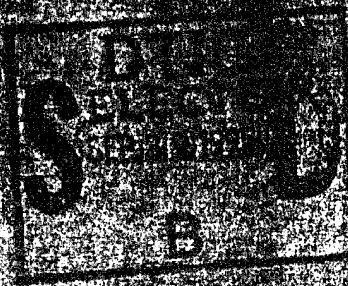


September 1995

UNMANNED AERIAL VEHICLES

Maneuver System Schedule Includes Unnecessary Risk



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Sep 95

National Security and
International Affairs Division

B-260440

September 15, 1995

The Honorable William J. Perry
The Secretary of Defense

Dear Mr. Secretary:

Unmanned Aerial
Vehicles:
Maneuver System
Schedule Includes
Unnecessary Risk

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We are currently reviewing the Joint Tactical Unmanned Aerial Vehicle (UAV) program, including (1) the Hunter UAV system; (2) a variant of the Hunter, referred to as the Maneuver system; and (3) another Hunter variant for shipboard use. These systems are expected to cost about \$4.2 billion.

We are issuing this interim report to bring to your attention certain aspects of the program status and the Joint Tactical UAV Project Office's proposed acquisition strategy for the Maneuver system that we believe will unnecessarily increase the Department of Defense's (DOD) risk on the program.

Background

Both the Hunter and Maneuver UAVs are intended to perform reconnaissance, surveillance, target acquisition, and other military missions by flying over enemy territory and transmitting imagery back to ground stations for use by commanders. The Maneuver UAV, formerly called the Close-Range UAV, is to be smaller and have less range capability than the Hunter. The Maneuver UAV is to be used by Army and Marine Corps units operating in the forward battle area.

Each Maneuver system is to include four air vehicles and a downsized version of ground support equipment used with the Hunter. The ground support equipment is already being developed, and development of the Maneuver air vehicle, which is to include a low-rate production phase, is planned to start about September 1995.



