UNMANNED AERIAL VEHICLES

Outlook

GAO

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

National Security and
International Affairs Division

B-276890

September 23, 1997

The Honorable William S. Cohen
The Secretary of Defense

Dear Mr. Secretary:

The Department of Defense (DOD) has undertaken a number of efforts in the past to acquire unmanned aerial vehicles (UAVs) to complement its mix of manned and national reconnaissance assets. Our previous reviews of UAV programs have shown that DOD's acquisition efforts to date have been disappointing.[1] This report discusses the Outrider, a UAV system, which DOD is acquiring through a streamlined acquisition process known as an Advanced Concept Technology Demonstration (ACTD).[2] We examined whether (1) DOD is applying lessons learned from prior UAV programs to the Outrider and (2) the Outrider is likely to meet user needs.

Results in Brief

DOD is not applying lessons learned from prior unmanned aerial vehicle programs to the Outrider ACTD. For example, despite problems with the Pioneer and Hunter stemming from DOD's decision to award further production contracts without conducting operational testing or demonstrating that the system is user-supportable, DOD is pursuing the same strategy for the Outrider. In addition, DOD has underestimated, as it did for the Pioneer and the Hunter programs, the time and effort necessary to integrate nondevelopmental items into Outrider.[3] Moreover, the Outrider system may not satisfy user needs unless problems associated with meeting joint requirements are resolved and interoperability with other DOD systems is ensured. Consequently, DOD will not have assurance that Outrider will meet user needs by the time of the planned fiscal year 1998 low-rate production decision.

[1]Unmanned Aerial Vehicles: DOD's Acquisition Efforts (GAO/T-NSIAD-97-138, Apr. 9, 1997).

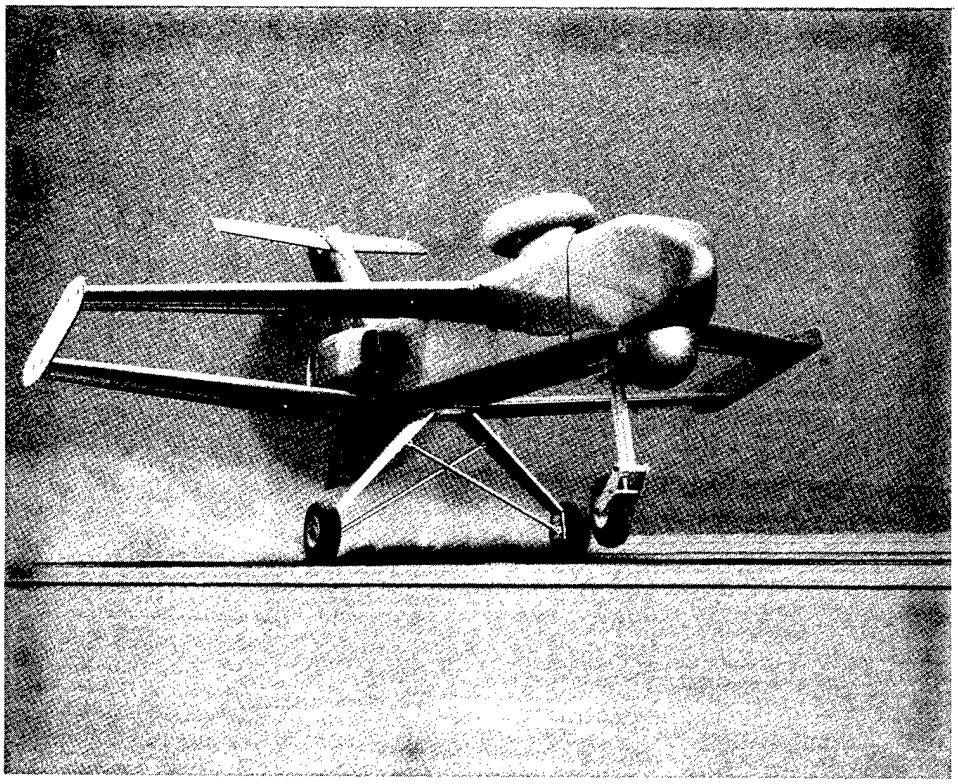
[2]ACTDs are a product of DOD's acquisition reform efforts and are used to determine if a mature technology can satisfy a military mission. ACTDs are intended to enable the services to examine new capabilities without committing to the large research and development investments required in traditional acquisition programs. This approach allows the user to operate the new capability and (1) determine its utility, (2) develop related concepts of operation, and (3) define specific requirements. If successfully completed and a significant number of systems is required, it then transitions to the formal acquisition process. Systems acquired under the ACTD process are not subject to the stringent reporting and oversight requirements of DOD's traditional acquisition process.

[3]A nondevelopmental item is: (1) any previously developed item of supply used exclusively for governmental purposes by a federal agency, state, or local government, or a foreign government with which the United States has a mutual defense cooperation agreement or (2) any item described in (1) that requires only minor modifications or modifications of the type customarily available in the commercial marketplace in order to meet the requirements of the procuring department or agency.

Background

UAVs are pilotless aircraft, controlled remotely or by preprogrammed on-board equipment. The Outrider system consists of four air vehicles, ground control equipment, one remote video terminal, four modular mission payloads, communications devices, a means of launch and recovery, and one mobile maintenance facility for every three Outrider systems (see fig. 1). The Outrider ACTD grew out of the Joint Tactical UAV program. The original concept of the Joint Tactical UAV program was to acquire (1) a 50-kilometer UAV system, the Maneuver, to satisfy reconnaissance and surveillance needs of Army brigade and Marine Corps regimental commanders and (2) a 200-kilometer UAV system, the Hunter, to satisfy the reconnaissance and surveillance needs of Army corps and division commanders and Navy task force commanders. The Joint Tactical UAV program was restructured in fiscal year 1996. The Hunter portion was canceled and the Maneuver portion was reconstituted as the Outrider ACTD to evaluate one UAV system's ability to perform both the Hunter and Maneuver missions.

