AIRWORTHINESS QUALIFICATION PLAN (AQP) FOR THE REDUCED FORM FACTOR (RFF) TRANSPONDER

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This Airworthiness Qualification Plan (AQP) defines the airworthiness qualification requirements for the RFF Transponder. The Product Manager, Aviation Mission Equipment will be responsible for procurement of RFF Transponder. Requirements are provided for the following platforms: UH-60A/L/M, CH-47F, MH-47, MH-60, HH-60, AH-64D, OH-58D/F, ERMP UAS (MQ-1C), Shadow UAS, C-12, RC-12, C-20, C-23, UC-35, C-26, C-37. Airworthiness qualification requirements include engineering analysis, qualification tests, and airworthiness evaluations.

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FOR THE REDUCED FORM FACTOR (RFF) TRANSPONDER

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AIRWORTHINESS QUALIFICATION PLAN (AQP) FOR THE REDUCED FORM FACTOR (RFF) TRANSPONDER

1.0 Scope

This Airworthiness Qualification Plan (AQP) defines the box level and integration airworthiness qualification requirements for the RFF Transponder. The Product Manager, Aviation Mission Equipment will be responsible for procurement of the system and integration into the following platforms: UH-60A/L/M, CH-47F, MH-47, MH-60, HH-60, AH-64D, OH-58D, ERMP UAS (MQ-1C), Shadow UAS, C-12, RC-12, C-20, C-23, UC-35, C-26, C-37. Airworthiness qualification requirements include engineering analysis, qualification tests, and airworthiness evaluations.

2.0 System Function and Configuration

The RFF Transponder is an Identification Friend or Foe (IFF) Transponder designed for installation on Unmanned Aerial Systems (UAS), fixed wing, and rotary wing aircraft. The Transponder provides identification, altitude, and surveillance reporting in response to challenges from airborne, ground-based and surface interrogators. Interrogation processing and reply generation capabilities are provided for Mark XIIA IFF Modes 1, 2, 3/A, C, 4 and Mode 5 Level I and II operation. In addition, the RFF Transponder provides Mode S Level 3 Extended Squitter (ES) capability, including Automatic Dependent Surveillance Broadcasts (ADS-B) Out, and is compatible with Traffic Alert and Collision Avoidance System (TCAS) II equipment.

The RFF Transponder will have a modular external Mode 4/5 cryptographic computer which shall perform all Mode 4 and Mode 5 cryptographic-related interrogation and reply processing functions as described in DoD AIMS (Air Traffic Control Radar System (ATCRB) Identification Friend or Foe (IFF), Mark XII/XIIA, Systems) 03-1000A, 04-900A, and the "Cryptographic Equipment Interoperability Requirements Specification for Mark XIIA Mode 5 Air Identification Friend or Foe System" dated 21 May 1999.

The RFF Transponder is located internally to the aircraft platform. The same antennas will be used for the RFF Transponder. On aircraft which past Transponders were integrated on, the antenna will be located in the same position.

2.1 Airworthiness Qualification Criteria Assumptions

The assumptions detailed herein form a basis for airworthiness qualification criteria. Any changes made to the assumed configurations or functionality may result in corresponding changes to airworthiness qualification verification.

a. The RFF Transponder is considered Mission Essential equipment. If the system classification changes, the requirements shall be re-evaluated.

b. The Remote Control Unit (RCU) is not part of this development effort.

c. Once component level testing is successfully completed, no changes to that component will be made. If changes are made, testing requirements shall be re-evaluated.

d. Once system level testing is successfully completed, no changes will be made on a system level. If changes are made, testing requirements shall be re-evaluated.

e. The following test requirements assume all components are internally mounted. If changes are made, testing requirements shall be re-evaluated.

3.0 Qualification Methods

Qualification shall be performed to verify compliance with this AQP. Methods of qualification shall be by similarity, analysis, test, or demonstration. The Electromagnetic Environmental Effects (E3) and Vibration testing, specific to all additional A and B-Kit, shall not be qualified by similarity.

3.1 Qualification Definitions:

Safety of Flight (SOF). Safety of Flight is defined as the first flight, limited experimental test flights, user evaluations, or ferrying flights for the purpose of gathering system data, verifying system operation of newly designed or modified mission equipment, or moving an aircraft from one location to another. A SOF AWR is valid until the date identified on the specific AWR and is terminated upon transfer of the subject helicopters, changes in equipment configuration, or upon issuance of a later AWR, whichever occurs first.

Full Qualification: Full Qualification is defined as formal compliance with this AQP and other technical specifications cited in the contract. The RFF Transponder will be considered fully qualified when it has successfully demonstrated compliance to all formal qualification test requirements and is ready for deployment.

3.2 Qualification by Similarity

Qualification by Similarity (QBS) may be proposed for components or systems that have been previously qualified for use on US Army aircraft. ADS-51-HDBK shall be used for reference and information only for QBS. When QBS is proposed for environmental qualification requirements, follow the requirements in ADS-71-SP, paragraph 4.4.3. Reports shall be prepared including all supporting data and qualification reports to verify compliance with this AQP. QBS reports shall be submitted prior to the qualification test plan package. This approach will facilitate a timely review of the similarity report which, if disapproved, will provide sufficient time to revise the similarity report or develop the appropriate test plans to perform the required qualification testing. Aviation Engineering Directorate (AED) review and approval is required.

3.3 Qualification By Analysis

Qualification by Analysis involves proving an item meets its design requirements by a technical evaluation of the electrical, aeromechanical, propulsion, and structures capability of the installed system. All requirements being qualified by analysis shall be addressed and shown to comply with their respective system specification and requirements documents. Analysis reports shall be

submitted prior to the qualification test plan package. This approach will facilitate a timely review of the analysis report which, if disapproved, will provide sufficient time to revise the analysis or develop the appropriate test plans to perform the required qualification testing. AED review and approval is required.

3.4 Qualification by Testing

Qualification by Testing shall be used for a component, subassembly, software and system that do not meet qualification by similarity or analysis standards. Testing shall include test plans, test procedures, test reports, and AED review and approval.

3.5 Qualification by Demonstration

Qualification by Demonstration shall be conducted to show the capability of the system or subsystem to comply with the requirements. A survey shall be conducted to show the maximum capability of the system or sub-system. Testing shall include test plans, test procedures, test reports, and AED review and approval.

