

November 2009

# DEFENSE ACQUISITIONS

## Strategic Airlift Gap Has Been Addressed, but Tactical Airlift Plans Are Evolving as Key Issues Have Not Been Resolved



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Highlights of [GAO-10-67](#), a report to Subcommittee on Air and Land Forces, Committee on Armed Services, House of Representatives

## Why GAO Did This Study

DOD used nearly 700 aircraft, as well as commercial and leased aircraft, to carry about 3 million troops and 800,000 tons of cargo in support of wartime, peacetime, and humanitarian efforts in 2008. C-5s and C-17s move troops and cargo internationally (strategic airlift) and C-130s are the primary aircraft that moves them within a theater of operation (tactical airlift). Over the next 4 years, DOD plans to spend about \$12 billion to modernize and procure airlifters and is currently studying how many it needs.

GAO was asked to (1) identify the status of DOD's modernization and acquisition efforts and (2) determine how well DOD is addressing any capability gaps and redundancies. In conducting this work, GAO identified the cost, schedule, and performance of airlift programs, as well as DOD's plan for addressing gaps and redundancies. GAO also discussed mobility study efforts with DOD, Institute for Defense Analysis (IDA), and RAND officials.

## What GAO Recommends

GAO recommends, among other things, that DOD broaden the scope of its portfolio discussions, determine if additional C-17s are needed, and determine how Army direct support requirements will be met. DOD partially concurred with the recommendations, citing they have ongoing plans or processes to address the issues raised. As discussed in the report, GAO believes DOD needs to take additional steps to fully respond to the recommendations.

View [GAO-10-67](#) or [key components](#). For more information, contact Michael J. Sullivan (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov).

## DEFENSE ACQUISITIONS

### Strategic Airlift Gap Has Been Addressed, but Tactical Airlift Plans Are Evolving as Key Issues Have Not Been Resolved

#### What GAO Found

DOD has recently revamped airlift investments due to modernization cost increases and requirement changes. For strategic airlift, the number of C-5s that will be fully modernized were cut in half because of substantial reengining cost increases and C-17 quantities were increased from 180 to 213 aircraft. These twin changes resulted in a net cost increase of about \$3 billion. Additional costs and force structure changes are possible pending decisions on C-5 retirements, other modifications, the potential need for more C-17s to meet tactical airlift needs, and the planned shutdown of C-17 production. For tactical airlift, substantial cost increases for modernizing C-130 avionics tripled unit costs, delayed its schedule, and resulted in almost 60 percent fewer aircraft being modernized. There have been large increases in the C-130J quantity to replace older C-130s, but modest increases in unit costs. The joint Army-Air Force C-27J program was recently transferred to the Air Force and quantities were cut from 78 to 38 aircraft, with an uncertain effect on the Army's airlift missions. The Army and Air Force must also resolve fundamental differences in operating requirements and employment strategy for the Joint Future Theater Lift (JFTL).

DOD appears to have addressed its strategic airlift gap, but there is a potential future tactical airlift gap for moving medium weight equipment. Also, questions regarding how the Air Force will meet the Army's direct support mission have not been resolved. DOD is using \$5.5 billion appropriated by Congress to procure 23 additional C-17s, which DOD officials believe more than offsets the strategic airlift gap associated with the restructured C-5 modernization program. However, there is a potential gap in the tactical airlift of medium weight loads beyond the capability of the C-130s. The C-17 is the only aircraft capable of moving this type of Army equipment within a theater of operation, although not to austere, short, or unimproved landing areas. The JFTL is envisioned to provide this capability, but will not be available for 15 years or more under the current acquisition strategy. While the various mobility studies acknowledge the C-17's significant dual role, they did not comprehensively evaluate the expanded use of the C-17 to transport medium weight equipment in theater and how this could impact the force structure, the C-17's service life, and decisions related to when to shut down the production line. In addition, questions remain about the number of C-130s and C-27Js needed to fulfill Army direct support missions. Two studies reached somewhat different conclusions about the cost effectiveness of using C-130Js and C-27Js for this mission. The Air Force and Army have not completed a plan for meeting Army direct support requirements, which could affect future decisions on both the C-27J and the C-130J. DOD's recently established portfolio management structure is supposed to provide a useful forum to address the broad range of airlift investment decisions. However, efforts so far have primarily focused on new programs rather than addressing gaps and making other airlift decisions such as when and how many C-5s to retire or the appropriate mix of C-130s and C-27Js needed to perform Army missions.

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## Abbreviations

AMP	Avionics Modernization Program
DOD	Department of Defense
IDA	Institute for Defense Analysis
JFTL	Joint Future Theater Lift
RAND	RAND Corporation
RERP	Reliability Enhancement and Reengining Program

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United States Government Accountability Office  
Washington, DC 20548

November 12, 2009

The Honorable Neil Abercrombie  
Chairman  
The Honorable Roscoe Bartlett  
Ranking Member  
Subcommittee on Air and Land Forces  
Committee on Armed Services  
House of Representatives

The Department of Defense (DOD) employs over 700 aircraft to move troops and cargo in support of wartime operations, peacetime missions, and humanitarian aid efforts. In 2008, these airlifters along with commercial and leased aircraft flew more than 160,000 sorties, moving about 800,000 tons of cargo and 3 million troops. The Air Force's C-5s and C-17s perform the intertheater movement of troops and cargo, referred to as strategic airlift, and its C-130s provide most intratheater transport, referred to as tactical airlift.

The department plans to spend about \$12 billion over the next 4 years to modernize and recapitalize its airlift fleets. This includes upgrading the avionics on C-5s and selected C-130 models, replacing engines on about half of the C-5 fleet, and acquiring additional C-17s and C-130Js. DOD is also procuring C-27J Joint Cargo Aircraft and has begun initial planning efforts on the Joint Future Theater Lift (JFTL), both slated for tactical airlift. Growing fiscal pressures, however, may cause DOD to reexamine or restructure programs that exceed cost and schedule targets. Because of the costs, complexities, and interrelationships of airlift programs and the need for greater insight, we examined, at your request (1) the cost, schedule, and performance status of modernization efforts and new airlift programs and (2) how well DOD is managing the airlift portfolio to make investment decisions that address any capability gaps and redundancies. This report builds and expands upon information reported to you on strategic airlift issues in November 2008<sup>1</sup> and provides new information on tactical airlift programs and issues.

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<sup>1</sup> GAO, *Defense Acquisitions: Timely and Accurate Estimates of Costs and Requirements Are Needed to Define Optimal Future Strategic Airlift Mix*, [GAO-09-50](#) (Washington, D.C.: Nov. 21, 2008).

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In conducting our work, we interviewed and obtained documentation from officials within the Office of the Secretary of Defense and U.S. Transportation Command related to the ongoing Mobility Capabilities and Requirements Study 2016 and portfolio management activities. DOD officials did not provide a copy of or detailed information about the study results because the analysis had not been completed. Instead, officials provided status updates and answered questions about potential gaps and redundancies. We met with officials from each of the weapon system program offices<sup>2</sup> to obtain current cost, schedule, and performance information. When appropriate, we discussed reasons for variances from cost, schedule, and performance targets and upcoming acquisition, modernization, or retirement decisions related to their particular program. In addition, we met with Institute for Defense Analysis (IDA) and RAND Corporation (RAND) officials to discuss the results of their DOD-sponsored mobility studies. We also relied on our previous reports related to portfolio management, DOD mobility studies, and various weapon systems for information. A list of these reports is included in the Related GAO Products section at the end of this report. We conducted this performance audit from January 2009 to November 2009 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

DOD uses a variety of aircraft to move weapons, equipment, and troops from the United States to and within theaters of operation. C-5s and C-17s are used for strategic airlift. They carry weapons and equipment too large for any other DOD aircraft from the United States to staging locations throughout the world. The family of C-130 aircraft, which includes the C-130E, C-130H, and C-130J aircraft, is then the primary asset used to move weapons, equipment, and troops within a theater of operation.<sup>3</sup> The

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<sup>2</sup> Program offices we visited included the C-130 Avionics Modernization Program, C-130J, C-17, C-27J, and C-5. We also met with science and technology officials that are working on the Joint Future Theater Lift.

<sup>3</sup> DOD began using the C-130Es in 1962 and the C-130Hs, which included more powerful engines in 1974. DOD added the C-130J to the C-130 family in 1999. It includes a new propeller design and engines. A stretch version, the C-130J-30, which includes a 15-foot fuselage extension, has also been introduced.

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C-17 is dually capable of performing both strategic and tactical airlift missions and supplements the C-130 for tactical airlift. All of these aircraft are owned and operated by the Air Force and are considered part of the common user pool of aircraft that can be used to support any of the services' missions. DOD also relies on the Air Force's aerial refueling tankers (KC-10 and KC-135), commercial aircraft, and leased aircraft to supplement airlift capabilities. Officials at the U.S. Transportation Command and its Air Force component, the Air Mobility Command, decide on how best to use the assets on a daily basis. Often, these aircraft are scheduled for departure when they have a full load, to ensure assets are used cost-effectively. The services may also use their own airplanes and helicopters that are not in the common user pool to move people and cargo within a theater of operation. For example, these assets include the Army's C-23 Sherpas and the Marine Corps' V-22 Osprey aircraft. These aircraft are used to perform time-sensitive, mission-critical requirements and may take off without full loads since urgency is the primary driver for the mission, not efficiency or cost-effectiveness.

The Air Force is in the process of modernizing its C-5 and C-130H aircraft and acquiring C-17s, C-130Js, and C-27Js to meet its future strategic and tactical airlift requirements and improve aircraft availability. It plans to retire C-130Es from the tactical airlift fleet by 2014. C-5s are being modernized in two phases. During the first phase, known as the Avionics Modernization Program (AMP), aircraft receive upgraded avionics capabilities and an all-weather flight control system. During the second phase, known as the Reliability Enhancement and Reengining Program (RERP), aircraft engines are replaced and electrical, fuel, and other subsystems are modified. Together, the two modifications will help improve the C-5s wartime mission capable rate. C-130H aircraft are also receiving an AMP modification and will undergo a center wing box replacement because of severe cracking discovered in that area.

DOD periodically assesses global threats, the national military strategy, and its force structure to determine future airlift requirements and to judge the sufficiency of its acquisition and modernization plans. The analytical basis for DOD's current airlift requirements is the Mobility Capabilities Study completed in December 2005.<sup>4</sup> Officials used the study results to report in the 2006 Quadrennial Defense Review that 180 C-17s and 112 fully modernized C-5s (those that received the AMP and RERP

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<sup>4</sup> Other studies were completed in 1992, 1994, and 2001.

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modifications) would be sufficient to meet the national military strategy for strategic airlift with acceptable risk. This could change pending the completion of the ongoing DOD Mobility Capabilities and Requirements Study 2016, two other DOD-sponsored airlift studies conducted by IDA and RAND, the 2010 Quadrennial Defense Review, and potential changes in threat assumptions and the national security strategy. The IDA study has already been completed and the remaining studies are expected to be completed by January 2010.

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## Airlift Acquisition and Modernization Programs Have Been Restructured to Address Rising Costs and Changes in Airlift Needs

Over the last 2 years, DOD has restructured its airlift investments, primarily due to sharp cost increases for modernization programs and changes in requirements. The Air Force now intends to fully modernize less than one-half of the C-5s it originally planned and will procure additional C-17s. C-130 avionics modernization quantities were also cut more than half and the schedule was delayed due to cost increases. The Air Force is procuring more C-130J models than planned, due in part to a decision to retire the older C-130E model. Pending decisions on aircraft retirements, additional modifications, and new acquisitions could further affect future costs and the force structure. Furthermore, changing needs and uncertain strategies could lead to cost, schedule and performance variances on two new airlift programs, the C-27J and the JFTL. Appendix 1 contains more in-depth cost, schedule, and performance information on the department's strategic and tactical airlifters that we reviewed.

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## Strategic Airlift: DOD Is Modernizing Fewer C-5s, but Acquiring More C-17s

DOD has cut its C-5 modernization efforts by more than half and is acquiring additional C-17s. Significant cost increases on the C-5 RERP and AMP programs drove up unit costs and delayed schedules. These problems, along with additional congressional appropriations that DOD is using to procure more C-17s, led to a decision to fully modernize only 52 C-5 aircraft instead of the entire fleet. Congress has provided enough funding for DOD to procure 33 more C-17s. The last one will be delivered in March 2011.

