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Report to the Chairman, Subcommittee on Military Research and Development, Committee on National Security, House of Representatives

October 1998

DEFENSE ACQUISITION

Advanced Concept Technology Demonstration Program Can Be Improved

GAO/NSIAD-99-4

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-278429

October 15, 1998

The Honorable Curt Weldon
Chairman, Subcommittee on Military
Research and Development
Committee on National Security
House of Representatives

Dear Mr. Chairman:

The Advanced Concept Technology Demonstration (ACTD) program was initiated by the Department of Defense (DOD) to determine the extent to which a given mature technology will improve military capabilities before entering the normal acquisition process and, by using mature technology, reduce the length of time to develop and acquire weapon systems. According to the ACTD program documentation, the ACTD program was established in 1994 in response to recommendations of the 1986 Packard Commission[1] and a 1991 Defense Science Board study.[2] The Packard Commission concluded that major improvements could be made in defense acquisition by emulating the practices of successful commercial companies. Accordingly, the Commission recommended, among other things, building and testing prototypes to assess military utility and provide a basis for realistic cost estimates before committing to acquisition. The Defense Science Board's study discussed the need for early dialogue between the potential system's user and producer for a proper analysis of cost, risk, and operational capability.

ACTDs have been the subject of congressional interest since the program's inception. Congressional committees have expressed concerns about the validity of several technologies selected for the ACTD program and the number of assets procured for the projects. At your request, we assessed the current ACTD program. Specifically, we determined whether (1) the selection process includes criteria that are adequate to ensure that only mature technologies are selected for ACTD prototypes and (2) guidance on transitioning to the normal acquisition process ensures that a prototype appropriately completes product and concept development and testing before entering production. Finally, we assessed DOD's current practice of

[1]The Packard Commission was created by former President Reagan in 1985 to review the defense acquisition system to determine how military acquisitions could be made quicker and at lower costs.

[2]Report of the Defense Science Board, 1991 Summer Study on Weapon Development and Production Technology, November 1991.

procuring more ACTD prototypes than needed to assess the military utility of a mature technology.

Background

Through fiscal year 1998, about $172 million has been allocated to the ACTD program and 48 projects have been approved. DOD's budget request for fiscal year 1999 for the ACTD program is $116.4 million. An additional 10 to 15 projects are expected to be funded in fiscal year 1999.

Under the current ACTD program, DOD builds prototypes to assess the military utility of mature technologies, which are used to reduce or avoid the time and effort usually devoted to technology development. Demonstrations that assess a prototype's military utility are structured to be completed within 2 to 4 years and require the participation of field users (war fighters).

ACTD projects are not acquisition programs. The ACTD program seeks to provide the war fighter with the opportunity to assess a prototype's capability in realistic operational scenarios. From this demonstration, the war fighter can refine operational requirements, develop an initial concept of operation, and make a determination of the military utility of the technology before DOD decides whether the technology should enter into the normal acquisition process.

Not all projects will be selected for transition into the normal acquisition process. The user can conclude that the technology (1) does not have sufficient military utility and that acquisition is not warranted or (2) has sufficient utility but that additional procurement is not necessary. Of the 11 ACTD projects completed as of August 1998, 2 were found to have insufficient utility to proceed further, 8 were found to have military utility but no further procurement was found to be needed at the time,[3] and 1 was found to have utility and has transitioned to the normal acquisition process.

ACTD funding is to be used to procure enough prototypes to conduct the basic demonstration of military utility. At the conclusion of the basic demonstration, ACTD projects are expected to provide a residual operational capability for the war fighter. Under the current practice, ACTD funding is also to be available to support continued use of ACTD prototypes that have military utility for a 2-year, post-demonstration period. The

[3]Three of the projects in this category are primarily software, for which production would not be appropriate.

2 years of funding is to support continued use by an operational unit and provide the time needed to separately budget for the acquisition of additional systems. Further, if the ACTD prototypes—such as missiles—will be consumed during the basic demonstration, additional prototypes are to be procured.

As stated in the ACTD guidance, a key to successfully exploiting the results of the demonstration is to enter the appropriate phase of acquisition without loss of momentum. ACTDs are intended to shorten the acquisition cycle by reducing or eliminating technology development and maturation activities during the normal acquisition process. Further, DOD can concentrate more on technology integration and demonstration activities. Time and effort usually devoted to technology development can be significantly reduced or avoided and the subsequent acquisition process reduced accordingly, if the project is deemed to have sufficient military utility.

ACTD candidates are nominated from a variety of sources within the defense community, including the Commanders in Chief, the Joint Chiefs of Staff, the Office of the Secretary of Defense agencies, the services, and the research and development laboratories. The candidates are then reviewed and assessed by staff from the Office of the Deputy Under Secretary of Defense (Advanced Technology). After this initial screening, the remaining candidates are further assessed by a panel of technology experts. The best candidates are then submitted to the Joint Requirements Oversight Council, which assesses their priority. The final determination of the candidates to be funded is made within the Office of the Deputy Under Secretary of Defense (Advanced Technology), with final approval by the Under Secretary of Defense (Acquisition and Technology).

