BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Army Helicopter Improvement Program's Future May Depend On Success In Controlling Cost

In less than 3 years, costs of the program to improve the Army s scout helicopter have gone from an initial estimate of $1 3 billion to $2 7 billion The latest estimate would permit procuring only 578 helicopters instead of the original 720 Additional cost increases can be anticipated

Since the helicopter s configuration had not been fully defined when the initial cost estimate was prepared, Defense officials maintain that the initial estimate should not be given too much credence GAO considers the initial cost estimate, which prompted congressional approval, particularly significant given the repeated congressional objections to the high cost of earlier scout helicopter starts

Unlike some other Army weapon system programs which have been rushed into production this one is proceeding at a moderate pace There fore, the program has a better chance of succeeding than did its predecessors

The Army s ability to contain further cost growth will likely determine the program s future

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To the President of the Senate and the
Speaker of the House of Representatives

This report presents our views on the major issues concerning the Army's Helicopter Improvement Program.

For the past several years, we have reported annually to the Congress on the status of selected major weapon systems. This report is one in a series that is being furnished to the Congress for its use in reviewing fiscal year 1984 requests for funds.

We are sending copies of this report to the Director, Office of Management and Budget, and to the Secretary of Defense.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

ARMY HELICOPTER IMPROVEMENT PROGRAM'S FUTURE MAY DEPEND ON SUCCESS IN CONTROLLING COST

D I G E S T

If successfully developed, the Army's Helicopter Improvement Program will provide a capability to overcome major deficiencies in existing scout helicopters. However, the program's cost growth has been dramatic, its cost having more than doubled in less than 3 years from an initial estimate in February 1980 of $1.3 billion to a current estimate of $2.7 billion. The program is still in the early stage of development. So far, the helicopter's capabilities have not been tested and demonstrated. Coupled with other uncertainties that exist in the program, some additional cost increases can be anticipated.

How well the Army can control the program's cost is likely to determine its future. Because of congressional displeasure with their high cost, past Army efforts to develop a new scout helicopter were halted early in development.

The new helicopter is to be capable of acquiring and designating targets for the attack helicopter not only in daylight, but also at night and in periods of limited visibility, things the current helicopter cannot do. A sight mounted outside the aircraft above the main rotor, equipped with a television, infrared sensors, and a laser designator, is to provide the helicopter the capability to view and designate targets with only the sphere which houses the sight exposed. (See pp. 1 to 4.)

PROGRAM EXHIBITS A RELATIVELY CONSERVATIVE ACQUISITION STRATEGY

Certain aspects of the helicopter program offer the promise that it may survive where previous efforts to develop a scout failed. The scout helicopter is not a completely new development but, rather, a modification of an existing helicopter, the Army's OH-58. Also, unlike several other current Army weapon system acquisitions,

the program's milestones show an orderly and moderately paced progression towards large-scale production.

The milestones allow for a 41-month, full-scale engineering development program. They provide for completing development testing and for flight testing its most critical component, the mast-mounted sight, before the helicopter begins production. Although most operational testing will not have been accomplished before the first production option is to be exercised, only 16 of the programmed 578 helicopters will have entered production before a full-scale production decision is due in April 1985. The second production option, for 44 aircraft, is not due to be exercised until 9 months after testing is completed, leaving ample time for the results to be evaluated and reported. (See pp. 2 and 9.)

SOME PROGRAM RISKS AND UNCERTAINTIES EXIST

The helicopter program is not without some risk and uncertainty. The most important among these is developing and testing the mast-mounted sight, a component employing relatively advanced technology. Other concerns involve the pilot's ability to maintain the aircraft's hovering position and the aircraft's compatibility for night operations with the Apache attack helicopter, for which it is to designate targets. The attack helicopter has a superior night vision capability. These concerns should be addressed in the development and operational tests which are to begin July 1984 and end January 1985. (See pp. 6 to 9.)

The helicopter program has not advanced sufficiently to permit an assessment of its potential. The first definitive indications of its progress will not appear until development and operational tests begin in July 1984. Therefore, GAO is not making any recommendations now.

AGENCY COMMENTS

Defense officials said the initial $1.3 billion planning estimate should not be given too much

credence. They explained the large program cost increase as due to the planning estimate having been made when the helicopter's configuration had not been fully defined.