Substantial C-17 production line shutdown costs—ranging from about \$465 million to about \$1 billion by Air Force and Boeing estimates, respectively—have yet to be determined, but will need to be funded soon. Table 1 summarizes changes in cost and quantities from original estimates.



**Table 1: Cost and Quantity Changes for Strategic Airlift Programs**

	Total cost (then-year dollars in millions)			Quantity			Program acquisition unit cost (then-year dollars in millions)		
	Initial estimate	Current estimate (July 2009)	Percentage change	Initial estimate	Current estimate (July 2009)	Percentage change	Initial estimate	Current estimate (July 2009)	Percentage change
C-17	\$39,754	\$67,799	71	211	213	1	\$188.4	\$318.3	69
C-5 RERP	\$11,094	\$7,694	-31	126	52	-59	\$88	\$148.0	68
C-5 AMP	\$911	\$1,405	54	112	112	0	\$8.1	\$12.5	54
<b>Total</b>	<b>\$51,759</b>	<b>\$76,898</b>	<b>49</b>						

Source: GAO analysis and DOD selected acquisition and program baseline reports. C-17 data were adjusted to include funding and quantities included in supplemental budgets.

Notes: DOD plans to AMP a total of 112 C-5s. One aircraft that had already received the AMP modification crashed.

DOD has nearly completed its C-17 acquisition program and is about midway through the C-5 AMP modernization program. According to program officials, 24 C-17s are yet to be delivered and 57 C-5s still need the AMP modification. The C-5 RERP modernization program is just beginning the low rate initial production phase. Only 3 of 52 C-5s have received the RERP modification as part of the development program. DOD has already spent about \$69.2 billion on research, development, test and evaluation (RDT&E) and procurement funds on these programs and program officials project they will need to invest about \$7.7 billion to complete the programs as currently planned (see table 2).

**Table 2: Cost and Quantity Remaining for Strategic Airlift Programs as of July 2009**

	Investments (then-year dollars in millions)		Quantity	
	Prior	To go	Delivered	To go
C-17	\$65,995	\$1,804	190	23
C-5 RERP	\$2,138	\$5,557	3	49
C-5 AMP	\$1,062	\$343	55	57
<b>Total</b>	<b>\$69,195</b>	<b>\$7,703</b>		

Source: GAO analysis and DOD selected acquisition reports.

Note: The C-17 quantity delivered figure includes one aircraft that is dedicated to provide airlift capability to a consortium of European nations.

The department planned to spend about \$12 billion to make AMP and RERP modifications to the fleet of C-5 aircraft by 2020. However, the Air Force declared a Nunn-McCurdy cost breach<sup>5</sup> in the RERP program in September 2007, due to increased labor and parts costs. The AMP effort required additional software development to address deficiencies found during developmental testing. Development costs would have been higher except that the Air Force decided not to address 250 deficiencies and 14 operational requirements in this program. These events resulted in revised plans to provide the AMP upgrade to all C-5 aircraft and the RERP modification to 52 aircraft. The combined cost for both modifications was reduced to \$9.1 billion, but now less than one-half of the fleet will be fully modernized and at a much higher unit cost than originally estimated—\$160.5 million for both modifications versus \$96.1 million. The portion of the fleet that does not get both modifications will continue to experience mission capable rates of around 50 percent compared to about 75 percent for the portion that does get both modifications. The last modifications are supposed to be finished in 2015.

Additional costs and changes in the force structure for the C-5 and C-17 are possible pending decisions on future modifications and retirements of older C-5s. For example, program officials said that many of the deficiencies and requirements dropped from the current C-5 AMP effort will be addressed in annual AMP software upgrades, the C-5 RERP, or a

<sup>5</sup> 10 U.S.C. § 2433 establishes the requirement for unit cost reports. If certain cost thresholds are exceeded (known as unit cost or Nunn-McCurdy breaches), DOD is required to report to Congress and, in certain circumstances, certify the program to Congress.

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new block upgrade program that is scheduled to begin in fiscal year 2010. The C-17 is also addressing modernization through a series of aircraft upgrades designed to address emerging issues such as international airspace access requirements and critical operational/safety issues.

Significant C-5 cost growth and further delays are possible if the RERP program is not adequately funded. We previously reported that, according to the department's Cost Analysis Improvement Group, the RERP program was underfunded by about \$294 million, with additional funding needed in fiscal years 2012 and 2013.<sup>6</sup> Replacement engines are the costliest portion of the RERP upgrade, and DOD officials said if funding is insufficient to meet yearly production quantities in existing purchase agreements, anticipated price breaks will not occur and could likely result in another Nunn-McCurdy unit cost breach and program restructure. Department officials said the Air Force is committed to fully funding the RERP modification of 52 aircraft, but did not provide us with new budget data for fiscal years 2011 and beyond.

Planned quantities of C-17s have fluctuated over the years. C-17 procurement began in 1988 and the Air Force initially planned to acquire 210 aircraft. Following a major acquisition review in 1990, the program was reduced to 120 aircraft because of technical problems and funding shortfalls during the full-scale development program, which resulted in higher than expected cost increases and schedule delays.<sup>7</sup> In subsequent years, DOD expanded the program from 120 aircraft to 180 aircraft and, in the past 3 fiscal years, Congress has provided funding that would allow DOD to procure 33 additional aircraft: 10 in fiscal year 2007,<sup>8</sup> 15 in fiscal

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<sup>6</sup> [GAO-09-50](#).

<sup>7</sup> GAO, *Military Airlift: Status of the C-17 Development Program*, [GAO-T-NSIAD-93-6](#) (Washington, D.C.: Mar. 10, 1993).

<sup>8</sup> Title III of the Department of Defense Appropriations Act, 2007, provided funds for Air Force aircraft procurement. Pub. L. No. 109-289. The Conference Report related to this legislation reflected \$2 billion for the Air Force to procure ten C-17 aircraft. H.R. Conf. Rep. No. 109-676, at 372 (2006).

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year 2008,<sup>9</sup> and 8 in fiscal year 2009.<sup>10</sup> This would bring the total number of C-17s DOD plans to procure to 213. As of July 2009, DOD had taken delivery of 190 aircraft. The program is expected to end with the delivery of the 213th aircraft in March 2011, at which time the production line could be shut down if Boeing does not receive additional international orders for the aircraft. The Air Force's fiscal year 2010 budget includes \$91.4 million to fund some of the shutdown costs and a DOD official stated that additional funding would be included in future budgets. However, final shutdown costs have not been negotiated between the Air Force and Boeing, the prime contractor. Last year we reported that the Air Force estimated the costs to be around \$465 million and Boeing's estimate was about \$1 billion.<sup>11</sup>

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### Tactical Airlift: C-130 AMP Modernization Program Has Been Cut and Uncertainty Surrounds New Programs

DOD's tactical airlift investments have also experienced cost and schedule fluctuations and continue to experience significant uncertainty. The AMP program to modernize the C-130H fleet has been substantially reduced, although officials are examining a possible follow-on effort to include more aircraft. Procurement quantities for the C-130J have increased to replace retiring C-130E models and plans, quantities, and employment strategies for the newest tactical aircraft, the C-27J, have yet to be finalized following a decision to transfer the joint program entirely to the Air Force. Table 3 summarizes changes in cost and quantity for current tactical aircraft. The JFTL, expected to augment the C-130 fleets, is in concept development and cost and quantity estimates are unavailable.

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<sup>9</sup> Title IX of the Supplemental Appropriations Act, 2008, provided funds for Air Force aircraft procurement. Pub. L. No. 110-252. The *Congressional Record* related to this legislation reflects that both the House of Representatives and the Senate recommended \$3.6 billion for the Air Force to procure 15 C-17 aircraft. 154 Cong. Rec. H3953, 3971, 3979, 3981 (daily ed. May 15, 2008) (statement of Rep. Obey); 154 Cong. Rec. S4302, 4329, 4330 (daily ed. May 19, 2008) (statement of Sen. Byrd).

<sup>10</sup> Title III of the Supplemental Appropriations Act, 2009, provided funds for Air Force aircraft procurement. Pub. L. No. 111-32. The Conference Report related to this legislation reflected \$2.17 billion for the Air Force to procure eight C-17 aircraft. H.R. Conf. Rep. No. 111-151, at 93 (2009).

<sup>11</sup> [GAO-09-50](#).

**Table 3: Cost and Quantity Changes for Tactical Airlift Programs**

	Total cost (then-year dollars in millions)			Quantity			Program acquisition unit cost (then-year dollars in millions)		
	Initial estimate	Current estimate (July 2009)	Percentage change	Initial estimate	Current estimate (July 2009)	Percentage change	Initial estimate	Current estimate	
								(July 2009)	Percentage change
C-130 AMP	\$3,965	\$5,800	46	519	221	-57	\$7.6	\$26.3	244
C-130J	\$840	\$15,018	1689	11	168	1,427	\$76.3	\$89.4	17
C-27J	\$4,088	\$1,912	-53	78	38	-51	\$52.4	\$50.3	-4
<b>Total</b>	<b>\$8,893</b>	<b>\$22,731</b>	<b>156</b>						

Source: GAO analysis of DOD selected acquisition reports for the C-130 AMP program. GAO analysis of selected acquisition reports for the initial estimates on the C-130J and C-27J programs and Air Force updates for the current estimates.

Notes: Numbers may not add due to rounding. C-27J current cost estimate does not include military construction funding.

DOD has not yet begun its C-130 AMP production program and has only taken delivery of 2 C-27Js as of July 2009. The department has more than half of its C-130J acquisitions—95 aircraft—yet to procure. DOD has already spent \$10.1 billion in RDT&E and procurement funds on these programs. Program officials project it will cost about \$12.6 billion to complete the programs as currently planned (see table 4).

**Table 4: Cost and Quantity Remaining for Tactical Airlift Programs as of July 2009**

	Investments (then-year dollars in millions)		Quantity	
	Prior	To go	Delivered	To go
C-130 AMP	\$1,796	\$4,004	3	218
C-130J	\$7,739	\$7,280	73	95
C-27J	\$584	\$1,329	2	36
<b>Total</b>	<b>\$10,118</b>	<b>\$12,613</b>		

Source: GAO analysis of C-130 AMP selected acquisition reports for investments and quantity information. GAO analysis of C-130J and C-27J selected acquisition reports for prior investment and quantity information and Air Force updates for to go investment and quantity information.

Note: Numbers may not add due to rounding. C-130J quantities include orders for all U.S. military customers.

The C-130 AMP entered system development in 2001, but funding instability and problems integrating hardware and software, as well as an Air Force decision to exclude C-130E aircraft from the program, triggered a Nunn-McCurdy unit cost breach in February 2007. The program was subsequently restructured to include far fewer aircraft—221 instead of

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519—at a cost \$1.8 billion greater than the original program estimate. In spite of the restructuring, incomplete production decision documentation and software integration problems, as well as senior leadership concerns about the acquisition strategy, have delayed a low-rate production decision by more than a year from the revised baseline—a slip of more than 4 years from the initial estimate. As of July 2009, the program was still awaiting approval from the Under Secretary for Acquisition, Technology and Logistics to award a production contract. The Air Force is considering another program restructure as well as a follow-on effort to modernize avionics on additional C-130 aircraft, but officials did not provide us an estimate of costs and quantities.

The department is now procuring more C-130J aircraft than originally expected, in part because of a decision to retire C-130Es. Production quantities for J-model aircraft have grown significantly over the last several years, from an initial baseline of 11 aircraft in 1996 to a current estimate of 168 aircraft, but according to program estimates, program unit costs have remained relatively stable. Program officials estimate a total program cost of \$15 billion. As of July 2009, 73 C-130Js have been delivered.

Recently, the department took delivery of the first two C-27J airlifters as part of the Joint Cargo Aircraft program to provide direct support for Army time-sensitive, mission-critical troop resupply. In June of 2007, the Under Secretary for Acquisition, Technology and Logistics approved an acquisition program baseline for the joint program of 78 aircraft, with the Army planning to buy 54 aircraft, and the Air Force 24. However, as part of its fiscal year 2010 budget request, the department transferred the program, along with the resupply mission it supports, exclusively to the Air Force and reduced the program from 78 to 38 aircraft. Air Force operational plans for the fleet and employment concepts for meeting Army direct support requirements have not been finalized.