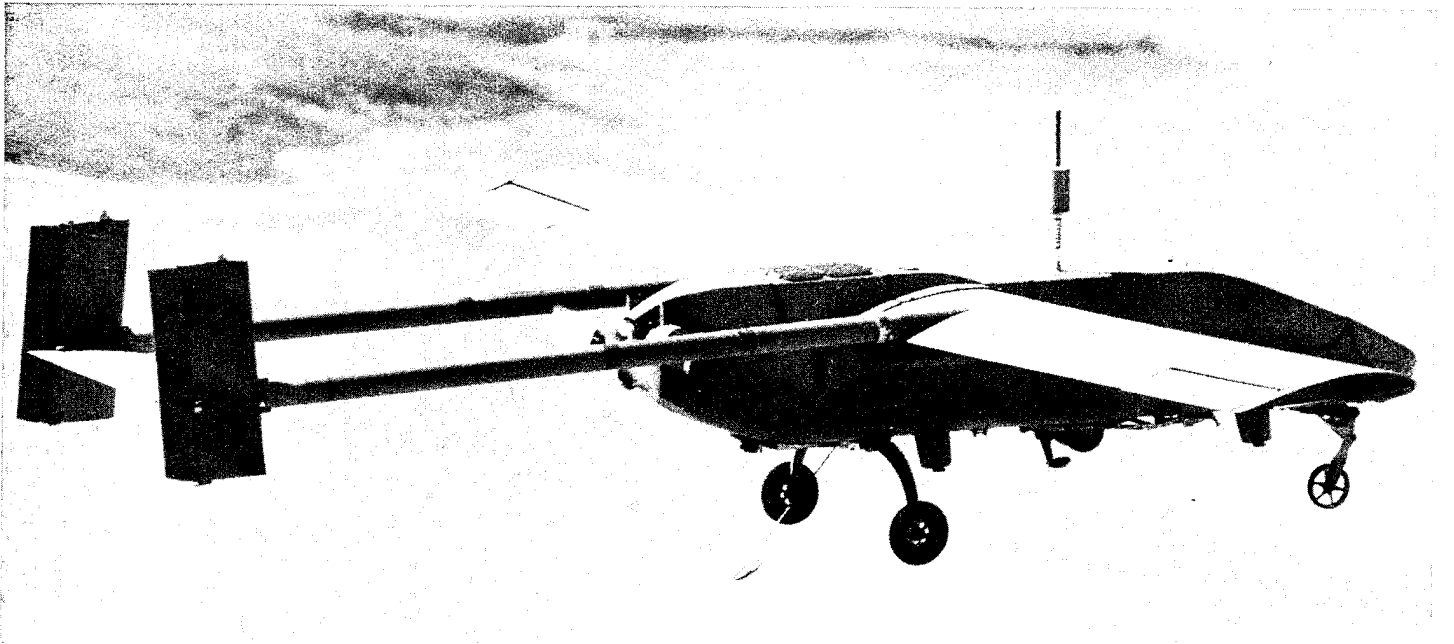
Results in Brief

Past UAV acquisition programs have been marked by premature entry into production that resulted in extensive and costly system redesigns in attempting to achieve acceptable system performance. Nevertheless, the Joint Tactical UAV Project Office plans to begin production of the Maneuver system without adequate assurance that it can meet operational performance requirements. As a result, DOD will again risk becoming committed to acquiring an unsatisfactory system.

Adverse Impact of Premature Production on Other UAV Systems

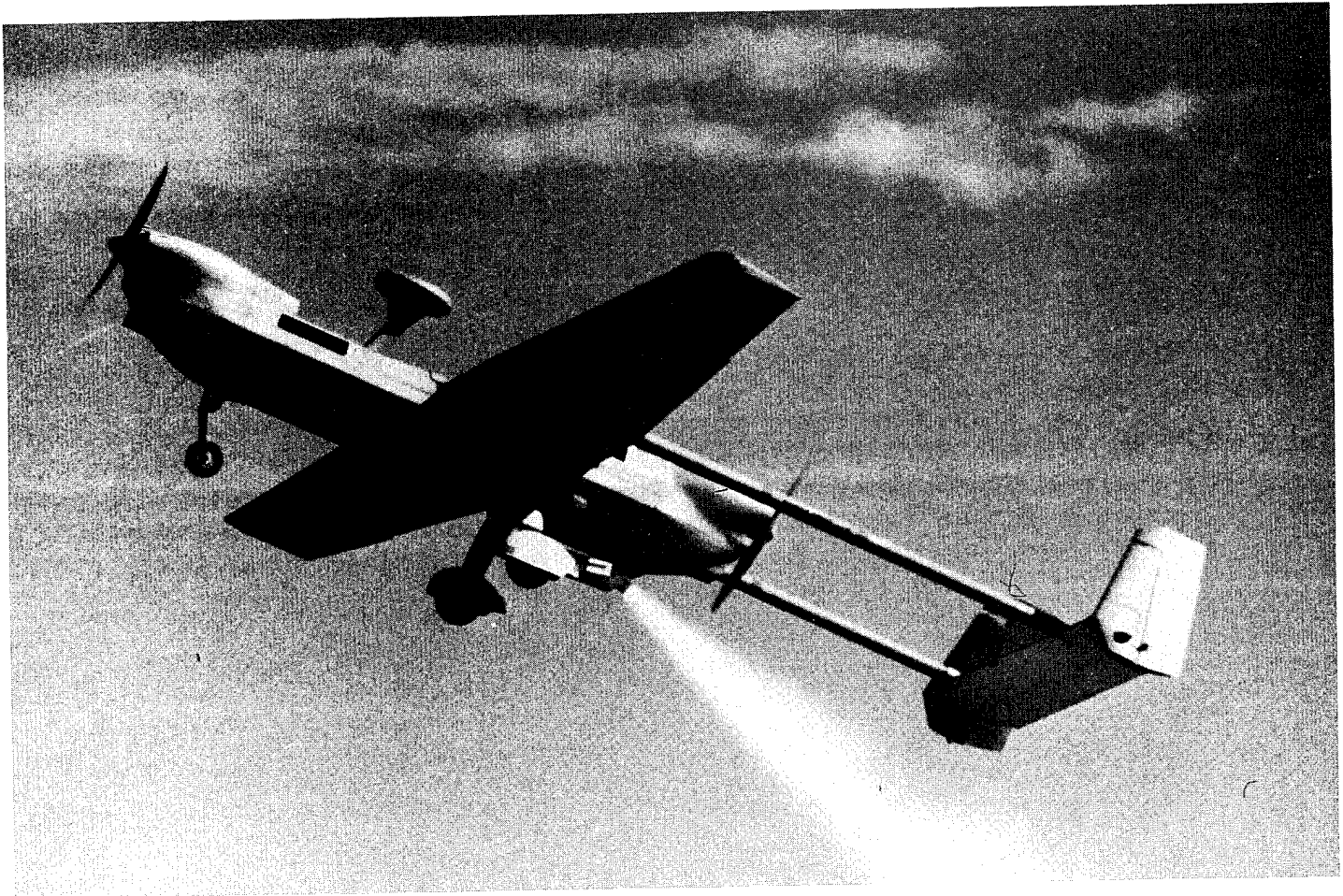
Despite the importance of operational testing as a management control to ensure adequate system performance, DOD started producing two UAVs, the Pioneer and more recently the Hunter, before subjecting them to any operational testing. (See figs. 1 and 2.) These two systems, both acquired as nondevelopmental items¹ from the same foreign contractor, clearly illustrate the adverse consequences of beginning production without having adequate assurance of satisfactory system performance. For example, premature production of the Pioneer resulted in a doubling of the costs for the nine acquired systems that do not meet service requirements. DOD has also spent \$627 million to acquire and support seven Hunter systems that are experiencing problems and an uncertain future.