Defense officials added that improvements to the helicopter's night vision and hovering will be considered for procurement after the aircraft's performance is assessed in development and operational testing. They believe adopting a pilot night vision system similar to the one incorporated in the Apache may not be warranted by the additional cost and weight this would entail.

GAO believes the original cost estimate was very significant given the repeated congressional objections to the high cost of earlier scout helicopter starts. GAO attaches particular importance to the forthcoming development and operational tests where the helicopter's performance without the improvements will be demonstrated. If the tests show a need for the improvements, the effectiveness they could provide will have to be measured against the increased cost they would entail.

GAO performed this review to provide the Congress with the status of the program before it begins to evaluate the Army's fiscal year 1984 request for funds to finance the helicopter's continuing development.

Contents

ABBREVIATIONS

AHIP	Army Helicopter Improvement Program
GAO	General Accounting Office

The Army s AHIP Scout

CHAPTER 1

INTRODUCTION

The Army Helicopter Improvement Program (AHIP) is the latest in a series of programs designed to upgrade current observation helicopter capabilities to meet the Army needs on the modern battlefield. The Army made earlier attempts, in 1972 and again in 1976, to develop a helicopter for the scout role but these ended shortly after they began because the Congress deemed the programs to be too costly.

For affordability reasons, the Army, rather than develop an entirely new aircraft, extensively modified its OH-58A observation helicopter to provide at a lower cost an improved scout which could be fielded relatively quickly. In September 1981, the Army awarded Bell Helicopter Textron a fixed-price incentive contract with a $148 million target price to design and fabricate five prototype aircraft. The Army estimates total costs of the development at $228 million and the modification of 578 aircraft at an additional $2.5 billion.

SYSTEM DESCRIPTION AND MILESTONES

According to the Army, the AHIP scout will provide a capability to perform reconnaissance, acquire targets at standoff distances and designate targets for attack helicopter, air cavalry, and field artillery units. It is to be capable of operating in daylight, at night, and in moderately adverse weather. A mast-mounted sight equipped with a television, infrared sensors, and laser designator is to provide the helicopter with the ability to survey the battlefield from hidden positions, undetectable by the enemy's radar, to enhance its chances of survivability.

AHIP provides for extensive modifications and additions to the OH-58A helicopter. The superstructure of the present OH-58A will remain but its rotor system, engine, power train, and avionics components will be replaced with equipment presently in use commercially or militarily or with new technology components. Project officials estimate that 44 percent of the aircraft weight will basically represent hardware employing new technology. Some of the major modifications include

--a mast-mounted sight above the main rotor,

--a control display system which displays necessary target, navigation, and flight information;

--a four-bladed fiberglass composite main rotor and composite main rotor hub;

--an uprated drive system with a 435-horsepower main transmission,

--an uprated 110-horsepower tail rotor drive system;

--vibration isolation pylon mounting system;

--an Allison engine with 650-shaft horsepower;

--provisions for mounting the multipurpose lightweight missile;

--improved nap-of-the-earth communications and navigation avionics, and

--survivability equipment, including a radar warning receiver and infrared suppressor.

The following schedule reflects key milestones for the program.

Full-scale engineering development contract awarded	Sept. 1981
Critical design review	Nov. 1982
Long lead time release	June 1983
First flight with dummy mast-mounted sight	Aug. 1983
First flight with operational mast-mounted sight	Oct. 1983
Contractor testing completed	July 1984
Government development testing	July to Aug. 1984
Government operational testing	Sept. 1984 to Jan. 1985
First production option (16 aircraft)	Sept. 1984
Full-scale production decision	Apr. 1985
Second production option (44 aircraft)	Oct. 1985
Initial delivery	Oct. 1985
Initial operational capability	June 1986

NEED FOR AHIP

The light observation OH-58 helicopter, now serving as the Army's scout, does not possess flight or mission equipment capabilities to perform such required scout functions as acquiring targets at long ranges and laser designation. It must be fully exposed to observe enemy targets. Its inherent performance limitations restrict adequate so-called nap-of-the-earth flight whereby it could fly close to the earth's surface to avoid detection. Neither does it have sufficient power and maneuvering capability to accept additional weight from added mission equipment. AHIP, by incorporating engine, power train, and rotor system improvements, permits adding various items of equipment to enhance the mission. These are also to provide better aircraft performance capabilities, including the ability to perform in hot climates and at high altitudes. The additional equipment provides better communications, navigational aids, and survivability. Incorporating the mast-mounted sight above the rotor blades would allow the helicopter to perform required critical target acquisition and designation functions while remaining hidden from enemy view. The sight's infrared sensors would enable the scout to fly and acquire targets in adverse weather when visibility conditions are reduced.

