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.

REPORT

Investment Strategies for Improving Fifth-Generation Fighter Training

John A. Ausink, William W. Taylor,
James H. Bigelow, Kevin Brancato

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 is available for this publication**.**

ISBN: 978-0-8330-5060-1

Published 2011 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

Since 1997, the Air Force has argued that it is increasingly difficult to safely and affordably train CAF aircrews the way they will be required to fight. CCDR requirements are increasing, but reduced force structure stretches the ability of units to support sufficient training. Budget constraints have led to reduced funding for flying hours to the point that they are insufficient to meet RAP training requirements. Safety considerations, increased mission complexity for fifth-generation aircraft, airspace and range restrictions, and real-world commitments limit the amount of training that can be accomplished in live aircraft.[1]

Air Force training experts believe that the increased use of simulators, more widespread and effective use of DMO (the ability to connect simulators and/or aircraft at widely dispersed locations worldwide), and new applications of LVC media are required so that fifth-generation pilots are able to acquire the skills they need and so that training risks can be mitigated. Regarding LVC media, these training experts are particularly interested in increasing the ability to "inject" battlefield effects and simulated or constructive threats into live aircraft systems. Developing a *persistent* (always available) environment in which training participants cannot distinguish among live, simulated, and constructive entities might not only lower costs (by decreasing the amount of training that must be accomplished in live aircraft) but also simplify the coordination and accomplishment of exercises that involve large numbers of participants. Full-mission "rehearsal" will become easier.

The potential benefits of LVC training are accompanied by technological uncertainties in the development of some capabilities, so the Air Force needs to take a careful approach to investing in LVC. It is particularly important for the Air Force to understand what its training needs really are in order to determine whether investments in LVC are necessary (or worthwhile) to fill potential training gaps.

This study uses a variety of data sources to determine whether there are training gaps for fifth-generation fighter aircraft. These sources include a 2008 survey jointly conducted by the U.S. Air Force, Air Combat Command (ACC), and the Warfighter Readiness Research Division of the Air Force Research Laboratory (AFRL); interviews with F-22 pilots and other personnel involved in fighter pilot training; mission essential competencies (MECs) developed for the F-22; and flying hour data for current fighter training. For the following three reasons, we conclude that the evidence for a training gap is strong:

[1] These limits to training in live aircraft were described in Clark, 2009.

1. Inexperienced F-22 pilots are currently accomplishing only six or seven live sorties per month. They are unable to achieve RAP training minimums and are flying excessive "red air" missions.[2]
2. F-22 respondents to the ACC survey (AFRL, 2008) indicate the need for an increase in both live and simulator training, as well as a change in the distribution of mission categories flown.
3. Preliminary MEC analyses show that there are existing and potential gaps between experiences that F-22 pilots need to have and what they are able to receive.

With this evidence for a training gap, we use a linear programming model to examine the potential to redistribute training in order to increase training effectiveness. We start with the assumption that F-22 flying is funded so that RAP minimums (ten aircraft sorties per month, three simulator missions per month[3]) can be accomplished. We then use the model to determine the optimal training distribution between live and simulator sorties if pilots fly at least eight live blue sorties per month (RAP establishes a maximum of two red-air sorties per month). This information is used to establish a framework to compare the costs of ensuring that the minimum of eight blue sorties can be flown. Our conclusion is that, in the long run, development of the LVC ability to inject simulated and constructive threats into live aircraft may be the only fiscally responsible approach to improving training. However, the technological uncertainty that remains in developing this capability requires a careful investment approach.

Conclusions

One of our major findings is that fully documented training requirements for realistic training scenarios are extremely scarce in RAP and other training documentation. The Realistic Training Review Boards that are conducted regularly to address these issues are reluctant to document specific training requirements that cannot be accomplished in the normal course of events because this could ensure that large numbers of aircrew members would have to be decertified from combat mission status when the difficult-to-complete training events were not accomplished. However, if the Air Force does not articulate its training needs more effectively, resources that are essential for effective operational training could be lost.

Our determination of the existence of a training gap for fifth-generation fighters and our analysis of costs associated with the development of improved LVC training capabilities leads us to the following conclusions:

1. The Air Force needs to ensure that funding for the F-35 mission training center (MTC) is sufficient to make it DMO capable. Unless the F-35 MTC can connect to the Dis-

[2] These are missions in which the pilots play the role of an adversary. "Red air" adversaries are an important component for almost all air-to-air (as well as some tactical surface attack) training missions, but flying as an adversary provides less training than flying a "blue" (U.S. and allied forces) training sortie.

[3] At the time the model was developed, 60 simulator missions were required over a 20-month period for the F-22 (see HQ ACC, 2008). In October 2009, this requirement was changed to 26 simulator sorties over a 12-month period for slightly more than two simulator sorties per month.

tributed Mission Operations Network (DMON), there is little chance that the benefits of virtual and constructive training can be fully realized.
2. The Air Force needs to maintain investments in threat-generation capabilities to make sure that they remain concurrent with existing aircraft and integrated air defense system threats. Expansion of the Distributed Training Operations Center (DTOC) or the development of a DTOC-like facility elsewhere will be crucial for the maintenance of an Air Combat Simulator–like capability for the F-22 and F-35.
3. Funding for the DMON must be maintained. The network is already used successfully for training—most notably by the DTOC, but also for Virtual Flag exercises—and a networking capability is an important component of any persistent virtual training capability.
4. Continued investments in developing solutions to various multilevel security and cross-domain solution problems must be made in order to enable the MTCs at different locations to participate in training and to allow connections with other organizations for joint and combined virtual exercises.
5. The F-35 has the capability to accept an embedded-threat module, and it can also accommodate a "P5 pod," which allows some types of simulated training in the aircraft.[4] Both of these capabilities are first steps in the ability to inject virtual and constructive threats into aircraft systems, so they should be funded if possible.

Investments in these areas alone will improve fifth-generation fighter training. The potential is high that injecting battlefield effects and virtual and constructive threats into live aircraft will yield even greater improvements. However, because of the technological uncertainties related to this capability, the best way to proceed is to maintain targeted, relatively small investments in injection development. Only when technological uncertainties are resolved should larger investments be made.

[4] The pod is part of the fifth-generation P5 Combat Training System/Tactical Combat Training System designed by Cubic Corporation. (See Shamim, 2007.)