Figure 1: Outrider in Flight



To streamline the acquisition process, DOD designated Outrider an ACTD in December 1995 and awarded a contract for a 2-year ACTD in May 1996. During this period, DOD will acquire 6 nondevelopmental Outrider systems with 24 air vehicles at a cost of approximately $57 million. DOD can procure more systems during the ACTD using low-rate production options built into the contract and, according to an Outrider program official, has requested $30 million for fiscal year 1998 to do so. According to DOD, the purpose of the Outrider ACTD is to evaluate the utility of the system through a series of operational demonstrations. The Army, the Navy, and the Marine Corps will prepare assessments of the system's military utility based on the operational demonstrations. At the end of the ACTD, Defense Acquisition Board executives will review the service assessments and determine if the ACTD should become a formal acquisition program. If DOD approves transition to the formal acquisition process, program officials must prepare documentation identical to that required of traditional acquisition programs.

DOD Has Not Learned Past UAV Lessons

Prior to beginning the Outrider ACTD, DOD acquired three other nondevelopmental tactical UAV systems: Pioneer, Hunter, and Predator. Each of these UAV programs provided DOD with important lessons about acquisition strategies, system integration, and logistic supportability. However, DOD is not applying these lessons to the Outrider ACTD.

Outrider Acquisition Strategy Repeats Mistakes of the Hunter

DOD's acquisition strategy for the Outrider closely resembles the acquisition strategy used for the Hunter program. After a user demonstration, DOD awarded a low-rate production contract for 7 Hunter systems with 56 aircraft before demonstrating through operational testing that the system was potentially operationally effective and suitable.[4] Testing of the low-rate production Hunter systems revealed numerous problems, and eventually DOD terminated the Hunter program.

Similarly, according to an Outrider program official, DOD plans to exercise a contract option for low-rate production of three to six additional Outrider systems in April 1998 before conducting realistic operational testing. The program official stated that user demonstrations conducted prior to April 1998 as part of the ACTD will provide a sufficient basis for making a low-rate production decision. These user demonstrations, however, will not provide the same level of assurance for justifying a

[4]Operational effectiveness refers to the ability of a system to accomplish its mission in the planned operational environment. Operational suitability is the degree to which a system can be placed satisfactorily in field use considering such factors as reliability and maintainability.

low-rate production commitment as would operational testing since such testing involves meeting minimally acceptable thresholds for key performance parameters. Outrider as an ACTD system has neither key parameters nor thresholds, and DOD is not required to establish them for the demonstrations.

Lessons learned from prior UAV programs illustrate that nondevelopmental UAV systems should be operationally tested in realistic environments before beginning low-rate production. Our past work has shown that production of nondevelopmental UAV systems before operational testing can result in adverse consequences. DOD started producing two nondevelopmental UAVs—the Pioneer and, more recently, the Hunter—before subjecting either to any operational testing. The problems DOD has experienced with these systems clearly illustrate the adverse consequences of beginning production without having adequate assurance of satisfactory system performance. Specifically, in 1990, we reported that lack of Pioneer operational testing led the Navy to costly and time-consuming trial and error while trying to adapt the system for shipboard use.[5] Ultimately, DOD spent about $50 million redesigning and modifying Pioneer systems initially acquired for $56 million.

Undeterred by the experience with Pioneer, DOD then started production of the Hunter without subjecting it to operational testing. In 1992, we reported that DOD should not award a production contract for the Hunter based on limited testing in unrealistic environments.[6] Nevertheless, DOD awarded a contract for seven Hunter systems. These systems were unable to meet requirements, and the program was terminated in 1995 after an investment of over $757 million.

Outrider System Integration May Prove More Difficult Than Expected

Integrating nondevelopmental components into a fieldable Outrider system is proving more challenging than DOD anticipated. According to program officials, integrating components necessary to satisfy the naval requirements, such as electromagnetic interference shielding and stronger landing gear, delayed Outrider's first flight from November 1996 to March 1997. Because the Outrider ACTD has a 2-year time limit, schedule delays result in less time available for the users to assess the system's military utility.

[5]Unmanned Aerial Vehicles: Realistic Testing Needed Before Production of Short-Range System (GAO/NSIAD-90-234, Sept. 28, 1990).

[6]Unmanned Aerial Vehicles: More Testing Needed Before Production of Short-Range System (GAO/NSIAD-92-311, Sept. 4, 1992).

These nondevelopmental UAV integration lessons are not new to DOD. The Hunter and Pioneer were both procured by DOD as nondevelopmental systems. Both systems required the expenditure of unexpected development time and money in retroactive attempts to solve integration problems. For example, we stated in our September 28, 1990, report, that the Pioneer system required substantial development to integrate the system into a shipboard environment. In addition, in 1995, DOD concurred with us that the complexity of the Hunter subsystem integration was significantly underestimated by both the government and the contractor.[7]

An independent DOD team that reviewed the Hunter UAV in 1995 reported that using nondevelopmental subsystems misled many into believing that integrating nondevelopmental subsystems would not require substantial development. The team recommended that the services should consider and reevaluate the advantage of attempting to procure nondevelopmental subsystems without allowing for some developmental effort needed to integrate them into the overall system.

ACTD Will Not Demonstrate Outrider Supportability

DOD plans to award a low-rate production contract for up to six Outrider systems without demonstrating a critical component of military utility—whether the system is user-supportable. The ACTD's operational demonstrations will not realistically address the user-supportability of the Outrider system. According to an Outrider program official, the user will perform only basic maintenance during the operational demonstrations, while the contractor will perform all other maintenance. Furthermore, the Outrider ACTD will not include a logistics demonstration to show that the system is user-supportable without contractor assistance.

