

Leading the Transformation

RAH-66 Comanche Enters EMD Phase of Systems Acquisition Life Cycle

LT. COL. FORREST HENDRICK, USA

The RAH-66 Comanche aircraft is the U.S. Army's next generation reconnaissance, security, and light attack helicopter and is an essential element of Army Transformation. This aircraft will replace the Army's aging fleet of OH-58D Kiowa Warrior aircraft in the required mission roles beginning around the fiscal 2007 timeframe. Able to perform air combat operations and all operations under limited visibility, day or night, the Comanche RAH-66 will use Low-Observable (LO) technologies to enhance mission effectiveness and capability.

A fully integrated, lightweight, low-cost, twin-engine, two-pilot, advanced technology helicopter weapons system, Comanche is intended to enhance commanders' ability to project, protect, and sustain the force; gain information dominance; shape the battlespace; and conduct decisive operations, while increasing operator and maintainer efficiency. It will perform these missions in support of the Regimental Cavalry, Division, or Corps commanders' scheme of maneuver. As spelled out in Part I, *RAH-66 Comanche Test and Evaluation Plan*, 1999, the Comanche will operate with the UH-60 and AH-64 aircraft and will be interoperable with Joint Forces.

Comanche improvements over the Kiowa Warrior system include:

- Composite airframe structures
- Protected anti-torque systems
- Low-vibration, high-reliability rotor systems



RAH-66 Comanche aircraft.

- Reduced signature
- Built-in diagnostics/prognostics
- Second-generation target acquisition and night vision sensors
- Comanche radar.

The Comanche electronics architecture will incorporate integrated communi-

cations, navigation, and identification avionics modules, and integrated electronic warfare systems technology. The Under Secretary of Defense for Acquisition, Technology and Logistics Defense Acquisition Board (DAB) approved the RAH-66 for entry into the Milestone II Engineering, Manufacturing, and De-

Hendrick is the Army National Guard Aviation Advisor to the Aviation and Missile Command and a member of the Acquisition Corps.

velopment (EMD)/Milestone B phase of the acquisition life cycle in April of fiscal 2000.

The EMD phase of Comanche development will test various aspects of the system to mature the technology necessary to ensure a successful program. The Comanche Test and Evaluation Master Plan incorporates several innovative approaches. For the first time, Army Aviation has initiated a major



weapon system acquisition of this type, with a two-company industry prime team performing the design, development, and production. This approach offers many potential advantages and disadvantages. To reduce risk and increase the overall likelihood of program success, established key exit criteria will guide the Test and Evaluation (T&E) effort. The following list summarizes the Milestone II exit criteria approved by the DAB:

- Vertical rate of climb
- Night forward-looking infrared radar recognition range
- Radar Cross Section (RCS) signature
- Infrared (IR) signature
- Ballistic vulnerability
- Readiness
- Support and demo of reduced-size Comanche radar antenna.

Comanche T&E Organization

Crucial to the overall success of Comanche development is the Test and Evaluation Integrated Process Team (T&E IPT). The Comanche Program Manager is responsible overall for the developmental T&E program and serves as chairman of the T&E IPT. The Assistant Program Manager for T&E is the central point of contact for T&E-related direction and guidance for the Comanche program. An IPT guides the overall T&E effort for Comanche. All Comanche test requirements are integrated through the T&E IPT. The chart at the top of the next page describes the Comanche T&E IPT membership.

The Comanche Program Office will use a Combined Test Team (CTT) to support the overall T&E effort. As the primary test execution arm of the T&E IPT, the goal of the CTT is to reduce redundant testing through a continuous combined government and industry T&E process. The CTT is a combined government-industry team of engineers, users, the Army Test and Evaluation Command (ATEC), the Army Training and Doctrine Command, the Defense Logistics Agency, the Light Helicopter Turbine Engine Co., U.S. Army Simulation, Training and Instrumentation Command, and the Army Research Lab. With unrestricted access to data, the CCT will be involved in the following:

- Airframe Development
- Flight Controls Development Handling Qualities
- Armament Fire Control Systems
- Propulsion Systems
- Environmental Testing
- Survivability Demonstrations
- RAM Analysis
- Logistics Supportability

