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BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

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Issues Concerning Air Force KC-10A Advanced Tanker/Cargo Aircraft

The Air Force plans to buy 20 McDonnell-Douglas DC-10 convertible freighter aircraft, designated the KC-10A, at an estimated program cost of $1.055 billion, with options to buy up to 60 aircraft. They have also approved modification programs to the current KC-135 tanker to extend its service life and improve its performance at a cost that could be as high as $12 million an aircraft.

However, the Air Force has not yet evaluated the relative cost effectiveness of a mix of KC-10As, KC-135s, and other alternatives to fulfill total aerial refueling requirements.

The Air Force was able to negotiate an economical procurement plan when it awarded the contract, but its current procurement plan does not take complete advantage of the lowest prices in the contract. As a result, under the current plan the Air Force will have to pay an additional cost of $1,780,000 for each aircraft over the minimum price available to them.

report

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

B-163058

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

This report presents our views on the major issues of the KC-10A advanced tanker/cargo aircraft. A draft of this report was reviewed by agency officials associated with the program, and their comments are incorporated as appropriate.

For the past several years, we have annually reported to the Congress on the status of selected major weapon systems. This report is one of a series that is being furnished to the Congress for its use in reviewing fiscal year 1980 requests for funds.

We made our review 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).

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretary of Defense.

ACTING Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

ISSUES CONCERNING AIR FORCE KC-10A ADVANCED TANKER/ CARGO AIRCRAFT

D I G E S T

The Air Force plans to buy 20 DC-10 convertible freighter aircraft modified with fuel tanks, an aerial refueling boom, and other equipment necessary to convert it to a refueling tanker. The contract, awarded to the McDonnell-Douglas Corporation in January 1978, provides for engineering effort to design the modifications and provides six options for procurement of up to 60 KC-10As at fixed prices with economic escalation provisions. Options for two aircraft were exercised on November 20, 1978, at a cost of $151.1 million, which includes $15.6 million for initial spares. The estimated program cost through fiscal year 1984 is $1,055 million, including $113.3 million for logistics support. (See pp. 1, 3, 4, and 16.)

The primary mission of this advanced tanker, designated the KC-10A, is to provide improved mobility by

--permitting strategic airlift aircraft to fly from U.S. bases to most parts of the world with large payloads, thus eliminating or reducing the need for enroute refueling stops at bases on foreign soil;

--supporting long-range deployment of tactical fighters by providing in-flight refueling and cargo airlift simultaneously; and

--augmenting airlift forces by carrying palletized cargo and bulk fuel between major aerial ports.

The existing KC-135 tankers have neither the range, fuel offload capability, nor cargo capability to fulfill that Air Force mission. (See pp. 1 and 18.)

In addition to planning the procurement of the 20 KC-10As, the Air Force has approved modification programs to the KC-135s--the current tankers--to extend their service life

and improve their performance. Additional modifications are being considered, the most expensive being to replace the KC-135 engines. The estimated cost to complete the current and proposed modifications could be as high as $12 million an aircraft. (See pp. 8 and 9.)

The Air Force has not yet evaluated the relative cost effectiveness of a mix of KC-10As, KC-135s, and other alternatives to fulfill total aerial refueling requirements. However, Air Force officials have told GAO that they are now in the process of gathering data to do a cost-effectiveness study.

GAO analyzed the capabilities of the KC-10A and the KC-135, considering two primary factors--offload capability and flying hour rates. Under the set of assumptions GAO used, though somewhat simplified, one KC-10A is equivalent in performance to as many as five KC-135s modified with new engines. Since the program unit cost of a KC-10A is about $47 million and the cost to modify five KC-135s could be as much as $60 million, it may be more cost effective to procure additional KC-10As than to modify 15- to 20-year-old KC-135s.

The Air Force stated that for some missions, such as support of the strategic bomber force, the reengined KC-135 may be as effective as the KC-10A. While GAO's analysis is not conclusive in itself, it does illustrate that the cost effectiveness of all aerial refueling assets, including the KC-10A and the KC-135 modifications, needs comprehensive study. (See pp. 8 to 10.)

The contract for procurement of KC-10As provides annual options for ordering production aircraft in specific quantities and prices, or within certain limitations, higher or lower quantities. Deviation from the specific option quantities, however, results in changes in the fixed unit price. Fixed prices for the aircraft are subject to adjustment for economic escalation. The Air Force's current procurement plan deviates from the most economical procurement schedule provided in the contract for the first 20 aircraft.

According to Air Force officials, funding for lower priority programs in fiscal year 1979 had to be reduced to stay within the overall Air Force budget. The KC-10A program did not have the priority to receive enough money for the full complement of four aircraft. As a result, funds for the KC-10As were reduced and the options were exercised for two rather than four aircraft. (See p. 17.)

Under the current plan, this will result in an additional cost of $1,780,000 per aircraft for the first 20 aircraft.

Further changes in the Air Force procurement plan could cause additional increases in unit prices and charges for economic escalation. (See pp. 16 to 18.)

The Air Force also awarded McDonnell-Douglas a contract for maintenance of the KC-10A fleet. The contractor is to perform major maintenance and inspections while the Air Force's responsibility will be limited primarily to flight-line maintenance and minor inspections. The Air Force estimated that using contractor support for a fleet of 20 KC-10As would be less costly over a 20-year period than establishing its own support system. While that estimate is premised upon procurement of a small fleet of KC-10As, the number of KC-10As that will eventually be procured is uncertain. (See pp. 11 and 15.)

Four of the six contract production options for the advanced tanker must be exercised before operational tests are completed. Since both the aircraft and the refueling boom have already been tested extensively, the technical risk of entering production before operational tests are completed is considered low by both Air Force and McDonnell-Douglas officials. (See p. 25.)

RECOMMENDATIONS

The Secretary of Defense should

--evaluate all alternatives and determine the most cost-effective aircraft or mix

of aircraft to fulfill Air Force requirements for aerial refueling;

--establish a phased schedule for fulfilling the requirements in the most economical manner;

--determine at what total amount of KC-10As, if any, it becomes more cost effective to develop an Air Force logistics support system rather than to maintain a contract for logistics support; and

--expeditiously decide where the KC-10As will be based so that, if facilities are needed, construction can begin as soon as possible to have the needed facilities available when the first aircraft is delivered. (See pp. 10 and 15.)