Figure 1: Pioneer UAV



¹Nondevelopmental item means any item that is (1) commercially available, (2) in use by a U.S. agency or foreign government with which the United States has a mutual defense cooperation agreement, or (3) any of the items in (1) or (2) that require only minor modification.

Figure 2: Hunter UAV



Importance of Operational Testing

Operational testing is DOD's primary means of evaluating weapon system performance in a combat representative environment. It is supposed to be structured to determine a system's operational effectiveness and suitability² and to determine if the minimum acceptable operational performance requirements have been satisfied.

Thus, operational testing can be an effective internal control over the acquisition process to ensure that DOD managers have adequate knowledge

²Operational effectiveness refers to the ability of a system to accomplish its mission in the planned operational environment. Suitability is the degree to which a system can be placed satisfactorily in field use considering such factors as reliability and maintainability.

about a system's performance before authorizing production. If used effectively, it can minimize the risk of producing a defective system that later requires costly redesign and retrofit to achieve satisfactory performance.

Experience With Pioneer

DOD did not use operational testing as an effective internal control over the Pioneer acquisition and later paid the consequences. Because Pioneer's predecessors had been used successfully by Israeli forces, the Navy procured the Pioneer without testing it and deployed the system to operational forces. As we reported in 1990,³ numerous problems ensued that led the Navy to redesign and modify virtually the entire system at a cost of about \$50 million. These redesign and modification costs about matched the Navy's cost of \$56 million to initially procure its nine systems.

Four years after the initial procurement, the Navy was still buying replacement hardware, such as completely modified air vehicles, to bring Pioneer systems up to a minimum essential level of performance. Despite this effort, Pioneer was assessed as being unable to meet service requirements. So, DOD started acquiring the Short-Range Joint Tactical UAV, now called Hunter.

Experience With Hunter

Undeterred by the experience with Pioneer, DOD has also started production of Hunter without subjecting it to operational testing. As a result, DOD has so far spent \$627 million acquiring and supporting a faulty system whose future is uncertain.