UAV lessons learned show that procuring nondevelopmental systems without assurance that they are user-supportable results in cost growth and program delays. For example, a logistics demonstration conducted after DOD procured seven low-rate production Hunter systems revealed the system was not user sustainable. DOD analysts reported that the perception in the Hunter program was that logistics would be easy to add to a nondevelopmental system. In reality, adding military logistics to a nondevelopmental system proved a significant challenge. The analysts noted that an expensive, time-consuming developmental effort was needed to acquire the logistics support for Hunter. In addition, while ACTD unit cost may be low, militarizing capabilities and adding logistics support

[7]Unmanned Aerial Vehicles: No More Hunter Systems Should Be Bought Until Problems Are Fixed (GAO/NSIAD-95-52, Mar. 1, 1995).

increases program costs. For example, while a Predator ACTD system cost about $15 million, a Predator combat-ready production system, with configuration changes, added subsystems, and full integrated logistics support provisions, costs about twice that amount.

Outrider May Not Satisfy User Needs

The Outrider system may not satisfy user needs unless problems associated with meeting joint requirements are resolved and interoperability with other DOD systems can be achieved. Design changes necessary to increase Outrider's range to 200 kilometers have delayed the program and have increased the weight of the air vehicle to the point it may not be suitable for shipboard operations. Furthermore, developing an air vehicle engine suitable for naval use has proven problematic. In addition, the Outrider analog datalink is not compliant with DOD's communications interoperability standards for reconnaissance assets and provides limited payload growth options.

Problems Associated With Meeting Joint Requirements

The Outrider system is encountering technical problems that must be resolved before the system can meet user needs. First flight of the Outrider system was delayed 4 months because of these problems. According to program officials, these problems arose from modifying the Outrider to satisfy joint requirements. The Outrider system was originally designed to satisfy the 50 kilometer, land-based, Army maneuver UAV requirement. Under the ACTD, Outrider's joint range requirement is 200 kilometers and includes operation from amphibious ships.

Modifications to satisfy joint requirements have necessitated several changes to the air vehicle design. These changes, such as adding electromagnetic interference shielding for shipboard operations and increasing air vehicle size to satisfy the range requirement, have added a large amount of weight to the air vehicle. Since DOD awarded the ACTD contract in May 1996, the weight of the fueled air vehicle has grown from the proposed 385 pounds to an actual of 578 pounds. The added weight increases the distance necessary to launch and recover the air vehicle. According to an Outrider oversight official, this could necessitate the use of arresting cables or barrier nets on the deck of a ship.

According to Navy officials, the Navy is reluctant to use cables or nets to recover the Outrider because of the impact on other shipboard flight operations. The Navy has previously expressed concerns about the adverse impact of arresting cables and barrier nets on the normal flight

operations of amphibious assault ships. In December 1995, we reported that Navy fleet officials opposed fielding the Hunter UAV on Navy ships because erecting barrier nets would adversely impact other flight operations from their amphibious assault ships.[8]

Additionally, Outrider's joint requirements include a heavy fuel engine. Naval use requires a heavy fuel engine because the automotive gasoline currently used by the Outrider is considered too combustible for safe use on ships. DOD research officials estimate it may ultimately cost $100 million to develop a heavy fuel engine that is small enough to power the Outrider. Without a heavy fuel engine, the system will not satisfy naval users. A senior program official acknowledged the heavy fuel engine development is not proceeding as successfully as planned, and the current gasoline engine is not performing adequately. Consequently, 1 year into the ACTD, DOD now plans to acquire another gasoline engine.

Potential Interoperability Issues Exist

DOD is not capitalizing on opportunities to demonstrate that Outrider will be interoperable with other DOD systems during the ACTD period. DOD will not be demonstrating the Outrider with the Army and the Navy's standardized computer workstations or with the software being designed to control all tactical UAVs, including the Predator UAV system, which is already in production. Nor will DOD be demonstrating the Outrider with a DOD-compliant Common Data Link (CDL) that would allow information from the Outrider to be more easily transferred to other DOD systems.

Outrider ACTD Schedule Not Aligned With Tactical Control System Schedule

DOD is developing a tactical control system that will control all tactical UAVs. The current Outrider and Predator control systems are incompatible and do not meet standards for communications compatibility with DOD's other airborne reconnaissance systems. Although the Outrider will be required to work with the tactical control system, according to an Outrider program official, DOD will attempt to demonstrate interoperability on only one occasion during the ACTD.

A potentially serious interoperability issue may arise if the Outrider development schedule is not aligned with the tactical control system program schedule. The tactical control system is primarily software designed to perform common mission planning and control for all tactical UAVs, including the Outrider, and it will be installed on computers already

[8]Unmanned Aerial Vehicles: Hunter System Is Not Appropriate for Navy Fleet Use (GAO/NSIAD-96-2, Dec. 1, 1995).

used by the services, such as the Navy's TAC-4 and the Army's Sunspark Systems. However, during the ACTD, DOD is allowing the Outrider contractor the option of using either (1) Outrider-specific hardware and software that is supposed to be interoperable with the tactical control system or (2) the tactical control system. According to the Outrider Demonstration Manager, the contractor has opted to use the Outrider-specific equipment, and only one demonstration of interoperability between the Outrider equipment and the tactical control system is planned for the ACTD. If the actual tactical control system and service computers are not used during the ACTD, the services' overall assessments of military utility will not be based on actual system performance. DOD acknowledges the risk their plan creates of not achieving the required interoperability between the Outrider and the tactical control system.

