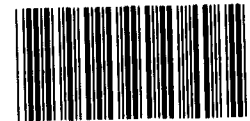
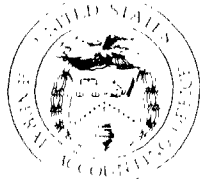


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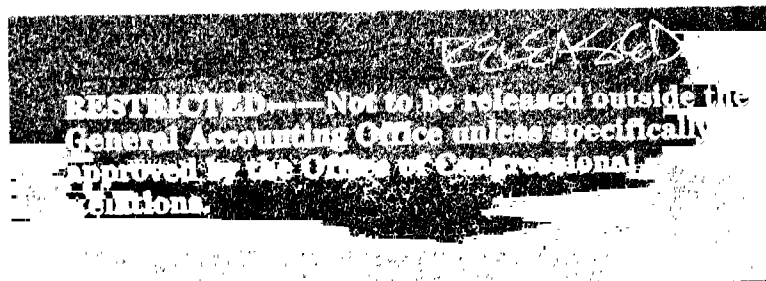
SPECIAL OPERATIONS FORCES

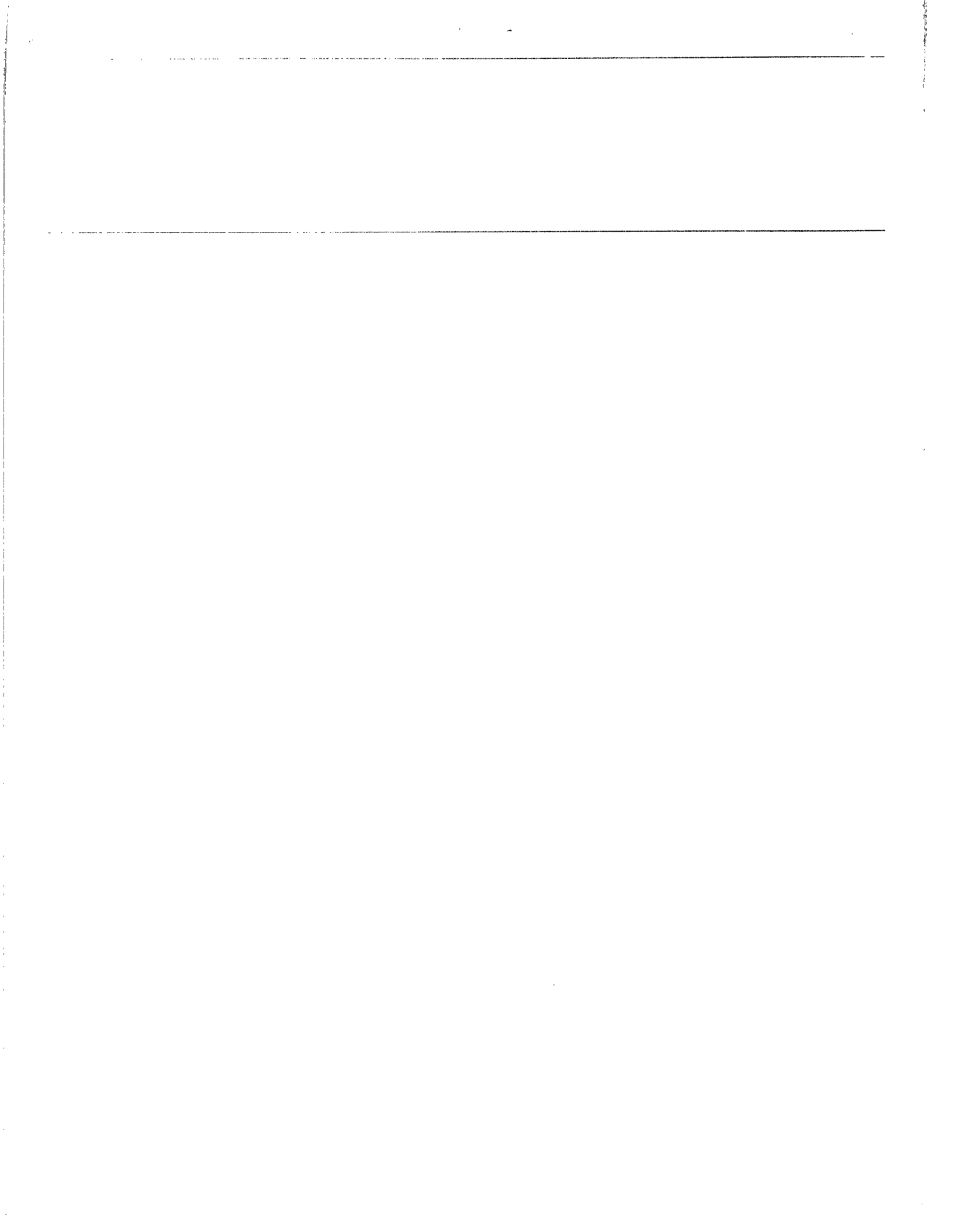
Army Plans Highly Concurrent Acquisition Strategy for Costly Helicopters



