bases.

The C-141 stretch program

In May 1975, the Air Force awarded a $41.5 million contract to Lockheed-Georgia Company to modify and test one C-141 that will incorporate

--a fuselage about 23 feet longer than standard C-141s (estimated cost $627 million).

--including an improved fairing to reduce wing bending without increasing drag, and

--an aerial refueling system (estimated cost $53 million).

The Air Force plans to begin flight testing the modified aircraft around March 1977, with a production decision anticipated in December 1977.

The modification program for 275 aircraft is estimated to cost about $680 million (escalated dollars) and will require about 8 years to complete.

The Air Force estimates that the stretched C-141 would carry an average payload of 25 tons each sortie, increasing the 30-day airlift capability to Europe from 71,000 to 87,500 tons, an increase of 16,500 tons. Air Force officials, however, have furnished data to us which indicates that the average loading of current models of the C-141 is about 23.5 tons. Thus, the increase to 25 tons represents only a 1.5 ton increase. With an increase of only 1.5 tons per sortie, the increase in airlift to Europe from stretching C-141s would be only about 4,700 tons in the first 30 days. At an estimated cost of $627 million (escalated), it is questionable whether this modification plan is cost effective.

Air Force and Lockheed officials observed that these differences in estimated capabilities are not necessarily inconsistent. We found that calculations of the increase in capability ranged upward to more than 21,000 tons. Aircraft loads can and do vary based on distances to be flown and the stress to be placed on the aircraft.

An aerial refueling system would reduce the C-141's reliance on enroute support bases and would decrease the distance to be flown to Europe by 4-percent by eliminating a refueling stop at Dover Air Force Base. The Air Force estimates that this 4-percent reduction permits about a 3,000-ton increase in the 30-day capability of the C-141. The cost to add an in-flight refueling system to the C-141 is estimated to be about $53 million (escalated).

Technical risks in the C-141 stretch program

Air Force engineering evaluations concluded that the C-141 stretch modification is technically feasible and well within the state of the art. In November 1974, the Air Force Scientific Advisory Board established an Independent Review Team to assess the proposed C-141 modifications and determine the technical risks in the program. The Review Team assessed the risks involved with stretching the C-141 and in October 1975 indicated that there were two areas of concern, the deterioration of stall characteristics and the remaining life of the C-141 airframe. In an interim report they stated sufficient data will be available during the last half of calendar year 1976 to decide whether to go ahead with the modifications in mid-1977.

During 1975, at approximately 70,000 test hours (equivalent, for safety purposes, to about 18,000 flight hours), the C-141 fatigue article, used to establish the life of the C-141 fleet, developed a crack on the lower wing surface similar to those which have created the need for modification of the C-5A wings. Although made of the same material and design as the C-5A wing, the C-141 wing material is thicker, subject to lower stresses, and connected with fasteners less susceptible to fatigue damage than those on the C-5A. Random inspections of high-time C-141 aircraft, some of which exceed 20,000 flight hours, have not disclosed comparable cracking in the C-141 fleet. The Air Force is now analyzing the significance of the C-141 fatigue article crack problem.

The Independent Review Team will evaluate the Air Force's C-141 service life assessment. A report of the team's evaluation is expected about August 1976, at which time more reliable information concerning the remaining service life of the C-141 will be available. In addition, the team asserts that early and favorable results from the C-141 service life assessment are essential for any C-141 stretch production go-ahead decision.

Conclusions

The increase in 30-day airlift capability to Europe as a result of stretching the C-141 may be only about 4,700 tons--not 16,500 tons as projected by the Air Force. If the increase in airlift capability from stretching C-141s is far less than Air Force estimates, the costs of alternatives may be more competitive than previously indicated by the Air Force, and it may not be cost effective to spend $627 million for a minor increase. As stated on page 9, it is also uncertain whether the use rate of the C-141 could be increased to 12.5 hours per day.

The cost of the stretch modification also seems less desirable when the remaining service life of the aircraft is considered--the C-141 aircraft have flown an average of about 17,000 of their estimated total 30,000-hour life. Since adding the in-flight refueling system may be cost effective, the Air Force should further evaluate the payback offered by this modification.

