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AUG 29 1975



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The Honorable John L. McClellan
Chairman, Committee on Appropriations
United States Senate

Dear Mr. Chairman:

Your letter of June 26, 1975, requested us to verify the reasonableness of estimates of the cost to install new wings on C-5A aircraft. In testimony before the Senate Armed Services Committee, the Secretary of Defense stated that the cost of the new wings would be about \$1 billion. Current Air Force and Office of Secretary of Defense estimates, range from about \$1.06 billion to about \$1.34 billion.

Three different cost estimates have been prepared by the C-5A System Program Office (SPO), the Air Force Aeronautical Systems Division (ASD), and the Office of the Secretary of Defense (OSD). The OSD estimate was prepared to assist the Defense Systems Acquisition Review Council (DSARC) in its deliberations regarding program approval, and the ASD estimate was prepared principally to examine the difference between the SPO and OSD estimates. Our analysis of the estimates showed that each estimate was apparently reasonably accurate and logically prepared, although for various reasons they projected different total estimated costs for the program.

In 1973, known wing structural problems led to the establishment of a review team composed of Air Force and industry personnel. As a result of this effort the Air Force selected, from several options, a modification plan which included: (1) research and development, (2) fabrication of modification kits, and (3) installation of the kits.

The research and development segment includes (1) designing new center and inner wing boxes using stronger and heavier materials, (2) fabricating modified wing sections for fatigue and flight test articles, (3) installing modified wing sections in a fatigue article aircraft for flight testing, and (4) testing the fatigue article and flight test aircraft.

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*Aircraft Components
Analysis*

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The other major tasks (and the most expensive) include procurement and fabrication of the modified wing sections for the C-5A force, and installation of the modified wing sections and reworking the outer wings. Appendix I is a diagram of the wing modification.

Several issues remain to be resolved concerning the method of carrying out the modification program. Since cost estimates are necessarily prepared on the basis of specific assumptions, any changes to those assumptions can have dramatic effects on the cost estimates. Issues have been raised concerning a considerable degree of concurrency ^{1/} in the program schedule, competition in procurement of the program, and the scope of work on the outer wing. Decisions that will be made in the future on these issues may have a substantial impact on the cost estimates for the program.

The sections that follow describe the estimates that have been made for the program and the areas of uncertainty concerning concurrency, competition, and the outer wing.

COST ESTIMATES

The initial estimate by the SPO projected a cost of \$896.3 million. The estimate assumed that the program would start on April 1, 1975, that it would be under a sole source contract with Lockheed, and that the outer wing boxes would be reworked rather than replaced. Independent estimates made by OSD and the ASD were based on that same program plan.

The SPO made a new estimate in August 1975. That estimate assumed the development effort would begin in November 1975, and that one less aircraft had to be modified because of the Vietnam crash in April 1975. Neither ASD nor OSD have prepared later estimates to take these factors into account. The estimates we reviewed are shown below.

<u>Organization</u>	<u>Date of estimate</u>	<u>Estimated cost</u> (escalated millions)
C-5A SPO	November 1974	\$ 896.3
OSD	April 1975	1,343.9
ASD	April 1975	1,037.6
C-5A SPO	August 1975	1,068.5

^{1/} Concurrency as defined for use in this report is concurrent development and production. See page 3 and Appendix II.

Since the SPO prepared a revised estimate of the program in August 1975, we did not examine in detail the initial SPO estimate based on an April 1975 start date. We looked into the methodology, data and assumptions and made a comparison of the August 1975 SPO estimate with the ASD and OSD estimates. The schedule on the following page shows a breakdown of all four estimates by research and development, kit fabrication, and installation in 1974 and escalated dollars. The principal differences in the estimates are caused by (1) differences in assumptions in the program schedule and content, and (2) differences in cost estimating methods and data bases. Estimates are subject to variances because of differences in type and source of data, and assumptions employed by different persons studying the same program. Our analysis of the estimates showed that each estimate was apparently logically prepared based on the data available and the experience and estimating methods used by each estimating group.