Outrider Datalink Not Compliant With DOD Standard Architecture

The Outrider datalink is not compliant with the CDL, DOD's standard for communications interoperability for all airborne reconnaissance and surveillance missions, including those missions performed by the Outrider. The CDL requires a digital data link, whereas the Outrider employs an analog data link.

According to officials from the Defense Airborne Reconnaissance Office, which is responsible for airborne reconnaissance and intelligence communications interoperability, the analog data link has no growth options and operates in the same widely used band of the microwave spectrum as European and Korean television. These officials noted that a CDL-compliant digital data link would offer the Outrider program several advantages over the current analog link. For example, a digital data link would (1) be less susceptible to distortion and interference, (2) minimize a system's signature, (3) provide anti-jam capabilities, and (4) offer encrypted communications. The digital data link also provides for greater capability, including (1) a means to upgrade to all-weather payloads, such as the synthetic aperture and millimeter wave radars and (2) computer processing of gathered imagery.

A Defense Airborne Reconnaissance Office study indicates that a short development effort could result in a CDL-compliant digital data link for the Outrider at an acceptable cost. However, Outrider officials maintain that a CDL-compliant digital data link would be too expensive given Outrider's post-ACTD cost limit of $350,000 for the 33rd air vehicle and sensor.

Recommendation

Because DOD's strategy for acquiring the nondevelopmental Outrider system will not provide assurance of successful performance and interoperability before DOD's planned low-rate production decision, and to avoid repeating the mistakes of prior UAV programs, we recommend that the Secretary of Defense delay low-rate production of the Outrider system until the results of operational testing of available systems demonstrate it is potentially operationally effective and operationally suitable for all intended users.

Agency Comments and Our Evaluation

DOD reviewed a draft of this report. DOD disagreed with most of our findings. It partially concurred with our recommendation. Specifically, DOD disagreed that it had not learned from problems in past programs and stated these problems in part led it to initiate the Outrider ACTD. DOD also disagreed that Outrider may not satisfy user needs unless it meets the Navy's shipboard requirements and is interoperable with the tactical control system. It stated that the ACTD responds to an approved joint requirement and does not identify service unique requirements, but will address the effect of weight and engine type. DOD also noted that it has formed an integrated team between the Outrider and tactical control system programs and taken other measures to ensure interoperability.

We recognize that DOD is aware of problems with past UAV programs and agree that an ACTD can provide useful insights. However, we remain concerned about DOD's strategy for the Outrider because the planned demonstrations of military utility that will precede DOD's low-rate production decision are (1) limited in scope; (2) will not be complete before the decision; and (3) may not identify and resolve serious system deficiencies, such as compatibility with joint requirements, and interoperability with the tactical control system. As detailed in this report, similar acquisition strategies for the Hunter and Pioneer programs resulted in the acquisition of additional systems that required costly modifications in order to meet user needs.

DOD has the opportunity to operationally test the Outrider's performance without risking commitment to additional unproven systems under low-rate production. DOD is acquiring 6 Outrider systems with 24 aircraft under the original contract. If the Outrider is assessed positively during the ACTD, DOD could modify the ACTD hardware to the production representative design for operational tests. If the required changes are so significant that the ACTD systems cannot be made production

representative, DOD guidance on transitioning ACTDs to formal acquisition indicates that a new competition should be conducted.

In responding to our recommendation, DOD concurred that Outrider should not enter production until the results of operational testing demonstrate its effectiveness and suitability. DOD noted that completing operational test and evaluation is a statutory requirement for formal acquisition programs entering production. DOD added, however, that this statute does not apply to ACTDs entering low-rate production. We recognize that full operational testing is not a statutory requirement for ACTDs entering low-rate production. However, our past work shows that awarding low-rate initial production contracts without any operational testing has resulted in the procurement of substantial inventories of unsatisfactory weapons requiring costly modifications to achieve satisfactory performance and, in some cases, deployment of substandard systems to combat forces.

Scope and Methodology

To determine whether DOD is applying lessons learned from prior UAV lessons learned to this program, and whether the Outrider would meet user needs, we reviewed program plans, test schedules, performance documents, and other records relating to the Outrider ACTD and examined DOD guidance related to systems acquisition, acquisition streamlining and reform, and ACTDs.

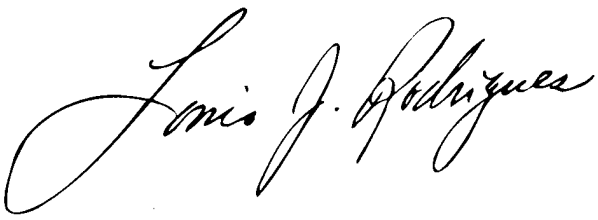
We also interviewed and obtained information from knowledgeable officials of the Joint Chiefs of Staff; the Office of the Secretary of Defense; Defense Airborne Reconnaissance Office; Chief of Naval Operations; Department of the Navy, Program Executive Office for Cruise Missiles and UAV Joint Project; Department of the Army, Operational Test and Evaluation Command; and the Department of the Air Force, Deputy Chief of Staff Plans and Operations. All of these officials are located in the greater Washington, D.C., metropolitan area. Furthermore, we interviewed and obtained information from representatives of the Commander in Chief, U.S. Atlantic Fleet, Norfolk, Virginia; the Department of the Navy, Operational Test and Evaluation Forces Command, Norfolk, Virginia; the Joint Tactical UAV Project Office, Huntsville, Alabama; Defense Contract Audit Agency, Hopkins, Minnesota; Defense Contract Management Command, Hopkins, Minnesota; and the Outrider ACTD contractor, Alliant TechSystems, Hopkins, Minnesota.