4.0 Testing Process

Tests, surveys, and demonstrations, as required to complete the airworthiness qualification of the equipment specified in this document, shall be planned and conducted. Requirements cited herein are to be considered the minimum to substantiate component level airworthiness qualification. Airworthiness qualification will be granted upon successful completion of the test program, approval of the test reports, and satisfactory completion of an airworthiness review and functional configuration audit.

4.1 Test Sequencing

A schedule of tentative individual tests arranged in a logical sequence, which minimizes program risks, shall be provided. Prepare schedule and submit to AED for approval in accordance with (IAW) DI-NDTI-81284. The schedule shall reflect maximum involvement of government witnessing, test personnel, and facilities. It is highly recommended that the component test sequencing follow the sequencing of MIL-STD-810G to minimize program risk.

4.2 Test Witnessing/Participation

Based on the master test schedule, the AED, the Software Engineering Directorate (SED), and the procuring agency will designate those tests that will require government witnessing/ participation. The procuring activity shall be notified in sufficient time before conducting any required test, or before component disassembly following a test, so that AED and SED representatives may witness the test or component disassembly. Typically, AED and SED need a minimum notification of 10 working days prior to conducting any component, subsystem, software or system airworthiness qualification test or demonstration, and before component disassembly, following a test.

4.3 Test Plan(s) and Procedures

Qualification test plans and procedures, except E3, shall be prepared IAW DI-NDTI-80566A for all tests and demonstrations required by this AQP and shall be submitted to the procuring activity for AED review and approval. Electromagnetic Interference (EMI) test plans and procedures shall be prepared IAW DI-EMCS-80201C and shall be submitted to the procuring activity for AED review and approval. All other E3 test plans and procedures shall be prepared IAW DI-EMCS-81541A and shall be submitted to the procuring activity for AED review and approval. Environmental qualification test plans and procedures shall be prepared IAW the data requirements outlined per paragraph 3.0 in each of the MIL-STD-810G test methods. AED approved test plans shall be used to conduct all tests. The test plan shall be prepared and submitted IAW the Integrated Master Schedule. Test plans and procedures shall be submitted for review and approval no later than 45 days prior to the start of test, survey, or demonstration.

4.4 Test Report(s)

Documentation of all results of tests, demonstrations, and analysis required by this AQP shall be submitted to AED for review and approval to verify compliance with applicable design requirement. Results of tests required by this AQP, except E3, shall be prepared IAW DI-NDTI-80809B. Results of EMI tests required by this AQP shall be prepared IAW DI-EMCS-80200C. Results of all other E3 tests required by this AQP shall be prepared IAW DI-EMCS-81542A. Environmental qualification test reports shall be prepared IAW the data requirements outlined per paragraph 3.0 in each of the MIL-STD-810G test methods. Reports shall be submitted to the procuring activity for AED review within 60 days of test completion. The test reports shall be prepared and submitted IAW the integrated Master Schedule.

5.0 FIRST FLIGHT AWR REQUIREMENTS

5.1 Ground Tests

Ground tests performed off the aircraft or on the aircraft without the engines operating do not require an AWR. Ground tests performed on the aircraft with the rotors turning will require an AWR.

5.2 Flight Tests

Submittal and approval of the following are required per aircraft platform for a Safety of Flight AWR with the RFF Transponder installed:

5.2.1 Internal Loads and Static Strength Analysis Reports for the respective aircraft. See paragraph 8.4 Structural Substantiation for details.
5.2.2 Crashworthiness analysis of new and modified equipment. See paragraph 8.4 Structural Substantiation for details.

5.2.3 Test plans, test procedures, and test reports for the following:

5.2.3.1. Environmental SOF box level testing as shown in Table 6.1.

5.2.3.2. CE101, CE102, CE106, and RE102 IAW MIL-STD-461F.

5.2.3.3. Electro-Explosive Device (EED) safety margin testing IAW ADS-37A-PRF.

5.2.4 Safety Assessment Report (SAR).

5.2.5 Electrical and mechanical drawings which completely define the configuration and installation.

5.2.6 Operator Instructions for the RFF Transponder.

5.2.7 Interface Control Document (ICD).

5.2.8 Ramp Test Procedure.

5.2.9 Flight Test Procedure.

5.2.10 Software Version Description (SVD).

5.2.11 EMC test procedure IAW ADS-37A-PRF, paragraph 4.3.1. Completed and signed checklists from the EMC test shall be provided to AED upon completion of the flight.

5.2.12 Electrical Loads Analysis (ELA).

5.2.13 Failure Mode, Effects, and Criticality Analysis (FMECA). The FMECA shall also address software. Use DI-ILSS-81495 as a reference.

5.2.14 Weight and Balance Analysis Reports (see Para 8.3 Weight and Balance).

5.2.15 Software Functional Qualification Test (FQT) Report.

5.2.16 Gunfire shock test report shall be provided prior to the first flight that includes firing of aircraft guns.

6.0 Component Level Airworthiness Requirements

Component level qualification is required by this AQP for the RFF Transponder. The following shall be completed for component qualification of the RFF TRANSPONDER. Test plans, procedures, and reports for all tests listed in this section shall be submitted to AED for review and approval.

6.1 Environmental Requirements

Table 6.1: Box Level Environmental Airworthiness Qualification Testing

Notes	Test	MIL-STD-810G Method and Procedure
	Low Pressure (Altitude) Storage/Air Transport	500.5, Procedure I
	High Temperature Storage	501.5, Procedure I
	Low Temperature Storage	502.5, Procedure I
	Temperature Shock	503.5, Procedure I-C
	Dripping Rain	506.5, Procedure III
	Humidity	507.5, Procedure II
	Fungus	508.6
	Salt Fog	509.5
	Sand and Dust	510.5, Procedure I and Procedure II
SOF	Explosive Atmosphere	511.5, Procedure I
	Acceleration	513.6, Procedure I and II
SOF	Vibration	514.6, Procedure I, Category 13 and 14
	Gunfire Vibration	AH-64D: McDonnell Douglas Helicopter Systems document LL0060-200 A006-5 OH-58D/F: 519.6, Procedure III
	Functional Shock	516.6, Procedure I
SOF	Crash Hazard Shock	516.6, Procedure V
	Bench Handling Shock	516.6, Procedure VI
	Catapult Launch Shock	516.6, Procedure VIII
SOF	Temperature, Humidity, Vibration, and Altitude	520.3, Procedure III

6.1.1 Low Pressure (Altitude) Storage/Air Transport: RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 500.5, procedure I. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance after exposure to altitudes up to 50,000 feet above sea level.

