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REPORT
NO. 92-002

October 9, 1991

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE (FORCE MANAGEMENT AND PERSONNEL)

SUBJECT: Audit Report on the Operation and Modification of Flight Simulator Training Devices (Project No. 0FC-0011)

Introduction

This is our final report on the operation and modification of flight simulator training devices, provided for your information and use. The objectives of the audit were to determine if flight simulator training devices were modified in a timely and effective manner that satisfied requirements for the training of aircrews. We also evaluated internal controls applicable to the modification of flight simulator training devices. The audit was performed from November 1989 to December 1990 and was initiated because of a previously reported condition that tactical flight simulators were not fully compatible with the aircraft they simulated.

Scope of Audit

The Military Departments operate about 800 complex flight simulators worldwide. We could not determine the total value of these simulators because of their ages and the unknown cost of previous modifications. However, the 63 flight simulators included in our audit had an acquisition cost of about $1.1 billion. We reviewed in detail the available modification documents for these flight simulators and the associated aircraft. Enclosure 1 lists the activities visited or contacted during the audit.

This program audit was made in accordance with auditing standards issued by the Comptroller General of the United States as implemented by the Inspector General, DoD, and accordingly included such tests of internal controls as were considered necessary.

Internal Controls

This audit and reviews by the Services showed that in the past, controls were not in place to ensure that flight simulator training devices were modified concurrently with changes in aircraft. As a result, training of aircrews could have been

adversely affected. We found that the Services recognize this problem and continue to address it.

Background

Flight simulators are hardware and software designed to demonstrate a concept or simulate an operational environment for training purposes. They instill habits and decrease reaction time to a given situation and imitate the functional and physical characteristics of operational aircraft.

Activities periodically evaluate the usefulness of their flight simulators. The Services use the results of these evaluations to improve training curriculums and ensure that flight simulators meet the training requirements of using commands.

Flight simulators are required to be designed and developed as part of operational weapon systems. DoD Directive 1430.13, "Training Simulators and Devices," April 22, 1986, requires concurrent development of weapon systems and training systems. DoD Directive 5000.53, "Manpower, Personnel, Training, and Safety (MPTS) in the Defense System Acquisition Process," December 30, 1988, states that DoD policy is to enhance the operational suitability and effectiveness of initial procurements and modifications of all systems, including simulators.

Prior Audit Coverage

The Naval Audit Service issued Report No. 021-S-89, "Multilocation Audit of Requirements Determination, Utilization, and Effectiveness for Training Devices," January 18, 1989. This audit found that the Chief of Naval Operations had not established goals and standards for the use of flight simulators and that utilization data had been improperly collected and reported. Also, improper procedures were used to project new requirements for aviation simulators. Use of improper procedures resulted in the procurement of incorrect quantities. In addition, the Chief of Naval Operations had not developed procedures for certifying the use of aviation training devices as a substitute for actual flight time. The Naval Audit Service considered management's responses adequate.

Discussion

Our audit determined that flight simulators were not modified concurrently with changes to operational aircraft. This condition occurred because modifications to simulators and modifications to operational aircraft were not funded early or simultaneously. We also found that the Services were not

evaluating the effectiveness of training. Therefore, the Services were not able to identify deficiencies in simulators and assess the overall effectiveness of these devices.

Modifications to Flight Simulators. Flight simulators were not being modified concurrently with aircraft modifications because needed modifications were not identified promptly. Also, funding was not designated or available early in the modification process.

Comprehensive documentation was not always available to determine how long modifications to simulators lagged behind modifications to the operational aircraft they were designed to represent. Ideally, improvements to simulators should have been developed in parallel with aircraft to ensure that new training capabilities were available. Specific examples of outdated simulator configurations are discussed below:

o F-15E Simulator - The Air Force used two F-15E weapon system trainers. There were significant differences in the operational flight program software in the aircraft and the simulators. This affected the air-to-air and air-to-ground radars, and the targeting and navigation capabilities of the simulator.

o F-14A Simulator - The Navy had four operational flight trainers and two weapon system trainers to support training on the F-14 aircraft. Because updated computer software was scheduled to be installed up to 2 years late, shortfalls existed in simulations of electronic warfare, full weapon systems threat modeling, and simulations of the pod system for tactical air reconnaissance.

o SH-2 and SH-60 Simulators - The Navy's inventory included weapon systems and operational flight trainers. The simulators were deficient in acoustic training capabilities and had discrepancies in flight fidelity (the ability to represent aircraft performance, characteristics, and environment) and autorotation. The SH-2 weapon system trainers had such poor visual cues that they were used only as procedural trainers.

Funding for Modifications of Flight Simulators. Modifications to training systems and aircraft generally had not been funded together. For example, the Navy funded $4.6 million of the $14.9 million needed to upgrade the SH-2 weapon system trainer. The Air Force's unfunded requirements for the F-15E weapon system trainer totaled $143 million for engineering changes, software support, and visual systems.

