



UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

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PROCUREMENT AND SYSTEMS
ACQUISITION DIVISION

B-163058

JUNE 25, 1979

The Honorable Harold Brown
The Secretary of Defense

Attention: Assistant for Audit Reports
Room 3A336
ASD (Comptroller)

Dear Mr. Secretary:

During calendar year 1978, we reviewed (and individually reported on) the military services' development test and evaluation (DT&E) of six weapon systems totaling an estimated \$12 billion in development and procurement costs. (See enc. I.) This letter brings to your attention problems that, in our opinion, are common to all programs reviewed and require your attention for their resolution.

In general, our review showed that as the design and development phase progressed, the six programs experienced cost growth, schedule slippages, and performance degradation problems. To offset some of the increased cost and schedule slippages, the agencies responsible for developing the systems, without formally assessing risks and benefits, (1) reduced the scope of (and hardware for) DT&E during critical system and subsystem tests, (2) advanced programs into operational testing and production before the completion of DT&E on the basis that problems noted could be better handled later in the acquisition cycle, and (3) approved concurrent production and development.

In five of the six programs, planned tests resolving technical uncertainties affecting mission success (battle outcomes) either were reduced or not performed without any formal or clear assessment of the risks involved. Also, final test reports either were not available or did not state the critical issues to be resolved before a given stage of development could be considered successfully demonstrated or completed.

Peter Robert

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In one of the five programs, the Air Force conducted joint development and initial operational test and evaluation (DT&E/IOT&E). By joining the two different classes of tests, the system was allowed to advance into IOT&E before problems noted during DT&E could be analyzed and corrected. As a result, much of the IOT&E was spent rediscovering design and technical dissatisfaction that should have been corrected during the earlier development tests. In addition, because some DT&E testing had been deleted, new technical flaws were uncovered that should have been discovered earlier. Our November 6, 1978, report concluded that neither class of testing accomplished its objectives.

In the sixth program, the Department of Defense's (DOD's) decision to produce MK-12A reentry vehicles for operational deployment was made in December 1976, before completing the design and initiating the development flight test program. According to Air Force officials, the program involved low technical risks and concurrent development and production was justified because the concurrency permitted a less disruptive transition from development to production. No formal assessment of either risks or benefits had been made.

In summary, actions reducing or limiting DT&E before production in the five programs, similar to concurrent development and production in the sixth program, could result in the systems entering production before their performance capabilities become known. On other programs in the past this has proven to be an unsatisfactory procedure because it usually resulted in producing systems with degraded performance or incurring substantial additional costs to bring the systems to their required performance levels. In the early 1970s, DOD initiated its fly-before-buy policies specifically for avoiding problems resulting from starting production before completing development. In 1972, the then Deputy Secretary of Defense, David Packard, observed:

"There has been real waste of both time and money in almost every program in which production was started before development and testing was complete. That includes almost every program."

We recognize the problems of cost growth and schedule slippages. We believe, however, that actions to reduce development time and costs by (1) eliminating or reducing development tests of systems and subsystems, (2) joining

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DT&E with IOT&Es in support of production decisions, and (3) undertaking concurrent development and production should be based on a clear assessment of the risks involved in achieving required performance. The assessments should identify sensitive elements and parameters, as well as any high risk areas, that should then be closely monitored.

The need to assess risks as well as benefits of reduced development time and costs when shortcutting the development testing phase is discussed below.

BACKGROUND

According to the 1972 Report of the Commission on Government Procurement, the two main reasons for inadequate testing are that (1) testing is expensive, difficult to stage and execute, and time consuming, and (2) advocates of major systems believe that negative test results at any stage can jeopardize a program or cause unnecessary problems and delays. The report further stated that to overcome the lack of incentive for adequate testing by system advocates, clear direction must be given that defines the type and expected results of various classes of testing. It concluded that possibly the only way such direction can be implemented is to develop a strong testing activity that will insist on doing its job.

In 1973, DOD issued a policy directive on testing that defined the types and expected results of various classes of testing. In general, DT&E was defined as part of the repetitive development process of design, test, evaluate, and redesign that continues until technical uncertainties and reliability problems are resolved. When the DOD policy directive is followed, the developmental testing process is capable of disclosing problems and acquisition risks before production and, by verifying solutions to the problems, reducing the risks when options for doing so are greater and costs are less.

