Appendix A

UH-60M BLACK HAWK UPGRADE PROGRAM

System Engineering Plan (SEP)

(2 March 2007 Update)
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A-1.0 Introduction

The SEP for the UH-60M Upgrade builds on the UH-60M Block 1 Increment 1 (Baseline) SEP foundation, applying lessons learned and utilizing commercial processes and standards where appropriate. The UH-60M Baseline SEP, along with this Appendix describes the detailed method for planning and executing all technical activities required to transform the user needs, requirements, and constraints into an optimized system solution for the UH-60M Upgrade Program. This Appendix describes only those aspects of the UH-60M Upgrade system engineering process that diverge from the UH-60M Baseline SEP. Sections that have no text can be crosswalked to the same section within the UH60M Baseline SEP for complete descriptions/definitions. This Appendix will describe the SE approach that will guide all technical management aspects of the UH-60M Upgrade Program. The UH-60M Upgrade Program SEP leverages the lessons learned during the UH-60M Baseline development and will continue to evolve as the program proceeds through requirements definition through the life-cycle of the program. These documents are supported by the prime contractor’s SEMP that provides the foundation of the systems engineering processes used to develop a Contractor IMP delivered as part of the System Development and Demonstration program. The UH-60M Baseline historical documents and current UH-60M Upgrade documents serve as the basis for this document and are updated in support of Milestone decisions. The UH PO will update the UH-60M Upgrade SEP as needed throughout the lifecycle of the program as required.

A-1.1 Program Description and Applicable Documents

A-1.1.1 UH-60M Upgrade Program Description

The UH-60M/HH-60M Upgrade, which this document addresses, completes the design process initiated during the Block 1/ Increment 1 program to achieve compliance with objective Block 1 requirements identified in the “Operational Requirements Document (ORD) for Modernization of the UH-60 BLACK HAWK Utility Helicopter Fleet.” The UH-60M/HH-60M Upgrade Program retains capabilities of baseline program and achieves compliance with the ORD objective requirement for Level 1 Handling Qualities. The UH-60M/HH-60M Upgrade implements directed avionics commonality changes and enhances communications interoperability capability and survivability over the UH-60M Block 1/ Increment 1 program through design considerations that focus on empowering the UH-60M Upgrade with the complete integration of Blue Force Tracker, integration of all aircraft survivability equipment including the Common Missile Warning System (CMWS) into the common cockpit displays, dual multi-mode receiver VHF Omni Range (VOR), Tactical Air Navigation (TACAN) and multi-band radios (Figure A-1). The UH-60M/HH-60M Upgrade Program offsets weight growth associated with new requirements by employing advanced composite technologies in the airframe and through design and weight reduction benefits of the FBW FCS integration. The integration of these technologies results in minimal net weight growth for the UH-60M/HH-60M Upgrade aircraft over the UH-60M Block 1/ Increment 1 configuration. The HH-60M Upgrade will retain capabilities of the UH-60M Upgrade Program with the addition of the HH-60M Upgrade unique integration items.
The UH-60M Upgrade Program is structured to be a low risk, technology insertion program designed to field the latest technologies while keeping program cost and schedule risks to a minimum. The Utility Helicopters Project Office will meet these requirements by integrating technologies into the UH-60M helicopter that have been developed by the RAH-66 Comanche helicopter program and other FAA helicopter programs (FBW FCS, Composites), developed for multiple platforms including CH-47F and Special Operations Aviation (SOA) (Common Avionic Architecture System (CAAS), Full Authority Digital Engine Control (FADEC), multi-band radios, integrated ASE) and developed by Joint Strike Fighter (JSF) (Active Controls). When technology or cost and schedule risks prevent the insertion of a technology into the UH-60M Upgrade Program, the program will endeavor to provide the enabling hardware components or architecture to enable the insertion of the technology at a later date.

The UH-60M Upgrade aircraft will retain the capability to perform the Aeromedical Evacuation (MEDEVAC) mission that integrates the medical mission subsystems found in the UH-60Q, HH-60L and HH-60M while retaining the capabilities of the UH-60M Upgrade aircraft.
A-1.1.2 Applicable Documents

The UH-60M Upgrade System Performance Specification (AVNS-PRF-10018) was developed in 2003-2005 and established the technical baseline for the Risk Reduction contract/phase. It was a combination of legacy requirements drawn from the UH-60A/L/M Baseline, combined with derived requirements for FBW FCS. The UH-60M Upgrade System Performance Specification remains under configuration management as the program evolves.

The UH-60M Upgrade TEMP serves as the master document for outlining the test and evaluation requirements for the acquisition program. The UH-60M Upgrade Program will develop an Appendix to the UH-60M Baseline TEMP. The TEMP will describe the development, operational test and live-fire testing requirements required to evaluate the interoperability, operational performance, suitability, and survivability of the overall UH-60M Upgrade Program as required to support a UH-60M Upgrade FRP.

The Acquisition Strategy will follow the guidance provided in DoD Directive 5000.1, 23 OCT 2000, and DoD Instruction 5000.2, 23 OCT 2000. The Acquisition Strategy continues to follow the evolutionary approach developed by the UH-60M Baseline Program to complete the design process initiated during the Block 1/Increment 1 program to achieve compliance with objective Block 1 requirements identified of the “Operational Requirements Document (ORD) for Recapitalization of the UH-60 BLACK HAWK Utility Helicopter Fleet”. The UH-60M Upgrade Acquisition Strategy describes the strategy for completing the design and productionization of the UH-60M Upgrade aircraft in terms of capability, funding, development, test, production and support. The UH-60M Program Acquisition Strategy supports the Milestone decision relevant only to the UH-60M Upgrade Program.

The IMP describes the management approach for the UH-60M Upgrade Program execution established to comply with the UH-60M Upgrade Statement of Work, Performance Specification and airworthiness certification using the processes outlined in the Sikorsky Aircraft SEMP. The objective of the IMP and its associated schedule, the IMS, is the same as the UH-60M Baseline Program.

The UH-60M Upgrade Specification Tree (Figure A-4) was developed in cooperation with the Contractor (Sikorsky Aircraft Corporation). The specification tree provides traceability from the platform ORD, to include multiple other organizational ORDs (GATM, FBCB2, the Performance Specification, Segment Specifications, and multiple other layers of documentation. It has been developed utilizing the format/structure of the WBS, Attachment A-2. This provides the complete traceability of all requirements documents. Any document that provided a PVI was identified within the specification tree. CM of the specification tree is being maintained by the Government and continues to provide interim updates as the system matures. The top layers, down to and including the Performance Specification identify the Functional Baseline. The next level, the Segment Specifications and the Avionics SSDD, compile what is defined as the allocated baseline. All documents below this level represent the Product Baseline.
A-1.2 Program Technical Status

The UH-60M Upgrade, at the date of the SEP (Figure A-2), has conducted a System Requirements Review (SRR) (25 – 26 January 2005) and numerous informal System Segment Requirements Review. System Functional Review (SFR) was conducted on 4 August 2005 at which time the functional baseline was approved. Preliminary Design Review (PDR) was conducted on 12 – 14 October 2005. At the completion of the System PDR, a new contracting effort will begin which will carry the design from Post-PDR through completion of developmental testing, aircraft qualification and IOT&E, this contract was awarded December 2005. The major elements of the UH-60M Upgrade Program include the fly-by-wire flight control system with active control including hydraulic and electrical system upgrades necessary for a flight critical flight control system, Common Avionics Architecture System including enhanced navigation systems, digital map and pilot vehicle interface, JTRS Alternate Communications Suite (JACS) and integration of all ASE including CMWS into a single ASE display, composite tail cone and driveshafts and FADEC of the 701D engine. Critical Design review was conducted 23 – 27 October 2006.

**FIGURE A-2. UH-60M (UPGRADE) PROGRAM SCHEDULE**
The UH-60M Upgrade Program will take advantage of common development efforts with the UH-60M Baseline Program and UH-60A/L upgrade efforts. These programs include the following:

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<td>JTRS Alternate Communications Suite (JACS)</td>
<td>Pre-PDR development with UH-60M Baseline with provisions for UH-60M Upgrade design – Efforts has progressed to modification of Baseline LRIP aircraft and is maintaining connectivity with the Upgrade program</td>
</tr>
<tr>
<td>Common Missile Warning System (CMWS)</td>
<td>Pre-PDR development with UH-60M Baseline with provisions for UH-60M Upgrade design – Efforts has progressed to modification of Baseline LRIP aircraft and is maintaining connectivity with the Upgrade program</td>
</tr>
<tr>
<td>Improved Stabilator Actuator</td>
<td>Post PDR / Pre-CDR; managed as a Modification Effort (common to all UH-60 Models) – Program is progressing – Upgrade interface has been maintained</td>
</tr>
<tr>
<td>Full Authority Digital Electronic Control (FADEC)</td>
<td>Pre-Contract Award; managed as a Engines Effort preliminary application will be on the UH-60M Upgrade and will be managed to support the UH-60M Upgrade schedule – Contract has been awarded, ICD for Engine / Air Craft interface has been signed and is maintaining connectivity with the Upgrade program</td>
</tr>
<tr>
<td>Composite Tailcone / Composite Driveshaft</td>
<td>Component Development managed by MANTECH – CTC qualification and all Post CDR CDS efforts are now under an PM managed delivery order and is maintaining connectivity with the Upgrade program</td>
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**A-1.3 Approach for SEP Updates**

The UH-60M Upgrade Appendix is submitted as a requirement to support the UH-60M Baseline Program and the UH-60M Upgrade Interim Program Review (IPR). Modifications to the UH-60M Upgrade SEP will be submitted as changes to the UH-60M Baseline SEP which will identify the changes to this appendix. Updates will be submitted as required for major milestone events or as deemed appropriate by the PM.
A-2.0 Systems Engineering Application to Life Cycle Phases

A-2.1 Life Cycle Phases

The UH-60M Upgrade shall progress through the design phases outlined in the UH-60M Baseline SEP. The phases of the program that have been completed to date as well as those that are currently underway are defined below.

A-2.1.1 Pre-SDD Phase (Risk Reduction Phase)

From 2002-2004, the UH PO began development of the fly-by-wire flight control system segment specification and funded an Engineering Services Modification (ESM) to evaluate the feasibility of executing a program to integrate a fly-by-wire flight control system as an ECP to the UH-60M Baseline Program to meet the Level 1 handling qualities requirements of the existing UH-60M ORD. Numerous trade studies were conducted to determine main rotor servo configuration, engine integration, tail rotor actuator integration, reduced area stabilator requirements, auto-moding of control laws to enhance the capabilities of the existing Comanche control laws, review of the helicopter active control technology program to determine the feasibility of integrating tactile cueing and determining program costs associated with such a program. The UH PM made the decision to execute numerous separate ECPs as part of an integrated program rather than several large scale ECPs in order to deliver a better product to the warfighter. The Risk Reduction phase of the program also reviewed numerous commonality initiatives to include common FBW FCS FCC and common FADEC integration with Block III, AH-64D, common software and pilot-vehicle interface with CH-47F and SOA, development of a common composite tailcone with SOA. The UH-60M Upgrade Program conducted early assessments of MH-60L/K CAAS documents and hot benches as well as attended on-going CH-47F design reviews and crew station working groups. A program performance specification and program objectives were developed and integrated into a program plan and presented in conjunction with the UH-60M Baseline MS C decision to obtain concurrence with an approved acquisition strategy.

A-2.1.2 SDD Phase (Integration and Qualification Phase)

Since November 2004, the UH-60M Upgrade Program has been executing the SDD phase of the program. The Acquisition Memorandum for the UH-60M Baseline Program gave permission for the UH-60M Upgrade Program to proceed and conduct an IPR in 1QFY06 in lieu of a MS B prior to conducting a MS C decision in 3QFY08. Design reviews are scheduled as shown in the schedule shown in Figure A-2.

