



PROJECT AIR FORCE

- THE ARTS
- CHILD POLICY
- CIVIL JUSTICE
- EDUCATION
- ENERGY AND ENVIRONMENT
- HEALTH AND HEALTH CARE
- INTERNATIONAL AFFAIRS
- NATIONAL SECURITY
- POPULATION AND AGING
- PUBLIC SAFETY
- SCIENCE AND TECHNOLOGY
- SUBSTANCE ABUSE
- TERRORISM AND HOMELAND SECURITY
- TRANSPORTATION AND INFRASTRUCTURE
- WORKFORCE AND WORKPLACE

This PDF document was made available from www.rand.org as a public service of the RAND Corporation.

[Jump down to document](#) ▼

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.

Support RAND

[Purchase this document](#)

[Browse Books & Publications](#)

[Make a charitable contribution](#)

For More Information

Visit RAND at www.rand.org

Explore [RAND Project AIR FORCE](#)

View [document details](#)

Limited Electronic Distribution Rights

This document and trademark(s) contained herein are protected by law as indicated in a notice appearing later in this work. This electronic representation of RAND intellectual property is provided for non-commercial use only. Permission is required from RAND to reproduce, or reuse in another form, any of our research documents for commercial use.

This product is part of the RAND Corporation technical report series. Reports may include research findings on a specific topic that is limited in scope; present discussions of the methodology employed in research; provide literature reviews, survey instruments, modeling exercises, guidelines for practitioners and research professionals, and supporting documentation; or deliver preliminary findings. All RAND reports undergo rigorous peer review to ensure that they meet high standards for research quality and objectivity.

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



RAND PROJECT AIR FORCE

The research described in this report was sponsored by the United States Air Force under Contract FA7014-06-C-0001. Further information may be obtained from the Strategic Planning Division, Directorate of Plans, Hq USAF.

Library of Congress Cataloging-in-Publication Data

Keating, Edward G. (Edward Geoffrey), 1965–
Valuing programmed depot maintenance speed : an analysis of F-15 PDM / Edward G. Keating,
Elvira N. Loredo.
p. cm.
Includes bibliographical references.
ISBN-13: 978-0-8330-3968-2 (pbk. : alk. paper)
1. Eagle (Jet fighter plane)—Maintenance and repair—Costs—Evaluation. I. Loredo, Elvira N. II. Title.

UG1242.F5K43 2006
358.4'383—dc22

2006028059

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.

© Copyright 2006 RAND Corporation

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2006 by the RAND Corporation
1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138
1200 South Hayes Street, Arlington, VA 22202-5050
4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665
RAND URL: <http://www.rand.org/>
To order RAND documents or to obtain additional information, contact
Distribution Services: Telephone: (310) 451-7002;
Fax: (310) 451-6915; Email: order@rand.org

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.)