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

PROCUREMENT AND SYSTEMS
ACQUISITION DIVISION

B-199334

JULY 14, 1980

The Honorable Harold Brown
The Secretary of Defense

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

Dear Mr. Secretary:

Subject: DOD Should Determine Cost and Operational Effectiveness of Helicopter In-Flight Escape Systems (PSAD-80-65)

We have reviewed the Department of Defense's (DOD's) efforts to develop helicopter in-flight escape systems to determine what actions were taken on our recommendations for development in our June 1973 report to the Congress. 1/ Primarily, we assessed the bases for subsequent decisions not to develop the escape systems, especially the one for the AH-1 Cobra attack helicopter.

Studies by the services before 1973 supported the need for escape systems. We found, however, that virtually all development efforts stopped in 1974, even though interest in the systems has resurfaced from time to time and still exists today. More recent studies generally supported a continuing need for the Cobra in-flight escape system. We also found that decisions against development were based on subjective appraisals rather than quantitative analyses which would have provided the best decision base. An Army organization recommended such an analysis as far back as 1973.

The in-flight escape issue is complex and emotional. Benefits would include

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1/"In-Flight Escape Systems for Helicopters Should Be Developed to Prevent Fatalities," B-177166, June 12, 1973.

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--saving the lives of trained and experienced pilots,

--increasing pilot morale and military readiness,

--reducing death benefit payments, and

--curtailing training costs of replacement pilots.

On the other hand, system penalties would include adding some technical complexity and weight to the helicopter which would decrease operational effectiveness by reducing ordnance and/or fuel payload.

Because of the potential for saving lives, the complexity of the issue, and the lack of quantitative bases for a proper decision to develop or not develop the system, we recommend that you require a cost and operational effectiveness study of the Cobra attack helicopter escape system. The study would be especially appropriate now because of the concerns of the House Armed Services Committee and renewed interest by the Navy and Marine Corps.

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DEVELOPMENT EFFORTS BEFORE 1973

In 1964 the Navy began developing helicopter in-flight escape systems for troop carrying helicopters. The AH-1 Cobra attack helicopter was developed in the mid-1960s and entered combat in Vietnam in 1967. By 1970 the United States was losing an average of seven Cobra pilots every month, and in 1971 the Navy directed its attention to the need for an escape system for the Cobra flown by the Marine Corps. Contributing to the Navy's interest were the following:

--A February 1971 Board of Inspection and Survey Report stated that (1) the low altitude and high speed operation of the Cobra precluded manual bailout and (2) the lack of an assisted means of escape compromised crew safety.

--A July 1971 Navy report analyzing Army and Marine Corps Cobra fatal accidents and combat losses from September 1967 through October 1970 concluded that 6 out of 10 crew fatalities might have been prevented by an in-flight escape system.

--An operational requirement for an escape system was established for Marine Corps Cobras.

Because the Army also used Cobras, in May 1971 the Navy asked the Army whether it had a similar requirement for an in-flight escape system. Although no formal requirement existed, the Army validated the Navy's analysis of fatal mishaps and proposed that the development work be a joint Army-Navy effort, and the Navy agreed.

In 1972 the Army drafted a requirement document. In commenting on the draft early the next year, the U.S. Army Aviation Center recognized the urgent need for the Cobra escape system and recommended continued development. However, the Center pointed out that weight and performance penalties associated with the system should be closely evaluated against the benefits to be derived.

The U.S. Army Armor Center, in its comments on the draft requirement, questioned the need for the escape system because (1) the altitudes at which the Cobra would operate during nap-of-the-earth operations--treetop and among the trees--would not allow the time needed to operate the system and (2) the fuel or ordnance trade-offs due to the system's weight were unacceptable.

In June 1973 we issued a report to the Congress recommending that available technology for in-flight escape systems be applied to new helicopters. In reply, DOD stated that these systems had not been demonstrated to be the most effective method in improving helicopter flight safety, considering both human life values and dollar cost. We believed, however, that DOD had not adequately considered savings represented by the potential decrease in fatalities and severe injuries.

DOD also said that the in-flight escape system solution was not consistent with its objective of reducing weapon systems' cost and complexity, except perhaps for selected attack helicopters. Therefore, DOD intended to continue technology efforts at an appropriate level to increase the effectiveness of escape systems for these helicopters.

In December 1979 we decided to examine recent DOD efforts to develop helicopter in-flight escape systems, primarily for attack helicopters. We interviewed officials and reviewed reports and studies made on the need for,

development of, and economic benefits from such systems. (See app. I.)