A-2.1.3 Production and Deployment Phase (PD)

The UH-60M Upgrade Program will proceed into the PD Phase of the program as shown on the schedule in Figure A-2. The content and extent of these phases shall be the same as the UH-60M Baseline program with the exception of the number of aircraft used for the conduct of the development and operational testing described below and pending decisions made during the MS C approval process.
A-2.1.3.1 Low Rate Initial Production (LRIP)

The UH-60M Upgrade shall proceed into the LRIP Phase of the program as shown on the schedule in Figure A-2. The LRIP Phase will continue to monitor the reliability and maintainability of the aircraft and continue the FRACAS process of the three LRIP aircraft planned for operational testing as well as continue refinement of the manufacturing and production processes.

A-2.1.3.2 Full Rate Production (FRP)

No change from the UH-60M Baseline Program.

A-2.1.3.3 Production and Quality

No change from the UH-60M Baseline Program.

A-2.1.3.4 Product Assurance

No change from the UH-60M Baseline Program.

A-2.1.3.5 System Evaluation.

The UH-60M Upgrade T&E program utilizes combined test assets, schedule, and budget to evaluate the performance and airworthiness qualification requirements of the UH-60M Upgrade Program. Figure A-2 depicts the UH-60M Upgrade test schedule as it relates to the overall Upgrade development. DT&E will evaluate the UH-60M Upgrade aircraft performance and airworthiness qualification requirements and evaluate system readiness for OT. As with the UH-60M Baseline program, an integrated DT&E program using the Contractor/Government CTT approach is planned for integration qualification to support a single, continuous Army systems evaluation.

A-2.1.3.5.1 DT&E to Date

As of the signing of this document, no DT&E testing has been conducted.

A-2.1.3.5.2 Future DT&E

The current DT flight test program is estimated at 402 flying hours for the two prototype aircraft and approximately 100 hrs of risk reduction flight testing on the JUH-60A for control law development and control law integration with the active inceptors. The RASCAL flight test will consist of a combined contractor/Government development flight test activity at the Aeroflightdynamics Directorate at NASA Ames Research Center for evaluation of control laws and conclude with an EUD of the optimized control laws to demonstrate initial capabilities at least 6 months prior to first flight. DT&E will be conducted by an Integrated Contractor/Government CTT in accordance with the Integrated Test Program Schedule (Figure A-2). The ATTC will serve as the principal Government test agency for Developmental Test. Government and Contractor generated data collected during the DT program will be used to substantiate compliance with user and contractual requirements; to verify that the modifications do not compromise the airworthiness of the aircraft; and to verify that critical technical parameters are
met prior to the start of dedicated OT. Contractor and Government analyses and test reports will provide data for the Army's independent system evaluation and evidence that the program is ready to proceed to MS C/LRIP and subsequently to a FRP decision. One instrumented prototype UH-60M Upgrade aircraft will support the envelope expansion, handling qualities and structural flight testing and an additional lightly instrumented UH-60M Upgrade aircraft will support the communications and navigation, interoperability, and Electromagnetic Environmental Effects (E3) aircraft level testing. The UH-60M Upgrade DT&E will occur after the 1QFY06 IPR through the FRP decision.

A-2.1.3.5.2 Modeling and Simulation

No change from the UH-60M Baseline Program.

A-2.1.3.5.3 OT&E Overview

A separate Operational Test program will be required to evaluate the operational performance, suitability, and survivability for the UH-60M Upgrade Program. These Operational Test events will leverage the operational assessment of the Baseline UH-60M by focusing the operational evaluation on the improvements derived from the UH-60M Upgrade Program. Three production representative UH-60M Upgrade aircraft are planned for the IOT&E. Army Test and Evaluation Command (ATEC) will prepare a SEP to document the detailed evaluation strategy and overall test effort. The SEP defines measures of performance, evaluation methodology, and concepts for planned events (contractor, DT and OT) which will provide data to support development of Event Design Plans (EDP), Detailed Test Plans (DTP), and the SER.

A-2.1.3.5.3.1 OT&E Phases

The operational testing of the UH-60M Upgrade will be conducted in two phases. Phase I, the LUT in the SIL, is to be conducted in FY 08. The LUT in the SIL will support the LRIP decision review by providing a limited evaluation of operational pilot's effectiveness and suitability using the CAAS cockpit and the status of the interoperability software. Phase II, the Initial Operational Test (IOT), will be conducted in 4th Qtr FY 09 and will culminate in an evaluation of the system’s effectiveness, suitability, and survivability as input to a FRP Decision Review. The Upgrade Program IOT will focus on the differences of the Upgrade Program compared to the UH-60M.

A-2.1.3.5.3.2 OT&E Evaluation

An overall evaluation of effectiveness, suitability, and survivability of the system will be performed using DT, OT, and M&S data. The system will be evaluated based on the user’s ORD, the approved COICs, and any additional issues developed by the AST. Effectiveness will be expressed in terms of the aircraft’s ability to support the user's utility helicopter requirements. Suitability will be expressed in terms of reliability, maintainability; integrated logistics support (ILS), MANPRINT, and computer resource support. Survivability will be expressed in terms of the system’s ability to conduct mission operations and provide crew protection under battlefield
environments including E3, Nuclear, Biological, and Chemical, High Altitude Electromagnetic Pulse, conventional ballistics, and electronic warfare.

A-2.1.3.5.3 OT&E Scenarios

During the UH-60M Upgrade IOT&E, three production representative aircraft (platoon size element) will conduct an IOT over a 12-week period. The IOT will start with a COMEX to verify the aircraft communication systems, perform any required JITC certification, and to verify proper establishment of the Tactical Internet. The test aircraft will be operated as an Aviation Platoon from an Assault Helicopter Company. Portions of the platoon’s parent company leadership and battalion staff, from the Assault Helicopter Battalion and the AVUM Company, will also participate in the test. An Infantry Company and an Artillery Battery will act as the supported unit. The anticipated test location is Fort Hood, the unit will execute scenario driven missions developed from the NEA 4.0 scenario and the OMS/MP.

A-2.1.3.5.4 Live Fire Test and Evaluation

The UH-60M Upgrade aircraft has been designated for Live Fire Test and Evaluation (LFT&E) oversight by the Office of Secretary of Defense (OSD), Director of Operational Test and Evaluation (DOT&E). A decision on the requirements for LFT&E has not been made due to the immaturity of the existing designs. A decision on LFT&E testing is expected by the MS C decision. The UH PO will invite LFT&E personnel to participate major system reviews in order to provide the latest design and development information from which a live fire test testing strategy can be formulated.

A-2.1.3.5.5 First Article Test

The contractor shall conduct a FAT on an early LRIP aircraft, prior to DD250, using the same CTT approach as described in Contract DAAH23-01-C-0053. The purpose of this test is to survey the LRIP aircraft’s ability to meet the performance requirements (rate of climb, transmission and receipt of JVMF Messages, maximum altitude, maximum speed, etc). The scope of the test shall be restricted to a two-week effort and 10 flight hours with little to no aircraft instrumentation. The Contractor will conduct the FAT at a Sikorsky facility. The Contractor will submit a request for a CFR a minimum of 60 calendar days prior to the planned FAT using the CTT process. The contractor shall notify the Government 10 business days prior to start of First Article Activity. During conduct of the testing, the contractor shall provide support of aircraft and all logistical (not including GFE items) and maintenance support for the FAT.

A-2.1.3.6 Reliability and Maintainability

The UH-60M Upgrade continues to monitor developments in the UH-60M Upgrade program as they relate to the collection, analysis and evaluation of R&M data during the DT and OT programs and implementation of the growth curve as opposed to point estimates for the determination of suitability. The UH-60M Upgrade program will adopt whichever method is determined appropriate for the UH-60M Baseline Program.
A-2.1.4 Operation and Sustainment Phase (O&S)
No change from the UH-60M Baseline Program.

A-2.2 System Capabilities, Requirements & Design Considerations

A-2.2.1 Capabilities to be Achieved and Concept of Operations
The UH-60M Upgrade shall meet all the mission and functional capabilities as defined in the UH-60M Upgrade Performance Specification (AVNS-PRF-10018) and the SOW. The UH-60M Upgrade will meet all the capabilities of the UH-60M Baseline aircraft and provide the following improvements:

- Integration of common avionics hardware and pilot vehicle interface with CH-47F and maximum reuse of software modules to reduce development and O&S costs
- Complete cockpit integration of aircraft survivability equipment including common missile warning system and other UH-60M Baseline ASE
- Improved Handling Qualities to meet the Level 1 handling qualities requirements defined in the ORD and enable growth capability for tactile cueing for enhanced situational awareness and improved maneuverability with eyes out of the cockpit.
- Improved system integrity and reliability through the use of design assurance processes for hardware and software processes as well as an integrated system safety assessment process developed from commercial safety and design processes required for development and qualification of complex systems.

A-2.2.1.1 Avionics
The CAAS cockpit will replace key Avionics components of the UH-60M Block 1/Increment 1 cockpit hardware and software. The CAAS cockpit is designed and developed by the U.S. Army Special Operations Aviation Technology Applications Project Office (TAPO) for the MH-47G, MH-60L and MH-60K. TAPO will provide qualified hardware components for integration in the UH-60M Upgrade aircraft, and initial Army fielding being completed by CH-47 Program Management Office (PMO). The integration of the CAAS cockpit will replace the two FMSs, four MFD) and IDM from the UH-60M/HH-60M Block 1/Increment 1, with four MFD-268C3s, two CDU 7000s, two Data Concentrator Units (DCU), two General Purpose Processor Units (GPPU) (a Processor Switch Module (PSM) and a Video Processing Module (VPM)) and may require an additional Electronic Standby Instrument System (ESIS). The UH-60M Upgrade program will implement bus architecture and hardware changes as necessary to meet the integrity and functional requirements of the UH-60M Upgrade Performance Specification while maximizing the reuse of existing software to the greatest extent possible with CH-47F and MH-60 to reduce development costs.

A-2.2.1.2 Integrated Vehicle Health Monitoring System.
The UH-60M Upgrade will integrate the full capabilities of the UH-60M Baseline while defining and collecting appropriate data from the new or modified systems integrated under the Upgrade program. The IVHMS monitors and records flight and system parameters to improve Reliability, Maintainability, and Safety through regime recognition. The IVHMS improves force protection,
accelerates the flow of information and improves readiness. The IVHMS provides the capability
to simultaneously acquire, store, and process data to include aircraft structural, engine, drive
train, electrical and voice data. The IVHMS includes a CVR/FDR to support aircraft accident
prevention and investigation. The IVHMS also, provides an On Board Rotor Track and Balance
(OBRTB) capability. The data collected by the IVHMS will be used for maintenance,
maintenance history, supply, trending, aircraft monitoring, training and will assist in accident
investigations. The IVHMS is integrated with an automated logbook to tie diagnostics solutions
to maintenance actions for analysis, parts ordering, parts forecasting, inventory management,
work orders, parts marking, Integrated Electronic Tech Manual (IETM) integration, and
reduction in maintenance man-hour per flight hour expenditures. Integration of the IVHMS with
FBW and FADEC will allow the removal of some dedicated sensors for this subsystem by
utilizing functionally equivalent sensors resident within the flight controls and engines.

A-2.2.1.3 Blue Force Tracker (BFT)
Radio transmits and receives information containing aircraft position and other critical mission
information. Data is received by other systems where it is collected with other units and
transmitted via Command and Control links. System provides improved battlefield situational
awareness. Design efforts and integration of the Blue Force Tracker will maximize commonality
with the UH-60M Block 1/ Increment 1 aircraft.

A-2.2.1.4 Common Missile Warning System
The CMWS provides warning of IR guided surface-to-air and air-to-air missiles. Equipped with
dispensing capability, the CMWS also provides decoys, replacing the M-130 Chaff Dispenser.
This system increases survivability by providing the crew additional threat information,
previously not available. CMWS threat information will be integrated with existing threat
displays. Design efforts and integration of the CMWS shall maximize commonality with the
UH-60M Block 1/ Increment 1 aircraft.

A-2.2.1.5 TACAN
AN/ARN-153 TACAN transceiver, currently part of the HH-60M MEDEVAC configuration,
will become common across the UH-60M Upgrade aircraft in to enhance shipboard
compatibility. System provides capability to navigate to Navy ships offshore during multi-
service operations by providing azimuth and distance to the ship.