The Temperature/Altitude/Humidity/Vibration method 520.3, procedure III, can be tailored to include the Low Pressure (Altitude) Storage testing at the beginning of the first cycle.

6.1.2 Non-Operational Temperature

a. High Temperature Storage: RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 501.5, procedure I for storage/non-operational. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to temperatures as high as + 85°C (+185°F). A minimum of seven diurnal cycles IAW Table 6.2 shall be performed for the storage/non-operational test.

Table 6.2
High Temperature – Storage (Non-Operational) (+85°C) Diurnal Cycle

Time of Day	Temperature		Time of Day	Temperature		Time of Day	Temperature	
	°C	°F		°C	°F		°C	°F
0100	36	96	0900	48	118	1700	80	175
0200	34	94	1000	58	136	1800	74	165
0300	34	94	1100	64	148	1900	63	146
0400	33	91	1200	74	165	2000	54	128
0500	33	91	1300	82	180	2100	44	111
0600	33	91	1400	84	183	2200	41	106
0700	37	99	1500	85	185	2300	38	101
0800	43	109	1600	84	183	2400	36	96

b. Low Temperature Storage: RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 502.5, procedure I for storage/non-operational. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to temperatures as low as -62°C (-80°F).

The Temperature/Altitude/Humidity/Vibration method 520.3, procedure III, can be tailored to include the Low Temperature Storage testing at the beginning of the first cycle.

6.1.3 Temperature Shock

RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 503.5, Procedure I-C. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance after being subjected to thermal shocks from -62° C to + 85° C (-80°F to +185°F). A minimum of three complete temperature shock cycles shall be performed for full qualification.

6.1.4 Dripping Rain

RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 506.5, procedure III. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to falling water from condensation or leakage from upper surfaces..

6.1.5 Humidity

The equipment shall be tested IAW MIL-STD-810G, method 507.5, Procedure II. Components shall be subjected to an atmosphere of clear water vapor for ten cycles under the conditions and times as specified in the MIL-STD-810G. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to a warm, humid atmosphere. Perform operational checks at the end of the 5th and 10th cycles.

6.1.6 Fungus

The equipment shall be tested IAW MIL-STD-810G, method 508.6. Operation of the equipment during the test shall not be required. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance subsequent to exposure to a fungus environment. There shall be no evidence of support of fungus growth during or after the 84-day test with environments containing the fungus groups listed in MIL-STD-810G. If the supplier proposes that this requirement be met via analysis, sufficient documentary evidence that only approved non nutrient materials are used throughout, or all of the parts are suitably treated to resist fungus, and the proper cleaning procedures were used, shall be supplied. The supplier may use Guideline 4 of MIL-HDBK-454 as a guide to identify those materials, which are acceptable non-nutrients of fungus, and to establish conditions under which fungus nutrient materials are acceptable. AED recommends that any analysis reports be submitted at the same time as the qualification test plan package. This approach will facilitate a timely review of the analysis report which, if disapproved, will provide sufficient time to perform the required qualification testing.

6.1.7 Salt Fog

RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 509.5. RFF Transponder equipment shall be subjected to a minimum of four 24-hour alternating wet/dry cycles. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to salt fog conditions.

6.1.8 Sand and Dust

Equipment shall be tested IAW MIL-STD-810G, test method 510.5, procedures I and II with the following exception: For internally mounted equipment the sand test may be conducted using the minimum allowed air velocity. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to blowing sand and dust conditions.

6.1.9 Explosive Atmosphere

The equipment shall be tested IAW MIL-STD-810G, method 511.5, procedure I. During the test, components shall have maximum input voltage applied to them, and shall be operated continuously at their maximum loads. During each altitude condition, all make and break

contacts shall be operated. The RFF Transponder equipment shall operate without causing ignition in fuel-air an explosive atmosphere.

6.1.10 Acceleration

The equipment shall be tested IAW MIL-STD-810G, method 513.6, procedure I and II. For procedures I and II, the acceleration level shall be 6 g's in all directions except the 'up' direction; procedure I shall be 10.5 g's in the 'up' direction and procedure II shall be 7 g's in the 'up' direction. The RFF Transponder equipment shall structurally withstand the loads and operate without degradation in performance during and subsequent to acceleration loads.

6.1.11 Vibration

a. Vibration shall be performed IAW MIL-STD-810G, method 514.6, procedure I, category 13 and 14 with a duration of four hours per axis. Separate testing for each aircraft platform shall be performed. In lieu of conducting multiple aircraft specific tests, multi-platform compliance may be shown by first conducting a modal sine sweep survey of each Line Replaceable Unit (LRU) in the frequency range of 0-500 Hz (10-2000 Hz if installed in close proximity to drive system elements) and identifying the principle modes of vibration of the components within the LRU. Subsequently, the aircraft vibration spectrum from Method 514.6 corresponding to the worst case, based on proximity of natural frequency to the forcing frequencies, shall be selected and applied.

b. Gunfire vibration testing shall be performed IAW McDonnell Douglas Helicopter Systems document LL0060-200 A006-5, Qualification Test Criteria for Gunfire Vibration on AH-64D Longbow Apache. Separate gunfire vibration testing for the OH-58D/F is not required if the RFF Transponder successfully completes the AH-64D gunfire vibration test. If the AH-64D test is not successfully completed, gunfire vibration shall be performed IAW MIL-STD-810G, method 519.6 procedure III for OH-58D/F. Gunfire shock testing shall be completed prior to the first flight that includes firing of aircraft guns.

6.1.12 Shock

a. Functional Shock: The equipment shall be tested IAW MIL-STD-810G, method 516.6, procedure I. The test shall be conducted under room ambient conditions. The test shall employ the SRS spectrum from MIL-STD-810G Figure 516.6-8 as the test spectrum for each axis, provided that T of the test shock time history falls between the values in Table 516.6-I for flight equipment. While the SRS spectrum is the preferred approach, a classical shock pulse is permissible in lieu of the SRS spectrum. The classical pulse shall be the terminal peak sawtooth IAW Figure 516.6-10 and Table 516.6-II for flight vehicle equipment. The test item shall be operational before, during, and after the test as is appropriate to its functional use. The RFF Transponder equipment shall sustain no physical damage and shall operate without degradation in performance during and subsequent to exposure to shock levels up to 20g.