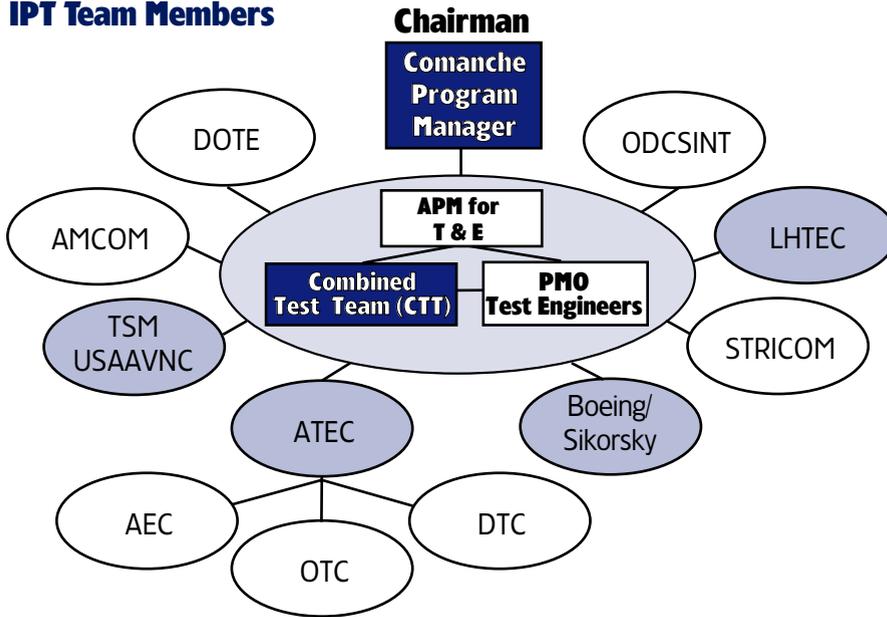
- Electromagnetic Environmental Effects
- Manpower and Personnel Integration
- Shipboard Compatibility
- Embedded Computer Resources
- Self Deployment
- Integrated Training Program
- Live, Virtual, and Constructive Simulation Events
- Real-time Feedback of Developmental and Operational Issues.

THE COMANCHE CONTINUES TO FACE TECHNOLOGICAL CHALLENGES THAT MAY CAUSE DIFFICULTY FOR THE MOST WELL-PLANNED SCHEDULES. THE EFFECT OF THESE CHALLENGES ON PROGRAM COST, SCHEDULE, AND PERFORMANCE MUST BE WEIGHED CAREFULLY TO ENSURE THAT THE ARMY RECEIVES THIS CRUCIAL AVIATION ASSET.

EMD Development Phase

Developmental testing of the Comanche began in 1995 and will continue through fiscal 2006. The majority of the developmental testing on the air vehicle was completed during the 1995 to 2000 timeframe. Live fire testing began in fiscal 1999 and will continue in phases up through fiscal 2006. The EMD phase of the Comanche, which began with approval to enter Milestone

IPT Team Members



It in March 2000, will include: continuation of aerodynamic envelope and structural integrity determination; integration of the Target Acquisition System (TAS); integration of the T800/T801 growth engine; and T&E of critical airframe and full Mission Equipment Package (MEP) system performance. The objectives of T&E during this phase include verification of EMD progress and certification of readiness for dedicated operational testing as evaluated against the system specification and the Operational Requirements Document (ORD).

EMD T&E Key Points

Two prototype aircraft have been in operation since January 1996 performing required aerodynamic and other tests. These aircraft will conduct a series of developmental tests during EMD with combined contractor and government aircrews. This early involvement of military aircrews in the developmental process will strengthen the outcome of the T&E program for the Comanche.

Electro-Magnetic Compatibility, LRIP Aircraft

Prototype aircraft will complete important electro-magnetic compatibility testing during the EMD phase. A total of six aircraft will perform a total of 2,774 flight hours during the EMD phase of development. Four additional

pre-Low Rate Initial Production (LRIP) aircraft will be produced in the fiscal 2004 timeframe.

Comanche MEP Subsystems

Further EMD testing on Comanche MEP subsystems will be conducted, such as electro-optical sensor system, target acquisition designation system, night vision pilotage system, pilotage, target classification, and aircraft survivability equipment. The majority of the MEP T&E will occur during the later stages of the EMD phase due to early program funding constraints. This fact may be a cause of increased program risk to the overall Comanche program.