MODIFICATION OF COMMERCIAL AIRCRAFT

The Air Force has proposed a program to modify commercial wide-bodied passenger aircraft to cargo capable configurations suitable for airlift of oversize military cargo. The Air Force proposes to (1) pay for the modifications; (2) compensate the airlines for downtime during modification and revenue lost due to increased aircraft weight; and (3) pay an annual incentive of $50,000 for each aircraft modified and returned to passenger service. In addition, carriers were to be offered a cost-sharing arrangement for new wide-bodied cargo-capable aircraft they may be acquiring or for modification of passenger aircraft to be used in civil cargo services. In this case the Air Force would pay an amount equal to 50 percent of the cost to modify a similar type passenger aircraft to a cargo convertible configuration.

The Air Force issued a request for proposals to the airlines in December 1974 describing the possible modifications; the objective being to modify a fleet equivalent to 110 B-747 aircraft.

In response to the request, the airlines initially offered a total 90 B-747 aircraft, later reduced to 81 with the foreign sale of nine aircraft by Trans World Airlines. A breakdown by type of modification and estimated 10-year cost is shown below.

Type of modification	Number a/	Estimated cost
Full	23	$120.7 million
Mini	58	431.3 million
	81	$552.0 million

a/ Includes four new aircraft and 11 existing aircraft to be modified and used in civil cargo service.

The full modification consists of a side cargo door with a permanent freighter floor. The mini-modification consists of a nose cargo door with minimal floor reinforcement and a kit for vehicle support.

The Congress rejected the CRAF modification program because of inadequate justification by the Air Force, legal questions regarding civilian pilots flying into hostile areas, and the responsibility for loss or damages if a commercial airline crash were determined to be the result of the modifications.

The Air Force will request funds to modify all 81 of the Boeing 747s offered by the airlines even though some have already been modified at the airlines' expense for use in commercial freight operations. The Air Force believes it has a moral but not a legal obligation to the airlines to share this cost since the Air Force in December 1974 offered to do so and the airlines responded to that offer.

Air Force officials told us that the wide-body aircraft recommended for modification to a cargo-capable configuration were acquired by the airlines beginning in 1970 and are anticipated to possess a structural life of at least 20 years. Based on this, the earliest anticipated retirement date for the subject aircraft would be 1990.

If the 81 modifications are accomplished, the 30-day airlift capability of oversize cargo to Europe will increase by about 70,000 tons.

Conclusions

The CRAF modification program appears to be a cost effective option because the Air Force

--can obtain a large increase in emergency strategic

airlift capability without buying any aircraft,

--does not incur increased personnel cost because the airlines will provide the crews for the CRAF aircraft, and

--does not fly and maintain the CRAF aircraft in peacetime and thereby avoids the annual operating cost.

The Congress has not questioned the potential cost effectiveness of the CRAF modification program, but rather the related problems of cost-sharing and legal responsibilities. The Air Force also has not demonstrated, to the satisfaction of the Congress, that there is a need for the increased CRAF capability. The Air Force should resolve the issues concerning the CRAF modification program, including

--legal questions concerning commercial pilots flying aircraft in war zones,

--responsibility for damages if a converted aircraft crash results from the modification,

--the remaining fatigue life of Boeing 747s that would be modified,

--the Government's responsibility for sharing in the cost of modifications completed by the owners, and

--the overall need for the increased capability.

CHAPTER 4

OTHER PROGRAMS TO EXPAND AIRLIFT CAPABILITY

Other Air Force programs that will have a significant impact on strategic airlift capabilities in the 1980s include

--C-5A wing modification

--Advanced tanker/cargo aircraft

--Advanced medium short-take-off-and-landing transport.

These programs are discussed below.

MODIFICATION OF THE C-5A

The Air Force plans to make several modifications to the C-5A aircraft to increase the life of the wing, correct remaining defects, and make a number of other improvements.

Correction of the wing defect

The Lockheed production contract required that the C-5A be capable of lifting a 220,000 pound payload at a load factor of 2.5G (one G equals the force of gravity) and established a 30,000-hour goal for aircraft service life. Testing the aircraft has revealed that the payload and service life do not meet the goals. The expected wing service life is now estimated at about 8,750 hours, with the payload limited to 174,000 pounds at 2.0G. Even with limited payloads and flight conditions, the first aircraft could reach the 8,750-hour limit and be grounded in 1979. The entire C-5A force could be grounded by 1983.

To attain the 30,000-hour service life and increase the strength of the wing, the Air Force plans to replace the inner and center wing structures and rework the outer sections of the wings. Cost estimates have ranged from about $900 million to $1,343 million. The Air Force budget estimates are based on a total program cost of $1,091.9 million, as shown in the chart on the following page.