b. Crash Hazard Shock: This test is required for any component that will be in the cockpit or cabin of any platform. The equipment shall be tested IAW MIL-STD-810G, method 516.6,

procedure V. The test limit shall be 40g in each axis. The test shall employ the SRS spectrum from MIL-STD-810G Figure 516.6-8 as the test spectrum for each axis, provided that T of the test shock time history falls between the values in the accompanying Table 516.6-I for flight equipment. While the SRS spectrum is the preferred approach, a classical shock pulse is permissible in lieu of the SRS spectrum. The classical pulse shall be the terminal peak sawtooth IAW Figure 516.6-10 and Table 516.6-VII for flight vehicle equipment. Operation of the test item after the test shall not be required. The RFF Transponder equipment shall maintain structural integrity and remain intact when exposed to shock levels up to 40g.

c. Transit Drop: The equipment shall be tested IAW MIL-STD-810G, method 516.6, procedure IV. The RFF Transponder equipment shall sustain no physical damage and operate without degradation in performance subsequent to exposure to shocks associated with accidental drops.

d. Bench Handling Shock: A bench handling test shall be conducted IAW MIL-STD-810G, Test Method 516.6, Procedure VI, to verify the ability of equipment to withstand typical levels of shock associated with bench handling (maintenance and repair), or packaging. This test shall apply to medium-to-large equipment out of its transit or combination case that has a maximum dimension greater than approximately 23 cm (9 inches). Small materiel systems, in general, will be tested to higher levels during Procedure IV, Transit Drop.

e. Catapult: The equipment shall be tested IAW MIL-STD-810G, method 516.6, procedure VIII.

6.1.13 Temperature/Altitude/ Humidity/ Vibration

RFF Transponder equipment shall be tested IAW MIL-STD-810G, method 520.3, procedure III, Qualification. Vibration is the only test parameter that may be tailored out of the combined environments test. The RFF Transponder shall sustain no physical damage and shall operate without degradation in performance after exposure to temperatures ranging from -54°C to +71°C (-65°F to +160°F). Operational altitude testing shall be from base or sea level to 25,000 ft pressure. For a SOF AWR, perform a minimum of three cycles of the operational exposure test. For full qualification, perform a minimum of ten cycles of the operational exposure test. The equipment shall satisfy all of the functional requirements during and after operational testing within its performance specification which shall be recorded in the test report.

Note: If Low Temperature Storage and Low Pressure (Altitude) testing is tailored into this procedure, testing shall be performed at the beginning of the first cycle.

6.2 Electromagnetic Environmental Effects (E3)

6.2.1 Electromagnetic Interference (EMI) Testing

The following tests shall be conducted IAW MIL-STD-461F as modified by ADS-37A-PRF: CE101, CE102, CE106, CS101, CS114, CS115, CS116, RE101, RE102, RS101, and RS103.

RS103 testing shall be conducted to the levels and modulations identified in Table I Parts A and B of ADS-37A-PRF. The maximum test level may be limited to 200 V/m. Testing shall be performed using aircraft representative cables/wiring (type, size, length, shielding, and grounding). When multiple platforms are being considered, one test may be performed providing that engineering data (i.e. analysis, drawings, etc.) is submitted to show that the cable proposed for use is the worst case configuration. A test plan shall be provided for review and approval by AED prior to test.

6.2.2 Electrostatic Discharge (ESD)

The system shall preclude damage or upset from electrostatic discharge (ESD) due to handling of the equipment by operating or maintenance personnel. ESD compliance shall be verified by test. The ESD level associated with personnel for non-EEDs is ±15 kilovolts represented by a 500 picofarad capacitor discharging through a 500 ohm resistor to the equipment. All equipment surfaces and connector pins that are accessible to operating and maintenance personnel shall be tested for ESD compliance.

6.2.3 Electrical Bonding

Electrical bonding shall be IAW MIL-STD-464A, paragraph 5.10. Equipment on the exterior of the aircraft, such as antennas, shall have provisions for bonding that are adequate for lightning protection. Electrical bonding shall be per ADS-37A PRF.

6.2.4 Lightning

The effects of indirect severe lightning strikes on the RFF Transponder equipment shall be determined IAW ADS-37A-PRF, paragraphs 3.8 and 4.8. Direct effects may be conducted by analysis. Indirect effects shall be conducted by test per DO-160F, Section 22, waveform set K, level 3.

6.3 Electrical Requirements

The RFF Transponder system shall meet the worst case scenario for aircraft power per MIL-STD-704A-F. Wiring shall be per SAE-AS50881 Revision D.

6.4. Component Drawings

A complete set of mechanical and electrical drawings are required for each component of the Transponder system IAW DI-SESS-81000C.

6.5 Failure Modes Effects and Criticality Analysis (FMECA).

A Failures Modes Effects and Criticality Analysis shall be submitted which documents the operational impacts hardware and hardware/software interface failures will have on the system. This may be combined with the software FMECA provided it includes hardware/firmware failure modes. Use DI-ILSS-81495 as a reference.

6.6 AIMS Certification

AIMS component level certification is required. All test plans and reports shall be submitted to AED for review.

6.7 National Security Agency

The National Security Agency approval letter shall be submitted to AED.

6.8 Federal Aviation Administration (FAA) TSO-C112

FAA TSO-C112 certification letter and all documents required by the FAA for the TSO-C112 certification shall be provided or be made available to AED for review.

6.9 Complex Electronic Hardware Documents Required for Airworthiness Qualification

Complex electronic Hardware includes devices such as Application Specific Integrated Circuits (ASIC), Programmable Logic Devices (PLD) and Field Programmable Gate Arrays (FPGA). Where the functionality of such devices is allocated to or performed by software RTCA/DO-178B shall be used as the guide for software development and design assurance. The software documents required are those shown above in paragraph 7.1. Where the functionality is allocated to and performed by hardware, RTCA/DO-254 shall be used as guidance for the development and design assurance of complex electronic devices and the documents below are required to be delivered.

6.9.1 Plan for Hardware Aspects of Certification: reference RTCA/DO-254 Section 10.1.1 and DI-MISC-80508B for content.

6.9.2 Hardware Verification Plan: reference RTCA/DO-254 Section 10.1.4 and DI-MISC-80508B for content.

6.9.3 Hardware Accomplishment Summary: reference RTCA/DO-254 Section 10.9 and DI-MISC-80508B for content.

6.9.4 Top Level Drawing: reference RTCA/DO-254 Section 10.3.2.2.1 and Section 6.4.1 of this document for content.

7.0 Software Qualification for Airworthiness

Software for the RFF Transponder shall meet Software Level C requirements of RTCA/DO-178B. The software documents listed in paragraph 7.1 are the minimum documents that are required to be delivered to AED for review and approval. All complex electronic hardware required by the RFF Transponder shall be developed, tested, managed and documented IAW RTCA/DO-178B or RTCA/DO-254. The complex electronic hardware documents listed in 7.2 shall be delivered to AED for review and approval.