Results in Brief

Through the determination of military value of mature technologies and their use in the acquisition process, ACTDs have the potential to reduce the time to develop and acquire weapon systems. However, several aspects of the ACTD program can be improved.

DOD's process for selecting ACTD candidates does not include adequate criteria for assessing the maturity of the proposed technology and has resulted in the approval of ACTD projects that included immature technology. DOD has improved its guidance on the maturity of the technologies to be used in ACTD projects but the revised guidance describes several types of exceptions under which immature technologies

may be used. Where DOD approves immature technologies as ACTD program candidates and time is spent conducting developmental activities, the goal of reduced acquisition cycle time will not be realized.

Further, guidance on entering technologies into the normal acquisition process is not sufficient to ensure that a prototype completes product and concept development and testing before entering production. According to the ACTD guidance, if the prototype is found to have military utility, ACTD can directly enter production. The guidance does not mention the circumstances when transition to development may be appropriate or the kinds of developmental activities that may be appropriate. While commercial items that do not require any further development could proceed directly to production, many ACTDs may still need to enter the engineering and manufacturing development phase to proceed with product and concept development and testing before production begins. Through the ACTD early user demonstration, DOD is expected to obtain more detailed knowledge about its technologies before entering into the acquisition process. However, in the one case in which an ACTD has proceeded into production, DOD made that decision before completing product and concept development and testing, thereby accepting programmatic risks that could offset the schedule and other benefits gained through the ACTD process.

DOD's current practice of procuring prototypes beyond those needed for the basic ACTD demonstration and before completing product and concept development and testing is unnecessarily risky. This practice risks wasting resources on the procurement of items that may not work as expected or may not have sufficient military utility—as would be determined in the basic demonstration—and risks a premature and excessive commitment to production.

Inadequate Guidance for Assessing Maturity of Technology

By limiting consideration to prototypes that feature mature technology, the ACTD program avoids the time and risks associated with technology development, concentrating instead on technology integration and demonstration activities. The information gained through the demonstration of the mature technology could provide a good jump start to the normal acquisition process, if the demonstration shows that the technology has sufficient military value. Time and effort usually devoted to technology development could be reduced or avoided and the acquisition process shortened accordingly.

Program officials stated that they have a mechanism in place to ensure that only those projects using mature technology are allowed to become ACTDs. These officials explained that an ACTD candidate's technology is assessed by high-ranking representatives from the services and the DOD science and technology community before candidates are selected. Program personnel stated that determining technology maturity is important before a candidate is selected because ACTD program funding is not intended to be used for technology development. According to program guidance, the ACTD funding is to be used for (1) costs incurred when existing technology programs are reoriented to support ACTD, (2) costs to procure additional assets for the basic ACTD demonstration, and (3) costs for technical support for 2 years of field operations following the basic ACTD demonstration. We were told that no ACTD money was to be used for technology development activities.

However, the project selection process does not ensure that only mature technologies enter the ACTD program. We found examples where immature technologies were selected and technology development was taking place after the approval and start of the ACTD program. The current operations manager of the Combat Identification project, which began in fiscal year 1996, told us that one of his major concerns has been that some of the ACTD funding was being used for technology development, and not exclusively used for designing and implementing the assessment. However, during the ACTD project, technical or laboratory testing was still necessary to evaluate the acceptability of many of the 12 technologies included in the initial project. Eventually, 6 of the 12 technologies had to be terminated. According to the demonstration manager, 2 of the 6 technologies were terminated because they were immature. According to the manager, that is one of the reasons the project is currently behind schedule.

Another example of the inclusion of immature technology occurred in the Outrider Unmanned Aerial Vehicle project. According to the management plan for the project, one of the individual technologies to be incorporated into the vehicle was a heavy fuel engine. According to a program official, it was later deemed that this individual technology was too immature and an alternate technology had to be used. However, trying to use this immature technology has already caused schedule slippage and cost overruns in the ACTD project.

Insufficient Guidance for Transitioning ACTDs to the Normal Acquisition Process

To complete the basic demonstration within the prescribed 2 to 4 year period, ACTDs typically use early prototypes. If the demonstrated technology is deemed to have sufficient military utility, many ACTD projects will still need to enter the normal acquisition process to complete product and concept development and testing to determine, for example, whether the system is producible and can meet the user's suitability needs.[4] These attributes of a system go beyond the ACTD's demonstration of military utility to address whether the item can meet the full military requirement. Commercial items that do not require any further development could proceed directly to production. However, other non-software related ACTDs should enter the engineering and manufacturing development phase to proceed with product and concept development and testing.

According to ACTD guidance, if further significant development is needed, a system might enter the development portion of the engineering and manufacturing development phase. However, the guidance states that, if the capability is adequate, the ACTD can directly enter production. The guidance does not specifically define what is considered an "adequate capability" to allow an ACTD system to enter low-rate production.

