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**STATEMENT OF**

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**BEFORE THE**

**SENATE HOMELAND SECURITY AND GOVERNMENT AFFAIRS COMMITTEE**
**SUBCOMMITTEE ON FEDERAL FINANCIAL MANAGEMENT, GOVERNMENT INFORMATION, FEDERAL SERVICES, AND INTERNATIONAL SECURITY**

**HEARING ON**
**COST EFFECTIVE AIRLIFT**

**SEPTEMBER 27, 2007**
**342 Dirksen SENATE OFFICE BUILDING**

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Mr. Chairman, distinguished members of the subcommittee, thank you for inviting me to speak with you today about cost effective airlift . As requested, I will address the issues pertaining to C-5 modernization and C-17 procurement and the pros and cons of pursuing each program.

As the C-17 production line wanes, pressure is building to procure more aircraft. In effect, this brings C-17 funding in direct competition with C-5 modernization. The main point I'd like to make today is that there are strong arguments for both programs and viewing them from an "either/or" perspective may not be necessary or constructive.

Broader trade-offs exist within the long-range airlift mission area. If, for example, the Air Force replaces its KC-135 aerial refueling aircraft with one that carried more cargo, fewer C-5s or C-17s might be acceptable. Because the C-17 can perform both long- and short-range airlift, it competes to some degree with the C-130 for funding and mission. Thus, decisions on C-130 recapitalization effect long-range airlift. Preferably, these airlift and aerial refueling programs can be developed, planned, funded, and executed in a joint, interdependent way.

Decisions on military airlift are also strongly influenced by the capabilities of very dissimilar programs such as fast sea lift ships, propositioned equipment, and employment of the Civil Reserve Air Fleet (CRAF). These programs are undergoing changes. Have the linkages to the C-5 and C-17 programs been considered?

From a strictly budgetary perspective, the C-5 and C-17 programs can be linked to, and traded against an even broader menu of programs. While many think only of budgetary trade-offs within a given account (e.g. airlift aircraft, infantry vehicles, surface ships), other, lower-priority programs outside the Air Force's airlift account could potentially be reduced if required to support C-5 vs C-17 funding decisions. Thus, it appears to be artificial, and to some perhaps even imprudent to make "live-or-die" decisions on the C-5 and C-17 programs as if they existed in a vacuum.

With that as an introduction, I'd like to spend the majority of my statement addressing whether DoD's plans to maintain and modernize its long-range heavy lift airlift fleet will meet the national military strategy, and if so, whether they will do so cost-effectively. Key discussion points include requirements, costs, budgeting, and capability, and risk.

**Airlift Requirements to Meet the National Military Strategy**

The number of C-17s that should be procured and the number of C-5s to be modernized are related to the overall airlift requirement, which is typically measured in millions of ton-miles per day (MTM/D). In March 2001, the Air Force announced the findings of its Mobility Requirements Study 05 (MRS-05). MRS-05's principal finding was that the goal set by the previous mobility study for an airlift fleet capable of moving 49.7 MTM/D of personnel and cargo was inadequate to meet the national military strategy. MRS-05 recommended an airlift fleet capable of 54.5 MTM/D. At that time, DOD's strategic airlift capability was approximately 44.7 MTM/D, nearly 10 MTM/D short of the MRS-05 goal.

The terrorist attacks of September 11, 2001, and the subsequent operation in Afghanistan led many to believe that the findings of the MRS-05 were outdated. Significant changes in the National Military Strategy were required, and a different strategy would likely

require different airlift capabilities. In June 2004 DOD began its first "post 9/11" review of transportation requirements. This Mobility Capabilities Study (MCS), once scheduled for completion in March 2005, was completed and briefed to Congress in February 2006.

Unlike past mobility studies, the MCS did not provide an estimate of airlift requirements in MTM/D. The MCS identified a need for between 292 and 383 strategic airlift aircraft which put the Air Force's program of record at the time of 292 aircraft (180 C-17s and 112 C-5s with engine and avionics upgrades) at the bottom of the range of aircraft necessary to meet National Military Strategy requirements with acceptable risk.[1] Subsequently, the 2006 Quadrennial Defense Review stated DoD's goal of maintaining 292 strategic airlift aircraft.[2] The terms "moderate" and "acceptable" are subjective, and subject to interpretation. A close examination of this classified study, and the acknowledgment that the projected force now includes 190 C-17s, could lead some to view the risk as "low."

The MCS caught many observers by surprise, who expected the study to project a growth in airlift needs, perhaps a requirement closer to 60 MTM/D than the 2000 estimate of 54.5 MTM/D.[3] Others speculated, however, that the MCS would not increase the 54.5 MTM/D requirement, because planners know that DoD cannot afford to purchase enough aircraft to provide this amount of airlift.[4] An "acceptable" risk does not argue for more aircraft as strongly as "high" or "unacceptable" risk. Those who hold this perspective imply that the MCS is not an unbiased study of requirements, but a compromise between what is needed and what can be achieved.

Many have criticized the MCS. In a September 14, 2005, letter to Defense Secretary Rumsfeld, for example, the GAO documented a number of shortcomings in the MCS' methodology.[5] Others criticized the study for not assessing intra-theater lift needs, and for focusing on "near term" capabilities rather than taking a longer view.[6] Some have called on DoD or an independent agency to conduct another mobility study to rectify the MCS' perceived shortcomings. DoD appears to be responding to these criticisms by executing a follow-on, "MCS-2006 study."[7]

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[1] "KC-X: The Next Mobility Platform, the Need for A Flexible Tanker." (White Paper). U.S. Air Force. Headquarters, Air Mobility Command. P.4.

[2] *Quadrennial Defense Review Report.* February 6, 2006. On-line at http://www.defenselink.mil/pubs/pdfs/QDR20060203.pdf

[3] Marc Selinger, "DoD Launching New Review of Transportation Needs," *Aerospace Daily,* Mar. 11, 2004.

[4] John Tirpak. "Air Mobility in the Doldrums." *Air Force Magazine.* August 2005.

[5] *Defense Transportation: Opportunities Exist to Enhance the Credibility of the Current and Future Mobility Capabilities Studies*. Government Accountability Office. September 14, 2005. William M. Solis, Director Defense Capabilities and Management.

[6] John T. Bennett. "Influential DoD Mobility Study's Focus on Intratheater Needs Questioned." *Inside the Air Force.* April 7, 2006.

[7] *Defense Transportation: Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study and Report.* Government Accountability Office. (GAO-06-938) September 2006. p.1.

How significant is a potential shortfall in airlift? Does it jeopardize current and future force projection capabilities? The actual U.S. airlift capabilities have met the stated MTM/D requirement only twice in the past 19 years.[8] During this time, the United States has successfully conducted military operations in Afghanistan, Southwest Asia, Bosnia and Kosovo. It can thus be argued that the airlift requirement set by MRS-05 and other studies is greater than is really needed, and less airlift is acceptable. A counter-argument is that airlift requirements are designed to satisfy a worst case scenario: executing two "near simultaneous" major combat operations. Adherents to this perspective say the 54.5 MTM/D requirement is justified, and the United States has been fortunate over the last 19 years not to have faced the worst-case scenario.

It may be difficult for Congress to evaluate DoD's airlift recapitalization plans because objective answers in MRS-05 and the MCS are either dated, unclear, or classified. Questions include: How much outsize/oversize airlift capacity is required, now that major state-on-state conventional warfare appears less likely than it did in the past (but for which DoD must still plan)? How many aircraft are required now that irregular warfare – which can occur less predictably, and frequently in theaters with limited infrastructure – appears more likely?

In attempt to provide Congress with greater clarity into airlift requirements, P.L. 109-364 Sec. 1034 required DoD to submit a report to Congress no later than February 1, 2007 defining airlift requirements in terms of million ton miles per day. In response to this requirement, DoD delivered a classified report to the congressional defense committees on February 27, 2007.

