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Dated 13 Sept 1960

MILITARY SPECIFICATION

DEMONSTRATION REQUIREMENTS

FOR

AIRPLANES

This specification has been approved by the Naval Air Systems Command, Department of the Navy.

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1. SCOPE

1.1 SCOPE. - This specification contains the general requirements of NAVAIR (Naval Air Systems Command Headquarters) for the contractor demonstration of airplanes. It also describes reporting requirements relating to these demonstrations. In the procurement of Navy airplanes, these general requirements will be modified and amplified by contract addenda to this specification. The expression "demonstration" refers to any of the contractor's work (as applied to specific airplane models and contracts) during development and as specified herein including modifications and amplifications contained in pertinent contractual documents. The modified and amplified requirements may limit the demonstration for a particular contract or airplane model to only a limited number of tests to be performed at a single location and, also, may contain requirements for the demonstration of features and characteristics not included in this general specification.

1.1.1 CORRELATIVE PROVISIONS

1.1.1.1 GOVERNMENT RESPONSIBILITIES. - This specification, in addition to covering contractors' demonstration work, delineates certain responsibilities of Government officers concerning such work, and sets forth the policy of NAVAIR on operating standards and material effectiveness of all Naval aircraft, on release for flight, and on restrictions to be observed in subsequent operations.

1.1.1.2 USE OF DEMONSTRATION DATA BY BOARD OF INSPECTION AND SURVEY. - It is the policy of INSURV (Board of Inspection and Survey) to accept for trials' purposes, data from any source provided that in the judgement of the activity conducting the trials, the data are valid and fully representative of the production article undergoing trials. Properly validated demonstration test data are of assistance to INSURV and thus decrease the time required for trials.

1.1.1.3 POLICY FOR COORDINATION OF TEST AND EVALUATION. - The COMNAVAIRTESTCEN (Commander, Naval Air Test Center) is assigned the responsibility of coordinating Navy tests and evaluations of aircraft and their components as weapons systems and the reporting thereof. In addition, COMNAVAIRTESTCEN is responsible for the coordination and reporting of contractor demonstration tests under the witnessing authority of all Navy activities other than the NAVPRO (Naval Plant Representative Office).

1.1.1.4 POLICY ON RELEASE OF NAVAL AIRCRAFT FOR TRIALS AND FLEET USE. - NAVAIR Instruction 13100.7 contains the policy of NAVAIR concerning the release of naval aircraft for INSURV Acceptance Trials and for use by the Fleet.

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1.1.1.5 POLICY ON OPERATING LIMITS OF FLEET AIRCRAFT WITH AND WITHOUT STORES. - NAVAIR Instruction 3710.7 contains general information pertaining to operating limitations of Fleet aircraft with and without stores.

1.2 PURPOSE OF DEMONSTRATION. - The primary purposes of demonstrations are: (1) to determine that the airplane can be safely operated by Navy pilots during trials to limits consistent with the contract design limits for the airplane; (2) to obtain early basic information regarding the military potential of new models of airplanes and the operability of all their equipment; (3) to permit early decisions regarding attainment of superior characteristics; and (4) to obtain quantitative information on safe limits for operation by Fleet pilots.

1.3 DURATION OF DEMONSTRATION. - The demonstration of a specific model of airplane begins with the first contract work performed by the contractor in compliance with provisions of this general specification (i.e., submittal of demonstration planning information, preparation of an airplane for demonstration, or conference with representatives of the Government concerning actual details of the specified demonstration, whichever occurs first) and ends with satisfactory completion by the contractor of all specified tests, submittal by the contractor of all required reports and data, and acceptance by Government of all reports and data concerning the demonstration that are required to be submitted for acceptance.

2. APPLICABLE DOCUMENTS

2.1 EFFECTIVE DATES OF DOCUMENTS. - The effective dates of documents referred to herein shall be as specified in applicable airplane contract detail specifications for the demonstration airplanes. For a specific contract, these documents may be modified by the detail specification, or other contractual documents applicable to the specific contract. Such modifications shall form a part of the requirements of this specification applicable to the specific contract.

2.1.1 SPECIFICATIONS AND STANDARDS. - The following specifications and standards form a part of this specification to the extent specified herein and as qualified in the specific addendum to this specification; or in the contract detail specification:

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2.1.1 (Cont)

SPECIFICATIONS AND STANDARDS
MILITARY

MIL-P-4252	Processing Unit, Photographic Film 70mm to 9½ inch roll film, Type B-5A.
MIL-I-5072	Instrument Systems; Pitot-Static Tube operated, Installation of
MIL-W-5088	Wiring, Aircraft; Installation of
MIL-E-5400	Electronic Equipment, Aircraft, General Spec. for
MIL-T-5422	Testing, environmental, Aircraft Electronic Equipment
MIL-P-26366	Propellers, Type Test of
MIL-T-5522	Test Procedure for Aircraft Hydraulic and Pneumatic Systems, General
MIL-T-5842	Transparent Areas, Anti-icing, Defrosting and Defogging Systems, General Spec. for
MIL-E-6051	Electrical-Electronic System Compatability and Interference Control Requirements for Aeronautical Weapons Systems, Associated Subsystems and Aircraft
MIL-E-6059	Engines, Aircraft, Reciprocating, Processes for Corrosion Protection Preoiling, and Ground Operations of
MIL-I-6115	Instrument Systems; Pitot Tube and Flush Static Port Operated, Installation of
MIL-D-6728	Dampers, Engine Exhaust Flame and Glare
MIL-L-6730	Lighting Equipment; Exterior, Installation of Aircraft (General Specification)
MIL-E-7016	Electric Load and Power Source capacity, Analysis of; Method for Aircraft and Missiles
MIL-E-7080	Electrical Equipment; Piloted Aircraft Installation and Selection of; General Spec. for
MIL-C-7188	Compasses, Pilot's Standby, Installation of
MIL-M-7700	Manuals; Flight
MIL-C-7762	Compasses, Installation of
MIL-A-7772	Antenna Systems, Airborne; General Spec. for the Design, Location and Installation of
MIL-F-7872	Fire Warning Systems, Continuous, Aircraft Test and Installation of
MIL-G-7940	Gages, Fuel Quantity, Capacitor Type, Installation and Calibration of
MIL-A-8591	Airborne Stores and Associated Suspension Equipment, General Design Criteria for
MIL-J-8667	Jet Assisted take-off, Installation of in Naval Aircraft
MIL-I-8670	Installation of fixed guns and associated equipment in naval aircraft
MIL-I-8671	Installation of droppable stores and associated release systems