SCOUT HELICOPTER HISTORY

After its earlier attempts to develop an advanced scout helicopter were ended, the Army, in 1977, began modifying OH-58A helicopters to OH-58Cs to provide a limited performance capability to function as an interim daytime scout. At about the time this modification program was started, the Army established specific operational requirements for an advanced scout helicopter. In August 1978, a special study group was formed to determine how the advanced scout mission and requirements could be satisfied. The group recommended a new development airframe to include twin engines and an upgraded mission equipment package which included a mast-mounted sight.

In November 1979, a special Army Systems Acquisition Review Council reaffirmed the Army's need for the advanced scout helicopter. The Council concluded, however, that developing a completely new aircraft was unaffordable and could not be completed quickly enough to meet the Army's needs. As a result, it recommended pursuit of a near-term program that would use existing helicopter inventories. This program was designated AHIP in December 1979 and in July 1980 the program was approved by the Army. Design competition between Hughes Helicopters Incorporated and Bell was initiated in January 1981 and a contract awarded to Bell in September 1981 for full-scale engineering development.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our review was made to evaluate the status of AHIP to assist the Congress in its review of the fiscal year 1984 budget. Our objectives included a review of the current cost and potential cost growth of the program, program risks and development concerns, and the helicopter's survivability.

In conducting our review, we examined numerous documents, including analytical studies; intelligence reports; program cost, schedule, and performance data; and other contractor and Defense documents. Also, we interviewed officials having the responsibility for these programs within the Defense, the Department of the Army; and various subordinate organizations of the Army's Materiel Development and Readiness Command, including the Scout Helicopter Project Manager's Office, the Army's Training and Doctrine Command officials, and the prime contractor program officials.

Our review did not include an overall assessment of the capabilities of AHIP to perform its mission in conjunction with the Army's AH-64 attack helicopter. The tactics which the two aircraft are to employ, and the anticipated results, have been studied by the Army in cost and effectiveness analyses and other studies but the flight tests of both aircraft working together are not planned to be held before mid-1984.

Our review was made in accordance with generally accepted government auditing standards.

CHAPTER 2

PROGRAM COSTS HAVE GROWN AND ARE STILL A CONCERN

Cost growth is the program's major concern. In less than 3 years, estimated costs for AHIP have more than doubled from an initial estimate in February 1980 of $1.3 billion to a current estimate of $2.7 billion. This dramatic rise in costs necessitated a reduction in the planned procurement of helicopters from 720 to 578. In an attempt to contain the rise in costs, the Army entered into a fixed-price contract with Bell for full-scale engineering development and negotiated option prices for the first two production increments. However, cost performance reports are beginning to show a trend of slippage in the development schedule. There are other areas which could result in further cost growth.

HISTORY OF AHIP COST GROWTH

The first estimate of program costs, prepared by the project office in February 1980, projected $1.3 billion in escalated dollars as the cost for 720 AHIP scouts. This planning estimate contemplated the use of an existing engine, drive train, avionics, and rotor system, while incorporating a minimum range mast-mounted sight capable of day or night operation. At that point, the Army had not completed AHIP's performance requirements.

In July 1980, an Army Systems Acquisition Review Council management review increased performance requirements to enable the helicopter to operate at nap-of-the-earth altitudes in cold and hot weather environments. This caused the need for configuration changes which included upgrading the engine and the power train to sustain the larger engine, a new main rotor for improved hot day performance, and a new tail rotor for better control at low speeds. The Army also decided to expand AHIP testing to reduce technical risk. This program redirection, along with additional cost escalation, pushed program costs up almost $357 million.

AHIP is one of several new weapon programs whose procurement the Army, in fiscal year 1981, decided to extend because it was going to have difficulty obtaining funds to finance all of them in the quantities desired and within the period they were to be acquired. Consequently, the Army lengthened the program 2 additional years. This stretch-out, and configuration changes following industry responses to the Army's request for proposals, further increased the estimated procurement cost to over $2 billion. At this cost, the Army determined it would be unable to buy the programmed 720 aircraft. Therefore, it lowered the quantity to 578 aircraft.