**Costs**

Although the metrics needed to objectively evaluate the number of C-17s or C-5s required are not clear, it is clear that C-17 procurement and C-5 modernization are directly competing for the same budget authority. In recent months, for example, senior Air Force officials have proposed purchasing 30 additional C-17s instead of modernizing 29 C-5As. It is argued that the life-cycle cost of these 30 additional C-17s would be offset by the life cycle cost savings accrued by not re-engining the C-5A fleet.

Many believe that at issue in this year's budget is how many C-17s to purchase and how many C-5As to modernize. As it did last year, the Air Force is proposing not to procure any C-17s in FY08; although two C-17s are on the Air Force's Unfunded Priority List (UPL). Boeing representatives say that depending on their success in negotiating near-term international sales of the C-17, it will require funding for between 14 and 18 Globemasters in FY08 or the production line will begin to shut down in January or February 2008 toward a complete shutdown in mid-2009.[9] The Air Force's stated plan is to modernize both C-5A and C-5B fleets with the Avionics Modernization Program (AMP), and Reliability Enhancement and Re-Engining Program (RERP). There has been speculation that as budgets become tighter, the Air Force may opt not to RERP the C-5A fleet. Recent press reports

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[8] Presentation by Brig. Gen. Robert Bishop to congressional staff, *Airlift Portion of MRS-05*, Mar. 28, 2001.

[9] Telephone conversation between CRS and Boeing officials. February 26, 2007. "Boeing Announces C-17 Line May End in mid-2009; Stops Procurement of Long-lead Parts." *News Release.* Boeing Integrated Defense Systems. March 2, 2007.

about RERP cost increases have added to this speculation.[10] The table below outlines some of the relevant cost and procurement information.

| Table 1: C-5 Modernization Vs C-17 Procurement | | |
|---|---|---|
| | **Modernize C-5 Fleet** | **Buy More C-17s** |
| Average Procurement Unit Cost[11] | $97 Million* | $280 Million |
| Est. Flying Hour Cost[12] | $23,075** | $11,330 |
| Production Rate | ~12 aircraft/ year | ~15 aircraft/year |
| Aircraft Life Remaining | 26,000 hours | 30,000 hours |
| Notes<br>* These costs have and will likely fluctuate over time. The procurement cost of future C-17s will likely be lower than the average, as learning increases and fixed costs are amortized over a longer production run.<br>**Aircraft Reimbursable Rates (per Flying Hour) reflect amortization of modernization programs, but not procurement costs. Because the C-5 AMP and RERP modernization programs are in their early phases, these costs strongly affect the hourly cost to operate the C-5. The C-17 is not implementing a modernization plans on the scale of AMP and RERP. | | |

Making an "apples-to-apples" comparison of C-5 and C-17 costs is complicated. The scope-time considered (e.g. Fly-away cost, procurement cost, life-cycle cost), rate of production assumed, and procurement method used (e.g. multi-year procurement, annual procurement, supplemental procurement) all effect cost estimates and comparisons. For example, it is estimated that the 10 C-17s procured via congressional ear marks cost approximately $20 million more per aircraft than C-17s procured via multi-year procurement contracts.[13] Some may question whether it is appropriate to compare these costs to those incurred by procurements included in annual Air Force budgets.

The Air Force decision to modernize all of its C-5 aircraft was informed by a March 2000 study by the Institute for Defense Analyses (IDA) on the cost and reliability implications of various C-17 and C-5 procurement options. IDA noted that earlier studies indicated that

> Upgrading the C-5 may be cost-effective if the C-5 is to be retained in the fleet long enough, the larger question of whether money spent for improving strategic airlift should be directed toward C-5 improvements or toward some other improvements, such as

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[10] See, for example, Carlo Munoz. "Air Force Mulling Future of Dueling C-5 Modernization Programs." *Inside the Air Force.* December 16, 2006. Amy Butler. "C-5 Reengining Cost Could Alter Program Course." *Aviation Week & Space Technology.* February 19, 2007.

[11] *Selected Acquisition Report (SAR)* Department of Defense OUSD(AT&L). Defense Acquisition Management Information Retrieval (DAMIR). C-17A, C-5AMP, C-5RERP.

[12] *Aircraft Reimbursement Rates (per Flying Hour) FY2007.* Air Force Cost Analysis Agency, Cost Factors Branch. Table A15-1.

[13] Conversation between SAF/AQQ and CRS. September 21, 2007.

adding more C-17s, or even some of both, is an issue.[14]

The IDA study examined nine different alternatives to modernizing the C-5 and C-17 fleets. It measured cost effectiveness in terms of the estimated life-cycle cost (LCC) for each alternative, and found that "...the least costly option is Alternative 6, a full upgrade to the C-5 fleet with no additional C-17s," and that "...the $5 billion required for the upgrades in Alt 6 more than pays for itself in reduced operating costs over the 40-year period examined."[15] The findings of the IDA study are summarized in the table below.

**Table 2: Life-Cycle Cost (LCC) Estimates of Potential Alternatives to Modernizing the Strategic Airlift Fleet**[i]

| Alternative | MTM/D | C-5A upgrade | C-5B upgrade | # + C-17 | LCC Constant $B | LCC Discounted $B | LCC Then-year $B |
|---|---|---|---|---|---|---|---|
| 1 | 24.9 | - | - | 0 | 60.5 | 32.9 | 98.5 |
| 2 | 27.1 | - | - | 20 | 72.4 | 40.8 | 115.5 |
| 3 | 30.1 | - | - | 45 | 87.3 | 50.4 | 137.0 |
| 4 | 27.8 | - | Full | 20 | 70.2 | 40.4 | 110.6 |
| 5 | 30.7 | - | Full | 45 | 85.1 | 50.0 | 132.1 |
| 6 | 27.2 | Full | Full | 0 | 56.7 | 32.5 | 89.5 |
| 7 | 32.3 | Full | Full | 45 | 83.5 | 50.0 | 127.9 |
| 8 | 27.7 | - | Full | 75 | 80.2 | 49.0 | 120.9 |
| 9 | 27.9 | - | - | 132 | 88.3 | 55.4 | 129.3 |

Source: *Analysis of Alternatives for Out- and Over-Size Strategic Airlift: Reliability and Cost Analyses*. Institute for Defense Analyses. IDA Paper P-3500. March 2000. Tables 2 and 3 combined by CRS.

[1] All cost estimates expressed in $FY2000. Constant dollars allow comparisons over different time periods without inflation. Discounted dollars are adjusted to account for the year in which funds are expended. OMB discount factor of 2.9% per year used. Then-year dollars represent the estimated actual outlay of funds through 2040, including inflation.

IDA found that the LCC for a re-engined C-5 fleet is lower than one without re-engining and that the less costly re-engined C-5 fleet also has a higher MTM/D capacity. Air Force officials have recently argued for early retirement of some C-5As and perhaps C-5Bs. Based on IDA's findings, some would argue that it is prudent to many to maintain more C-5s in the inventory and to procure fewer new C-17s.

Air Force officials now expect the C-5 RERP program to cost as much as $60 million

[14] *Analysis of Alternatives for Out- and Over-Size Strategic Airlift: Reliability and Cost Analyses*. Institute for Defense Analyses. IDA Paper P-3500. March 2000.p.2.

[15] *Ibid.* p.11.

per aircraft more than previously projected.[16] These reports appear to be somewhat at odds with official cost reports from the DoD comptroller. The December 2006 Select Acquisition Report (SAR) for the C-5 RERP showed average procurement cost growth of 2.9% over the current acquisition program baseline (APB) and 16% over the original APB. This rate of cost growth is significantly lower than 15% and 30% cost growth, respectively, that is required to trigger a Nunn-McCurdy breech notification.

The SAR notes that many of the factors that contributed to RERP current cost growth appear to be one-time management problems that will not affect future program costs.[17] Further, Lockheed Martin argues that current projections of RERP cost growth are driven in large part, by an Air Force decision to slow down RERP production and to extend it by two years. Because of slower production rates, for example, RERP propulsion system costs could increase, from $6.1 million per engine to $6.9 million. (The relationship between production rate and projected cost will be addressed in greater detail in the following section).