NEED FOR ASSESSING RISKS WHEN REDUCING DEVELOPMENT TESTING

The developing agencies frequently deleted, reduced, or substituted planned development tests without any clear assessment of the risks involved. Their actions usually affected system and subsystem tests coming late in the development phase. Also, test reports often were untimely

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or unavailable or did not clearly state the critical issues yet to be resolved before a given stage of development could be considered successfully completed.

The military services attributed their actions to limit and reduce development testing to their need to reduce costs and schedule slippages.

For example, because of cost and schedule constraints, the Air Force reduced its plan to test simultaneously two development prototype EF-111A aircraft. To conserve time and limit development cost growth, one prototype was fitted with a redesigned vertical stabilizer to test air worthiness, but no electronic subsystems, and the second was equipped with the electronic subsystems to test electronic performance and capability, but no redesigned stabilizer. Those actions precluded the testing of one complete EF-111A prototype and eliminated the opportunity to evaluate the electronic compatibility and performance of two EF-111A's operating together.

Because of program cost increases, the Army reduced the number of Stinger missiles (from 159 to 90) to be tested during prototype qualification tests. Deleted tests were to provide data on system safety, reliability, and performance at the system's upper- and lower-performance boundaries. Subsequent test results showed that certain problems were still unresolved, although full production was authorized.

To reduce costs and avoid a 1-year schedule delay, the Army substituted limited lab testing for planned arctic and tropic testing in the Patriot program. The Army development test agency took exception to the substitutions on the basis that the substitutions were inadequate. The Army also reduced the number of missiles (from 115 to 80) to be tested during the engineering development phase, and deleted extensive developmental and operational flight tests scheduled to follow a limited production decision. As a result of the above substitutions, reductions, and deletions, the Army accelerated the full-scale production decision date by 3 years--from April 1983 to April 1980. The accelerated program assumes a high degree of success for the remaining tests and will not resolve several important technical and operational uncertainties, including the system's effectiveness against the revised threat estimate.

To stay within its \$276 million cost ceiling, the Army reduced its planned missile firings from 146 to 60 in the Roland program. Current test plans for the Roland system provide limited flight testing against maneuvering targets, electronic countermeasures, and other important performance requirements.

Army representatives responsible for operational testing stated that weapon system schedules are generally rigidly structured, and slippages during development testing are not permitted to result in comparable slippages in initial deployment dates. As a result, time allowed for developmental and operational testing is compressed. The Army representatives thought the time factor was probably the greatest problem in conducting adequate testing prior to production.

Need to assess risks when combining
development with operational testing

Reducing acquisition time and, consequently, costs is evident in DOD's revised Directive No. 5000.3, dated April 11, 1978. The directive states that DT&E and IOT&E may be combined where clearly identified and significant cost/time benefits would result or where separate testing would result in unacceptable program delays or costs.

Of the six systems reviewed, only the Air Force EF-111A program had scheduled joint development and operational tests. No assessment of the cost/time benefits or the additional risks had been made.

In the latter part of 1977, the Air Force transferred its EF-111A prototype equipped with the electronic subsystems to the Western Test Range to commence joint DT&E/IOT&E although results of the Government-conducted DT&E at the Eglin Test Facility were not then available. The DT&E flight crew reports at Eglin had (1) noted numerous hardware and man-machine interface problems and (2) questioned the effectiveness of two major avionics subsystems and the readiness of one subsystem to begin operational testing. The joint testing allowed no slack time between development testing, at either Eglin or the Western Test Range, and operational testing for resolving many of those inevitable problems arising in any development program. As a result, operational testing at the Western Test Range rediscovered design and technical flaws that should have been corrected prior to commencing IOT&E to support a production decision. Our November 6, 1978, report on the EF-111A joint DT&E/IOT&E concluded that the system's development was incomplete and its operational effectiveness and suitability had not been demonstrated.

In February 1979, DOD approved limited production of six EF-111A tactical jamming aircraft and a 12-month development program to correct and demonstrate fixes to certain technical/design deficiencies affecting operational suitability identified during operational testing. The 12-month development effort is to be completed before the full-scale production release decision is made.

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Formal risk and benefit assessment
to support concurrency needed

The Secretary of Defense approved production of the MK-12A reentry vehicle in December 1976, before completing the system's design and initiating development flight tests. The Air Force justified the concurrency between development and production on the basis that it involved low technical risks, and that concurrency would provide a smoother transition from one to the other while reducing the acquisition timespan. The Air Force did not make a formal assessment of the risks or benefits to be derived at the time of the decision.

