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TECHNICAL
R E P O R T



Valuing Programmed
Depot Maintenance Speed
An Analysis of F-15 PDM

Edward G. Keating, Elvira N. Loredó

Prepared for the United States Air Force



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Summary

Every day (or hour) that a commercial airline operates an aircraft, it expects to generate a level of profit. Such a profit-per-day metric can then be used to assess the premium an airline would be willing to pay to get an aircraft through depot-level maintenance more quickly.

The U.S. Air Force lacks a profit metric for its aircraft. Yet, it faces cost-benefit calculations in its depot maintenance practices. Would it be worth investing \$50,000 to expedite by a month an aircraft's PDM visit? How about \$500,000?

This report presents a new methodology to calculate the value of expediting PDM. We use the fact that the Air Force has chosen to pay for intermittent PDM visits to estimate a defensible lower bound on what expedited PDM would be worth. We use F-15 data to illustrate our methodology.

The F-15 and Its Programmed Depot Maintenance

The F-15 is an all-weather, extremely maneuverable tactical fighter designed to permit the Air Force to gain and maintain superiority in aerial combat. F-15s receive PDM at the Warner Robins Air Logistics Center at Robins Air Force Base in central Georgia.

F-15s are generally on a six-year PDM cycle, i.e., they return to PDM six years after they leave. We assume that an F-15 stays in the fleet for 30 years, so we expect an aircraft to make four visits to PDM over its lifetime. Over the last six years, WR has produced 100–110 F-15 PDMs annually. In fiscal year (FY) 2005, the average duration of a completed F-15 PDM visit was about 130 days. (See pp. 6–8.)

A Simple Valuation of Expedited PDM

Our model supposes there must be enough net benefit (total benefit above incremental cost) after completion of a PDM visit to justify the cost of PDM. Fiscal year 2005 Air Force Total Ownership Cost system data suggest that a typical F-15 PDM visit during that year cost about \$3.2 million. (See p. 11.)

There are different aircraft valuation curves consistent with a PDM visit being worthwhile. Assuming that net valuation does not increase as an aircraft ages, the most conservative valuation curve (generating the lowest value of expedited PDM) is a horizontal line.

With a horizontal valuation line, we estimate expediting an F-15's last PDM visit by one month would be worth about \$60,000. A horizontal valuation line also implies that it is preferable to expedite an older, rather than newer, aircraft's PDM visit. (See pp. 13–14.)

Valuing F-15 PDM Speed with Declining Aircraft Valuation

We think aircraft tend to be worth less (adjusting for inflation) as they age. As time passes, potential adversaries obtain new technology that may render an aircraft less effective. Additionally, the aircraft may have declining availability and/or rising maintenance costs with age.

Unfortunately, we do not observe aircraft valuation over time. We do, however, observe aircraft mission capability (MC) and full mission capability (FMC) rates. F-15C/D MC and FMC rates increased substantially in the early months of calendar year 2002, but have otherwise undergone a long-term decline. A declining mission capable rate as an aircraft ages is consistent with declining aircraft valuation. Declining mission capability may cause declining valuation or it may be a symptom of declining valuation. (See pp. 15–18.)

We incorporated declining aircraft valuation into our PDM acceleration valuation calculation. With a 1.35-percent annual valuation decline rate (consistent with the observed F-15C/D FMC rate of decline), expediting an F-15's last PDM visit is estimated to be worth at least \$74,366 (up from \$60,639 with constant valuation). More pronouncedly, our estimates of the value of accelerating earlier PDM visits for newer aircraft increase markedly, e.g., accelerating a newer F-15's first PDM visit is worth more than \$180,000. Acceleration values are greater using a 1.7-percent annual valuation decline rate consistent with the observed F-15C/D MC rate of decline. (See pp. 18–22.)

We find it reasonable and intuitive that expediting a newer aircraft's PDM visit is more valuable than expediting an older aircraft's visit.

Robustness Explorations

Previous RAND research (see, for example, Pyles, 2003) has documented aging aircraft effects, such as rising maintenance costs as aircraft age.

Using plausible, though purely illustrative, aging aircraft maintenance cost growth parameters, we repeated our estimation of PDM acceleration valuation.

Incorporation of aging aircraft maintenance cost effects consistently raises our estimated value of PDM acceleration. In particular, when the fourth and final PDM visit is more expensive, aircraft valuation throughout the life cycle must be greater, assuming that undertaking the last PDM visit was appropriate. (See pp. 23–25.)

We also explored an additional constraint that an aircraft's life-cycle net benefits must equal or exceed its life-cycle costs, including acquisition costs.

If aircraft valuation is assumed to be level over an aircraft's life span, imposition of this additional constraint is very important and drives up the implied valuation of expedited PDM markedly. If, however, aircraft valuation is assumed to decline over time, imposing this addi-

tional acquisition cost constraint makes little (1.35-percent valuation decline case) or no (1.7-percent valuation decline case) difference in our estimates of the value of accelerated PDM. (See pp. 26–29.)

We also explored a structure in which aircraft valuation jumps after PDM visits. Such jumps reduce the estimated value of accelerating earlier PDM visits but have no effect on the estimated value of accelerating the last PDM visit. (See pp. 29–31.)