Noteworthy disagreement exists between the Air Force and Lockheed Martin on the potential future cost growth in the RERP program. In "then-year" dollars, the Air Force believes that the total RERP program will cost $16.1 billion. This figure compares very unfavorably to Lockheed Martin's projection of $11.6 billion and the most recent SAR's estimate of $11.3 billion for the entire RERP program. Lockheed Martin argues that if its cost estimates are proven correct that the RERP program will grow at rates below the Nunn-McCurdy threshold notification requirement and that the RERP program will fit within current long-term budgets.[18] The Air Force disagrees on both points.

The most significant difference between the Air Force and Lockheed Martin estimates of future RERP costs pertains to the approximately 500 engines that are to be procured. The Air Force and Lockheed Martin also disagree on the cost of engine pylons, and the cost of installation. The number of man-hours of touch labor for each C-5 (i.e. 95,000 hours vs. 100,000 hours) and the slope of the "labor learning curve" (i.e. 85% vs. 89%) is also debated.

It appears that Air Force officials who forecast significant C-5 RERP cost growth are obliged to reconcile their estimates with the relatively modest cost growth reflected in the SAR, and address Lockheed Martin's arguments. Further, once the cost growth forecasts are reconciled with official cost growth reports, it appears essential that Air Force officials explain how this growth would effect the IDA findings. Specifically, is the estimated cost of C-5 RERP sufficient to make C-5 fleet LCC more costly than alternative fleets with fewer C-5s and more C-17s?

**Budgeting**

Some suggest that retiring some number of C-5 aircraft early could make available funds to purchase additional C-17s. However, these funds do not "line up" effectively. C-17

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[16] Caitlin Harrington, "C-5 Re-Engining Too Costly, Says USAF." *Jane's Defense Weekly*. July 18, 2007.

[17] For example, on p. 4, the SAR notes that in addition to funding and engineering challenges, the RERP program was significantly delayed by Berry Amendment and Commercial Commodity determinations.

[18] *White Paper on C-5 Reliability Enhancement and Re-Engining Program (RERP) Costs* Lockheed Martin. Corp. Undated. Emailed to CRS on April 27, 2007

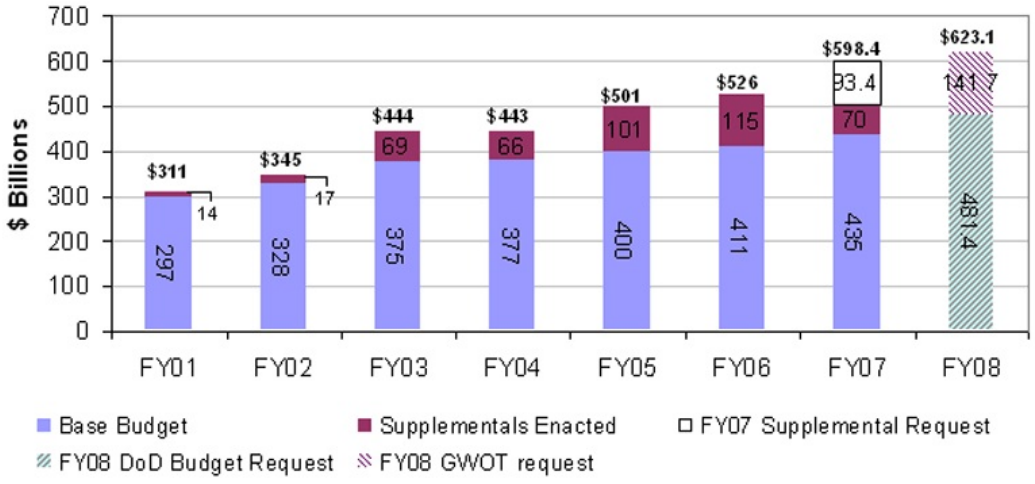
procurement funding is an FY08 issue, C-5 RERP procurement funds for FY08 are only $253 million, which is less than the cost of a single C-17. C-5 RERP funds in FY09 are $540 million, which is less than the cost of two C-17s. Significant C-5 RERP funds are not projected to be available until the end of the Future Years Defense Plan (FYDP). Therefore, if more C-17s are to be purchased in FY08, Congress and DoD will need to either find room in the Air Force's "base budget," or Congress will need to add funds to DoD's FY2008 Global War on Terror funding request. Some in the Air Force argue that because of noteworthy pressures elsewhere in the Air Force budget, additional C-17 procurement is only executable as an add to the FY08 GWOT request.[19]

As depicted in the figure below, defense appropriations exempted from budget caps (including "bridge funds" for overseas operations provided as separate titles in the regular defense appropriations bills) have grown considerably in recent years in both absolute terms and as a proportion of overall defense spending. According to some experts this growth

> ...reflects a progressive expansion of the kinds of equipment and operational support that both the Defense Department and Congress have agreed to consider as sufficiently urgent to warrant inclusion in emergency funding measures, even though the funding may not meet definitions either of the narrowly defined incremental costs of military operations, or of what constitutes an emergency by congressional standards.[20]

Decisions to add funds to DoD's FY08 GWOT request for C-17s are likely to be influenced by a wider debate on whether some of the large increase in weapons procurement requested in the FY07 supplemental goes beyond the expanded definition of war-related requirements that Congress has come to accept. Those who are opposed to expanded use of emergency supplementals, may argue that adding funds to the FY08 GWOT request is

**Fig. 1: DoD Base Budget and GWOT**




Source: *FY2008 Global War on Terror Request*. Department of Defense. February 2007. p.1.

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[19] CRS interview with SAF/FML April 27, 2007.

[20] CRS Report for Congress RL33900. *FY2007 Supplemental Appropriations for Defense, Foreign Affairs, and Other Purposes*. Updated April 24, 2007. P.15.

inappropriate because the rational for doing so is not related to the immediate conflict. Instead, the arguments proffered by the Air Force pertain to long-term savings. Those in favor of expanded use of supplemental appropriations may point to congressional action on the FY07 supplemental, where Congress provided over $2 billion more than requested.

It may be that Congress may find good reason to add C-17 funds, or C-5 RERP funds to the Air Force base budget. As the following table suggests, significant savings might be incurred by keeping the C-5 RERP on a shorter production schedule.

**Table 3: RERP Production Schedules & Cost Growth**

| | FY07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Tot $B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PB 03 | 5 | 7 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | | | | 8.7 |
| PB 06 | 1 | 3 | 5 | 7 | 9 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | | 8.9 |
| PB 08 | | 1 | 3 | 9 | 10 | 10 | 10 | 12 | 12 | 13 | 13 | 12 | 2 | | | 9.8 |
| LM | | 1 | 3 | 5 | 7 | 10 | 10 | 10 | 12 | 12 | 13 | 13 | 12 | | | 11.6 |
| AF 01/07 | | 1 | 3 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 12 | 12 | 12 | 13 | 14.9 |
| Key: PB = President's Budget, LM = Lockheed Martin, AF= U.S. Air Force | | | | | | | | | | | | | | | | |
| **Source: Lockheed Martin Aeronautics Company. September 10, 2007** | | | | | | | | | | | | | | | | |

The most efficient rate of RERP production is 12 aircraft per year. Getting to 12 aircraft per-year and sustaining this rate of production for a longer period could potentially save, for example $6 billion, when comparing the PB 03 and most recent Air Force RERP profiles.[21] The challenge in achieving this cost-saving production schedule appears to be primarily budgetary. More money is required, it is argued, in the Air Force's air mobility account during the Future Years Defense Plan (FYDP) than currently exists. This may be true, but Congress could, of course, add funds to the Air Force's air mobility budget.

This potential budget increase doesn't necessarily require a net growth in DoD's base budget or its supplemental requests, and reinforces why supporting the C-5 and C-17 programs is not an "either/or" decision. There are a number of programs in the Air Force budget that could be leveraged as a "bill payer" for a more aggressive, and less costly RERP production schedule. A number of satellite programs, for example, may not have as high a priority as cost-effective airlift, and are also significantly over-budget. Also, it has been widely noted that the F-22 multi-year procurement contract is expected to save taxpayers $410 million compared to purchasing the same number of aircraft by three single-year procurement contracts.[22] Might these savings be invested in saving even more money by

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[21] There are likely other factors beside production rate that affect the total program costs depicted in the last column of this table, making the degree of causality uncertain.