Since the development contract award, costs have increased $163 million for additional spares due to a change in spares estimating methods and $226 million due to revised inflation indexes. In October 1982, total estimated program costs amounted to about $2.7 billion.

Although cost growth has slowed considerably since the Army fully defined system requirements, the potential for additional cost increases exists because of program uncertainties. The most important among these is developing and testing the mast-mounted sight, a component employing relatively advanced technology. Also, an improvement may be needed in the ability to maintain the aircraft's covering position to enhance flight handling characteristics for effectively operating the mast-mounted sight. There is some concern about the aircraft's compatibility for night operations with the Apache attack helicopter, for which it is to designate targets, since the attack helicopter has a superior night vision capability. This visual advantage renders the attack helicopter more capable of flying nap-of-the-earth in darkness than the scout helicopter. The Army believes it has advanced the prospects for controlling costs by negotiating a fixed-price contract for engineering development and initial production.

DEVELOPING THE MAST-MOUNTED SIGHT REPRESENTS HIGHEST PROGRAM TECHNICAL RISK

The mast-mounted sight, the key new component and the most costly portion of the AHIP development, presents the greatest technical risk to the program. The sight is critical to the success of the program and is the pacing item in development. It is built by McDonnell Douglas Corporation in conjunction with Northrop Corporation. The mast-mounted sight is a sphere 25 inches in diameter, mounted about 30 inches above the main rotor. The sphere contains sensors and a laser rangefinder and designator. Its development cost is estimated to be about 40 percent of the $228 million AHIP development cost.

Some difficulties with program cost and schedule, primarily related to the mast-mounted sight's development, were first reported in the contractor's August 1982 cost performance report. This showed total program cost overruns of $4.8 million above target costs with $4.2 million of that amount attributed to the sight. At that time, two dummy mast-mounted sights were expected to be delivered 2 weeks late, while the remaining operational sights were 6 weeks behind schedule. The effect of these delays on program costs is uncertain.

When compared with the attack helicopter's sight, the mast-mounted sight has shorter target detection and recognition ranges with a much wider field of view. According to Army officials, the scout will be used more for searching and reconnaissance

purposes at closer ranges than the attack helicopter and thus a short range, wide field of view sensor is practical.

The Army assesses the overall risk of the mast-mounted sight as moderate. The basic components are repackaged proven designs and the Army, therefore, considers them to carry a low risk. The major risk contributor is the mechanical integration of the components into the thermal, space, and weight restrictions of the sphere.

An important problem has been the inadequate fatigue life of the internal bearing isolators. The contractor's analysis showed isolators failing after 200 hours instead of the 4,500 hours required. Since that time, the isolator material and design have been changed, and Army officials believe, based on subsequent contractor analyses, that fatigue requirements will be met.

The actual integration of the mast-mounted sight with the airframe will begin in July 1983. Before that, Bell will use dummy mast-mounted sights, stabilized but without sensor packages, for initial testing. First flight of a fully operational sight is planned for October 1983.

CONCERNS ABOUT FURTHER COST GROWTH

Certain additions to the helicopter may result in further cost growth. A proposal has been solicited from the contractor to improve the helicopter's hovering capability. The Army has also taken preliminary action to incorporate an air-to-air missile, included in its requirements, and may consider an infrared system to improve pilot night vision as a future product improvement.

Hover improvement may be needed

A February 1982 Army study of human factors affecting the scout's operation revealed that the effectiveness of the mast-mounted sight hinges on the ability of the pilot to hold the helicopter in a precision hover. The study noted that holding this hover could create a very high workload on the pilot and, accordingly, it recommended that an altitude hold and hover system be developed.

In view of the potential need for this capability, AHIP program officials have requested the prime contractor to submit a proposal for the development of such a system. These officials said that if costs of the hovering system are affordable, it will be incorporated into the development contract. If not, the scout, without an automatic hovering capability, may not be able to maintain the required hovering position once it emerges from its hidden position to designate targets.

