

# CH-47F Improved Cargo Helicopter (ICH)

### SUMMARY

- Navigational improvements associated with the new cockpit enhance mission effectiveness reduce pilot in-flight workload and instill confidence in the aircrews.
- As tested during Initial Operational Test (IOT) Phase I, the CH-47F did not attain threshold goals to improve system reliability by ten percent. However, the CH-47F is attaining reliability rates better than the CH-47D.
- As tested during IOT Phase I, the CH-47F did not demonstrate all digital interoperability capabilities required for Block 1 aircraft.
- The full-rate production decision, for approximately 39 Aircraft through Lot 5, will take place during 1QFY05.



*The U.S. Army Test and Evaluation Command conducted IOT&E at Fort Campbell, Kentucky, from March 23 through May 6, 2004.*

### SYSTEM DESCRIPTION AND MISSION

The CH-47F program is a rebuild of the current CH-47D helicopter with selected upgrades intended to extend service life and increase operational performance. The CH-47D is a twin-turbine tandem rotor helicopter designed for combat and combat support heavy-lift cargo missions. During this past year, senior Army leadership directed the Program Management Office to develop and integrate a new Common Avionics Architecture System cockpit and to initiate non-recurring engineering efforts to qualify monolithic machine airframe components on the aircraft as an additional effort to increase performance, increase reliability, and reduce operational and support costs. The prime contractor, Boeing, will build 55 new CH-47Fs and rebuild nearly 397 existing CH-47Fs.

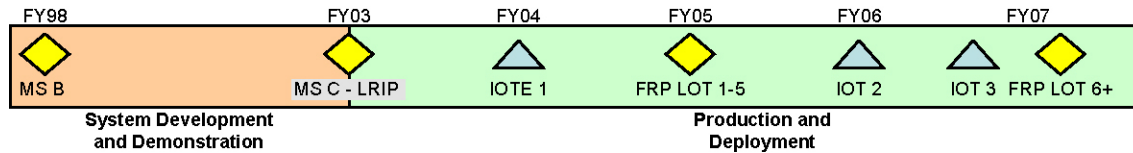
The Office of the Secretary of Defense (OSD) approved entry into the engineering and manufacturing development (EMD) phase in FY98, based on perceived low-technical risk, and delegated Milestone decision Authority to the Army Acquisition Executive. The program has experienced delays, changes to the Operational Requirements Document, and production unit cost overruns due to rate increases and contractor cost estimates. An OSD Program Decision Memorandum, directing a program restructure in FY02, delayed the First Unit Equipped fielding of the CH-47F until FY07 to accommodate the MH-47G program. The Army Acquisition Executive's approval for the purchase of up to 30 low-rate initial production aircraft occurred on August 19, 2002. The Army completed the Initial Operational Test and Evaluation (IOT&E) in May 2004, and plans the full-rate production decision in early FY05 for the first 37 production CH-47F aircraft.

The Joint Requirements Oversight Council approved the updated Operational Requirements Document in March 2004. DOT&E approved the current Test and Evaluation Master Plan (TEMP) in January 2002. A TEMP update is in process with an expected approval date in early FY05.

DOT&E approved an alternative Live Fire Test and Evaluation (LFT&E) strategy in December 1997. USD (AT&L) approved the waiver and provided certification to Congress in March 1998. DOT&E approved the Army's LFT&E plan in January 1999.

# ARMY PROGRAMS

## TEST AND EVALUATION ACTIVITY



Two refurbished EMD aircraft completed 518 flight hours of reliability and maintainability testing in January 2004. Developmental test pilots conducted heavy-lift mission profiles and contractor maintenance personnel performed organizational-level maintenance. The Army conducted the majority of test flights in Alabama and included loading and unloading the aircraft with simulated mission cargo. This developmental testing provided estimates for reliability and maintainability of partially equipped aircraft in benign environments using highly qualified crews and maintainers.

The Army has an evolutionary acquisition/two block approach for meeting requirements. The Army plans to test and evaluate this two-block approach in three phases of operational test. IOT Phase I is complete and tested most Block I capabilities. IOT Phase II will take place using a low-rate initial production aircraft. This test will evaluate the capability of the CH-47F to meet Block I interoperability requirements not demonstrated in IOT Phase I and all Block II interoperability requirements. IOT Phase II will also test the new Common Avionics Architecture System cockpit and the new Digital Automatic Flight Control System. Phase III IOT will be conducted using the production representative monolithic airframe aircraft and test any other changes made to the aircraft prior to the fielding of the system to the first unit equipped in FY07.

