CHAPTER 2
AIRWORTHINESS QUALIFICATION PROGRAM

This chapter discusses the elements of airworthiness qualification programs. The Airworthiness Qualification Plan, Airworthiness Qualification Specification, and Airworthiness Qualification Substantiation Report are discussed. In addition, discussions are included on airworthiness test management, standard and specification tailoring, survey versus demonstration requirements, and the use of other airworthiness certification criteria.

2-1 INTRODUCTION

Upon receipt of an approved Mission Need Statement (MNS) a Test Integration Working Group (TIWG) should be established and chaired by a program manager (PM). The composition and responsibilities of the TIWG are described in subpar. 2-5.2.1. Also the US Army Training and Doctrine Command (TRADOC) should prepare an Operational Requirements Document (ORD). The ORD and System Threat Assessment Report (STAR), if any, should be used to develop a system specification and a Test and Evaluation Master Plan (TEMP). Department of Defense Regulation (DoDR) 5000.2-R, *Mandatory Procedures for Defense Acquisition Programs (MPDAPs) and Major Automated Information Systems (MAIS) Acquisition Program*, (Ref. 1) establishes the requirement for a TEMP. The TEMP is an iterative planning and scheduling document. The purpose of a TEMP is to serve as a management tool to ensure that the necessary elements of a test program are defined, to ensure that adequate coordination is effected among the agencies requiring test data, to ensure that adequate testing is planned for arriving at type classification and production decisions, and to provide justification for test resources including the number of prototypes to be used during testing. The TEMP also provides the justification to combine tests, to conduct them concurrently, or to eliminate them in order to avoid duplicate and unnecessary testing. The critical technical parameters and critical operational issues defined in the TEMP form the basis for the test requirements. Responsibility for the preparation of a TEMP belongs to the program manager in cooperation with the members of the TIWG. The types of airworthiness tests that should be included in the TEMP, the test agency, test hardware, and objective for each test are summarized in Tables 2-1 and 2-2. Chapter 11 provides details for preparation of a TEMP. Often the development of an Airworthiness Qualification Plan (AQP) parallels development of the TEMP. The AQP provides general guidance for required engineering analyses, formal inspections, design reviews, safety assessments, contractor demonstrations, and all contractor and Governmental qualification tests essential to defining and implementing the procurement of an air vehicle.

2-2 AIRWORTHINESS QUALIFICATION PLAN (AQP)

An Airworthiness Qualification Plan is developed by the procuring activity and included in the request for proposal (RFP) to communicate the requirements of the Government for airworthiness qualification to the contractor. The AQP is the basis upon which the contractor prepares his Airworthiness Qualification Specification (AQS) in response to the RFP. Appendix A, “The Elements of an Airworthiness Qualification Plan”, describes the purpose, content, scope, references, test accomplishment, test

TABLE 2-1. SUMMARY OF TEMP TEST REQUIREMENTS--AIR VEHICLE SYSTEM

TEST TYPE	TEST AGENCY	TEST HARDWARE	TEST OBJECTIVE
Contractor's Airworthiness Qualification Tests (AQT)	Contractor	Models Mockups Components Subsystems Allied Equipment Prototype System	Development: Prove out assemblies, components, and the total air vehicle Qualification: Determine design limits and flight envelope Demonstration of adequacy of air vehicle to function safely within flight envelope
Preliminary Airworthiness Evaluation	Materiel Developer (TACOM)	Prototype System	Verification of flight envelope and preliminary contract compliance Provide quantitative and qualitative flight test data Detection of deficiencies and evaluation of corrections Provide preliminary operational use data
Airworthiness and Flight Characteristics	Materiel Developer (TACOM)	Prototype System	Final verification of flight envelope and contract compliance Achievement of applicable military specifications Detailed stability, performance, and handling characteristics Operational characteristics for technical manuals Adequacy of the system, subsystems, and allied equipment under extreme environmental conditions
Endurance	Contractor	Prototype System	Determination of endurance and reliability of basic design Determination of adequacy of design changes to correct deficiencies revealed during prior tests
Operational User Tests	Operational Evaluation Command	Prototype System	Determination of the degree to which the system meets the characteristics of the requirements document Determination of inspection cycles Development of operating and maintenance costs Determination of component service life and quick change kits Refinement of manpower, equipment, skills, and training requirements

TABLE 2-2. SUMMARY OF TEMP TEST REQUIREMENTS--ALLIED EQUIPMENT

TEST TYPE	TEST OBJECTIVES	RELATION TO SYSTEM TEST
Engineering Design Tests (EDT)	Determination of the inherent structural, mechanical, electrical, and physical properties Determination of human and safety implications	Contractor development and airworthiness qualification tests
Contractor Demonstration (CD)	Demonstration of performance against contract specifications Determination of human performance requirements	Contractor development and airworthiness quali fication tests
Research and Development Acceptance Tests (RDAT)	Determination that specifications of development contract have been fulfilled Serves as basis for acceptance or rejection of prototypes	Preliminary airworthiness evaluation
Developmental Tests	Determination of technical performance, reliability, maintainability, endurance, and safety characteristics of the item and its maintenance package Determination of human factor implications of design and materials	Airworthiness and flight characteristic test
Operational Tests	Determination of the military worth of the item Determination of the degree to which the item meets the characteristics of the requirements document	Operational tests

management, and documentation generation of the AQP.