7.1 Software Documents Required for Airworthiness Qualification

The software documents listed below shall be submitted to AED for review and approval.

7.1.1 Plan for Software Aspects of Certification: reference RTCA/DO-178B, Section 11.1 and DI-MISC-80508B for content.

7.1.2 Software Development Plan: reference RTCA/DO-178B, Section 11.2 and DI-IPSC-81427A for content.

7.1.3 Software Configuration Management Plan: reference RTCA/DO-178B Section 11.4 and DI-MISC-80508B for content.

7.1.4 Software Quality Assurance Plan: reference RTCA/DO-178B Section 11.5 and DI-MISC-80508B for content.

7.1.5 Software Verification Plan (Software Test Plan): reference RTCA/DO-178B Section 11.3 and DI-IPSC-81438A for content. The Software Verification Plan shall explain the structural coverage analysis/testing that will be performed for compliance to Level C of RTCA/DO-178B as well as the regression testing strategy that will be used for software changes.

7.1.6 Software Safety Program Plan: content shall be IAW DI-SAFT-81626 using IEEE STD 1228-1994 as a guide.

7.1.7 Software Requirements Specification: reference RTCA/DO-178B Section 11.9 and DI-IPSC-81433A for content.

7.1.8 Interface Control Documents: reference DI-CMAN-81248A for content.

7.1.9 Interface Requirements Specification: reference DI-IPSC-81434A for content.

7.1.10 Software Design Description: reference RTCA/DO-178B Section 11.10 and DI-IPSC-81435A for content.

7.1.11 Interface Design Description: reference DI-IPSC-81436A for content.

7.1.12 Software Test Description: reference RTCA/DO-178B Section 11.13 and DI-IPSC-81439A for content.

7.1.13 Software Test Report: reference RTCA/DO-178B Section 11.14 and DI-IPSC-81440A for content.

7.1.14 Software Version Description Document: reference RTCA/DO-178B Section 11.16 and DI-IPSC-81442A for content.

7.1.15 Software Users Manual: reference DI-IPSC-81443A for content.

7.1.16 Software Accomplishment Summary: reference RTCA/DO-178B Section 11.20 and DI-MISC-80508B for content.

7.2 Software Testing

Requirements software testing is satisfied through functional bench testing and possible acceptance testing. Software requirements in the SRS shall be traced to the test procedures in the Software Test Description. If a software requirement does not trace to a test performed in the functional bench test or acceptance test then a software test is required to be performed to verify that the software requirement is met. AED and SED shall be notified no NLT 10 days prior to testing so that arrangements can be made to witness testing as required by SED. Structural coverage testing shall be conducted during the software functional test for the assigned software level. The structural coverage testing shall ensure that:

a. All code has been executed
b. All code paths have been tested
c. Data coupling and control coupling between software components is correctly achieved
d. No dead code exists

Software testing methodology shall be addressed in the Software Verification Plan.

8.0 SYSTEM LEVEL AIRWORTHINESS REQUIREMENTS

The following system testing shall be performed on UH-60A/L/M, CH-47F, MH-47, MH-60, MH-6, HH-60, AH-64D, OH-58D/F, ERMP UAS (MQ-1C), Shadow UAS, C-12, RC-12, C-20, C-23, UC-35, C-26, and C-37 platforms operated by the Army. Test plans, procedures, and reports for all tests listed in this section shall be submitted to AED for review and approval.

8.1 Electrical Load and Power Source Capacity Analysis

An electrical loads and power source capacity analysis shall be performed. A short form electrical load analysis may be used to provide the electrical load information including description of the RFF Transponder, aircraft interface, busses, circuit breakers, added/removed loads, before/after total loads, all RFF Transponder applicable operating conditions, and total load growth capacity. Latest Electrical Load Analysis and MIL-E-7016F shall be used as guidelines.

8.2 Performance Testing

Performance testing shall be required with the installation of RFF Transponder into each platform. The purpose of performance testing is to evaluate and verify the functionality of the Transponder as it is implemented/installed into each operational platform. Integration Level AIMS Certification. Testing shall be IAW DoD AIMS 03-1 102 and 03-1103 documents.

8.3 Weight and Balance

A Weight and Balance analysis report shall be submitted for approval no later than 45 days prior to first flight for each Mission Design Series (MDS). The reports shall contain detailed weights and x, y, z (Station, Buttline, Waterline) locations of all part numbers in each applicable airframe reference system. Status of the weights shall be included to state if the weights are calculated or actual. The analysis shall include mission buildups to determine impact to the aircraft weight and center of gravity. Appropriate instructions for modifications to the aircraft weight and balance records shall be included IAW TM 55-1500-342-23 to reflect the subject installation.

8.4 Structural Substantiation

a. A structural substantiation shall be performed for each RFF Transponder system installation to ensure that it meets the structural requirements for transportation, flight, ground, and crash loads IAW the platform-specific structural design criteria documented in Table 8.4. The structural analysis shall be submitted IAW DI-GDRQ-80198A using AED Standard Operating Procedure (SOP) EF2002-111, Structural Integrity Substantiation of Airframe Structural Modifications, as a guideline. Structural integrity shall be assessed to ensure that all new components, mounting hardware, or modified aircraft structural members have been analyzed and exhibit positive safety margins and that the structural integrity and fatigue strength of existing structure is not compromised. If there is penetration in the pressure vessel, damage Tolerance analysis needs to be performed. For internally mounted components, crash loads analyses shall verify that components can withstand the loads during a crash sequence without causing equipment to break loose. This analysis shall also include back-up structure.

b. Loading: For all components, analysis shall be performed using a crash load factor as per FAR requirements. Crash loading shall be considered in stowed configuration. Aerodynamic loads shall be considered for externally exposed components (i.e. antenna mounting hardware).

c. Drawings: Detail drawings of components, surrounding airframe structure, assembly drawings, and installation drawings shall be provided and include the locations of installed components on the interior and exterior of the aircraft. Component specifications shall be included with the drawing package.

d. Factor of Safety: A safety factor of 1.5 shall be applied to all limit loads such as flight loads. Ultimate loads, such as crash loads, do not require an additional factor of safety.