The Secretary of the Air Force should consider the impact on KC-10A unit prices when developing future year plans for procurement quantities and funding. (See p. 25.)

This report was reviewed by DOD officials associated with management of the program. Their comments have been incorporated as appropriate.

Contents

ABBREVIATIONS

AFLC	Air Force Logistics Command
AFTEC	Air Force Test and Evaluation Center
FAA	Federal Aviation Administration

GAO	General Accounting Office
JPO	Joint Program Office
NATO	North Atlantic Treaty Organization
SAC	Strategic Air Command

CHAPTER 1

INTRODUCTION

The Air Force plans to buy KC-10A advanced tanker/cargo aircraft based on the stated need for an aerial refueling tanker, which can offload a greater amount of fuel at longer ranges than existing tankers. The primary mission of the advanced tanker, designated the KC-10A, is to provide mobility enhancement by (1) extending the range and payload of strategic airlift aircraft, thus eliminating or reducing the need for enroute stops at bases on foreign soil, (2) supporting long-range deployment of tactical fighters by providing in-flight refueling and cargo airlift simultaneously, and (3) augmenting airlift forces by carrying palletized cargo and bulk fuel between major aerial ports. The KC-135, the Air Force's primary tanker, has neither the range, fuel payload capacity, nor cargo carrying capability to fulfill that Air Force mission.

The Strategic Air Command (SAC) is responsible for providing aerial refueling when needed by the military. The role of the KC-135, which has been in service over 20 years, is to support U.S. strategic bomber forces. They also support the general purpose forces, but in such instances, the strategic deterrence posture could be affected.

The Air Force plans to buy 20 advanced tanker/cargo aircraft to augment the KC-135 force to support the general purpose forces. The estimated total program cost for the 20 advanced tankers is $1,055.8 million.

KC-10A REQUIREMENT

The need for a long-range, large-capacity tanker to operate from the United States with reduced reliance on foreign bases for refueling was recognized in a formal Air Force requirement document in April 1976. Although SAC will operate the new tanker, the Air Force does not intend that the KC-10A be committed to support only the strategic bomber force. If a crisis arises after the KC-10A fleet is in operation, it is likely to be used in whatever mission the Joint Chiefs of Staff deems appropriate.

In defining the formal requirement for the advanced tanker, the Air Force made several studies and flight tests to identify and analyze the alternatives for an improved tanker. The alternatives ranged from modifying existing aircraft, such as the KC-135 tanker, to developing an all

new aircraft. The Air Force concluded that converting a wide-bodied commercial aircraft to a tanker was the most feasible and cost-effective solution. The Air Force also concluded that modifying the KC-135 to fulfill the long-range mission requirements was impractical due to cost and technical risks and that development costs alone for an all new tanker would exceed $1 billion.

Support of long-range aircraft missions

Because of the limited range of the KC-135 and that fleet's commitment to the strategic bomber force, airlift aircraft may have to rely on foreign bases as "stepping stones" to reach many parts of the world. If U.S. aircraft were denied the use of those bases for either ground or aerial refueling operations, the effectiveness of strategic mobility could be reduced or eliminated.

For example, during the 1973 Mideast airlift, the KC-135 was not used to support Mideast airlift missions. As a result, C-5A and C-141 airlift aircraft flying between the United States and Israel were forced to land on the Azores Islands (southwest of Europe) for fuel. With refueling at the Azores, the C-5As and C-141s carried average payloads of 148,000 and 55,000 pounds, respectively. To make the return flight to the United States, the aircraft used 1.3 pounds of fuel from the Mideast for every pound of cargo delivered. Air Force officials told us removal of fuel from the theater of conflict is undesirable and could be critical if there is a shortage.

Using data from the 1973 airlift, the Air Force estimated that aerial refueling of the C-5As and C-141s from an advanced tanker operating out of the United States could have (1) increased the payloads by over 52,000 pounds and 9,000 pounds, 1/ respectively, (2) avoided the dependence on enroute bases, and (3) eliminated the need for about 100 trips. Had use of an advanced tanker been available, the Air Force would also have removed less fuel from the Mideast.

Support of European deployment

An early priority in mobilization to Europe is the deployment of tactical fighter squadrons and their equipment.

1/The C-5A payloads could have been increased from 148,000 pounds to 200,000 pounds only if the wings were replaced. The C-141s could have been refueled and payloads increased only if they were equipped with refueling receptacles.

The large fuel capacity of the KC-10A combined with its cargo capability could speed the deployment of fighter squadrons. For example, the McDonnell-Douglas Corporation estimated, and the Air Force verified, that 10 KC-10As could deploy 144 tactical fighters from the United States to Europe in 72 hours. These 10 KC-10As, in addition to refueling the fighters enroute, could carry a payload of about 573,000 pounds, which would otherwise have to be transported in C-5As and C-141s. After fighters were deployed the KC-10A could then be used in a cargo role, hauling up to 170,000 pounds of cargo per trip.

PROCUREMENT CONCEPT

The underlying procurement concept for acquisition of the KC-10A, as well as its support, is to take advantage of the commercial aircraft industry's investment in and experience with wide-bodied aircraft. This is being accomplished by

- --adapting an operational, wide-bodied convertible freighter aircraft certified by the Federal Aviation Administration (FAA);
- --using existing commercial maintenance organizations, facilities, and data systems to logistically support the aircraft; and
- --maintaining commonality with the commercial counterpart.

By using an existing aircraft, the Air Force avoids nearly all the research and development costs associated with the acquisition of a new weapon system. The Air Force also estimated that using contractor logistics support over a 20-year period would be less costly than creating a military support system for 20 KC-10As.

SOURCE SELECTION

Originally four aircraft were considered as advanced tanker candidates: McDonnell-Douglas Corporation's DC-10, Boeing Company's 747, and Lockheed Corporation's L-1011 and C-5A. The L-1011 was not competitive because there was no freighter model and the C-5A was eliminated because it was not in production. The DC-10 and Boeing 747 became the two prime candidates because they were in production and provided the capacity to carry large quantities of fuel and/or cargo over long distances.