2-3 AIRWORTHINESS QUALIFICATION SPECIFICATION (AQS)

The Airworthiness Qualification Specification defines the contractor's obligation to conduct specific analyses, reviews, tests, surveys, and demonstrations to fulfill the requirements of the AQP. The function of the AQS is to establish the requirements for test and evaluation of the system. In turn, the data generated by the AQS requirements are the basis for issuance of airworthiness releases and the Airworthiness Qualification Substantiation Report (AQSR). Appendix B, "The Elements of an Airworthiness Qualification Specification (AQS) and Their Contents", provides a detailed discussion of AQS requirements.

2-4 SURVEY VERSUS DEMONSTRATION TEST REQUIREMENTS

Surveys and demonstrations are two types of tests typically defined and required in an AQS. The purpose of each is to establish system performance characteristics. The difference is that surveys are performed to document physical characteristics or the current performance status of the design, whereas demonstrations establish whether or not a system performs adequately against stated requirements. Survey requirements should state clearly the intended purpose of the test and the expected use of the survey data. Demonstration requirements should

define the pass-fail criteria against which the system will be judged. Because of the significant difference in the nature of surveys and demonstrations, the choice between the two should be carefully weighed when establishing the AQS requirements.

2-4.1 SURVEYS

A survey is the act of collecting information, measuring, determining, and assembling data to define the characteristics or capabilities of an item. A limited sampling of facts to indicate, extrapolate, or predict what a complete collection of facts and analysis would reveal is also a survey. The purpose of the survey is to determine the current state of the design with respect to established system performance requirements. The contractor's obligation is to plan and conduct the test, to collect the data, and to report the test results in accordance with the AQS. There is no obligation to correct deficiencies by virtue of the survey requirements alone. A survey incurs an obligation to collect valid data but does not obligate compliance with pass-fail criteria. Examples of typical surveys are provided in Table 2-3. Three general categories of surveys are simple surveys, verification and effect surveys, and surveys for analysis.

2-4.1.1 Simple Survey

A simple survey is a data collection effort to establish baseline performance characteristics and the impact of the modification relative to this baseline. Simple surveys are performed for specific reasons and collect limited amounts of data. The number of test runs and the amount of data collected are dependent upon the type of subsystem or component being analyzed. A simple survey would be a design support test to obtain engineering design data.

2-4.1.2 Verification and Effect

Verification and effect surveys are frequently conducted on modified systems to determine the impact of the modification and whether minimum performance characteristics are still met. Such surveys are usually partial samplings, not full and comprehensive tests. An example is to measure baseline performance and any change in performance after a modification.

2-4.1.3 Survey for Analysis

A survey for analysis is conducted to collect data for analysis because there is no practical method of directly measuring the desired characteristic. A flight load survey is an example of a survey for analysis. The survey provides data that may be compared with design loads or stresses for flight conditions in the maneuver spectrum defined for the air vehicle. The load data may be used to perform fatigue damage analysis and fatigue life calculations. The survey is correct and complete if valid data are acquired regardless of the correlation with analytical results. The AQS may require the repeat of certain surveys to support analytical requirements when conditions warrant. Such conditions may include changes in the configuration or operating conditions.

2-4.2 DEMONSTRATIONS

A demonstration is the act of proving with measurements made during the actual performance of the act or accepted analysis that a requirement has been met. The demonstrations are the proof required for approval of airworthiness qualification and the basis for establishing safe operating limits for rated, but not test rated, pilots in the expected operating environment. The obligation of the contractor is not only to conduct the test and collect valid data but also to meet contractually specified pass-fail