The Army and the Air Force are jointly pursuing the JFTL to replace the C-130H airlifter and augment the rest of the C-130 fleet. The joint concept development effort was initiated in January 2008 following a decision by the Army and Air Force Chiefs of Staff to merge requirements for separate heavy lift efforts in progress at the time. The JFTL is anticipated to have a payload capacity of up to 36 tons, with a combat mission radius of 500 nautical miles. However, the services have different concepts for the aircraft. The Army concept is for a vertical take-off and landing tiltrotor that could provide sustainment of forces at the point of need and enable the maneuver of a mounted force (i.e., forces deployed with combat

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vehicles) by air. The Air Force is pursuing a fixed wing concept that would address the need to operate on short, soft, or rough airfields and the need for greater speed. Officials from both services stated they would like to have the JFTL initial capabilities document validated and begin work on an analysis of alternatives<sup>12</sup> in the late summer of 2009, to help ensure a sufficient basis for budget deliberations in March 2010. As of July 2009, this had not occurred. Documents provided by these officials indicate that system development for whichever concept is selected is not expected to begin until at least 2014, with the new system to be fielded beginning around 2024.

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## Strategic Airlift Gap Has Been Addressed, but a Potential Tactical Airlift Gap for Moving Medium Weight Equipment and Other Questions Have Not Been Resolved

Additional funds provided by Congress for C-17 procurement more than offset the strategic airlift gaps associated with reduced C-5 modernization plans. However, there is a potential future gap in tactical airlift capabilities for transporting medium weight Army equipment that cannot fit on C-130 aircraft. The C-17 fleet, in its dual role of providing both strategic and tactical airlift, currently provides this capability and is anticipated to continue to do so for many years. The JFTL is envisioned to eventually replace the C-130H and perform this and other roles, but will not be available for 15 years or more under the current acquisition strategy. While the various mobility studies acknowledge the C-17s' significant dual role, they did not comprehensively evaluate an expanded future use of the C-17 for the transport of medium weight equipment and how this could affect the force structure, the C-17s' service life, and when to shut down the C-17 production line. For example, the studies do not quantify current and anticipated future use of the C-17 for tactical airlift. This is because DOD officials do not consider the C-17 to be a suitable substitute for the JFTL. In addition, there are differing opinions about the transport of small loads in direct support of Army units, which could call into question the quantity of C-27Js needed to perform the Army mission. Two studies reached somewhat different conclusions about the cost effectiveness of using C-130Js and C-27Js for this mission. The Air Force and Army are working on a plan for how the Air Force will meet Army direct support requirements, but the details have not been finalized. DOD's recently established portfolio management structure is supposed to provide a useful forum to

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<sup>12</sup> The analysis of alternatives is an analytical study that is intended to compare the operational effectiveness, cost, and risks of a number of alternative potential solutions to address valid needs. Department of Defense Instruction 5000.02, Operation of the Defense Acquisition System Enclosure 2, section 4(c), paragraphs 5 and 6 (Dec. 8, 2008); Interim Defense Acquisition Guidebook chapter 3.3.1 (June 15, 2009).

address the broad range of airlift investment decisions. However, efforts so far have been primarily focused on new programs rather than addressing gaps and redundancies across the current portfolio, as well as making other airlift decisions, such as when and how many C-5s to retire or the appropriate mix of C-130s and C-27Js needed to perform Army missions.

### Acquisition of Additional C-17s Addresses Strategic Airlift Gap

Following DOD’s decision to reduce the number of C-5s that will be fully modernized from 111 to 52 aircraft, Congress has appropriated around \$5.5 billion that DOD plans to use to procure up to 23 additional C-17s. This would bring the total number of C-17s the Air Force now plans to acquire to 213 aircraft. DOD and Air Force officials believe this current quantity of C-17s more than adequately addresses their strategic airlift requirements in terms of the number of aircraft needed and the collective delivery capabilities. Table 5 shows the changes in the strategic airlift mix since the time the 2005 Mobility Capabilities Study was completed and the impact the different mixes have had on DOD’s ability to meet strategic airlift requirements for the timely inter-theater transport of required equipment and supplies.

**Table 5: Changes in Strategic Airlift Force Structure and Capabilities**

	December 2005	September 2006	February 2008	June 2008	June 2009
Event	Mobility Capability Study released	Congressional appropriation for additional C-17s	C-5 RERP program is restructured	Congressional appropriation for additional C-17s	Congressional appropriation for additional C-17s
Number of C-17s	180	190	190	205	213
Number of C-5s	112 fully modernized	112 fully modernized	59 avionics only 52 fully modernized	59 avionics only 52 fully modernized	59 avionics only 52 fully modernized
Estimated million ton-miles per day capability	33.09	33.95	32.17	33.79	34.79

Source: GAO analysis of DOD budget and program data.

Note: The million ton-mile measure is a common metric included in prior capability studies that describes the daily capacity of a specified fleet of strategic airlifters.

A recent IDA study concluded that 316 strategic airlifters, which include 205 C-17s, 52 fully modernized C-5s, and 59 partially modernized C-5s, meets DOD’s strategic airlift requirements established in the 2005 Mobility



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Capability Study.<sup>13</sup> Further, if additional airlift capacity is needed above what the current mix of aircraft can deliver, it could be achieved without procuring additional C-17s or modernizing C-5s. Specifically, IDA found that additional capacity could be obtained by

- using C-5s at Emergency Wartime Planning levels
- transporting some small oversize as well as bulk cargo using Civil Reserve Air Fleet aircraft
- making use of host nation airlifters to the maximum extent possible and
- using tankers not involved in tanker missions to carry cargo in theater.

In the event that even more capacity is needed, the IDA study states that it would be more cost-effective to provide the RERP modification to more C-5s than to procure additional C-17s because the near-term acquisition costs are offset by reduced operation and support costs. IDA also concluded that retiring older C-5As to free up funds to buy and operate more C-17s would result in a less capable force at comparable overall cost and thus would not be cost-effective.

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### Potential Tactical Airlift Gap Exists in Movement of Medium Weight Equipment on the Battlefield

A potential future capability gap exists in the deployment and redeployment of Army medium weight weapon systems within a theater of combat. The C-17 is the only aircraft currently capable of transporting heavier equipment, such as combat configured armored Strykers and Mine Resistant Ambush Protected vehicles, within a theater of operations as these are too large and bulky for C-130s to carry. However, the C-17 cannot transport this equipment into austere, short, or unimproved landing areas. DOD's long-term plan is to use the JFTL, the planned C-130H replacement, to transport these vehicles in theater, including to such access-challenged locations. However, it will not be available for at least 15 years as currently planned. While the various mobility studies acknowledge the C-17 can perform both strategic and tactical airlift missions, none of the three recently completed or ongoing studies comprehensively considered the C-17 in the tactical force structure, even though about 20 percent of the tactical sorties flown by the C-17 fleet in fiscal year 2007 were for missions where loads were too large for C-130s. As such, DOD has not evaluated the impact the increasing tactical heavy lift mission will have on future tactical airlift requirements, the C-17's service life, its availability to perform strategic airlift and other tactical

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<sup>13</sup> Institute for Defense Analyses, *Study on Size and Mix of Airlift Force*, February 2009.

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airlift missions, and the impact it could have on C-17 production shutdown plans.

DOD officials do not believe that the C-17 is a suitable substitute for the JFTL mission. A DOD official stated that preliminary results of the Mobility Capabilities and Requirements Study 2016 show that in the worst case planning scenario there would be enough C-17s to perform its primary role as a strategic airlifter, as well as some tactical missions through 2016. This is because the study analysis shows the peak demand for the C-17 and the C-130 occurs at different times and the C-17 is aging as planned. However, officials indicated that none of the current mobility studies analyzed the need for the C-17 to perform additional tactical heavy lift missions for the 8-year period between 2016 and 2024, when the JFTL is expected to be fielded. Furthermore, because we were not granted access to the preliminary study information, we could not ascertain the extent to which the C-17's heavy lift mission had been considered in DOD's analysis through 2016. C-17 production is scheduled to end in March 2011. As we previously reported a well-reasoned, near-term decision on the final C-17 fleet size could help DOD avoid substantial future costs from ending production prematurely and later restarting production.<sup>14</sup> For example, the Air Force has estimated that restoring the production line could cost \$2 billion. Costs and challenges associated with such a course include hiring and training a workforce of nearly 3,100 people, reinstalling and restoring production tooling, and identifying suppliers and qualifying their parts and processes.

Although it is too early to comment on JFTL program outcomes, we believe DOD officials will need to exercise caution to avoid pitfalls we have previously identified in connection with developing new weapon systems so the new system will be delivered on time and within cost estimates.<sup>15</sup> These pitfalls include taking a revolutionary versus an evolutionary approach for weapon system development, over promising performance capabilities; increasing requirements; and understating expected costs, schedules, and risks associated with developing and producing the weapon. DOD understands many of the problems that affect acquisition programs and has revised its acquisition policy as a foundation

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<sup>14</sup> [GAO-09-50](#).

<sup>15</sup> GAO, *Defense Acquisition: DOD Must Balance Its Needs with Available Resources and Follow an Incremental Approach to Acquiring Weapon Systems*, [GAO-09-431T](#) (Washington, D.C.: Mar. 3, 2009).

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for establishing sound, knowledge-based business cases for individual acquisition programs.<sup>16</sup> For example, the policy recommends the completion of key systems engineering activities before the start of development, including a requirement for early prototyping, and establishes review boards to evaluate the effect of potential requirements changes on ongoing programs. The policy also supports evolutionary acquisitions and states that increments should be fully funded, include mature technologies, and normally be developed in less than 5 years. However, to improve outcomes, DOD must ensure that its policy changes are consistently implemented and reflected in decisions on individual programs.

Both Air Force and Army science and technology officials indicated that no new technology invention is needed for either of their concepts. However, tiltrotor technology has never been applied to a system of the size needed to carry all the Army's ground vehicles (excluding the M-1 tank). In fact, the Army envisions the JFTL's payload capacity will be nearly 5 times that of the V-22, the world's first production tiltrotor aircraft and nearly 3 times that of the CH-47 Chinook, a heavy lift helicopter used to transport ground forces, supplies, and other critical cargo. In addition, the Senate Armed Services Committee recently noted that to support the JFTL initial operational capability, a prototype would need to be flying by 2015.<sup>17</sup> Yet, the committee could not identify any DOD funds budgeted for accomplishing this objective, and further observed that waiting to conduct a competitive prototyping effort as part of an acquisition program would take years to begin. As such, the committee requested the Under Secretary for Acquisition, Technology and Logistics to, among other things, assess the merits of initiating a low-cost, highly streamlined competitive prototyping effort immediately, determine whether cost and performance goals can be met, help define requirements, and sustain the industrial base.

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<sup>16</sup> Department of Defense Directive 5000.01, The Defense Acquisition System (May 12, 2003); Department of Defense Instruction 5000.02, Operation of the Defense Acquisition System (Dec. 8, 2008).

<sup>17</sup> S. Rep. No. 111-35, at 52-54 (2009).

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## Mix of C-130s and C-27Js Needed to Support Army Missions Has Not Been Determined

Questions remain about the number of C-130s and C-27Js needed to support Army direct support missions. As stated earlier, as part of its fiscal year 2010 budget request, the department transferred the C-27J program, along with the resupply mission it supports, exclusively to the Air Force and reduced the program from 78 to 38 aircraft. In a recent hearing, congressional leaders questioned the Secretary of Defense about how the Air Force will fulfill this mission with fewer aircraft than initially anticipated.<sup>18</sup> In response, the Secretary of Defense stated that the reduced number of C-27Js was based on the number needed to recapitalize the Army's fleet of C-23 Sherpas and that uncommitted C-130 aircraft can be used to complement the C-27Js to fulfill the Army's mission. In addition, he said there needs to be a change in the Air Force's culture with respect to how the direct support mission is accomplished.

The Air Force and Army are in the process of developing plans on how the Air Force intends to fulfill the direct support mission, which would include important decisions on employment concepts, basing, and life-cycle support. The plans are in various stages of development and are expected to be completed by October 2012. However, congressional concerns remain regarding the service's commitment to that mission. This concern is based on historical instances in which the Air Force assigned lesser priority to direct delivery missions compared with traditional airlift operations, most notably during the Vietnam War when the Air Force assumed ownership of the Army's C-7 Caribou aircraft and subsequently dropped some missions. It is also unclear what effect this program change will have on the Air Force's C-130 fleet operations.