In 1992, we reported⁴ that DOD's plans to start the Hunter system's production before operational testing would result in premature commitment to production of an unproven system. We recommended that the Secretary of Defense require that limited production be deferred until realistic operational testing provided reasonable assurance that the system would perform satisfactorily. DOD disagreed, maintaining that the system had already been tested sufficiently to warrant a commitment to production. Accordingly, in February 1993, DOD awarded a \$171 million contract for production of 7 systems with 56 air vehicles.

³Unmanned Aerial Vehicles: Realistic Testing Needed Before Production of Short-Range System (GAO/NSIAD-90-234, Sept. 28, 1990).

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

Since then, the system has undergone some 180 major hardware and software design changes in an attempt to solve its performance problems. The system has been grounded for much of the time and government acceptance of the first production system was delayed for almost 1 year because of the system's inability to pass tests. DOD finally accepted the system in April 1995 but only after granting numerous waivers to contract specifications and performance requirements. Meanwhile, the program is still being restructured to allow additional time for enhancing the system's chances for passing operational tests.

Unnecessary Risk on Maneuver Program

Despite this history, the Joint Tactical UAV Project Office is planning to begin a 3-year development program for the Maneuver system in fiscal year 1995 that includes starting low-rate production before the system's performance is proven in operational testing. The low-rate production is scheduled to begin in fiscal year 1997 and is to include manufacture of 6 systems, including 24 air vehicles, that are not needed for operational testing. Further increasing the risk on the Maneuver program is the fact that the system is to use a downsized version of Hunter ground support equipment as well as Hunter software that is so far unproven. Moreover, the development program is also to include manufacture of 5 prototype Maneuver systems with 20 air vehicles. Three of these systems with 12 air vehicles are to be production-representative and could be used for operational testing before beginning low-rate production.

Recommendation

We recommend that the Secretary of Defense change the Maneuver system's acquisition strategy to require that sufficient operational testing be conducted before the start of low-rate production. The purpose of this change is to demonstrate that without any major or costly design changes, the system can achieve its primary mission and meet requirements for performance and suitability.

Agency Comments and Our Evaluation

In commenting on a draft of this report, DOD cited various tests identified in the Maneuver system's proposed acquisition strategy and stated that it would ensure that sufficient testing occurs to demonstrate satisfactory performance before low-rate production. However, DOD stopped short of committing to have the system undergo operational testing before low-rate production. We believe that operational testing can be used as a management control to ensure that the Maneuver system meets its key performance parameters before a production commitment. We, therefore,

affirm our recommendation. DOD comments are presented in their entirety in appendix I along with our evaluation of them.

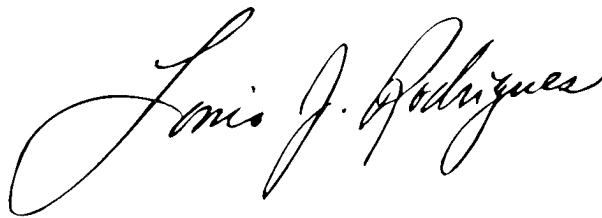
Scope and Methodology

Our evaluation included an examination of the Joint Tactical UAV Project Office plans and proposed schedule for acquiring the Maneuver System. We also discussed the program with officials of the Joint Tactical UAV Project Office in Huntsville, Alabama, and the UAV Joint Project Office in Washington, D.C. We conducted our work from March 1995 to May 1995 in accordance with generally accepted government auditing standards.

We are sending copies of this report to appropriate congressional committees; the Secretaries of the Army and the Navy; the Commandant of the Marine Corps; and the Director, 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 Jack Guin, Mark Lambert, John S. Warren, and Charles A. Ward.

Sincerely yours,



Louis J. Rodrigues
Director, Systems Development
and Production Issues

Comments From the Department of Defense.