We performed our work from July 1996 to June 1997 in accordance with generally accepted government auditing standards.

This report contains a recommendation to you. As you know, 31 U.S.C. 720 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 Reform and Oversight not later than 60 days after the date of the report. A written statement also must be submitted to the Senate and House Committees on Appropriations with an agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to appropriate congressional committees; the Secretaries of the Army and the Navy; and the Office of Management and Budget. We will make copies available to others on request. Please contact me at (202) 512-4841, if you or your staff have any questions concerning this report. Major contributors to this report were Tana Davis, John Warren, and Charles Ward.

Sincerely yours,



Louis J. Rodrigues
Director, Defense Acquisitions Issues

Comments From the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

ACQUISITION AND TECHNOLOGY

09 JUL 1997

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

Dear Mr. Rodrigues,

See pp. 9 and 10.

This is the Department of Defense (DoD) response to General Accounting Office (GAO) Draft Report to the Secretary of Defense, "UNMANNED AERIAL VEHICLES: Outrider Demonstration Will Be Inadequate To Justify Further Production, dated June 1997, GAO code 707181, Office of the Secretary of Defense (OSD) Case Number 1381. The Department nonconcurs with the majority of this draft report findings.

See comment 1.

The analysis conducted by the GAO assumed that the Department is initiating production of the Outrider system prior to full operational testing. This is not the case. The purpose of the Outrider ACTD is to assess overall operational utility of the system. Only after a successful ACTD would the decision be made to transition the program. A limited set of production representative hardware would be procured under LRIP to enable full operational testing. The Department recognizes that all facets of the current Outrider system may not satisfy all of the Joint requirements. However, it is the purpose of the ACTD to provide the data necessary to make a military utility and subsequent production decision.

Detailed DoD comments on the report findings and recommendation are provided in the enclosure. In addition, IDA has recently completed an analysis of lessons learned from the Predator demonstrations and fielding. I would welcome the opportunity for you to hear their assessment. The DoD appreciates the opportunity to comment on the GAO report.

Sincerely,

Kenneth R. Israel

KENNETH R. ISRAEL, Maj Gen, USAF
Director
Defense Airborne Reconnaissance Office

Enclosure:
Department of Defense Comments

GENERAL ACCOUNTING OFFICE DRAFT REPORT (GAO CODE 707181) OSD CASE 1381

"UNMANNED AERIAL VEHICLES: OUTRIDER DEMONSTRATION WILL BE INADEQUATE TO JUSTIFY FURTHER PRODUCTION"

DEPARTMENT OF DEFENSE COMMENTS

****

FINDINGS

Finding A: DoD HAS NOT LEARNED PAST UAV LESSONS:

Finding A(1): Outrider Acquisition Repeats Mistakes Of The Hunter. The GAO report argues that DoD's acquisition strategy for the Outrider closely resembles the acquisition strategy used for the Hunter program. The report notes that after a user demonstration, DoD awarded a low-rate production contract for seven Hunter systems with 56 aircraft before demonstrating through operational testing that the system was operationally effective and suitable. GAO noted that testing of the low-rate production Hunter systems revealed numerous problems, and eventually DoD terminated the Hunter program. The report claims that DoD plans to exercise a contract option for low-rate production of three to six additional Outrider systems in April 1998 before conducting realistic operational testing. The GAO points out that DoD believes user demonstrations conducted as part of the Advanced Concept Technology Demonstration (ACTD) will provide a sufficient basis for making a production decision. GAO contends that lessons learned from prior UAV programs illustrate that nondevelopmental UAV systems should be operationally tested in realistic environments before beginning low-rate production. GAO illustrated the adverse consequences of producing nondevelopmental UAV systems before operational testing is completed using Pioneer and Hunter as examples.

DoD Response: Nonconcur. The Department's strategy is in full compliance with both regulatory and statutory requirements for Operational Test and Evaluation (OT&E) and Low Rate Initial Production (LRIP), as well as DoD guidance on ACTDs. It is not the Department's intent to make a full production decision based on the ACTD results. The Department intentionally initiated the Outrider effort as an ACTD program in accordance with Department of Defense Regulation, DoD 5000.2-R, which states: "ACTDs themselves are not acquisition programs." Initiation of the TUAV ACTD is in part due to the lessons learned during the Hunter program. The Department realized questions existed on the utility and overall integration challenges associated with tactical UAVs to meet a Joint requirement and therefore chose the ACTD approach. The fact that an LRIP is programmed for FY98 is due to the necessity for the Department to program for activities 1-1/2 years before budget appropriation and execution. Programs and schedules reflect the goals and objectives of planned activities. The ACTD approach for the TUAV provides the users, along with the acquisition community, the capability to assess the utility, overall capability and life cycle cost of the program. The ACTD process, by design, allows the warfighter to evaluate a technology's military utility prior to committing to a major acquisition effort, develop concepts of operations for employing the new technology, and retain a residual capability if desired. User demonstrations conducted as part of the ACTD are sized and structured to provide clear evaluation of military capability and utility,

See pp. 9 and 10.

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See comment 1.

not to support a production decision. The user, with support from the Operational Test Agencies (OTAs), defines the measures of effectiveness and measures of performance to characterize effectiveness and suitability. If the Outrider ACTD is assessed positively by the users, the data collected during the demonstrations will be used to support a LRIP decision and entry into an appropriate phase of the formal acquisition process. LRIP would provide the production representative systems for use in Operational Test and Evaluation (OT&E). This operational testing will be conducted using the TUAV requirements documented in the Joint Requirements Oversight Counsel (JROC) Memoranda (JROCM) 150-95 and 135-95. This strategy is in accordance with acquisition policy (DoD 5000.2-R), and statutory requirements (10 U.S.C. 2400(b), and 10 U.S.C. 2399). According to DoD 5000.2-R section 1.4.4.1 (Low Rate Initial Production (LRIP)):

- The objective of this activity (i.e., LRIP) is to produce the minimum quantity necessary to: provide production configured or representative articles for operational tests, establish and initial production base for the system, and permit an orderly increase to production rate for the system, sufficient to lead to full-rate production upon successful completion of operational testing.