In recent studies, IDA and RAND assessed the use and roles of the C-130s and C-27Js in performing tactical missions. Although the study parameters were different, they both looked at the tactical movement of cargo. IDA's analysis focused on the use of these aircraft within the context of major combat operations as well as persistent global involvement in numerous smaller operations. IDA found that the tactical fleets they examined were equally cost-effective at transporting cargo in major combat operations. Whereas C-130s are more cost effective than the C-27Js in specific missions that demand full loads, the opposite is true when missions require small loads. Further, in non-major combat operations, IDA found

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<sup>18</sup> Department of Defense Budget Request for Fiscal Year 2010: Hearing Before the H. Armed Services Comm., 111th Cong. (2009) (statements of Rep. Bartlett, Ranking Member, H. Armed Services Comm., and Robert Gates, Secretary of Defense).

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that the global demand for small loads on numbers of aircraft in different locations made additional C-27Js more cost-effective than additional C-130s.

According to RAND officials, RAND work on this topic has been underway for several years. The first RAND study focused on determining the most cost-effective way to recapitalize the C-130 fleet in order to meet the official wartime requirement. This study concluded that acquisition of the extended version of the C-130J was the most cost effective option to perform tactical missions defined in the officially approved wartime requirement. The C-27J provides about 40 percent of the cargo capacity (in terms of pallets) as the extended C-130J at about two-thirds the cost, based on net present value total life cycle costs. In addition, the study also concluded that the extended C-130J and the C-27J were equally cost-effective at conducting the ongoing resupply missions in Iraq and Afghanistan. RAND was then asked to consider the cost-effectiveness of the C-27J in eight additional missions that were not part of the official requirement. The study concluded that the C-27J was not cost-effective or appropriate for five of those missions and was comparable to the C-130J in three of the missions. RAND also found that the C-130J and the C-27J have comparable performance under operationally consistent circumstances of delivering the same amount of cargo at the same distances.

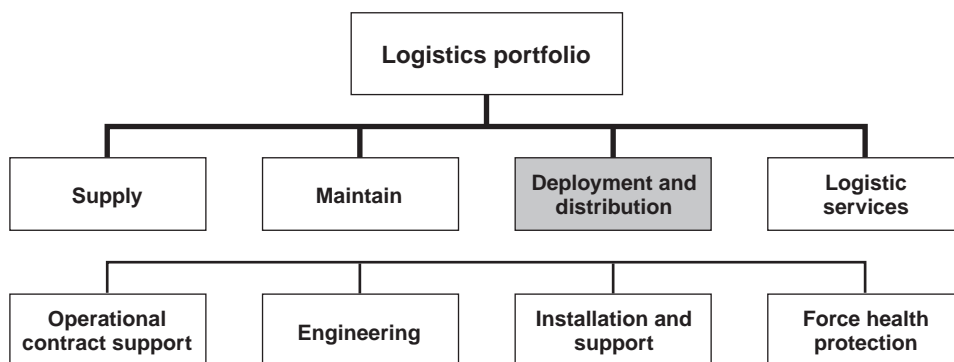
It should be noted that neither of these studies addressed recent C-27J program decisions that resulted in the transfer of the program to the Air Force and a reduction in aircraft quantities. Likewise, neither of the studies considered the number of C-130s that may be necessary to supplement these missions or the impact the missions may have on the C-130 fleet. Furthermore, because the C-27J was not initially considered part of the common user pool, the ongoing DOD Mobility Capabilities and Requirements Study 2016 did not include the C-27J in the common user pool in its analysis. Following the restructuring, an Air Force official told us that, while the C-27J's primary use is expected to be for direct support of the Army, it would also be available for movement of cargo in the common user pool.

## New Portfolio Management Initiative Offers Opportunities to Better Manage Airlift Investments

In September 2008, the department instituted a new process for helping senior leaders make investment decisions, including those for airlift.<sup>19</sup> Known as capability portfolio management, the new process enables the department to develop and manage capabilities, as opposed to simply individual programs, and enhance the integration and interoperability within and across sets of capabilities. Previously we reported that leading commercial companies use portfolio management to collectively address all of their respective investments from an enterprise level rather than as independent and unrelated initiatives.<sup>20</sup> This approach, among other things, allows the companies to weigh the relative costs, benefits, and risks of potential new products and helps the companies balance near- and future-term market opportunities.

According to DOD officials, airlift issues fall under the purview of the logistics portfolio and are included in the deployment and distribution subgroup, along with sealift and ground transportation. Figure 1 shows the major capability areas included in the logistics portfolio.

**Figure 1: DOD Logistics Portfolio Management Structure**



Source: DOD.

The new capability portfolio management directive states that DOD shall use capability portfolio management to advise the Deputy Secretary of

<sup>19</sup> Department of Defense Directive 7045.20, Capability Portfolio Management (Sept. 25, 2008).

<sup>20</sup> GAO, *Best Practices: An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes*, GAO-07-388 (Washington, D.C.: Mar. 30, 2007).

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Defense and the heads of DOD components on how to optimize capability investments across the defense enterprise and minimize risk in meeting the department's capability need in support of strategy. The Under Secretary of Defense for Acquisition, Technology and Logistics and the Commander of U.S. Transportation Command share responsibilities for managing the logistics portfolio. They are expected to identify airlift issues, priorities, and capability resources and mismatches (gaps, shortfalls, and redundancies). According to officials that assist with logistics capability portfolio management activities, logistics portfolio managers now have access to the Deputy's Advisory Working Group that they may not have had access to before to discuss unresolved logistics issues, including the Deputy Secretary of Defense and the Vice Chairman of the Joint Chiefs of Staff.

We believe portfolio management offers DOD an opportunity to address the full range of airlift issues, but DOD's implementation thus far has not had a big impact on the way airlift assets are managed. Officials we spoke with stated that the Under Secretary of Defense for Acquisition, Technology and Logistics and U.S. Transportation Command continue to focus on activities they were already performing prior to the establishment of the portfolio, mainly concerned with new weapon system programs and future capabilities but not as much on modification programs on legacy aircraft. For example, the U.S. Transportation Command has been and continues to be responsible for developing an integrated priorities list that details the top new capabilities needed and identifying capability gaps and shortfalls for airlift. The Under Secretary of Defense for Acquisition, Technology and Logistics continues to play an advisory role for addressing these gaps and shortfalls.

Officials stated that to date, the logistics portfolio managers have not provided input to recent or upcoming airlift decisions related to the appropriate mix of strategic and tactical airlifters, changes in modernization programs, C-5 retirements, C-17 production shutdown, and changes in the Air Force's roles and missions for airlift. In addition, no airlift issues have been brought to the working group for resolution. Given this approach, we believe the department is still at risk of continuing to develop and acquire new airlift systems and modernization programs without knowing whether adequate resources are available to complete programs within cost and schedule estimates.

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## Conclusions

Growing fiscal pressures are forcing DOD leaders to look closely at weapon system investments. DOD has to make tough investment and

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programmatic decisions regarding strategic and tactical airlift in the near future. However, the path forward is not clear because recently completed and ongoing mobility studies lack some crucial information that would help department officials make sound airlift investment decisions. Namely, the studies do not quantitatively account for the increasing tactical role of the C-17, especially in light of the fact that C-130s are not capable of delivering heavier equipment demanded by our warfighters and that the JFTL, which is envisioned to perform this mission, will not be available for 15 years. Further, the studies do not explore the possible use of C-27Js in a common user role or the impact on the fleet and number of C-130s needed to support Army time-sensitive, mission-critical requirements.

While Congress and DOD appear to have addressed the strategic airlift capability gap, some fundamental questions remain: Can the Air Force adequately fund the C-5 RERP modification program over the next 5 years? When should C-5s be retired and how many? And how many C-5s would need the AMP modification if some of the aircraft are retired? Even larger questions exist for tactical airlift: Are 213 C-17s enough to perform both strategic and tactical missions? What are the potential impacts on C-17 service life, maintenance, and availability from its expected increased use in the future for the tactical airlift of heavier and bulkier Army equipment? How will the Air Force meet the Army's time-sensitive mission-critical requirements with 40 fewer C-27J aircraft? Will there be a fundamental shift in the Air Force's roles and mission that would require the Air Force to assume more Army-specific missions? Can the department set technically realistic requirements for the JFTL and follow an evolutionary acquisition strategy that includes selecting mature technologies, normally developing increments in less than 5 years and fully funding each increment?

More information is needed to help the department address these questions and avoid the unnecessary expenditure of billions of dollars on redundant capabilities or a potentially premature C-17 production line shutdown. The airlift portfolio management team has the requisite authority to address these questions and influence budget decisions, but greater attention must be paid to all facets of the airlift life cycle—from cradle to grave. Making sound modernization and retirement decisions is just as important as deciding when and what type of new programs to start. Moreover, approaching these decisions from a portfolio perspective rather than on a weapon system by weapon system basis and considering new roles and missions for the Air Force may help the department strike the right balance for its airlift investments.



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## Recommendations for Executive Action

We are making five recommendations to help improve DOD's management of strategic and tactical airlift assets. We recommend that the Secretary of Defense direct

- the portfolio management team, consisting of U.S. Transportation Command and the Under Secretary of Defense for Acquisition, Technology and Logistics, to provide more comprehensive advice to senior leaders on the full range of airlift investment decisions, including new program starts, modernization efforts, and retirement decisions. This would also include identifying alternatives for using existing common user aircraft to meet service-specific missions and considering new roles and missions for the Air Force;
- the Office of the Secretary of Defense (Cost Assessment and Program Evaluation) and Commander, U.S. Transportation Command to develop a specific airlift plan that would identify when C-5s will be retired and identify the total number of additional C-17s, if any, that would be needed to replace C-5s or perform tactical heavy lift missions until the time the JFTL is fielded;
- the Commander, Air Mobility Command, to determine the appropriate mix of C-27Js and C-130s that are needed to meet Army time-sensitive, mission-critical requirements and common user pool requirements;
- the Air Force and Army to reach agreement on plans detailing how Army time-sensitive, mission-critical requirements will be addressed and prioritized against other Air Force priorities; and
- the joint Air Force and Army program office to develop a plan to follow an evolutionary approach for developing the JFTL based on DOD acquisition policy that includes selecting mature technologies, normally developing increments in less than 5 years, and fully funding each increment.

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## Agency Comments and Our Evaluation

DOD provided us with written comments on a draft of this report; these are included in appendix II. DOD partially concurred with all five recommendations, stating that it either has plans and processes in place or ongoing efforts to address our concerns. During the course of our review, DOD officials explained the steps they were taking to make strategic and tactical airlift decisions, but in some cases did not provide us with supporting documentation and, in other cases, the plans were in the initial stages of development and there was not yet sufficient detail for us to determine the extent to which they addressed our concerns. Despite the positive actions DOD described, we believe that the department's efforts

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in some cases still fall short and that our recommendations are warranted to help guide subsequent actions and transition plans to effective implementation. DOD officials also provided technical comments on our draft and we revised our report where appropriate.

In response to our first recommendation about the portfolio management team providing more comprehensive advice to senior leaders on the full range of investment decisions, DOD says it has a structured process in place for assessing its mobility capabilities and requirements that includes strategic and tactical airlift decisions. We understand that DOD has a process in place to make airlift decisions, but they are not being made from a comprehensive portfolio management perspective, per DOD regulation. DOD officials could not provide us with any evidence that the portfolio management team had even discussed airlift issues from a portfolio perspective, even though the logistics portfolio began as a pilot program for portfolio management 2 years ago. We believe DOD portfolio managers need to take a broader perspective on airlift issues to ensure that the appropriate amount of attention and resources are available to address the most pressing issues for new and legacy programs and to avoid unnecessary expenditure of funds for modernizations or acquisitions. Therefore, we do not believe that DOD's response adequately addresses our recommendation.