A-2.2.1.6 Integrated JTRS Alternate Communications Suite
The JACS is a multi-band radio that encompasses the functional capabilities of the existing
AN/ARC-164, AN/ARC-186 and AN/ARC-201 radios, while also incorporating many
interoperability functions slated for the JTRS. Two multi-band radios in conjunction with two
ARC-201D VHF-FM SINCGARS radios will replace the legacy radios providing an interim
solution that meets the UH-60M Upgrade communications requirements until JTRS is ready for
insertion into the fleet. The multi-band radios utilized in the UH-60M Upgrade will incorporate
Satellite Communication (SATCOM) functionality. Due to the ongoing competition for multi-
band radios, a specific radio has yet to be selected; however, preliminary design efforts and
integration for the UH-60M Upgrade aircraft shall maximize commonality with the of the AN/ARC-231 integration being conducted under the UH-60M Block 1/ Increment 1 aircraft program.

**A-2.2.1.7 Fly By Wire Flight Control System**

UH-60M Upgrade will include a digital FBW FCS that replaces the mechanical flight control system and dual digital automatic flight control system (AFCS), stabilator control functions of the UH-60M Block 1/ Increment 1. The FBW FCS improves aircraft handling qualities, reduces weight, and improves safety and readiness. In addition, the FBW FCS increases survivability over the UH-60M Block 1/ Increment 1 through the reduction in vulnerable area and parts count achieved by elimination of the mechanical control linkages and all hydraulic and electrical actuators with main and tail rotor actuators only. The FBW FCS will replace the existing cyclic and collective controls and trim actuator functions with electronically synchronized cyclic and collective inceptors capable of providing active control feedback technology to improve the pilot’s capability to fully exploit the aircraft capabilities without damaging components. This technology increases safety and mission capability by significantly reducing pilot workload in adverse conditions and during aggressive maneuvering.

**A-2.2.1.8 Full Authority Digital Engine Control**

The FADEC replaces the existing limited authority engine control on the T700-GE-701D engine to increase engine response characteristics and improve high altitude/hot weather performance. Integration of the FADEC with the FBW FCS will further improve handling qualities. The FADEC increases safety and mission capability through the addition of a second control channel versus the single channel system on the legacy engine. FADEC provides the following improvements over the legacy engine controls:

- FADEC system provides performance advantages over a Digital Engine Control (DEC)/Hydro Mechanical Unit (HMU) system on the T700-701D in the areas of:
  - Power management/engine transient performance
  - Torque Matching
  - Reduced spare part inventory
  - Redundancy and mission reliability
  - Reduced pilot workload
  - Improved training/mission planning
  - Improved maintainability/diagnostics
  - More flexibility for easier development

**A-2.2.1.9 Composite Tailcone**

The composite tailcone replaces existing aluminum tailcone structure and reduces the weight of the assembly compared to its aluminum equivalent. Design and subsystem qualification are being managed by the U.S. Army Manufacturing Technology (MANTECH) with technology insertion funds outside this program. The UH-60M Upgrade Program will be responsible for integration and flight test as well as updates to drawings, production processes and maintenance manuals. Composite technology reduces inspection requirements found on metal structures because of its fatigue and corrosion resistance properties.
A-2.2.10 Tail Drive Shaft
To resolve the problem associated with difference in thermal expansion between the composite tail cone and aluminum shaft the three drive shaft segments over the composite tail cone will be redesigned with composite material. The composite drive shaft design, development, and component qualification effort is funded under the MANTECH program. The composite drive shaft will not significantly impact the system/aircraft level qualification test program. The composite drive shaft will resolve the corrosion problem between aluminum shafts and titanium end fittings.

A-2.2.2 Key Performance Parameters
The Key Performance Parameters for the UH-60M Upgrade are unchanged from the UH-60M Baseline.

A-2.2.2.1 Force Protection and Survivability
“Force Protection and Survivability” is a KPP being added to the Baseline aircraft and will be unchanged from the UH-60M Baseline.

A-2.2.3 Certification Requirements.
The UH-60M Upgrade shall meet the same certification requirements outlined in the UH-60M Baseline SEP including DITSCAP, JTIC, Interoperability Certification issued by the CTSF, Spectrum Certification Compliance.

A-2.2.4 Design Considerations
The UH-60M Upgrade Program shall retain as much of the UH-60M Baseline Program as practical, integrate UH-60M Upgrade hardware and software modifications as a function of the design process, integrate CAAS MFD, CDU, GPPU and DCU hardware previously qualified by other Army programs without modifying the qualified hardware components while looking for opportunities to improve the pilot-vehicle interface and architecture as necessary to enhance system integrity, reduce pilot workload or improve pilot efficiency, achieve improved handling qualities, reduce aircraft weight wherever possible within the design constraints, meet the design integrity requirements outlined by the UH-60M Upgrade Performance Specification for all new or modified equipment, implement a system safety assessment process integral to the overall design process to establish design allocations for reliability and design assurance for components and functional groups as part of the requirements definition process. Insertion of additional software and hardware capability such as tactile cueing algorithms, control law changes or integration of JTRS shall be the focus of ECPs to the UH-60M Upgrade aircraft and inserted at the discretion of the UH PO as technology and funding become available to meet specific requirements.

The UH-60M Upgrade Program will manage these design considerations against the available technical budgets to determine the optimal design. Technical budgets for items such as weight, cost, and reliability are established and maintained by the performance specification and Systems Engineering IPT with concurrence by the appropriate segment IPT. For example, weight allocations will be established and maintained by the Systems Integration Working Integrated Product Team (WIPT), which includes Systems Engineering, cost allocations concurred with by the Business WIPT, and reliability allocations concurred with by the Supportability WIPT. The final design will be influenced not only by the requirements contained in the performance
specification but also by design considerations from outside dependencies and “ilities”. A trade process has been used by offerors to design the optimum design with the unique items required for the system to meet the requirements of the performance specification.

A-2.3 Systems Engineering Organizational Integration

A-2.3.1 UH-60M Chief Engineer
No change from the UH-60M Baseline Program.

A-2.3.2 DCMA Sikorsky Engineering
No change from the UH-60M Baseline Program.

A-2.3.3 IPTs

A-2.3.3.1 UH-60M Upgrade IPTs Structure
The UH-60M Upgrade IPT will utilize the IPT process and structure developed and implemented for the UH-60M Baseline with modifications to support the integration of the FBY FCS. Existing IPTs / Sub-IPTs will be led by new IPT leads where the involvement of the current UH-60M Baseline lead prohibits their involvement due to time constraints or where technological differences dictate. Otherwise, IPT leads will remain the same as the UH-60M Baseline (Figure A-3). IPT Charters are enclosed as Attachment A-1.

A-2.3.3.2 Contractor Organization
The structure of the Sikorsky contractor/Government UH-60M Upgrade team supports the Army’s Integrated Product and Process Development (IPPD) approach. The IPPD approach systematically employs the teaming of core competency areas to integrate and concurrently apply all necessary processes to product an effective and efficient product that satisfies the customer’s needs. Each IPT team is assigned a Sikorsky CAMs who shares lead responsibilities with their Army counterpart. This process is identical to the UH-60M Baseline and has been extremely effective in the resolution of over one hundred SCNs. The IPT structure is one of the main components of the SCN process. Subcontractors and suppliers are integrated into the IPT Process as early as possible and are functioning members.
A-2.3.3.3 Engineering IPT

The UH-60M Upgrade Engineering IPT will coordinate the efforts of the SE sub-IPT, the Air Vehicle (AVeh) sub-IPT, the Avionics (AV) sub-IPT, and the FCS sub-IPT to ensure that the allocated design achieves a system solution that meets spec and schedule requirements of the contract. The sub-IPTs are structured to perform essential functions within the systems engineering process. The SE sub-IPT will prepare and maintain an effective Systems Engineering Plan for the UH-60M Upgrade and accomplish requirements analyses and allocation. The Avionics sub-IPT, AVeh sub-IPT, FCS /Operations sub-IPT will synthesize major aircraft parts: Hardware/software subsystems: and perform integration and assembly tasks. The Engineering IPT will ensure that aircraft delivered to test are built to established standards and are compliant with product specifications. Responsibilities include:

- Identify processes and standards for systems integration.
- Set overall technical objective within contract requirements, and assist sub-IPTs in identifying intermediate goals leading to the objective system.
- Ensure that each sub-IPT is properly resourced to accomplish its goals.
- Provide timely flow of information to coordinating and superior IPTs.
The UH-60M Chief Engineer reports directly to the UH-60M PM and Deputy Product Manager (DPM). The Engineering IPT is led by the UH-60M Upgrade Chief Engineer who reports directly to the UH-60M Upgrade Assistant Product Manager (APM) and the UH-60M Chief Engineer. The UH-60M Chief Engineer has the final approval authority over technical issues within the UH-60M Upgrade and establishes budgets for the UH-60M Upgrade program through the UH-60M PM. The UH-60M Upgrade Chief Engineer provides input to the budget process and allocates funding for engineering support from other Government and contractor agencies supporting the UH-60M Upgrade technical analyses to include programmatic contract support. The UH-60M Upgrade Chief Engineer’s counterpart within the prime contractor’s organization has similar responsibilities over the prime contractor’s engineering staff and provides subcontractors with technical direction. The UH-60M Upgrade Chief Engineer coordinates with the chief engineers of other Government programs which provide GFE to the UH-60M Upgrade in order to coordinate and resolve technical interface issues and funding as necessary.

A-2.3.3.3.1 Systems Engineering Sub-IPT

The UH-60M Upgrade SE sub-IPT has the same duties and responsibilities as the UH-60M Baseline SE sub-IPT; however, the UH-60M Upgrade System Engineering sub-IPT lead reports directly to the UH-60M Upgrade Chief Engineer.

A-2.3.3.3.2 Air Vehicle / Dynamic Sub-IPT

The UH-60M Upgrade Air Vehicle Sub-IPT has the same duties and responsibilities as the UH-60M Baseline Air Vehicle Sub-IPT in addition to the responsibility for the integration of the FADEC controlled 701D to the Air Vehicle. UH-60M Upgrade AVeh Sub-IPT lead reports directly to the UH-60M Upgrade Chief Engineer.

A-2.3.3.3.3 Fly-By-Wire Flight Control System IPT

The FBW FCS Sub-IPT is responsible for:

- Developing, integrating and qualification of the digital flight control system, to include, but not limited to, all inceptors, flight control computer, main and tail rotor actuators, hydraulic modifications, electrical power system modifications required for fault tolerance and flight critical power, interface with stabilator system components, engine, avionics and pilot vehicle interfaces integrated with flight control elements, flight control hardware and software elements, redundancy and flight control I/O management, control law and flight director software, flight control interface with the CAAS/Avionics and FADEC Systems.
- Developing FCS segment and item specifications.
- Estimating, measuring and controlling progress of the FCS effort.
- Managing design integrity and system safety processes necessary for the development of a flight critical flight control system.
- Synthesize/integrate major aircraft hardware (HW)/Software (SW) segments and subsystems.
The UH-60M Upgrade FBW FCS Sub-IPT lead reports directly to the UH-60M Upgrade Chief Engineer. The FBW FCS Sub-IPT lead manages the FBW FCS related issues within the UH-60M Upgrade program. The FBW FCS Sub-IPT lead’s counterpart within the prime contractor’s organization has similar responsibilities over the prime contractor’s FBW FCS engineering staff and provides internal liaison with the contractor’s program staff and functional leads.

A-2.3.3.3.4 Integrated Manufacturing Sub-IPT

The Integrated Manufacturing Sub-IPT has the same duties and responsibilities as the UH-60M Baseline Integrated Manufacturing Sub-IPT in addition to the management of the UH-60M Upgrade production planning to include the development and oversight of prototyping and merging the UH-60M Upgrade and the UH-60M LRIP/FRP schedules to meet UH-60M Upgrade program objectives, conducting and coordinating LRIP and Upgrade process trade studies with design trades studies, and developing and maintaining manufacturing, industrial base, and obsolescence management plans. The UH-60M Upgrade Integrated Manufacturing Sub-IPT lead reports directly to the UH-60M PMWG IPT Lead/APM UH-60M Upgrade.