Propulsion System Test Bed

The Propulsion System Test Bed (PSTB) will provide the opportunity to developmentally test the Comanche engines and power train for up to 1,350 operating hours. The PSTB is a fixed-base power train prototype designed specifically to test the dynamics of Comanche's power train system. The PSTB will allow full power dynamic load testing of the entire Comanche power train system. In fiscal 2004, PSTB testing will continue with an upgraded engine and power train components. PSTB developmental testing will offer the opportunity to significantly reduce risk during system development and ensure program success.

LO and RCS

Evaluation of the LO and RCS of the Comanche will occur during EMD. Aircraft LO, RCS, infrared visibility, and acoustic testing are of primary interest during this phase. Testing will occur on contractor and government instrumented testing facilities. During this time, Comanche prototype or pole model aircraft replicas will be modeled against threat systems for observability and survivability. The RCS signature of the aircraft in millimeter wave frequencies will be determined during pole testing. Testing in representative field environments and flight envelopes will provide an opportunity to assess the durability of the aircraft materiel as well as effectiveness of the maintenance/materiel process in restoring the aircraft's RCS signature.

IOTE

Prior to entrance into Initial Operational Test and Evaluation (IOTE), the software configuration of the Comanche will be frozen. Outstanding Priority 1 or 2 Software Trouble Reports (STR) will be eliminated prior to IOTE. The user representative will approve STR priority 3 deficiencies that remain open, and also determine if the prescribed workarounds are acceptable prior to IOTE. Any deferred solutions to STRs will be approved by the user and identified as to when, in the future delivery of software, these STRs will be resolved.

V&V

The Comanche software will undergo a series of 12 Independent Verification and Validation (V&V) activities during developmental testing, resulting in the following products: the software development plan, the system/segment specifications, the system/segment design documents, the software requirements specifications, software design documents, interface requirements specifications, interface design documents, informal software test plans, informal software test descriptions, informal software test reports, software quality program plan, and the computer resources integrated support document. Management quality indicators will be used to assess control of software development.

The prime contractor team provided the indicators at the completion of Program Definition and Risk Reduction (PDRR). These management indicators provide visibility into the current management and programmatic issues, whereas the quality indicators provide visibility into the quality of the resultant software products. Thirteen discrete evaluation factors are established to gauge the readiness of the Comanche software development effort.

M&S

The Comanche EMD T&E program will make extensive use of Modeling and Simulation (M&S) technology. M&S technologies will increase opportunities for success by reducing overall EMD costs and bridging the gap between test conditions and the conditions cited in the ORD, where actual testing cannot duplicate the required environment. Some of the modeling techniques that will be used by the Comanche CTT follow:

- The Advanced Tactical Combat Model, a man-in-the-loop simulation designed to test survivability against IR and Radio Frequency threats.
- The Interactive Tactical Environment Management System, which will simulate threat and friendly battlefield environments.
- Modular Semi-Automated Forces that enable construction of Distributed Interactive Simulations and computer-generated force applications.
- The Laser Designation Weapon System Simulation Model, which models the kinematics and dynamics of semi-active laser-guided weapons.
- ACQUIRE, which will facilitate determination of the probability of detection of an IR source target as a function of range.
- Modular Unix-based Vulnerability Estimation Suite S2 (Stochastic Analysis of Fragment Effects/Stochastic Qualitative Analysis of System Hierarchies), which is a point burst vulnerability/lethality modeling system under development by the Survivability/Lethality Analysis Directorate of the Army Research Lab that will model the effects of indirect fire frag-

menting munitions, armor piercing, high explosive, high explosive incendiary, and small projectiles.

- The Evaluation of Air Defense Effectiveness Model, which will model many-on-many aircraft engagements and is similar to the Advanced Tactical Combat Model except it does not have a man-in-the-loop capability.
- The Terrain/Rotorcraft Air Combat Evaluation Simulation, which will allow air-to-air combat simulation evaluations.

This partial list of M&S techniques indicates the high level of M&S the Comanche program will use during the EMD phase. The experience and knowledge gained through these M&S technologies will reduce cost, reduce risk, and provide significant insight into overall Comanche performance characteristics. The M&S techniques will also provide considerable information on the development of training tactics, techniques, and procedures; as well as sub-system or MEP performance.