The department agreed with our second recommendation on the need to develop a plan for strategic airlift that identifies the number of C-5s that will be retired and the number of additional C-17s, if any that might be needed. In its comments, DOD stated that the Secretary of the Air Force, in coordination with the Office of the Secretary of Defense (Cost Assessment and Program Evaluation) and U.S. Transportation Command has already developed this plan based on the current level of congressional funding for the C-17 and preliminary results of the Mobility Capabilities Requirements Study 2016 and the Quadrennial Defense Review. Specifically, DOD officials believe an adequate number of C-17s have been procured to cover all necessary missions to satisfy the National Defense Strategy and will retire some C-5s. We were not provided any details about this plan for strategic airlift, the ongoing mobility study or the Quadrennial Defense Review to comment on the adequacy of the analysis, but believe that a thorough analysis is needed for senior leaders to make sound investment decisions. We are concerned about the adequacy of the plan because during the course of our review, DOD officials told us that the Mobility Capabilities Requirements Study 2016 does not specifically quantify the use of the C-17 in a tactical role or evaluate the impact on its service life resulting from the increased use in

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that regard. In 2007, over 20 percent of the C-17 missions were for tactical missions and this could grow given that it is the only aircraft that is capable of moving certain types of equipment within a theater of operations that are too large or bulky for the C-130. Further, it is unclear whether DOD has identified how many C-5s need the AMP modification since additional C-17s are being procured or when and how many C-5s will be retired. In addition, we previously reported on deficiencies in how DOD conducted its previous mobility capabilities study and we do not know if DOD has addressed these flaws in the current study.<sup>21</sup> As a result, we do not know the extent to which the new study will provide clear answers for senior leaders regarding strategic and tactical airlift or engender more questions.

DOD commented that it believes it has fulfilled the requirements for our third and fourth recommendations by recently tasking the Air Force and Army to determine the appropriate mix of C-27Js and C-130s to perform Army time-sensitive, mission-critical requirements and common user pool requirements, as well as develop plans detailing how Army requirements will be prioritized against Air Force priorities. These are good first steps. However, the plans are still in development and, according to an Air Force briefing to the Deputy's Advisory Working Group, more work needs to be done. Critical details, including a concept for employment, a final basing plan, and a decision on the maintenance concept will have to be worked out over the next several years. These issues have also generated much debate within the department and in Congress concerning aircraft quantities and employment strategies. As we stated earlier, the Air Force has historically had trouble balancing Army priorities with its own and, according to the Secretary of Defense, the Air Force will need to change its culture to successfully meet both requirements. In addition to completing the plans, we believe DOD may need to exert sustained oversight by senior leaders, including the portfolio management team, to ensure the Air Force is able to perform these missions over the long-term.

Finally, DOD believes that it has fulfilled the requirement for our fifth recommendation related to using an evolutionary approach for developing the JFTL that includes selecting mature technologies, developing increments in less than 5 years, and fully funding each increment. DOD

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<sup>21</sup> GAO, *Defense Transportation: Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study and Report*, [GAO-06-938](#) (Washington, D.C.: Sept. 20, 2006).

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stated that the Air Force and Army are currently engaged in approving a JFTL initial capabilities document and commencing with a formal analysis of alternatives to consider all viable options for addressing capability gaps. We believe these start-up actions are appropriate and, if accomplished according to policy, should provide a solid foundation to inform subsequent decisions for a new weapon system acquisition program. Our recommendation, however, is geared not only to these initial planning steps but also looking forward to the smooth transition to system development and effective acquisition program management. This recommendation will take several steps and years to complete, and we believe senior leaders, including the portfolio management team, need to ensure that the JFTL program has a solid business case at the start of development with mature technologies, adequate funding, and an incremental plan for development. Our previous work on many other weapon systems programs<sup>22</sup> has shown that without these, programs are likely to encounter significant cost and schedule growth that will, if realized on the JFTL program, impact the department's ability to move medium weight equipment within a theater of operations directly to the warfighter. It may also have an impact on the C-17 program as these aircraft may be used more frequently than planned for tactical missions. We therefore believe that DOD will need to take additional steps to be fully responsive to this recommendation.

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We are sending copies of this report to the Secretary of Defense and interested congressional committees. The report is also available at no charge on the GAO Web site at <http://www.gao.gov>.

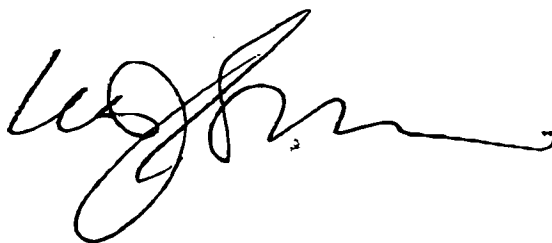
If you have any questions about this report or need additional information, please contact me at (202) 512-4841 or [sullivanm@gao.gov](mailto:sullivanm@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found

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<sup>22</sup> GAO, *Defense Acquisitions: Charting a Course for Lasting Reform*, GAO-09-663T (Washington, D.C.: Apr. 30, 2009).

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on the last page of this report. Key contributors to this report were Bruce Fairbairn, Assistant Director; Cheryl Andrew; Marvin Bonner; Andrew Redd; Kristine Heuwinkel; and Robert Swierczek.

A handwritten signature in black ink, appearing to read "Michael Sullivan". The signature is fluid and cursive, with a large loop at the beginning and a long, sweeping tail.

Michael Sullivan  
Director  
Acquisition and Sourcing Management

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# Appendix I: A Summary of Strategic and Tactical Airlift Systems—Ongoing and Future Efforts

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This appendix provides more details on strategic and tactical airlift new and modernization programs to expand upon summary information provided in the body of this report. We include a brief description of each aircraft's mission, program status, and our observations on upcoming program decisions. Where applicable, we highlight our recent work on some systems. The appendix also includes a funding table for each aircraft. Because the fiscal year 2010 budget did not include funding projections beyond fiscal year 2010, we used information from the Fiscal Year 2010 Defense Budget for funding data related to fiscal years 2008 through 2010 and the Fiscal Year 2009 Defense Budget for fiscal years 2011 through 2013 when possible. Since the C-5 Reliability Enhancement and Reengining Program (RERP) and C-27J programs were restructured, we relied on information from the Air Force for fiscal years 2011 through 2013 data. The budget information in each table is expressed in current (then year) dollars and the totals may not add exactly because of rounding.

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## Strategic Airlifters



The Department of Defense (DOD) uses a mix of modernized C-5s, which were manufactured 30 to 40 years ago, and newer C-17s to complete the strategic airlift mission. Both strategic airlifters possess intercontinental range with aerial refueling and can carry weapons and equipment too large for any other DOD aircraft. Each also has some complementary characteristics that favor a mixed fleet. The larger C-5 can carry more cargo than the C-17 and is the only aircraft capable of handling some equipment, such as the Army's 74-ton mobile scissors bridge. The C-17 is more modern, has a higher mission capable rate,<sup>1</sup> and is more flexible in that it also provides tactical airlift to forward-deployed bases. Figure 2 compares the two strategic airlifters.

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<sup>1</sup> DOD uses mission capable rate as a measure of an aircraft's readiness to perform at least one assigned mission.

**Appendix I: A Summary of Strategic and Tactical Airlift Systems—Ongoing and Future Efforts**

**Figure 2: Comparison of C-5 and C-17 Capabilities and Characteristics**

	 C-5	 C-17
<b>Loads</b>	270,000 pounds of cargo (36 pallets) 81 troops	170,900 pounds of cargo (18 pallets) 102 troops
<b>Wingspan</b>	223 feet	170 feet
<b>Length</b>	247 feet	174 feet
<b>Maximum take-off weight</b>	840,000 pounds	585,000 pounds
<b>Range</b>	6,320 miles (unrefueled) Unlimited (air refueled)	2,700 miles (unrefueled) Unlimited (air refueled)
<b>Speed</b>	518 mph	572 mph
<b>Minimum runway length</b>	6,000 feet	3,500 feet
<b>Crew</b>	7	3
<b>Mission capable rate (2008)</b>	52 percent	86 percent
<b>Cost per flying hour (2008)</b>	\$20,947	\$12,014

Source: GAO analysis of DOD data; graphics by Lockheed Martin Corporation.

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## C-5 Galaxy

**Figure 3: C-5 Galaxy**



Source: U.S. Air Force photo/Jason Minto.

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### Mission

The C-5 is one of the largest aircraft in the world and is used by DOD for strategic airlift purposes. It can carry outsize and oversize cargo over intercontinental ranges and can take off or land in relatively short distances. With aerial refueling, the aircraft's range is limited only by crew endurance. The C-5 can carry nearly all of the Army's combat equipment, including large heavy items such as the 74-ton mobile scissors bridge. Ground crews can load and off-load the C-5 simultaneously at the front and rear cargo openings. The landing gear system permits lowering of the parked aircraft so the cargo floor is at truck bed height to facilitate vehicle loading and unloading.

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### Program Status

The Air Force acquired a total of 126 C-5s in two production batches. Aircraft designated C-5A were built between 1969 and 1974 and given new wings in the 1980s.<sup>2</sup> Aircraft designated C-5B were built in a second production run in the 1980s. Since then, the Air Force has retired 14 C-5As and 1 C-5B crashed, leaving a total of 111 C-5 aircraft (60 C-5As, 49 C-5Bs, and 2 C-5Cs).

In 1999, the Air Force began modernizing its C-5 aircraft. Modifications are intended to improve operational capability while improving flight safety,

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<sup>2</sup> Two C-5As were later modified to carry National Aeronautics and Space Administration components and other outsized cargo and were re-designated C-5Cs.



reliability, and maintainability. The two primary modifications are as follows<sup>3</sup>

- The Avionics Modernization Program (AMP), which upgrades capabilities, including Global Air Traffic Management, navigation and safety equipment, modern digital equipment, and an all-weather flight control system.
- The Reliability Enhancement and Reengining Program (RERP), which replaces engines and modifies over 70 electrical, fuel, and other subsystems.

Together, these two upgrades were expected to improve the fleet's wartime mission capable rate to at least 75 percent, thereby increasing payload capability and transportation throughput, and to reduce total ownership costs over the life cycle through 2040 by about \$14 billion in 2008 dollars.<sup>4</sup>

DOD initially expected to spend about \$12 billion on the C-5 AMP and RERP efforts. However, both modernization efforts experienced cost and schedule problems since going into development. AMP development costs increased by approximately 20 percent and would have been higher had the Air Force not reduced requirements and deferred some development activities to other programs. Officials waived 14 operational requirements and deferred the correction of 250 deficiencies identified during testing, many of which will be addressed and funded in RERP or future efforts. In addition, the C-5 RERP experienced a Nunn-McCurdy cost breach. The program was restructured and the Air Force now plans to RERP 52 aircraft—47 C-5 B aircraft, both C-5 Cs, and 3 aircraft that had already been modified during system development and demonstration (two C-5Bs and one C-5A). While the Air Force is expected to spend \$3.4 billion (then-year dollars) less under the restructured RERP program, ultimately, less than one-half of the aircraft will be modernized and at a much higher unit cost than originally estimated—\$160.5 million for both modifications

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<sup>3</sup> Other modifications include replacing Aft crown skins, the on-board monitoring system, and floor panels and troop compartments impacted by corrosion; installing the Large Aircraft Infrared Countermeasures System and other defensive systems; and updating trainer configurations.

<sup>4</sup> According to DOD, throughput is defined as the amount of work that can be performed or the amount of output that can be produced by a system or component in a given period of time. For airlifters, it refers to the amount of freight or passengers that can be carried by an aircraft during a specified time period.

versus \$96.1 million originally estimated in then-year dollars. DOD now expects that the C-5 AMP modification of 112 aircraft and the C-5 RERP modification of 52 aircraft will reduce total ownership costs over the life cycle through 2040 by about \$8.9 billion base year 2000 dollars.

According to program officials, as of July 2009, 55 of the C-5s have received the AMP modification. The last B model received the modification in August 2009. All focus is now on the A models. Many of the deficiencies found during testing have been corrected. Other deficiencies and waivers will be addressed in the RERP program or a planned block upgrade that is slated to begin in fiscal year 2010. According to program officials, only 3 C-5 aircraft used during systems development and demonstration have received the RERP modification thus far. The first production aircraft will enter modification in August 2009. The Air Force has received low rate initial production approval for the first 3 lots, totaling 9 aircraft. The full rate production decision is scheduled for December 2010.

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## GAO Observations

It is unclear whether the Air Force is going to adequately fund the restructured C-5 RERP program because the fiscal year 2010 budget does not include funding details for the program through 2015. Further, program officials could only comment on the fiscal year 2010 budget. On the basis of the fiscal year 2009 budget however, DOD's Cost Analysis Improvement Group concluded that the restructured C-5 RERP program was underfunded by about \$294 million then-year dollars across the Future Years Defense Plan for fiscal years 2009 through 2013. Approximately \$250 million then-year dollars less is needed in fiscal years 2009 through 2011, and \$544 million then-year dollars more is needed in fiscal years 2012 and 2013. DOD officials stated that if the budget is not sufficient to meet agreed-upon quantities, then anticipated price breaks would not occur, resulting in increased cost to the program and government.