In 1994, we reported on numerous instances of weapon systems that began production prematurely and later experienced significant operational effectiveness or suitability problems.[5] In our best practices report, we reported that typically DOD programs allowed much more technology development to continue into the product development phase than is the case in commercial practices.[6] Turbulence in program outcomes—in the form of production problems and associated cost and schedule increases—was the predictable consequence of DOD's actions. In contrast, commercial firms gained more knowledge about a product's technology, performance, and producibility much earlier in the product development process. Commercial firms consider not having this type of knowledge early in the acquisition process an unacceptable risk. In responding to that report, the Secretary of Defense stated that DOD is vigorously pursuing the adoption of such business practices. Specifically, he stated that DOD has taken steps to separate technology development from product development through the use of ACTDs. The ACTD guidance and DOD's current practice do not appear to reflect this emphasis.

[4]"Suitability" involves factors such as maintainability, reliability, safety, and supportability.

[5]Weapons Acquisition: Low-Rate Initial Production Used to Buy Weapon Systems Prematurely (GAO/NSIAD-95-18, Nov. 21, 1994).

[6]Best Practices: Successful Application to Weapon Acquisitions Requires Changes in DOD's Environment (GAO/NSIAD-98-56, Feb. 24, 1998).

In the case of the Predator ACTD, the one ACTD that has proceeded into production, DOD decided to enter the technology into production before proceeding with product and concept development and testing, thereby accepting programmatic risks that could offset the schedule and other benefits gained through the ACTD process. In the early operational assessment of the Predator's ACTD demonstration, the Director, Operational Test and Evaluation, did not make a determination of the system's potential operational effectiveness or suitability. However, the system was found to be deficient in several areas, including mission reliability, documentation, and pilot training. The assessment also noted that the ACTD demonstration was not designed to evaluate several other areas such as system survivability, supportability, target location accuracy, training, and staffing requirements.

The basic ACTD demonstration may have clarified the Predator's military utility but it did not demonstrate its system requirements or its suitability. Thus, instead of using the knowledge acquired during the demonstration to complete the Predator's development through the product and concept development and testing stages of acquisition, DOD allowed it to directly enter production.

Procuring ACTD Prototypes Beyond Those Needed for Basic Demonstration Is Unnecessarily Risky

DOD's practice is to procure sufficient ACTD prototypes to provide a 2-year residual capability. When it determines that the original prototypes will be consumed during the basic demonstration, additional prototypes are procured for potential use after the basic ACTD demonstration. However, these additional assets—like the basic demonstration prototypes—have not been independently tested to determine their effectiveness and suitability. Procuring additional ACTD prototypes before product and concept development and testing is completed risks wasting resources on the procurement of items that may not work as expected or may not have sufficient military utility. Representatives from the service test agencies did not support this practice and agreed that it had the potential for problems. Without a meaningful independent assessment of a product's suitability, effectiveness, and survivability, users cannot be assured that it will operate as intended and is supportable.

Congress has expressed concern about the amount of equipment being procured beyond what is needed to conduct the basic ACTD demonstration. Its concern is that DOD is making an excessive commitment to production before military utility is demonstrated and before appropriate concepts of operation are developed. For example, DOD plans to procure 192 Enhanced

Fiber Optic Guided missiles at an estimated cost of $27 million and 144 Line-of-Sight Anti-Tank missiles at an estimated cost of $28 million beyond the quantities of missiles required for the ACTD demonstrations—64 and 30 missiles, respectively. The production of these additional missiles will follow the production of the missiles needed for the basic demonstration and will continue on a regular basis throughout the 2-year, post-demonstration period. If the prototypes are deemed to have sufficient military utility, the service involved will be expected to fund the production of additional missiles beyond these quantities. By establishing a regular pattern of procurement in this way, DOD risks committing to a continuing production program before a determination is made about the technology's military utility and before there is assurance that the system will meet validated requirements and be supportable.

Conclusions

The strength of the ACTD program is in conducting basic demonstrations of mature technology in military applications before entering the normal acquisition process. This practice could significantly reduce or eliminate the time and effort needed for technology development from the acquisition process. For this to occur, it is essential that DOD use only mature technology in its ACTDs. DOD's criteria for selecting technologies for ACTD candidates should be clarified to ensure the selection of mature technology with few, if any, exceptions.

Further, ACTDs may not, by themselves, result in an effective and safe deployment of military capability. It is important that product and concept development as well as test and evaluation processes be allowed to proceed before the service commits to the production of the demonstrated technology. If an ACTD project is shown to have military value, the normal acquisition processes can and should be tailored—but not bypassed—before DOD begins production. Lastly, emphasizing the need to complete concept and product development and testing before procuring more items than needed for the basic demonstration would reduce the risk of prematurely starting production.