[22] Rebecca Christie. "DoD Letter To Congress Puts Lockheed Closer To F-22 Deal." *Wall Street*
(continued...)

conducting C-5 RERP at a more efficient rate?

**Capabilities**

Some argue that C-17 procurement should be increased at the C-5A's expense because of the growing need to engage terrorists and insurgents in theaters with limited aviation infrastructure. The Cold War model of using strategic cargo aircraft to move large amounts of materiel to forward U.S. bases, then moving it a second time to the theater of operations on smaller airlift aircraft is not efficient, they argue. The C-17 can do the job of both the C-5 (strategic airlift) and the C-130 Hercules (intra-theater airlift) and move war materiel directly from the United States into combat, if need be.

The C-17 has proven highly effective in the tactical airlift role. For example, in late 2004, military commanders increased intra-theater airlift capability to reduce the number of ground convoys exposed to ambush in Iraq and Afghanistan. C-17s were tasked to transition to the tactical airlift role along side C-130s to perform this mission. The effect of increased tactical airlift has been to "relieve nearly 3,500 vehicles and 9,000 convoy operators per month from having to travel treacherous Iraqi and Afghan roads."[23] Also, as a more modern aircraft, the C-17 also potentially offers more opportunity for upgrades and modifications than the C-5.

On the other hand, the C-5's unique capabilities argue for its continuation, potentially at the expense of additional C-17s. In a period where DoD's force posture is moving from forward basing to expeditionary, it may be unwise to prematurely retire aircraft in today's inventory. Although the C-5 is not as modern as the C-17, the Air Force's Fleet Viability Board found that the C-5A fleet — with appropriate investments — has at least 25 years of life remaining.[24] Thus, today's investments could potentially be recouped for decades. Current estimates of the per-aircraft cost of AMP and RERP are expected to be approximately one-third that of a new C-17, and the C-5 will carry twice the C-17's payload. The figure below provides a comparison of airlift capabilities.

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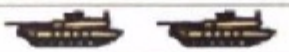
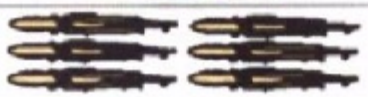
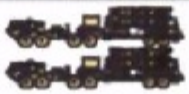
[22] (...continued)
*Journal.* July 8, 2007.

[23] Gen T. Michael Moseley, USAF, "CSAF's Vector: Air Mobility's Strategic Impact," May 23, 2007, http://www.af.mil/library/viewpoints/csaf.asp?id=324.

[24] Tech. Sgt. David A. Jablonski. "Air Force Fleet Viability Board releases C-5A Assessment," *Air Force Print News,* July 15, 2004. Amy Butler, "With a Little Help — And Cash — C-5As Can Fly For 25 More Years, Panel Says," *Defense Daily,* July 19, 2004.

**Figure 2 Comparison of C-5 & C-17 Capabilities**

| | C-5 34,795 ft³ | C-17 20,900 ft³ |
|---|---|---|
| Cargo Space |  |  |
| M1A1 |  |  |
| M2/M3 Bradley |  |  |
| AH-64 Helicopter |  |  |
| Multiple Launch Rocket System |  |  |
| Patriot Missile Launcher |  |  |
| HMMWV TOW |  X 14 |  X 10 |
| Pallets | 36 | 18 |
| Max Payload | 261,000 lb | 164,900 lb |

Source: *FY06 Congressional Overview (C-5, C-130J)*. "C-5 Operations During Iraqi Freedom." Lockheed Martin Aeronautics Company. p.18.

The C-5 also has superior load/off load capabilities. The upgraded aircraft (called the C-5M), is also expected to have greatly improved mission capable rates.[25] It may be noteworthy that during Operations Enduring Freedom and Iraqi Freedom, DoD leased Russian An-124 aircraft to carry outsize and oversize cargo because not enough C-5 aircraft were available.

The An-124 *Condor* is a strategic lift aircraft larger than, but comparable to the C-5. As Figure 3 below illustrates, the Air Force has spent $170 million since FY2002 for An-124 missions. It also appears that the number of An-124 missions is accelerating. FY07 figures already are on par with FY05 figures, and the fiscal year is not yet half over. While the C-5 may not be as modern as the C-17, or able to operate from as many runways, the fact that DOD has to outsource missions to Russian aircraft indicates that the C-5 still offers important capabilities that other U.S. aircraft may not be able to satisfy. Conversely, commercial contract air carriers play a key role in providing strategic airlift on a daily basis. The figure below shows DoD contracting for one An-24 sortie every three days. It is possible that these An-124 missions may be the result of the current availability of relative low-cost airlift near a busy theater of operations. Since the Air Force retired 14 C-5s in 2004 the number of An-124 missions have increased. Whether the C-5 retirement or on-going availability issues are causal or coincidental is unclear. (A description of the An-124 can be found at Appendix 1.)

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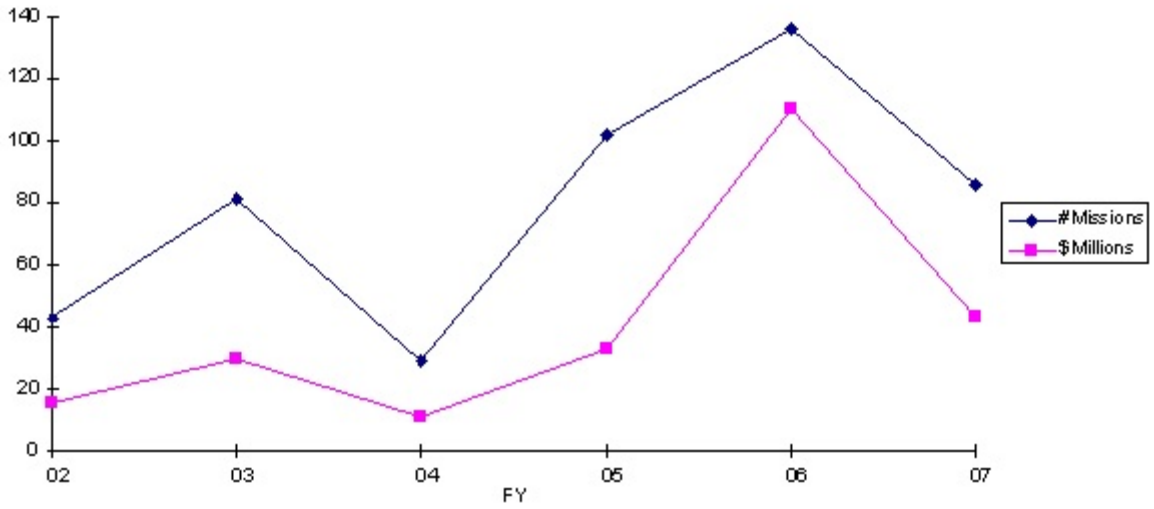
[25] David Hughes, "C5 Avionic and Engine Upgrades Rolling," *Aviation Week & Space Technology,* Oct. 25, 2004. *C-5 Galaxy Modernization*, FY2006 Point Paper, Lockheed Martin Corp, Jul. 2005.

**Figure 3: Number and Cost of An-124 Missions Contracted by Air Mobility Command**




TOTAL: 434 missions. $168,434,265.00

*Source: USAF Air Mobility Command. International Airlift Procurement Branch. Feb. 23, 2007.*

The potential cost and budgeting considerations of the Air Force's "30/30 proposal" have been discussed. Replacing 30 C-5 aircraft with 30 C-17s also presents airlift capability issues. Airlift capability can be measured in different ways, but it appears clear that on a one-for-one basis, the C-5 can carry more outsize cargo and more cargo pallets than the C-17. In many cases each C-5 can carry twice as much of a given piece of outsize cargo as the C-17.[26]

The C-5's advantage in size is offset, to a degree, by lower availability. Thus, Fig. 2 above does not compare accurately the two aircraft's capabilities over multiple sorties. The following table illustrates the effect the C-17's higher availability has on respective capabilities, and provides a simplified comparison of the capabilities of 30 C-5s and 30 C-17s.