A-2.3.3.3.5 Avionics Sub-IPT

The UH-60M Upgrade Avionics Sub-IPT has the same duties and responsibilities as the UH-60M Baseline Avionics Sub-IPT with the following additions. The UH-60M Upgrade Avionics Sub-IPT reports to the UH-60M Upgrade Chief Engineer.

- Developing, integrating and controlling interfaces of all avionics and digitization components of the system to include CAAS hardware and software, mission computers, mission critical software, on and off system digital test, diagnostic, and measurement equipment (to include integrated electronic technical manuals), digital maintenance equipment, on and off system training devices, and interfaces with simulation and models, warning, caution and advisory systems.
- Merging the Directed CFE CAAS equipment and existing capabilities with the Avionics segment and developing all Avionics item specifications.
- Estimating, measuring, and controlling progress of the CAAS/Avionics effort.
- Participate in CAAS User’s group and CAAS coordination meetings to maximize the reuse of CAAS software and identify opportunities for cost savings during development effort by leveraging other ongoing CAAS development efforts within DoD.
- Developing, testing, qualifying, and documenting all non FCS computer software CSCIs

A-2.3.3.4 Business Management IPT

The UH-60M Upgrade Business Management IPT has the same responsibilities as the UH-60M Business Management IPT and reports directly to the UH-60M PMWG IPT Lead/APM UH-60M Upgrade.

A-2.3.3.5 Logistics Management IPT

The UH-60M Upgrade Logistics IPT has the same responsibilities as the UH-60M Logistics IPT and reports directly to the UH-60M PMWG IPT Lead/APM UH-60M Upgrade.
A-2.3.3.6 Test Management IPT

The UH-60M Upgrade Test Management IPT has the same responsibilities as the UH-60M Test Management IPT and reports directly to the UH-60M PMWG IPT Lead/APM UH-60M Upgrade.

A-2.4 Systems Engineering Process

The UH-60M Upgrade will utilize the existing system engineering process employed on the UH-60M Baseline.

A-2.4.1 Requirements

A-2.4.1.1 Requirements Development/Analysis

The ORD for Recapitalization of the UH-60 BLACK HAWK Utility Helicopter Fleet calls for increased capabilities as technology matures through the use of evolutionary requirements. ORD requirements are captured and refined in AVNS-PRF-10018 and allocated throughout as required throughout the AVNS-PRF-10018 Specification Tree.

Requirement analysis is the process of analyzing higher-level requirements and deriving lower-level interface, functional and performance requirements that satisfy the high-level requirement. Inputs to the UH-60M Upgrade requirements analysis process included customer needs and objectives, missions, measures of effectiveness/suitability, environments, Mission Needs Statements, ORD as well as outputs requirements from the previous (higher-level) application of the system engineering process. The output of the process is a set of functional, interface and performance requirements. The example below describes the requirement (mission) analysis process that was implemented on the UH-60M that translated user requirements into the UH-60M Upgrade System Performance Specification, AVNS-PRF-10018.

Mission Analysis is the process of analyzing customer needs, objectives, and requirements in the context of UH-60M missions, system utilization and environments. The UHPO with the support of SAC and others has conducted several definition efforts to fully understand the capability and performance of FBW, CAAS, Composite Tailcone/Driveshaft, aircraft survivability equipment, communications and navigation, Safety, RAM, Design Assurance and SW development. The results of completing these analyses combined with similar US Army analyses are reflected in the ORD and AVNS-PRF-10018. Requirements in the UH-60M Upgrade System Performance Specification have been developed to satisfy US Army needs and maximize system cost-effectiveness over the system life cycle. System Specification requirements are based upon Operational Requirements Documents which were derived from the UH-60 Mission Needs and mission performance analysis.

During the risk reduction phase of the UH-60M Upgrade Program, initial mission requirements were baselined and continually refined to meet the mission and environment to fully support overall system definition through the trade study process. Sikorsky conducts relative worth evaluations to quantify operational effectiveness of trade/design options in terms of overall mission capability. The operational effectiveness data is combined with peacetime life cycle
costs to identify the trade/design alternative that maximizes system cost effectiveness. The evaluation method is used for system and segment level trades. Analytical models and man-in-the-loop simulations are used as appropriate and, based on the tools employed; measures are developed to quantify mission effectiveness.

A-2.4.1.2 Functional Analysis

Functional analysis for the UH-60M Upgrade utilized the same process as with the UH-60M with lessons learned from the UH-60M Baseline program.

A-2.4.1.3 Synthesis

For the UH-60M Upgrade, the DMU models that include geometry suitable for the direct application to the manufacturing of tools, parts or assemblies will be used for new or modified contractor furnished equipment or components.

A-2.4.1.4 Requirements Verification

No change from the UH-60M Baseline Program.

A-2.4.1.5 Requirements Flowdown

The requirement flowdown process originates with the US Army’s ORD and the linkage to the UH-60M Upgrade Performance Specification. Analysis of requirement documentation and discussions with the user resulted in development and establishment of the UH-60M Upgrade System Performance Specification, AVNS-PRF-10018. The Performance Specification establishes the baseline performance for the unique UH-60M Upgrade requirements. Requirements flowdown links performance specification requirements to applicable system segments and subsequent configuration items. These requirements are allocated first to all system elements (FCS, Avionics, Airframe, Dynamics, GSE, and Integrated Logistics Support) and then decomposed and further allocated to components and modules that map to the Contractor’s WBS.

This hierarchy of requirements flowdown and performance allocations establishes clear traceability throughout the system from the source (UH-60M Upgrade System Performance Specification) to the segment and configuration item levels. In all cases, each technical performance requirement is traceable to the applicable higher and lower levels. All lower level “children” requirements are traceable to a “parent” requirement. When compliance (Figure A-5) with a performance requirement calls for more than one subsystem to accomplish the specified functionality, an interface is identified between the affected subsystems. Interface requirements are developed for new or unique requirements to specify the role each subsystem has in satisfying the requirement. The UH-60M Upgrade System Performance Specification will consist of functional, allocated and physical baselines defined by AVNS-PRF-10018, Performance Item Specifications (Segment Specifications) plus software requirement specifications and interface requirements specifications and Product Specifications (Sikorsky Engineering Specification (SES), Source Control Drawings, Vendor Specifications), respectively.
A-2.4.1.5.1  Specification Tree

The specification tree (Figure A-4) provides traceability from the UH-60M Upgrade Performance Specification, Segment Specifications, and multiple other layers of documentation. This resulted in the complete traceability of requirements documents. CM of the specification tree is being maintained by the Government via a local contractor that provides interim updates as the system matures. This Specification Tree has a tabular and a graphical format. The top layers, down to and including the Performance Specification identify the Functional Baseline. All documents below this level represent the Product Baseline.

FIGURE A-4. UH-60M UPGRADE SPECIFICATION TREE
The UH-60M Upgrade has three (3) aircraft performance do not complies and are driven by overall aircraft weight and drag. These do not complies are related to aircraft performance and are not credited in any one specific segment.

Requirements flowdown to the Detail Item Specification level is a continuous process during the SDD phase. Detail Items are defined at the fourth or fifth level of the WBS for flowdown. Segment leads will participate in a flowdown of requirements through the allocation of segment level requirements to the individual Detail Item Specifications. Physical legacy interfaces will be defined by installation drawings and wiring diagrams. Legacy Detail Items Specification will use existing CIDS, SESs, source/specification control drawings and contractor specifications where applicable. As with segment level interfaces, all unique UH-60M Upgrade and UH-60M Upgrade MEDEVAC unique items will use Interface Control Specifications (ICS) to define the interface control document list. UH-60M Upgrade unique detail requirements will be documented in CIDS, SESs, source/specification control drawings and contractor specification where applicable.
A-2.4.1.6 Tools and Resources
A-2.4.1.6.1 Deleted

A-2.4.2 Modeling and Simulation

A-2.4.2.1 Modeling and Simulation Tools

A-2.4.2.1.1 Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL)

The RASCAL is a JUH-60A helicopter that has been modified with the addition of a high-bandwidth, full-authority, digital FBW Research Flight Control System (RFCS). This facility provides an easily re-configurable, fully programmable capability to investigate a wide range of flight control, cockpit display, and crew systems concepts, including integration of mission equipment. A model-following control system architecture, see Figure A-6, RASCAL Architecture Block Diagram, allows for the simulation of a wide range of simulated aircraft dynamics. In addition, the RASCAL flight environment is supported by several levels of flight simulation capabilities, resulting in an efficient desktop-to-flight capability for developing and flight-validating control or display concepts. A key feature of the RASCAL system architecture is its fail-safe design, which reverts to the JUH-60A mechanical control system upon detection of critical RFCS faults or disengagement by the safety pilot. Indeed, the safety pilot station is unchanged from the JUH-60A, and the safety pilot controls are back-driven by the RFCS servos, allowing the safety pilot to monitor the state of the aircraft and control positions and take control at any time.

The RASCAL UH-60A will be used to conduct cost-effective in-flight evaluations of candidate UH-60 Upgrade flight control laws, pilot cuing concepts, and prototype pilot inceptors. These evaluations will occur earlier in the development cycle than would be possible with production FBW hardware, allowing any required design changes to be included in production equipment in a cost-effective manner.

**Figure A-6. RASCAL ARCHITECTURE BLOCK DIAGRAM**
A-2.4.2.1.2 Advanced Prototyping and Experimentation and System Integration Laboratories

The PM will host four CSWGs and two EUDs. The purpose is to involve the user, operational aircrews and the test community in the technical baseline development prior to final configuration at the SW CDR for the Avionics Segment and the FBW FCS Segment and to examine entrance criteria for the MS C/LRIP decision. The user and operational aircrews will have the opportunity to provide feedback on the recommended baselines.

2.4.2.1.3 Modeling and Simulation Prototyping and Re-Configurable Simulation Tools and Facilities

The use of virtual and immersive environments to evaluate subsystems to better define system requirements and evaluate crew performance as well as to stimulate actual hardware is the UH-60M Upgrade program’s approach to effective utilization of hardware and Man-in-the-Loop (or Pilot) simulators. Combined with reconfigure-able cockpits, fixed based simulators, the SILs, and the Battlefield Highly Immersive Virtual Environment (BHIVE), the UH-60M Upgrade M&S Strategy reflects a comprehensive balance between constructive and virtual simulation.

2.4.2.1.4 Government SIL

A Government SIL is also available at AMRDEC’s Software Engineering Directorate. The SIL is configured to test avionics hardware and software to include mission computers, data buses, flight displays, Ethernets, cross-channel data links and other mission equipment. The Government SIL is integrated with the cockpit and cabin of a UH-60A/L aircraft that is digitally connected with a flight model so that testing can be performed in a mission scenario with realistic pilot workload encountered during performance of combat missions.

SIL is a real-time hardware-in-the-loop (HWIL) facility that functionally tests aircraft avionics software in a simulated non-destructive environment. SIL is integrated with hardware-in-the-loop such as avionics, mission computers, flight and engine control panels, aircraft radios, aircraft survivability equipment. These hardware elements and some virtual components such as hydraulic components, aircraft engines and flight control computers are simulated in the lab and external sensors are stimulated in the lab environment to generate actual displays in the cockpit to evaluate pilot workload and mission performance. The SIL was developed as a joint venture between ATTC and the AMCOM Software Engineering Directorate. The Government SIL can be seen in Figure A-7.
The UH-PO intends to make the Government SIL available to the prime contractor and its subs to support development, analysis, and test activities in support of BLACK HAWK modernization program. The intent is to use the facilities to reduce program risk and distribute activities between contractor and Government facilities. The Government SIL will provide a quality test environment to support contractor and user activities so that timelines are met, risk is reduced, and flightline testing can proceed with a minimum of ground testing prior to the first airborne tests.