The U.S. Army Test and Evaluation Command conducted IOT&E at Fort Campbell, Kentucky, from March 23 through May 6, 2004. Two CH-47F aircraft flew fifteen operational missions in 99 flight hours during the test. Mission types included air assault, resupply, movement of artillery and ammunition, and transport of ammunition and fuel. Fort Campbell pilots and maintainers, who recently returned from Afghanistan, conducted limited mission planning, structured mission briefs, mission execution, and unit-level maintenance in accordance with unit standard operating procedures.

The LFT&E program started in FY99. The Army used a production CH-47D aircraft as the LFT system-level ground test vehicle. The ground test vehicle was operational, though no longer flight worthy. The Army completed testing in FY04. The evaluation of test results is ongoing.

## TEST AND EVALUATION ASSESSMENT

Analysis of CH-47D/F vibration and strain data indicates that both the CH-47D and CH-47F model aircraft are experiencing structural fatigue damage. Developmental test results indicate that cockpit vibrations levels are lower in the cockpit area of the CH-47F than the CH-47D. However, similar but different vibrations in the aft cabin area for both type aircraft will continue to cause fatigue damage especially when flying in medium to high gross weight and high airspeed flight conditions. Stresses in the aft frames exceed design limits and fatigue damage will continue to occur when the aircraft conducts missions at medium or heavy gross weights. To address these issues, the program manager will incorporate monolithic airframes into all CH-47F aircraft beginning with the FY07 deliveries.

During developmental and operational testing, the CH-47F demonstrated the capability to self deploy and completed all required operational mission types with range and power to spare. Navigational improvements associated with the new cockpit enhance mission effectiveness reduces pilot in-flight workload and instills overall confidence in both pilots and crews.

During IOT&E Phase 1, the aircraft system did not meet program goals for a ten percent improvement in reliability. DOT&E also found the system did not demonstrate appropriate levels of digital interoperability. Reliability testing to date has confirmed that failures in the CH-47F are common to legacy CH-47D aircraft. IOT&E results indicate that the mean time between mission abort is 19.7 hours. The threshold requirement for mean time between mission aborts is 44 hours. Additionally, the demonstrated mean time between essential maintenance actions is 2.5 hours, while the threshold value is 3.3 hours.

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The CH-47F program did not demonstrate that it has successfully integrated aircraft survivability equipment and communications enhancements. Electronic warfare testing concludes that the CH-47F, with its current aircraft survivability equipment suite of countermeasures, may be susceptible to attack. During IOT&E Phase I, radar and missile warning receivers had such a high false alarm rate that pilots habitually disabled the equipment, rendering themselves susceptible to any missile threat, had one existed. The Army plans to add the Common Missile Warning System to replace the legacy aircraft survivability equipment installed during IOT&E Phase I. This new system will require additional testing. Electro-magnetic Interference testing as it relates to the Modified Engine Air Particle Separator and Aircraft Survivability Equipment identified additional concerns. The CH-47F did demonstrate the capability to send and receive selected digital messages between aircraft and with an obsolete tactical internet ground station in a sterile environment. The aircraft has yet to demonstrate a fully functional digital messaging capability that is interoperable with a ground-based tactical internet. Pilots were also not able to establish clear communications on all required secure and high frequency voice networks. The CH-47F did not meet the Interoperability Key Performance Parameter by demonstrating all Block 1 requirements during test. The Army plans to test the remaining Block 1 requirements and all Block 2 requirements for the Interoperability Key Performance Parameter during IOT Phase II.

Overall, the CH-47F LFT&E program was a robust program. Test data from the Army's LFT of the CH-47F, combined with the DOT&E's Joint Live Fire program test of the CH-47D, is adequate to evaluate the vulnerability of the CH-47F relative to the CH-47D. The results identified areas where vulnerability reduction features would be desirable. Premature loss of the ground test vehicle in an accident precluded dynamic testing of the rotor blades, fire detection/suppression system, and tunnel region. This somewhat limited the overall assessment. The vulnerability of these subsystems pertains to legacy design and does not contribute to addressing the primary issue of whether the CH-47F is any more vulnerable than the CH-47D. The test results and development of an overall vulnerability assessment are being evaluated. The program should plan to test these three areas when a suitable test article becomes available.