The Air Force considered two alternatives to the C-5A wing modification; procurement of either a modified Boeing 747 or an austere C-5B, but decided that modification of the wing was the most cost effective alternative.

Cost and Schedule Estimates of the C-5A Wing Modification Program

Funding requirements

	Fiscal Years							
	Prior to 1977	1977	1978	1979	1980	1981	1982-1986	Total
	(millions)							
Design and test (RDT&E appropriation)	$38.5	$22.6	$41.5	$ 25.0	$ 21.0	$ 18.0	$ 19.9	$ 186.5
Fabrication (Procurement of aircraft appropriation)	2.0		41.8	85.5	76.0	72.2	78.7	356.2
Installation (Operations and maintenance appropriation)	—	—	—	—	13.9	105.2	430.1	549.2
Total	$40.5	$22.6	$83.3	$110.5	$110.9	$195.4	$528.7	$1,091.9

Schedule

Begin design effort	December 1975
Commitment for fabrication of modified wing structures	May 1978
Begin fatigue test	June 1979
Commitment for installation of modified wing structures	November 1979
Begin flight test	June 1980
Begin modification of aircraft	November 1980
Complete flight test	October 1980
Complete first aircraft	January 1982
Complete last aircraft	January 1986

Based on the schedule there will be an average of about 10 C-5As out of service each month from November 1980 through January 1986. This will have a significant impact on the strategic airlift capability during that period.

The schedule and funding requirements are based on the assumption that Lockheed will do the entire C-5A wing modification, including the design, testing, fabrication, and installation. The Air Force, however, studied various alternative procurement approaches and concluded that

--some degree of competition is technically feasible;

--assignment of the installation effort to San Antonio Air Logistics Center is not considered desirable by Air Force Logistics Command;

--of the various competitive alternatives studied, the best case is the one in which only the installation effort is procured using the competitive process;

--sole source to Lockheed for the entire program would have the least impact on the operational force; and

--a competitive procurement approach for the entire program should not be considered a viable alternative because of the resulting elongated schedule and significant increased cost.

The Secretary of the Air Force decided to proceed sole source to Lockheed for the design and test, but to maintain the option for soliciting competitive bids for the fabrication and installation.

In April 1975, the Defense Systems Acquisition Review Council reviewed the wing modification program and recognized several potential problems with the program. Among other things, the Council directed the Air Force to reanalyze the alternatives to the wing modification to determine under what conditions an alternative would become attractive. As of May 1976, the Air Force had not responded.

In a recent report to the Chairman, Senate Appropriations Committee, concerning the cost estimates for the wing modification, we stated that the estimate was not final and that decisions concerning the start of work, concurrent development and production, and competition in procurement of the modification services could lead to significant increases in the cost.

In December 1975, the Air Force awarded a contract to Lockheed for $28.5 million to initiate the design effort for the modified wing and plans to commit funds in May 1978 to produce the modified wing. Funds for that effort will probably be requested in the fiscal year 1978 budget.

Other planned modifications to the C-5A

As a result of two accidents in fiscal year 1975, delays in obtaining approval for the C-5A wing modification program, and other concerns, an Air Force study group known as "APEX" was formed in April 1975 to review all aspects of the C-5A. The APEX group concluded that no major deficiencies existed in the C-5A system which impaired its safe operation. However, the group recommended that the Air Force:

--Provide additional simulator capability.

--Eliminate fire sources and provide an extensive fire detection and suppression system.

--Install electronic aids to prevent inadvertent collision with the ground.

--Implement an effective corrosion control program.

--Increase the spares and parts inventories to reduce cannibalization.

--Improve the management system for implementing corrective actions.

--Replace avionics systems with off-the-shelf equipment.

--Install a lift distribution control system to reduce wing fatigue damage.

--Provide for a special wing inspection program prior to wing modification.

--Return the aft cargo door complex to full operational use.

The total cost to implement the APEX recommended improvements is unknown at this time. We believe, however, a substantial cost will be incurred for additional work resulting from the study.

Conclusions

If C-5As are to be available for airlift through the 1980s, the wing modification and other modifications such as the aft cargo door, installation of a fire suppression system, and a lift distribution control system are apparently essential. The Air Force should firmly establish and present to the Congress the total costs associated with modifying and correcting all defects. That cost should then be compared with the cost of alternative methods of achieving the mission now assigned to the C-5A, such as prepositioning material, utilizing fast sealift capability, or procuring outsize versions of the 747 (or equivalent) freighter.