The Air Force completed the source selection in December 1977. Boeing and McDonnell-Douglas competed for the aircraft sale and, along with several other contractors, also submitted proposals for logistics support of the aircraft.

Acquisition contract

The Air Force awarded McDonnell-Douglas a fixed-price contract effective January 1978 for $28 million to begin initial preproduction engineering, planning, testing, and other activities to convert the DC-10-30F to a KC-10A. A series of contract options allows the Air Force to order up to 60 aircraft at fixed prices with economic escalation provisions from fiscal years 1979 to 1983. The Air Force exercised options on November 20, 1978, at a cost of $151.1 million which includes $15.6 million for initial spares. The exercised options require McDonnell-Douglas to complete engineering work, deliver a test aircraft, provide engineering support for testing, provide certain support equipment, and deliver the first production aircraft.

Development activities on the KC-10A are limited primarily to the aerial refueling subsystems. The most significant changes to the basic aircraft are the addition of

--integral bladder tanks beneath the cargo floor,

--an aerial refueling operator station,

--an aerial refueling boom,

--a hose and drogue refueling system,

--an aerial refueling receptacle,

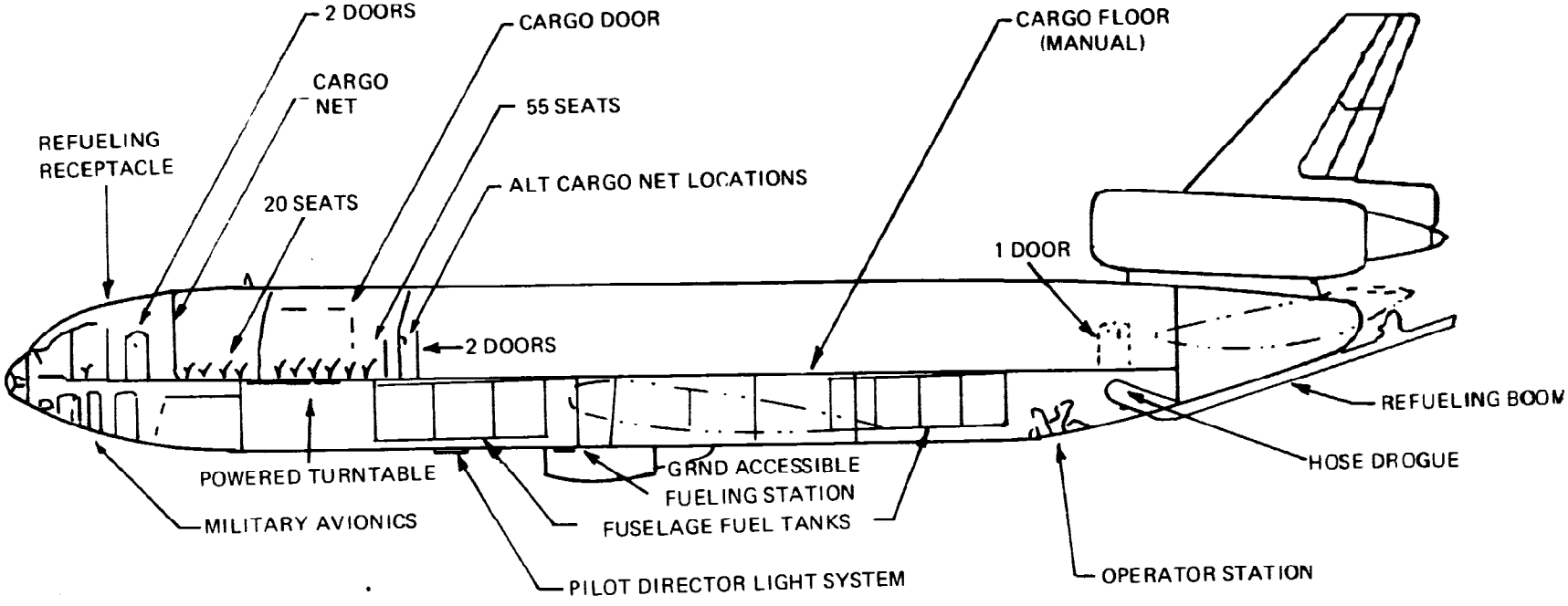
--a cargo handling and personnel accommodation system, and

--a complement of military avionics items.

A diagram of the DC-10-30F showing the major features of the KC-10A is included on page 5.

The KC-10A will be produced on the commercial DC-10 production line. McDonnell-Douglas estimates the KC-10A and the DC-10-30F will be 88 percent common. FAA certified the DC-10-30F in March 1973, and by May 1978, 12 aircraft had been in service with a cumulative flight time of over 150,000 hours. McDonnell-Douglas estimates that by the time the

McDONNELL-DOUGLAS DC-10-30F
WITH KC-10A MAJOR FEATURES



KC-10A enters Air Force service, the 12 DC-10-30F aircraft will have been in operation for over 7 years and will have accumulated over 260,000 flight-hours.

The contract requires FAA to certify the KC-10A. FAA's objective is to ensure that the KC-10A complies with its minimum safety standards for that type of aircraft. FAA will follow its standard procedures and upon successful completion of the necessary inspections and tests, will amend or supplement the DC-10 type certificate to include the advanced tanker. FAA officials said the KC-10A certification is not a major project.

Logistics support contract

The Air Force requested proposals for logistics support of the advanced tanker from 20 firms. Several responded, including Boeing and McDonnell-Douglas.

Because McDonnell-Douglas' proposal for logistics support met the requirements and was much less costly than the nearest competitor, the Air Force awarded it the contract, effective January 1978.

PROGRAM MANAGEMENT

The Air Force Logistics Command (AFLC) is the major command responsible for procurement of the advanced tanker. AFLC has assigned overall management responsibility to a Joint Program Office (JPO) within its Acquisition Logistics Division. The program office is a hybrid organization composed of personnel from both AFLC and the Air Force Systems Command, which is normally responsible for major aircraft development and production programs.

The nature of the KC-10A program (modification of an existing production line aircraft) enables the Air Force to manage the program with a staff of about 80, compared with about 200 for programs involving development of new major weapon systems.