TABLE 2-3. EXAMPLES OF SYSTEM SURVEYS

EXAMPLE	DESCRIPTION
Flight Load Survey	Loads data obtained throughout flight envelope for all critical components Provides data for preliminary estimate of fatigue lives Determines whether resonant frequencies of critical components are tuned to the frequencies of the primary exciting forces
Engine Vibration Survey	Flight and ground tests Conducted to verify that engine vibrations do not exceed the allowable limit specified in the engine model specification
Propulsion System Temperature Survey	Flight and ground temperature monitoring Conducted to verify that engine(s) , engine accessories, engine fluids, airframe structure, transmission system, gear brakes, heat exchangers, etc., do not exceed their allowable temperature limits
Total System Vibration Survey	Flight and ground vibration monitoring Conducted during accelerated and unaccelerated flight over the full range of the flight envelope and of the allowable rotor speeds Provides data to substantiate compliance with vibratory comfort requirements and demonstrate air vehicle is free from excessive vibrations affecting structural integrity or ability to perform its mission
Crew Environment Survey	Conducted to demonstrate compliance with new environmental requirements under all specified operating conditions and modes Includes crew comfort considerations related to performance degradation and contamination characteristics
Infrared (IR) Signature Survey	Demonstrates that the IR signature is reduced to acceptable levels Documents its IR signature for use in countermeasure studies, tradeoffs, and require- ments

criteria per the AQS, system specification, and statement of work. Inherent in that obligation is that if initial demonstrations are unsuccessful, corrective actions must be implemented to eliminate the deficiencies, and the test must be fully or partially repeated, depending on circumstances. This cycle is referred to as “test, analyze, fix, test”. It is important to state clearly the contractual pass-fail and retest cycle criteria in the AQS to ensure that demonstration requirements are fully delineated.

2-4.2.1 Testing

Demonstration of system performance requirements may be accomplished by direct measurement of a required characteristic. This method is appropriate for quantitative requirements that are clearly measurable. An example is demonstration of the achievement of specified vibration levels for avionics equipment mounting points. The mounting points would be instrumented, the air vehicle would be flown under specified conditions, data would be recorded, and a determination would be made as to whether the recorded vibration levels fall within the specified range of acceptability.

2-4.2.2 Action

Some specification requirements are not quantitative in nature but require that a capability to perform a function be provided. The adequacy of maintenance training and procedures, as written in the manuals, is demonstrated by having troops perform the procedures (by the book) on an actual air vehicle. Qualitative maintainability requirements are also demonstrated in this manner. Demonstration of achievement of this requirement would be the accomplishment of the action or procedure under the specified conditions by a person or persons representative—in terms of physical characteristics, abilities, and training—of the crew member populations.

2-4.2.3 Analytical

Some quantitative specification requirements either are not directly measurable at all or are not directly measurable at a specified design point or under a specified set of conditions. An example of the first situation is the fatigue life of nonflight-critical components. It might be impractical to attempt demonstrating the achievement of such requirements through test because testing would be prohibitively long and because failure could have catastrophic results. The alternative is to measure the loads and stresses and compare them analytically with the physical properties of the item to predict fatigue life. An example of the second situation is the requirement to demonstrate the range performance requirements for a target-sighting system under specified climatological and atmospheric conditions. The specified conditions may seldom, if ever, occur concurrently, and waiting to test under those conditions would not be practicable. The alternative is to make measurements at conditions different from the specified conditions and to make the appropriate adjustments. In both situations analytical techniques must be used to determine the achievement of requirements. It is essential that the analytical technique used to demonstrate requirements be validated. Also the AQS should specify the data collection efforts required to support the analysis.

2-5 AIRWORTHINESS QUALIFICATION PROGRAM—TEST MANAGEMENT

The successful conduct of an airworthiness qualification program requires both flexible and vigilant control of the test program. Flexibility allows for proper reaction to unforeseen contingencies. Vigilance is necessary to minimize the impact of undesirable events through early detection and corrective action implementation and to ensure valid results. These factors are crucial for both proper qualification assurance and achieving qualification within schedule and cost.

2-5.1 PLANNING

Preparing an Airworthiness Qualification Plan centers on test sequencing. An AQP should account for test-analyze-fix-test cycles and for the fact that test article and test facility availability may pace a program. Prudent test sequencing requires a progressive buildup of test objectives. Inappropriate sequencing may increase program risk and lead to invalid results if configuration changes alter a critical performance characteristic. No specific sequence of analyses or tests for airworthiness qualification is given in this handbook because the definition and scheduling of tests will be altered by new or novel features, by the risk to the performance of these features and equipment, by economic considerations, and by delivery constraints.

The contractor should propose a schedule for the AQS that will result in a logical sequence of analysis and test efforts to minimize the risks. A minimum risk program would require that all components be well-developed prior to subsystem testing, that critical subsystems be qualified prior to total air vehicle system testing, and that all operational conditions for the air vehicle be tested prior to first flight. Each of the test phases would be preceded by sufficient analyses to assure that design requirements have been met and that successful completion of subsequent tests is probable. The manufacture and assembly of preproduction air vehicles should be undertaken concurrently with the qualification program because this is practical and will prevent an unreasonably long and expensive program.