DEVELOPMENT AND PROCUREMENT OF NEW AIRCRAFT

In addition to modifying and increasing the use of existing aircraft to increase airlift capability, the Air Force has plans for two new aircraft that would increase the strategic airlift capability in the 1980s. These two programs, the advanced tanker/cargo aircraft and the advanced medium short-takeoff-and-landing transport, are discussed below.

Advanced Tanker/Cargo Aircraft

The Air Force has concluded that an advanced tanker is needed to

"***provide the expanded air refueling capacity needed in support of: (1) general purpose tactical aircraft during strategic deployment/employment operations, (2) airlift aircraft during strategic airlift operations, and (3) strategic aircraft during deployment/employment operations."

Specifically, MAC has stated that an advanced tanker/cargo aircraft is needed because:

--A firm requirement exists for a large tanker to meet the future aerial refueling demands of C-5 and C-141 aircraft.

--These demands will be most acute during crises such as the October 1973 Middle East airlift and during deployment of combat units to foreign bases.

--Use of the AT/CA for C-5A/C-141 aerial refueling during a NATO or Asian deployment will minimize the impact of theater fuel availability.

--The KC-135 tankers cannot support the refuelng requirements of the airlift force during contingencies or theater deployments unless foreign landing rights are guaranteed and other tanker requirements are minimized.

--The bonus cargo capability of the AT/CA is desirable in terms of the additional airlift flexibility it provides but is not a hard requirement.

In his fiscal year 1977 annual defense department report, the Secretary of Defense stated the AT/CA is being proposed primarily as a tanker and its main contribution to strategic airlift would be to expand the range/payload capability of the C-5As and C-141s.

The following table shows a comparison of the KC-135 and the various AT/CA candidates in terms of pounds of fuel or cargo carrying capability.

	Use for tanker fuel offload at 2,500 mile radius mission	Use for airlift allowable cabin load at 4,000 mile range
KC-135A	52,000	62,000
B-747-200F	197,000	195,000
DC-10-30CF	150,000	148,000
C-5 (note a)	150,000	195,000
L-1011	78,000	96,000

a/Assumes wing modification completed.

The Air Force plans to buy a total of 41 AT/CAs (747 version, or equivalents of DC-10 versions). The Air Force's acquisition strategy for the AT/CA is direct procurement of off-the-shelf, currently available, wide-bodied freighter aircraft modified to (1) provide an air refueling capability, and (2) fully utilize the cargo carrying capability of the aircraft. The AT/CA, as currently planned, will not be capable of carrying outsize cargo. The Air Force also plans to develop an improved air refueling subsystem , intended for use on the KC-135 and available for use on the AT/CA.

The preliminary schedule and funding requirements for the AT/CA procurement program, as of January 1976, are shown below.

Program reviewed by the Secretary of Defense	May 1976
Release request for proposals	August 1976
Receive proposals	October 1976
Defense Systems Acquisition Review Council review	March 1977
Award contract	April 1977
First aircraft delivery	a/June 1979
Last aircraft delivery	Mid-1983

a/This is the earliest possible date.

Funding requirements (note b)

(millions)

FY 1977	$ 37.2
FY 1978	357.4
FY 1979	922.3
FY 1980	920.7
FY 1981	919.6
Total	$3,157.2

b/These funding requirements are based on the high cost candidate aircraft (B-747) and include nonrecurring costs, flyaway costs, ground equipment, training equipment, data, and initial spares.

The Air Force does not consider the AT/CA as part of its airlift enhancement program even though the planned buy of 41 could provide a substantial increase to the current airlift capability. The extent of the AT/CAs' contribution to airlift would depend on the candidate aircraft selected and the number of AT/CAs that would be available for use in the cargo role. Aircraft manufacturers' concepts of the AT/CA are depicted in appendix II.

Advanced medium short-takeoff-and-landing transport

The AMST is being developed as a tactical airlift aircraft, but it will also be capable of augmenting the strategic airlift forces. The acquisition strategy for the AMST is prototyping followed by selection of one source for full-scale development and production. Boeing and McDonnell-Douglas are each building two prototype aircraft.