If the ASD Comptroller or OSD were to revise their estimates to account for the later starting date, and the loss of an aircraft in April 1975, we believe the estimates would still be at variance, to some degree, with the SPO's August 1975 estimate of \$1,068.3 million. Accordingly, when the schedule and methods of carrying out the program stabilize, it may be advisable for the ASD Comptroller and OSD to again prepare independent estimates of the program.

FACTORS WITH POTENTIAL IMPACT
ON THE COST OF THE PROGRAM

The cost estimates for the program were necessarily tailored to a specific schedule and certain assumptions. Changes to the schedule and the assumptions can have dramatic effects on cost estimates. The following issues under consideration could have a substantial effect on the estimated cost of the program.

Concurrency

The estimate prepared by the SPO in August 1975, assumes the design effort will begin on November 1, 1975. The schedule presumes that a contract will be awarded to Lockheed for kit fabrication in November 1977, yet testing of the fatigue article will not begin until September 1979. The cost estimates and program schedule assume Lockheed will also handle the installation work. A commitment to start installation work is scheduled for May 1979. Appendix II is a chart showing the timing of decision and major tasks involved in the program.

COST (millions)

Estimator	Date	RDT&E		Fabrication of kits		Installation		Total	
		1974 \$	Escalated \$	1974 \$	Escalated \$	1974 \$	Escalated \$	1974 \$	Escalated \$
C-5A SPO	11/74	\$ 90.9	\$ 129.6	\$182.8	\$ 317.5	\$ 241.7	\$ 449.2	\$ 515.4	\$ 896.3
OSD	4/75	90.9	129.6	318.2	552.7	356.0	661.6	765.1	1,343.9
ASD									
Comptroller	4/75	94.9	138.7	192.1	335.1	309.1	563.8	596.1	1,037.6
Adjusted estimate									
C-5A SPO	8/75	128.4	182.1	199.2	352.1	274.0	534.1	601.6	1,068.3

Both Air Force and DSARC recognize that substantial concurrency is built into the schedule. The Air Force believes the concurrency is necessary in order to begin modifying aircraft before they must be grounded. The Air Force and Lockheed believe the risk involved in concurrent development and production is low because:

--Lockheed will do substantial component testing in the development phase of the program to prove the design;

--the basic design of the wing has changed only in the type of material and its thickness--the modification is essentially the old wing with replaced internal structure incorporating changes already designed.

The DSARC stated that the program as structured has a considerable degree of concurrency and the schedule proposed would require a waiver of certain Department of Defense instructions which require adequate testing before a commitment to production. The DSARC stated that it expects the Air Force to accomplish critical tests as early as possible and minimize obligation of procurement funds (for fabrication of kits) until test results are available. There would undoubtedly be a substantial impact on the cost of the program if the program schedule were changed to eliminate concurrency. To entirely eliminate concurrency, however, would delay the fabrication and installation of modification kits for several years.

Since the Air Force has determined that the C-5A capability is necessary, it may be impractical to eliminate all concurrency from the program. However, there can be an impact on cost as a result of concurrency if tests uncover unexpected problems after the fabrication and/or installation effort has begun. In that connection, Lockheed officials believe any problems will be uncovered early in the fatigue test program, and at that time, no modified C-5As will have been delivered.

In our view, the Air Force and DOD are in somewhat of a dilemma--without concurrent development and production, C-5As will be grounded and a valuable capability lost for a period of time. With the concurrency there is undoubtedly some degree of risk which could increase cost and cause slippages in the program schedule. In that connection, the DSARC stated that the Air Force should plan to have a high level independent review team evaluate the adequacy of the design for the wing modification and assess the technical risk involved at an appro-

priate point in the development. The Air Force plans to have that independent review take place in February 1977, about 9 months prior to the planned contract award for fabrication of kits.