In June 2009, the Air Force was granted authority by Congress to begin retiring C-5A aircraft.<sup>5</sup> Air Mobility Command officials told us that fiscal and personnel demands require that the command limit overall fleet size once warfighting risk is reduced to a reasonable level. Therefore, the Air Mobility Command will consider retiring C-5s, as the law and requirements

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<sup>5</sup> Supplemental Appropriations Act, 2009, Pub. L. No. 111-32, § 311 (2009).

**Appendix I: A Summary of Strategic and Tactical Airlift Systems—Ongoing and Future Efforts**

allow, on a one-for-one basis after 205 C-17s have been procured, to ensure the right combination of aircraft and capability is balanced against cost and risk. According to program officials, operational testing for an A model will take place between October 2009 and January 2010. The final report will be issued in July 2010. A decision on whether and when to retire C-5s will not likely be made until after the Mobility Capabilities and Requirements Study 2016 has been completed.

If DOD decides to retire C-5A aircraft, it may not need to provide the AMP modification to all of its C-5 fleet. The Air Force plans to have 40 of the 60 C-5A AMP modification kits on contract by the end of 2009 and at least 8 C-5A models will have actually received the modification by that time.

**Table 6: C-5 Funding**

Then-year dollars in millions						
<b>FY 2009 budget</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
<b>C-5 AMP</b>						
RDT&E	\$10.2	\$4.2	\$3.9	\$0	\$0	\$0
Modification	\$84.4	\$94.9	\$79.9	\$75.3	\$77.5	\$75.3
<b>Total C-5 AMP</b>	<b>\$94.6</b>	<b>\$99.1</b>	<b>\$83.8</b>	<b>\$75.3</b>	<b>\$77.5</b>	<b>\$75.3</b>
<b>C-5 RERP</b>						
RDT&E	\$163.8	\$122.9	\$71.7	\$35.6	\$15.6	\$0
Modification	\$148	\$280.1	\$502.3	\$891.4	\$1,154.6	\$1,242.7
<b>Total C-5 RERP</b>	<b>\$311.8</b>	<b>\$403</b>	<b>\$574</b>	<b>\$927</b>	<b>\$1,170.2</b>	<b>\$1,242.7</b>
Other programs	\$60.5	\$126	\$101.9	\$6.2	\$6.4	\$6.5
<b>Total</b>	<b>\$466.8</b>	<b>\$628.1</b>	<b>\$759.7</b>	<b>\$1,008.5</b>	<b>\$1,254.1</b>	<b>\$1,324.5</b>

Source: For fiscal years 2008-2010, DOD's Fiscal Year 2010 President's Budget; for fiscal years 2011-2013, DOD's Fiscal Year 2009 President's Budget for AMP and Other programs and the June 2008 Selected Acquisition Report for RERP. Numbers may not add due to rounding.

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## C-17 Globemaster

**Figure 4: C-17 Globemaster**



Source: C-17 Program Office.

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## Mission

The C-17 is a multi-engine, turboprop, wide-body aircraft that improves the overall capability of the United States Air Force to rapidly project, reinforce, and sustain combat forces worldwide. It is used by DOD for both strategic and tactical missions. For example, the C-17 is capable of rapid strategic delivery of troops and all types of cargo to main operating bases or directly to forward bases in the deployment area. The aircraft can perform tactical airlift and airdrop missions and can also transport ambulatory patients during aeromedical evacuations when required. The inherent flexibility and performance of the C-17 force improve the ability of the total airlift system to fulfill the worldwide air mobility requirements of the United States.

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## Program Status

The Air Force originally planned to procure 120 C-17s, with the last one being delivered in November 2004. The Air Force's current plans are to acquire a total of 213 C-17s for \$68 billion, with the last one being delivered in March 2011. The Air Force has taken delivery of 190 aircraft through July 2009. This includes one aircraft that is dedicated to provide airlift capability to a consortium of European nations, effectively setting the Air Force's operational force at 212.

The Air Force has a number of ongoing improvement efforts for the C-17, including

- improving C-17 airdrop system operations,
- integrating an advanced situational awareness and countermeasures system,

- 
- upgrading mission planning by integrating a new joint precision airdrop system,
  - replacing the core integrated computer processor, and
  - providing advanced defensive capability.

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## GAO Observations

In recent years, the two prominent issues surrounding the C-17 program have been determining how many C-17s are needed to meet strategic airlift requirements as well as determining when to begin shutting down the C-17 production line. Following a C-5 RERP restructuring in 2008, the U.S. Transportation Command identified a need for 205 C-17s, 25 more than were authorized at the time the 2005 Mobility Capabilities Study was completed. Subsequent to the study, Congress provided additional funding that the Air Force used to procure 10 more C-17s in 2007, 15 more in 2008, and 8 more in 2009, bringing the total that will now be procured to 213. According to Air Mobility Command officials, the command will consider retiring C-5s, as the law and requirements allow, on a one-for-one basis after 205 C-17s have been procured, to ensure the right combination of aircraft and capability is balanced against cost and risk.

According to program officials, a decision when to shut down the C-17 production line along with the associated costs has not been finalized. In our November 2008 report we reported that plans called for the C-17 production line to shut down in September 2010.<sup>6</sup> This was based on the Air Force acquiring 205 aircraft. Now that the Air Force will be acquiring 213 aircraft, the last delivery is now expected to be in March 2011. We also reported that the total cost to shut down the line has not been determined. The Air Force estimated the costs to shut down production to be \$465 million whereas Boeing (the prime contractor) estimated \$1 billion. Officials reported that while the Air Force and Boeing continue to negotiate the final cost to shut down the C-17 production line, the Air Force did include \$91 million in its fiscal year 2010 President's budget submission to begin these activities.

According to a DOD official, the C-17s are currently being employed to fill a capability gap existing in the department's ability to airlift medium-weight vehicles within a theater of operations using dedicated tactical airlifters. DOD officials do not consider the C-17 to be a viable long-term

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<sup>6</sup> GAO, *Defense Acquisitions: Timely and Accurate Estimates of Costs and Requirements Are Needed to Define Optimal Future Strategic Airlift Mix*, [GAO-09-50](#) (Washington, D.C.: Nov. 21, 2008).

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solution as it cannot access short, austere, or unimproved landing areas in close proximity to combat operations. The JFTL is expected to provide this long-term solution; however, the JFTL is not expected to be available until 2024.

**Table 7: C-17 Funding**

Then-year dollars in millions

<b>FY 2009 budget</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
RDT&E	\$166.2	\$235.4	\$161.9	\$206.5	\$222.6	\$223.2
Procurement	\$244	\$317.9	\$88.5	\$214.1	\$216.1	\$196.3
Modifications	\$194.8	\$315.4	\$469.7	\$469.4	\$415.8	\$628
Supplemental	\$3,387.9	\$2,187.2	\$132.3	\$0	\$0	\$0
<b>Total</b>	<b>\$3,992.9</b>	<b>\$3,055.9</b>	<b>\$852.4</b>	<b>\$890.0</b>	<b>\$854.5</b>	<b>\$1,047.5</b>

Source: For fiscal years 2008-2010, DOD's Fiscal Year 2010 President's Budget; fiscal years 2011-2013, DOD's Fiscal Year 2009 President's Budget.

**Tactical Airlifters**

As of April 2009, DOD’s tactical airlift fleet consisted of 92 C-130E aircraft, 268 C-130Hs, 53 C-130Js, and 2 C-27Js—a total of 415 aircraft. DOD plans to retire its aging C-130E fleet by the end of fiscal year 2014, and according to its Air Mobility Master Plan, looks to meet its tactical airlift needs with a mix of approximately 406 C-130H and C-130J airlifters through the end of the next decade. The Army and Air Force are working on concepts for the Joint Future Theater Lift (JFTL)—an eventual replacement for the C-130H that is projected to be capable of carrying most of the Army’s large vehicles into forward operating locations, which C-130s currently cannot do. Additionally, the Joint Requirements Oversight Council has validated the Army’s time-sensitive, mission-critical resupply requirements that provide the basis for the Joint Cargo Aircraft program to procure 38 C-27Js. These missions are comprised of relatively small payloads that are needed in forward locations within tight time frames. Table 8 compares the capabilities of the C-130H, C-130J-30, and C-27J airlifters.

**Table 8: Comparison of C-130H, C-130J-30, and C-27J Capabilities and Characteristics**

	<b>C-130H</b>	<b>C-130J-30</b>	<b>C-27J</b>
Loads	42,000 pounds 6 pallets, or 92 combat troops	44,000 pounds 8 pallets, or 128 combat troops	14,190 pounds 3 pallets, or 46 combat troops
Wingspan	133 feet	133 feet	94 feet
Length	98 feet	113 feet	75 feet
Maximum take-off weight	155,000 pounds	164,000 pounds	67,241 pounds
Range <sup>a</sup>	1,720 miles	2,780 miles	2,645 miles
Average speed	345 mph	368 mph	288 mph
Minimum runway length	3000 ft.	3,000 ft.	2,000 ft.
Crew	5	3	3
Mission capable rate (2008)	74	80 <sup>b</sup>	Not available <sup>c</sup>
Cost per flying hour (2008)	\$7,500	\$5,000 <sup>b</sup>	\$3,871 <sup>c</sup>

Source: GAO analysis and DOD data.

Notes: All values are rounded to the nearest whole number. Cost per flying hour includes fuel costs. The C-130J-30 has an additional 15 feet of fuselage length compared to the base C-130J. Most combat delivery aircraft the Air Force is procuring will be this extended model.

<sup>a</sup> Range is based on a 35,000 pound payload for the C-130H and C-130J-30 and a 13,000 pound payload for the C-27J, based on contractor data.

<sup>b</sup> Figure includes rates/costs for C-130J fleet, which includes both base C-130J as well as C-130J-30 models.

<sup>c</sup> Only 2 C-27J aircraft have been delivered thus far and are being used for training and developmental testing. Average cost per flying hour is the 2008 estimate.

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## C-130 Hercules

**Figure 5: C-130 Hercules**



Source: C-130J Program Office.

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## Mission

The C-130 is the principal combat delivery aircraft for the U.S. military and is employed primarily as a tactical airlift aircraft for the transport of cargo and personnel within a theater of operation. C-130s also have the capability to augment strategic airlift forces, as well as support humanitarian, peacekeeping, and disaster relief operations. The C-130J is the latest addition to DOD's fleet of C-130 aircraft, providing performance improvements over legacy aircraft in the series. Variants of the C-130J are being acquired by the Air Force, Marine Corps, Coast Guard, and several foreign militaries to perform their respective missions.

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## Program Status

The C-130E and C-130H fleets are nearly 30 years old and have serious reliability, maintainability, and supportability issues, and some are reaching the end of their service life. For example, aircraft maintainers discovered severe cracking in the center wing box on some aircraft early in fiscal year 2005. The program office recommended retiring or grounding aircraft with more than 45,000 flying hours, and restricting aircraft with more than 38,000 hours from flying with cargo or performing tactical maneuvers. In response to these recommendations, the Air Force is using some operations and maintenance funding to extend the service life of some C-130 aircraft by 3 to 5 years, including part of the C-130E fleet, which the Air Force plans to retire by the end of fiscal year 2014. In addition, the Air Force is currently funding the replacement of the center wing box on older C-130 aircraft, and plans to replace the wing structure on the remainder of the C-130H fleet in a later phase of the program. The cost of the replacement is approximately \$6.5 million per aircraft, and according to Air Force officials, the program is meeting all cost, schedule, and performance goals.



The Air Force also has several other modification efforts underway for the C-130H fleet that will address known capability shortfalls. Efforts include a Large Aircraft Infrared Countermeasures program, a Surface-to-Air Fire Look-out Capability modification, and a number of communications upgrades. The largest modernization effort is the Avionics Modernization Program (AMP) to standardize cockpit configurations and avionics, as well as provide for increased reliability, maintainability, and sustainability. Initially, the Air Force planned to upgrade all C-130E and C-130H aircraft, including special operations aircraft. However, after the program entered system development in 2001, it experienced funding instability and hardware and software integration issues. These problems, as well as an Air Force decision to retire C-130E aircraft, triggered a Nunn-McCurdy cost breach in February 2007. The program was subsequently restructured to include far fewer aircraft—221 instead of 519—and assume less developmental risk. Under the revised plan, only a portion of the C-130H fleet would receive the modification. Since that time, the program's production decision has been delayed 13 months because of documentation and software integration problems and senior leadership concerns about the program's acquisition strategy. A low rate production decision has not been scheduled as the department is considering another program restructure. Program officials further stated that a second phase of the AMP is now being considered that will modernize C-130s not included in the first phase.