[26] Outsize cargo is defined by DoD as cargo that exceeds the dimensions of oversized cargo and requires the use of a C-5 or C-17 aircraft or surface transportation. A single item that exceeds 1,000 inches long by 117 inches wide by 105 inches high in any one dimension.

| Table 4: C-5 & C-17 Capabilities over 30 Sorties Considering Desired Mission Capable Rates | | |
|---|---|---|
| | **C-5M (75% MCR)** | **C-17 (85% MCR)** |
| M1A1 Abrams | 45 | 25 |
| M2/M3 Bradley | 90 | 51 |
| AH-64 Apache | 135 | 76 |
| Patriot Missile Launcher | 45 | 25 |
| HMMWV TOW | 315 | 255 |
| Pallets | 810 | 459 |
| Max Payload | 58,72,500 lb | 42,04,950 lb |

For many, potential cost and capability concerns intersect when reductions to the size of the C-5 fleet are discussed.. The Air Force's program of record maintains a fleet of over 100 C-5Ms through the 2040s. If the C-5As are not modernized, sooner or later the Air Force will be left with a fleet of approximately 50 C-5Ms.

A fleet size of 50 aircraft could create LD/HD (low density / high demand) challenges addressed briefly in this testimony in the context of the KC-X program. Both the 1997 and 2001 Quadrennial Defense Reviews identified the challenges of operating and maintaining small aircraft fleets that are heavily used in peacetime and in war. Both studies recommended changes to asset management that would reduce the prevalence of LD/HD aircraft fleets, and Air Force leaders have taken steps, such as implementing the Expeditionary Aerospace Force (EAF) construct, in part to mitigate the LD/HD problem.

As mentioned above, the C-5 can carry some cargo too big for the C-17, and approximately twice as much cargo generally as the C-17. These capabilities suggest that operational demand for C-5s could remain high, even as the fleet size decreases. Air Force leaders may wish to explain how, all other things being equal, operating a relatively small C-5 fleet will or will not create LD/HD challenges they are actively trying to resolve in other parts of the aerospace force.

Long-range airlift capabilities are not just confined to the C-5 and C-17. The Air Force's aerial refueling fleet also provides noteworthy long-range delivery of palletized cargo. As DoD and Congress consider options for recapitalizing the KC-135 fleet, the amount of airlift that could ultimately be provided could have important implications for the C-5 and C-17. The Air Force's 59 KC-10 *Extender* aerial refueling aircraft currently represent approximately 3% of DoD's organic airlift capability. The procurement of larger KC-X aircraft could increase the percentage of airlift capacity provided by the tanker fleet, and could potentially reduce the number of dedicated airlifters such as C-5s and C-17s. The procurement of smaller KC-X aircraft could potentially have the opposite effect. Gen. Schwartz has testified to the relationship between the amount of airlift provided by tankers and the strategic airlift fleet: "If I had an airplane that could carry passengers there with

defensive systems, like a new tanker, I would use that instead, and we would be able to better manage the workload on the C-17 fleet and apply it against the things that it does exceptionally well, moving cargo."[27]

**"Bad Actors"**

As stated earlier, the Air Force's program of record is to RERP and AMP all C-5As in the TAI (Total Aircraft Inventory). However, the Air Force has also taken action to reduce this inventory, such as retiring 14 aircraft in FY04. P.L. 108-136, Sec. 132 prohibits retiring any C-5A aircraft until the effectiveness of the C-5A AMP and RERP efforts have been determined through testing and evaluation and reported to Congress.

During deliberations on the FY2008 budget request, Air Force leaders have frequently requested permission to retire some number of C-5A aircraft independent of the test results on C-5A RERP and AMP. To support their request for permission to retire C-5As, Sec. Wynne and Gen. Moseley have testified that some subset of the C-5A fleet is composed of "bad actors" aircraft that are "hard broke" and are prime candidates for early retirement.

> GEN. MOSELEY: In a perfect world, we would like to be able to manage that inventory and divest ourselves of the bad-acting tail numbers, and some of them are bad actors; they're broke. A lot of the C-5As have low flight hours on them because they're broke and you can't fly them...If I could line up the best B model or the best A model at the head of a line, a 59-two and 49, and go to the back end of the line and begin to kill off the bad actors and replace them with something new, I would be very happy. That doesn't mean all of them; it doesn't mean that we class or block-retire airplanes, it just means let us get at the tail numbers that are bad actors.[28]
>
> SEC. WYNNE: There's some that are really bad actors. And I think if you gave us the right to manage the fleet, you would find that we would manage it in a way that would actually retain the best mission profiles....[29]
>
> SEC. WYNNE: I can tell you, sir, that right now some worry about the entirety of the C-5 fleet. There are two things we should know about this. First is that we don't -- we want to line up worst to best, and we think there are between 20, 25 and 30 of bad actors that we would like to retire.[30]

Some in Congress have appeared supportive of Sec. Wynne's and Gen. Moseley's "bad actor" testimony, and have requested that the Air Force provide a list of these "hard broke" aircraft, presumably to make a judgement on whether these aircraft should indeed be retired

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[27] Seapower Subcommittee Hearing on FY2007 Budget. *OpCit.*

[28] Hearing of the House Armed Services Committee on Fiscal Year 2008 National Defense Budget Request From the Department of the Air Force. February 28, 2007. 2118 Rayburn House Office Building. Congressional Transcript. Federal News Service, Inc.

[29] Ibid.

[30] Hearing on the Senate Armed Services Committee on Air Force Authorization Request for Fiscal Year 2008 and the Future Years Defense Program. March 20, 2007. 325 Russell Senate Office Building. Congressional Transcript. Federal News Service, Inc.

early.[31] Others in Congress have responded to the Air Force's "bad actor" statements negatively, expressing concern Congress has not received "factual data" on the health and performance of the C-5A fleet. These members oppose the retirement of any C-5As prior to testing and operational evaluation of fully modernized C-5A aircraft.[32]

To date, it does not appear that the Air Force has provided a list of "bad actor" C-5As to Congress. There may be several reasons why this list has not yet been provided. Perhaps the most prominent reason is that comparing the reliability, performance, and health of a large sample of aircraft is difficult. Despite a number of recognized measures, or "yard sticks" for measuring these attributes, picking a subset of C-5 aircraft that are the poorest performers is a subjective exercise inherently vulnerable to criticism and second-guessing.

CRS examined a number of C-5 reliability and maintainability statistics for the past three fiscal years and conducted hours of interviews with Air Mobility Command officials and Air Force officers currently or formerly in the C-5 fleet. CRS could find no obvious subset of the C-5 fleet that stood out as notably "bad actors." Reliability and availability measures studied included the amount of time spent in depot or otherwise unavailable due to maintenance, mission capable rate, and mission departure reliability.

Some argue that *all* of the C-5As could be considered bad actors. This suggestion does not appear to stand up to even passing scrutiny. The Air Force Fleet Viability Board , the Defense Science Board, the Institute for Defense Analyses have all endorsed the viability of the C-5A fleet. Further, C-5A performance and reliability is not uniformly inferior to C-5B performance. Over the past three years, for example, the C-5A fleet has averaged a higher mission departure reliability rate (83.1%) than the C-5B fleet 81.3%.

As of the summer of 2007, two C-5A aircraft are restricted from flight, and 12 are restricted in their flight load or flight profile due to a variety of maintenance or repair issues. Some suggest that these 14 aircraft are appropriate candidates for early retirement. Counter-arguments to retiring these aircraft include, first, that it is estimated to cost only $26.7 million to repair all 14 aircraft, and second, that eight of the 14 restricted aircraft require routine modifications to address human-error damage incurred during routine maintenance. These problems are minor, it is argued and easily addressed. They in and of themselves do not warrant early retirement. While this counter-argument appears sound, it also speaks to the value of conducting robust analysis of an aircraft's maintenance and performance history and projected future costs and challenges. A single-point snap shot of an aircraft's condition can be an incomplete and misleading description of it's health, and, in and of itself a poor foundation for making retirement decisions.