Even without major technical difficulties, minor changes in a variety of components, each relatively small in cost, can have a huge total cost impact, especially after starting production. Engineering design problems have arisen in the MK-12A program and, as with any complex development program, more can be expected as the development and evaluation process continues.

When we ended our field review in June 1978, only 5 of 10 development flight tests had been completed. The last three flight tests had no final test reports, and a number of corrections/modifications had still to be flight tested.

In 1978, we reported on the significant technical risks present during the 1976 production decision and on the need for continuing flight tests to fully evaluate the risks. The technical risks arise from a combination of a new miniaturized arming and fuzing system, high reliability requirements, and the extreme flight stress that a ballistic reentry vehicle is subjected to.

In reply to our letter, DOD stated in January 1979, that:

"* * * The tests which remain are essentially repeats of previous ones and confidence is high for a favorable outcome. Delaying production for another six months to allow completion of testing would cost in the neighborhood of \$30 M (million). Based on current development status and production readiness activity, the ongoing concurrency between test and development is an appropriate response to the occasionally conflicting requirement to reduce cost and risk."

Procurement history over the past 20 years shows the need to formally and fully assess the risks and benefits to be derived before concurrent development and production decisions are made. Because concurrency has resulted in costly retrofits or degraded performance, greater accountability and caution is required.

CONCLUSIONS AND RECOMMENDATIONS

One of the primary findings in the 1972 Report of the Commission on Government Procurement was that too much was committed on individual major system development and production before ideas, needs, designs, and hardware were tested and evaluated. The study attributed the inadequate testing mainly to the fact that testing is expensive and time consuming and the developers' belief that negative test results can jeopardize their programs or cause unnecessary problems and delays. The systems that we reviewed appear to be going down the same path with the same probable results.

In our opinion, history has repeatedly shown that shortcutting development testing without thoroughly assessing the risks involved and without providing schedule or funding reserves commensurate with the risks, usually results either in weapon systems that provide degraded capabilities or require costly retrofits to achieve the necessary capabilities.

We, therefore, recommend that you:

- Require that DT&E reports identify any deleted, reduced, or substituted tests and provide a clear statement of the risks associated with these actions as well as their implications on achieving the technical requirements affecting operational measures of effectiveness.
- Require that test plans show the additional risks of joint DT&E/IOT&E test schedules and allow time to correct technical deficiencies discovered during DT&E before commencing IOT&E to support a production decision.
- Require formal assessment of risks and benefits before concurrent development and production is approved.
- Require developers to closely monitor sensitive system elements and parameters, as well as any high

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risk areas, and provide schedule and funding reserves to resolve problems as they are identified.


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We are sending copies of this report to the Director, Office of Management and Budget; the chairmen of the Senate and House Committees on Appropriations and Armed Services, House Committee on Government Operations, and Senate Committee on Governmental Affairs; and the Secretaries of the Air Force, Army, and Navy.

Section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We would appreciate receiving your comments on these matters when they are submitted to the congressional committees.

Sincerely yours,



J. H. Stolarow
Director

Enclosure

ENCLOSURE

ENCLOSURE

GAO REPORTS ISSUED ON SYSTEMS
REVIEWED DURING CALENDAR YEAR 1978

<u>System designation</u>	<u>Report</u>	<u>PSAD no.</u>	<u>Issuance date</u>
Patriot	Status of the Army's Patriot Air Defense System	78-15	Mar. 10, 1978
Roland	Issues To Be Resolved Before Committing the Army's Roland Missile System to Production	78-16	Mar. 10, 1978
Stinger	Status of the Army's Stinger Surface-to-Air Missile Program	78-20	Mar. 15, 1978
EF-111A	Status of the Air Force's EF-111A Tactical Jamming System	78-32	Mar. 23, 1978
EF-111A	Assessment of Testing of EF-111A Tactical Jamming System	78-130	June 30, 1978
Roland	Status of the Roland Missile Program	78-128	July 18, 1978
VLAD	Assessment of Testing Vertical Line Array DIFAR Sonobuoy AN/SSQ-77	78-120	Aug. 18, 1978
MK-12A	Letter report on concurrent development and production	79-2	Oct. 23, 1978
EF-111A	Assessment of Joint DT&E/IOT&E Results on EF-111A Tactical Jamming System	79-5	Nov. 6, 1978