Repairing or Replacing Aging Aircraft

How Do Modifications and Depot Capacity Affect the Decision?

The U.S. Air Force operates a number of aging fleets including tankers and cargo aircraft. As these systems age, planners face the difficult decision of whether to spend money repairing and maintaining older aircraft or to face the considerable cost of purchasing new ones. This decision is made more difficult by the possibility that maintenance costs may increase as aircraft grow older. Previous research by RAND Project AIR FORCE (PAF) has helped to clarify the repair-or-replace decision with a mathematical model for determining when the cost of repairing an aging system exceeds the cost of replacing it. More recently, PAF researchers have extended this work in two important directions:

• **Analysts can assess how modifications affect the repair-or-replace decision.** The Air Force must sometimes modify older systems to update equipment such as airframe, avionics, engines, and landing gear. These modifications can be necessary to ensure that older aircraft continue to perform safely and remain effective against evolving threats. Although such modifications can involve high initial costs and temporarily remove aircraft from service, they may reduce maintenance costs and increase the number of hours an aircraft can fly in the long run. PAF’s model can calculate the effect of a proposed modification on the cost per available year of an aging system. Thus, planners can see when it may be optimal either to modify an existing aircraft or to acquire a new one.

• **Analysts can assess the desirability of investing in additional depot-level capacity.** Queuing is a source of considerable delay in depot-level maintenance. As aging aircraft undergo such maintenance, an important question is whether it is worthwhile for the Air Force to invest in extra facilities, repair equipment, labor, and spare parts to reduce or eliminate depot-level queues. PAF has developed a model to assess this question. Interestingly, the model suggests that while an increase in depot-level capacity can be desirable, it does not always delay the optimal retirement age of the aircraft. Rather, the effect can be limited to increasing the operating command’s possession rate while the aircraft is in service.

Researchers have illustrated these techniques using data from the C-5A cargo aircraft. While the findings were strictly notional, they demonstrate the usefulness of these methods for Air Force planners who face important decisions about such systems in the foreseeable future.
This research brief describes work done for RAND Project AIR FORCE documented in Aging Aircraft Repair-Replacement Decisions with Depot-Level Capacity as a Policy Choice Variable by Edward G. Keating, Don Snyder, Matthew Dixon, and Elvira N. Loredo, MG-241-AF (available at www.rand.org/publications/MG/MG241/), 2004, 54 pages, ISBN: 0-8330-3692-0. Copies of this research brief and the complete report on which it is based are available from RAND Distribution Services (phone: 310.451.7002; toll free: 877.584.8642; or email: order@rand.org). The RAND Corporation is a nonprofit research organization providing objective analysis and effective solutions that address the challenges facing the public and private sectors around the world. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. RAND® is a registered trademark.