

ARMY PROGRAMS

Comanche (RAH-66)

The RAH-66 Comanche is a twin-engine, two-pilot, stealthy armed reconnaissance/attack helicopter. The Comanche intends to feature low observable composite technologies with retractable landing gear and weapons pylon to achieve a low radar cross-section (RCS) and a unique engine exhaust system to suppress its infrared signature. A five-bladed main rotor and a shrouded tail rotor minimize the acoustic and radar signatures. A fly-by-wire flight control system and fully integrated digital avionics assist in piloting the aircraft. The Mission Equipment Package integrates the radar, a forward-looking infrared sensor, and an image-intensified television sensor for night flying and target acquisition. The Comanche armament systems are to consist of the Joint Missile/Hellfire Missile, 2.75-inch aerial rockets, a turreted 20mm gun, and an air-to-air missile.

The Army intends for Comanche to be a key enabler in achieving the air-ground synergy required for the Army's Future Force. As a component of a Future Force air-ground task force, Comanche units will conduct reconnaissance, mobile strike, close combat with ground forces, and vertical maneuver. Comanche's primary role in these operations is to collect and share intelligence information and destroy enemy forces.

The Army received OSD approval for a sixth program restructuring in order to reduce risk and accommodate emerging Future Force requirements in October 2002. The new schedule will add 30 months to Engineering Manufacturing and Development (EMD), establish a blocked acquisition strategy, and reduce the amount of concurrent developmental testing, training, and operational testing. The schedule includes a low-rate initial production (LRIP) decision in FY07, delivery of an initial operational capability in FY09, and a full-rate production decision in FY10.

The Comanche program is a covered system for LFT&E. The latest revision date for the OSD approved LFT&E Strategy is June 2003. This strategy is an integral part of the updated Test and Evaluation Master Plan. The LFT&E Strategy presents a sequential test program, progressing from components to subsystems and, ultimately, to full-up system-level testing. The full-up system-level test article will be a Block I production representative aircraft. In addition, the strategy includes the lethality testing for the new XM1031 20mm ammunition being developed for the Comanche.

Comanche program actions during FY03 necessary to implement the restructure include the reorganization of the government-contractor development team and the completion of the system-level critical design review. Major assembly of the first EMD aircraft began in August 2003.

TEST & EVALUATION ACTIVITY

Testing has featured the flight-testing of two prototype aircraft (program totals at the conclusion of FY03 include 530 flights resulting in 630 flight hours), the use of a Propulsion System Test Bed for dynamic component testing, RCS testing of a full-scale model, contractor testing of mission equipment, (sensors, antennas, communications, armament) and crew- and team-level simulation events.

LFT&E activities include the completion of the initial vulnerability assessment and the start of a series of risk reduction ballistic and structural tests on evolving designs for the main rotor blade, the lightweight crew armor, and several tail rotor components. These components are being redesigned to reduce weight and cost, as well as to reduce the vulnerable area against high explosive incendiary (HEI) projectiles. The



Testing to date has featured flight testing of the prototype aircraft and crew and team-level simulation events.

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risk reduction ballistic effort will provide data to assist in the validation and verification of a finite element analysis model that will be used to determine the dynamic structural response of the tail rotor system when impacted by HEI projectiles. There is still an open issue with the Army to determine the specific configuration of the full-up system-level test article with specific emphasis on deciding whether to have fully operational avionics components installed versus representative non-functional ones. The latter approach could avoid damaging valuable avionics hardware; yet still have necessary avionics operation for the test. An Event Design Plan describing the lethality evaluation for the 20mm projectile is complete and OSD-approved.

TEST & EVALUATION ASSESSMENT

Technical challenges remain for software integration and testing of mission equipment, weight reduction, radar signatures, antenna performance, gun system performance, and aided target detection algorithm performance. Since the restructure, the Program Office identified engineering solutions to the known technical challenges. The efficacy of those solutions and identification of the unknown issues will not become apparent until developmental testing begins in FY05. The approved Comanche test program will provide ample opportunity to evaluate these technical issues and determine the effectiveness and suitability of the Comanche helicopter.

The Comanche program retains a medium-risk strategy for integration and testing of mission equipment on the aircraft. Software for delivery prior to LRIP will have minimal function (no armament, radar, aircraft survivability equipment, or digital communications). Integration testing of most mission equipment software and advanced functionality occurs in the last year of EMD. Memory requirements, software throughput, and bus requirements for several subsystems are projected to exceed allocations.

Empty weight projections for Block I, II, and III aircraft are slightly higher than weight goals for each block. Projected aircraft performance at these projected weights meet ORD requirements for vertical rate-of-climb. To achieve these projections, the Army must keep weight growth during development lower than historical averages and also successfully implement weight reduction initiatives.

Based on analysis of current designs and limited testing on a contractor range, the radar warning receiver and two communications antennas do not meet some RCS allocations. The satellite receiver antenna does not meet performance requirements, and the radar warning receiver sensitivity is marginal. Efforts to reduce the RCS are likely to adversely affect the performance of already marginal antennas.

While the Program Office has taken steps to begin design of a telemetry antenna for the Operational Test and Training Instrumentation System (OTTIS) that will limit the effect of the system on the RCS of the Comanche platform, this remains a risk area. The OTTIS system requires the installation of an external antenna that could have a large RCS signature, perhaps eclipsing the radar signature of the remainder of the aircraft. In testing and training environments, the Comanche radar signature could potentially be much larger than the wartime signature. If so, the Army's maxim to "train as you fight" will be compromised and the validity of susceptibility testing will be degraded.

The current turreted gun system design features a lightweight (312 pounds) 20mm armament system that makes it difficult to stabilize the gun and maintain accurate fire. Gun firing will also produce elevated barrel temperatures that rapidly approach the temperature limits of nearby composite components. After firing, the gun must remain deployed until the barrel cools. Leaving the gun deployed increases the aircraft's radar and infrared signatures compared to the stowed position.

In laboratory testing, Comanche Aided Target Detection-Classification algorithm performance in known terrain environments is outstanding; however, in environments with complex thermal and spatial clutter, performance can be degraded.

The LFT&E program remains adequate under the new acquisition strategy for Comanche. The LFT&E strategy anticipates completion of the program to support the Milestone III review in 1QFY10. The strategy includes component qualification and subsystem level ballistic testing for over 20 critical components, and dynamic testing on the full-up production-representative aircraft. However, because of the late (2QFY08) delivery of the LFT&E aircraft, correction of vulnerabilities discovered during LFT&E will be difficult to implement on initial production aircraft.