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Report to the Chairman, Subcommittee on Defense, Committee on Appropriations, House of Representatives

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INTELLIGENCE PROGRAMS

New RC-135 Aircraft Engines Can Reduce Cost and Improve Performance

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The Honorable John P. Murtha
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

In response to your request, we are providing information on the replacement of engines for the Department of Defense's fleet of 21 RC-135 aircraft. Specifically, this report addresses (1) the estimated cost to replace the RC-135 aircraft's TF-33 engines, (2) the projected savings in future operation and maintenance costs by replacing the engines, and (3) the operational benefits resulting from engine replacement.

Results in Brief

The cost savings and operational benefits of replacing the engines on the RC-135 aircraft have been recognized by the Department of Defense for some time. The Air Force has committed to funding the engine replacement for 15 of the 21 aircraft. However, funding for the remaining six aircraft remains uncertain.

The total estimated cost to replace the TF-33 engines on the 21 RC-135 aircraft with CFM-56 engines is about $631 million (in then-year dollars), excluding the cost of spares. Spares are estimated to cost between $24 million and $40 million, depending on the future aircraft-basing option selected. On the basis of our review of the Air Force's cost data, we estimated that replacing the TF-33 engines could save about $1.5 billion in future fuel, maintenance, and aircraft tanker support through the year 2020. This figure accounts for the deduction of the cost of new engines and spares.

Installing the CFM-56 engines on the RC-135 aircraft offers the Air Force several operational benefits as well. With these engines, the Air Force can (1) increase aircraft reliability, (2) expand overseas basing options to airfields with less than 10,000-foot runways, (3) increase the unrefueled flight time by as much as 4 hours, (4) enhance the performance of the sensor packages by increasing the operating altitude of the RC-135 aircraft by about 5,000 feet, and (5) decrease environmental pollution. In addition, the CFM-56 engines will increase the gross take-off weight capability of the RC-135 aircraft from about 298,000 to about 322,000 pounds and enhance

the margin of safety for these aircraft, which routinely take off and land at or near maximum weights during inclement weather.

Background

The RC-135 fleet is the C-135 aircraft modified to satisfy specific intelligence requirements. Although the Air Force is the lead service for the program, several of the RC-135s are funded by the Defense Intelligence Agency, the National Security Agency, and the Army. The overall RC-135 fleet consists of 21 aircraft: 15 RC-135 V/W aircraft (including a trainer) called Rivet Joint, 2 RC-135U aircraft called Combat Sent, 3 RC-135S aircraft (including a trainer) called Cobra Ball, and 1 RC-135X aircraft called Cobra Eye.

The RC-135 fleet supports reconnaissance and certain other operations on a continuing basis from worldwide forward operating locations. More than 100 operational RC-135 missions are flown monthly to support this effort, and the fleet of aircraft fly about 18,000 hours annually.

The RC-135 fleet was built in the early 1960s and still has the original TF-33 engines. These engines have remained essentially unchanged since that time. Each aircraft is powered by four TF-33 engines. The cost to maintain these engines is increasing and their reliability is decreasing due to their age. According to the Air Force, the original engines must be upgraded or replaced to keep the fleet operating until the year 2020.

Estimated Cost to Replace RC-135 Aircraft Engines and Funding Status

As of May 1992, the Air Force estimated that it would cost about $631 million (in then-year dollars) to replace the TF-33 engines with the CFM-56 engines on 21 RC-135 aircraft. This figure excludes the cost of spares, which the Air Force estimated would cost between $24 million and $40 million, depending on the future aircraft-basing option selected.

Until recently, the RC-135 engine replacement program had not been given sufficient Air Force priority to receive funding. We previously reported in a 1988 classified report that installing modern engines on the RC-135 aircraft would cost about $490 million but could potentially save up to $1.5 billion (in constant 1987 dollars) in future operation and maintenance costs through the year 2020.

We had also reported that the Air Force planned to replace engines on its KC-135 tanker aircraft before replacing engines on the RC-135 aircraft, even though the RC-135 aircraft flew about three times as many hours per

aircraft. We pointed out that the savings would be greater by replacing RC-135 engines before replacing KC-135 engines.

In the fall of 1991, we learned that the number of hours flown by the RC-135 aircraft had increased to four times that of the KC-135 aircraft. We also learned that although the operating command was continuing the KC-135 engine replacement, it had not requested funds in the fiscal year 1993 budget submission to the Air Force to begin the RC-135 engine replacement. Since the fall of 1991, we discussed this with Air Force officials at various levels. Subsequently, the Air Force added $134 million for the RC-135 program in the fiscal year 1993 budget to begin replacing engines on the RC-135 Rivet Joint aircraft. In June 1992, the Secretary of the Air Force increased the fiscal year 1993 funding for the RC-135 program to $307 million, decreased funding for the KC-135 program, and added $138.5 million in fiscal years 1995 through 1997 to replace engines on all 15 RC-135 Rivet Joint aircraft.

