Statement by Dr. William L. Greer

Assistant Director, System Evaluation Division

Institute for Defense Analyses, Alexandria, VA

for the

Senate Homeland Security and Governmental Affairs Subcommittee on

Federal Financial Management, Government Information, Federal Services, and International Security

Hearing on the Cost-Effectiveness of Procuring Weapon Systems in Excess of Requirements

July 13, 2010

Mr. Chairman and Members of the Subcommittee, I am pleased to come before you today to discuss a recent study of airlift aircraft conducted by the Institute for Defense Analyses (IDA). The Department of Defense (DoD) selected IDA to examine the tactical and strategic airlift issues posed by the Congress in the National Defense Authorization Act (NDAA) for fiscal year 2008.[1] I will confine my testimony today to the parts of the IDA study that deal with strategic airlift aircraft, namely the C-5s and C-17s.

A. Background

As called for in the NDAA, we considered a wide range of operational scenarios, including peacetime operations, humanitarian aid and disaster relief, homeland security, irregular warfare, the war on terrorism, and major combat operations. Within these, the study considered numerous alternatives that included upgrading existing C-5s and procuring additional C-17s. We also examined strategic airlift fleets that were both larger and smaller than those planned for acquisition. In addition, we assessed both operational effectiveness and life-cycle costs. I will summarize for you today the basic approach taken, the alternatives considered, and our findings.[2]

DoD's airlift Program of Record (POR)[3] in fiscal year 2009 was the study's base case against which alternatives were compared. For strategic airlift, the POR included 205 C-17s and 111 C-5s for a total of 316 aircraft. The C-5s consisted of 59 C-5As and 52 C-5Ms, the latter being C-5B/C aircraft that are scheduled to be upgraded through the Reliability Enhancement and Re-engining Program (RERP). The RERP modifications include new engines, pylons, auxiliary power units, and other upgrades. Alternative airlift forces, both larger and smaller than the POR, were examined. Note that the program of record in our study included 205 C-17s. With additional C-17s procured subsequently, today's POR includes 18 more aircraft, for a total of 223 C-17s.

B. Findings

The main questions in the NDAA and the findings of the IDA study are summarized here.

What are the airlift requirements?

As noted above, the study examined Major Combat Operations (MCOs) as well as a variety of other scenarios in which airlift aircraft would be needed. Our analyses of

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[1] National Defense Authorization Act for Fiscal Year 2008, Section 1046, *Study on Size and Mix of Airlift Force*, enacted 28 January 2008.

[2] *Study on Size and Mix of Airlift Force: Unclassified Synopsis*, IDA Paper P-4428, Institute for Defense Analyses, February 2009.

[3] The Program of Record included 205 C-17s, 52 C-5As, 59 C-5Ms, 269 C-130Hs, and 120 C-130Js, plus tankers and Civil Reserve Air Fleet (CRAF) commercial airlifters available in various call-up stages.

MCOs were based on the 2005 *Mobility Capabilities Study (MCS),*[4] which, at the time the IDA study began, represented DoD's latest official set of transportation requirements for airlift forces in two concurrent MCOs. For other operational scenarios – hereinafter referred to as "non-MCO" scenarios or cases, IDA's analyses were based on early versions of DoD's Steady State Security Posture (SSSP) scenarios. The SSSP scenarios were more demanding than the non-MCO cases used in earlier airlift studies conducted by DoD and others. Together, these MCO and non-MCO scenarios provided the transportation requirements examined in the study.

Does the currently programmed fleet meet the requirements?

Yes, it does. We found that the POR fleet met DoD's benchmark airlift needs identified in the MCS for moderate acceptable risk, while concurrently meeting other critical non-MCO demands.

What programmatic alternatives were considered and how well do they meet these requirements? What are the life-cycle costs of these alternatives?

The study considered 40 alternative fleet mixes and sizes and compared them in cost and effectiveness with the POR. Alternatives were selected to span the decision space indicated by the NDAA questions.

The numbers of C-17s in the alternative fleets ranged from 205 to 305. Alternatives included:

- Base Case POR: 205 C-17s, 59 C-5As, 52 C-5Ms
- Excursions from the POR that hold the C-5 RERP fleet constant; and:
  - Buy more C-17s; or
  - Retire some or all C-5As, and buy more C-17s; or
  - Retire some or all C-5As, and buy no additional C-17s.
- Excursions from the POR that increase the C-5 RERP fleet by:
  - Converting all C-5A/B/Cs to C-5Ms; or
  - Converting all C-5A/B/Cs to C-5Ms, and buying more C-17s.
- Excursions from the POR that decrease the C-5 RERP fleet by upgrading only 19 C-5Bs to C-5Ms; and:
  - Retaining all remaining C-5A/B/Cs; or
  - Retaining all remaining C-5A/B/Cs, and buying more C-17s; or
  - Retaining all remaining C-5B/Cs, and retiring remaining C-5As; or
  - Retiring remaining C-5A/B/Cs, and buying more C-17s.

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[4] *Mobility Capabilities Study*, Office of the Secretary of Defense, December 2005.