Section 3.4.5 (Operational Test and Evaluation) states it is mandatory that:

- The independent operational test activities shall use production or production representative test articles for the dedicated phase of OT&E that supports the full-rate production decision, or for ACAT IA or other acquisition programs, the deployment decision.

Finding A(2): Outrider System Integration May Prove More Difficult Than Expected. The report suggests that integrating components, specifically necessary to satisfy the naval requirements, such as electromagnetic interference shielding and stronger landing gear, delayed Outrider first flight from November 1996 to March 1997. GAO noted that with a two-year time limit, schedule delays result in less time available for the users to assess the system's military utility. The report points out that nondevelopmental UAV integration lessons are not new to DoD UAV efforts since both Hunter and Pioneer were both procured by DoD as nondevelopmental systems but required expenditure of unexpected development time and money to resolve integration problems. The report states that in 1995 a DoD team recommended that the Services consider and reevaluate the advantage of attempting to procure nondevelopmental systems without allowing some developmental effort needed to integrate them into the overall system.

See comment 2.

DoD Response: Partially Concur. *The Department concurs that integration may prove more difficult than expected, and recognizes that integration in any advanced technology program is a challenge.* However, the Department nonconcurs with GAO's statement that the program delays were necessitated by efforts to satisfy "naval requirements". As previously stated, the ACTD is focused on satisfying "Joint" requirements, as approved by the JROC. ACTDs are based on mature or nearly mature technologies. By limiting consideration to mature technology, the ACTD avoids the time and risks associated with technology development, concentrating instead on the integration and demonstration activities. This approach permits an early user demonstration and is expected to greatly reduce schedule at a lower cost, relative to a formal acquisition program. The integration challenges for Outrider were considered reasonable when assessed during the source selection process. The Department is striving to achieve the proper balance between use of commercial off-the-shelf (COTS) technology and integration risk while still achieving the ambitious Outrider ACTD performance goals. It is the Department's intent that despite the program delays occurring during system integration, the users shall be provided adequate time to assess the system's military utility and gain some insight to its operational effectiveness and suitability. **The development of Outrider is event vice schedule**

See comment 3.

driven. The Services and the Joint Staff remain strong supporters of the ACTD approach.

Finding A(3): The ACTD Will Not Demonstrate Outrider Supportability. The GAO reports that the ACTD's operational demonstrations will not realistically address the user-supportability of the Outrider system. The GAO report states that, according to program officials, the user will perform only basic maintenance during the operational demonstrations, while the contractor will perform all other maintenance. Furthermore, the ACTD will not include a logistics demonstration to show that the system is user supportable without contractor assistance. The GAO notes that lessons learned show that procuring nondevelopmental systems without assurance they are user-supportable results in cost growth and program delays, and that adding military logistics to a nondevelopmental system proved to be a significant challenge with the Hunter UAV program. The GAO also noted that while ACTD unit costs may be low, militarizing capabilities and adding logistics support increases program costs. For example, a Predator ACTD system cost about $15 million, a Predator combat-ready system production system, with configuration changes, added subsystems, and fully integrated logistics support provisions, costs about twice that amount.

DoD Response: Partially Concur. *The Department concurs that procuring nondevelopmental systems without supportability assurances that they are user-supportable results in cost growth and program delays. The Department also acknowledges that a complete logistics supportability package to demonstrate user-supportability of the Outrider system, equivalent to that of a formal acquisition program, will not be accomplished during the ACTD.* The Department nonconcurs with the finding that it has not implemented lessons learned from previous UAV efforts with regard to logistics supportability. The Department will demonstrate supportability before full system acquisition, if a decision is made to acquire the Outrider. Fully demonstrating supportability, however, prior to an acquisition decision would significantly increase the costs of the ACTD. Logistics supportability will be assessed by the users during the ACTD in accordance with USD(A&T) direction provided in the 21 December 1995 memorandum initiating the TUAV ACTD. Users will be trained and equipped to accomplish the organizational level maintenance actions determined by the integrated logistics support level of repair analysis. During the demonstrations, a contractor logistics support team will be with each Service to provide intermediate and higher level repair support, as needed. Flight and maintenance data are being recorded throughout the ACTD to enable the Services to make informed, data-based decisions on how they would support the systems. The Transition Integrated Product Team (TIPT) will review the system's interoperability, life cycle cost, manning, training, and logistics supportability. The TIPT's plans and actions are based upon lessons learned from the Predator ACTD, which are being applied to all of the Department's ACTDs. Cost data is being captured during the ACTD to determine the life cycle costs of the Outrider system, and will be presented as part of the LRIP decision. Should the Outrider ACTD proceed into LRIP, a full supportability demonstration will be conducted prior to operational testing. Additionally, the Department nonconcurs with GAO's use of Predator's ACTD cost estimates versus production costs as misleading. The ACTD or development estimate only included hardware costs, appropriate to an ACTD, whereas the production estimate includes Pre-Planned Product Improvements (P3I), Integrated Logistics Support (ILS), and Engineering Change Orders (ECOs), which are not typically included in development estimates.

See comment 4.

See comment 5.

Finding B: OUTRIDER MAY NOT SATISFY USER NEEDS:

Finding B(1): Problems Associated With Meeting Naval Requirements.