Also, in April 1992, the Defense Intelligence Agency included funds to replace engines on the three Cobra Ball aircraft (including one trainer aircraft) in the General Defense Intelligence Program budget for fiscal years 1996 through 1998. However, these funds are subject to reallocation by the Defense Intelligence Agency to meet other intelligence program requirements. The source and availability of funds for the remaining three aircraft is still unresolved. One of these aircraft (Cobra Eye) is jointly funded by the Air Force and the Army. The other two aircraft (Combat Sent) are jointly funded by the Air Force and the National Security Agency.

Projected Savings From Engine Replacement

Potential savings from fitting the RC-135 fleet with new engines are still on the order of $1.5 billion (in then-year dollars). The total estimated life-cycle cost of the RC-135 fleet of aircraft equipped with the TF-33 engine is about $6 billion through the year 2020, compared with a cost of about $4.5 billion if they are equipped with the new CFM-56 engine. These estimates were computed using an Air Force contractor's cost model and current Air Force operating and fuel cost data. Both of these life-cycle cost estimates include a onetime upgrade or acquisition—a $50 million engine upgrade for the TF-33 or a $652 million acquisition for a new CFM-56 engine and spares. Table 1 compares the costs of the TF-33 with those of the CFM-56 for fuel, maintenance, and aircraft tanker support.

Table 1 : Life-Cycle Cost Savings Realized by Replacing TF-33 Engines with the CFM-56

Dollars in millions

		CFM-56 engine	
Category	**TF-33 engine cost**	**Cost**	**Savings**
Fuel	$3,034	$2,437	$597
Maintenance	1,284	212	1,072
Tanker support	1,581	1,176	405
Engine upgrade or acquisition	50[a]	652[b]	-602
Total	**$5,949**	**$4,477**	**$1,472**

[a]This figure is the minimum TF-33 engine upgrade program that would be required to keep the aircraft operational through the year 2020. Depending upon the extent of the upgrade, the cost could range as high as $694 million.

[b]The estimate for acquisition of the CFM-56 engine and spares is slightly less than the current Air Force estimate of $631 million for engines and between $24 million and $40 million for spares.

Source: GAO analysis of Air Force and contractor data.

Our review of Air Force data shows that the nearly 30-year old TF-33 engine is more expensive and harder to maintain and less fuel efficient than modern engines. The new CFM-56 engines would burn about 20 percent less fuel than the TF-33 engines. Currently, the cost of fuel is $0.70 per gallon, an increase from the cost of $0.55 per gallon in 1990. On the basis of the current cost of fuel and current annual flight hours, the new CFM-56 engines would burn $597 million less fuel through the year 2020. An increase in fuel cost would increase the amount of savings realized.

The maintenance costs of the RC-135 fleet would be dramatically reduced by replacing the TF-33 engine with the CFM-56 engine. For example, the maintenance staff-hours expended per flight hour is 2.55 for the TF-33 versus 0.53 for the CFM-56, nearly an 80-percent reduction. The CFM-56 engine, already in use on other Air Force aircraft, has over 18 million in-flight engine hours and the lowest shop visit rate per thousand flight hours of all engines used on Air Force heavy multiengine aircraft. Shop visit rates per thousand engine flying hours show a 96-percent reduction for the CFM-56 over the TF-33. The average unscheduled engine removal rate per thousand engine flying hours for reliability problems on the CFM-56 has been at least 65 percent less than for the TF-33. This reduced maintenance with the CFM-56 engine would equate to a life-cycle savings of over $1 billion.

Installing the CFM-56 engines on the RC-135 fleet could also reduce aircraft tanker support by about 59 percent, which equates to $405 million of the life-cycle cost savings, according to Air Force figures derived from current operating costs. For example, Air Force records show that the

RC-135 aircraft flew 1,479 operational reconnaissance missions between January 1, 1991, and June 30, 1992. These missions required 2,094 tanker sorties for refueling. If CFM-56 engines had been installed on the RC-135 aircraft during this period, only 758 tanker sorties would have been required to support the missions, a 64-percent reduction in tanker support. This reduction in RC-135 tanker support is possible because the increased fuel efficiency enables the aircraft to fly farther and longer (by as much as 4 hours) with one tank of fuel. This capacity enables most missions to be completed without refueling and other missions to be performed with only one refueling.