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



ACQUISITION AND TECHNOLOGY

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON DC 20301-3000



July 10, 1995

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

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to General Accounting Office (GAO) Draft Report, GAO/NSIAD-95-161, "UNMANNED AERIAL VEHICLES: Maneuver System Schedule Includes Unnecessary Risk," dated May 24, 1995, (GAO Code 707097), OSD Case 9949. The Department partially concurs with the report.

The Pioneer system was procured as an interim system to fill an urgent need outlined by the Navy. The system underwent combined developmental and operational testing which identified system corrections which were implemented, resulting in the Pioneer providing an interim crisis and contingency capability. The Congress understood this was to be an interim system and funded only nine systems. The Hunter system completed sufficient government developmental and operational testing to provide the basis for the Defense Acquisition Executive to approve award of a low rate initial production contract for seven Hunter systems. These seven systems incorporate multiple changes as a result of earlier testing, and provide production representative systems for developmental testing events leading to the Initial Operational Test and Evaluation. The Department has deferred any consideration of further production until completion of a User's Demonstration planned for October 1995.

The Department is developing an acquisition strategy for the Maneuver Program which will incorporate lessons learned from both the Hunter and Pioneer programs as well as appropriate items from the Hunter Independent Review Team effort. In the case of the Maneuver system, the Department will ensure sufficient testing occurs prior to a low rate production approval.



See comment 1.


See comment 2.

See comment 3.

See comment 4.

**Appendix I
Comments From the Department of
Defense.**

Detailed DoD comments on the report findings and recommendation are provided in the enclosure. The DoD appreciates the opportunity to comment on the draft GAO report.


George R. Schneider
Director
Strategic & Tactical Systems

Enclosure.

GAO DRAFT REPORT - DATED MAY 25, 1995
(GAO CODE 707097) OSD CASE 9949

"UNMANNED AERIAL VEHICLES: MANEUVER SYSTEM SCHEDULE
INCLUDES UNNECESSARY RISK"

DEPARTMENT OF DEFENSE COMMENTS

FINDINGS

Finding A: Adverse Impact of Premature Production on Other Unmanned Aerial Vehicle Systems. The GAO reported that despite the importance of operational testing as a management control to ensure adequate system performance, DoD started producing two UAVs, the Pioneer and more recently the Hunter, before subjecting them to any operational testing. The GAO noted that these two systems, both acquired as non-developmental items from the same foreign contractor, clearly illustrate the adverse consequences of beginning production without having adequate assurance of satisfactory performance. The GAO noted for example, premature production of Pioneer resulted in a doubling of the costs for nine acquired systems that do not meet Service requirements. The GAO pointed out that DoD has also spent \$627 million to acquire and support seven Hunter systems that are experiencing problems and an uncertain future. (pp. 2-7/GAO Draft Report)

DoD Response: Nonconcur. Pioneer was procured as an off-the-shelf item in December 1985 using an invitation to bid (IFB) process, and after a competitive fly-off. A key feature of the program was to conduct concurrent developmental and operational testing, and fielding with a minimum essential capability with the winning system under what was known at that time as "the baseline concept." As part of the baseline process, the Marine Corps and Navy (aboard the *USS Iowa*) both conducted an operational assessment--the Marine Corps in September/October 1987 and the Navy in October 1987. Each operational assessment provided baseline configuration changes that were evaluated during an operational evaluation conducted from September 15 to October 3, 1989. Pioneer was procured as an interim system, with Congress limiting the procurement to nine systems until a joint Service UAV could be developed. The operational evaluation determined Pioneer to be potentially operationally suitable after specified corrections were accomplished. Those corrective actions--storing and dispensing of gasoline, tracking antennae stability--were subsequently taken. The Pioneer system was used effectively in Desert Storm for pinpointing Iraqi artillery. It has also been used in Somalia and Bosnia with excellent results.

See comment 5.

See comment 6.

See comment 3.