SCOPE

This review was conducted as part of our continuing commitment to report to the Congress each year on selected major weapon system acquisitions by the Department of Defense (DOD). This report is being issued for the Congress to use during its consideration of DOD's fiscal year 1980 budget request.

We reviewed documents concerning the requirement for the advanced tanker; the management of the program; and tests that had been completed, are planned, or are in process. We reviewed the source selection records and examined selected aspects of the resulting contracts and interviewed Air Force and contractor personnel. Agency officials associated with management of the program reviewed this report and their comments have been incorporated as appropriate. We made the review at the following locations:

Air Force Logistics Command, Acquisitions Logistics Division, Wright-Patterson Air Force Base, Ohio.

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

Headquarters Air Force, Pentagon, Washington, D.C.

McDonnell-Douglas Corporation, Long Beach, California.

Federal Aviation Administration, Western Region, Los Angeles, California.

CHAPTER 2

THE BEST MIX OF AERIAL REFUELING RESOURCES IS UNKNOWN

The Air Force plans to buy 20 KC-10As primarily to support missions that the KC-135 cannot support. The KC-10A is, however, expected to be an efficient tanker even for those refueling missions that can be accomplished by the KC-135.

Considerable uncertainty has existed over the number of advanced tankers required to fulfill future support missions. In 1976 the Air Force planned to buy 41 advanced tankers. On December 30, 1976, the Office of the Secretary of Defense issued a Program Budget Decision directing procurement of 91 advanced tankers. In February 1977 a new program budget decision deferred the advanced tanker procurement 1 year, to allow the new administration time to assess the requirement. Subsequent reviews during the Air Force planning cycle identified the need for a small advanced tanker fleet, currently planned as 20 aircraft. In January 1978 the Air Force awarded a contract to McDonnell-Douglas providing for delivery of up to 60 aircraft with varying prices and delivery schedules.

UNCERTAINTY CONCERNING THE MOST COST-EFFECTIVE MIX OF TANKERS

The Air Force has not yet evaluated the relative cost effectiveness of a mix of KC-10As, KC-135s, and other alternatives to fulfill total aerial refueling requirements. The Air Force, in addition to planning procurement of 20 KC-10As, has approved modification programs to extend the life of the KC-135 force and improve its capabilities. Those modifications include reskinning the lower part of the wing and adding a new strategic doppler navigation system. Other modifications are being considered, the most expensive being to replace the engines. In June 1978 an AFLC official estimated that the cost to complete the current and proposed KC-135 modification programs could be about $12 million per aircraft.

We analyzed the capabilities of the KC-10A and the KC-135 to perform a representative mission considering two primary factors--offload capability and flying hour rates. For example, the KC-10A offload capability on a typical tanker rendezvous mission with a 2,500 nautical mile radius is 160,000 pounds of fuel. The offload capability of the

reengined KC-135 (assuming current structural limits) on a mission of the same radius is expected to range from 59,000 to 69,000 pounds. For that radius mission, 1 KC-10A is equal to about 2.5 KC-135s. The KC-10A is expected to surge 1/ to 12 to 15 hours a day in wartime. The KC-135 surge capability is not expected to exceed 5-1/2 hours a day during wartime. The KC-10A could surge to at least twice the daily rate of the KC-135. Consequently, in this example, based only on those two factors, the KC-10A is the equivalent of as many as five KC-135s.

The program unit cost of a KC-10A is about $47 million. Using the AFLC official's estimate, the cost to modify five KC-135s would be about $60 million. We believe the operating and support cost for five KC-135s, regardless of how efficient they are, would far exceed the operating and support cost of a single KC-10A, which could provide the same capability in terms of fuel offload.

We realize this simplified analysis does not consider all the potential methods of improving aerial refueling capability and does not account for a multitude of other factors, such as peacetime operations, the need for dispersal of aircraft, logistics cost, a balance of missions, and so forth. However, it does illustrate that the cost effectiveness of all aerial refueling alternatives, including the KC-10A and the KC-135 modifications, needs a comprehensive study.

CONCLUSIONS

The Air Force has not yet evaluated the relative cost effectiveness of mixes of KC-10As, KC-135s, and other alternatives for meeting aerial refueling requirements, either in terms of acquisition or life-cycle costs. They have advised us, however, that they are now in the process of gathering data to do a cost-effectiveness study. Our simplified analysis indicates that procurement of additional KC-10As may be more cost effective than modification of 15- to 20-year-old KC-135s. The Air Force stated that for some missions, such as support of the strategic bomber force, the reengined KC-135 may be as effective as the KC-10A. While our analysis is not conclusive in itself, it illustrates the need for a comprehensive study of cost effectiveness of alternatives.

1/Surge is an increase in daily use rate to meet extraordinary demands.

Until the relative cost effectiveness of all alternatives is studied and an appropriate mix of the programs is decided, the KC-10A program quantity and/or schedule may fluctuate. Delays in resolving this issue can result in increased unit prices for KC-10A aircraft. (See ch. 4.)

RECOMMENDATIONS

We recommend that the Secretary of Defense (1) evaluate all alternatives (KC-135, KC-135 modified, and KC-10A, along with any other potential alternatives) and determine the most cost-effective aircraft or mix of aircraft to fulfill Air Force requirements for aerial refueling and (2) establish a phased schedule for fulfilling the requirements in the most economical manner.

CHAPTER 3

CONTRACTOR LOGISTICS SUPPORT FOR THE KC-10A

The maintenance and supply support for the KC-10A will be provided by McDonnell-Douglas. The Air Force determined this to be more economical than if the Air Force were to create its own maintenance and support activity. Major factors influencing the Air Force decision were the small number of KC-10As programed, the commercial industry's experience with wide-bodied aircraft, and the availability of commercial maintenance facilities and support equipment.

LOGISTICS SUPPORT CONTRACT

On January 3, 1978, the Air Force awarded McDonnell-Douglas a fixed-price contract for logistics support of the KC-10A, with provisions for price adjustments for economic fluctuations. AFLC estimated that using contractor support for a fleet of 20 KC-10As over a 20-year period would be less costly than creating a military support system. Although the number of KC-10As to be procured is uncertain, the Air Force did not estimate whether contractor support would be appropriate if more than 20 aircraft are procured.