Given this discussion, certain minimum test precedence requirements normally apply. A test of the power and propulsion

system should be completed on the ground prior to first flight. This test may be conducted with either a tied down air vehicle or a simulated vehicle containing all required subsystems. In addition, the structural static test program should have demonstrated the adequacy of the airframe for design limit loads. Included in this requirement is landing gear drop testing. Further, sufficient component fatigue test data should be available to assure that the service life of fatigue-critical components is adequate for initial flight testing.

Prior to initiation of ground tie-down test, the principal components of the drive system should have completed adequate testing including maximum rated torque and speed and pertinent transient conditions.

Demonstration requirements for individual subsystems, as defined by pertinent military specifications, may require an analysis of system capability and performance be submitted for approval together with appropriate subsystem drawings and descriptions prior to test initiation. Such stipulations should not affect qualification schedules. The analyses required are performed during design of the system and must therefore be completed well in advance of subsystem testing.

The RFP for a specific model air vehicle will typically indicate the number of prototypes to be assigned to test and qualification programs. Should these RFP guidelines not include specific assignments, such as for structural testing, flying qualities and flight performance testing, avionics and armament testing, the contractor should be required to define use of the assigned air vehicle in the proposed schedule. In addition to minimizing risk, proposal preparation for prototype use and test sequencing should also consider cost and schedule impacts.

2-5.2 TEST INTEGRATION

The extremely complex and interrelated issues associated with the conduct of a development program require close coordination among numerous Government agencies. A Test Integration Working Group should be established as a forum to effect coordination of and solve routine problems in the test and evaluation process. There are members and associate participants. Also there are many interface groups, such as the Threat Coordinating Subgroup, Computer Resources Working Group (CRWG), Manpower and Personnel Integration (MANPRINT) Joint Working Group, Safety Working Group, and Live-Fire Test and Evaluation Working Group, that have a close tie with the TIWG. TIWG and the CRWG are described in the subparagraphs that follow.

2-5.2.1 Test Integration Working Group

A TIWG is an integrated product team (See subpar. 4-6.9.) that is chartered to structure the test and evaluation (T&E) program and integrate the various T&E and milestone requirements. It is chaired by the program manager or the materiel developer (PM/MATDEV) and includes qualified representatives who have been entrusted to speak for their parent organizations. The purposes of a TIWG are to optimize the use of appropriate T&E expertise, instrumentation, targets, facilities, simulations, and models to implement test integration; to integrate test requirements; to provide input to the PM/MATDEV to review and give preliminary approval of the TEMP; to resolve cost and scheduling problems; and to ensure T&E common goal planning, execution, and reporting. During the conduct of a development program, the TIWG may conduct risk assessments and may provide program modification recommendations because of problem situations.

TIWG participants are selected to fill the needs of the program they support. Gen-

erally, the principal TIWG members are the PM/MATDEV, the combat developer, the developmental and operational testers, the developmental and operational independent evaluators, and a logistician. Other specialties that may be included as principal are a trainer, a threat integrator, and a survivability/lethality analyst.

An associate member of a TIWG is a nonvoting member who provides a needed supportive role to address necessary T&E requirements and to support subordinate working groups. The TIWG may require subgroups to perform specialized tasks, define the details of the T&E program, handle the interfaces with other disciplines, prepare for testing, and develop supporting T&E documentation. The TIWG will charter, as necessary, a Reliability, Availability, and Maintainability (RAM) Working Group (RAMWG) and a Supportability T&E Working Group (STEWG). The RAMWG is co-chaired by the materiel developer and the combat developer to address RAM issues, such as failure definition and scoring criteria, RAM Rationale Annex, and data collection. Further details of this subgroup are contained in AR 702-3, *Army Materiel Systems Reliability, Availability, and Maintainability*, (Ref. 2). The STEWG is chaired by the materiel developer's Integrated Logistic Support (ILS) manager and coordinates the TIWG activities with the Integrated Logistic Support Management Team. Topics to be coordinated include supportability test issues, test requirements, and logistic demonstration requirements in the TEMP. Further details of this subgroup are contained in AR 700-127, *Integrated Logistic Support*, (Ref. 3).

Additional information regarding TIWG and test and evaluation is included in Department of the Army (DA) Pamphlet (PAM), *Operational Testing and Evaluation Methodology and Procedures Guide*, (Ref. 4).