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**National Security and
International Affairs Division**

B-240262

September 28, 1990

The Honorable William V. Roth, Jr.
United States Senate

Dear Senator Roth:

As you requested, we evaluated cost, schedule, and test plans for the Army's special operations forces (SOF) helicopter program. Specifically, we reviewed (1) the Army's planned concurrency of prototype and operational testing with helicopter production and (2) current cost estimates for the program.

Results in Brief

The Army plans to award full-rate production contracts for SOF helicopters before it completes developmental testing and long before it completes operational testing. In fact, the Army plans to have about 90 percent of its SOF helicopters either delivered or in production before the completion of operational testing.

The Army's current acquisition strategy for SOF helicopters increases the risk of having to make expensive retrofits on production helicopters to correct deficiencies identified in testing rather than limiting the risk to only those systems produced in a low-rate initial production run. Further, the Army plans to field these systems without an important self-defense capability required for certain missions.

The Army currently reports total SOF helicopter modification program costs at about \$1.36 billion. However, a more accurate estimate of the cost is at least \$2.1 billion because some component and airframe costs are being reported and paid for by Army activities other than the SOF product office. In addition, many other costs were not included in the Army's estimate. Furthermore, this estimate does not include the added costs of installing additional equipment after the helicopters are fielded and of overcoming problems identified during testing.

Background

The Army initiated SOF modification programs in 1986 for some of its CH-47 Chinook and UH-60 Black Hawk helicopters. Operationally, these modified aircraft, designated the "MH-47E" and the "MH-60K," are expected to be able to perform clandestine, deep-penetration airlift missions in adverse weather conditions and high-threat environments.

Appendix I provides greater detail on the modifications being made to the Chinooks and Black Hawks to convert them to SOF aircraft.

Believing that both the MH-60K and the MH-47E helicopters were nondevelopmental items, the Army originally decided that little helicopter developmental testing and no operational testing were needed. In its 1989 statement of its SOF helicopter acquisition strategy, the Army assumed that because the helicopters used in the program were qualified systems, planned testing and evaluation would consist primarily of integrating and testing already qualified components. Recently, however, the acquisition and testing strategies for both helicopters have been restructured to include additional developmental testing and evaluation of the prototype aircraft. The Army believes that current SOF program cost and performance risks are acceptable.

Although the Army has designated the SOF aircraft as nondevelopmental items, the SOF modifications include an extensive integration of both off-the-shelf and newly developed avionics equipment. More specifically, the Army plans to combine about 40 pieces of communications, navigation, and aircraft survivability equipment into the integrated avionics subsystem in the SOF aircraft. In addition, the Army plans to integrate a multimode radar, a forward-looking infrared sensor system, a map display generator, and an aviator's night vision imaging system. According to independent Army evaluators, it is the extensive integration of avionics equipment that puts the SOF aircraft at risk.

In addition to producing one prototype helicopter for each program, the Army plans to award a series of contracts for the production of 50 MH-47E and 22 MH-60K helicopters between fiscal years 1990 and 1993. Of these, the Army has designated the first 11 MH-47E and 11 MH-60K helicopters as low-rate initial production helicopters.

High-Risk Acquisition Test Strategy

Department of Defense and Army regulations call for operational testing before production decisions are made to reduce cost and technical risks. Past unsatisfactory experience in system acquisition demonstrates the need for this testing. In the SOF program, however, the Army does not plan to conduct initial operational test and evaluation before proceeding beyond low-rate initial production. Rather, under current Army plans, most SOF aircraft (53 of the planned 74) will be in production or delivered before operational tests even begin. Further, the Army plans to test and field SOF helicopters that do not possess all the equipment necessary to satisfy operational capability requirements.

Acquisition Policies and Regulations Provide Internal Controls to Reduce Developmental Risks

Current acquisition guidance calls for early developmental and operational testing to demonstrate that a system will work as intended and can accomplish its intended mission. Department of Defense policy mandates the completion of initial operational testing and the assessment of results before the full-rate production phase. Army regulations state that low-rate initial production may be conducted to verify production capability and to provide the assets necessary to conduct various types of testing, including operational testing. These regulations also require that before the full-rate production decision, initial operational test and evaluation on a production-representative system must be conducted, with a dedicated phase of initial operational test and evaluation on a system certified as ready for fielding.