DOD is in the process of procuring 168 C-130J airlifters to replace the retiring C-130E fleet. According to program officials, as of July 2009, 73 C-130J aircraft have been delivered of 117 on contract.<sup>7</sup> One program official said all C-130J aircraft currently being purchased by the Air Mobility Command are the C-130J-30 model which, compared to the base model, has an extended fuselage and is capable of carrying 2 additional cargo pallets, for a total of 8 pallets. The C-130J fleet is also receiving a number of upgrades to meet communications, navigation, and surveillance, as well as air traffic management requirements. These efforts are being funded and developed in partnership with other countries as part of the International Cooperative Block Upgrade Program.<sup>8</sup> A C-130J program official reports that aircraft availability rates continue to exceed the fleet standard and are better than rates for C-130H models.

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<sup>7</sup> The program of record includes orders for all U.S. military customers.

<sup>8</sup> Partner nations include Italy, Denmark, United Kingdom, Australia, Canada, and Norway.

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**GAO Observations**

Recently, the Secretary of Defense testified that DOD could use “uncommitted” C-130 aircraft to complement C-27Js in order to fulfill Army time-sensitive, mission-critical requirements. However, according to an Air Force official, the impact to the C-130 fleet of supplementing C-27Js in direct support missions is not clear, including how it would affect C-130 availability for other missions. The Air Force has drafted a concept of employment for direct support of Army time-sensitive, mission-critical missions that addresses a number of coordination issues between the services, but the potential impact of these missions on the C-130 fleet has not been assessed, such as fuel costs, maintenance to address potential wear on landing gear and other components, and addressing flight restrictions for runway length.

**Table 9: C-130 Funding**

Then-year dollars in millions

<b>FY 2009 budget</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
C-130 budget						
RDT&E	\$233.3	\$179.3	\$201.3	\$47.5	\$12.9	\$9.9
Modifications	\$216.9	\$434.6	\$354.5	\$471.7	\$412.7	\$429.2
Supplemental	\$140.7	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$590.9</b>	<b>\$613.9</b>	<b>\$555.8</b>	<b>\$519.2</b>	<b>\$425.6</b>	<b>\$439.1</b>
C-130J						
RDT&E	\$62.1	\$27.3	\$30.0	\$59.9	\$59.9	\$58.3
Procurement	\$681.4	\$120.7	\$393.6	\$632.9	\$637.5	\$557.8
Modifications	\$58.3	\$34.3	\$13.6	\$115.8	\$129.3	\$105.7
Supplemental	\$1,100.7	\$9	\$72	\$0	\$0	\$0
<b>Total</b>	<b>\$1,902.5</b>	<b>\$191.3</b>	<b>\$509.3</b>	<b>\$808.6</b>	<b>\$826.7</b>	<b>\$721.8</b>

Source: For fiscal years 2008-2010, DOD's Fiscal Year 2010 President's Budget and Fiscal Year 2009 Overseas Contingency Operations Supplemental; fiscal years 2011-2013, DOD's Fiscal Year 2009 President's Budget.

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## C-27J Joint Cargo Aircraft

Figure 6: C-27J Spartan



Source: L-3 Communications.

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### Mission

The C-27J Spartan is a mid-range, multifunctional aircraft. Its primary mission is to provide on-demand transport of time-sensitive, mission-critical supplies and key personnel to forward deployed Army units, including those in remote and austere locations. It can also be used for humanitarian relief and homeland security efforts. The aircraft is capable of carrying up-armored High Mobility Multipurpose Wheeled Vehicles and heavy, dense loads such as aircraft engines and ammunition.

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### Program Status

The Joint Cargo Aircraft program began in late 2005 when the Under Secretary for Acquisition, Technology and Logistics directed the Army and Air Force to merge their requirements for small intra-theater airlifters.<sup>9</sup> In June 2007 the Under Secretary of Defense for Acquisition, Technology and Logistics issued an Acquisition Decision Memorandum certifying the program with approval to proceed to low rate initial production. This memorandum set the acquisition program baseline at 78 aircraft: 54 for the Army and 24 for the Air Force. The Army primarily viewed the C-27J as on-call airlift directly tied to the tactical needs of ground commanders, sometimes referred to as transporting cargo the “last tactical mile.” The Air Force planned to use its C-27J assets to provide “general support” airlift for all users, but also views the delivery of time-sensitive, mission-critical Army cargo as its role.

The joint Army/Air Force program office selected the C-27J as the Joint Cargo Aircraft in a full and open competition and awarded a firm-fixed

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<sup>9</sup> These similar Army and Air Force efforts were designated the Future Cargo Aircraft and Light Cargo Aircraft, respectively.

price contract to L-3 Communications, Integrated Systems in June 2007. Two aircraft of a total of 13 the Army has ordered through fiscal year 2009 have been delivered and according to program officials are being used to conduct training and developmental testing. In May 2009, as part of budget deliberations, the Army and Air Force Chiefs of Staff agreed to transfer responsibility for the C-27J program to the Air Force, along with the task of fulfilling the Army's time-sensitive, mission-critical resupply mission. As part of this restructuring, program quantities were reduced by about 50 percent, from 78 to 38 aircraft. The 13 ordered aircraft, including the 2 already delivered, will be transferred to the Air Force, who will procure an additional 25 aircraft between 2010 and 2012.

C-27J aircraft are currently built in Turin, Italy. Manufacturer Alenia Aeronautica (primary sub contractor to L-3 Communications, Integrated Systems) had planned to break ground on a manufacturing facility in Jacksonville, Florida, in April 2009, but according to an Alenia Aeronautica official, this decision has been presently postponed. According to program officials, Alenia Aeronautica had planned to assemble C-27J aircraft 16 through 78 at the Jacksonville facility, in addition to those ordered by foreign customers. With DOD's decision to procure fewer aircraft, it is unclear whether Alenia will proceed with construction of the facility.

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## GAO Observations

The Air Force has offered some insight into how it will meet the Army's time-sensitive, mission-critical resupply requirement and is in the process of further developing concepts of operation and employment for the C-27J. Although the service is buying only 38 C-27J aircraft, it is investigating possibilities for fulfilling the direct support mission requirement at least in part from a common user pool fleet construct. For example, an Air Force official said C-130s are already used for some time-sensitive, mission-critical operations. The Secretary of Defense has indicated that the 38 C-27Js can be complemented by any of about 200 "uncommitted" C-130s, which he noted can access 99 percent of the landing strips that C-27Js can access.<sup>10</sup> However, it is unclear if or how such an approach will affect the number of C-130Js the service plans to buy, or the availability of C-130 aircraft to meet other requirements associated with major combat operations. The Mobility Capabilities and Requirements Study 2016 may help shed light on this issue.

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<sup>10</sup> Army officials said this statement assumed that if the C-130J could access an airfield within 50 nautical miles of the point of need, then this was sufficient, even if there were landing zones or surfaces accessible by the C-27J closer to the point of need.

There is also concern about the Air Force’s commitment to direct support of the time-sensitive, mission-critical requirement. Over the past several decades, the Air Force has retired its direct support assets, including the Vietnam-era C-7 Caribou and an earlier version of the C-27. At issue are basic roles and missions philosophies which DOD recognizes need to be updated to reflect lessons learned in ongoing combat operations. The Secretary of Defense testified in May 2009 that there needs to be a change in the Air Force’s culture with respect to how the direct support mission is accomplished. Similarly, the department’s Quadrennial Roles and Missions Review Report for January 2009 notes that the services need to standardize the airlift process by sharing aircraft employment and availability data and adjust concepts of operations to allow traditionally general support assets to be used for direct support and vice versa. However, the Quadrennial Roles and Missions Review Report also determined that the service responsibilities for intratheater airlift operations were appropriately aligned and the option that provided the most value to the joint force was to assign the C-27J to both the Air Force and the Army. An Air Force official said the service has drafted a platform-neutral concept of employment for direct support of the time-sensitive, mission-critical mission. The vision is to use the capabilities of the entire mobility airlift fleet (i.e., C-130, C-17, C-5, Operational Support Airlift) to supplement the 38 C-27Js as required in time-sensitive, mission-critical operations abroad.

While the Mobility Capabilities and Requirements Study 2016 and other studies consider tactical airlift requirements into the future, officials involved with the study have not indicated that they address the impact of potential departures from traditional roles and missions constructs—such as changing how the services will approach time-sensitive, mission-critical resupply. As such, it is not known how these changes may affect overall requirements for tactical airlifters. Moreover, there is speculation that the 2010 Quadrennial Defense Review will establish priorities based on one major combat operation, rather than two simultaneous ones. Considered together, these points raise the question of how many C-27Js DOD needs.

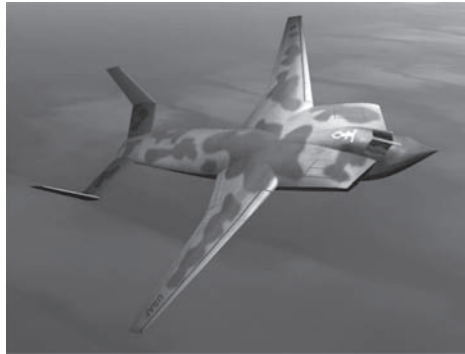
**Table 10: C-27J Funding**

Then-year dollars in millions						
<b>FY 2009 Budget</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
RDT&E	\$26.8	\$19.7	\$9.4	\$26.5	\$19.2	\$6.8
Procurement	\$156.0	\$263.4	\$319.1	\$371.3	\$576.5	\$0
<b>Total</b>	<b>\$182.8</b>	<b>\$283.1</b>	<b>\$328.4</b>	<b>\$397.8</b>	<b>\$595.7</b>	<b>\$6.8</b>

Source: For fiscal years 2008-2010, DOD’s fiscal year 2010 President’s Budget; for fiscal years 2011-2013, Air Force revised program estimates.

## Joint Future Theater Lift

Figure 7: Joint Future Theater Lift



Source: Contractor's rendering, Lockheed Martin.



Source: Contractor's rendering © 2008 Karem Aircraft/ Lockheed Martin.

## Mission

DOD plans to replace C-130H aircraft and augment the remaining C-130s with the Joint Future Theater Lift (JFTL). Currently, it is still at the conceptual stage and is not yet a formal acquisition program. The Army and Air Force have independently engaged in laboratory efforts to develop competitive technology solutions including a large tiltrotor, vertical takeoff and landing aircraft, and a versatile fixed wing, short takeoff and landing aircraft, respectively.<sup>11</sup> A draft Initial Capabilities Document notes that the JFTL must be capable of transporting current and future medium-weight armored vehicles into austere locations with unprepared landing areas. According to an Army official, another capability under investigation is the ability to operate from naval vessels (seabasing) to enhance access to remote areas and to reduce predictability. The JFTL is anticipated to have a payload capacity of 20 to 36 tons and a combat mission radius of 500 nautical miles. The Air Force Air Mobility Command expects the JFTL to be fielded sometime around 2024.

## Program Status

JFTL concept development became a joint effort in January 2008 following a decision by the Army and Air Force Chiefs of Staff to merge requirements for separate heavy lift efforts in progress at the time.<sup>12</sup> The

<sup>11</sup> The Army is partnered with the Navy, Special Operations Command, Defense Advanced Research Projects Agency, and the National Aeronautics and Space Administration. A tiltrotor aircraft, such as the V-22, is one that operates as a helicopter for takeoffs and landings and, once airborne, converts to a turboprop aircraft.

<sup>12</sup> The Army and Air Force programs were known as Joint Heavy Lift and Advanced Joint Air Combat System, respectively.

Air Force was designated as the administrative lead for the development of the Initial Capabilities Document for the JFTL, and submitted a draft into DOD's Joint Capability Integration and Development System earlier this year; however, the Army did not agree with the draft, citing critical disagreements. According to an Army program official, a recent general officer meeting between the two services appears to have resolved the Army's remaining critical comments, and the services could potentially seek approval of the Initial Capabilities Document at the Joint Requirements Oversight Council by late summer 2009. Both Army and Air Force officials stated they would like to have the Initial Capabilities Document validated and begin work on the analysis of alternatives in the summer of 2009, to provide a sufficient basis for budget deliberations in March 2010.