A-2.4.2.1.5 Battlefield Highly Immersive Virtual Environment

The Government BHIVE is a constructive and interactive/virtual simulation laboratory. This AMCOM Simulation Support & Development Directorate (SS&DD) lab is configured to provide detailed survivability and mission effectiveness analysis in support of the systems engineering process. It is digitally connected with the other labs such as the Air Maneuver Battle Lab (AMBL) at Fort Rucker, Mounted Maneuver Battle Lab (MMBL) at Fort Knox, and the Maneuver Battle Lab (MBL) at Fort Benning, GA. It can provide simulated combat environments for test and evaluation of system or subsystem performance and addresses system integration issues using engineering level M&S tools. The lab is compliant with both internal networking protocols and external DIS and HLA protocols. The facility is equipped with high-speed computers and an extensive suite of constructive simulation models and terrain databases.
A BLACK HAWK Player Station (BHPS) within the BHIVE allows pilots to fly in synthetic environments in an interactive mode and can serve as a Tactics, Techniques, and Procedure (TTP) checkout facility. Testing will be performed with realistically simulated flight to perform rigorous checkout of all the flight control components. This connection allows engineers to evaluate the flight control system while a pilot performs simulated combat/combat support missions.

The BHIVE is used to support CSWG, EUDs and other related test. The ability to rapidly prototype changes to page layout and pilot vehicle interfaces makes it a valuable tool for evaluation of requirements.

**A-2.4.3 Trade Studies and Assessment**

The UH-60M Upgrade trade studies are defined in the UH-60M Upgrade SOW that states trade studies will be conducted to explore opportunities to increase system performance.

**A-2.5 Technical Management and Control**

With the addition of a System Functional Review (SFR), the Technical Management of the UH-60M Upgrade will be the same as the UH-60M Baseline.

**A-2.5.1 Interface Management**

**A-2.5.2 Configuration Management**

The UH-60M Upgrade utilized the same Configuration Management as the UH-60M baseline and combined with the UH-60M LRIP effort to develop a single CM Plan for all H-60 platforms.

**A-2.5.3 Technical Objectives**

**A-2.5.3.1 Technical Performance Measures**

TPMs provide a measure of technical progress as the system matures through the development process. The TPM for the UH-60M Upgrade are the same as the UH-60M shown in Table 6 of the main body of this SEP except as modified below:
## Technical Performance Measures (TPM)

<table>
<thead>
<tr>
<th>TPMS</th>
<th>METRIC</th>
<th>COMMENTS</th>
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</thead>
<tbody>
<tr>
<td>Software Lines of Code (LOC)</td>
<td># LOC</td>
<td>Lines of executable code developed for MFD's and CDU's – Defined in the individual Software Development Plans for each vendor providing software</td>
</tr>
<tr>
<td>Memory Reserve Capacity</td>
<td>40% usage at PDR (60% reserve) 50% usage at CDR (50% reserve) 80% usage for Life Cycle (20% reserve)</td>
<td>Defined as capacity of system memory + throughput + bus-loading</td>
</tr>
<tr>
<td>Average Unit Cost (AUC)</td>
<td>$/unit</td>
<td>Defined as average unit cost of all configurations of the UH-60M Upgrade. MEDEVAC will have unique AUCs components that contribute to the AUC that will be identified and tracked. GFE costs will be based on AMDF pricing. Deleted as a TPM</td>
</tr>
<tr>
<td>Design to Operating and Support Cost (DTOSC)</td>
<td>$DTOSC</td>
<td>DTOSC is based on a peacetime operating scenario and includes: cost of consumption of parts (consumables &amp; repairables) and direct labor at all maintenance levels, and petroleum oil and lubricants (POL) costs. Parts include contractor furnished equipment (CFE) and GFE equipment. Deleted as a TPM</td>
</tr>
<tr>
<td>Software</td>
<td>Documented in the Approved SDP</td>
<td></td>
</tr>
</tbody>
</table>

### A-2.5.4 Requirements Traceability

### A-2.5.5 Overview of Government and Contractor Data Rights

The approach of contracting for unlimited software rights on all software developed for the UH-60M Upgrade Program does not change from that of the UH-60M Baseline Program.

### A-2.5.6 Technical Reviews

The technical management and control for the UH-60M Upgrade is the same as the UH-60M Baseline with two differences. The first is the addition of a System Functional Review (SFR) prior to the SRR. The second deals with technical authority in chairing major
reviews. Major technical reviews will be chaired by the UH PO Chief Systems Engineer and/or the UH PO Technical Management Division Chief.


The SRR is a formal review of the conceptual design and methodology of the UH-60M Upgrade system to establish the system capability to satisfy the performance requirements of AVNS-PRF-10018. The SRR covers all system elements at Sikorsky’s facility following IPT recommendation and PMWG agreement that the SRR entrance criteria have been satisfied.

A-2.5.6.1.1 SRR Entrance Criteria

Demonstrate, by means of a crosswalk, that the system design meets all requirements of the UH-60M Upgrade Performance Specification (AVNS-PRF-10018). The crosswalk shall:

- Show the derived requirements traceability throughout the allocated baseline.
  - Responsible IPT: SE IPT
- Contain a list of proposed segment specifications and identify hardware CIs and software CSCIs for each segment.
  - Responsible IPT: SE IPT
- Contain a list of all required Interface Requirements Specifications (IRS) and Interface Control Documents (ICD).
  - Responsible IPT: SE IPT
- Show the UH-60M Upgrade Performance Specification (AVNS-PRF-10018) Tree and the method of requirements flow down.
  - Responsible IPT: SE IPT
- Prepare an update to the Flight Safety Parts List.
  - Responsible IPT: SE IPT
- Prepare an UH-60M Upgrade Performance Specification (AVNS-PRF-10018) Tree of proposed specifications.
  - Responsible IPT: SE IPT
- Prepare proposed specification changes to the UH-60M Upgrade Performance Specification (AVNS-PRF-10018) for the functional baseline.
  - Responsible IPT: SE IPT Lead; All IPT Support
- Prepare a Specification Requirement Verification Matrix detailing the compliance to the AVNS-10018 Sections 3 and 4 compliance and proposed non-compliant resolutions.
  - Responsible IPT: SE IPT Lead; All IPT Support
- Prepare a Upgrade Program Software Development Plan (SDP).
  - Responsible IPT: FCS / Avionics IPT
- Prepare the Upgrade Program Plan for Software Aspects of Certification (PSAC).
  - Responsible IPT: FCS / Avionics IPT
- Prepare a Upgrade Test and Evaluation Program Plan (TEPP).
  - Responsible IPT: Test IPT
- Prepare a Upgrade Level Functional Hazard Assessment (FHA).
  - Responsible IPT: SE IPT; All IPT Support
- Prepare a preliminary Modeling and Simulation (M&S) Configuration Management Plan.
  - Responsible IPT: SE IPT
• Prepare a System Safety Program Plan (SSPP).
  o Responsible IPT: SE IPT
• Prepare an update to the Hazardous Materials Management Program (HMMP) Plan.
  o Responsible IPT: SE IPT

A-2.5.6.1.2 SRR Exit Criteria

Minimum exit criteria included establishment of the baseline and the path ahead for resolution of action items, documentation of all Government comments that must be addressed to obtain Government approval of submitted deliverables, Government concurrence that the SRR exit criteria have been satisfied, and any additional criteria agreed to at the kick-off meeting.

A-2.5.6.2 System Functional Review—Completed 4 August 2005 – all action items closed.

The SFR is a multi-disciplined product and process assessment to ensure that the system under review can proceed into preliminary design, and that all system requirements and functional performance requirements derived from the Capability Development Document (CDD – formerly ORD) are defined and are consistent with cost (program budget), schedule (program schedule), risk, and other system constraints. Generally this review assesses the system functional requirements as captured in system specifications (functional baseline), and ensures that all required system performance are fully decomposed and defined in the functional baseline. System performance may be decomposed and traced to lower level subsystem functionality that may define hardware and software requirements. SFR determines whether the systems functional definition is fully decomposed to its lower level, and that the IPT is prepared to start preliminary design

A-2.5.6.2.1 SFR Entrance Criteria:

• Gov/SAC shall close all SRR Action Items / Complete Delta SRR (Section 4)
  o Responsible IPT: SE IPT
• Gov/SAC shall Baseline AVNS-PRF-10018 (Government signature cycle)
  o Responsible IPT: SE IPT
• SAC shall deliver for approval Subsystem Segment Specifications prior to SFR
  o Responsible IPT: All IPTs
• SAC shall deliver for Gov review the Avionics Design Document (AVDD) and Avionics Interface Design Document (AVIDD)
  o Responsible IPT: SE IPT
• SAC shall deliver for Gov review drafts of designated item performance and item detail specifications prior to SFR
  o Responsible IPT: All IPTs
• SAC deliver the Preliminary System Design Architecture (Interfaces) 10 days prior to SFR
  o Responsible IPT: All IPTs
Gov/SAC Subsystem IPTs shall present consensus to proceed into SFR 15 days prior to SFR
  o  Responsible IPT: PMWG
PM IPT determines: Documentation and requirements flow form a satisfactory basis for proceeding to preliminary design
  o  Responsible IPT: PMWG
SAC shall deliver IMP 10 days prior to PDR
  o  Responsible IPT: SE IPT

A-2.5.6.2.2 SFR Exit Criteria:
  • Obtain Government approval for path ahead to resolution of action items
    o  Responsible IPT: SE IPT
  • Obtain Government approval functional baseline
    o  Responsible IPT: All IPTs
  • Obtain Government concurrence of recommended PDR entrance and exit criteria.
    o  Responsible IPT: SE IPT
  • Government Approval of all Entrance Criteria Documents
    o  Responsible IPT: PMWG

A-2.5.6.3 System Preliminary Design Review – Completed 12 - 14 October 2005 – all action items closed.

A System PDR will be conducted for all Computer Software-related items in accordance with the approved Program Master schedule. Agenda for the System PDR will be submitted in advance to the UH-60 Modernization Program Management Office. For CSCI, this review focuses on (1) evaluation of the progress, consistency, and technical adequacy of selected top level design and test approaches; and (2) compatibility between software requirements and preliminary design. The System PDR is normally accomplished for the purpose of establishing integrity of software at the Computer Software Component (CSC) level. Additional guidance for conducting the PDR for CSCIs is contained in Sikorsky Software Development Plan.

A-2.5.6.3.1 PDR Entrance Criteria
  • For computer software related items, proposed allocated baseline
  • For computer software related items, requirements allocation traceability and verification methods to the CI level
  • Updated FMEA/FMECA with identification of Category I and Category II failure modes and proposed elimination or mitigation.
  • For computer software related items, submittal of Performance Specifications
  • Allocation of unit production costs to meet the requirements of paragraph 1.0 to the CI level
  • For computer software –related items, Submittal of the ICDs Documentation List
  • Review of all SRR action items and risk mitigation efforts
  • Updated TMDE requirement
• Submittal of an initial Software FMECA
• Submittal of updated Interface Requirements Specifications (IRs)
• Submittal of updated Software Requirements specifications (SRSs)
• Submittal of preliminary top level Software Design Descriptions (SDDs) and Software Test Plans (STPs)
• Submittal of an updated DISR compliance matrix that is ready for submittal to the ADO
• Updated software performance budgets (timing, sizing, and throughput)
• Submittal of updated Depot Partnership Study Technical Report
• Any additional criteria agreed to at SRR

A-2.5.6.3.2 PDR Exit Criteria
Minimum exit criteria includes:
• establishment of the allocated baseline and the path ahead for resolution of action items
• documentation of all Government comments that must be addressed to obtain Government approval of submitted deliverables
• list of components below the CI level requiring further requirement allocation and traceability as agreed upon by the TM IPT
• Government concurrence that the PDR exit criteria have been satisfied
• and any additional criteria agreed to at the SRR.


A System CDR for the UH-60M will be conducted in accordance with the approved Program Master schedule. Agenda for the System CDR will be submitted in advance to the UH-60 Modernization Program Management Office. Updated versions of all specifications presented at the System PDR, all PIDs and CID’s and engineering documentation are presented for review. Both CSCIs and HWCIs are presented at the review meeting. Additional guidance for conducting a System CDR for CSCIs is contained in the Sikorsky SDP. For CSCIs this review will focus on determination of the acceptability of the detailed design, performance and test characteristics of the design solution, and adequacy of operation and support documents. The System CDR for the CSCIs is a formal technical review of each CSCI detail design, including database and interfaces. The software CDR is for the purpose of establishing the integrity of computer software design at the Computer Software Unit (CSU) level prior to coding and testing.