The Hunter system underwent operational testing in the form of a Limited User Test during June/July 1992. The Director, Operational Test and Evaluation prepared an independent Operational Assessment for the Defense Acquisition Board in January 1993, recommending entry of the program into low-rate initial production. The assessment concluded that: 1) "the Limited User Test was adequate to make a limited assessment of potential capability;" 2) the system demonstrated "that it has the potential to support mission planning, launch, control and recover operations, modify missions enroute, and conduct remote video operations," and 3) the system has "no inherent or systemic problems that would unconditionally prevent the system from performing other required functions." Significant changes [176 software and hardware design changes] to the initial two competitive fly off Hunter systems are being incorporated into the seven low rate initial production systems. These systems verify the production process and serve as the production-representative systems to be used for the Initial Operational Test and Evaluation currently scheduled for fiscal year 1997.

See comment 7.

The Joint Tactical UAV-Maneuver Program Office has proposed an acquisition strategy which is being evaluated by the Department. While this strategy is still to be approved, the Program Office has put in place the proper programmatic controls to ensure satisfactory performance prior to a low-rate initial production approval.

See comment 8.

Finding B: Unnecessary Risk on Maneuver Program. The GAO reported that the Joint Tactical UAV Project Office is planning to begin a 3-year development program for the Maneuver system in fiscal year 1995 that includes starting low-rate production before the system's performance is proven in operational testing. The GAO noted that the low-rate production is scheduled to begin in fiscal year 1997 and is to include manufacture of six systems, including 24 air vehicles, that are not needed for operational testing. The GAO asserted that increasing the risk on the Maneuver program is the fact that the system is to use a downsized version of Hunter ground support equipment as well as Hunter software that is so far unproven. The GAO added that the development program is also to include manufacture of five prototype maneuver systems with 20 air vehicles. The GAO further added that three of these systems with 12 air vehicles, are to be production representative and could be used for operational testing before beginning low-rate production. (p. 7/GAO Draft Report)

See comment 4.

DoD Response: Partially concur. The Maneuver Program does not have an approved acquisition strategy at this time. The Department is still evaluating and refining the proposed acquisition strategy prior to presenting it to the Acquisition Executive for decision. The acquisition strategy must include sufficient operational testing to assure operational effectiveness and suitability, and appropriate exit criteria to insure system maturity.

See comment 9.

While the Department recognizes the hardware and software risk to the Maneuver Program by use of Downsized Ground Control Equipment based on the Hunter

system, it is not nearly as great a risk as using a totally new development ground control system. This approach is, moreover, in keeping with the Congressional direction of total interoperability between Hunter and Maneuver. Risk mitigation will be achieved by testing the Downsized Ground Control Equipment with Hunter and then Maneuver. Hunter software has completed Level I & II software Independent Verification and Validation. Level III is ongoing. The Maneuver Program intends to use the Joint Technology Center/Systems Integration Laboratory, which provides a man-in-the-loop testing and simulation capability, to identify and resolve hardware and software integration issues.

The GAO is correct in that three systems from the pilot production line will be used for operational testing. The proposed acquisition strategy contains man-machine interface evaluations, environmental qualification and flight testing, a multiservice Limited User Test, a Logistics/Maintainability Demonstration, and simulated operational exercises. Successful completion of these events would demonstrate satisfactory system performance.

RECOMMENDATION

Recommendation: The GAO recommended that the Secretary of Defense change the Maneuver system's acquisition strategy to require that sufficient operational testing be conducted before the start of low rate production. (p. 8/GAO Draft Report)

DoD Response: Partially concur. The Department is developing an acquisition strategy for the Maneuver Program which is expected to be complete by the first quarter FY 1996. The acquisition strategy will incorporate lessons learned from both the Hunter and Pioneer programs as well as appropriate items from the Hunter Independent Review Team effort. For the Maneuver system, affordability will be the cornerstone of the acquisition strategy. The Department will pursue a cost-effectiveness approach which minimizes the number of specified key performance parameters and permit contractors to make cost-performance tradeoffs with user concurrence. The Department will ensure sufficient testing occurs prior to a low-rate production approval.