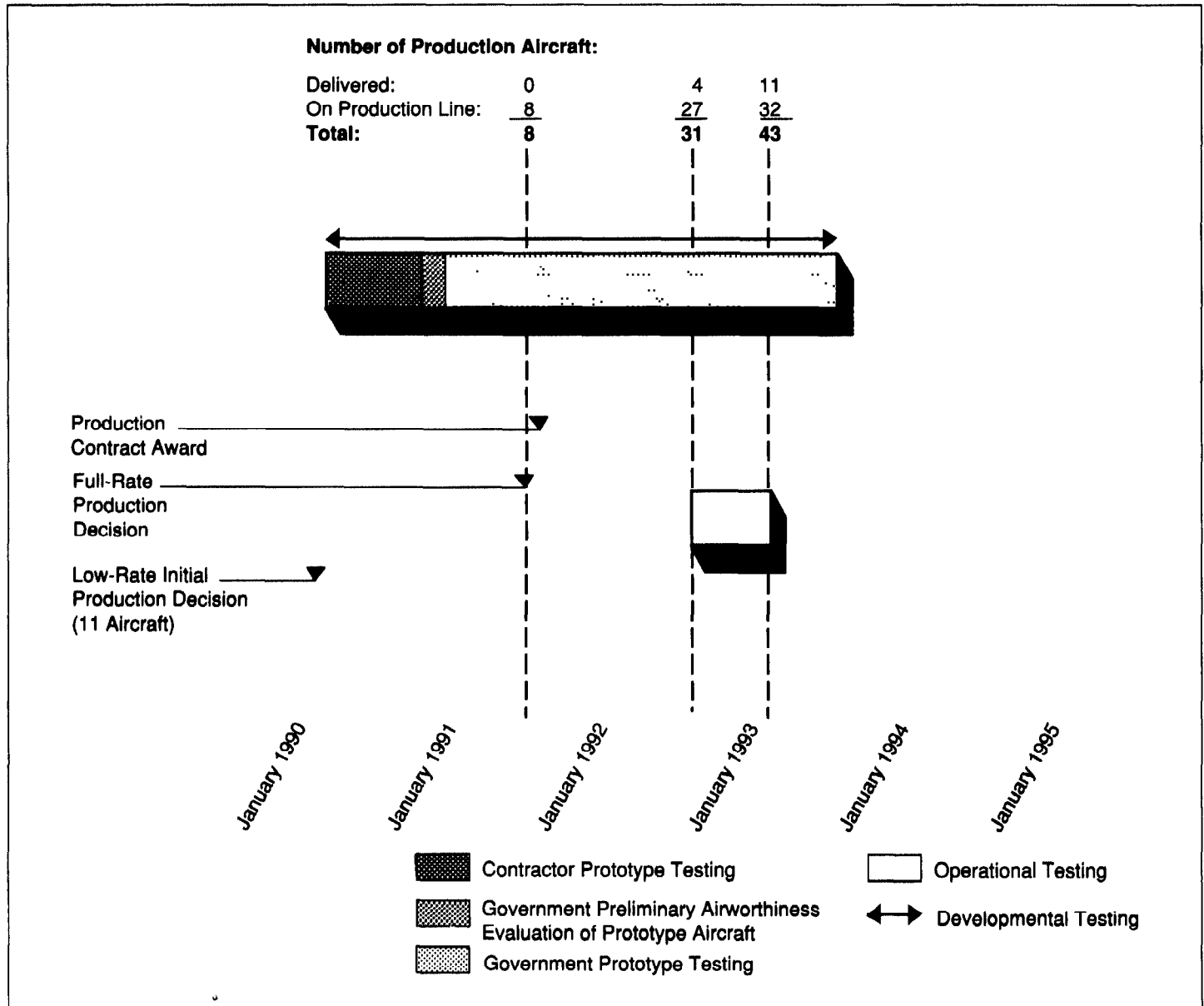
When the Army does not follow operational testing requirements, it risks fielding systems that require expensive retrofits or are unable to perform their required missions. For example, in 1985, we reported that the Army had little performance information available on the Sergeant York air defense gun to measure its reliability, maintainability, and effectiveness before production began. The acquisition and testing plan for the Sergeant York was similar to that of the SOF helicopter program in that critical operational test information about the ability of the Sergeant York to perform its mission under realistic conditions was unavailable prior to the production decision. The Army judged both performance and cost risks on the Sergeant York to be acceptable, based on the use of mature components and subsystems and contractor responsibility and experience. Thus, with only limited test results, production began on an unproven system. However, the system integration process proved more difficult than expected. When operational testing was eventually conducted, the Sergeant York was unable to perform as intended, and the Secretary of Defense consequently terminated the program.