The AMST prototype program will cost the Air Force about $229 million. There is no commitment or congressional approval to proceed with AMST development beyond prototyping, but the Air Force is planning to budget $618.1 million for full-scale development. Development and production program cost estimates are not firm. In December 1975, the Secretary of Defense directed the funding plan for AMST full-scale development be reduced to $257.4 million.

The Air Force recently advised the Congress that the AMST program unit cost was about $21.5 million assuming procurement of about 300 aircraft. An estimate of $6.3 billion has been reported as the total program cost for 277 aircraft.

Prototype flight testing is scheduled for completion in July 1977. Approval for AMST full-scale development and production programs are planned for the summer of 1977 and the spring of 1981, respectively. The first production aircraft would be available sometime in 1983.

Air Force officials project a payload capability of approximately 56,000 pounds for the AMST in a strategic role. The AMST cargo compartment dimensions are: height, 135.6 inches; width, 140.4 inches; and length, 564 inches. With these dimensions the AMST will be capable of carrying some outsize cargo.

Although the Air Force did not include the AMST in its airlift enhancement program, the AMST could provide a significant increase in stategic airlift capability. If 234 AMST's were available for use during the first 20 days of a NATO deployment, they could airlift over 50,000 tons of equipment.

We believe the potential contribution of the AMST should be considered in any evaluation of future strategic airlift requirements and capabilities.

CHAPTER 5

OVERALL CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

In our opinion, the airlift programs have not been evaluated in terms of a most cost effective combination of airlift forces needed to meet the requirement. The requirement, the limitations on meeting the requirement, and all combinations of existing, planned, or modified aircraft needed to meet the requirement have not been assessed. Consideration of all of these factors may show a need to change the mix and relative quantities of airlift aircraft.

RECOMMENDATIONS

Airlift requirements must be considered in relation to other deployment alternatives such as sealift and prepositioning of supplies and equipment. We therefore recommend that a comprehensive study of the alternatives of airlift vs sealift, vs prepositioning be accomplished by the DOD and presented to the Congress. As a minimum, DOD should identify (1) the airlift requirement in terms of specific items and weights and required delivery dates, (2) the costs, and the advantages and disadvantages of alternatives such as increased prepositioning of supplies and equipment, and (3) the timeliness and availability of sealift.

BUDGET IMPACT

Modification programs	Type of funds	Prior to 1977	1977	1978	1979	1980	1981	To complete	Total
		Fiscal year (millions of escalated dollars)							
C-5A wing	3,600	$38.5	$ 22.6	$ 41.5	$ 25.0	$ 21.0	$ 18.0	$ 19.9	$ 186.5
	3,010	2.0	-	41.8	85.5	76.0	72.2	78.7	356.2
	3,400	-	-	-	-	13.9	105.2	430.1	549.2
Total		40.5	22.6	83.3	110.5	110.9	195.4	528.7	1,091.9
C-5A other					UNKNOWN				
C-141 stretch and refueling	3,010	41.5	-	95.6	88.5	116.2	42.4	-	384.2
	3,400	-	-	-	34.6	92.7	131.3	38.1	296.7
Total		41.5	-	95.6	123.1	208.9	173.7	38.1	680.9
CRAF (note a)	3,010	-	29.2	96.1	52.2	248.3	33.2	(c)	459.0
Total		$82.0	$ 51.8	$275.0	$285.8	$568.1	$402.3	$566.8	$2,231.8
Increased use of aircraft									
Personnel (note b):									
C-5	3,500	24.4	29.0	37.3	37.3	37.3	37.3	223.6	426.2
C-141	3,500	28.6	34.0	43.7	43.7	43.7	43.7	262.4	499.8
Total		53.0	63.0	81.0	81.0	81.0	81.0	486.0	926.0

BEST DOCUMENT AVAILABLE

APPENDIX I

Increased use of aircraft	Type of funds	Prior to 1977	1977	1978	1979	1980	1981	To complete	Total
War reserve material:									
C-5A	3,010	20.6	26.6	79.6	79.6	79.6	-	-	286.0
C-141	3,010	19.1	20.7	9.0	9.0	9.0	-	-	66.8
Total		39.7	47.3	88.6	88.6	88.6	-	-	352.8
Total		92.7	110.3	169.6	169.6	169.6	81.0	486.0	1,278.8
New aircraft									
ATCA	3,600	$ 6.6	$ 8.0	$ 9.6	$ -	$ -	$ -	$ -	$ 24.2
	3,010	-	37.2	357.4	922.3	920.7	919.6	-	3,157.2
Total		6.6	45.2	367.0	922.3	920.7	919.6	-	3,181.4
AMST	3,600	206.7	29.3	90.0	75.0	70.0	15.0	5,814	6,300.0
Total		213.3	74.5	457.0	997.3	990.7	934.6	5,814	9,481.4
TOTAL		$388.0	$236.6	$901.6	$1,452.7	$1,728.4	$1,417.9	$6,866.8	$12,992.0

a/Excludes incentive payments to airlines and costs for increased weight. Total 10-year cost is $552 million.

b/Expressed in constant 1976 dollars.