Table 8.4

Platform	Structural Design Criteria
UH-60 A/L/M HH-60L/M	SER-70534, Structural Design Criteria Report (UH-60A/L/M and HH-60L/M)
CH-47F	Boeing 145-SS-603, Structural Design Criteria for CH-47D/F and MH-47G
MH-47	Boeing 145-SS-603, Structural Design Criteria for CH 47D/F and MH-47G
MH-60	SER-70534. Structural Design Criteria Report (MH-60L) SER-701318, MH-60K Structural Design Criteria Report M016059, MH-60M Structural Design Criteria Report
AH-64D	McDonnell Douglas Helicopter Systems Structural Design Criteria for the AH-64D Longbow Apache Prototype Attack Helicopter, Appendix B, 77-Y-8001-3 December, 1991 Revised June, 1995
OH-58D/F	Bell System Spec 406-947-500C and Structural Design Criteria Report 406-930-200 Revision G
ERMP	Unqualified aircraft flown via risk acceptance process
Shadow	Unqualified aircraft flown via risk acceptance process
C-12	Certification Basis as listed in FAA type certificate A24CE
RC-12	Certification Basis as listed in FAA type certificate A24CE
C20	Certification Basis as listed in FAA type certificate A12EA
C23	Certification Basis as listed in FAA type certificate A41EUFAA Federal Aviation Regulation, Part 25, Section 561 for C-23B/B+
UC35	Certification Basis and special conditions as listed in FAA type certificate A22CE
C-26	Certification Basis as listed in FAA type certificate A18SW
C-37	Certification Basis and special conditions as listed in FAA type certificate A12EA

8.5 E3 Airworthiness Requirements

8.5.1 Hazards of Electromagnetic Radiation to Personnel (HERP): Personnel maximum safe exposure times and minimum safe stand-off distances from RFF Transponder as installed on the aircraft shall be IAW Tables 2 & 3 of ADS-37A-PRF. This may be satisfied through either test or analysis.

8.5.2 Hazards of Electromagnetic Radiation to Fuel (HERF): Fuels shall not be inadvertently ignited due to the integration of the RFF Transponder system to the aircraft. This may be satisfied through either test or analysis.

8.5.3 Precipitation Static (P-Static) – The RFF Transponder as installed on the aircraft shall not be susceptible to performance degradation or damage due to build-up of electrostatic charges caused by P-Static effects and air flow. This may be satisfied through either test or analysis.

8.5.4 Electromagnetic Compatibility (EMC)

All new equipment installations on the aircraft shall be tested at the aircraft level IAW the EMC test requirements of ADS-37A-PRF, section 3.3, and demonstrate compliance IAW ADS-37A-PRF, section 4.3, Electromagnetic Compatibility (EMC) Verification. An EMC Test Procedure shall be submitted to AED for approval prior to test. The EMC testing shall include source-victim tests, receiver noise floor testing (if deemed necessary by AED from the RE102 test results), electrical power system transients, electrical/electronic subsystem transients, EED safety margin testing, and flight evaluation. The EMC test results shall be documented in a Test Report and submitted to AED for approval.

8.5.5 Electromagnetic Vulnerability (EMV)

EMV shall be verified IAW the requirements of ADS-37A-PRF, paragraphs 3.4 and 4.4. An EMV Test Procedure prepared shall be submitted to AED for approval prior to test. An EMV Test Report shall be submitted for approval.

8.5.6 Electrical Bonding

All aircraft electrical and electronic bonds shall meet the requirements of MIL-STD-464A, paragraph 5.10. Equipment on the exterior of the aircraft, such as antennas, shall also be bonded adequately for lightning protection.

8.6 Human Factors Engineering Qualification Requirements

8.6.1 Human Factors Assessment

A Human Factors assessment shall be performed for any modification to operability and human interface. The assessment shall evaluate controls, information management, and workload. The critical dimensions for each application and reach accommodation [5th percentile female through 95th percentile male] shall be evaluated and identified. The assessment must include

representative personnel attire in personal and protective clothing and equipment including, but not limited to, cold weather and MOPP IV.

8.6.2 Operator Workload Assessment

An Operator Workload Assessment shall be performed to identify high workload segments and tasks for the operator, IAW an AED approved test procedure. If workload was previously assessed for the aircraft platform, determine any increased workload due to the integration of the RFF Transponder. Apply system error rates to operator workload. Quantify error rates and their affect on workload to determine if they negatively affect safe flight operations during mission scenarios.

8.7 System Safety/Hazard Analysis

8.7.1 Safety Assessment

A safety assessment of the aircraft shall be conducted using SAE ARP4761 as a guide.

8.7.2 Hazard Analysis

System Hazard Analysis (SHA), Operating and Support Hazard Analysis (O&SHA), Occupational Health Hazard Assessment (OHHA), and Software Requirements Hazard Analysis (SRHA) shall be conducted using SAE ARP4761 as a guide. The SHA shall address the criticality of military IFF and civil surveillance functions over the lifetime of the box. These analyses shall support the airworthiness qualification program.

8.8 Integration Drawings

A complete set of mechanical and electrical drawings are required for each configuration of the RFF Transponder showing how the RFF Transponder will be integrated into the aircraft. The integration drawings shall include Corrosion Prevention and Control (CPC) Plan requirements of each platform and shall have sufficient detail to verify the correct materials and processes have been incorporated.

8.9 Software Qualification

8.9.1 Software Qualification for Non-Bussed Aircraft

There are no integration software requirements for non-bussed aircraft due to the RFF Transponder not being integrated into platform software. All qualification software requirements for non-bussed aircraft are in section 7.1 for component level software requirements.

8.9.2 Software Qualification for Bussed Aircraft

Integration software for bussed air vehicles shall at least meet Software Level C requirements. Prior to first flight the integration software shall be:

a. Analyzed / tested to show at least complete (100%) statement coverage has been achieved.

b. Analyzed / tested to show data and control coupling is achieved.

c. Software Functional (Integration) Qualification Testing, applicable to the performance of the RFF Transponder, shall be completed to confirm all software requirements in the Software Requirements Specification applicable to the air vehicle integration software have been successfully completed.

A Test report shall be delivered to the government showing that items a, b and c above have been accomplished successfully.