Figure 1 illustrates the relative capabilities of selected alternative fleets that differ only in numbers or types of strategic lift aircraft (i.e., numbers and types of C-5s and C-17s). Results are shown relative to the capabilities needed to meet the MCS moderate - risk delivery demands for cargo. The focus in this figure is on meeting MCO delivery demands, but in all cases, some airlifters are being used in critical, concurrent, non-MCO activities and are therefore not available for the MCO deliveries.

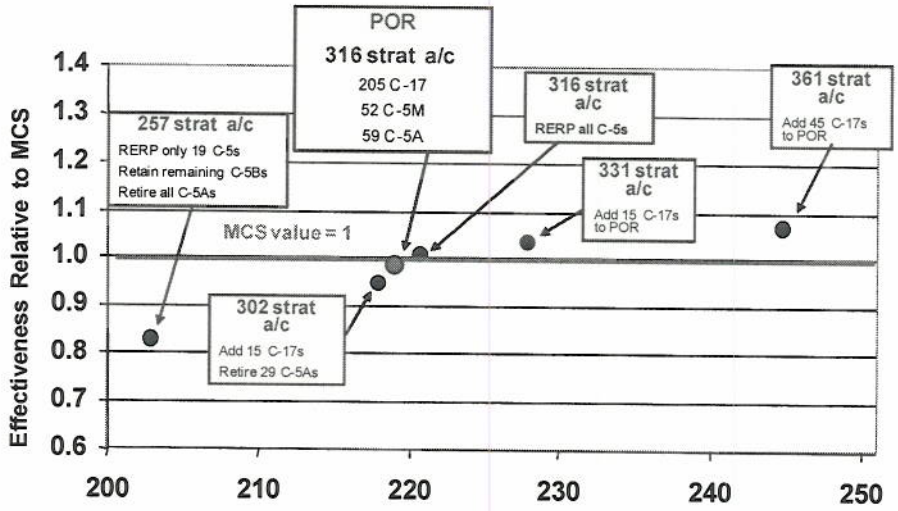

Figure 1. Comparison of Cost-Effectiveness for Selected Airlift Force Alternatives in Two Concurrent MCOs

A small amount of additional capability (2-3 percent) could be achieved if all C-5s were converted via RERP to C-5Ms. This would require not only upgrading the 52 C-5s already programmed to become C-5Ms but also the 59 C-5As that currently are not planned to be upgraded. As Figure 1 shows, this alternative is comparable in life-cycle costs to the POR. In this alternative, near-term C-5A RERP acquisition costs are essentially repaid over time by improved reliability and the resulting reduced operating and support (O&S) costs in the subsequent years.

The study identified several relatively inexpensive ways of generating higher capability from existing forces, without procuring additional strategic airlifters, and at essentially no additional costs. These are not traditionally accounted for in analyses, but their practice during actual operations could provide a greater airlift capability than shown in Figure 1. These include the following:

- Use C-5s at Emergency Wartime Planning levels during MCOs (adds 2-4 percent to the POR delivery rate, depending on whether the extra weight carried is fuel or cargo). This allows C-5s to carry heavier loads during a short wartime surge than are normally carried in peacetime – an action that may lead over time to more frequent repairs because of the greater stress on wings, airframes, and landing gears;
- Transport via CRAF (Civil Reserve Air Fleet consisting of commercial airlifters that supplement military aircraft during peacetime and wartime) whatever oversize cargo such as small vehicles that CRAF can carry, in addition to bulk cargo on pallets, in order to free up organic military airlifters for the larger and heavier cargo (adds 10 percent). This would probably require periodic peacetime exercise to ensure that appropriate CRAF aircraft maintained proficiency in carrying the larger cargo;
- Use host-nation airlifters to the maximum extent possible (up to 4 or 5 percent, depending on the nations involved); and
- Use tankers not involved in tanking missions to carry cargo within their assigned theater (adds about 4 percent). This requires being able to know confidently that selected tankers would not be needed as tankers for a day or more during which they would be employed as temporary in-theater airlifters.

Use of these capabilities could also allow for a smaller strategic fleet that still meets MCS benchmark delivery requirements. Thus, our analyses using the MCR moderate-risk benchmark suggest that an upper bound on the number of required strategic airlifters is 316, indicated by the two yellow boxes in Figure 1.

Traditionally, airlift aircraft and most other DoD force elements are sized to meet the demands of major combat operations, not steady-state, non-MCO scenarios. In looking at high-tempo non-MCO operations such as in Iraq and Afghanistan today, we note that some C-5As could be retired to save O&S costs with no loss in capability for those missions. Although strategic airlift aircraft are used in many SSSP scenarios, most of the missions involve small loads in many concurrent situations with locations that are geographically separated and are more cost-effectively supported by tactical airlift. This is illustrated in Figure 2 where the fraction of all non-MCO concurrent demands met by each alternative is plotted against the life-cycle cost for each. A number of alternatives can be seen that provide comparable or better coverage of the non-MCO scenarios at lower cost than the POR. One involves retiring all C-5As and working with a smaller strategic airlift fleet. However this alternative fell far below the requirement set in Figure 1 for MCO support, and so, despite its attractiveness for non-MCO scenarios, it would not be a prudent choice if DoD wants flexibility to respond to MCOs at current levels of risk.