**Incurring and Mitigating Risk**

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[31] See for example dialogue between Reps. Marshall and Saxton and LtGen. Carol "Howie" Chandler. Hearing of the Air and Land Forces Subcommittee of the House Armed Services Committee on Air Force and Army Airlift and Aerial Refueling Fixed-Wing Aircraft Programs. March 7, 2007. 2118 Rayburn House Office Building. Congressional Transcript. Federal News Service, Inc.

[32] See for example, "Biden and Kennedy Continue Push to Keep C-5 Viable Part of Nation's Strategic Airlift." *Press Release*. March 26, 2007. Http://biden.senate.gov/newsroom

Debate over the number of C-5s to modernize and the number, if any, of additional C-17s to procure frequently touches upon the concept of risk. For example, when DoD officials defended the FY06 budget decision to end C-17 procurement, they argued that keeping the C-17 production line open "would be a smart thing to do" from a pure risk perspective, but, "the cost would be prohibitive" given the other airlift procurement programs that the Air Force plans."[33] In a 2006 study on mobility, the Defense Science Board (DSB) also considered risk an issue to consider in determining the total number of C-17s to purchase.

> The task force understands that each year of additional (C-17) production beyond 2008 would represent an additional $2.4 billion acquisition and $2-3 billion life cycle cost commitment, which the department must weigh against other war-fighting capabilities it could not acquire. However, in view of the prominence of organic strategic airlift in enabling rapid response to crises, the task force believes it is prudent to keep options open for the acquisition of additional C-17s.[34]

A key question during this legislative cycle is, how much risk does DoD incur by allowing the C-17 line to close? Conversely, how much additional security is purchased by keeping the C-17 line open? Perception of risk is inherently subjective, but a few observations may help policy makers make an informed assessment.

First, when planning for the C-17 line's end, the Air Force budgeted $650 million to be spent shutting down the line in a manner that would facilitate its restoration if necessary. The advantage of this strategy is that the government pays a one-time sum to hedge its bets. A disadvantage of "smart shutdown" is that more money will likely be required to re-start the line, if necessary, and doing so will take time. The monetary cost of storing and maintaining the tooling necessary to build C-17s in the future is relatively easy to quantify. The potential loss of human capital, as skilled worker retire, move to other Boeing programs, or leave Boeing for other jobs, is difficult to quantify, and potentially costly. Additionally, some believe it is likely that Boeing may sell its production site in Long Beach, CA when the C-17 line ends, which would lead to additional costs to restarting the C-17 production line at a new location.[35]

Purchasing aircraft predominantly in order to keep the line alive will safeguard rapid production capability, if required, but will also incur billions of dollars of costs over the aircraft's lifetime. A comparison of estimated costs over different time spans between "smart shutdown," followed by line restoration, and keeping the C-17 line open via additional purchases may be useful.

A second observation is that the potential risk incurred by ending C-17 production is not apportioned solely over the airlift fleet. Long-range cargo aircraft are only one component of a much larger military mobility system. While aircraft offer advantages over other transportation modes, such as speed and flexibility, these characteristics may

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[33] Michael Sirak. Senior DoD Officials Defend Decision To Halt C-17 Production At 180." *Defense Daily*. February 10, 2006.

[34] *Defense Science Board Task Force on Mobility.* Office of the Under Secretary of Defense (AT&L) September 2005. P.14.

[35] "C-17 Lobbying Picks up in Wake of Commerce Department Report." *Defense Industry Daily.* February 22, 2006.

potentially be offered by a mix of other assets. Assets that could potentially be used to augment the airlift fleet, and thus mitigate potential risk of ending C-17 production include increasing the use of the Civil Reserve Air Fleet (CRAF), increasing the use of pre-positioned equipment, and re-invigorating DoD's development of large, heavy-lift airships.

The Civil Reserve Air Fleet (CRAF) supports Department of Defense (DOD) airlift requirements in emergencies when the need for airlift exceeds the capability of military aircraft. The airlines contractually pledge aircraft to the various segments of CRAF, ready for activation when needed. To provide incentives for civil carriers to commit aircraft to the CRAF program and to assure the United States of adequate airlift reserves, the government makes peacetime airlift business available to civilian airlines that obligate aircraft to the CRAF. DoD offers business through the International Airlift Services.

The primary shortcoming of CRAF aircraft is that they are incapable of moving outsized and oversized cargo. The primary benefit that CRAF imparts is low cost. The Government Accountability Office (GAO) notes that CRAF provides up to half of the nation's long range airlift capability without the government having to buy additional aircraft, pay personnel costs, or maintain the aircraft during peacetime. GAO references the use of CRAF during Operation Desert Storm to illustrate its point:

> The use of CRAF aircraft during an activation is not free — DOD pays rates based on weighted average carrier costs — but the cost is minimal in comparison to the costs of acquiring and supporting aircraft, paying and training aircrew, and other expenses of maintaining standby military airlift capability. AMC paid the carriers about $1.5 billion for using their aircraft during the operation. Purchasing additional military aircraft to provide similar capability would cost from $15 to $50 billion, according to Air Force officials, depending on assumptions used for aircraft replacement cost.[36]

It appears that CRAF is capable of providing more capacity if required. In February 2003 it was reported that DoD's requirement for cargo and passenger aircraft was only approximately one half of what air carriers had committed to the CRAF program.[37] Recent events may suggest that a growing use of commercial aircraft for every-day DOD needs is already in evidence. In January 2005, for example, it was reported that commercial airlines moved twice as many U.S. troops overseas as they moved in January 2004.[38]

The efficacy of increasing the use of CRAF is a complicated calculation. Commercial aircraft cannot employ austere runways, for example, and take longer to load and unload than military air lifters. Currently, civilian aircraft do not employ defensive countermeasures such as flares, chaff, or directed infrared countermeasures. However, it appears clear that CRAF represents a "safety valve" or surge capability in airlift if more capability is required and no airlift production capability exists.

Both the Defense Science Board and the Congressional Budget Office (CBO) have

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[36] Military Readiness. Civil Reserve Air Fleet Can Respond as Planned, but Incentives May Need Revamping. General Accounting Office (GAO-03-278) December 2002. p.15.

[37] "CRAF Requirements and Commitments." *Air Force Magazine.* February 2003. P.28.

[38] Micheline Maynard. "Airlines Moving More Troops This Month." New York Times. January 25, 2005.

recommended that DoD improve its mobility capabilities by increased investments in afloat pre-positioning of equipment, not by large investments in fixed-wing long-range airlift. For example, the DSB found that

> investments now in intermediate staging bases, more and improved force and sustainment pre-positioning and high-speed, intratheater vessels capable of austere port access could add significant new capabilities to enable land force deployments and meet a variety of contingencies. These investments need to be *complemented* by incremental investments in aerial tankers and *possibly* in strategic airlift." (Emphasis added)[39]

Both the DSB and CBO found that pre-positioning equipment offered opportunities to increase the promptness of delivery, a key feature of airlift. For example, the DSB found "Pre-positioning is the sole component of the mobility system that can deliver employable heavy/medium land forces early in a campaign."[40] CBO wrote "Prepositioning sets of unit equipment offers greater improvements in the promptness of cargo deliveries than the other options that CBO examined" such as increasing airlift and fast sea-lift capabilities.[41] Further, "increasing the number of existing ships and aircraft would offer very limited improvements in the promptness of unit deliveries during large deployments."[42]

Further, there are some instances where fielding more aircraft would not increase mobility capabilities, but potentially exacerbate logistical choke-points. Often, the transportation problem is not too few aircraft, but too few airfields or infrastructure. A study by the Army's Military Traffic Management Command found that the biggest roadblock to achieving the service's deployment goals is the limited infrastructure at forward airfields.[43] Examples of infrastructure shortfalls include limited ramp space and loading/unloading equipment. In Operation Allied Force, as another example, "there were not enough air bases in the area immediately around Kosovo to support all the aircraft...."[44] The CBO made a similar observation "Aircraft offer rapid delivery of individual loads, but any attempt to significantly increase their total cargo deliveries to a distant theater would probably be hampered by constrained infrastructure at airfields, which is anticipated for many, if not most, future conflicts."[45]

Another potential strategy to mitigate the risk of shutting down the C-17 production line

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[39] *Defense Science Board Task Force on Mobility.* Office of the Under Secretary of Defense (AT&L) September 2005. P.4.