Army Plans Production Concurrent With Developmental Testing and Before Operational Testing

The Army plans a low-rate initial production of 22 SOF helicopters (30 percent of the total helicopter buy) concurrent with developmental testing on the prototype aircraft. The Army also plans to award full-rate production contracts for both helicopters nearly 2 years prior to the completion of the developmental testing of the prototype helicopters and over a year earlier than planned operational testing is to begin. Over 90 percent of the 72 MH-47E and MH-60K production helicopters are to be in production or delivered by the time operational testing is to be completed.

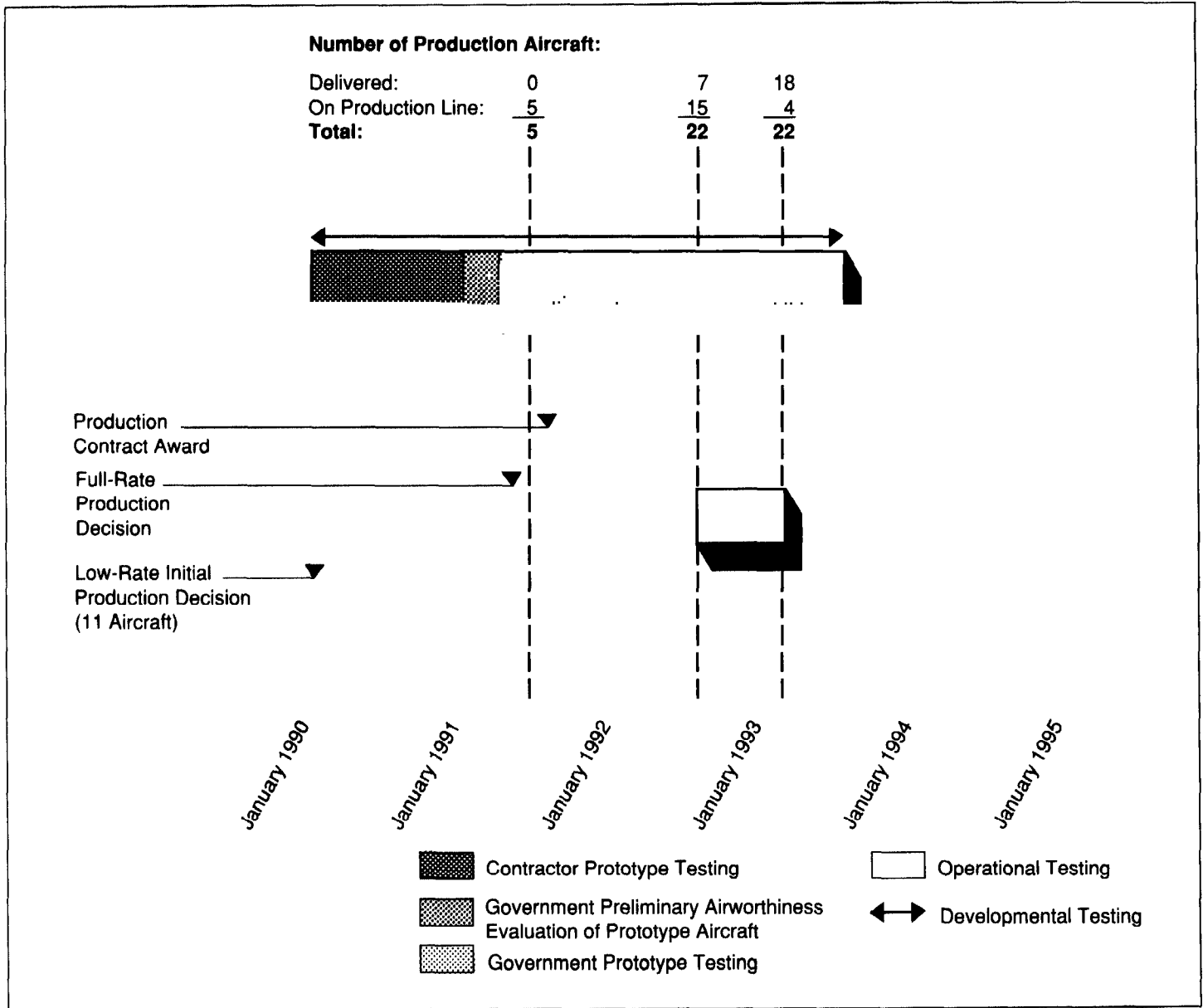
Figures 1 and 2 show the developmental and operational testing schedules for the Army's SOF helicopter modification programs, along with the production decisions for each of the helicopters.