Recommendations

We recommend that the Secretary of Defense clarify the ACTD program guidance to (1) ensure the use of mature technology with few, if any, exceptions and (2) describe when transition to the development phase of the acquisition cycle is necessary and the types of development activity that may be appropriate. Further, we recommend that the Secretary of Defense limit the number of prototypes to be procured to the quantities

needed for early user demonstrations of mature technology until the item's product and concept development and testing have been completed.

Agency Comments and Our Evaluation

In commenting on a draft of this report, DOD partially concurred with each of our recommendations. DOD said that it continues to refine the ACTD selection and implementation process. DOD agreed that the ACTD program should focus on mature technologies and stated that it had improved its definitions of mature technology. DOD's new guidance on the maturity of technology to be used in ACTDs states

". . . new technologies proposed for incorporation into an ACTD should not be in the 6.1 (basic research) or 6.2 (applied research) budget categories. Furthermore, the technologies must have been successfully demonstrated at the subsystem or component level and at the required performance level prior to the start of the ACTD."

While this guidance is improved over previous versions, the new guidance permits the selection of immature technology—even as the primary or core technology—provided that it is demonstrated prior to the ACTD demonstration. Also, some recent ACTD projects have been approved without the technologies having been identified. Moreover, the new guidance goes on to describe several types of exceptions under which immature technologies may be permitted to be used in an ACTD. As our report states, the use of immature technologies has delayed programs and we continue to believe DOD needs to focus the ACTD program on the use of mature technology with few, if any exceptions.

DOD also agreed that some but not all ACTDs may require additional product and concept development before proceeding into production. DOD states that a mandatory engineering and manufacturing development phase would not be appropriate for all ACTD projects. We agree, however, the existing ACTD guidance focuses on the transition directly to production and provides too little guidance concerning a possible transition to development. As stated in our recommendation, the guidance should specify when a transition to development may be appropriate and the kinds of developmental activities that may be appropriate.

Finally, DOD agreed that the number of ACTD prototypes to be procured should be limited until the Under Secretary can confirm that sufficient testing has been satisfactorily completed to support any additional procurement. We agree with DOD that test results should form the basis for starting limited procurement. However, DOD's equating a determination of

military utility (based on an ACTD demonstration) with a determination of a system's readiness to begin production is inappropriate because production decisions require more testing data. We have long held the view and have consistently recommended that DOD use extreme caution to avoid premature commitments to production.

Scope and Methodology

To determine the adequacy of the ACTD program's selection criteria in assessing technology maturity and guidance for transitioning to the normal acquisition process, we reviewed existing program guidance, published reports, the Office of the Inspector General's April 1997 ACTD report, and the recommendations of the 1986 Packard commission and the 1996 Defense Science Board. We discussed selection criteria, transitioning to the acquisition process, and all 34 of the individual ACTD programs approved through fiscal year 1997 with representatives from the Office of the Deputy Under Secretary of Defense (Advanced Technology), Washington, D.C.; the Army's Deputy Chief of Staff for Operations and Plans, Office of Science and Technology Programs, Washington, D.C.; the Air Force's Director for Operational Requirements, Rosslyn, Virginia; the Navy's Requirements and Acquisition Support Branch, Washington, D.C.; the Marine Corps' Combat Development Command Office of Science and Innovation, Quantico, Virginia; the Joint Staff's Acquisition and Technology Division and Requirements Assessment Integration Division, Washington, D.C.; and the Office of the Commander in Chief, U.S. Atlantic Command, Norfolk, Virginia.

We discussed the issue of procuring additional residual assets for early deployment with representatives from DOD's Office of the Director, Operational Test and Evaluation, Washington, D.C.; the Army's Test and Evaluation Management Agency, Washington, D.C.; the Army's Operational Test and Evaluation Command, Alexandria, Virginia; the Marine Corps' Operational Test and Evaluation Activity, Quantico, Virginia; the Air Force's Test and Evaluation Directorate, Washington, D.C.; and the Navy's Commander, Operational Test and Evaluation Force, Norfolk, Virginia.

We conducted our review from September 1997 to July 1998 in accordance with generally accepted government auditing standards.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies to other

interested congressional committees; the Secretaries of Defense, the Army, the Air Force, and the Navy; the Commandant of the Marine Corps; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others upon request.

Please contact me at (202) 512-4841, if you or your staff have any questions concerning this report. The major contributors to this report were Bill Graveline, Laura Durland, and John Randall.

Sincerely yours,

Louis J. Rodrigues
Director, Defense Acquisitions Issues

Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

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ACQUISITION AND TECHNOLOGY

AUG 31 1998

Mr. Louis J. Rodrigues
Director, Defense Acquisitions Issues
National Security and International Affairs Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, 'DEFENSE ACQUISITION: Advanced Concept Technology Demonstration Program Can Be Improved,' dated July 28, 1998 (GAO Code 707299/OSD Case 1659). The attached document contains both technical corrections and a detailed substantive response to the draft report.