8.9.2.1 Software Development Documents: the following documents shall be delivered for government approval.

a. A Software Development Plan (SDP) shall be provided IAW DI-IPSC-81427A. The SDP shall describe how the developer will develop, manage / control and test all the integration software associated with this AQP. The SDP shall address the identification of the software design standards and software code standards for this project. The SDP shall address how quality assurance and configuration management will be conducted. The SDP shall address the chosen software development environment in terms of hardware and software. This includes the programming language(s), coding tools, compilers, linkage editors and loaders to be used. The hardware platforms for the tools to be used shall be listed.

b. A Software Requirements Specification (SRS) shall be provided IAW DI-IPSC-81433A. The SRS shall specify the requirements the software performs and the methods to be used to ensure that each requirement has been met. An SRS is required for each CSCI that is developed or modified for the RFF Transponder integration.

c. An Interface Requirements Specification (IRS) shall be provided IAW DI-IPSC-81434A. The software IRS shall specify the requirements imposed on the Hardware/Software Interface, and interfaces between software. An IRS is required for each CSCI that is developed or modified for the RFF Transponder integration.

d. A Software Design Description (SDD) shall be provided IAW DI-IPSC-81435A. The SDDs shall describe the design of the software. The SDD shall also describe software design decisions, the architecture design decision, the architectural design, and detailed design (define as the lowest software component that make up the CSCIs (e.g., Computer Software Units (CSU), packages)) needed to implement the software. The SDD shall include a matrix that show where requirements from the corresponding SRS are designed into the software code. An SDD is required for each CSCI that is developed or modified for the RFF Transponder integration.

e. An Interface Design Document (IDD) shall be provided IAW DI-IPSC-81436A. The IDD shall incorporate as applicable any information that would be located in a data base design for one or more interfaces between one or more CSCIs and other configuration items. If it is not

included in the SDD, an IDD is required for each CSCI that is developed or modified for the RFF Transponder integration.

f. A Software Product Specification (SPS) shall be provided IAW DI-IPSC-81441A. The SPS shall include the source and executables.

g. A Multiplex Interface Control Document (MICD) shall be provided IAW DI-MISC-80343. The MICD shall document the electronic communication between the RFF Transponder and the 1553 bus controller.

h. Software Problems/Change Reports. A software defect management approach shall be documented in the Software Development Plan (SDP). The defect history of any software product delivered at any time shall be provided with that product. A software problem/change tracking database shall be maintain that addresses software issues. This tracking database shall be made available electronically for Government review.

8.9.2.2 Software Testing Documentation: the following documents shall be delivered for government approval.

a. A Software Test Plan (STP) shall be provided IAW DI-IPSC-81438A. The STP shall describe plans for qualification and integration testing of the software. It shall also describe the software test environment to be used for the testing, identify the tests to be performed, and provide schedules for test activities. The STP shall address the method(s) that will be used to perform software regression testing, if required. The STP shall be done on the target hardware. The STP shall address each CSCI that is developed or modified for the RFF Transponder integration. This document shall also describe how the 100% statement coverage, data coupling and control coupling will be performed. If tools are used to perform the statement coverage, data and control coupling then they shall be listed. It is expected that all coverage testing will be conducted on the target hardware. If testing is not conducted on the target hardware this document shall give the reasons why and an alternate test approach shall be described. The Contractor shall prepare and document the results of this coverage analysis/testing in the Software Test Report.

b. A Software Test Description (STD) shall be provided IAW DI-IPSC-81439A. The STD shall include the test preparations, test cases, and test procedures to be used to perform qualification testing of the integrated software. An STD is required for each CSCI to be integrated into the platform, and each platform CSCI that was modified for the integration.

c. A Software Test Report (STR) shall be provided IAW DI IPSC-81440A. The STR shall be the record of the software qualification testing performed. The STR shall include the result of each test, the procedure used for the test, and the personnel that witnessed the test. An STR is required for each CSCI that is developed or modified for the RFF Transponder integration. The STR shall also document the results of the statement coverage, data and control coupling.

d. Incremental drops (builds) shall be provided of the latest software products for evaluations IAW DI-MCCR-80700. Incremental submittals of documentation/code shall be coordinated with

the Government to meet program milestones. These drops shall be incorporated into the master schedule. A report shall provide that defines the capabilities and limitations of each build.

8.9.3 System Integration Laboratory Testing

a. The RFF Transponder subsystem integration and operation shall be verified on a Software Integration Lab (SIL) or Avionics Integration Lab (AIL) bench prior to being installed on the aircraft/air vehicle.

b. The Developer shall develop a Software Test Description (STD) IAW DI-IPSC-81439A. The STD shall include the test preparations, test cases, and test procedures to be used to perform integration testing of the software.

c. The Developer shall develop a Software Test Report (STR) IAW DI-IPSC-81440A. The STR shall be the record of the software integration testing performed. The STR shall include the result of each test, the procedure used for the test, and the personnel that witnessed the test.

d. A Software Safety Regression test shall be developed that includes at least one test case for each safety requirement identified in the Software Requirement Specification. The Software Safety Regression Test shall be documented in the Software Test Description for the integration.

e. Software Version Description (SVD): The SVD shall contain a list of all changes incorporated into the software version since the previous version. The SVD identifies the problem reports, change proposals, and change notices associated with each change and the effects of each change on the system operation, and on interfaces with other hardware and software. The Developer shall develop a Software Version Description (SVD) IAW DI-IPSC-81442A after integration to reflect subsequent releases of each software configuration item.

8.10 Software Formal Qualification Test (FQT) / Acceptance Testing

All software requirements in the Software Requirements Specification are to be tested/verified using the test procedures listed in the Software Test Description and performed in the target (flight configuration) environment. This testing is considered to be the software Formal Qualification Test (FQT) / Acceptance Testing.

9.0 Government Documents

The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

STANDARDS, HANDBOOKS & SPECIFICATIONS

ADS-37A-PRF 28 May 1996	Aeronautical Design Standard, Electromagnetic Environmental Effects (E3) Performance and Verification Requirements
ADS-51-HDBK 21 October 1996	Aeronautical Design Standard, Handbook, Rotorcraft and Aircraft Qualification (RAQ) Handbook
ADS-71-SP 7 October 2009	Aeronautical Design Standard, Standard Practice, Environmental Airworthiness and Qualification Requirements for Electronics, Avionics, and Mission Equipment Installed on Army Aircraft
MIL-W-25140B, 7 April 1997	Weight and Balance Control System (For Aircraft and Rotorcraft), Notice 1
MIL-HDK-454 28 April 1995	General Guidelines for Electronic Equipment
MIL-HDBK-46855A 17 May 1999	Human Engineering Program Process and Procedure
MIL-STD-461F 10 December 2007	Requirements for the Control of Electromagnetic Interference (EMI) Characteristics of Subsystems and Equipment
MIL-STD-464A 19 December 2002	Electromagnetic Environmental Effects (E3) Requirements For Systems
MIL-STD-704A-E	Aircraft Electrical Power Characteristics
MIL-STD-810G 31 October 2008	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-882D 10 February 2000	Standard Practices for System Safety
MIL-E-7016F 18 March 1981	Analysis of Electric Load and Power Source Capacity