Figure 1: MH-47E Testing and Production Schedule



Source: GAO analysis of Army data.

Figure 2: MH-60K Testing and Production Schedule



Source: GAO analysis of Army data.

Aircraft Will Be Fielded Without Some Required Equipment

Each of the Army's SOF helicopters is to have an air-to-air missile system and a flight data recorder, neither of which will be available when the helicopters are to be fielded. Flight data recorders are required; however, they are not critical to the SOF helicopter's ability to perform its

missions. On the other hand, the air-to-air missile provides a key defensive capability for the helicopter when it is performing certain missions. Without the missile, there is little to protect these helicopters if they are discovered by the enemy while on such missions. Neither the missile nor the recorders have been developed, but the Army plans to incorporate both items into the helicopters at a later date through preplanned product improvements.

Army Has Identified Some Program Risk

The Army has identified four areas of risk associated with the SOF helicopter program: (1) the development of the Integrated Avionics Subsystem mission processor, (2) the time required for the certification and qualification of the multimode radar system, (3) the performance of government-furnished equipment, and (4) retrofit costs for four helicopters in production during contractor flight testing and government preliminary airworthiness evaluation flight tests.

While the Army has identified these areas of risk, it has not addressed the risk associated with concurrent production and government developmental and operational testing. On the contrary, Army officials told us that delaying a full-rate production decision until after the completion of operational testing would result in cost increases for MH-47E aircraft. They believe that costs would increase because MH-47E and other modifications would have to be made after the CH-47D production line is closed.

Operational testing of the MH-47E is expected to be completed in February 1993. At that time the Army will have 32 CH-47D aircraft in production. As we reported in February 1990, the Army does not have a mission-based justification for 34 of the 51 MH-47E aircraft it plans to procure.¹ Therefore "E" modifications could be made to 16 of the 32 CH-47D aircraft still in production after the completion of operational testing and before the close of the CH-47D production line.

Program Costs Much Higher Than Currently Estimated

The Army has estimated the SOF modification program cost for 74 helicopters to be about \$1.36 billion. However, a more accurate estimate of the cost is at least \$2.1 billion because some component and airframe costs that will be incurred are being reported and paid for by Army activities other than the SOF program office. The government is likely to

¹See Special Operations Forces: Army Plans to Buy More MH-47E Helicopters Than Needed (GAO/NSIAD-90-118, Feb. 14, 1990).

incur additional costs to correct problems identified during developmental and operational testing and to install equipment that will not be included on the helicopters when they are fielded. This additional equipment, such as the air-to-air missile, is necessary to make the MH-47E and MH-60K helicopters capable of meeting operational requirements.

**Many Costs Not Included
in SOF Modification
Program Estimates**

Currently reported cost estimates for the modification program exclude many costs associated with obtaining fully equipped SOF helicopters, including the cost of mission-essential equipment that has not yet been developed.

The Army's current SOF program cost estimate of \$1.36 billion does not include costs associated with SOF helicopter equipment that is paid for and reported by other Army activities. These other costs include (1) the cost of changes being made to the older CH-47C helicopters (under the CH-47D modification program) before they are upgraded to the MH-47E model; (2) much of the cost of obtaining T-712 engines, which are modified to provide better performance for the MH-47E; and (3) the cost of providing internal auxiliary fuel tanks needed to make the MH-47E self-deployable. Costs to obtain the basic Black Hawk airframe, the engine and equipment common to both the basic Black Hawk and the MH-60K, and the 230-gallon external fuel tanks required for some MH-60K missions are also reported in other programs. Finally, over \$195 million is needed to fund cost increases that have been identified by the SOF product office but are not reflected in current Army estimates. Table 1 details a more accurate estimate of the SOF modification program's costs.

Table 1: Estimate of Actual Program Costs

Dollars in millions			
Cost element	MH-47E	MH-60K	Total
Current Army estimate ^a	\$888.35	\$467.95	\$1,356.30
Other costs ^b			
CH-47D modifications	318.24	0	318.24
T-712 engine	66.28	0	66.28
MH-47E fuel tanks	16.80	0	16.80
Basic Black Hawk airframe	0	142.13	142.13
Black Hawk external fuel tanks	0	1.18	1.18
Subtotal	1,289.67	611.26	1,900.93
Cost increases ^c	97.60	97.60	195.20
Total	\$1,387.27	\$708.86	\$2,096.13

^aIncludes research, development, and procurement costs for 51 MH-47E and 23 MH-60K aircraft plus 2 combat-mission simulators.