DEVELOPMENT EFFORTS STOP SOON AFTER 1973

Army and Navy support of escape systems development continued until 1974 when work ceased. Subsequently, the Army alerted the Navy not to do any more work, pending the Army's release of funding.

In March 1975 the Navy asked the Army to clarify its position and intentions on the joint Cobra development program. The Army replied that its requirement had to be evaluated. A June 1975 Army internal memorandum stated that tentative conclusions of a Cobra study indicated that the escape system was "a nice to have feature" but weight and cost considerations in comparison with other subsystems did not support the requirement. The memorandum also requested that the Army withdraw from the joint program. The Army then sent a letter to the Navy withdrawing its support because of the lack of a "formal" requirement. The Army also noted that the system was incompatible with attack helicopters in a nap-of-the-earth environment.

The Army's action caused the Marine Corps to reevaluate its requirement and advise the Navy it could no longer fund the program without the Army's participation. This in turn caused the Navy to terminate its planned Cobra in-flight escape system engineering development phase in August 1975. DOD has not expended funds since then for in-flight escape system development. The Army has emphasized funding for helicopter crashworthiness.

ARMY RENEWS INTEREST IN ESCAPE SYSTEMS

The Army Aviation Research and Development Command expressed renewed interest in in-flight escape systems in 1977, partly because of a study issued by the Army Safety Center in February 1976 entitled "AH-1 Helicopter Escape System: A View From the Seat." The study determined how pilots perceived the need for and use of an in-flight escape system. Questionnaires were given to 152 Cobra pilots, and the results were analyzed. The principal findings were that

--in-flight emergencies existed in which the pilots felt they needed and would not be reluctant to use an escape system,

--94 percent of the pilots responded that "all attack helicopters should be equipped with an in-flight escape system," and

--60 percent of the pilots had experienced in-flight situations in which they felt the tension and anxiety would have been reduced had an in-flight escape system been available.

The study also raised the issue of assessing the moral, ethical, and legal implications of not providing a helicopter in-flight escape system. It stated that lawsuits involving fatalities resulting from "human factor design negligence" had highlighted the need for these considerations and that similar charges could arise from helicopter accident fatalities and injuries which could have been prevented had an in-flight escape system been available.

The Army Aviation Research and Development Command updated its draft requirement document and sent it to the Army Aviation Center in October 1977. The Center replied that there was no requirement for an escape system because

--doctrine dictated that attack helicopters will operate nap-of-the-earth, enhancing their survivability against antiaircraft weapons;

--the system imposed a weight penalty; and

--pilot reaction time would probably be insufficient to activate the system.

Although the Center did not concur with the draft requirement document, it did recommend that the program continue until a technical data package could be developed because future doctrine and tactics such as air-to-air combat might require helicopters to operate at higher altitudes.

Views within the Army differ on requirement for in-flight escape systems

Internal staffing documents show that the Aviation Center's official rejection of the requirement document was far from unanimous. For example, the Army Aeromedical Research Laboratory's position was that some sort of escape system was essential and mentioned that the Army/National Aeronautics and Space Administration Rotor Systems Research

Aircraft had an operating system. The Laboratory questioned the logic of the argument that nap-of-the-earth flying precluded sufficient time for the pilot to use the system. It felt this argument was not supportable based on "intimate" familiarity with numerous studies of "time to escape" and other literature on pilot escape decision processes.

The Army Safety Center also disagreed with the Aviation Center's position, citing studies indicating that fatalities and injury costs could be reduced with the escape system. It pointed out that in-flight escape systems would complement crashworthiness rather than replace it because each concept generally benefited different emergency situations.

In April 1979 the Aviation Research and Development Command told the Aviation Center that the system could not go into the engineering development phase without an approved requirement document. The Center replied that no need existed for continued development of the system because the "* * * environment in which our attack helicopter fleet operates today and for the foreseeable future, precludes use of such a system." Therefore, the Aviation Center had determined that developing a technical data package was unwarranted.

Army continues to study in-flight escape systems

While the Aviation Research and Development Command and Aviation Center dialogue took place, two other Army studies were done. The first, issued by the Applied Technology Laboratory in November 1977, recounted the systems' pros and cons and the various organizational positions. The study mentioned that the North Atlantic Treaty Organization's Advisory Group for Aerospace Research and Development was a strong proponent of such systems and concluded that accident statistics indicated that the use of in-flight systems would save lives. The benefits were difficult to assess, however, because of nap-of-the-earth flight trends and the increasing emphasis on crashworthiness. It also concluded that strong differences of opinion existed over the need for and desirability of such systems.