MIL-STD-3009 2 February 2001	Lighting, Aircraft, Night Vision Imaging System (NVIS) Compatible
MIL-STD-1472D 14 March 1989	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
SOP EF2002-111 26 November 2002	Structural Integrity Substantiation of Airframe Structural Modifications
DI-EMCS-80200C 30 November 2007	Electromagnetic Interference Test Report (EMITR)
DI-EMCS-80201C 30 November 2007	Electromagnetic Interference Test Procedures (EMITP)
DI-EMCS-81541A 19 December 2002	Electromagnetic Environmental Effects (E3) Verification Procedures (E3VP)
DI-EMCS-81542A 19 December 2002	Electromagnetic Environmental Effects (E3) Verification Report (E3VR)
DI-GDRQ-80198A 31 July 1995	Internal Loads and Static Strength Analysis Report
DI-NDTI-80809 24 January 1997	Test /Inspection Report (TIR)
DI-ILSS-81495 30 October 1995	Software Failure Modes, Effects and Criticality Analysis (SWFMECA)
DI-IPSC-81427A 10 January 2000	Software Development Plan (SDP)
DI-IPSC-81428A 15 December 1999	Software Installation Plan (SIP)
DI-IPSC-81433A 15 December 1999	Partitioned Software Requirements (SRS)
DI-IPSC-81434A 15 December 1999	System Interface Requirements (IRS)
DI-IPSC-81435A 15 December 1999	Software Design Description (SDD)

DI-IPSC-81436A 15 December 1999	Interface Design Description (IDD)
DI-IPSC-81438A 15 December 1999	Software Test Plan (STP)
DI-IPSC-81441A 15 December 1999	Software Product Specification (SPS)
DI-IPSC-81443A 15 December 1999	Software User Manual (SUM)
DI-IPSC-81439A 15 December 1999	Software Test Description (STD)
DI-IPSC-81440A 15 December 1999	Software Test Report (STR)
DI-IPSC-81442A 11 January 2000	Software Version Description (SVD)
DI-SESS-81000C 10 September 2004	Product Drawings/Models and Associated Lists
DI-MGMT-81501 20 November 1995	Actual Weight Report
DI-MGMT-81502 20 November 1995	Sample Chart A & E Report
DI-MISC-80508B November 14, 2006	Technical Report- Study/Service
DI-SAFT-80102B 31 July 1995	Safety Assessment Report (SAR)
DI-SAFT-81626 August 1, 2001	Software Safety Program Plan
FAA Order 8130.2 F 05 November 2004	Airworthiness Certification of Aircraft and Related Products
FAA TSO-C112 5 February 1986	Air Traffic Control Radar Beacon System/Mode Select (ATCRB/Mode S) Airborne Equipment

14 Code of Federal Regulations – Part 23	Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplane
14 Code of Federal Regulations – Part 25	Airworthiness Standards: Transport Category Airplane

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

10.0 Non-Government publications

145-SS-603	Structural Design Criteria; Revision F; for CH-47D/F and MH-47G
406-930-200 18 Oct 1990	Structural Design Criteria Report for AHIP Model 406, Bell Helicopter Textron Inc. (BHTI), Rev: G
406-947-500C 3 Nov 2006	System Specification for OH-58D Kiowa Warrior (Improved AHIP), Bell Helicopter Textron Inc. (BHTI), Rev: C
77-Y-8001-3 December, 1991 Revised June, 1995	McDonnell Douglas Helicopter Systems Structural Design Criteria for the AH-64D Longbow Apache Prototype Attack Helicopter, Appendix B
M016059	MH-60M Structural Design Criteria Report
RTCA/DO-160F 6 December 2007	Environmental Conditions and Test Procedures for Airborne Equipment, RTCA, Inc., Washington, DC
RTCA/DO-178B December, 1992	Software Considerations in Airborne Systems and Equipment Certification, RTCA, Inc., Washington, DC
RTCA/DO-254 April 19, 2000	Design Assurance Guidance for Airborne Electronic Hardware
SAE-ARP4761 1996	Guidelines and Methods for Conducting the Safety Assessment December Process on Civil Airborne Systems and Equipment
SAE-ARP4754 10 April 1996	Certification Considerations for Highly Integrated or Complex Aircraft Systems
SER-701318	MH-60K Structural Design Criteria Report
SER-70534	Structural Design Criteria Report

11.0 List of Acronyms

ADS	Aeronautical Design Standard
AED	Aviation Engineering Directorate
AIL	Avionics Integration Lab
AIMS	(Air Traffic Control Radar System (ATCRB) Identification Friend or Foe (IFF), Mark XII/XIIA, Systems)
AQP	Airworthiness Qualification Plan
AWR	Airworthiness Release
CSCI	Computer Software Configuration Item
CSU	Computer Software Unit
E3	Electromagnetic Environmental Effects
EED	Electro-Explosive Device
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMV	Electromagnetic Vulnerability
FMECA	Failure Modes Effects Criticality Analysis
FPGA	Field Programmable Gate Arrays
FQT	Formal Qualification Testing
FSAQAP	Flight Software Airworthiness Qualification Assessment Procedure
HA	Hazard Analysis
HDBK	Hand Book
HERO	Hazards of Electromagnetic Radiation to Ordnance
IAW	In Accordance With
ICD	Interface Control Drawings
IDD	Interface Design Description
IRS	Interface Requirements Specification
LRU	Line Replaceable Unit
MICD	Multiplex Interface Control Document
QBS	Qualification By Similarity
RE	Radiated Emissions
RS	Radiated Susceptibility
SAR	Safety Assessment Report
SDD	Software Design Description
SDP	Software Development Plan
SED	Software Engineering Directorate
SWFMECA	Software Failure Modes Effects Criticality Analysis
SHRI	Safety Hazard Risk Index
SIL	Software Integration Lab
SOF	Safety of Flight
SPS	Software Product Specification
SRS	Software Requirement Specification
SSCFA	Software Safety Critical Function Analysis
STD	Software Test Description
STP	Software Test Plan
STR	Software Test Report

SUM	Software User Manual
SVD	Software Version Description
TIR	Test /Inspection Report