Plans for a helicopter air-to-air missile

While the Army has a requirement to equip the scout helicopter with air-to-air missiles, no funding for this effort has been requested. The AHIP's basic development merely calls for designing the aircraft with sufficient space, weight, and power provisions to accept a defensive missile system if it is added later. Without this capability, the scout has no self-protection against an enemy air threat. This limitation is of concern to the Army's user representatives, who believe that an air defense capability would enhance not only the AHIP scout's survivability but also that of the attack helicopter with which it will frequently be employed.

The Army has plans to install air-to-air missiles on some number of its scout helicopters as specific missions dictate. The Army's initial program estimate for a scout air-to-air missile development is $44 million. So far, no funds have been requested for this development.

Night flight limitations

Whereas the attack helicopter is equipped with a complex pilot night vision system, the scout helicopter will be equipped with night vision goggles that are also used in other Army helicopters. As a result, system performance and operational limitations exist because (1) the use of goggles for night flying presents difficulties in designing cockpit lighting and (2) it would preclude the scout pilot from flying nap-of-the-earth under certain conditions such as total darkness.

There are two types of night vision goggles that will be used in the scout. The pilot night vision system goggles are presently in the Army inventory. Another model of night vision goggles, the aviator's night vision imaging system, has been developed and is now in production. Both systems are light amplification devices which require ambient light from sources such as the moon or stars. Neither type will perform well on extremely dark nights although the newer goggles require much less ambient light.

The Army's human factors study concluded that, at times, environmental and night conditions could preclude the scout and attack helicopters from operating as a compatible, effective team. This would occur because the attack helicopter's infrared pilot night vision system is capable of seeing with no ambient light while the goggles require a minimum specific level of light.

The Army decided not to incorporate an infrared pilot night vision system in the scout helicopter because of cost and weight considerations. The attack helicopter version weighs over 100 pounds. Army officials regard the incorporation of a pilot night vision system as a possible future modification to the AHIP scout once the technical community has developed a unit in the 20 to 30 pound weight range.

Use of fixed-price contract to control costs

In an attempt to control costs, the Army negotiated a fixed-price incentive contract for the full-scale engineering development phase of AHIP. In the first 13 months of the contract, target cost rose approximately $3.1 million but did not exceed the ceiling price. This increase was for the purchase of an additional mast-mounted sight prototype for testing purposes. To further control costs, the Army negotiated ceiling-priced options for the first two production buys of 16 and 44 aircraft, respectively. These options were included in the contract.

CONCLUSION

Certain aspects of the helicopter program offer the promise that it may survive where previous efforts to develop a scout helicopter failed. The Army's acquisition strategy is relatively conservative. The AHIP scout helicopter is not a completely new development. Also, the program's milestones show an orderly and moderately paced progression towards large-scale production. In these circumstances, the risk of sustaining large cost growth is reduced.

The milestones allow for a 41-month, full-scale engineering development program. They provide for completing development testing and flight testing its most critical component, the mast-mounted sight, before the helicopter begins production. Although most operational testing will remain to be accomplished before the first production option is to be exercised, only 16 of the programmed 578 helicopters will have entered production before a full-scale production decision is due in April 1985. The second production option, for 44 aircraft, is not due to be exercised until 9 months after testing is completed, leaving ample time for the results to be evaluated and reported.

However, the helicopter program has not advanced sufficiently to permit an assessment of its potential at this time. The first definitive indications of its progress will not appear until development and operational tests begin in July 1984. Therefore, we are not making any recommendations.

AGENCY COMMENTS

Defense officials said the initial planning cost estimate should not be given too much credence. They explained the large program cost increase as due to the planning estimate having been made when AHIP's configuration had not been fully defined. According to Defense officials, the original $1.3 billion estimate was for an aircraft with limited capability.

Defense officials added that improvements to the helicopter's night vision and hovering will be considered for procurement after the aircraft's performance is assessed in development and operational testing. They believe adopting a pilot night vision system similar to the one incorporated in the Apache may not be warranted by the additional cost and weight this would entail. They also said they were still reviewing the question of whether to add an air-to-air missile.

We believe the original cost estimate was very significant given the repeated congressional objections to the high cost of earlier scout helicopter starts. We attach particular importance to the forthcoming development and operational tests where the AHIP performance without the improvements will be demonstrated. If the test show a need for the improvements, the effectiveness they could provide will have to be measured against the increased cost they would entail.

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