The Department of Defense partially concurs with the draft report. While recognizing the GAO's concerns regarding technological maturity, ACTD transition to acquisition, and prototype procurement, the Department believes it has made great progress in these areas. In some cases, these improvements post-date the events analyzed by the GAO. The Department continues to refine the ACTD selection and implementation processes. Detailed DoD comments are provided in the enclosure.

The Department appreciates the opportunity to comment on the draft report.

Joseph J. Eash, III
Deputy Under Secretary of Defense
(Advanced Technology)

GAO Draft Report dated July 28, 1998. GAO Code 707299, OSD Code 1659

'DEFENSE ACQUISITION: Advanced Concept Technology Demonstration Program Can Be Improved'

Department of Defense Comments

Reference the GAO finding that : "The current process for selecting ACTD candidates lacks adequate criteria for assessing the maturity of a proposed ACTD's technology." (p.5)

DoD Response: DoD concurs with GAO's assertion that the Department lacked adequate criteria for assessing the maturity of technology of ACTDs initiated in FY95 and FY96. However, in response to the DoD Inspector General's report dated April 7, 1997, several changes were implemented in the selection process. In 1997, a working group comprised of representatives of the Office of the Under Secretary of Defense for Acquisition and Technology (OUSD(A&T)), developers, users, testers, and the office of the IG was convened to develop criteria for assessing technology maturity. The resulting criteria were subsequently used to re-examine the FY97 ACTDs and to evaluate the candidates for approval in FY98 and FY99. These criteria were published in the Defense Acquisition Deskbook in April 1998 and restated in the 1998 ACTD Master Plan and on the ACTD website. The ACTD candidate review process, including a final review (termed the 'Final Scrub'), is conducted just prior to the start of the new fiscal year. This final scrub of each candidate is focused on the ACTD selection criteria, as well as the transition strategy and proposed ACTD management structure.

The Department's new ACTD criteria states that for a technology to be deemed mature, it must be demonstrated at the required performance level and in the expected operating environment. All ACTDs started since the establishment of the new criteria have been compliant, and subsequently free of criticism on this issue.

See comment 1.

Less mature technology can be used in ACTDs, only in situations where it will have no impact on the overall demonstration project. There are two examples of such non-critical roles for immature technologies. The first is the case involving a "piggyback" technology (or advanced system) that is not an integral part of the ACTD capability being evaluated, will not be part of the utility assessment, and will not be left as part of the residual capability. These **advanced systems** participate in ACTD exercises and demonstrations on a non-interference basis, taking advantage of low cost data collection opportunities. While providing important insights, they are not critical to the overall success of the ACTD, and their maturity or lack of maturity is not a factor. If they fail to perform, they are removed from the program or the demonstration. These "piggy-backed" systems could be prohibited from participating in ACTDs; however, their participation has no negative impact on the ACTDs and their exclusion would result in the loss of valuable data collection opportunities.

See comment 2.

The two technologies in the Combat Identification ACTD, identified on page eight of the draft report as being terminated because they were immature, were non-critical **advanced systems.** They were not an integral part of the capability being evaluated. The draft GAO report states that "...immature technologies were selected and technology development was clearly taking place after the approval and start of the ACTD program." In addition the draft report states: "...during the ACTD project, technical or laboratory testing was still necessary to evaluate the acceptability of many of the 12 technologies included in the initial project."

Mature technologies such as the Battlefield Combat Identification System (BCIS), the Situational Awareness Data Link (SADL), and the Single Channel Ground and Airborne Radio System, System Improvement Program Plus (SINCGARS SIP(+)) served as the core technologies for this ACTD. The advanced concepts that were included were present on a noninterference basis. The two technologies cited by the GAO were terminated with no impact to the core systems and to the primary objectives of this ACTD.

See comment 2.

Technical and laboratory testing did occur during the CID ACTD. Technical testing is done with even the most mature components and subsystems to ensure they are properly integrated and are operating correctly before deployment to an exercise. It is also necessary to fully characterize and document subsystem level performance in order to conduct a valid assessment of the integrated system.

Three of the baseline CID technologies are scheduled for procurement --including BCIS and SADL. Two technologies, Mark XII/GPS and Laser/RF were dropped because they did not meet the key performance parameters for CID; even though these are mature technologies which have been deployed on operational systems. In addition, two technology programs were recommended for termination by the warfighters because they did not make operational sense, not because the technology was immature. And finally, two advanced systems were dropped from the ACTD and it was recommended that they go back to the technology base.

See comment 3.

The Department's ACTD technological maturity criteria also permits less mature technologies to be included if those systems or components are being used to provide an alternate solution to a core system or component of the ACTD. A less mature alternate solution may be available that offers significant benefits (e.g. higher performance, higher reliability or lower cost). The Department's criteria acknowledge that it may be prudent to support parallel evaluation of the alternate solution if the outlook is favorable and the cost is modest. Since these parallel solutions are not on the performance critical path, they pose no risk to the ACTD. An example is the Outrider heavy fuel engine (HFE) which was also discussed on page six of the draft report. The HFE was an attractive option, but it was not a requirement for this ACTD.