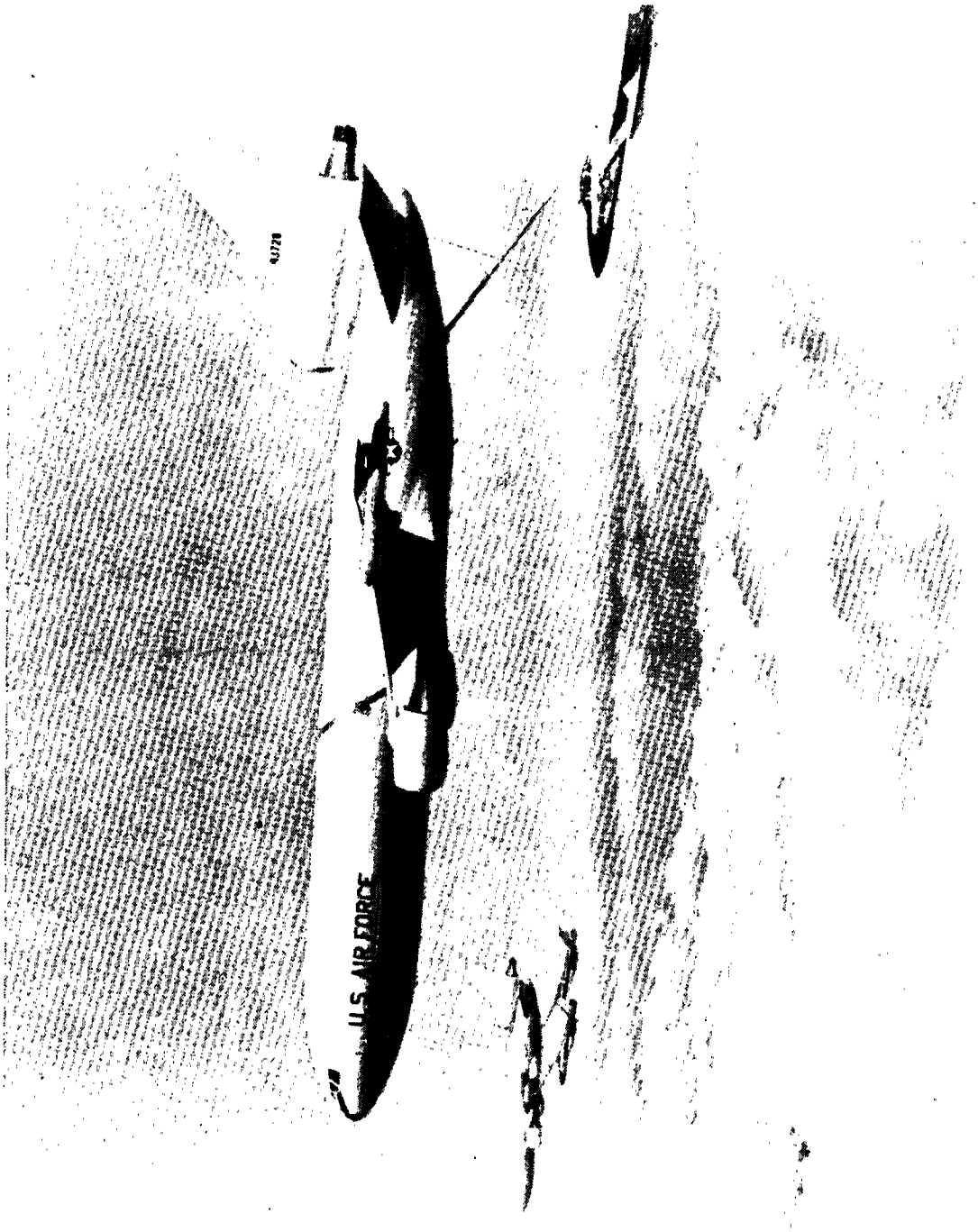
c/Not available at time of our review.