Changes in flight training

The Military Airlift Command (MAC) reduced the flying hours on C-5As to support minimum training requirements and adjusted the flight profiles to minimize the fatigue damage to the wings. This extends the time after which the C-5's would have to be grounded.

The DSARC was concerned that the efforts by MAC to reduce flying hours had not given any indication that wing life would be extended to a degree that would permit reduction of the concurrency in the modification program schedule. The DSARC directed the Air Force to immediately take steps to ensure that all usable synthetic (simulated) C-5 training capability be provided on an urgent basis. The Air Force was to incorporate visual systems on C-5A mission simulators, procure cockpit procedures, trainers and independent navigator training stations. These actions would presumably give the Air Force more time before the modification installation would be needed, and permit at least a reduction of the concurrency in the schedule.

To increase the C-5A synthetic training capability, MAC had ordered three additional visual systems and three additional cockpit procedures trainers at a total cost of \$18.4 million. According to a MAC official, the concurrency problem can be reduced if the additional synthetic training devices are received within the next 15 months. The MAC official stated that the use of the increased synthetic training should reduce the monthly minimal crew proficiency training use of the C-5A aircraft. We believe these costs associated with procurement of synthetic training devices should be considered a part of the modification program.

Outer wing

The program estimates assume that the outer wing will be reworked rather than replaced with new internal structures. The Air Force's plan for repairing the outer wing essentially involves reworking about 11,000 holes in each outer wing section and replacing the fasteners that hold individual wing panels together.

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The Air Force is uncertain whether replacement of the outer wing is cost effective. The project office requested Lockheed to provide cost estimates for replacing the outer wing as opposed to reworking it. If the decision is made to replace the outer wing, there would be an impact on the program cost.

Competition

An Air Force study of the capability available ruled out competition in the design and fabrication of the wing modification kits. Other aircraft manufacturers were technically able and probably willing to undertake the effort, however, the time available before the first C-5A would be grounded would not permit competition and source selection. The Air Force study states that only the installation effort (about 50 percent of the cost of the program) could be procured on a competitive basis, yet even in that effort, Lockheed would have a significant competitive advantage because they would have already installed two test kits during the RDT&E program. The project office, however, maintains that the fabrication effort, as well as the installation effort, can be competitive.

In connection with the competition, the DSARC stated that the options to incorporate competition into later phases of the program should continue to be studied and maintained. The DSARC requested the Air Force to provide a detailed briefing to the Assistant Secretary of Defense on competition aspects of the program as soon as possible. Thus, the impact on cost is not determinable at this time.

CONCLUSION

The most recent estimates of the modification cost ranged from \$1,068.3 million to \$1,343.9 million. While we found differences in the methods and assumptions in the various estimates that were made, we found no evidence that major elements of cost were omitted. We believe each estimate was logically prepared based on the data available and the experience and methods used by each estimating group.

Changes to the program content or schedule on which the cost estimate is based could have a substantial impact on the cost estimates, thus it is important to recognize that decisions by the Air Force or OSD on the issue of concurrency (including procurement of simulator equipment), the outer wing scope of effort, and the amount of competition, as well as any other decision affecting the program plan, may cause further increases in the program cost estimate.

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In addition, if the Air Force's conviction that the concurrency is low risk proves to be incorrect, changes to the production design could be necessary after a commitment has been made to produce the kits. In that connection, significant amounts of unplanned work could cause the schedule to slip and the actual costs to exceed the estimates.

When decisions concerning the above matters have been made, the Committee may wish to request that the Air Force and OSD again prepare independent cost estimates and present the estimated cost of the program to the Committee in cost ranges rather than as a specific figure.

We have discussed this report with officials of the C-5A program office and have considered their comments in preparing it.

We do not plan to distribute this report further unless you agree or publicly announce its contents.

Sincerely yours,


Robert F. Kennedy
Acting Comptroller General
of the United States

Enclosures

CURRENT C-5A H MOD CONFIGURATION