The GAO draft report states: "Another example of the inclusion of immature technology occurred in the Outrider Unmanned Aerial Vehicle project. According to program documentation, one of the individual technologies to be incorporated into the vehicle was a heavy fuel engine. According to a program official, it was later deemed that this individual technology was too immature and an alternate technology had to be used."

The GAO does not note that the heavy fuel engine (HFE) was an alternate propulsion option. The HFE was not part of ACTD requirement established by the Joint Requirements Oversight Council (JROC). Instead, the JROC recommended an aggressive effort to develop an HFE as part of a pre-planned product improvement (P3I) program. Similarly, the memorandum signed by the Under Secretary of Defense (Acquisition & Technology) did not require an HFE in the basic program but did envision it as a P3I effort. The company that won the ACTD contract proposed to use a gasoline engine initially, but to provide an HFE replacement if it performed as they predicted. Early in the program, their HFE solution was determined to be unworkable and all efforts on the HFE were terminated. While the HFE was an attractive option, it was not a requirement for this ACTD. It was simply proposed by the contractor as a potentially beneficial alternative, if it worked. The baseline engine was a very mature gasoline engine that later proved to have insufficient performance to offset the lower than expected lift achieved by the air vehicle. The original engine was subsequently replaced by another mature, but higher performing engine. All engines flown in the program were engines that had previously been certified and were already in production.

The Department believes the core technologies in both the CID and TUAV ACTDs were mature and had been properly demonstrated before initiation of the programs.

Reference the GAO statement: "...guidance is not sufficient to ensure that on completion of the basic ACTD demonstration, a military capability deemed to be worthwhile would enter the normal acquisition process at the appropriate point." (p.5)

DoD Response: The Department agrees that when an ACTD is determined to have sufficient military utility, it should result in a decision to field the residual capability and, if additional quantities are required, the program should enter the acquisition process. The objective of the program is to focus on priority military needs, and the expectation is that if the ACTD results in a determination of high military utility, the capability would be fielded. However, in the case of some ACTDs, the quantity required is very small and the residual systems may fully satisfy the need. In these situations, it is not necessary to enter the normal acquisition process. In addition, the decision to proceed into acquisition with a new capability is based on many factors, among which are: the degree of military utility the proposed capability will provide, the current threat projections, and the importance of other capabilities competing for resources. It would therefore not be appropriate for OSD to specify to the Services which specific systems they should acquire. However, we concur it is appropriate to develop guidance which requires

See comment 4.

ACTDs to demonstrate high military utility, and where additional quantities are required to satisfy the stated need, an acquisition decision be made in a timely manner.

With regard to the appropriate point of entry into the acquisition process, the DoD acquisition process encourages tailoring and allows a program's entry point to be selected based upon the circumstances of that individual program. The decision criteria for entry of an ACTD are the same as the criteria for any other program under consideration. It would be improper to establish separate criteria for systems that have previously been through the ACTD process. For example, to enter Low Rate Initial Production (LRIP), the system must have been determined by the operational testers to be potentially effective and suitable. This was the case for the Predator system. The term "military utility" is defined as effectiveness to perform its mission, suitability to be issued to the operators, and overall impact on the military operation. The GAO report is incorrect in stating that ACTDs do not address suitability. Suitability has been a factor since the start of the program and has continued to grow in significance.

See comment 5.

See comment 6.

The Predator ACTD was cited by the GAO as a program that did not enter into the correct stage of development after completing its demonstration. At the August 1997 Defense Acquisition Board Readiness Meeting, the Defense Acquisition Executive approved the Predator for entry into the formal acquisition process, per the August 8, 1997 Acquisition Decision Memorandum. The Predator ACTD was the first program originating as an ACTD to enter the formal acquisition process. Following the completion of that ACTD, a working group was established with representatives from OSD and the services to develop guidelines for the transition of ACTDs into the formal acquisition process. The objective of that effort was to apply the lessons learned during the transition of Predator to subsequent ACTDs. The resulting changes were designed to ensure that, when the objective is to enter into LRIP, the necessary preparations are made during the ACTD to ensure the system design and testing fully support that objective. Many parallels with commercial practices were suggested in the GAO report, but the commercial sector does not design, build and test a product and then require that all such products be redesigned and re-tested prior to the entry into production. Instead, they ensure that the initial design/build/test phase is adequate to support entry into production. Where the objective is to transition into production, this same approach is being taken in the ACTD program.

See comment 7.

See comment 8.

The alternative recommended by the GAO, to follow an ACTD with an EMD program, would be inefficient, costly, and would defeat the objective of reducing the time required to field high priority, new military capabilities. It also runs counter to efforts underway in the normal acquisition process to emphasize a single development phase prior to the start of production. Multi-phase development programs for military systems can take two to four times longer than development programs in the commercial sector. The DoD believes the proper approach is to design the development process to result in producible systems in a single development phase. Since ACTDs begin the process with mature technologies and include not only development testing, but extensive operational testing as well, pursuing a single development phase is a prudent approach.