A-2.5.6.4.1 System CDR Entrance Criteria
The following entrance criteria, as a minimum, shall be completed prior to and addressed at the System CDR:
• Proposed software product baseline structure (software design and interface design complete and ready to release to code).
• For computer software-related items, requirements allocation traceability and verification methods for the list of components below the CI level as agreed upon at PDR
• FMEA/FMECA with identification and prioritization of Category I and Category II failure modes and proposed verification method for elimination or mitigation
• For computer software-related items, Submittal of Detailed Specifications to the component level agreed upon at PDR
• Results from 1st EUD conducted during the I/Q phase addressed.
• Allocation of unit production costs to meet the requirements of paragraph 1.0 of AVNS-PRF-10002 to the component level agreed upon at PDR
• Updated verification methods for Section 4 of AVNS-PRF-10002 and the AQSOW
• Updated TMDE requirements
• Review of all System PDR action items and risk mitigation efforts
• Identification of proposed new, revised or deleted Flight Safety Parts
• Presentation of algorithm descriptions to include BIT
• Submittal of an initial Software Transition Plan
• Submittal of updated SDDs, STPs, and preliminary Software Test Descriptions (STDs)
• Submittal of updated SRSs, if changed from previously approved CDRL submission
• Submittal of updated IRSs, if changed from previously approved CDRL submissions
• Submittal of an updated DISR compliance matrix
• Submittal of an updated Software FMECA, if changed from previously approved CDRL submission
• Elimination or proposed testing of single point catastrophic and critical failure paths for software
• Submittal of an update to the Depot Partnership Study Technical Report
• Process capability analyses
• Production resources commonality matrix
• Production/RECAP/Upgrade tooling list
• Any additional criteria agreed to at the System PDR

A-2.5.6.4.2 System CDR Exit Criteria
Minimum exit criteria includes:
• establishment of the hardware product baseline
• software design complete and ready to release to code
• the path ahead for resolution of action items, documentation of all Government comments that must be addressed to obtain Government approval of submitted deliverables
• Government concurrence that the System CDR exit criteria have been satisfied, and any additional criteria agreed to at the System PDR

A-2.5.7 Work Breakdown Structure (WBS)
The UH-60M Upgrade utilized the same WBS as the baseline UH-60M (with minor changes to account for the increased flight control effort over the UH-60M Baseline). See Attachment A-2.

A-2.5.8 GFE Management
The UH-60M Upgrade will utilize the same GFE management approach as the UH-60M Baseline.
A-2.6 Integration with Other Program Management Control Efforts

A-2.6.1 CAIV

A-2.6.1.1 Cost Reduction and Avoidance Issues

A-2.6.1.1.1 Cost Plus Award Fee Contract

- The Development contract was awarded for developing, integrating, qualifying and testing both recapitalize/upgrade and production applications for UH-60M Upgrade. In doing so, the contract includes two UH-60M Upgrade aircraft for developmental and operational test purposes. A CPAF contract is used to provide motivation for the contractor and leverage for the Government. Research and Development funding was used for this contract. For each award fee period, portions of the award fee pool will be available to the Contractor based on his performance with respect to the following criteria: Effectiveness of meeting and exceeding the performance requirements of AVNS-PRF-10018
  - Effectiveness of completing entrance and exit criteria for Technical Reviews as scheduled in the Government approved IMS
  - Effectiveness of meeting and exceeding the TPM and KPP
  - Effectiveness of management of overall weight growth as percent growth of the defined empty weight of the aircraft
  - Effectiveness in defining and meeting the design assurance requirements of AVNS-PRF-10018 utilizing the safety assessment process.

A-2.6.2 Risk Management

The UH-60M Upgrade utilized the same Risk Management Plan as the UH-60M Baseline and will be continually evaluated for potential improvements, to ensure risk management identifies a risk, documents a plan, executes a plan to the resolution of the risk and historical documentation.

A-2.6.3 Earned Value Management

The UH-60M Upgrade utilized the EVMS that was used for the UH-60M Baseline. EVM in the use of an integrated management system that coordinates work scope, schedule, and cost goals and objectively measures progress toward these goals.

A-2.6.3.1 Organization and Staffing

The UH-60M Upgrade utilized the same organization and staffing as the UH-60M Baseline.

A-2.6.3.2 Planning

The UH-60M Upgrade utilized the same planning as the UH-60M Baseline.

A-2.6.3.3 Directing

The UH-60M Upgrade utilized the same directing as the UH-60M Baseline.
A-2.6.3.4 Controlling

The UH-60M Upgrade utilized the same controls as the UH-60M Baseline.

A-2.6.4 Leveraging Other Efforts

The UH-60M Upgrade is utilizing the results of other Government programs developing material for use in Army Aviation. As a result, some material is being provided as GFE. Some of it is directly portable to the UH-60M and others require some tailoring for installation on the UH-60M Upgrade Airframe. The efforts being leveraged are defined below:

a. Common Missile Warning System (CMWS): The UH-60M Upgrade will utilize the designed developed for the UH-60M Baseline while fully integrating the system into the cockpit displays.

b. Blue Force Tracker (BFT): The UH-60M Upgrade will utilize the designed developed for the UH-60M Baseline while fully integrating the system into the cockpit displays.

c. Alternate Communications (Interim JTRS Solution): The UH-60M Upgrade will utilize the designed developed for the UH-60M Baseline while fully integrating the system into the cockpit displays. The initial design will be the integration of AN/ARC-231, should PM Aviation Mission Equipment, through contract actions, choose a different radio, additional integration / design will have to occur on the UH-60M Baseline.

d. Composite Tail Cone (CTC): The CTC is being developed and component qualified under a separate Manufacturing Technology (MANTECH) effort. Upon completion of the component qualification the system qualification will be conducted under the UH-60M Upgrade effort.

e. Improved Stabilator Actuator (ISA): The ISA will be integrated with the UH-60M Upgrade as original equipment, not through attrition as for the rest of the H-60 fleet. The ISA will have a specific digital interface for the UH-60M Upgrade Flight Control System.

f. Development of active inceptors as part of the Joint Strike Fighter Program. Technology and development activities leveraging ongoing SDD efforts for JSF which are approximately two years ahead in the development of the active controller technology.

g. Leverage the development of S-92 control law development which is developing the next generation of the Comanche control laws with simplified architecture and pilot explicit modes in addition to the auto-moding being developed under the UH-60M Upgrade effort.

h. S-92 development efforts for common hydraulic and electrical components which are required to provide fault tolerance and flight critical electrical power.

i. Development of common software modules for the integration of communications, navigation, pilot vehicle interface symbology, BFT and many additional hardware elements with the CAAS hardware. This joint development effort includes collaboration DoD wide on common CAAS software and hardware objectives to achieve GATM navigation compliance and improve system integrity.
A-2.6.5 Airworthiness Qualification

The UH-60M PM has made the decision that Airworthiness Qualification regulations will be rolled into a single contract and specification. The Airworthiness Qualification performance regulations are included in section 4.4 of AVNS-PRF-10018. Modification of section 4.4 is an evolutionary process and the UH-60M Upgrade program will maintain and update this section via the established ECN and SCN process.
## PROGRAM MANAGERS WORKING GROUP CHARTER

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>The PMWG provides mid-level management, coordination and oversight functions to ensure the acquisition of a producible, testable, a sustainable system that is affordable across the life cycle of the system, consistent with available funding and program milestones.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE OF WORK</td>
<td>The PMWG is responsible for planning, execution, integrated product development, design, and life cycle management to deliver a cost effective and supportable aircraft that meets the user’s requirements on schedule.</td>
</tr>
<tr>
<td>INTERFACES</td>
<td>The PMWG interfaces with the User community, the ESC, the IPTs/sub-IPTs, and the contractors.</td>
</tr>
</tbody>
</table>
| DESCRIPTION OF TASKS | The PMWG will manage the following:  
  ① Exercise program management methods and oversight  
  ② Ensure the UH-60M system meets the mission requirements  
  ③ Ensure UH-60M compatibility with other helicopter systems  
  ④ Facilitate program communications to all stakeholders  
  ⑤ Ensure necessary interfaces are established and are functional  
  ⑥ Prioritize activities and resource requirements  
  ⑦ Ensure Risk Management Program is being properly and effectively implemented  
  ⑧ Monitor IMS and EVMS for performance anomalies and ensure corrective action taken as necessary  
  ⑨ Support Milestone Decision Authority |
<p>| AUTHORITY | The PMWG has complete authority to direct the activities of the program as well as serve as the final authority to resolve questions or disputes. |</p>
<table>
<thead>
<tr>
<th>ACCOUNTABILITY</th>
<th>The PMWG is accountable to the UHPO and PEO Aviation for the delivery of the UH-60M system consistent with funding and program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCTS</td>
<td>PMWG Charter</td>
</tr>
<tr>
<td>PRODUCTS APPROVAL</td>
<td></td>
</tr>
<tr>
<td>Gov’t UH-60M PM</td>
<td>Date</td>
</tr>
<tr>
<td>Contractor UH-60M PM</td>
<td>Date</td>
</tr>
<tr>
<td>TEAM COMPOSITION</td>
<td>The PMWG is comprised of the UH-60M PM and his/her Sikorsky Aircraft Corporation counterpart.</td>
</tr>
</tbody>
</table>

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# EXECUTIVE STEERING GROUP CHARTER

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>This group is responsible for program oversight, direction, and providing resources.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE OF WORK</td>
<td>The ESC has the responsibility for programmatic oversight of the UH-60M development and production.</td>
</tr>
<tr>
<td>INTERFACES</td>
<td>Communication between the members of the Executive Steering Group is maintained through weekly telecoms.</td>
</tr>
<tr>
<td>DESCRIPTION OF TASKS</td>
<td>This program integrates multiple products managed by other Government agencies and project offices. The UH-60 PM and his staff will continuously focus their attention on implementing a program to meet the user’s needs while incorporating cost reduction initiatives and work share arrangements as appropriate.</td>
</tr>
<tr>
<td>AUTHORITY</td>
<td>The UH-60 PO exercises programmatic, technical, logistical, and financial control of the UH-60M Modernization Program.</td>
</tr>
<tr>
<td>ACCOUNTABILITY</td>
<td>The ESC is accountable to the User community, the leadership within the Office of the Secretary of Defense, and the Department of the Army.</td>
</tr>
<tr>
<td>PRODUCTS</td>
<td>ESC Charter</td>
</tr>
<tr>
<td>PRODUCTS APPROVAL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PEO Aviation</td>
</tr>
<tr>
<td></td>
<td>Sikorsky AC PM</td>
</tr>
<tr>
<td></td>
<td>UHPO</td>
</tr>
<tr>
<td>TEAM COMPOSITION</td>
<td>Utility Helicopter PM Program Executive Officer, Aviation Sikorsky Aircraft Corporation counterparts</td>
</tr>
</tbody>
</table>
## ENGINEERING IPT CHARTER

<p>| PURPOSE | The Engineering IPT will coordinate the efforts of the Systems Engineering (SE) sub-IPT, the Air Vehicle (AV) sub-IPT, the Avionics sub-IPT, Flight Control System and the Integrated Manufacturing (IM) sub-IPT to ensure that the allocated design achieves a system solution that meets spec and schedule requirements of the contract. |
| SCOPE OF WORK | The Engineering IPT will ensure that aircraft delivered to test are built to identified standards and are compliant with product specifications. The Chief Engineer also budgets the funding for engineering support from other government agencies supporting the UH-60M Modernization Program technical analyses to include programmatic contract support. |
| INTERFACES | The Chief Engineer’s counterpart within the prime contractor’s organization has similar responsibilities over the prime contractor’s engineering staff and provides subcontractors with technical direction. The UH-60M Chief Engineer coordinates with the chief engineers of other government programs which provide GFE to the UH-60M in order to coordinate and resolve technical interface issues and funding as necessary. |
| DESCRIPTION OF TASKS | • Identify processes and standards for systems integration. • Set overall technical objective within contract requirements, and assist sub-IPTs in identifying intermediate goals leading to the objective system. • Ensure that each sub-IPT is properly resourced to accomplish its goals. • Provide timely flow of information to coordinating and superior IPTs. |</p>
<table>
<thead>
<tr>
<th><strong>AUTHORITY</strong></th>
<th>The chief engineer interfaces with the other IPT leads and has the final approval authority over technical issues within the UH-60M Modernization Program.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACCOUNTABILITY</strong></td>
<td>The Engineering IPT is led by the UH-60M Chief Engineer who reports directly to the UH-60M Product Manager and Deputy Product Manager.</td>
</tr>
<tr>
<td><strong>PRODUCTS</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **PRODUCTS APPROVAL** | Chief Engineer, UH-60M  
Deputy PM, UH-60M  
PM, UH-60M |
| **TEAM COMPOSITION** | Chief Engineer, UH-60M  
Sub-IPT Leads  
AED  
User Rep |
# SYSTEMS ENGINEERING SUB-IPT CHARTER