^bCosts related to obtaining fully equipped Army SOF helicopters that are to be paid for and reported by Army activities other than the SOF product office.

^cTotal of \$195.20 million in cost increases not included in the Army's current estimate (a).

The Army's current unit cost estimate, including research, development, test, and evaluation plus procurement for 51 MH-47E helicopters, is \$17.4 million. The Army estimates a \$20.3 million unit cost for 23 MH-60K helicopters. Using our estimate of total program costs shown above, these unit costs are more likely to be \$27.2 million for the MH-47E, or \$9.8 million more than the Army's estimate, and \$30.8 million for the MH-60K, or \$10.5 million more than the Army's estimate.

Further Cost Growth Is Likely

The Army has not estimated the potential cost impact of developing, procuring, and installing some required equipment on the SOF production helicopters. Further, additional cost growth is anticipated for the MH-60K. The Army's required operational capabilities documents for SOF helicopters state that the SOF helicopters must be equipped with air-to-air missiles and flight data recorders. These capabilities are to be added as product improvements when they are developed. In addition, production costs for the MH-60K could increase if production of the basic UH-60 Black Hawk ends as planned with the fiscal year 1991 purchase. The Army has not yet estimated this potential cost increase.

Concurrent Testing and Production Plans Could Also Increase Program Cost Risk

The Army's plan to have most SOF aircraft in production or delivered before developmental and operational testing is completed not only increases technical risk but also increases program cost risk. At present, the Army has not estimated the total cost risk associated with this decision. The correction of problems identified during developmental and operational tests could increase program cost.

Recommendations

We recommend that the Secretary of Defense direct the Secretary of the Army to take the following actions:

- Limit low-rate initial production to the minimum number of MH-47E and MH-60K helicopters necessary for operational testing.
- Postpone contract awards beyond low-rate initial production until the Army can demonstrate that the aircraft can meet the operational needs of the users through required operational test and evaluation.
- Develop and provide to the Congress complete cost estimates that accurately reflect all costs to the government associated with acquiring fully equipped, mission-capable SOF helicopter systems.

Scope and Methodology

We conducted our work from January through June 1990 in accordance with generally accepted government auditing standards. As requested, we did not obtain formal agency comments on our draft report, but we did discuss our observations with agency officials during the assignment. We conducted interviews and obtained and analyzed data at the Army's Special Operations Aircraft Product Office; various offices at the Army Aviation Systems Command, St. Louis, Missouri, including the UH-60 Black Hawk Project Office and the CH-47 Chinook Project Office; the U.S. Special Operations Command, MacDill Air Force Base, Tampa, Florida; the Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflicts, the Pentagon, Washington, D.C.; the U.S. Army Materiel Systems Analysis Activity, Aberdeen, Maryland; and the U.S. Army Operational Test and Evaluation Agency, Alexandria, Virginia. We also visited the Sikorsky Aircraft Division of United Technologies Corporation, Stratford, Connecticut; the Boeing Helicopter Company, Philadelphia, Pennsylvania; and the IBM Federal Systems Division, Owego, New York.

As arranged with your office, unless you announce its contents earlier, we plan no further distribution of this report for 30 days. At that time,

we will send copies to the Chairmen of the Senate and House Committees on Armed Services and on Appropriations, the Director of the Office of Management and Budget, the Secretaries of Defense and the Army, and other interested parties.

Major contributors to this report were Henry Hinton, Associate Director; Jim Shafer, Assistant Director; Gary Billen, Assistant Regional Manager; John Wiethop, Evaluator-in-Charge; and Carole Coffey, Staff Member. Please contact me at (202) 275-4141 if you or your staff have any questions concerning this report.

Sincerely yours,

A handwritten signature in cursive script that reads "Richard Davis".