See comment 9.

See comment 10.

Additionally, it should be noted that the Predator system has performed extremely valuable work in the Department's current peace enforcement operations in Bosnia. The system has been praised highly by CINCEUR and others.

Reference the GAO statement: "DoD's current practice of procuring prototypes beyond those needed for the basic ACTD demonstration and before completing product and concept development and testing is unnecessarily risky." (p.6)

DoD Response: For 46 of the 48 ACTDs initiated to date, the procurement of prototypes has been limited to those needed for the basic ACTD demonstration. However, for the two remaining ACTDs, following that approach would preclude fielding a residual capability following the ACTD. In both cases, an Army company will be fully trained and equipped with a new missile system for evaluation during the ACTD. However, since all of the initially acquired missiles would be expended during the ACTD, there will be none left to provide a limited operational capability at the conclusion of the ACTD. Ironically, the cost of the additional missiles is a very small fraction of the cost of the ACTD, but without missiles there is no residual capability. The soldiers would have to be reassigned and the fire units and all supporting equipment placed in storage. An opportunity to reduce the time to field an important new capability would be lost. To prevent this situation, these programs were structured to include a procurement of a second lot of missiles, consisting of the minimum number necessary to equip a company. The second procurements were scheduled to occur after the initial lot of missiles had completed sufficient testing to confirm readiness for limited production. The first instance was the Enhanced Fiber Optic Guided (EFOG) Missile. Due to delays in the development and testing of that missile, there was insufficient test data to support a decision to initiate follow-on production. For that reason, the Army decided not to proceed with follow-on procurement and removed the procurement funds from the planned year. The Army subsequently determined that a similar situation would occur in FY02 for the Line-of-Sight Anti-Tank (LOSAT) missile program. The LOSAT ACTD was restructured to ensure that, prior to initiation of follow-on procurement, all required component, subsystem, and system flight-testing would be completed. The utility assessment, which includes the supportability assessment and the validation of requirements, will be completed prior to the 2-year post demonstration period when the initial procurement occurs.

See comment 11.

See comment 12.

The criteria for the limited procurement decisions were explicitly defined, reviewed and accepted by the appropriate officials within the Army who are responsible for such procurement decisions. The LOSAT system is designed to enhance the early entry forces by providing decisive firepower to counter armored opposition. Limited quantities are envisioned. If any follow-on procurement is required beyond the initial complement of missiles discussed above, that decision can be made prior to completion of the initial procurement.

The phasing for the follow-on procurement of LOSAT missiles has been carefully structured to reduce the time required to field this capability, but to ensure that all necessary information is available to support the procurement decision. Further delays would result in no additional data being collected and no reduction in risk, but would preclude having an early operational capability. It would also result in the company of trained LOSAT soldiers being dis-established and re-established two years later.

Recommendations

GAO Recommendation 1: That the Secretary of Defense specify in the program guidance a tangible metric to define the maturity of the technology to be used in each Advanced Concept Technology Demonstration project.

DoD Response: Partially concur. A tangible metric to define the maturity of technology is appropriate. However, in response to a similar recommendation by the DoD IG in 1997, a metric for technological maturity was established. The metric was published in the Defense Acquisition Deskbook in April 1998 and in the ACTD Master Plan in June 1998. This metric has satisfactorily addressed the DoD IG's concerns, and has been applied to all ACTDs in FY97-99. This criterion also addresses technology maturity for the required performance levels and operating environments, which are critical. The report cites no examples of immature technology in ACTDs initiated since 1996.

See comment 1.

Recommendation 2: That the Secretary of Defense clearly state in the program guidance that, if the demonstrated concept or equipment has military utility, the Service(s) involved should tailor an appropriate program to complete product and concept development and testing before production begins.

DoD Response: Partially concur. It is appropriate for the Secretary of Defense to state in program guidance that, where additional quantities are required, an acquisition decision will be made in a timely manner. However, the decision for a specific program to proceed into acquisition should be based on many factors, among which are: the degree of military utility the proposed capability will provide, the current threat projections, and the importance of other capabilities competing for resources. Directing the Services to proceed into acquisition based solely on military utility would not be appropriate. In addition, the entry point into the acquisition process should be selected based upon the circumstances of each individual program, using the same criteria that is used to determine the entry point of any program entering that process. Requiring that all ACTDs must undergo further product and concept development and testing prior to a production phase would seriously undermine one of the key objectives of the ACTD program - reducing acquisition cycle time. The Department feels the proper approach is to ensure that all ACTDs contain all product and concept development and testing necessary to support the planned entry point into the acquisition process. This approach is reflected in the published guidelines for transition of ACTDs into acquisition. The DoD recommends that the GAO consider this approach and the significant benefits from

See comment 8.

See comment 12.

both cost and schedule standpoints, as well as commercial sector evidence supporting this approach.