The basic contract provides funds for logistics planning, extending from contract award (January 3, 1978), to September 30, 1978, at a cost of about $245,000. The planning period may be extended in 1-year increments, to September 30, 1980, for a total of about $486,000.

Four options provide for logistics support as the aircraft production program progresses. The amount paid for the options will depend upon the number of locations at which the KC-10A is based, the number of KC-10As at each base, and the number of flight hours each aircraft is flown per year. The options are described below.

--Option 1 is to be exercised in conjunction with the exercise of the KC-10A production contract options, and is for purchase of initial spare parts and support equipment for the aircraft ordered.

--Option 2 will require the contractor to establish its operations at the Air Force base(s) selected as the main operating base(s) for the KC-10A.

--Option 3 will require, on a yearly basis, the contractor to provide aircraft maintenance and replenishment of spare parts.

--Option 4 will require the contractor to provide supplies and services to operate the main operating base(s).

The options provide support for up to 48 aircraft through September 30, 1985. At that time the Air Force plans to solicit competition for a follow-on logistics support contract.

KC-10A MAIN OPERATING BASES NOT SELECTED

The Air Force would like to station the aircraft at a base(s) in the southern part of the United States, where the temperature is moderate year round, eliminating the need for hangers.

SAC, which will operate the KC-10A fleet, has recommended to Air Force Headquarters the location(s) they believe should be selected as the main operating base(s). Their recommendation was based on an assessment of many factors, including reserve aircrew manpower, proximity to logistics facilities, climate, and environmental impacts. Candidate bases were evaluated for suitable runways, ramp space, fuel services, and hangars. Air Force Headquarters will make the final decision on where the base(s) will be. If the base or bases selected require major military construction to accommodate the KC-10As, Air Force officials said this construction, in all probability, could not be completed by the delivery date for the first aircraft. They said that for a military construction project to be completed by October 1980, the funding request would have to have been made by April 1978. According to the Air Force, a basic criteria for base selection is the availability and adequacy of existing facilities.

Contract change possible

The contract was proposed and priced based on three possible sites for operating bases and a specific sequence for activation. If the Air Force decides to locate the KC-10A other than at those three bases, the prices for options 2, 3, and 4 will be subject to renegotiation because certain cost elements vary depending on the bases' distance from the contractor's facility, the sequence of base activation, or the impact of the environment on the deterioration of certain spare parts.

If renegotiation is necessary, Air Force officials do not anticipate a significant change to the contract price.

MAINTENANCE AND SUPPLY CONCEPT

The KC-10A maintenance concept gives Air Force personnel responsibility for performing all flight-line maintenance tasks, including engine changes, and the contractor responsibility for all other maintenance. More specifically, Air Force responsibilities are to include

- --preflight and postflight inspection and servicing;
- --troubleshooting and removal and replacement of defective line replaceable units;
- --9-week minor airframe inspections at the main operating base;
- --18-week minor corrosion control inspection at the main operating base;
- --engine change; and
- --jacking up the aircraft for retraction tests, tire changes, and so forth.

McDonnell-Douglas' maintenance responsibilities are to involve

- --repair and overhaul of line replaceable units, including engines;
- --180-day major airframe inspections;
- --major modifications, major damage restoration, drop-in maintenance, and other categories of unplanned, short notice maintenance; 1/ and
- --an accumulation of aircraft maintenance data using McDonnell-Douglas' current automated system.

McDonnell-Douglas plans to subcontract repair efforts for the airframe, systems, engine, and components to commercial airlines and other contractors.

1/Air Force must specifically authorize these services, and costs not covered by the contract are to be negotiated separately.

The Air Force plans to station the advanced tanker at one to three Air Force bases designated as KC-10A main operating bases. A contractor operated and maintained base supply facility is to be located at each main operating base. McDonnell-Douglas is to supply spare parts support from that facility on a 24 hour a day, 7 days a week basis. The spare parts and support equipment are to be owned by the Government but left under the contractor's possession and control for the life of the contract. The inventory remains Government property at contract termination.

Contractually, McDonnell-Douglas must be prepared to support the advanced tanker fleet for average annual utilization rates up to 1,200 flying hours per aircraft per year. The Air Force anticipates the KC-10As will be flown an average of 1.5 hours a day in peacetime, with a higher rate (about 3 hours a day) during the first year of operation. The 1,200 hour utilization rate is expected to include operation (1) at an average rate of 12-1/2 to 15 hours a day for less than 5 days, (2) at up to 10 hours a day for 45 days with a follow-on 45-day period at 6 hours a day, and (3) at an average rate of 1-1/2 hours a day for the rest of the year. The contract also specifies that McDonnell-Douglas is to maintain the KC-10A so that available aircraft have a 96-percent probability of departing on a scheduled mission within 15 minutes of scheduled departure time. In addition, the contractor is to ensure a mission completion rate of 96 percent.

SAC, the single manager for all Air Force refueling assets, is to control KC-10A operations and SAC pilots are to fly the aircraft. The Air Force also anticipates having Air Force reserve units fly the KC-10As. The KC-10As are to return to the main operating base upon completion of aerial refueling missions. When KC-10As must operate out of a base other than the main operating base, an enroute support kit of additional spare parts is to be carried on board.

If a KC-10A should need emergency maintenance or spare parts while away from the main operating base, McDonnell-Douglas expects to request assistance from DC-10 commercial airlines. Interchange of spare parts for emergency maintenance is a common practice among commercial airlines. Air Force officials indicated they will permit temporary interchange of spare parts between the KC-10A and commercial airlines for emergency maintenance. The commercial DC-10 fleet currently serves 39 U.S. cities and 128 cities in foreign countries, and airlines own a spare parts inventory totaling nearly $550 million throughout the world.

CONCLUSIONS

McDonnell-Douglas is to provide logistics support for the KC-10A fleet under a fixed-price contract with the Air Force. The contractor will perform major maintenance and inspections; the Air Force responsibilities will be limited primarily to flight-line maintenance and minor inspections. McDonnell-Douglas is to support the KC-10A 24 hours a day on a worldwide basis in peace and under wartime conditions.