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>The Systems Engineering sub-IPT develops and executes an interdisciplinary program plan to ensure an integrated and life cycle balanced set of system product and process solutions to satisfy the warfighter’s requirements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE OF WORK</td>
<td>The work breakdown structure will define which elements fall under the direct responsibility of the SE IPT. As listed in the RAM, these WBS elements address air vehicle level analyses, test, and integration activities that could not be allocated or assigned to a specific team such as Automatic Flight Control or Fire Control.</td>
</tr>
<tr>
<td>INTERFACES</td>
<td>The SE Team interfaces with all program teams, the program management team, and functional management within the contractor team, PM Office and the customer.</td>
</tr>
</tbody>
</table>
| DESCRIPTION OF TASKS | • Executing and managing a structured systems engineering approach that provides a life cycle balanced set of system product and process solutions.  
• Performing system requirements analysis, managing changes to the system requirements within contract requirements, and tracking achievement of the system requirements.  
• Facilitating the development and completion of entrance and exit criteria for major performance-related program reviews (e.g. PDR, CDR) as they relate to technical issues.  
• Conducting, in conjunction with other IPTs, trade studies and analyses that consider cost, schedule, and performance as independent variables. |
- Conducting technical risk assessments, developing mitigation plans, and tracking technical risk status
- Maintaining and updating the SEP so that it remains a living document that defines the technical aspects of government and contractor programmatic activities and responsibilities. Metric development evolves from the IPTs.

**RESPONSIBILITIES**

The SE Team will manage coordinating the delivery of a technically compliant UH-60M on cost & schedule to the U.S. Army for Initial Operational Test & Evaluation.

**AUTHORITY**

Within the contracted SOW, the SE Team has the authority to affect the technical decisions which:
1. Can’t reach a consensus within a given IPT,
2. Affect more than a single IPT,
3. Cross organizational boundaries, or
4. Require air vehicle level trade offs to be considered. The SE Team is a vehicle to promote consensus between the affected IPTs based on a systems level review of available data. Carry forward SE IPT decisions to the Project Office for concurrence.

**ACCOUNTABILITY**

The SE Sub-IPT lead will focus on his/her respective technical areas and report directly to the chief engineer.

**PRODUCTS**

System Integration CDRLs, SE Charter

**PRODUCTS APPROVAL**

Govt UH-60M PM  
Contractor UH-60M PM  
Govt Chief Engineer  
Contractor Chief Engineer  
SE IPT Lead

**TEAM COMPOSITION**

Core Team Members:
- UH-60M Systems Engineer
- AED representative
- System engineering staff (as req’d)
- Contractor counterparts
## BUSINESS MANAGEMENT (BM) IPT CHARTER

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>The BM IPT executes the administration for all contractual and financial matters for the UH-60M program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE OF WORK</td>
<td>The BM IPT will manage the Work Breakdown Structure, Performance Measurement Baseline, Earned Value Management System, procurement management, program analysis and reporting along with baseline cost estimates. The BM IPT is also responsible for coordinating legal matters with appropriate parties. The BM IPT provides counsel and recommendations to the OIPT as necessary.</td>
</tr>
<tr>
<td>INTERFACES</td>
<td>The BM IPT interfaces with the Engineering IPT, Logistics IPT, and Test IPT.</td>
</tr>
</tbody>
</table>
| DESCRIPTION OF TASKS | The BM IPT will manage the following:  
  - Management of Milestone Requirements documentation  
  - Earned Value Management System  
  - Action Items database  
  - Personnel Rosters  
  - Meeting Minutes  
  - Program Library  
  - Baseline Cost Estimates  
  - Budgets  
  - Historical Records of Funding and Program Changes  
  - Coordination of contract-related matters  
  - Execution of the Integrated Baseline Review  
  - Management of the Performance Measurement Baseline |
<p>| RESPONSIBILITIES | The BM IPT will perform necessary program and cost analyses along with program performance reporting. Further, the BM IPT will work with the IPTs to identify those WBS elements and/or cost accounts which show variances to plan. |
| AUTHORITY | The BM IPT has the authority to work with the IPTs to ensure corrective actions are identified to bring about improved performance in a timely manner. |
| ACCOUNTABILITY | The BM IPT is accountable to the PMWG |</p>
<table>
<thead>
<tr>
<th>PRODUCTS</th>
<th>CDRLs, Cost Performance Report (CPR), PMB, CFSR, CARD, BM IPT Charter</th>
</tr>
</thead>
</table>
| PRODUCTS APPROVAL | Program Manager  
Contractor Program Manager  
Govt Contractor  
Govt Chief Engineer  
Contractor Chief Engineer  
SE IPT Lead |
| TEAM COMPOSITION | Core Team Members:  
- Business Management IPT Lead  
- Contractor Business Management IPT Lead  
- Procuring Contracting Officer  
- Program Analysts  
- Cost Analysts  
Associate Team Members:  
- Business Management staff (as req’d)  
- Technology staff (as req’d)  
- System engineering staff (as req’d) |
## TEST IPT CHARTER

| PURPOSE | To support the component and subsystem qualification test effort for the UH-60M weapons system by coordinating with all IPTs on test issues; and to manage the system level test program. |
| SCOPE OF WORK | Coordinate with segment IPTs on:  
- Risk Reduction test  
- Component qualification test  
- Subsystem qualification test  
- Systems bench test  
- Live Fire test  
Plan, conduct, and report on:  
- Combined Test Team operations  
- Aircraft flight test  
- Government technical and operational test  
The Test IPT has primary responsibility for the work contained in WBS X.X |
| INTERFACES | The Test IPT interfaces with the system design IPTs to establish test methods for component and subsystem testing, and to:  
1. Establish system level test requirements  
2. Prioritize objectives necessary to support aircraft qualification  
3. Obtain feedback from IPTs in order to evaluate and reprioritize goals to deliver a safe, qualified aircraft. |
| TEST IPT DESCRIPTION OF TASKS | - Coordinate on qualification requirements through coordination with design IPTs and Government qualification authorities.  
- Coordinate on component qualification test program  
- Coordinate on component and |
| subsystem qualification test requirements for vendor supplied items; monitor subcontractor qualification program  |
| - Plan, conduct, and report on subsystems bench testing  |
| - Plan, conduct, and report on flight test program  |
| - Coordinate Government test activities under the Combined Test Team  |
| - Monitor test program status through the Cost/Schedule Control System Criteria  |

### RESPONSIBILITIES

The Test IPT will manage the conduct of the system level test program. The Government Test Coordinator and the Assistant Product Manager for T&E are responsible for the Government test program and Combined Test Team operations. The IPT will manage the flight test program and coordinate effort between the contractor and Government testers.

### AUTHORITY

The Test IPT has authority over resource allocation and scheduling of flight test activities.

### ACCOUNTABILITY

The Test IPT is accountable to the Product Management Overarching IPT and the Government and company Program Managers.

### PRODUCTS

The primary product of the Test IPT is a fully qualified UH-60M Weapons System. To this end, the Test IPT produces system level qualification test plans and test reports, test schedules and budgetary reports.

### PRODUCTS APPROVAL

Govt Program Manager
Contractor Program Manager
Govt IPT Leader
Contractor IPT Leader
# LOGISTICS IPT CHARTER

## PURPOSE

The purpose of this Charter is to establish and empower a UH-60M Logistics Integrated Product Team.

## SCOPE OF WORK

The Logistics IPT will be empowered to develop and implement a supportability system which will ensure the UH-60M is reliable, maintainable, and supportable throughout its life cycle. The Logistics IPT will integrate and coordinate with other government offices and contractors both vertically and horizontally. The Logistics IPT will interact, coordinate, and ensure a working relation with the other UH-60M IPTs and government and contractor office of equal stature.

## INTERFACES

The Logistics IPT interfaces with all program IPTs, program management PMWG, contractor teams, DoD, and the customer.

## DESCRIPTION OF TASKS

The Logistics IPT will:

- Ensure that aircraft is supportable when delivered for testing and fielding.
- Develop support requirements related to readiness objectives, to design, and to each other.
- Integrate support considerations effectively into the system and equipment design.
- Identifying the most cost-effective approach to supporting the system.
- Ensuring that the required support structure elements are developed and acquired.
- Provide timely flow of information to IPTs and the PMWG.
- Ensure that the External Lift and Net Ready KPPs are demonstrated and met.

## RESPONSIBILITIES

The Logistics IPT will develop, implement and monitor execution of a Supportability program to support the UH-60M Program throughout the life cycle.
A. IPT Leader:
   a. Execution of the IPT Charter
   b. Formation of the UH-60M-Logistics IPT
   c. Set meeting dates, locations and milestones
   d. Ensuring the IPT fosters an atmosphere that promotes crossing organizational boundaries and free flow dialogue
   e. Day to Day management of the IPT process
   f. conduct/host IPT meetings
   g. Document decisions in minutes and distribution of minutes to the membership
   h. Maintain IPT membership
   i. Track and keep record of all action items and assignments

B. IPT Members:
   Shall meet as required to help plan, program, structure, and document/resolve issues.
   a. Identify issues and parameters
   b. Develop strategies and program planning
   c. Identify constraints and resources
   d. Establish a plan of action and milestones
   e. Propose resolutions
   f. Review and provide early input to documents
   g. Help in deciding roadmap/strategy
   h. Assume responsibility to obtain concurrence on issues
   i. Provide recommendations to the WIPT lead
   j. Accepting tasking that require research, writing, and/or briefing
   k. Actively participating in the WIPT by supporting and attending meetings
   l. Completing assigned tasks on schedule and providing results on issues

**AUTHORITY**

Within the contracted SOW, the Logistics Team has the authority to affect the Logistics decisions which
| a. Require resolution of conflicts of IPTs  
b. Affect more than a single IPT,  
c. Cross organizational boundaries, or  
d. Require air vehicle level trade offs to be considered.  
The Logistics Team is a vehicle to promote consensus between the affected IPTs based on a systems level review of available data. Carry forward Logistics IPT decisions to the Project Office for concurrence. |
| ACCOUNTABILITY |
| The Supportability Team is accountable to the program managers and Senior Logisticians within the Govt and contractor organizations |
| PRODUCTS |
| A supportable system that includes the following:  
A. Maintenance Planning  
a. Depot Maintenance Study  
b. Level of Repair Analysis  
c. Reliability predictions  
d. Maintainability predictions  
e. Failure Modes, Effects, and Criticality Analysis  
f. Failure Reports  
g. Root cause failure analyses  
h. Test plans  
i. Test Reports  
B. Supply Support  
a. Provisioning Master Record  
b. Authorized Stockage List/Prescribed Load List  
c. Replenishment Spares  
d. Maintenance Allocation Chart  
e. Government Furnished Equipment (GFE) requirements list  
f. GFE shortage list  
D. Training and Training Support  
a. Training Course Program of Instruction  
b. Instructor and Key Personnel Training  
E. Training devices  
a. T-BOS |
**b. Maintenance Training Device Suite**

F. Computer resources and software support  
   a. Maintenance Support Device  
   b. Diagnostic software  
   c. Automated Logbook  