2-5.2.2 Computer Resources Working Group

The Computer Resources Working Group is established by the PM/MATDEV to assist in the management of system computer resources. Membership of the CRWG includes the PM/MATDEV, the combat developer, the developmental and operational testers, the developmental independent evaluator, the operational independent evaluator, and the postdeployment software support activity. The function of the CRWG is to review and resolve computer resource issues that may impact the acquisition, deployment, and support of a weapon system. Risks associated with computer resource development are assessed, and recommendations for program modifications to mitigate those risks are activities of the CRWG. Specifically, the objectives of the CRWG are:

1. To improve the acquisition management of computer resources in the system
2. To increase the visibility of computer resources in the overall life cycle of the system
3. To decrease the proliferation of unique computer resources in the Army inventory by requiring the use of standard hardware and portable software to the maximum extent possible
4. To promote the use of higher order language (HOL), compilers, and other labor-saving and management of software tools
5. To provide for early planning in the development and test of the system to ensure compliance with policy, procedures, and plans and standards established for the acquisition of computer resources
6. To facilitate the preparation, review, and approval of a Computer Resources Management Plan (CRMP) for the system

7. To eliminate unnecessary redundancy in testing. Inherent in these functions is identification of the requirements for computer resource test facilities.

2-5.3 TEST COORDINATOR

A test coordinator is a representative of the procuring activity who is located at a test site—a Government or contractor test facility. The duties and responsibilities of the test coordinator are

1. To maintain liaison with the contractor in order to determine start and completion dates and the duration of each test
2. To develop and implement a procedure for rapid and timely witness or observer notification of tests, cancellations, and rescheduling
3. To design and distribute test-witnessing forms
4 . To provide witnesses or observers with written data and information, such as plant procedures, and forms on which to record data and observations
5. To brief each witness or observer on the status of the test including preceding and subsequent tests
6. To forward completed witness reports and comments to the procuring activity
7. To witness or observe tests when an authorized witness or observer has not been appointed or is absent.

2-5.4 GOVERNMENT PLANT ACTIVITY

The Government plant activity function is normally carried out by the Defense Plant Representative Office (DPRO). The DPRO is an extension of the procuring activity located at the site of the contractor. The authority of the DPRO is delegated by the procuring contracting officer (PCO) by making the DPRO the administrative contracting officer (ACO). This on-site representative of the procuring activity is responsible for contract administration and quality control and monitors the contractor to the full extent of the capability of the DPRO. Because it is impractical for the DPRO to assemble engineering talent equal to the expertise available throughout the US Army Materiel Command (AMC) commodity commands, the DPRO relies heavily on the commodity commands for assistance. Engineering data required to be developed and submitted under the contract is submitted to the procuring activity via the DPRO. The DPRO reviews the data submittals for completeness and for compliance with the applicable specifications and contractual requirement. The recent trend is toward reduced Government oversight, which is to be replaced by more reliance on contractor verification of the completeness and accuracy of submitted data. The program manager and the appropriate specialists should review and approve the submitted data for content and completeness.

2-5.5 TEST VERSUS SPECIFICATION MATRICES

A useful method of portraying test requirements is the test versus specification matrix. One such matrix is the environmental test method versus the specification. Such matrices may be developed at the component, subsystem, and system levels. Another useful matrix shows the test procedures and test reports cross-referenced to the

AQS requirements. Also system performance specification requirements are cross-referenced to the specific test procedures and test reports, which substantiate the achievement of the requirement. Table 2-4, "Test vs Specification Matrix", provides an example of the information to be included.

2-5.6 CONTRACTOR FLIGHT RELEASES

A Contractor Flight Release (CFR) is a technical document and transmittal letter signed by the appropriate PCO authorizing an element of industry to operate an Army air vehicle of an approved configuration within prescribed limitations by using established procedures. The purpose of a CFR is to control to a reasonable level the risk to Government assets and the amount of liability. A CFR is used when the Government holds ground and flight risk and a contractor pilot is the pilot-in-command. When a CFR is issued, the air vehicle is believed to be safe, and it is believed that no undue risk is being taken on the part of the flight crew, the contractor's management, or the Government. A CFR is usually required for initial ground and flight testing, i.e., prior to initial engine run-up, rotors turning, ground resonance testing, etc., provided that the air vehicle and property are not covered by a separate lease agreement. CFRs are not intended to be controlling configuration management documents, although they are related to approved configurations. As described in AR 95-20, Volume 2, *Government Flight Representative Guidance*, (Ref. 5), the Government Flight Representative (GFR) is responsible for the surveillance of all contractor flight operations involving Government air vehicles and other air vehicles for which the Government is assuming some of the risk of loss or damage. The GFR approves flight crew members, qualification training, and the contractor's flight operations procedures. Appendix C provides a detailed discussion of the requirements for a contractor flight release.

2-5.7 AIRWORTHINESS RELEASES

An Airworthiness Release (AWR) is a technical document that provides interim operating and maintenance information necessary for safe flight operation of an air vehicle system, subsystem, and allied equipment. The significant difference between a flight release for industry and an Airworthiness Release for Government operation of an Army air item is that of safety assurance. When an AWR is issued, the air vehicle is known to be safe based on analyses, demonstration of air vehicle and equipment, and demonstration of limitations, or a determination has been made that the remaining risks are acceptable. An AWR is required prior to operation of a new air vehicle system or a fielded air vehicle system that has undergone a major modification. Also an AWR is required prior to operation of an air vehicle with Federal Aviation Administration (FAA), US Air Force (USAF), National Aeronautics and Space Administration (NASA), or US Navy (USN) airworthiness approval if the air vehicle has been modified without certifying agency approval. Finally, an AWR is required anytime an Army pilot is going to be the pilot-in-command of a nonstandard configured air vehicle or an air vehicle that has not been issued a Statement of Airworthiness Qualification (SAQ). The SAQ may be issued temporarily as an interim SAQ after qualification is essentially complete but pending final documentation approval.