BEST DOCUMENT AVAILABLE

APPENDIX I

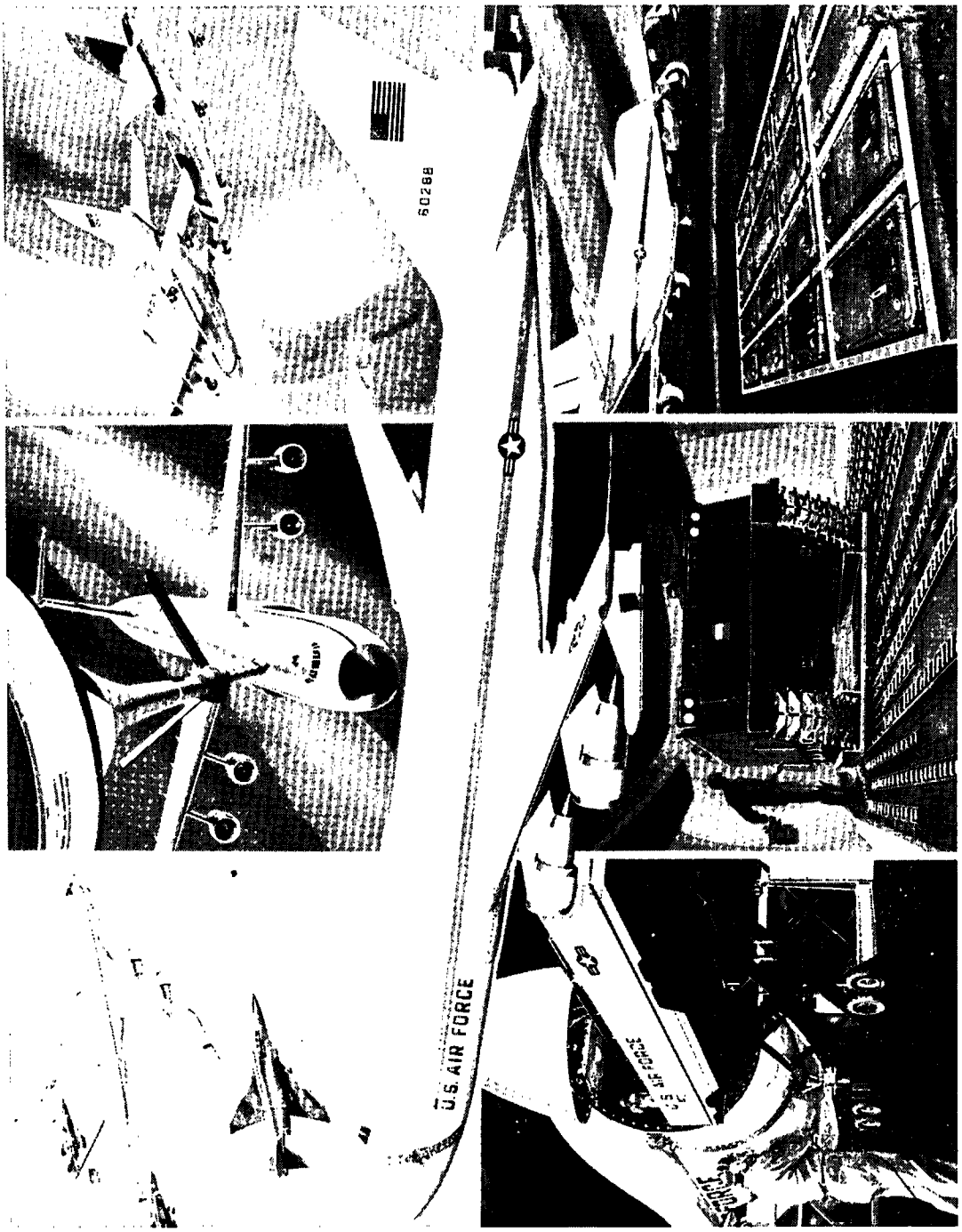
APPENDIX II

AIRCRAFT MANUFACTURERS' CONCEPTS OF AT/CA



MCDONNELL-DOUGLAS CONCEPT OF DC-10 AS AT/CA.

APPENDIX II



BOEING AIRCRAFT CO'S CONCEPT OF B-747 AS MULTI-MISSION AT/CA.