[40] *Defense Science Board Task Force on Mobility.* Office of the Under Secretary of Defense (AT&L) September 2005. P.10.

[41] *Options for Strategic Military Transportation Systems.* Congressional Budget Office. September 2005. P.x.

[42] *Options for Strategic Military Transportation Systems.* Congressional Budget Office. September 2005. P.x, xiii.

[43] Kim Burger, "Army Study: Poor Forward Airfields Jeopardize Deployment Goals," *Inside the Army*, Aug. 21, 2000.

[44] *Kosovo After Action Review*. Secretary of Defense William S. Cohen and Gen. Henry H. Shelton, Chairman of the Joint Chiefs of Staff. Senate Armed Services Committee, Oct. 14, 1999.

[45] *Options for Strategic Military Transportation Systems.* Congressional Budget Office. September 2005. P.x.

might be to re-invigorate DoD efforts to develop heavy-lift airships. Until cancelled by congressional appropriators in FY2006, the Defense Advanced Research Projects Agency (DARPA) was developing a hybrid airship capable of transporting up to 1,000 tons across international distances. Unlike traditional, cigar-shaped airships, a hybrid airship is shaped more like an aircraft's wing, to generate lift through aerodynamic forces. Advocates hope that such airships may potentially be capable of carrying a complete Army brigade directly from "the fort to the fight," overcoming logistic choke points and mitigating the effects of limited forward basing. The CBO study estimated that developing and procuring 14-16 heavy-lift airships would have the same life cycle cost as 21 C-17 aircraft ($11 billion) but would deliver cargo at a rate nearly three times greater. Airship detractors challenge their survivability and ability to operate in adverse weather.

**Summary**

In summary, while the C-5 and C-17 programs are very much related each program has specific merits worthy of being considered independently of the other platform. C-5 modernization and more specifically the RERP address the primary operational criticism of the C-5 – its reliability. The most current requirement as defined in the MCS call for the full C-5 fleet to be retained and for both AMP and RERP to be implemented across the remaining fleet. A fully modernized C-5 is expected to provide the unique capability to move bulk and outsize cargo through 2040. Additionally, decisions to pursue C-5 modernization were informed by independent analysis that identified a fully modernized fleet as integral to building the most cost-effective strategic airlift option. On the other hand, how serious cost growth will be in the C-5 RERP remains to be seen. In addition, it is unclear how much cost growth would have to take place to invalidate IDA's analysis of alternatives.

Likewise, the C-17 program has unique benefits as well. First, just as the C-5 possesses a unique ability to deliver large cargo loads and some unique outsize payload, the C-17 has become the backbone of our nation's airlift fleet due to its versatility. Not only does the C-17 perform well in the strategic role, but has proven its value in the tactical arena with its unique ability to deliver large, outsize payloads into austere fields. Additionally, continuing C-17 production provides a hedge against uncertainty currently associated with the C-5 RERP while also moving strategic airlift capability further up the continuum established by the most recent MCS – a study that has been widely criticized as being budget driven rather than requirement driven. Unfortunately, acquiring this capability requires tight budget dollars that will very difficult to locate with potentially effecting another critical defense program – potentially one with a currently validated requirement.

Mr. Chairman, this concludes my remarks. I appreciate the opportunity to appear before you, and look forward to any questions you or the other subcommittee members may have. Thank you.

# Appendix 1

**Description of An-124 *Condor* Heavy Lift Aircraft[46]**

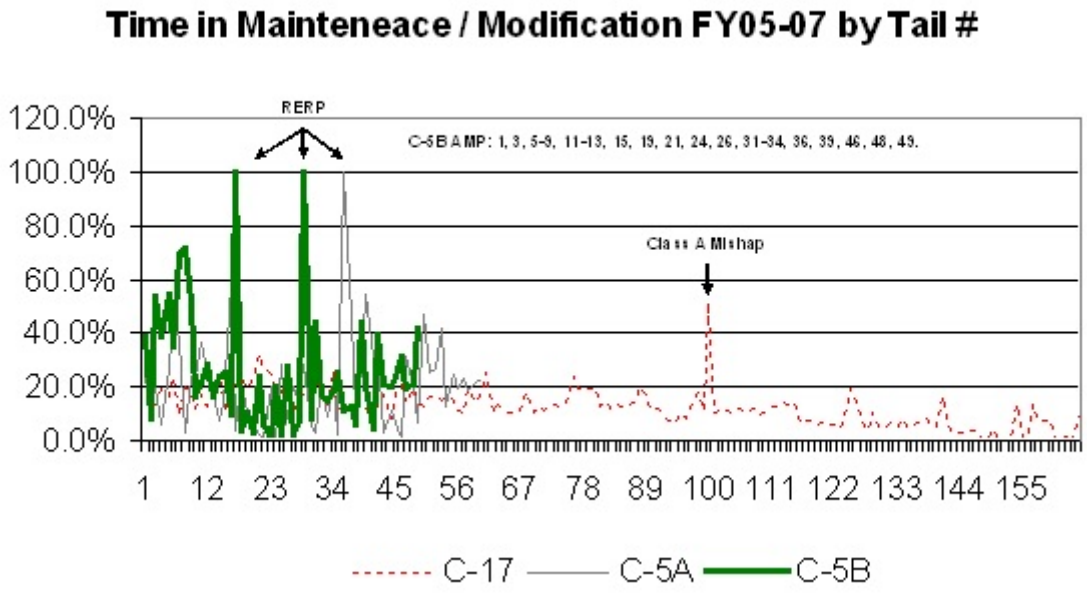
| | |
|---|---|
| Country of Origin | Russia |
| Builder | Antenov |
| Wing Span | 240 ft, 5 in (73.3 m) |
| Length | 226 ft, 3 in (69 m) |
| Height | 68 ft 2 in (20.78 m) |
| Empty Weight | 385,000 lbs |
| Engine | 4 - Lotarev D-18T, 229.9 kN thrust each |
| Cruising speed | 430 kts |
| Range | 2,900 nm |
| Service Ceiling | 35,000 ft |
| Payload | 88 passengers or approximately 330,000lbs cargo |
| Cargo Bay | 36.5 m x 6.4 m x 4.4 m (1027.8 cu. m) |
| Crew | Six--seven with loadmaster |

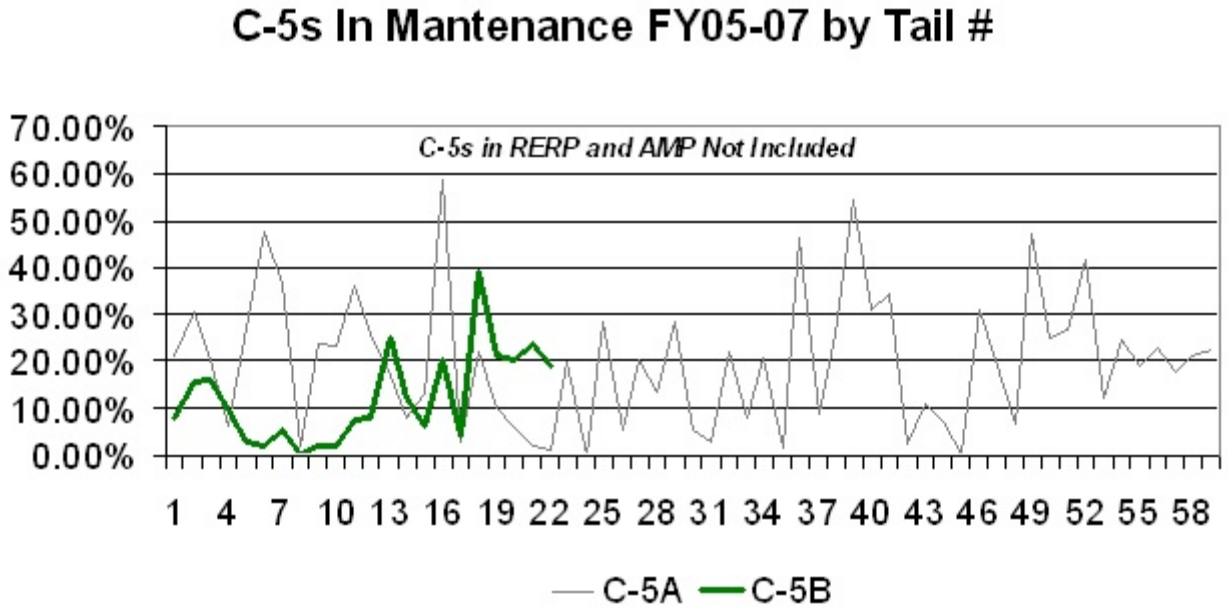
**AN-124 Condor**

[46] Sources: FAS.org, Jane's All the World's Aircraft. Flight International, 3-9 October 2006.