See comment 4.

See comment 4.

The following are GAO's comments to the Department of Defense's (DOD) letter dated July 10, 1995.

GAO Comments

1. Although the Navy maintains the Pioneer was procured as an interim system, this does not negate the need to test prior to procurement. The testing referenced by DOD occurred after the Navy had procured the Pioneer. When the testing revealed problems, the Navy employed a costly trial-and-error effort trying to overcome the problems. The necessary changes included a modified engine, new foam-filled wings so that crashed vehicles could float until salvaged, a new landing recovery system, new flight control software, and a new propeller. DOD records reveal that in the 4 years following initial procurement, the Navy spent \$28 million in research and development funds and an additional \$22 million in procurement funds for replacement hardware trying to get Pioneer's performance up to the minimum essential level.

2. The legislative history of the 1988 National Defense Appropriations Act shows that Congress limited procurement of Pioneer to foster commonality among service Unmanned Aerial Vehicle (UAV) programs. As we reported in a December 1988 report on UAVS (GAO/NSIAD-89-41BR, Dec. 9, 1988), during fiscal year 1988 budget proceedings, Congress refused to authorize funding for procurement of separate Navy and Army short-range systems and provided that funds were available only for a joint program. This led to curtailment of Pioneer and initiation of the Short-Range UAV program, now called Hunter.

3. Although originally scheduled for 1992, the Hunter system has not undergone any operational testing, which is now scheduled for 1997. Hunter tests that most resembled operational testing were called "limited user tests." Even so, these tests did not qualify as operational tests. First, the system was maintained by contractor technicians during the tests rather than by military personnel expected to maintain the system when deployed. Thus, use of the contractor technicians detracted from the realism of the tests. Also, DOD and the Army's test agencies stated they could not fully evaluate the test results because of a lack of performance criteria. For 81 of 97 measures of performance established for the tests, the test agencies only gathered related test data because no performance criteria were established for evaluation purposes; that is, the system could not be judged as having passed or failed the tests. These tests and the developmental testing were not an adequate basis for starting Hunter's low-rate production because the testing was not intended to evaluate the

system's effectiveness and suitability in a realistic operational environment.

4. As currently planned, the tests to be done before low-rate production will include various developmental tests and limited user tests similar to those conducted on Hunter. In our view, these tests will not be an adequate basis for committing the Maneuver system to production. See comment 3.

5. We could identify no information in these DOD comments that conflicts with or refutes what we said about the acquisition of Pioneer. See comment 1.

6. The Pioneer's performance in Desert Storm was not without problems. For example, according to after action reports, Pioneer's lack of reliability resulted in excessive maintenance and support requirements. Further, electromagnetic interference from other systems caused crashes in some cases and sometimes prevented video imagery from being transmitted to the ground control station so it could be used. The system was also too slow to keep up with mechanized forces and was determined to have inadequate range and endurance. Among other problems, Pioneer also encountered difficulties when trying to fly in the rain and required lengthy improved runways for operations.

7. The instability of Hunter's design, as evidenced by the 176 significant modifications referred to by DOD, convinces us that the system had not demonstrated its readiness for production. The many deficiencies detected in acceptance testing of the first of the seven production systems and the numerous waivers to specifications and performance requirements, despite the many design changes, are further evidence that Hunter was not ready for production. We would also point out that DOD recently granted numerous waivers in accepting the second of the seven systems.

8. We believe that these controls could be strengthened by requiring the system to demonstrate satisfactory performance during operational testing before the production commitment.

9. Our report does not criticize the planned use of downsized Hunter ground support equipment and software with the Maneuver system. Our point is that the downsized version is based on Hunter's unproven and rapidly changing design, which reinforces the need for adequate

Appendix I
Comments From the Department of
Defense.

operational testing of the Maneuver system before the production
commitment.