Appendix D provides a detailed discussion of the elements of an Airworthiness Release.

TABLE 2-4. TEST VS SPECIFICATION MATRIX

SYSTEM SPECIFICATION PARAGRAPH	TEST, SURVEY, AND DEMONSTRATION REQUIREMENTS	WBS	SOW PARAGRAPH	AQS PARAGRAPH	PIDS DOCUMENT NUMBER	REMARKS
3.2.7.2.1 3.2.7.2.2 3.2.11.5.1	Shake Test	3322	C.3.14.B	2.8.5.2.4.1	N/A	Requires MMA mass model dummy. IAW Section 5.1 of ADS-27. ADS-1 IAW Ground Test Plan. Document Number MSIP000050-205, Rev. B, Appendix N
3.2.7.2.1 3.2.7.2.2 3.2.1.1.5 3.2.11.5.1	Flight Vibration Survey	5321 5333	C.3.19.A	3.8.5.2.4.2	N/A	ADS-1, Section 4.0 of ADS-27
3.2.7.1, 3.7.15 and sub	Crew Environmental Survey	511A 5322 5331 5334 534	C.3.1.6 C.3.13.B C.3.14.A C.3.14.D C.3.15	3.8.5.2.3	DRC-P-H101890	For additional information see ADS-1, ADS-9, and ADS-27. Also see MSIP00050-212P, MSIP000050-205, Rev. B, Appendix T.
3.7.15.4 3.7.15.4.1 3.7.15.4.2	Environmental Control System Test	511A 5333	C.3.1.G C.3.14.C	3.8.5.2.5 3.8.5.2.B	DRC-P-H101930	
3.7.15.4	ECS Demonstration	511A 5332 5333	C.3.1.G	3.8.5.3.8	DRC-P-H100030A DRC-P-H101930	LRU loss of cooling air aircraft IAW design curve
3.7.8.3 3.7.8.3.2 3.7.8.3.9	IPAS Demonstration	511A 5117 5332 5333	C.3.1.F C.3.14.B C.3.14.C	3.8.5.3.5 3.8.5.8.6	DRC-P-H100330A DRC-P-H101930	
3.7.12 through 3.7.12.7	Armament Fire Control and System Survey	5331 5333 53334 534	C.3.14.A C.3.14.C C.3.15	3.8.5.2.4	DRC-P-H106000A DRC-P-H400030A	Survey with Hellfire missile, folding fin aerial rockets, and turreted gun.
3.7.6.2	Flight Controls Handling Qualities System Survey	5333	C.3.14.C	2.8.5.2.8	DRC-P-H1000SQA DRC-P-H1032SQA	Aircraft only, no FCR LRUs required
3.7.10 to 3.7.11	Communications Subsystem Survey	513 5322 5332 5333	C.3.2 C.3.10.D C.3.13.B C.3.14.B C.3.14.C	3.8.5.2.9	DRC-P-H300730A	Survey as needed to characterize fully antenna subsystem performance.
3.7.10 to 3.7.11	Communications Subsystems Demonstration	513 5322 5332 5333	C.3.2 C.3.13.B C.3.14.B C.3.14.C	3.8.5.3.10	DRC-P-H300730A	

WBS = Work Breakdown Structure SOW = Statement of Work AQS = Airworthiness Qualification Specification PIDS = Prime Item Development Specification

2-6 REQUIREMENTS TAILORING

The subparagraphs that follow discuss requirements tailoring concepts applicable to design, development, and airworthiness qualification. The primary benefits of tailoring are the reduction in time and funds required for development and qualification.

2-6.1 GENERAL PHILOSOPHY

"Tailoring" describes the selective application of standards and specifications in the design and development process. Selective application includes use of only a portion of the standard or specification, modifications of the standard or specification, or use of an alternative standard or specification. To ensure the suitability of an item or process for a specific application and to establish feasible, cost-effective design requirements, all design attributes should be considered. Tailoring is a method of controlling the extent to which the specification dictates design detail, which can inhibit innovation. The degree of tailoring is a function of the type of development. For a major or minor new development program, tailoring may be minimal. For nondevelopmental items or modification programs, tailoring could be extensive to take into account the previous qualification efforts and demonstrated use. Tailoring may be applied to the level (component, subsystem, or system) for which specific testing will be required. Tailoring may also be applied to the extent of data and documentation required to be furnished to the Government as well as to the ownership of the design and data.

