

COMANCHE (RAH-66)



Army ACAT ID Program

Total Number of Systems:	1,213
Total Program Cost (TY\$):	\$47.8B
Average Unit Cost (TY\$):	\$30.3M
Full-rate production:	1QFY07

Prime Contractor

Boeing/Sikorsky

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The RAH-66 Comanche is an advanced twin engine, two pilot (tandem) light attack/armed reconnaissance helicopter currently being developed for the U.S. Army by a joint venture comprising Boeing Helicopters and Sikorsky Aircraft. The Comanche features a five-bladed bearingless main rotor, a shrouded tail rotor, a low radar cross-section composite fuselage with retractable weapons pylons, a fly-by-wire flight control system, and a fully integrated cockpit. The mission equipment package incorporates forward-looking infrared and image-intensified television sensors for night flying and target acquisition. The Comanche will initially be armed with the Hellfire missile, the air-to-air Stinger missile, 2.75-inch aerial rockets, and a turreted 20-mm gun.

The Comanche is intended to replace the current fleet of AH-1 and OH-58 helicopters in all air cavalry troops and light division attack helicopter battalions, and supplement the AH-64 Apache in heavy division/corps attack helicopter battalions.

The Comanche will provide armed reconnaissance and light attack capability for attack helicopter and air cavalry units. The Comanche is a *dominant maneuver* platform that leverages *information superiority* and *precision engagement* to provide an element of *full-dimensional protection* to the ground maneuver force.

BACKGROUND INFORMATION

The development of the Comanche helicopter began in 1983 when it was first called the Light Helicopter Experimental (LHX). Since then, the erratic history of the Comanche program has produced no less than five program restructures. In the early 1980s, the LHX was envisioned to be a family of low-cost, lightweight helicopters that could come in either a scout, utility or attack version, and all were to have many interchangeable parts. Originally, all versions were to be single-seat aircraft, but by 1988, the Army reverted to the two-seat concept, decided on a single version (combined armed reconnaissance and attack), and reduced the planned acquisition from 4,292 to 2,096. Force structure reductions and increased costs have driven the acquisition quantity to 1213.

The Comanche program is currently in a program definition/risk reduction phase. First flight of the aircraft occurred in January 1996, and DT is proceeding in accordance with the TEMP. The program is scheduled to enter the EMD stage following a Milestone (MS) II decision in March 2000. The full-rate production decision is scheduled for December 2006.

The Comanche program was recognized as an LFT&E system in November of 1989. The LFT&E strategy was approved in fall 1995, with the latest revision being negotiated with the recent TEMP update, which was approved March 25, 1998.

TEST & EVALUATION ACTIVITY

A series of tests were conducted in calendar year 1999 to demonstrate that the Comanche meets its MS II exit criteria. Although a vast majority of the hours flown (190.5 as of December 21, 1999) on the two prototype aircraft have been for envelop expansion, some of those hours were flown in support of MS II Exit Criteria testing. The MS II exit criterion categories were Vertical Rate of Climb, Night Forward Looking Infrared Recognition Range, Radar Cross Section Signature, Infrared Signature, Ballistic Vulnerability, Readiness and Support, and Fire Control Radar. These developmental tests, although not conducted under operational conditions, were intended to demonstrate a degree of subsystem maturity prior to the MS II decision.

The Comanche TEMP is currently being revised to reflect an approved program restructure (July 1998). The emerging OT&E strategy is expected to combine simulation and actual flight activities. The major goal of the evaluation program is to clearly establish the operational effectiveness and suitability of the Comanche helicopter, with particular emphasis on situational awareness, survivability, lethality, and sustainability. DOT&E and the Army have agreed on a baseline evaluation strategy that will compare the performance of a Comanche-equipped air cavalry troop (ACT) to the performance of an OH-58D Kiowa Warrior-equipped ACT as each executes challenging missions. In addition, the Army is exploring the merits of using a Mission Success Template methodology to support the evaluation of unit effectiveness in the security (reconnaissance, guard, cover, and screen) and light attack missions. The dialogue between DOT&E and the Army regarding this issue continues.

In addition, the Comanche OT&E community has actively participated in the Comanche Analysis of Alternatives (AoA) to ensure that there is a linkage between the AoA and OT&E, particularly in the areas of scenarios and measures of effectiveness, the performance parameters that define the military utility of the system.