The Key to Program Success

The Comanche Program Manager structured the EMD phase of the Comanche system development with an extensive set of live and M&S test events and processes to ensure system effectiveness, within resource constraints, to meet the future goals of Army Aviation. Comanche has already achieved many successes during development that will increase the capability and lethality of Army Aviation in any future conflict.

As in previous leading-edge technology development programs, the Comanche continues to face technological challenges that may cause difficulty for the most well-planned schedules. The effect of these challenges on program cost, schedule, and performance must be weighed carefully to ensure that the Army receives this crucial aviation asset.

The MEP developmental testing is occurring late in the developmental life cycle of system acquisition. The primary reason for this shortfall is a lack of funding for the required high-cost testing and developmental efforts during the

PDRR phase of Comanche development. This delayed testing could have significant effects on the overall cost and schedule of Comanche development and fielding. Research and development testing for a system of this type is resource-intensive and is stretching the technological capabilities of industry and government. An additional area of risk is the uncertainty in the delivery of the planned technology that would decrease overall Comanche weight, allowing it to achieve overall performance requirements.

**ABLE TO PERFORM
AIR COMBAT
OPERATIONS AND ALL
OPERATIONS UNDER
LIMITED VISIBILITY,
DAY OR NIGHT, THE
COMANCHE RAH-66
WILL USE LOW-
OBSERVABLE (LO)
TECHNOLOGIES TO
ENHANCE MISSION
EFFECTIVENESS AND
CAPABILITY.**

A Government Accounting Office (GAO) Report #NSIAD-00-199 indicates that the DoD is requiring too many system-level tests on DoD weapon systems. Reporting that the inordinate amount of testing imposed on weapon system development is neither necessary nor fiscally responsible, GAO goes on to cite that DoD T&E is viewed as a pass-fail event and not designed to improve overall system capability or performance.

An additional shortcoming identified by the GAO is the DoD philosophy that success or failure during key testing events is closely linked to continued or decreased funding for weapon system

programs. If the Comanche program requires the same level of testing as indicated by the GAO, in all likelihood this effort could additionally affect the planned development schedule, cost, overall program risk, and planned Initial Operational Capability date.

To ensure Comanche program success, the program office, the ATEC, the Director of Operational Test and Evaluation, acquisition leaders, industry, and the user must maintain their strong relationships and establish agreements that will ensure this critical Army Aviation asset is delivered when required. The outcome of this effort will ensure that our soldiers and aircrews will have the most capable, safe, and reliable helicopter weapons system in the world – the RAH-66 Comanche.

Editor's Note: The author welcomes questions or comments on this article. Contact him at Forrest.Hendrick@redstone.army.mil.

Customary Progress Payment Rate For Large Business

Deidre A. Lee, the Director of Defense Procurement, announces a change to the Defense Federal Acquisition Regulation Supplement (DFARS) that increases the progress payment rate for large businesses from 75 percent to 80 percent. The progress payment rate change will apply only to contract awards made on or after Oct. 1, 2001. Contracts awarded before Oct. 1, 2001, will not be modified to include the 80 percent rate. This change will establish a progress payment rate for large businesses under DoD contracts that matches the rate currently used by other federal agencies. For additional information, contact Sandra Haberlin at (703) 602-0289 or via e-mail: sandra.haberlin@osd.mil.

DAU LAUNCHES NEW WEB SITE Continuous Learning Center Now Online

If you're looking for continuous learning opportunities for yourself or your colleagues, point your Internet browser to DAU's new Continuous Learning Center (CLC) Web site, <http://clc.dau.mil>. Activated July 9, 2001, the CLC has a wide variety of online continuous learning modules available, with more being added in the future. Topics range from Commercial Off-the-Shelf Acquisitions to Requirements Generation. Visit <http://clc.dau.mil> often, anytime, anywhere, from the convenience of your Internet-capable PC, to earn continuous learning points, learn about new acquisition policies and tools, or to brush up on your acquisition skills.

We welcome your comments and feedback, so take advantage of this easy-to-use 24/7 resource, become a regular visitor, and become a more productive and more effective member of the acquisition workforce.

<http://clc.dau.mil>