2-6.2 CONSIDERATIONS

There are three primary considerations that enter into all tailoring decisions. These are technical relevance, assessment of risk, and resource requirements. An application of these considerations would be the need for additional airworthiness qualification for an item that has already undergone similar qualification, e.g., Federal Aviation Administration or foreign agency certification. The questions to be answered are then

1. How similar are the qualification conditions to the new intended use of the system (technical relevance)?
2. What consequences result from not performing certain qualification efforts (risk assessment)?
3. What are the cost and schedule requirements associated with the qualification effort (resources)?

2-6.2.1 Technical Relevance

Technical relevance deals with the degree to which a specification requirement is applicable to the situation under consideration. For example, a general specification requirement for new equipment may deal with conditions that may not be encountered by a limited use system. The requirement could be modified or tailored on the basis of technical relevance. For modified equipment the requirement to comply fully with current standards may be waived (tailored) because these standards were not in force at the time of the original design. Secondary and indirect effects must also be considered. If, for example, it is decided to tailor the requirement to delete shipboard compatibility because it is not currently applicable, it may later be necessary to provide that capability due to changing circumstances in the future use of the system. Accordingly, the design may be required to be compatible, but testing and qualification may be deleted for the present program.

2-6.2.2 Assessment of Risk

Whenever a tailoring decision is under consideration, there is a risk that the decision may ultimately have a negative impact. The decision maker's judgment as to the probability of occurrence of the undesirable event along with the impact (severity) of the event combine to form an assessment

of risk. This technique of combining severity and probability is discussed further in Chapter 3. A factor that enters into assessing severity is the ease with which corrective actions for the undesirable event can be implemented. Obviously, easy fixes have low severity. The amount of tailoring a decision maker allows should be related to the probability and severity of risk. As the risk increases, the amount of allowed tailoring of standards and specifications should decrease.

2-6.2.3 Resources

Achievement of full specification or standard compliance may require an inordinate amount of resources. When a requirement is tailored on the basis of resource requirements, it is necessary to determine the value of the effort by means of economic analysis that considers the cost of test specimens, facilities, and conducting tests. This value must be compared with the cost and benefit of other program activities to ensure that activity priorities are still valid. Requirement specifications and standards are not generally tailored because of program funding constraints alone. However, tradeoffs should provide the most cost-effective system that meets the overall system performance requirements. If it is determined that tailoring to reduce cost by reducing resources is not prudent, the impact of requesting additional funds or resources must be assessed against negative impacts on program viability if preestablished thresholds would be breached.

2-7 OTHER AIRWORTHINESS CRITERIA ADOPTION

In addition to the US Army, the US Air Force, the US Navy, the Federal Aviation Administration, and the National Aeronautics and Space Administration also provide airworthiness qualification and certification. Their criteria are similar in that they seek to ensure that air vehicles operated under their cognizance are safe. They differ in that they serve different needs. In addition to safety the military agencies concern themselves with the military utility and effectiveness required by the various services. AR 70-62, *Research and Development Airworthiness Qualification of US Army Aircraft Systems*, (Ref. 6) documents policy for airworthiness qualification of air vehicle systems, subsystems, and allied equipment undergoing development and for major modifications to standard and nonstandard air vehicles. It also implements policy for issuance of airworthiness releases for flight performance and operational flight evaluation testing of domestic and foreign-made commercial air vehicles with potential military application, modified surrogate air vehicles, and foreign military air vehicles.

2-7.1 CIVIL AGENCIES

The FAA or NASA certification would be adopted for systems whose existing performance limits are similar in nature to the military requirements because the air vehicle was designed for a similar intended use. Some Army rotorcraft were certified under 14 CFR, Part 27, *Airworthiness Standards: Normal Category Rotorcraft*, (Ref. 7). Other aircraft were certified under 14 CFR, Part 23, *Airworthiness Standards: Normal Utility, Acrobatic, and Commuter Category Airplanes,* (Ref. 8) or 14 CFR, Part 25, *Airworthiness Standards: Transport Category Airplanes,* (Ref. 9). The extent to which the intended military use differs from the previous certified flight envelope and environment dictates the extent of partial or complete requalification necessary.