DoD Directive 5000.53 requires the Services to review the

funding for training simulators and address the impact of any shortfalls. We could not find any documentation to show that the Services complied with this requirement.

Training Evaluations. Training evaluations are used to assess the effectiveness of flight simulators and to determine if simulators provide useful training in specific tasks. Evaluations are a method of documenting deficiencies in the design of flight simulators when these deficiencies limit or prevent effective training. The Services did not always evaluate training as required by DoD and Service guidance, and could not uniformly show that simulators satisfied the training objectives of the using commands.

We found examples of flight simulator configurations that were outdated compared to actual aircraft. However, we could not determine how this affected the Services' ability to train aircrews.

Failure to perform training evaluations decreases the Services' ability to assess the performance of flight simulators. The lack of training evaluations, simulator certifications, and quality reviews means that the Services cannot confirm that simulators will be modified in the future. This deficiency will also limit the Services' ability to recommend modifications to simulators in the future.

To compensate for improperly configured flight simulators, the Services often used alternative methods to train pilots. Flight hours and increased student/instructor interaction were used to make up shortfalls in flight simulators.

Conclusion

The Services have documented the fact that flight simulators and aircraft have not been modified concurrently. An internal Navy report acknowledged deficiencies in this area, and recommended parallel funding and the establishment of an effective process for evaluating simulators. In FY 1984, a General Officer Simulator Broad Area Review by the Air Force addressed the problem of simulators that were not modified concurrently with the aircraft they supported. The review identified several problems: conflicts in training priorities, noncompliance with Air Force policy for flight simulators, and late funding. Recommendations included early and protected funding for simulators, timely direction of the simulator program, better definition of requirements, and ensuring that simulator modifications receive the same priority as aircraft modifications. In addition, an Air Force Inspector General Report issued in December 1990 described the adverse operational

impact and additional costs incurred when modifications to flight simulators and aircraft are not funded and installed concurrently.

Since the Services have recognized and continue to address the major problems with flight simulators, no recommendations were made in our report.

Management Comments

We provided a draft of this report to the addressee on June 28, 1991. Because there were no recommendations, no comments were required from management, and none were received. Therefore, we are publishing this report in final form. Copies will be distributed to the activities listed at Enclosure 3.

The courtesies extended to the audit staff (listed at Enclosure 2) are appreciated. If you have any questions about this audit, please contact Mr. James G. McGuire at (804) 766-9108 or Mr. Timothy J. Tonkovic at (804) 766-3319. We will give you a formal briefing on the results of the audit within 15 days of the date of this memorandum, should you desire it.

Robert J. Lieberman

Robert J. Lieberman
Assistant Inspector General
for Auditing

Enclosure

cc:

Comptroller of the Department of Defense
Assistant Secretary of the Army (Financial Management)
Assistant Secretary of the Navy (Financial Management)
Assistant Secretary of the Air Force (Financial
Management and Comptroller)

ACTIVITIES VISITED OR CONTACTED

Office of the Secretary of Defense

Assistant Secretary of Defense (Force Management and Personnel), Washington, DC

Department of the Army

Deputy Chief of Staff for Operations and Plans, Washington, DC
U.S. Army Materiel Command, Alexandria, VA
U.S. Army Training and Doctrine Command, Fort Monroe, VA
U.S. Army Aviation Center, Fort Rucker, AL
Project Manager for Training Devices, U.S. Army Materiel Command, Orlando, FL
U.S. Army Aviation Systems Command, St. Louis, MO
Headquarters III Corps, Fort Hood, TX

Department of the Navy

Assistant Chief of Naval Operations (Air Warfare), Arlington, VA
Commander in Chief, U.S. Atlantic Fleet, Norfolk, VA
Naval Air Systems Command, Arlington, VA
Commander Naval Air Force, U. S. Atlantic Fleet, Norfolk, VA
Naval Training Systems Center, Orlando, FL
Naval Training Systems Center, Atlantic Region, Portsmouth, VA
Fighter Wing One, Oceana Naval Air Station, Virginia Beach, VA

Department of the Air Force

Office of the Deputy Chief of Staff, Plans and Operations, Washington, DC
Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH
Tactical Air Command, Langley Air Force Base, VA
Ogden Air Logistics Center, Hill Air Force Base, UT
Air Force Inspection and Safety Center, Norton Air Force Base, CA
832nd Air Division, Luke Air Force Base, AZ
Tactical Air Warfare Center Detachment, Luke Air Force Base, AZ

Non-DoD Federal Organizations

U.S. General Accounting Office, Washington, DC

Non-Government Activities

Information Spectrum, Inc., Falls Church, VA
Advanced Engineering & Planning Corporation, Inc., St. Louis, MO

AUDIT TEAM MEMBERS

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Congressional Committees:

Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
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