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Managing Weapon System Software: Progress and Problems (Unclassified Digest of a Classified Report). FSAD-78-112; B-163058. July 10, 1978.

Report to the Congress; by Elmer B. Staats, Comptroller General.

Contact: Procurement and Systems Acquisition Div.
Budget Function: National Defense: Weapon Systems (057).
Organization Concerned: Department of Defense; Department of the Army; Department of the Navy; Department of the Air Force.
Congressional Relevance: Congress.

The Department of Defense (DOD) estimates that it spends over $3 billion annually for weapon system software, and the cost is steadily rising. However, software performance has often been unreliable because of serious technical and management problems with the way it is designed, developed, tested, and maintained. These problems increase weapon system life-cycle cost, extend development schedules, and degrade mission performance. Findings/Conclusions: Due to the lack of visibility in the acquisition process, software management is not given the same emphasis as hardware even though software is critical to operational performance of the major weapon systems. Recommendations: The Secretary of Defense should require the Defense Systems Acquisitions Review Council to include software management plans and issues at weapon system project review meetings, giving special consideration to plans for testing and evaluating software before approving systems for development and to the adequacy of software for system mission performance, reliability, and maintainability before approving systems for production; provide specific actions for improving test and evaluation and life-cycle maintenance of system software programs; and insure that when operational testing discloses major software discrepancies on systems approved for production, the services earmark funds for corrective actions within a reasonable time. The Congress should consider the following issues when reviewing the relevant system during DOD appropriation hearings: the Army did not perform complete operational testing of the Tactical Fire Direction System software before procuring the system; the Navy does not plan satisfactory software testing for the Light Airborne Multipurpose System Mark III before the production decision is made; and limited funding has hampered efforts to correct problems and test changes in S-3A fleet-issue software problems. (Author/SC)

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COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

MANAGING WEAPON SYSTEM SOFTWARE: PROGRESS AND PROBLEMS

D I G E S T

Software is a combination of computer programs and computer data, enabling computer equipment to perform various computational or control functions. Modern weapon systems use computers and associated software to perform functions critical to strategic and tactical missions. (See p. 1.)

The current U.S. lead in computer technology is an important factor that enables us to deploy highly complex weapon systems. This lead can serve to overcome the numerical advantage of enemy forces. (See p. 1.)

The Department of Defense estimates that it spends over $3 billion annually for weapon system software, and the cost is steadily rising. However, software performance has often been unreliable because of serious technical and management problems with the way it is designed, developed, tested and maintained. These problems increase weapon system life cycle cost, extend development schedules, and, most importantly, degrade mission performance. (See pp. 1 and 6.)

Due to the lack of visibility in the acquisition process, software management is not given the same emphasis as hardware, even though software is critical to operational performance of the major weapon systems. (See pp. 7 and 8.)

GAO reviewed software management for nine selected major weapon systems with a total estimated acquisition cost exceeding $44 billion. GAO found:

--Defense System Acquisition Council reviews of weapon system development do not consistently address software issues. (See p. 7.)

--The decision coordinating paper, the management document used to support the review and decisionmaking process, does not always include cost, schedule, or technical information relating to software. (See p. 8.)

--Information on software was not provided to the Congress in selected acquisition reports for four of the nine weapon systems reviewed. (See p. 9.)

--The Office of the Secretary of Defense has recognized the need and developed guidance to improve software management practices, but it did not emphasize software testing or the management of software changes after systems are deployed. (See p. 23.)

--There are no standard Office of the Secretary of Defense procedures for orderly software testing, and practices vary among programs and even within a single service. (See pp. 12 and 13.)

--There are no Defense-wide performance criteria to measure software quality and to establish a basis for acceptance. (See pp. 13 and 14.)

--Operational testing of software before production and deployment was not performed or completed on four systems reviewed. (See pp. 14 to 16.)

--Funds are either decreased or eliminated for software testing because of cost increases in other program areas. (See p. 16.)

--Independent verification of software design and coding in three systems was not planned before full system integration and testing. (See p. 17.)

--Testing of system software in three of nine cases did not include interoperability testing with those systems that have a technical

interface in order to assess the combined operational performance of the systems. (See pp. 18 and 19.)

--Test and diagnostic software requirements are reduced to cut program costs when other program areas experience a cost increase. (See pp. 19 and 20.)

GAO recommends that the Secretary of Defense:

--Require the Defense Systems Acquisition Review Council to include software management plans and issues at weapon system project review meetings, giving special consideration to (1) plans for testing and evaluating software before approving systems for development and (2) adequacy of software for system mission performance, reliability, and maintainability before approving systems for production.

--Provide specific actions for improving test and evaluation and life cycle maintenance of system software programs. Also, formulate policies and procedures which specifically prescribe how weapon system software should be tested during system development and life cycle maintenance.

--Insure that when operational testing discloses major software discrepancies on systems approved for production, the services earmark funds for corrective actions within a reasonable time. Funding requests should be supported by a detailed plan for implementing and testing the changes. The Secretary of Defense should review the status of software corrective actions before approving production of additional quantities of a system.

GAO's review of nine weapon systems disclosed several system-related issues which the Congress should consider when reviewing these systems during the Department of Defense appropriation hearings:

--The Army did not perform complete operational testing of the Tactical Fire Direction System software before procuring the system. (See p. 15.)

--The Navy does not plan satisfactory software testing for the Light Airborne Multipurpose System Mark III before the production decision is made. (See p. 19.)

--Limited funding has hampered efforts to correct problems and test changes in S-3A fleet-issued software programs. (See p. 24.)

--The Air Force has not completed development of software to be used for diagnosing and isolating malfunctions on the Airborne Warning and Control System. Therefore, operational testers were unable to evaluate system reliability and maintainability. (See p. 20.)

The Department of Defense generally agrees with GAO's conclusions and recommendations For example, test and evaluation procedures have been revised to include software consideration. However, Defense does not agree with GAO's findings regarding the specific system-related issues for the Army's Tactical Fire Direction System and the Navy's Light Airborne Multipurpose System Mark III. Its comments and GAO's evaluation on these are incorporated in the report where appropriate. (See pp. 15, 18, and 19.)