Disparate views on requirements are at the heart of the disagreement between the services. According to an Army official, there were foundational differences in anticipated usage of the aircraft that led to initial disagreements between the services. The land component (i.e., the Army, Marine Corps, and special operations forces) saw a critical need for an airlift capability that would enable expeditionary, mounted (i.e. forces deployed with combat vehicles) ground operations into access-challenged environments. The airlift community was pursuing a larger, longer range transport to better meet the current set of traditional airlift missions. The Army official said the two perspectives resulted in different technologies and system investigations. The land component, led by the Army, has been pursuing vertical takeoff and landing concepts that are less infrastructure-constrained, allow faster force buildup, and can more easily sustain maneuvering forces from either land or sea bases. The Air Force has been pursuing advanced lift system technology for turbofan fixed wing aircraft to improve operations on short, soft, or rough airfields while increasing cruise speed over current tactical transports. However, the Army official said development of the JFTL Initial Capabilities Document has combined these perspectives into one requirements document and served to converge the services into a more cohesive vision of future operations.

Both the Army and Air Force have continued to fund technology development efforts that support their previously separate programs. Army technology development efforts are focused on a high-efficiency tiltrotor concept that could become a candidate for the JFTL once requirements are established. According to an Army lab official, the aircraft would be nearly as aerodynamically efficient as a fixed wing aircraft and would have about the same fuel efficiency as a C-130J. While the concept is still "all on paper," the official said no new inventions are

needed—that the component technologies all have an existing lineage and could be practically implemented on an aircraft of the size anticipated (the maximum payload would be 36 tons). The Army has three contractors or contractor teams working on different tiltrotor configurations that could potentially meet the joint capability needs. A number of technology development/risk reduction efforts, including a tiltrotor test rig and a number of specialized studies, have been funded by the Army, Special Operations Command, National Aeronautics and Space Administration, Defense Advanced Research Projects Agency, and Office of Naval Research.

An Air Force official said the service’s technology development efforts are focused on a fixed wing concept that combines speed and agility to provide enhanced lift for short takeoffs. According to the Air Force official, three contractors have done work on this speed agile concept, with one—Lockheed Martin—on contract to develop a demonstrator model. The Air Force Research Laboratory has also, in partnership with Lockheed Martin, developed the Advanced Composite Cargo Aircraft, which utilizes composite materials in the fuselage and tail, and which completed a successful test flight in June 2009. An Air Force Research Lab official said this technology significantly reduces the number of parts needed, as well as tooling and touch labor needs in the manufacturing process. He said these processes and materials could potentially be used for the JFTL.

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## GAO Observations

A potential capability gap exists in the department’s ability to airlift medium-weight vehicles to access-challenged areas within a theater of operations using dedicated tactical airlifters. C-17 aircraft have been employed to transport medium weight vehicles in theater, but cannot access austere, short, or unimproved landing areas. In 2007 C-17s flew 15,436 tactical sorties, 3,102 of which—approximately 20 percent—involved carrying objects too large for a C-130 to carry. Nevertheless, DOD officials do not consider the C-17 to be a viable long-term solution given access issues noted above. JFTL is expected to provide this long-term solution.

We believe the JFTL effort presents the department an opportunity to address a critical capability gap using the evolutionary, knowledge-based approach outlined in DOD acquisition policy. However, DOD officials will need to exercise caution to avoid pitfalls we have identified in connection with developing new weapon systems, including taking a revolutionary versus an evolutionary approach for weapon system development;



overpromising performance capabilities; and understating expected costs, schedules, and risks associated with developing and producing the weapon.

Fielding the new capability may be a challenge for two reasons. First, although the services have reached agreement on operational requirements in developing the Initial Capabilities Document, the potential exists for future disagreements that could adversely affect program outcomes. The Army would like a tiltrotor aircraft that can be used in direct support of its maneuver and sustainment operations, and the Air Force favors a fixed wing aircraft to support common-user needs as well as the Army’s direct support mission. An Army official said the decision to pursue a tiltrotor or a fixed wing aircraft will be made during the analysis of alternatives, and that he expected a more cooperative relationship between the services once that is decided. However, we feel that if such a relationship does not emerge or continue throughout system development, program outcomes could be jeopardized. Our previous work has found that unstable requirements in conjunction with long development cycles can lead to considerable cost growth and schedule delays.

Second, the JFTL was intended to transport medium-weight vehicles, including Future Combat Systems vehicles; however, DOD recently cancelled the manned ground vehicle portion of the program with plans to re-launch a new vehicle modernization program incorporating lessons learned in recent operations in Iraq and Afghanistan. We believe the design of the new vehicles, including size and weight, could be an important factor in determining the type of aircraft best suited for the JFTL mission, primarily because the Army’s tiltrotor concept already envisions a rotorcraft much larger than any ever produced. However it could be several years before the Army has a good understanding of the size and weight of the new vehicles.

**Table 11: JFTL-Related RDT&E Funding**

Then-year dollars in millions						
Fiscal year	2008	2009	2010	2011	2012	2013
Air Force	\$38.5	\$22.6	\$26.0	\$49.0	\$44.0	\$40.2
Army	\$22.5	\$24.5	n/a	n/a	n/a	n/a
<b>Total</b>	<b>\$61.0</b>	<b>\$47.1</b>				

Source: For the Air Force, figures for fiscal years 2008 and 2009 represent funding that has been obligated on contract; figures for fiscal years 2010 through 2013 represent burdened dollars—funds that include personnel and other programmatic elements—as projected in the fiscal year 2009 President’s Budget request. For the Army, funds are a combination of Army, Special Operations Command, Defense Advanced Research Projects Agency, Navy, and National Aeronautics and Space Administration funding applied directly to Joint Heavy Lift activities.

# Appendix II: Comments from the Department of Defense



ACQUISITION,  
TECHNOLOGY  
AND LOGISTICS

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NOV -3 2009

Mr. Michael J. Sullivan  
Director, Acquisition and Sourcing Management  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, DC 20548

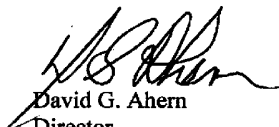
Dear Mr. Sullivan:

This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-10-67, "DEFENSE ACQUISITIONS: Strategic Airlift Gap Has Been Addressed, but Tactical Airlift Plans Are Evolving as Key Issues Have Not Been Resolved," dated September 9, 2009 (GAO Code 120800). DoD's responses to the report's recommendations are enclosed.

The Department partially concurs with all five recommendations. In general, the Department is already taking actions outlined in the report and does not believe additional directives from the Secretary are required at this time. A list of technical comments is also provided separately to ensure report accuracy.

The Department's goal remains to provide the Warfighter with the most capable and cost-effective strategic and tactical airlift fleets to meet our global requirements.

Sincerely,

  
David G. Ahern  
Director  
Portfolio Systems Acquisition

Enclosure:  
As stated

GAO DRAFT REPORT DATED SEPTEMBER 9, 2009  
GAO-10-67 (GAO CODE 120800)

“DEFENSE ACQUISITIONS: STRATEGIC AIRLIFT GAP HAS  
BEEN ADDRESSED, BUT TACTICAL AIRLIFT PLANS ARE  
EVOLVING AS KEY ISSUES HAVE NOT BEEN RESOLVED”

DEPARTMENT OF DEFENSE COMMENTS  
TO THE GAO RECOMMENDATIONS

**RECOMMENDATION 1:** The GAO recommends that the Secretary of Defense direct the portfolio management team to provide more comprehensive advice to senior leaders on the full range of airlift investment decisions, including new program starts, modernization efforts, and retirement decisions. This would also include identifying alternatives for using existing common user aircraft to meet service-specific missions and considering new roles and missions for the Air Force. (p. 20/GAO Draft Report)

**DOD RESPONSE:** PARTIALLY CONCUR. The Department has structured processes in place for assessing mobility capabilities and requirements that include strategic and tactical airlift decisions. AT&L, CAPE, USTRANSCOM and other DoD Components participate in these decisions.

**RECOMMENDATION 2:** The GAO recommends that the Secretary of Defense direct the Office of the Secretary of Defense (Cost Assessment and Program Evaluation) and Commander, U.S. Transportation Command to develop a strategic airlift plan that would identify when C-5s will be retired and identify the total number of additional C-17s that would be needed to replace C-5s or perform tactical heavy lift missions until the time the Joint Future Theater Lift (JFTL) is fielded. (p. 20/GAO Draft Report)

**DOD RESPONSE:** PARTIALLY CONCUR. The Department agrees on the need to develop a strategic airlift plan with the details as listed in the recommendation. Accordingly, the Secretary of the Air Force, in coordination with OSD CAPE and USTRANSCOM, has already developed a strategic airlift plan that identifies the retirement of C-5 aircraft based on congressional funding of additional C-17s not requested by the Department and preliminary findings from the Mobility Capability Requirements Study – 2016 and the Quadrennial Defense Review. The Department remains confident that it has procured adequate C-17s to cover all necessary missions to satisfy requirements of the National Defense Strategy. Recapitalization of the C-5 fleet is decades away. Prior to determining the C-5’s replacement, the Department will conduct a comprehensive Analysis of Alternatives to fully assess viable options.

**RECOMMENDATION 3:** The GAO recommends that the Secretary of Defense direct the Commander, Air Mobility Command, determine the appropriate mix of C-27Js and

Attachment  
Page 1 of 2

C-130s that are needed to meet Army time-sensitive, mission-critical requirements and common user pool requirements. (p. 20/GAO Draft Report)

DOD RESPONSE: PARTIALLY CONCUR. The Department agrees on the need to determine the appropriate mix of C-27Js and C-130s. Accordingly, the Secretary of Defense has already tasked the Air Force and the Army to determine the appropriate mix of C-27Js and C-130s that are needed to meet Army time-sensitive, mission-critical requirements and common user pool requirements, thus fulfilling the requirement of this recommendation.

RECOMMENDATION 4: The GAO recommends that the Secretary of Defense direct the Air Force and Army reach agreement on plans detailing how Army time-sensitive, mission-critical requirements will be addressed and prioritized against other Air Force priorities. (p. 21/GAO Draft Report)

DOD RESPONSE: PARTIALLY CONCUR. The Secretary of Defense has already tasked the Air Force and the Army to develop plans detailing how Army time-sensitive, mission-critical requirements will be addressed and prioritized against other Air Force priorities, thus fulfilling the requirement of this recommendation. An agreement was reached in the plan for USAF Direct Support of US Army Time Sensitive/Mission Critical Concept of Employment, approved and signed by Army and Air Force Vice Chiefs of Staff effective 13 Sep 09

RECOMMENDATION 5: The GAO recommends that the Secretary of Defense direct the joint Air Force and Army program office develop a plan to follow an evolutionary approach for developing the JTFL based on DoD acquisition policy that includes selected mature technologies, normally developing increments in less than 5 years, and fully funding each increment. (p. 21/GAO Draft Report)

DOD RESPONSE: PARTIALLY CONCUR. The AF and Army are currently engaged in approving a JFTL Initial Capabilities Document and commencing with a formal JCIDS Analysis of Alternatives (AOA) to consider all viable options for addressing capability gaps, thus fulfilling the requirement of this recommendation.

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[GAO-09-663T](#). Washington, D.C.: April 30, 2009.

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[GAO-09-326SP](#). Washington, D.C.: March 30, 2009.

*Defense Acquisitions: Timely and Accurate Estimates of Costs and Requirements Are Needed to Define Optimal Future Strategic Airlift Mix.* [GAO-09-50](#). Washington, D.C.: November 21, 2008.

*Defense Transportation: DOD Should Ensure that the Final Size and Mix of Airlift Force Study Plan Includes Sufficient Detail to Meet the Terms of the Law and Inform Decision Makers.* [GAO-08-704R](#). Washington, D.C.: April 28, 2008.

*Best Practices: An Integrated Portfolio Management Approach to Weapon System Investments Could Improve DOD's Acquisition Outcomes.*  
[GAO-07-388](#). Washington, D.C.: March 30, 2007.

*Defense Transportation: Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study and Report.* [GAO-06-938](#). Washington, D.C.: September 20, 2006.

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