Recommendation 3: The Secretary of Defense limit the number of prototypes to be procured to the quantities needed for early user demonstrations of mature technology.

DoD Response: Partially concur. The number of prototypes to be procured in an ACTD should normally be limited to the number needed for the assessment of military utility. Any additional procurements required to field a limited operational capability should be authorized by the Under Secretary of Defense (Acquisition and Technology) after confirming that sufficient testing has been satisfactorily completed to support the limited procurement.

The following are GAO's comments on the Department of Defense's (DOD) letter, dated August 31, 1998.

GAO Comments

1. DOD's guidance is improved over previous versions. DOD's revised guidance on the maturity of technology to be used in the Advanced Concept Technology Demonstration (ACTD) states that

". . . new technologies proposed for incorporation into an ACTD should not be in the 6.1 (basic research) or 6.2 (applied research) budget categories. Furthermore, the technologies must have been successfully demonstrated at the subsystem or component level and at the required performance level prior to the start of the ACTD."

The new guidance, however, permits the selection of immature technology—even as the primary or core technology—provided that it is demonstrated prior to the ACTD demonstration. The guidance goes on to describe several types of exceptions under which immature technologies may be permitted to be used in an ACTD. Moreover, the revised guidance would permit—as has occurred in some cases—the approval of ACTD projects without the technologies having been identified. Our point is that DOD should continue to focus the ACTD program on the use of mature technology with few, if any, exceptions.

2. For the Combat Identification ACTD, the management plan for the project shows that the technologies in question were integral parts of the capabilities being evaluated. The demonstration manager told us that the involvement of immature technologies was one of the reasons that the project was behind schedule.

3. According to the Outrider project's management plan, the heavy fuel engine was the primary technology to be used, not the alternative. Also, the involvement of this immature technology was one of the causes of schedule slippage and cost overruns on the project.

4. DOD's most current ACTD guidance states

". . .Strategies and approaches are described to facilitate transitioning from an ACTD to the acquisition process as defined in DOD 5000.2R. The suggested approaches are based on lessons learned. The focus of the suggestions are ACTDs that are planned—if successful—to enter the acquisition process at the start of LRIP."

Although there is a basic recognition that the transition to development may be possible, the bulk of the guidance is on how and when to transition to production. As pointed out in the report, the guidance does not describe when a transition to development or what types of development activity may be appropriate. In our view, the guidance needs to be more balanced between the possibility of transition to development and the transition of ACTD projects directly to production.

5. As discussed in the report, the independent operational testing agencies are observers in the ACTD demonstrations and not active participants. While the Office of the Director of Operational Test and Evaluation was an observer during the Predator demonstration, a determination was not made that Predator was potentially effective and suitable.

6. We agree that ACTDs address the technology's suitability. However, the ACTD focus on suitability is in a very general sense and extensive data is not collected on the system's reliability, maintainability, and other aspects of suitability needed to support production decisions.

7. As our report states, the Predator was rushed into low-rate initial production prematurely given the limited amount of testing conducted at that time and the problems that were uncovered during that limited testing.

8. DOD's equating a determination of military utility (based on an ACTD demonstration) with a determination of a system's readiness to begin production is inappropriate because production decisions require more testing data. During our review, we noted that sufficient information was not obtained from an ACTD demonstration to make a commitment to limited production. Commercial practice would dictate that much more information be obtained about a product's effectiveness, suitability, producibility, or supportability before such a commitment is made.[1] We believe the ACTD guidance needs to be more balanced and should anticipate that ACTD prototypes may need to conduct more product and concept development and testing prior to production. We have long held the view and have consistently recommended that DOD use extreme caution to avoid premature commitments to production.

9. We are not suggesting that a lengthy development phase be conducted on all ACTD products nor, as DOD appears to suggest, that an ACTD prototype

[1]Best Practices: Successful Application to Weapon Acquisitions Requires Changes in DOD's Environment (GAO/NSIAD-98-56, Feb. 24, 1998).

may be ready to start limited production immediately after its basic demonstration. As DOD stated in its intent to establish the ACTD program, we believe the benefit of the ACTD process is in eliminating or reducing technology development, not in making early commitments to production or in postponing product and concept development and testing activities until after production starts.

10. While ACTD demonstrations are performed in operational environments, they are not operational tests. During the course of our work, we held several discussions with officials from the operational test community. Those officials were in favor of the user demonstrations featured in the ACTD program, but none considered those demonstrations as substitutes for operational testing because of their informality, lack of structure, and the lack of a defined requirement by which to measure performance.

11. DOD appears not to recognize the very real possibility that the ACTD demonstration may find the technology in question to have little or no military utility or to be unaffordable in today's budgetary and security environment. In fact, due to budget constraints, the Army was forced to prioritize its procurement programs, and the planned procurement funding for Enhanced Fiber Optic Guided missiles has been reallocated.

12. While we agree with DOD that test results should form the basis for starting limited procurement, the testing needed goes beyond the basic demonstration of military utility provided by the ACTD program.

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