Richard Davis
Director, Army Issues

Descriptions of the Army's Special Operations Helicopter Modification Programs

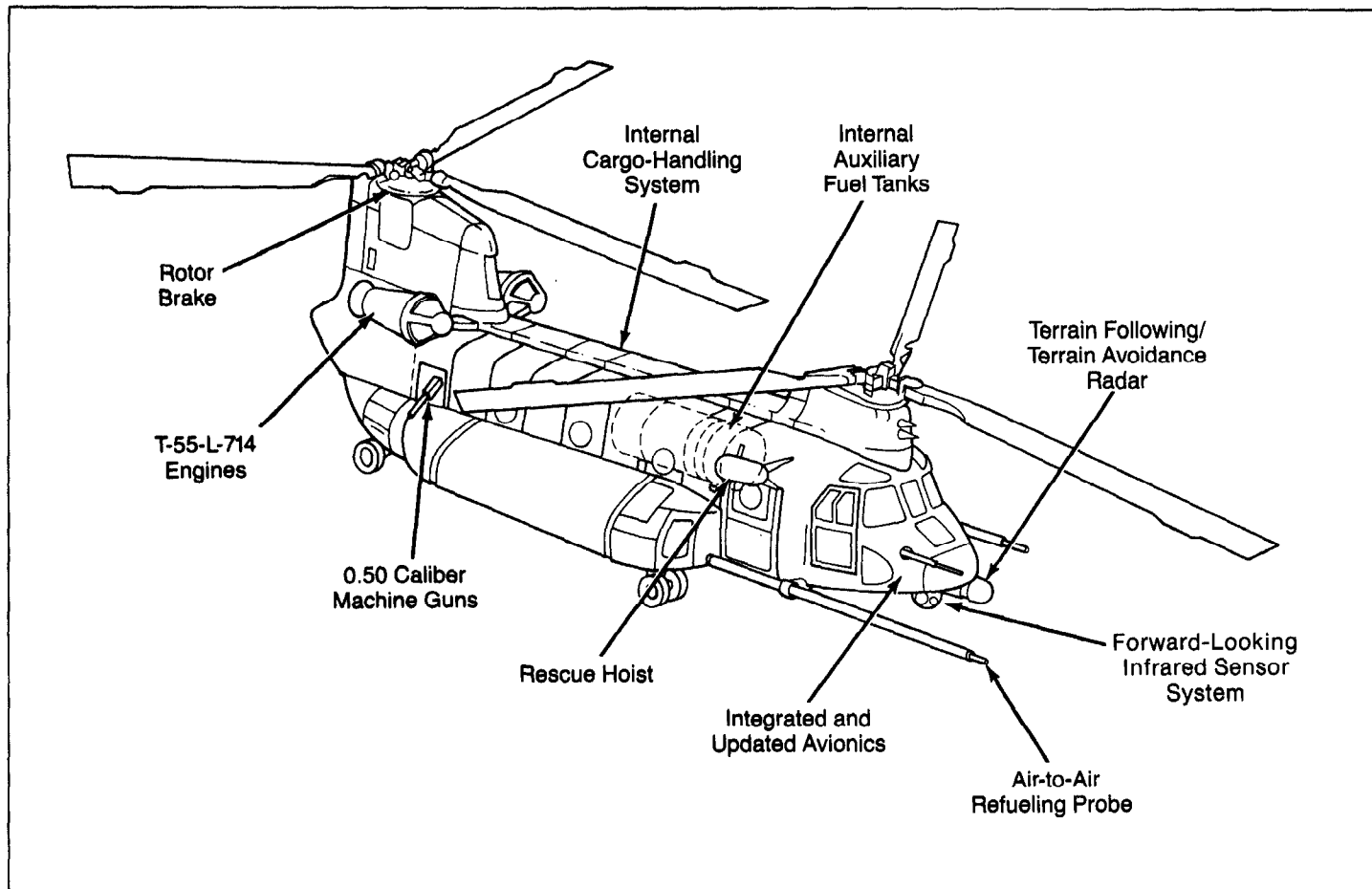
The Army modification programs for the SOF helicopter systems are among the most demanding helicopter development tasks to date. The modification programs stress commonality of upgrades to mission equipment systems. The MH-47E and the MH-60K helicopters also contain a common state-of-the-art integrated avionics subsystem.

MH-47E Helicopter

The MH-47E is being produced through a modification to the Army's ongoing CH-47D helicopter modernization contract. Under the CH-47D modernization effort, the Army is upgrading and modernizing earlier models of its tandem-rotor, twin-engine, medium-lift CH-47 helicopter to provide improved handling and increased performance. The Army had planned a total fleet of 472 CH-47D model helicopters. However, that number will be reduced to 421 if all 51 planned MH-47E models are produced.

The MH-47 "E" model will include some but not all of the CH-47D model's improvements. In addition to some "D" modifications, the MH-47E model will include an internal cargo-handling system, internal auxiliary fuel tanks, a terrain following/terrain avoidance radar, a forward-looking infrared radar, a rotor brake, an air-to-air refueling probe, a rescue hoist, additional troop seats, 0.50-caliber machine guns, and T55-L-714 engines (see fig. I.1). The MH-47E will also contain avionics system upgrades and an integrated avionics subsystem. Avionics improvements include aircraft survivability equipment, and the integrated avionics system includes both monochrome and color display monitors, mission and display processors, a map display generator/data transfer module, and remote terminal units.