G. Transportability  
   a. Transportability Demonstration  
   b. Transportability kit  
   c. Component shipping containers  
   d. Package instructions  

H. PBL  
   a. Core Depot Analysis  
   b. Business Case Analysis  
   c. Performance Based Agreements  
   d. Sources of Support

| PRODUCTS APPROVAL | Contractor Program Manager  
|                  | Program Mgmt IPT Lead  
|                  | Program Mgmt IPT Lead  
|                  | Govt Contractor |

| TEAM COMPOSITION | Core Team Members:  
|                 | Logistics IPT Lead  
|                 | Logistics Staff  
|                 | Associate Team Members:  
|                 | AMCOM IMMC  
|                 | TSM |
## INTEGRATED MANUFACTURING SUB-IPT CHARTER

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>The Operations sub-IPT’s primary purpose is to ensure that the product being built is producible at the required rate, identify production risks and develop strategies to address risks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCOPE OF WORK</td>
<td>The IM/O IPT interfaces with all program IPTs, program management, prime contractor, suppliers, Army Environmental Center, AMCOM G-4, Corrosion Prevention Action Team (CPAT).</td>
</tr>
<tr>
<td>INTERFACES</td>
<td>The IM/O IPT interfaces with all program IPTs, program management, prime contractor, suppliers, Army Environmental Center, AMCOM G-4, Corrosion Prevention Action Team (CPAT).</td>
</tr>
</tbody>
</table>
| DESCRIPTION OF TASKS | • Manage the Process Modeling and Simulation effort  
• Develop and utilize capacity analysis models  
• Identification and management of critical path production processes  
• Identification and management of parts critical to maintaining a smooth production flow  
• Validate requests for additional tooling  
• Identification and management of Industrial Base issues  
• Develop databases capturing production costs and other production data  
• Evaluate long lead procurement requirements  
• Develop production cost estimates  
• Conduct process proofing  
• Conduct production surveillance  
• Review hazardous material management program plan progress reports  
• Update the Programmatic |
<table>
<thead>
<tr>
<th>RESPONSIBILITIES</th>
<th>Environmental, Safety and Health Evaluation (PESHE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Develop and implement a Corrosion Prevention and Control (CPC) program</td>
</tr>
</tbody>
</table>

**AUTHORITY**

The Integrated Manufacturing/Operations Sub-IPT is lead by the UH-60M Integrated Manufacturing/Operations Lead and derives the authority to make decisions through empowerment from the UH-60M Chief Engineer.

**ACCOUNTABILITY**

The IM/O Team is accountable to the Engineering IPT and to the program managers and Chief Engineers within the Govt and contractor organizations.

**PRODUCTS**

- Updated Programmatic Environmental, Safety and Health Evaluation (PESHE)
- Corrosion Prevention and Control (CPC) program
- Production cost estimates
- Databases capturing production costs and other production data
- Capacity Models

**PRODUCTS APPROVAL**

- Govt Program Mgmt IPT Lead
- Contractor Program Mgmt IPT Lead
- Govt Chief Engineer
- Contractor Chief Engineer
- Govt IM/O IPT
- Contractor IM/O IPT Lead

**TEAM COMPOSITION**

- UH-60M Integrated Manufacturing/Operations Lead
- Contractor counterparts
### AIR VEHICLE SUB-IPT CHARTER

<p>| PURPOSE | The Air Vehicle (AV) Sub-IPT will manage the performance and operational requirements of the UH-60M Utility Helicopter. The AV Team’s purpose is to ensure aircraft subsystems and components, shown on the WBS, perform according to stated mission requirements. A main effort of the AV Team is to ensure the Airframe, Propulsion system, major computer hardware and software items, and auxiliary systems are fully capable of accomplishing the UH-60M mission under the conditions specified. |
| SCOPE OF WORK | The UH-60M Work Breakdown Structure lists the elements which fall under the direct responsibility of the AV Sub-IPT. These elements include integration, management, assembly, test and checkout of AV subsystems and components. Since the AV is predominantly OTS/NDI, the integration effort and associated testing will be significant efforts for the IPT. Hardware and software subject matter expertise will be required. The UH-60M Work Breakdown Structure lists the elements which fall under the direct responsibility of the AV Sub-IPT. These elements include integration, management, assembly, test and checkout of AV subsystems and components. Since the AV is predominantly OTS/NDI, the integration effort and associated testing will be significant efforts for the IPT. Hardware and software subject matter expertise will be required. |</p>
<table>
<thead>
<tr>
<th>INTERFACES</th>
<th>The AV Team interfaces with the SE IPT, Systems Engineering Team, the program management team, and functional management within the contractor team, PM Office, and the customer.</th>
</tr>
</thead>
</table>
| DESCRIPTION OF TASKS | The AV Team will ensure the accomplishment of the KPPs including:  
• IR Survivability  
• HOGE, Endurance and Range  
• Net-Ready  
Through analysis and participation in demonstration, testing, production and operation of the following subsystems and components:  
Airframe  
Propulsion  
Application and System Software  
Communications/Identification Systems  
Navigation and Guidance  
Central Computer  
Fire Control  
Data Displays and Controls  
Survivability Systems  
Reconnaissance  
Automatic Flight Control  
Central Integrated Checkout  
Armament  
Weapons Delivery  
Auxiliary Equipment |
| RESPONSIBILITIES | • Coordinating the performance and operational qualification of a mission capable UH-60M.  
• Developing and integrating all components of the aircraft to include airframe, mission computers, avionics, navigation, communications, mission critical software, propulsion, and flight control systems.  
• Chairing the Simulation Based Acquisition Team, evaluating and recommending alternative design |
| **AUTHORITY** | Within the contracted SOW, the AV Team has the authority to affect the technical decisions which relate to the KPPs and other operational factors. The Air Vehicle Sub-IPT is lead by UH-60M Air Vehicle Chief Engineer and derives the authority to make decisions through empowerment from the UH-60M Chief Engineer. The AV Sub-IPT will carry forward decisions to the SE IPT for concurrence and integration. |
| **ACCOUNTABILITY** | The AV Team is accountable to the Engineering IPT and to the program managers and Chief Engineers within the Govt and contractor organizations. |
| **PRODUCTS** | Air Vehicle Analyses, Qualification Reports |
| **PRODUCTS APPROVAL** | Govt Program Mgmt IPT Lead Contractor Program Mgmt IPT Lead Govt Chief Engineer Contractor Chief Engineer Govt AV IPT Contractor AV IPT Lead |
| **TEAM COMPOSITION** | Core Team Members:  
- Systems Engineering Manager  
- Engineering Operations Manager  
- Technology managers  
- Other IPT leaders  
- Business Operations team representative  
- Contracting Representative  
Associate Team Members:  
- Business Manager (as req’d)  
- Technology staff (as req’d)  
- System engineering staff (as req’d) |
# MEP SUB-IPT CHARTER

## PURPOSE
Integrate all MEP elements, both hardware and software, of the mission equipment package for the UH-60M Helicopter. Accomplish the Mission Equipment Package assigned tasks within the allocated budget and meet requirements.

## SCOPE OF WORK
Manage the integration and checkout of Non Developmental Item MEP to include the following equipment types: Communication, Improved Data Modem, Navigation (EGI, VOR/ILS, TACAN), Identification Friend or Foe (IFF), Controls and Displays, Aircraft Survivability Equipment, MEP Mission Computers and Data Busses.
In addition, any MEP software development, Information Assurance Strategy efforts, and Net Ready requirements efforts.

## INTERFACES
The MEP IPT interfaces with other IPTs, contractors, TSM, AED, and on-sight DCMA as needed.

## DESCRIPTION OF TASKS
Identify, track, resolve risks and areas of concern. Identify and implement processes and metrics. Develop and track MEP schedules. Perform integration and test of MEP in the laboratory. Assess MEP performance. Participate in integration, check-out, functionals (acceptance tests) and demonstrations of the MEP when installed on the aircraft. Status program management. Coordinate interoperability risk reduction, standards conformance, and certifications (e.g., CTSF and JITC).

## RESPONSIBILITIES
Covered in other sections of this charter.

## AUTHORITY
- Schedule Control
- Risk Management
- Interface Management
- Resolve Technical Disputes
<table>
<thead>
<tr>
<th>ACCOUNTABILITY</th>
<th>Sub-IPT leads focus on their respective technical areas and report directly to the chief engineer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCTS</td>
<td>Integrated MEP hardware and software AMPS Interface to UH-60M DATA PEPS ICDS IFMs</td>
</tr>
<tr>
<td>PRODUCTS APPROVAL</td>
<td>Engineering IPT Lead</td>
</tr>
<tr>
<td>TEAM COMPOSITION</td>
<td>Leads for Comm/Nav/IFF/C&amp;D/ASE Logistics AED Test/Flight Test * Contracts* * As Needed</td>
</tr>
</tbody>
</table>
# FLIGHT CONTROL SYSTEM (FCS) SUB-IPT CHARTER

<table>
<thead>
<tr>
<th><strong>PURPOSE</strong></th>
<th>Integrate the Fly By Wire, both hardware and software, of the Flight Control System for the UH-60M Upgrade aircraft. Accomplish the Flight Control System (FCS) assigned tasks within the allocated budget and meet requirements.</th>
</tr>
</thead>
</table>
| **SCOPE OF WORK** | **SDD**  
Manage the development, integration and qualification of the FBW FCS to include the following:  
- Flight Control Computers  
- Active Control Inceptors  
- Main and Tail Rotor Servo Actuators  
- Hydraulic Modifications  
- Conducting Subsystem Reviews  
- Integration of Commercial Safety and Software Standards  
- Level 1 Handling Qualities per ADS-33E-PRF (ORD Requirement) |
| **INTERFACES** | The FCS Team interfaces with other Sub-IPTs and IPTs (internal and external), TSM-Lift, AMRDEC (AED), and on-sight DCMA as needed |
# FLIGHT CONTROL SYSTEM (FCS) SUB-IPT CHARTER

## DESCRIPTION OF TASKS

- Developing, integrating and qualification of the digital flight control system, to include, but not limited to, all inceptors, flight control computer, main and tail rotor actuators, hydraulic modifications, interface with stabilator system components, engine and pilot vehicle interfaces integrated with flight control elements, flight control hardware and software elements, redundancy and flight control I/O management, control law and flight director software, flight control interface with the CAAS/Avionics Systems.
- Developing FCS segment and item specifications.
- Estimating, measuring and controlling progress of the FCS effort.
- Synthesize/integrate major aircraft HW/SW segments and subsystems

## RESPONSIBILITIES

Covered in other sections of this charter.

## AUTHORITY

- Schedule Control
- Subsystem/segment Risk Management
- Interface Management
- Resolve Technical Disputes with in the Subsystem/segment

## ACCOUNTABILITY

To Program Management and Chief Engineer

## PRODUCTS

- Integrated FBW FCS hardware and software
- DATA
- PIDS
- ICDS

## APPROVAL

K. Nunn
UH-60M Chief Engineer
<table>
<thead>
<tr>
<th>TEAM COMPOSITION</th>
<th>Leads for Electronics (FCC/Active Control Inceptors) / Mechanical (MTR / TTR) / Hydraulics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Finance</td>
</tr>
<tr>
<td></td>
<td>Quality</td>
</tr>
<tr>
<td></td>
<td>Supportability</td>
</tr>
<tr>
<td></td>
<td>Program Planning and Control</td>
</tr>
<tr>
<td></td>
<td>ON-SITE Government Offices</td>
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<tr>
<td></td>
<td>Weight Representative</td>
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<tr>
<td></td>
<td>Materiel/Subcontract Management</td>
</tr>
<tr>
<td></td>
<td>Test/Flight Test *</td>
</tr>
<tr>
<td></td>
<td>Contracts*</td>
</tr>
<tr>
<td></td>
<td>* As Needed</td>
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## Attachment A-2. UH-60M Upgrade WBS

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<tr>
<th>CWBS Element #</th>
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<td>AFT FUSELAGE (TRANSITION)</td>
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<td>1.2.4 TRAINING SYSTEM REQUIREMENTS</td>
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<td>1.4 SYSTEM TEST &amp; EVALUATION</td>
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