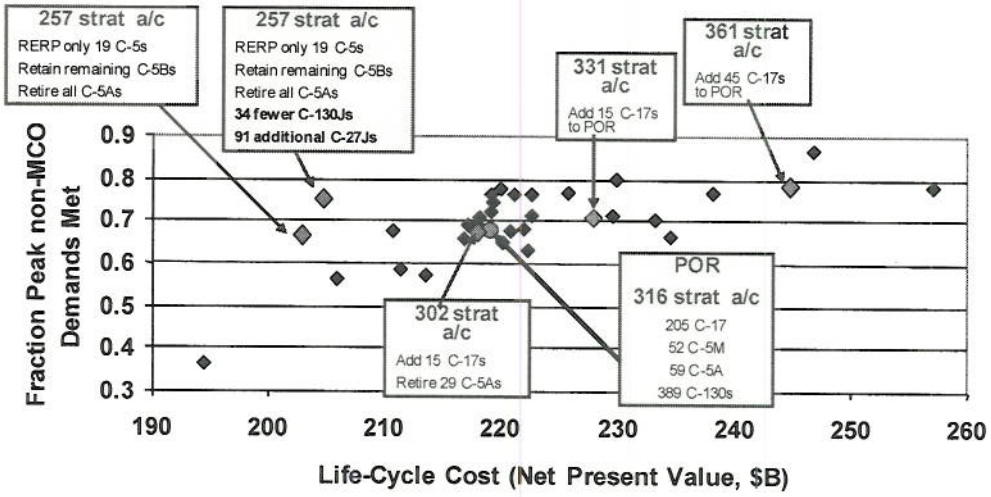

Figure 2. Comparison of Cost-Effectiveness for Selected Airlift Force Alternatives in Airlift-Stressing non-MCO Operations

What are the cost and other implications for stopping production of the C-17 line and restarting it later, if needed?

Our assessment of the C-17 line shutdown and restart is that continued production, even at low rates, is expensive relative to restart costs. Moreover, under the scenarios and other assumptions considered in our study, additional C-17s were not needed to meet the MCS moderate-acceptable-risk delivery rates used as a benchmark in our analyses. We also found that retiring C-5As to release funds to buy and operate more C-17s is not cost-effective. Although C-17s played an important role in some of the non-MCO scenarios, additional C-17s were not found cost-effective there either.

How do the alternatives differ in service life?

We projected aircraft service lifetimes based on planned flying hours and flying severity conditions. Excursions from the planned operating conditions were also examined. Virtually all the C-5s and C-17s have lifetimes beyond 2040.

C. Closing Remarks

Mr. Chairman and Members of the Subcommittee, that concludes my prepared remarks. Thank you for the opportunity to present our study findings.

About the Institute for Defense Analyses

The Institute for Defense Analyses (IDA) is a non-profit corporation that runs three Federally Funded Research and Development Centers (FFRDCs) to provide objective analyses of national security issues, particularly those requiring scientific and technical expertise, and to conduct related research on other national challenges. FFRDCs are private-sector organizations established to meet research or development needs integral to the missions of federal agencies, and operated in the public interest, free from conflicts of interest. IDA's Studies and Analyses Center, located in Alexandria, VA, is IDA's largest and oldest FFRDC. Established in 1956 at the request of the Secretary of Defense, IDA:

- Supports the Office of the Secretary of Defense, the Joint Staff, Unified Commands, Defense Agencies, and other Government organizations;
- Provides rigorously objective evaluations of systems and capabilities, advanced technologies, forces and strategies, and resource and support challenges; and
- Is a trusted source of high-quality research and advice.

About the Witness, Dr. William L. Greer

Dr. Greer has spent more than 30 years modeling and analyzing complex systems for the Department of Defense and other government agencies. Over the last two decades, he has accumulated extensive experience in leading analyses for a wide range of air mobility issues for the U.S. Transportation Command, the Joint Staff, and the Office of the Secretary of Defense. These include analyses of the cost and utility of numerous acquisition programs such as the C-5 Reliability Enhancement and Re-engining Program and the C-17 program; an assessment of airborne tanker requirements; a determination of C-130 force size requirements; and analyses of issues related to the C-130 Avionics Modernization Program. Dr. Greer was the task leader of the congressionally mandated *Study on Size and Mix of Airlift Force*, published by IDA in February 2009, that provided the material for today's testimony.

Dr. Greer is currently an Assistant Director in the System Evaluation Division at the Institute for Defense Analyses in Alexandria, VA. Prior to joining IDA, Dr. Greer worked in the Office of the Secretary of Defense (Program Analysis & Evaluation) and at the Center for Naval Analyses in Alexandria, VA. He also conducted post-doctoral scientific research at the National Institute for Science and Technology and the University of Maryland and has taught chemistry at the graduate and undergraduate levels at Georgetown University in Washington, DC, and George Mason University in Fairfax, VA.

Dr. Greer holds a Ph.D. in Chemistry from the University of Chicago and a B.A. in Chemistry from Vanderbilt University.