The GAO noted that design changes necessary to increase Outrider's range to 200 kilometers and addition of electromagnetic interference shielding have delayed the program and have increased air vehicle (AV) weight to a point it may not be suitable for shipboard operation. GAO noted that since DoD awarded the ACTD contract in May 1996, the weight of the fueled AV has grown from the proposed 385 pounds to an actual of 578 pounds, resulting in increased distance required to launch and recover the AV, and could necessitate the use of arresting cables or barrier nets on the decks of ships. The GAO reported that the Navy has previously expressed concerns about the adverse impact of arresting cables and barrier nets on the normal flight operations of amphibious assault ships. The GAO noted that in 1995 they reported that Navy fleet officials opposed fielding the Hunter UAV on Navy ships since erecting barrier nets for launch and recovery of UAVs would adversely impact other flight operations from their amphibious assault ships.

See comment 6.

DoD Response: Nonconcur. The Outrider ACTD responds to an approved Joint requirement defined in JROCM 150-95, and does not identify Service unique requirements. Air vehicle weight is not a requirement. However, the affect of weight on AV performance will be assessed during the ACTD. The purpose of the ACTD is to provide the Outrider system to Ground and Naval Forces for their assessment of military utility in accordance with Joint requirements. Recent DoD reviews with the Services have indicated their continued commitment and support of the current ACTD effort. In fact, tactical UAV remains the JROC's number one UAV priority. Continuing the ACTD allows opportunities to assess total system performance by the warfighter rather than analyzing projected performance estimates, and refine requirements - which are consistent with the intent of the ACTD.

Finding B(2): Without A Heavy Fuel Engine, The System Will Not Satisfy Naval Users. The report contends that naval (i.e. shipboard) use requires a heavy fuel engine (HFE) because the automotive gasoline currently used by the Outrider is considered too combustible for safe use on ships. The GAO points out that program officials acknowledge the HFE development is not proceeding as successfully as planned, and the current gasoline engine is not performing adequately. Consequently, one year into the ACTD, DoD now plans to acquire another gasoline engine. The GAO cites that DoD research officials estimate it may ultimately cost $100M to develop a HFE that is small enough to power the Outrider.

See comment 6.

DoD Response: Nonconcur. Again, the ACTD responds to an approved Joint requirement defined in JROCM 150-95, and does not identify Service unique requirements. The validity of the GAO's finding will be addressed through the ACTD process, and the user's assessment of military utility. A HFE is an objective requirement as stated in JROCM 150-95. The availability of a HFE in the weight-to-power class required for a tactical UAV was addressed in JROCM 150-95 and in the ACTD initiation memorandum which identified it as an option. The USD(A&T) direction for the engine was "as provided." Because this is a safety, and logistics concern of the Services, and an item of high interest, the acting USD(A&T) recently directed that all HFE efforts be ceased pending a complete review of the programs and an integrated program for HFE research be developed, outside the Outrider ACTD effort. The DoD research estimate of $100M to develop a HFE for Outrider cited by the GAO was not derived from any analytical cost estimating process, but was a rough estimate that included the development of a family of HFEs suitable for use in UAVs, with little definition of actual requirements. Greater analysis is required in this area before providing a realistic cost estimate. A strategy for accomplishing this analysis, as well as overall development of an integrated HFE approach, is currently under development by DUSD(AT).

See comment 7.

See comment 8.

Finding C: POTENTIAL INTEROPERABILITY ISSUES EXIST

Finding C(1): Outrider ACTD Schedule Not Aligned With Tactical Control System Schedule. The report argues that DoD is developing a tactical control system (TCS) that will control all tactical UAVs. The GAO notes that the current Outrider and Predator control system are incompatible and do not meet standards for communication compatibility with DoD's other airborne reconnaissance systems. The GAO points out that although the Outrider will be required to work with the TCS, DoD will attempt to demonstrate interoperability on only one occasion during the ACTD.

DoD Response: Nonconcur. Synchronization of the TUAV ACTD and TCS efforts is being actively pursued. The Department initiated the Outrider ACTD prior to formal initiation of the TCS effort. The TCS and Outrider have been synchronized by the Program Executive Office and are linked throughout the ACTD and beyond. At their onset, an Interoperability Integrated Product Team (IPT) was formed between the two programs. This technical IPT is ensuring interoperability. The program managers have established a Memorandum of Agreement (MOA) guaranteeing Outrider equipment, facilities, and range time for TCS integration. TCS has contracted with Outrider's prime contractor to facilitate development of Outrider/TCS interoperability. TCS has already demonstrated level one (i.e., sensor data receipt via ground control station, secondary imagery) receipt of Outrider video. Level two (sensor data receipt direct from UAV, direct broadcast) and level three (sensor data receipt direct from UAV sensor control) development will proceed during the remainder of the ACTD with a demonstration, prior to the end of the ACTD, that Outrider is compliant with TCS interoperability standards. Military users will participate in these demonstrations to assess military utility of the TCS with the Outrider air vehicle. Outrider will adopt the TCS for its ground station when it becomes available. TCS is tasked with meeting the Service's requirements for interoperable hardware and software. The TCS will disseminate Outrider air vehicle and payload data to other DoD systems. TCS will be interoperable with the Tactical Common Data Link (TCDL).

Finding C(2): Outrider Datalink Not Compliant With DoD Standard Architecture. The report contends that the Outrider datalink is not compliant with the CDL, DoD's standard for communications interoperability for all airborne reconnaissance and surveillance missions including those missions performed by Outrider. GAO points out the CDL requires a digital datalink, whereas the Outrider employs an analog datalink. The GAO cites officials from the Defense Airborne Reconnaissance Office (DARO) as stating the analog datalink has no growth options and operates in the same widely-used band of the microwave spectrum as European and Korean television. Advantages of the CDL-compliant digital datalink were listed. The GAO also cites DARO studies that indicate that a short development effort could result in a CDL-compliant digital datalink for the Outrider at an acceptable cost, but goes on to state that Outrider officials maintain that a CDL- compliant digital datalink would be too expensive given post-ACTD cost limits of $350K for 33rd AV w/sensor and $300K for 100th AV w/sensor.