New Engines Could Improve Aircraft Performance

Installing the CFM-56 engines on the RC-135 aircraft offers a variety of operational and performance enhancements. They include (1) increased engine reliability; (2) expanded overseas-basing options; (3) increased safety where current aircraft weight, weather, and runway conditions are marginal for landing and takeoff; (4) increased operating altitudes with expanded sensor coverage; and (5) decreased environmental pollution.

Reliability problems with the TF-33 engine have hampered the Air Force in accomplishing some RC-135 missions. Between July 1, 1991, and December 31, 1991, reliability problems with the TF-33 engine resulted in 3 delays, 11 aborts, and 10 cancellations of RC-135 missions. Air Force officials told us that occurrences of these types of reliability problems would increase until the TF-33 engine was replaced. The Air Force expects the increased reliability of the CFM-56 engine to significantly reduce these problems.

The CFM-56 engine will allow the RC-135 aircraft to operate from shorter (8,000 foot) runways due to the substantial increase in take-off thrust from 18,000 to 22,000 pounds. Also, the new engine's thrust reversers increase the margin of safety for landing the aircraft at maximum gross weight and under adverse weather conditions. Several modifications to the RC-135 over the years have increased the aircraft's gross weight and increased runway length requirements to at least 10,000 feet to achieve adequate speed for takeoff. These modifications have restricted RC-135 aircraft use of shorter airfields.

Currently, the airfields in certain parts of the world where the RC-135 can operate are limited. For example, the Air Force is restricted to one military airfield in the Mediterranean region suitable for the RC-135 aircraft. The Air Force has identified several potential additional military airfields in the

vicinity that have at least 8,000-foot runways. RC-135 aircraft that have the CFM-56 engines could operate from these locations.

The CFM-56 engine will increase RC-135 operating altitudes from 35,000 to 40,000 feet. At this higher altitude, the sensor coverage would be extended and potential standoff distances from hostile forces would be increased.

Lastly, environmental pollution would be reduced due to the 90-percent decrease in noise the CFM-56 engine would produce. RC-135 engine noise levels would be well within the Federal Aviation Administration's standards with the new CFM-56 engine. The TF-33 engine does not meet Federal Aviation Administration noise level requirements. Chemical pollution would also decrease by 69 percent, and visible smoke would be eliminated.

Matters for Congressional Consideration

The Air Force has approved funds for fiscal year 1993 and future budgets to install new engines on 15 of the 21 RC-135 aircraft. Tentatively, the Defense Intelligence Agency has approved future-year funds to replace engines on three additional RC-135 aircraft. However, neither the President's 1993 budget request nor the Secretary of Defense's 6-year defense plan include funding for the other three RC-135 aircraft because the organizations jointly responsible have not decided who will provide the funds. The Congress may wish to consider directing the Secretary of Defense to ensure adequate funding to complete the RC-135 engine replacement program. Completing the program would allow the full $1.5 billion life-cycle savings to be achieved and extend the life of the fleet to the year 2020.

Scope and Methodology

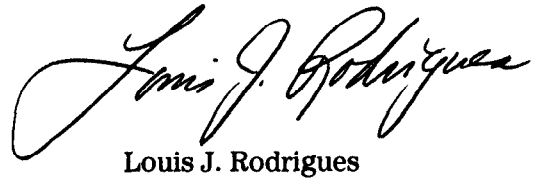
To accomplish our objectives, we interviewed officials and reviewed cost estimates and available documents at the Air Force Headquarters in Washington, D.C.; Headquarters, Strategic Air Command, Offutt Air Force Base, Nebraska; Headquarters, Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio; and at the General Electric CFM-56 Program Office, Evendale, Ohio.

We conducted our review from March through July 1992 in accordance with generally accepted government auditing standards. As requested, we did not obtain written agency comments on this report. However, we discussed our draft report with Department of Defense and Air Force officials and incorporated their comments where appropriate.

As agreed, we plan no further distribution of this report until 10 days after its issue date. At that time, we will send copies to appropriate congressional committees; the Secretaries of Defense and the Air Force; and the Directors of the National Security Agency, the Defense Intelligence Agency, and the Office of Management and Budget; and other interested parties.

Please contact me at (202) 275-4841 if you or your staff have any questions concerning this report. Other major contributors to this report were Howard R. Manning, Assistant Director; John M. Murphy, Jr., Issue Area Manager; and Katrina D. Stewart, Evaluator.

Sincerely yours,



Louis J. Rodrigues
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