The contract encompasses three phases for initial planning and coordinating efforts, and includes four options for acquiring spare parts and support equipment and for providing contractor-operated supply and maintenance activities at the main operating base(s).

The Air Force has not decided where it will base its advanced tanker force. If the selected base requires construction of new facilities, the decision will not only affect the total cost to the Air Force but may also conflict with the planned delivery schedule since the required construction probably could not be funded and completed by the time the first aircraft is delivered.

The contractor logistics support concept assumes that a small fleet of advanced tankers will be procured. The Air Force estimated it would be less costly over 20 years using this concept, if 20 KC-10As are procured. If the studies of an aerial refueling force mix, recommended in chapter 2, indicate that a greater number of advanced tankers is needed, contractor-provided logistics support may no longer be advantageous.

RECOMMENDATIONS

Because of the uncertainty concerning the number of KC-10As to be procured and in conjunction with studies of the appropriate mix of aerial refueling assets, we recommend that the Secretary of Defense determine at what number of KC-10As, if any, it becomes more cost effective to develop an Air Force logistics support system rather than contract for logistics support.

In addition, we recommend that the Secretary of Defense expeditiously decide where the KC-10As will be based so that if facilities are needed, construction can begin as soon as possible to have the needed facilities available when the first aircraft is delivered.

CHAPTER 4

KC-10A PROGRAM STATUS

The advanced tanker uses a commercially established DC-10-30F airframe with an improved refueling boom developed under a separate contract by McDonnell-Douglas. The boom was subjected to development and initial operational test and evaluation. Since both the aircraft and the boom have already been developed, the KC-10A program essentially involves modifying the commercial aircraft as necessary to incorporate the aerial refueling systems. Consequently, the KC-10A program is considered to have low cost, schedule, and technical risk.

In September 1978 the Secretary of the Air Force concurred with an Air Force Systems Acquisition Review Council recommendation that production of the KC-10A be approved. The Secretary of Defense approved the production program on November 6, 1978.

Funds were appropriated in the fiscal year 1979 budget for procurement of two KC-10As. The Air Force exercised options for two aircraft under the KC-10A contract in November 1978.

COST

As of October 17, 1978, the Project Office planning estimate of total program cost through fiscal year 1984 for 20 aircraft is $1,055.8 million, using the most recent inflation indexes from the Office of the Secretary of Defense. The aircraft acquisition cost is projected at $942.5 million, with $113.3 million for logistics support. The cost estimate is based on a procurement of two aircraft in fiscal year 1979, four in 1980, six in 1981, and eight in 1982.

The program cost estimate does not include any funding for military construction, which could be required if facilities available at the Air Force base(s) selected as the main operating base(s) for the KC-10A are inadequate.

KC-10A prices

The Air Force currently plans to buy 20 KC-10As. The contract gives the Air Force the flexibility to adjust its procurement quantities and increase the total to 60 aircraft. Prices are established in the contract for varying procurement schedules, with adjustments for economic fluctuations.

The program cost for 20 aircraft can vary substantially depending on the number ordered each fiscal year. To receive the lowest price for the 20 aircraft, the Air Force must place its orders according to the acquisition schedule included in the contract. The schedule in the contract is:

	Fiscal year			
	1979	1980	1981	1982
Number of KC-10As	4	4	6	6
Option exercise date	12/1/78	12/1/79	12/1/80	12/1/81

The Air Force can order as many as 40 additional aircraft under the contract. The last option must be exercised no later than December 1, 1982.

Current Air Force procurement plans do not take full advantage of option prices

The Air Force awarded the contract to McDonnell-Douglas in January 1978. In the same month, because of the relative priority of this program to other Air Force programs, the fiscal year 1979 budget was submitted to the Congress for two KC-10As (a test aircraft and the first production aircraft), two less than the procurement amount that would provide the lowest price. By deviating from the most economical procurement schedule, fixed prices are automatically increased. In addition, the prices for the first three production aircraft will be subject to adjustment for economic fluctuation. If the Air Force had ordered them according to the acquisition schedule in the contract, they would not have been subject to this adjustment.

The Air Force program now being contemplated (two aircraft in 1979, four in 1980, six in 1981, and eight in 1982) is estimated to cost $35.6 million (then-year dollars) more than if the 20 aircraft were procured according to the specified numbers in the contract. This amounts to an additional cost per aircraft of $1,780,000 in then-year dollars or $850,000 per aircraft in 1976 dollars.

According to Air Force officials, funding for various programs in fiscal year 1979 had to be reduced to stay within the overall Air Force budget. This was accomplished by taking funds away from the lower priority programs. The KC-10A program did not have the priority to receive enough money for the full complement of four aircraft. As a result, its funds were reduced and unit prices were increased in accordance with the terms of the contract.

Further price increases could occur on the 20 aircraft purchase depending on the number of KC-10As the Air Force buys in fiscal years 1980, 1981, 1982, and 1983. If the low priority of the KC-10A program continues, the prices could increase by a total of $80 million or more. The table on page 19 shows the most economical buys for the 20 aircraft program, three alternative acquisition profiles, and the change in price caused by deviation from the most economical schedule.

SCHEDULE

The Air Force exercised options for the first two aircraft in November 1978. They are scheduled for delivery in October and December 1980. Options for subsequent aircraft are available on or before December 1 of each of the following 4 years.

Option 1 of the logistics support contract is a recurring option which must be exercised within 15 days of the exercise of each production contract option. It is for initial spare parts and support equipment for the number of aircraft purchased. Option 2 of the logistics support contract may be exercised at any time during the contract period. It requires the contractor to ready its operations at the main operating base. Site activation is to follow 8 months after the exercise of this option.

Options 3 and 4 in the logistics support contract may be exercised annually and cover aircraft maintenance and spare part replenishment, and contractor supplies and services operate the main operating base.

PERFORMANCE

In the tanker role, the KC-10A, with its large fuel capacity and long flying range, will accomplish missions beyond the capability of the KC-135 force. As a cargo carrier, the KC-10A will offer an airlift option not available with the KC-135. The KC-10A will be able to accommodate about 170,000 pounds of cargo. With a full load of cargo, the KC-10A will still be able to carry a fuel payload of about 86,000 pounds. The KC-10A will have a commercial cargo handling system with some improvements to facilitate military cargo handling.