DoD Response: Partially Concur. *The Department concurs that the Outrider datalink is not compliant with CDL during the ACTD.* However, the Department is in full compliance with the JROCM 150-95, which specified CDL as a desired P3I capability, and the TUAV ACTD initiation memorandum which recognized the current lack of an affordable CDL for TUAV use and specified it as a "desired option". A digital datalink that meets the size, power, and weight required by "tactical" UAVs needs does not currently exist. The Outrider uses a standard C-band analog datalink, as does Predator, Hunter and Pioneer. While the JROC requested a growth path to a digital datalink, currently, there is no digital datalink available. Although the current datalink configuration for the Outrider UAV is not compliant with the DoD standard for collection datalinks on airborne reconnaissance

platforms which mandates the use of the Common Data Link (CDL) standard, there is a development activity under way for a TCDL system which will be suitable for use on the Outrider platform in the future. In a cooperative development effort with Defense Advanced Research Projects Agency (DARPA), the DARO has begun a development activity for a TCDL system. This activity was initiated since current CDL equipment is too expensive and too large to implement on a small tactical platform such as the TUAV, and would certainly exceed ACTD mandatory cost constraints for an AV with sensor. TCDL is specifically being targeted for tactical platforms, such as the Outrider and Predator UAVs. Design goals for the system have included size, weight, power, and recurring costs which are consistent with this class of vehicles. Representatives from the tactical UAV community are participating as government representatives on the Integrated Product Team (IPT) which is working closely with the contractor teams during their development activities. Due to the 24 month development time for TCDL, it will not be available in time to support Outrider ACTD flight testing. The DARO supports the use of a legacy C-band data link on the Outrider during flight vehicle development and flight testing phases, with the understanding that the Outrider datalinks will migrate to TCDL when it becomes available in the 1999 time frame.

See comment 8.

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RECOMMENDATION

Recommendation: GAO recommends that the Secretary of Defense delay further production of the Outrider system until the results of operational testing demonstrate it is operationally effective and operationally suitable for all intended users.

DoD Response: Partially Concur. The Department's response assumes that production of Outrider systems, discussed by the GAO, is beyond that of the current ACTD system deliveries. *GAO's recommendation is correct, in that Outrider should not enter production without successfully completing Operational Test and Evaluation to prove its operational suitability and effectiveness. This is a statutory requirement for all formal acquisition programs entering Phase III (Production . . .).* However, it does not apply to ACTDs, which are not acquisition programs. As mentioned in our earlier discussions, if Service military utility assessments from the ACTD are positive, operational information collected throughout the ACTD, and supported by the OTAs, may be adequate to support an assessment for an LRIP decision or entry into an appropriate phase of the formal acquisition process. Based on the ability of the system to satisfy military utility and other key program objectives during the ACTD, an LRIP would be approved. The purpose of LRIP would be to procure a limited number of Outrider production representative systems for OT&E. Accordingly, only after a successful OT&E would the Department support full production of the system.

See pp. 9 and 10.

The following are GAO's comments to the Department of Defense's (DOD) letter, dated July 9, 1997.

GAO Comments

1. We understand that the purpose of the Outrider Advanced Concept Technology Demonstration (ACTD) is to assess the utility of the Outrider system and note that DOD is acquiring 6 Outrider systems with 24 air vehicles under the original ACTD contract. If the Outrider is assessed positively, these could be used instead of building production representative systems under low-rate production. Specifically, DOD could modify the ACTD systems to create a production representative system that could be operationally tested prior to low-rate production. If required changes are so significant that the ACTD system cannot be successfully modified, DOD ACTD guidance indicates that a new competition should be conducted.

2. We agree that ACTDs should be based on mature technologies. However, DOD officials have acknowledged the Outrider system is not mature. We therefore continue to believe that DOD should resolve the integration challenges for Outrider before proceeding to a low-rate production decision.

3. Although DOD maintains that the development of Outrider is event rather than schedule driven, we note that DOD has not slipped the planned low-rate production decision or ACTD completion date in response to delays to the Outrider test schedule.

4. DOD states that it will demonstrate supportability prior to the full system acquisition. DOD ACTD guidance states that the full range of support areas must be considered if the plan for an ACTD is to transition to low-rate production. We believe that committing to further Outrider production without taking advantage of the opportunity to demonstrate supportability adds unnecessary risk to the planned acquisition program.

5. Our report specifically identifies the differences in the cost of a Predator ACTD system compared with a Predator production system.

6. We modified the text to clarify that the Outrider ACTD is based on joint requirements.

7. ACTD guidance points out that overall systems engineering efforts performed during the ACTD should include actions ensuring connectivity,

compatibility, and synchronization of ACTD products with systems these products will operate with on the battlefield. Receipt of secondary imagery from the Outrider ground control station (level 1) does not provide any evidence that the tactical control system will be able to control or receive information directly from the Outrider air vehicle (levels 2 and 3). DOD's plan to demonstrate Outrider's compliance with tactical control system's interoperability standards during the ACTD is not the same as demonstrating that levels 2 and 3 can be achieved in the field.

8. DOD's response indicates a tactical Common Data Link (CDL) may be available for use in Outrider in less than 2 years. The ACTD is scheduled for completion in May 1998. If Outrider low-rate production were delayed until the CDL became available, DOD could avoid retrofit risks and expenses.