Figure I.1: MH-47E Configuration



MH-60K Helicopter

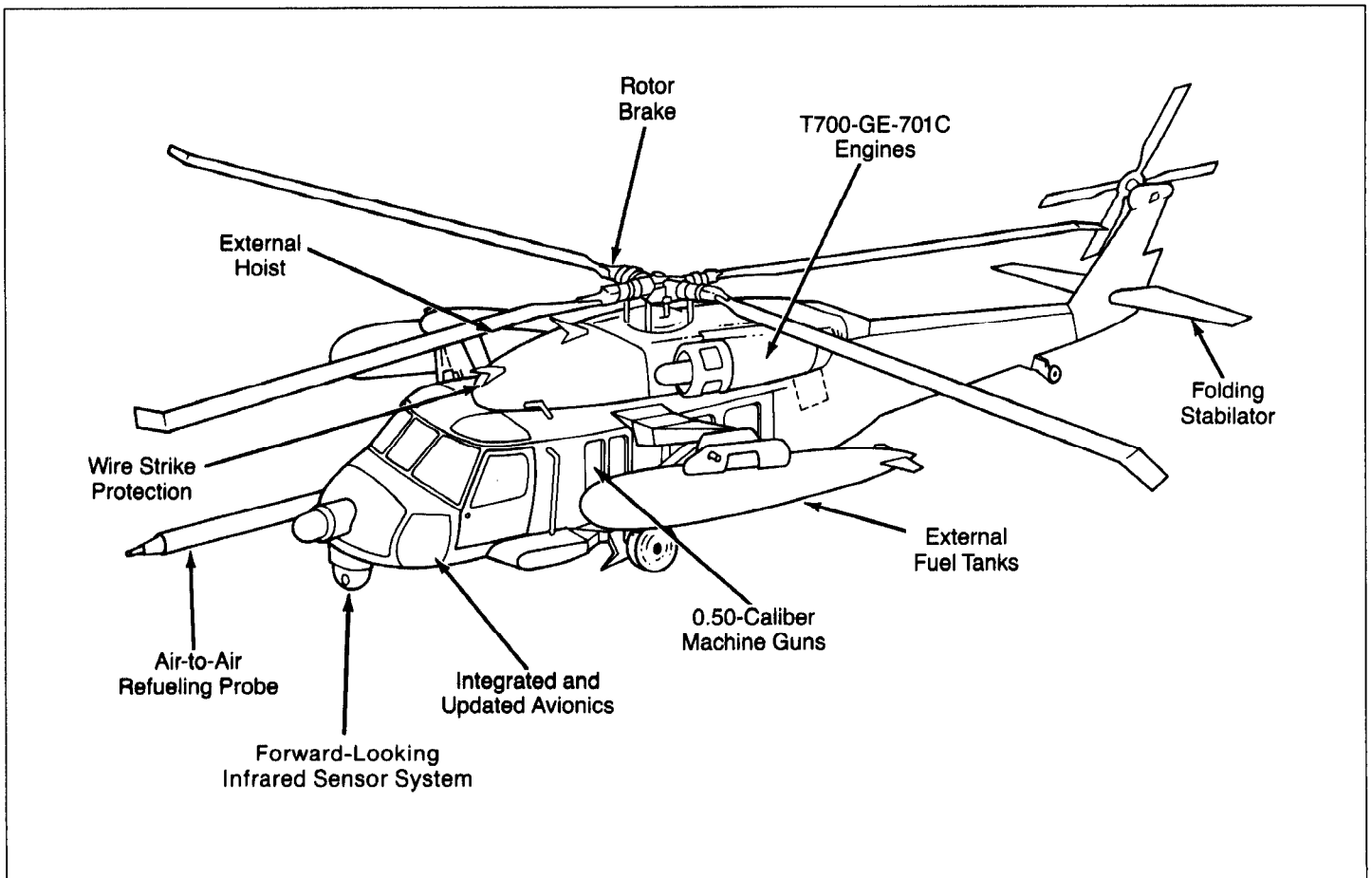
The Army is procuring MH-60K helicopters through a contract modification to its multiyear procurement of new production UH-60L Black Hawk helicopters. The Black Hawk is a twin-engine, single-rotor, medium-lift helicopter whose primary mission is to transport troops and equipment. Additional functions are to provide aeromedical evacuation, troop resupply, and command and control.

The MH-60K helicopter modification will include a folding stabilator, a rotor brake, an external hoist, wire strike protection, an air-to-air refueling probe, shipboard compatibility modifications, 0.50-caliber

Appendix I
Descriptions of the Army's Special
Operations Helicopter Modification Programs

guns, and external fuel tanks. The MH-60K will be equipped with essentially the same integrated avionics system and avionics system upgrades as the MH-47E helicopter.

Figure I.2: MH-60K Configuration



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