The study recommended that a Department of the Army position be established regarding the use of in-flight escape systems so that either action could be taken to provide the required capability or the subject could be laid to rest. As

far as we could determine, no Department of the Army position was taken as a result of this study.

The second study, by the Army Safety Center in March 1978, dealt with the economic benefits of in-flight escape systems. It estimated conservatively that an escape system would reduce injury costs by 15 percent over the 20-year operational life of an attack helicopter. The study did not address operational trade-offs and analyzed only noncombat Cobra accidents during the years 1971-76. It concluded that in-flight escape system benefits were complementary to the advanced attack helicopter's crashworthiness because they would generally benefit different emergency situations.

SOME STILL SEE A NEED FOR ESCAPE SYSTEMS

In 1979 the Navy expressed renewed interest in helicopter in-flight escape systems for the Marine Corps. A Navy committee, concerned with aircrew survival, determined the other services' positions and found that the Army is concentrating on helicopter crashworthiness instead of in-flight escape, and the Air Force has no efforts ongoing or planned.

The Marine Corps believes that helicopter in-flight escape is still a valid requirement. However, as indicated in 1975, an independent effort to develop such a system without active Army participation is considered questionable because of the limited number of Cobras in the Marine Corps. It has 110 Cobras, while the Army has over 900. The Marine Corps also believes that a feasibility study, including tactics and threats, is a necessary first step in any future development.

On April 30, 1980, the House Committee on Armed Services reported on the DOD Authorization Act for fiscal year 1981. The committee recommended authorizing $1 million to the Army to demonstrate the feasibility of a helicopter escape system for triservice application. The committee noted the absence of any research and development throughout DOD for helicopter escape systems and stated its belief that there are helicopter missions exclusive of nap-of-the-earth flying where an escape system would provide enhanced crew survivability.

CONCLUSIONS AND RECOMMENDATIONS

For years the services have considered the need for helicopter in-flight escape systems. The technical feasibility of attack helicopter in-flight escape systems has been demonstrated by developmental work already done and

by similar systems installed in Army/National Aeronautics and Space Administration Rotor Systems Research Aircraft. Furthermore, studies show that such systems can reduce the number of pilot deaths and serious injuries resulting from helicopter accidents.

However, differences of opinion still exist between and within the services over the need for escape systems in attack helicopters. Major considerations for determining the need are (1) the potential for saving human lives given the escape systems' performance and attack helicopters' operating environment and (2) the associated penalties on mission performance.

A definitive cost and operational effectiveness study has not been done to provide a sound basis for a decision. We believe that it is time to settle this issue. Accordingly, we recommend that a thorough and quantitative cost and operational effectiveness study be done of an in-flight escape system for the Cobra helicopter. Included should be such factors as

--the number of pilots that would be saved both in peacetime and during combat,

--benefits to be derived from increased pilot morale and military readiness,

--savings from eliminating death payments and reducing training costs,

--the percentage of time spent flying in the nap-of-the-earth environment,

--the effect of the system's added weight on the operational mission,

--costs to develop and retrofit the system on existing Cobras and install it on newly produced helicopters, and

--the concept's application to other service helicopters.

AGENCY COMMENTS

We discussed this report with a representative from the Office of the Deputy Under Secretary of Defense for Research

and Engineering (Research and Advanced Technology) who agreed with our findings, conclusions, and recommendations.

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

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

We would appreciate being informed of the actions you plan to take in response to our recommendation. If you have questions or wish to discuss the report, please call Jack Heinbaugh on (202) 275-3195 or Joseph Hopkins on (215) 441-3055.

Sincerely yours,

W. H. Sheley, Jr.
Acting Director

Enclosure

ENCLOSURE I

ACTIVITIES VISITED

Office of the Deputy Under Secretary of Defense for Research and Engineering (Research and Advanced Technology), Washington, D.C.

Department of the Army Headquarters, Washington, D.C.

Department of the Navy Headquarters, Washington, D.C.

Marine Corps Headquarters, Washington, D.C.

Naval Air Systems Command, Washington, D.C.

Naval Air Development Center, Warminster, Pa.

U.S. Army Aviation Research and Development Command, St. Louis, Mo.

U.S. Army Troop Support and Aviation Materiel Readiness Command, St. Louis, Mo.

U.S. Army Aviation Center, Fort Rucker, Ala.

U.S. Army Safety Center, Fort Rucker, Ala.

National Aeronautics and Space Administration Headquarters, Washington, D.C.

Stencel Aero Engineering Corporation and Talley Industries Company, Arlington, Va.