TABLE 2-5. SELECTED FEDERAL AVIATION REGULATIONS

PART	TITLE	APPLICATION
1	*Definitions and Abbreviations*	General definition of terms
21	*Certification Procedures for Products and Parts*	Procedural requirements for type certificates, materials, parts, and processes
23	*Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes*	Performance, flight characteristics, controllability and maneuverability, and stability
25	*Airworthiness Standards: Transport Category Airplanes*	Performance, flight characteristics, controllability and maneuverability, and stability
27	*Airworthiness Standards: Normal Category Rotorcraft*	Performance, flight characteristics, controllability and maneuverability, and stability
29	*Airworthiness Standards: Transport Category Rotorcraft*	Performance, flight characteristics, controllability and maneuverability, and stability
33	*Airworthiness Standards: Aircraft Engines*	Reciprocating and turbine engine design, construction, durability, and safety
35	*Airworthiness Standards: Propellers*	Propeller design, construction, and test
39	*Airworthiness Directives*	Reporting of unsafe conditions in parts or products
91	*General Operating Flight Rules*	Rules governing aircraft operations within the United States
125	*Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6000 Pounds or More*	Certification procedures, crew requirements, and flight operations rules
133	*Rotorcraft External--Load Operations*	Operation and certification rules for aircraft with external loads in the United States

Table 2-5 presents those air vehicle characteristics that could be adopted based on FAA certification. It should be noted that the FAA, because it is a regulatory agency, certifies to a minimum level of safety and does not qualify performance utility for any intended use. Also FAA regulations are not generally retroactive.

2-7.2 MILITARY

The circumstances under which other US military certification would be adopted are those for systems similar enough in nature and intended use. The extent to which the intended US Army military use and previous certification efforts differ dictates the extent of partial or complete requalification necessary. The discussions of par. 2-6, “Tailoring”, apply here.

2-7.3 FOREIGN

The circumstances under which foreign certification would be adopted are those for systems similar enough in nature and intended use and for which there exists a foreign agency approval recognized by a US agency or a US international agreement. Again, the extent to which the intended military use and previous certification efforts differ dictates the extent of partial or complete requalification necessary. The discussions of par. 2-6, “Tailoring”, apply here.

2-8 AIRWORTHINESS QUALIFICATION SUBSTANTIATION REPORT (AQSR)

An Airworthiness Qualification Substantiation Report is prepared and published upon successful completion of the airworthiness qualification program. The AQSR is the final report summarizing the

results of the airworthiness qualification effort and detailing specification compliance. Its purpose is to provide a single document to trace the airworthiness qualification decision. The report should be revised as needed to document subsequent modifications and airworthiness decisions.

2-8.1 VOLUME I—AIRWORTHINESS QUALIFICATION FINAL REPORT

Volume I of the AQSR, *Airworthiness Qualification Final Report*, summarizes the qualification program and system performance limits. It provides a description of the air vehicle, a description of the airworthiness qualification program including program schedule and test program summary, a structural demonstration summary, component lives, operating restrictions, and a qualification data summary and index for both contractor data and Government data. Appendix F, subpar. F-2.1, provides a detailed discussion of the first volume of the AQSR.

2-8.2 VOLUME II—SPECIFICATION COMPLIANCE BY PARAGRAPH

Volume II of the AQSR, *Specification Compliance by Paragraph*, documents each system performance specification result. It provides a paragraph compliance list with a reference to the proof of compliance. Appendix F, subpar. F-2.2, provides a detailed discussion of the second volume of the AQSR.

2-9 STATEMENT OF AIRWORTHINESS QUALIFICATION (SAQ)

A Statement of Airworthiness Qualification is a final AWR that is issued in conjunction with the AQSR. The statement is based on the final results of engineering tests conducted on the air vehicle and its subsystems or allied equipment. Issuance of this statement coincides with type classification Standard A, if applicable, and normally completes the airworthiness qualification program. The SAQ contains a description of the configuration of the air vehicle, operating instructions and procedures, limitations and restrictions, and requirements for sustaining airworthiness. Appendix E contains a detailed discussion of the SAQ.

REFERENCES

1. DODR 5000.2-R, *Mandatory Procedures for Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAIS) Acquisition Program*, 15 March 1996.

2. AR 702-3, *Army Material Systems Reliability, Availability, and Maintainability*, 1 May 1982.

3. AR 700-127, *Integrated Logistic Support*, 16 December 1986.

4. DA PAM 73-1, *Operational Testing and Evaluation Methodology and Procedures Guide*, 15 October 1979.

5. AR 95-20, *Contractor's Flight Operations*, 3 April 1979.

6. AR 70-62, *Airworthiness Qualification of US Army Aircraft Systems*, 15 July 1978.

7. 14 CFR, Part 27, *Airworthiness Standards: Normal Category Rotorcraft*, US Government Printing Office, Washington, DC, 1 January 1994.

8. 14 CFR, Part 23, *Airworthiness Standards: Normal Utility, Acrobatic, and Commuter Category Airplanes*, US Government Printing Office, Washington, DC, 1 January 1994.

9. 14 CFR, Part 25, *Airworthiness Standards: Transport Category Airplanes*, US Government Printing Office, Washington, DC, 1 January 1994.