

SUPPORTING ACQUISITION DECISIONS IN AIR MOBILITY

William L. Greer

The Problem

In recent years, DoD has faced several difficult decisions regarding the modernization and recapitalization of U.S. airlift forces, and, in each case, analysis of the effectiveness and costs of available options provided key insights to inform the decisions, while offering lessons for analysts going forward.

Air mobility forces—airlifters and aerial tankers—serve a crucial role, both in peacetime and in wartime military operations. We focus in this article on airlift, the rapid movement of cargo and passengers to, from, or within a theater. The cargo can include a diverse range of materiel, including mail, spare parts, and combat vehicles and ammunition. Passenger airlift can include rapid medical evacuation as well as the airborne movement of troops.

IDA has conducted a number of airlift cost-effectiveness analyses over the last 20 years. These assessments were variously called *Cost and Operational Effectiveness Analyses (COEAs)*, *Analyses of Alternatives (AoAs)*, or simply cost-benefit trade studies. All served the same end: to inform decision makers about the desirability of major acquisition programs and their alternatives.

Case Studies

We discuss here three examples of program designs that have been informed by the IDA studies on airlift.

C-17 COEA: What Kind of Airlifters Should DoD Buy?

Congress mandated an IDA analysis, *Cost and Operational Effectiveness Analysis of the C-17 Program* (1993), which was intended initially to investigate whether the aging C-141 airlifters should be given an extended life or whether a new airlifter—the C-17—should be bought instead. If C-17s were to be bought, the C-141s would be retired. The IDA analysis included C-141s and C-17s as alternatives, but added to the list of alternatives several military-modified commercial cargo airlifters. Our analysis showed that requirements could be met in the most cost-effective way not by buying just C-17s or by extending C-141 life, but by a mix of some C-17s and the less costly modified commercial cargo aircraft. This mixed fleet solution was influential in subsequent DoD decisions and led to a competition between the manufacturer of the C-17 and manufacturers of large commercial cargo planes. In the end, although DoD decided to buy only C-17s, the intense competition forced improved performance and led to lower costs for that choice.

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C-5M: Should the C-5 Fleet Be Upgraded with New Engines and Improved Reliability?

In the late 1990s, DoD was faced with a decision about improving the C-5 airlifter, the single largest airlifter in the U.S. inventory: invest in replacing the older C-5 engines and low-reliability parts with new ones, or maintain the existing systems. Which would be more cost effective? At that time, 126 C-5A/Bs were in the fleet. In the 1997 *Independent Analysis of C-5 Modernization Study*, IDA researchers estimated that the cost of replacing all engines and low-reliability parts plus the costs for maintaining the upgraded fleet over 25 years would be lower than the costs to maintain existing systems over the same time period. Despite the large initial expenses for new parts and engines, the ultimate savings expected from lower maintenance costs for the improved C-5, dubbed the C-5M, offset the initial new parts acquisition costs. And the added reliability of these improvements was projected to immediately improve mission capable rates and departure reliabilities. Table 1 shows this comparison. DoD decided to proceed with the C-5M program, made a request for proposals to industry, and shared

our analytical results with industry through a redacted version of the report that removed proprietary data provided to IDA by major contractors.

Size and Mix: Under What Conditions Should the C-17 Production Line Be Continued or Terminated?

When do you stop a program, particularly a program such as the C-17, which had proven to be effective operationally? Because successful programs often develop strong proponents, the arguments for termination need to be solid. In the congressionally mandated 2009 *Study on Size and Mix of Airlift Force*, we assessed the pros and cons for terminating the C-17 acquisition program. Terminating U.S. procurement didn't necessarily mean the production line would be shut down; the C-17 was still being built and delivered to foreign governments. But eliminating U.S. procurement would certainly limit the number of aircraft being built per year, leading to employee layoffs and increasing the unit cost of the smaller numbers of aircraft that were produced each year. Obviously, termination would not be warranted if U.S. military needs were not being met. But that was not the

Table 1. Comparison of Cost and Effectiveness of C-5 Alternatives

126 Aircraft Fleet	25-Year Cumulative Net Present Value (Billions of Dollars)	Operational Effectiveness	
		Mission Capable Rate (%)	Departure Reliability (%)
Full Modernization to C-5M	15.6	74	91
Base C-5A/B	16.1	64	85

case. Prior to IDA's research, the main argument against termination was that more U.S. C-17s should be procured as a hedge against emerging needs that demanded a larger-than-planned C-17 fleet. However, the IDA analyses showed that there were more than enough C-17s available for anticipated needs out to 10 years. Second, we showed that the cost of stopping and then restarting the C-17 line would be lower under reasonable discounting assumptions than the cost of retaining an open line and producing aircraft at a low sustaining rate, for the purpose of keeping the line open. We estimated that if the line were to be terminated and then reopened in 10 years, DoD would have saved money by waiting, in spite of large restart costs. Plus, in that period of time, it is likely that an entirely new airlifter design could be under serious consideration as a competitor to the C-17.

Lessons Learned

Although each study ended with its own set of specific insights and recommendations, several overarching factors emerged from our findings. The following lessons relate to airlift acquisitions but could be extended to other large military systems.

Competition

Competition forces all manufacturers to provide the most cost-effective aircraft they can, a pressure that would likely be missing if there were no alternative choices. The C-17 COEA provides a good illustration of that. The government actually ended up with the airlifter they were hoping to

buy initially, but at lower cost and with greater capability when competition was introduced.

Comparisons

Instead of comparing airlifters one-on-one, the appropriate comparison should be fleet-on-fleet, and the comparison medium might be mission accomplishment rather than a specific performance factor. This gives all airlifters in the fleet the opportunity to carry what they carry best, allowing for a potentially lower cost *fleet* alternative than would be achieved by a fleet with only one kind of airlifter.

Upgrades

Sometimes upgrades (rather than recapitalization) can be a cost-effective way to improve the airlifter fleet. And sometimes recapitalization is the more cost-effective route. There is no set answer; the answer depends on the details (e.g., service life remaining after upgrades are installed, relative costs of acquiring and maintaining different types of aircraft).

Termination

The point at which DoD should terminate acquisition is informed by the peacetime and wartime airlift requirements as well as affordability considerations. It will be a different answer for any specific sets of cases.

Dr. Greer is an Assistant Director in IDA's System Evaluation Division. He holds a doctorate in chemical physics from the University of Chicago and a BA in chemistry from Vanderbilt University.