Improved aerial refueling boom

The Air Force expects that the KC-10As performance will be enhanced by an improved aerial refueling boom. McDonnell-Douglas developed the boom prototype under a separate contract with the Air Force between 1975 and 1978. The new boom

Contract Provisions for a 20 Aircraft Program, Including Inflation Estimates

	Fiscal year					Total (note a)	Price increase plus inflation
	1979	1980	1981	1982	1983		
	(millions in then-year dollars)						
Most economical buy:							
Quantity	4	4	6	6	0	20	
Cost	$214.3	$162.3	$241.1	$248.1	0	$894.6	$ 0
Alternative A:							
Quantity	2	6	6	6	0	20	
Cost	$143.5	$241.3	$242.2	$247.7	0	$903.5	$ 8.9
Alternative B:							
Quantity	2	4	6	8	0	20	
Cost	$143.5	$175.2	$251.7	$331.0	0	b/$930.2	$35.6
Alternative C:							
Quantity	2	2	6	6	4	20	
Cost	$143.5	$ 98.0	$266.7	$262.3	$175.6	$974.9	$80.3

a/The total costs include $28.8 million appropriated in 1977.

b/This total is $12.3 million less than the currently projected program cost shown on page 19 because it does not incorporate the current Office of the Secretary of Defense inflation rates and does not include some additional program requirements.

offers several advantages over the boom used on the KC-135 including: (1) permitting fuel transfer at a higher flow rate than the current boom (1,200 to 1,500 gallons a minute versus 900), (2) allowing the tanker and receiving aircraft to fly farther apart (5 feet more vertically and 8 feet more horizontally), (3) having a larger envelope or area in which refueling can be accomplished (see diagram on p. 21), (4) allowing the aerial refueling boom to be independently disconnected from the receiver aircraft, and (5) being easier for the operator to control.

The KC-10A is to be equipped with an improved hose and drogue refueling system. The system is separate from the boom and is needed to permit refueling of both Air Force and Navy/North Atlantic Treaty Organization (NATO) aircraft during the same flight. This is because Navy/NATO aircraft require hose and drogue as opposed to boom refueling. In contrast, the KC-135 hose and drogue system must be attached to its boom before takeoff, and therefore only one type of receiver aircraft can be refueled per mission.

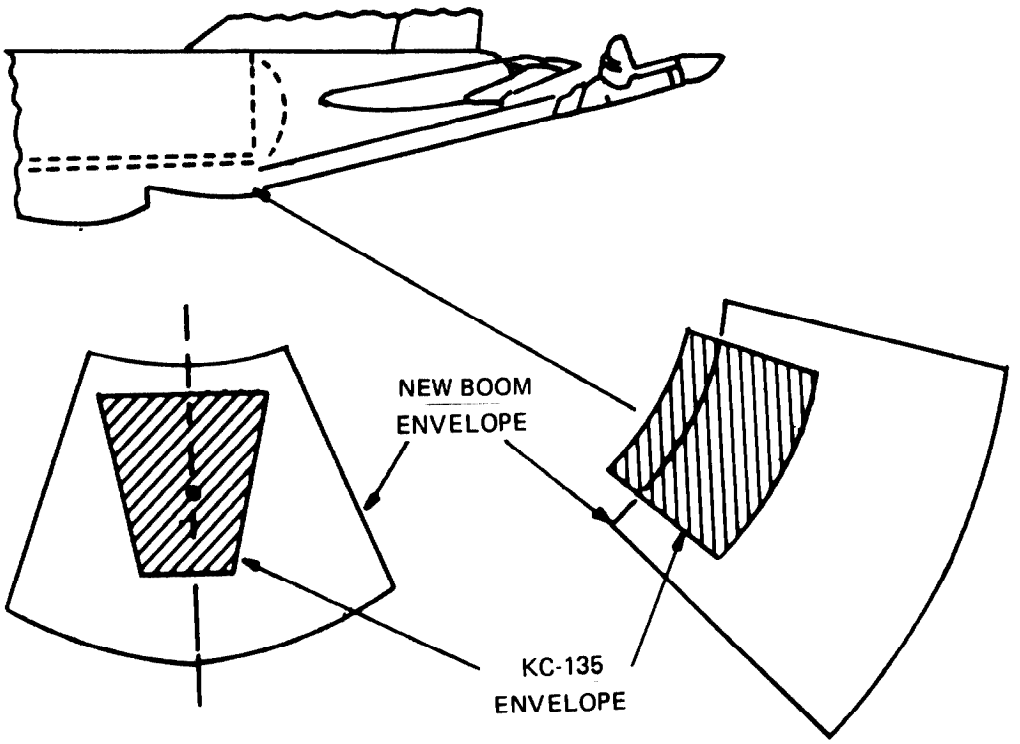
Prototype boom testing

The prototype of the new boom completed joint development and initial operational test and evaluation in April 1978. The 184-hour flight test included 1,398 couplings with six different Air Force aircraft--C-5A, F-4, NKC-135, A-10, TF-15, and B-52. The Air Force Test and Evaluation Center (AFTEC) conducted the initial operational test and evaluation, and the Air Force Flight Test Center conducted the development test and evaluation. Several other Air Force organizations as well as the contractor, McDonnell-Douglas, participated in the testing.

AFTEC test report, dated June 1978, indicates that the new boom demonstrated an enhanced aerial refueling capability and is substantially easier to maintain than the KC-135 boom. Sixty-nine deficiencies were identified during the test program. Only two were mission essential--the fail-passive design concept of the flight control system and the incompatibility of the boom's nozzle with the C-5A refueling receptacle. On the basis of testing, AFTEC concluded that production of the boom was warranted provided the fail-passive deficiency is corrected.

McDonnell-Douglas redesigned the fail-passive flight control system to meet the contract reliability and safety requirements. SAC and JPO consider the redesigned system adequate. AFTEC indicated that the redesigned control system met reliability and safety requirements in the specification.

COMPARISON OF REFUELING ENVELOPE OF NEW BOOM AND CURRENT KC-135 BOOM



REARVIEW

SIDEVIEW

McDonnell-Douglas also modified the design of the nozzle to correct its incompatibility with the C-5A.

