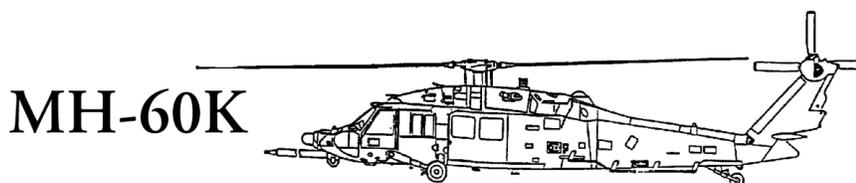
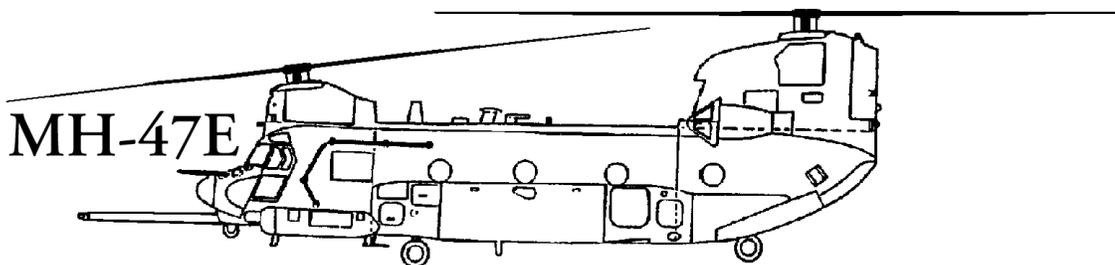


## MH-47E SPECIAL OPERATIONS AIRCRAFT AND MH-60K SPECIAL OPERATIONS AIRCRAFT



### Army ACAT IC Program

Total Number of Systems:	
MH-47E:	26
MH-60K:	23
Total Program Cost (TY\$):	
MH-47E:	\$690M
MH-60K:	\$633M
Average Unit Cost (TY\$):	
MH-47E:	\$26.55M
MH-60K:	\$27.52M
Full-rate production:	
MH-47E:	3QFY91
MH-60K:	3QFY91

### Prime Contractor

MH-47E: Boeing Helicopter  
MH-60K: Sikorsky Aircraft

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The MH-47E Special Operations Aircraft is a derivative of the Boeing CH-47 Chinook. Along with other modifications, it has a significantly increased fuel capacity with modified main and auxiliary fuel tanks. To enable long-range missions without refueling, the main fuel tank is enlarged to hold 2068 gallons while three auxiliary tanks, which hold 800 gallons each, are optional. The MH-60K is a derivative of the Sikorsky UH-60 Blackhawk. Its modifications include a significantly increased fuel capacity with two 185-gallon internal fuel tanks, side-by-side, against the rear bulkhead. In addition, in-flight refueling probes have been added. Both aircraft have modified integrated avionics suites and multi-mode radar, and are intended to provide adverse-weather infiltration/exfiltration and support to U.S. military forces, other agencies, and special activities. These U.S. Special Operations Command (USSOCOM) aircraft contribute to the *Joint Vision 2010* concept of *dominant maneuver* by helping to

create asymmetric advantages for combined application of land, air, and sea power against enemy defenses within the joint environment. They are capable, as modernized, multi-mission platforms operating within tailor-to-task organizations, of supporting precise, agile, fast-moving joint operations.

Due to their funding thresholds (less than the Major Defense Acquisition Program), the MH-47E and MH-60K SOA programs were not required to undergo operational test oversight from this office. However, these systems do qualify for LFT&E oversight since they qualify as major systems.