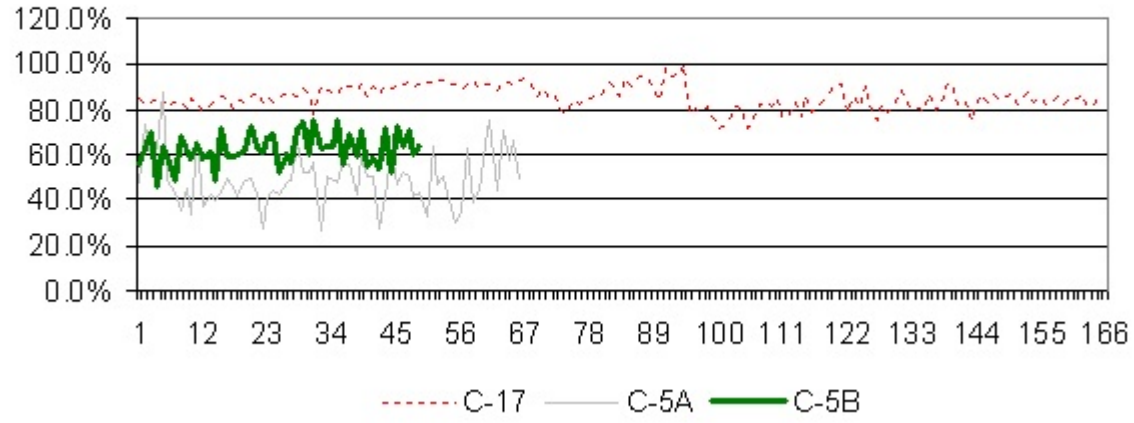
# Appendix 2

**C-5 and C-17 Availability, and Readiness Comparisons**

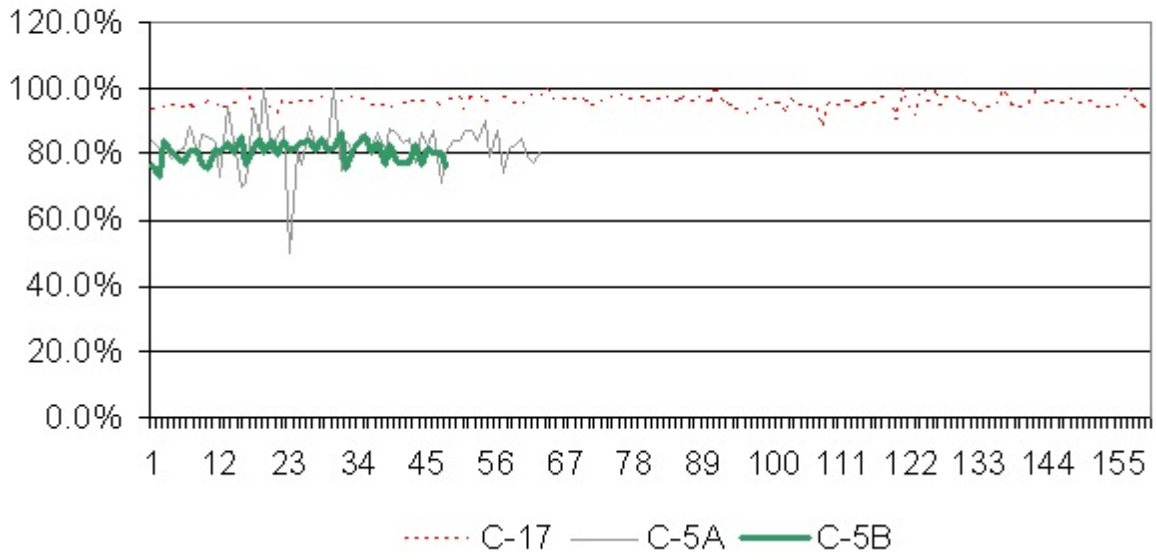


## Mission Capable Rate FY05-07 by Tail #




## Mission Departure Reliability FY05-07 by Tail #



# Comparison of C-5 Fleet for 3 Availability / Reliability Measures FY05-FY07

| Worst C-5s for Depot % | | | |
|---|---|---|---|
| Tail # | Depot % | MCR | MXR |
| *69000003* | 58.5 | 27 | 83.1 |
| *70000445* | 54.2 | 46.5 | 84.4 |
| *68000219* | 47.5 | 37.2 | 75 |
| *70000456* | 47.3 | 29.7 | 83.3 |
| *69000025* | 46.2 | 27.4 | 78.9 |
| 87000038 | 39.1 | 58.6 | 75.5 |
| *68000220* | 36.5 | 42.9 | 84.3 |
| *68000224* | 35.7 | 45.9 | 82.2 |
| 70000447 | 34.3 | 49.9 | 83.5 |
| *70000453* | 31.1 | 47 | 80 |
| 70000446 | 30.9 | 51.9 | 81.5 |
| 68000212 | 30.3 | 35.7 | 82.7 |
| C-5A Fleet Avg. | 21.3 | | |

| Worst C-5s for Mission Capable Rate | | | |
|---|---|---|---|
| | Depot % | MCR | MXR |
| 69000014 | 5.6 | 26.4 | 87.3 |
| *69000003* | 58.6 | 27 | 81.1 |
| *69000025* | 46.2 | 27.4 | 78.9 |
| *70000456* | 47.4 | 29.7 | 85.6 |
| 70000451 | 7.1 | 33.1 | 78.9 |
| 68000215 | 6.1 | 33.8 | 82.2 |
| 70000457 | 24.9 | 34.5 | 73.2 |
| *68000212* | 30.3 | 35.7 | 82.7 |
| *68000219* | 47.6 | 37.2 | 75 |
| 70000460 | 41.5 | 38.9 | 83.6 |
| 70000455 | 6.8 | 39.3 | 85.6 |
| 68000221 | 2.3 | 39.7 | 81.5 |
| C-5A Fleet Avg. | | 48.2 | |

| Worst C-5s for Mission Departure Reliability | | | |
|---|---|---|---|
| | Depot % | MCR | MXR |
| 70000168 | 0 | 59.1 | 50 |
| 70000461 | 12.6 | 44.6 | 70.1 |
| *70000462* | 24.7 | 65.3 | 71.4 |
| 69000010 | 1 | 65.9 | 71.4 |
| 84000059 | 63 | 62.3 | 73.1 |
| *70000457* | 24.9 | 34.5 | 73.2 |
| *69000020* | 22.1 | 42.6 | 74.6 |
| *68000219* | 47.6 | 37.2 | 75 |
| 85000005 | 51.3 | 58.2 | 75.6 |
| 87000029 | 15.1 | 62.8 | 75.6 |
| 87000045 | 42.3 | 59.6 | 75.8 |
| 67000174 | 0 | 48.8 | 76.9 |
| C-5A Fleet Avg. | | | 83.1 |

Tail Numbers in:

Italics = worse than average in all 3 categories

Bold = among the worst (not just below average) in two of the three categories

Bold and Background = among the worst in all three categories