Boom status

As of October 5, 1978, 6 of the 69 deficiencies identified during testing of the prototype boom had not been solved. The Air Force does not consider any of the remaining deficiencies as mission essential items.

As a result of problems encountered with the prototype nozzle, JPO officials were concerned about meeting the strength and tolerance requirements. The contractor is pursuing several different manufacturing techniques to ensure the production nozzle meets the strength and tolerances required by the KC-10A specification.

Critical design reviews of the boom are scheduled for early 1979. A review of the boom structure is planned in January and a review of the flight control system is planned in March. At the conclusion of those engineering reviews the Air Force is to have determined that the detailed design is consistent with specifications. JPO officials expect that deficiencies identified in the prototype boom tests and problems with manufacturing techniques will be resolved by the time the critical design reviews are completed.

TESTING

Testing of the KC-10A system will follow the same philosophy as all other aspects of the advanced tanker procurement--take maximum advantage of previous developments in commercial wide-bodied aircraft.

The testing will be carried out in two phases--predelivery test and evaluation, and follow-on operational test and evaluation.

Predelivery testing is to begin on the first aircraft in April 1980 and is to last about 5-1/2 months. This testing will be conducted at the contractor's facilities by a joint FAA/Air Force/Navy/contractor test team. The objectives of this testing phase are to certify that the aircraft complies with FAA's minimum flight safety standards and applicable military specifications. Testing will focus on the design and engineering aspects of the KC-10A.

Since the basic DC-10-30F is already FAA certified, only inspections and tests necessary to amend the basic certificate to include the advanced tanker model will be required.

Data from the original DC-10-30F test will be used wherever possible. Operating and support commands will also participate during the first phase as much as possible to make an early assessment of the plane's operational performance, suitability, supportability, and employment concepts.

SAC is to conduct the second testing phase--follow-on operational testing and evaluation--after the scheduled delivery of the first aircraft (October 1980). This testing will examine operational effectiveness and suitability of the aircraft and its systems, refine training requirements, and evaluate logistics and supportability. Six months has been allotted for the test phase.

ASSESSMENT OF RISK

McDonnell-Douglas and Air Force officials consider the KC-10A to be a low risk procurement. By the time the first KC-10A enters the Air Force inventory, commercially flown DC-10s will have been in operation for 9 years and some will be approaching 32,000 flight hours. The contract for the KC-10A provides a full warranty for defects identified in the first 5 years or 5,000 flight hours, whichever expires first. In addition, the contract includes a prorated service life policy for repetitive failures of airframe or landing gear components. That policy applies to airframe components up to 30,000 flying hours or 10 years and to landing gear components for 30,000 flying hours, 20,000 landings, or 10 years.

Fatigue testing was applied to the fourth production DC-10 airframe for 120,000 flight hours and 84,000 flights. For the fatigue test, McDonnell-Douglas used an average flight duration of 1.43 hours and an average aircraft landing weight of 386,000 pounds. No significant fatigue cracking was found on the test aircraft.

In comparison, the Air Force operational profile for the KC-10A indicates that flights will average 6.6 hours and the average landing weight will be 274,000 pounds. McDonnell-Douglas officials said most fatigue damage occurs during takeoff and landing, therefore the longer flight time and lighter landing weight will cause considerably less fatigue damage per flying hour to the KC-10A than the parameters applied to the fatigue test article. Consequently, McDonnell-Douglas officials are confident there is a large margin between the proven capability from fatigue testing and the KC-10A service life.

Further structural tests are currently underway. McDonnell-Douglas and Air Force officials identified the

two critical locations on the aircraft where stresses may be different in the KC-10A than simulated in the fatigue tests and contractor analyses. Two specimens for each critical location as well as about 68 additional locations will be subjected to stress loads. One specimen will be tested using the original DC-10 fatigue test parameters and the second will receive the KC-10A loads based on the Air Force flight profiles. The results will be used to validate or revise the projected economic life of the KC-10A. McDonnell-Douglas plans to have the results of these laboratory tests ready 1 year before the first KC-10A goes into service.

McDonnell-Douglas and Air Force officials consider the new boom the only critical development area on the KC-10A. Flight testing of the prototype boom was completed in April 1978 on a KC-135. Flight testing of the production boom will be conducted during predelivery testing and is to be completed in September 1980. Qualification laboratory tests will be performed on the new boom and nozzle to

--demonstrate that its structure satisfies the strength requirements of the specification,

--demonstrate that it satisfies selected functional and environmental requirements,

--evaluate the durability and damage tolerance of its structure and that it meets the service life requirements, and

--determine that the boom design meets fuel handling requirements of the specification.

JPO officials stated that during the flight and laboratory tests they will verify that all 69 deficiencies identified in the prototype have been corrected and that the performance of the production boom and nozzle meet the KC-10A specifications.

The follow-on operational test and evaluation, scheduled for completion in April 1981, should give the Air Force a thorough knowledge of the performance capabilities of the KC-10A aerial refueling system.

CONCLUSIONS

The Air Force awarded the KC-10A production contract for a planned 20 aircraft buy, with the flexibility to order as many as 40 additional aircraft.

However, the Air Force's current procurement plan does not take complete advantage of the lowest price available under the contract. The current plan will result in an additional cost of $850,000 (1976 dollars) an aircraft over the minimum price for the first 20 aircraft. In then-year dollars, this will be $1,780,000 an aircraft over the minimum price available.

The KC-10A will be a large capacity, long-range tanker with the added advantage of being able to carry as much as 170,000 pounds of cargo. A new boom developed for the advanced tanker should be a great improvement over the old one and enhance the KC-10A's overall performance.

Although four of the six production options must be exercised before operational tests are completed, both the aircraft and the boom have been tested separately before. The risk of exercising production options before tests are fully complete does not appear to be significant since the basic aircraft is operational, and McDonnell-Douglas and the Air Force have already agreed upon solutions to most of the 69 deficiencies that were identified in initial operational test and evaluation of the prototype boom.

RECOMMENDATION

We recommend that the Secretary of the Air Force consider the impact on KC-10A unit prices when developing future year procurement quantities and funding.

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