## **BACKGROUND INFORMATION**

These aircraft were treated as one program and were placed on the LFT&E oversight list in October 1991. Since the program was past Milestone III before the funding level breached that needed for LFT&E oversight, the National Defense Authorization Act for Fiscal Year 1993 made provisions to complete LFT&E prior to the Full Materiel Release Decision. The Acquisition Executive for USSOCOM has granted this system a waiver from full-up, system-level live fire testing. Letters notifying Congress of this waiver, along with the required accompanying LFT&E Alternative Plans (approved by DOT&E in July 1997) were submitted by the USSOCOM Acquisition Executive to the USD (A&T) on December 22, 1997. The DOT&E LFT&E Report on the results of this testing is near completion and will be forwarded to the congressional defense committees in FY00.

## **TEST & EVALUATION ACTIVITY**

Under the approved alternative LFT&E plan, testing was limited to the major changes made to the aircraft since the basic version of these aircraft have experienced combat damage already. In the case of the MH-47E, change occurred via the addition of up to three 800-gallon Robertson Auxiliary Fuel Tanks in the cabin and Boeing-designed sponson tanks with an expanded capacity of 2068 gallons and composite honeycomb shell construction. For the MH-60K, testing was limited to the two additional 185-gallon Robertson Auxiliary Fuel Tanks in the cabin.

Analyses conducted during the test planning phase revealed two potential vulnerabilities. The *first* potential vulnerability was associated with projectiles entering the fuel tanks in the volume above the liquid fuel level known as the ullage. Such impacts could ignite the fuel vapors and cause widespread explosions and/or fires. During test planning, USSOCOM decided to add an inerting system to the fuel tanks to avoid such fires/explosions. This system will undergo development and flight testing in the fall of 1999, and will begin installation in CY00. The MH-47E will be a lead-the-fleet system available for similar helicopter variants in other fleets. A *second* potential vulnerability was associated with projectiles impacting the fuel tanks below the fluid level and causing loss of fuel and or fires. To address this possibility, a series of Live Fire tests were completed at Aberdeen Proving Ground in August and September 1997, firing a variety of expected threats. In approving the alternative plan, DOT&E requested that additional tests be conducted with larger caliber threats if the test articles remained viable after the planned series of shots. These tests were completed in March 1998.

## **TEST & EVALUATION ASSESSMENT**

The MH-47E fuel tanks and the MH-60K auxiliary fuel tanks demonstrated exceptional ability to withstand ballistic impacts of projectiles associated with small arms, automatic weapons, and anti-aircraft

artillery. The tanks are designed to be self-sealing against 12.7-mm projectiles. However, the live fire tests indicated that the tanks designs are effective against much larger non-exploding projectiles, even with multiple impacts on the same tank. The designs also proved to be effective in mitigating the fuel loss from impacts by HEI projectiles. In addition, there were no fires in the 23 shots except for one, which self extinguished before any significant damage was done. One of the reasons for the strength of this design against ballistic threats is the fact that tanks are designed to be crashworthy, which adds to its robustness against the ballistic threat.

The LFT testing on these systems was completed in May 1998 and the Army's data reports were delivered to OSD in June 1998. The DOT&E independent LFT&E Report is in draft form awaiting the Army's final evaluation report, which is expected to be delivered in early FY00. The DOT&E independent evaluation report will be delivered to Congress within the required 45 days from when DOT&E receives the Army's evaluation.

### **RECOMMENDATIONS, CONCLUSIONS, LESSONS LEARNED**

The self-sealing fuel tanks of the MH-47E and the MH-60K performed better than expected. The Army is examining the potential use of these designs on other aircraft such as the CH-47D upgrade.

One of the lessons learned from this LFT&E program is that the initial analysis of an aircraft performed to identify Live Fire Test issues can have a direct impact on the design of the aircraft and should be performed carefully. In the case of the Special Operations Aircraft, fuel tank ullage explosion was identified as a potential vulnerability based on analysis and past testing. The analysis was sufficient to cause Special Operations Command to pursue fuel tank inerting without the cost of additional testing.

The fuel tank inerting is also an example of where a design feature incorporated to reduce ballistic vulnerability can have a positive effect on system safety in peacetime and war. Inerting the fuel tanks will reduce the hazards of fire and explosion from non-threat events such as the TWA 800 accident.