The Comanche Live Fire Test and Evaluation strategy includes component-level MS II exit criteria tests, EMD component-level tests soon after MS II, and full-up system-level tests of a production configured Comanche before MS III. The strategy identifies 34 components for testing, five of which were tested as part of the MS II exit criteria tests completed in latter FY99. Evaluation of these tests is ongoing. In addition to the exit criteria testing, a number of ballistic tests are being conducted during this current phase of testing as part of the risk reduction program.

TEST & EVALUATION ASSESSMENT

The Comanche has an extremely risky test and evaluation strategy largely because of constraints attributed to the program's funding profile. Most testing (developmental, live fire and operational), other than envelop expansion flight testing, has been deferred until the latter half of the program's EMD phase. The resulting test schedule compression allows little reserve in the schedule, thereby increasing the impact of unforeseen events/delays.

Although earlier acquisition strategies included dedicated early operational testing, as a result of the situation described in the previous paragraph, there has been no *dedicated* operational testing to date, and none is scheduled until 2004. (A program office-directed "Electro-Optical Sight System User Survey" is scheduled for fourth quarter FY03.) Consequently, there is little understanding of the operational utility represented by the current prototype aircraft for the MS II decision. Also, the proposed schedule plans all dedicated operational testing for the 20 months immediately before MS III (December 2006). The first (and only) period of dedicated "early" operational testing—a limited user test (LUT)—begins just 13 months before the start of the initial operational test and evaluation (IOT&E). Any significant problems requiring meaningful corrective actions will likely lead to substantial delay in IOT&E and the full-rate production decision.

Although there were no OT-specific events in 1999, evaluation of the results from flight testing and MS II exit criteria testing contributed to a better understanding of the Comanche's anticipated operational capabilities. A comparison of the flight envelope of the prototype aircraft (as demonstrated in DT) to the flight envelope of the OH-58D shows dramatic improvement. As an example, increases in forward, rearward and lateral airspeeds allow the Comanche to takeoff and hover at higher crosswind speeds than the OH-58D with attendant improvements in maneuverability and controllability. However, flight-testing also revealed a noticeable tail buffet as the aircraft's speed reached 80 to 100 knots. Although this does not immediately and directly affect flight safety, it is clearly undesirable from the user's perspective (vibration levels may interfere with weapons targeting and buffet loads contribute to tail structural fatigue). A reshaped pylon, flight-tested in 1999, reduced tail buffeting but compromised directional stability. Additional corrective changes have been identified and will be flight-tested, beginning in 2000.

There is a strong possibility that the program may require one more design iteration. Despite the considerable flight testing to date, an aero-dummy of the Comanche's fire control radar (FCR) will not be flown on either of the existing two prototype aircraft until March 2000. Furthermore, the third aircraft (and beyond) is expected to be equipped with a larger rotor (an increase of one foot in diameter) and blades fitted with anhedral tips. It is extremely difficult to predict with any degree of confidence whether

the FCR aero-dummy and the rotor and blade tip changes will affect the tail buffeting/directional stability problems observed on the two prototype aircraft. DOT&E is concerned whether these problems will be understood and corrected (or sufficiently mitigated) before the March 2000 MS II; furthermore, the subsequent addition of the FCR and the larger rotor may have other effects. Early integration of the mission equipment package would be most prudent for the program at this time.

The risk reduction tests that were conducted as part of the LFT&E program generated ballistic data for the redesign of the following four major subsystems: Tailcone and shroud, FANTAIL subsystems, main rotor blade, and composite panels. The purpose of the redesign of these components is mostly for weight/cost reductions.

LFT&E testing for 29 key components was shifted from before MS II to well after MS II due to unavailability of funds and the acceleration of MS II. Due to the compressed nature of the EMD phase, it will be difficult to correct any weaknesses discovered and hence adds the additional risk of not getting a potential design change incorporated and tested in time for full-rate production. As noted earlier, a MS II decision is scheduled for March 2000. The assessment of readiness to proceed into EMD will be based on limited knowledge. There is no operational testing to provide a base for a MS II operational assessment. It is not clear that the Comanche concept will have been “demonstrated” or “validated” by March 2000. Hence, the decision will rely primarily on technical test results (seven MS II exit criteria to be met) for insights into system operational effectiveness and suitability. It should be noted that the exit criteria are narrow in scope and only addresses a subset of the issues. Emerging MS II exit criteria testing results suggest that Comanche is just not as mature technically as one might expect for a MS II. In addition to the flight characteristics mentioned earlier, significant risks remain, including system integration on the platform and with each other, radar cross section and Comanche Radar.