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SPECIFICATIONS
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MIL-I-8672	Installation and Test of Aircraft Pyrotechnic Equipment
MIL-I-8673	Installation and Test of Flexible guns
MIL-I-8675	Installation: Aircraft Armor
MIL-I-8677	Installation of Armament control systems and associated equipment in naval aircraft
MIL-D-8678	Cooling Requirements of Power Plant Installation
MIL-I-8683	Installation of Oxygen Equipment in Aircraft
MIL-I-8700	Installation and Test of Electronics Equipment in Aircraft, General Spec. for
MIL-D-8706	Data and Tests; Engineering, Contract Requirements for Aircraft
MIL-D-8708	Demonstration Requirements for Airplanes
MIL-F-8785	Flying Qualities of Piloted Airplanes
MIL-D-8804	De-Icing System, Pneumatic Boot, Aircraft General Spec. for
MIL-A-8806	Acoustical Noise Level in Aircraft; General Spec. for
MIL-S-8812	Steering System, Aircraft, General Spec. for
MIL-A-8860	Airplane Strength and Rigidity, General Spec. for
MIL-A-8861	Airplane Strength and Rigidity, Flight Loads
MIL-A-8862	Airplane Strength and Rigidity, Landplane Landing and Ground Handling Loads
MIL-A-8863	Airplane Strength and Rigidity, Additional Load's for Carrier-Based Airplanes
MIL-A-8864	Airplane Strength and Rigidity, Water and Handling Loads for Seaplanes
MIL-A-8870	Airplane Strength and Rigidity, Vibration, Flutter and Divergence
MIL-F-17874	Fuel Systems, Aircraft Installation and Test of
MIL-I-18079	Installation of Angle of Attack and Sideslip Systems
MIL-R-18136	Research and Engineering Report; Format and General Requirements
MIL-C-18244	Control and Stabilization System; Automatic (Fixed Wing) Piloted Aircraft, General Spec. for
MIL-L-18276	Lighting, Aircraft Interior; Installation of
MIL-H-18325	Heating and Ventilating Systems, Aircraft General Spec. for
MIL-I-18370	Installation of Mechanically Ejected Life Rafts in Naval Aircraft
MIL-S-18471	Seat System, Ejectable, Aircraft, General Specification for
MIL-T-18606	Test Procedures for Aircraft Cabin Pressurizing and Air Conditioning System
MIL-T-18607	Thermal Anti-Icing Equipment, Wing and Empennage

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SPECIFICATIONS
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MIL-T-18847	Tank, Fuel, Aircraft, Auxiliary External, Design and Installation of
MIL-E-18927	Environmental System, Pressurized, Aircraft General Requirements for
MIL-I-19326	Liquid Oxygen Equipment in Aircraft, General Spec. for Installation of
MIL-A-19736	Air Refueling Systems, General Requirements for
MIL-O-19838	Oil Systems, Aircraft, Installation and Test of
MIL-L-22589	Launching System, Nose Gear Type, Aircraft
MIL-F-23447	Fire Warning System, Aircraft Radiation Sensing Type; Test and Installation of
MIL-C-23866	Control Set, Approach Power AN/ASN-54(V)
MIL-W-25140	Weight and Balance Control Data
MIL-I-26292	Pitot and Static Pressure Systems, Installation and Inspection of
MIL-L-006730	Lighting Equipment; Exterior, Installation of Aircraft, General Spec. for

STANDARDS

MIL-STD-203	Cockpit Controls Location and Actuation of for Fixed Wing Aircraft
MIL-STD-480	Configuration Control, Engineering Changes, Deviations and Waivers
MIL-STD-704	Electric Power, Aircraft, Characteristics and Utilization of
MIL-STD-757	Reliability Evaluation from Demonstration Data
MIL-STD-800	Procedure for Carbon Monoxide Detection and Control in Aircraft
MIL-STD-850	Aircrew Station Vision Requirements for Military Aircraft
MIL-STD-859	Standard Calibration Table for Aeronautical Measuring Equipment

(When requesting specifications, refer to both title and number. Copies of this specification and applicable specifications may be obtained upon application to the Commanding Officer, Naval Aviation Supply Depot, 5801 Tabor Ave., Philadelphia, Pennsylvania, 19120, Attention Code CDS).

2.1.2 PUBLICATIONS. - The following publications of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

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NAVAIR Instructions

3700.1	Minimum operating requirements for aircraft to be ferried
3710.1	Contractors' flight operations
3710.7	Aircraft/Store compatability and flight operating limitations for aircraft carrying stores
13100.4	Navy Contract Demonstration Requirements; Administration of Documentation stemming from and relating thereto
13100.5	Military Specifications MIL-D-8708, Demonstration Requirements for Airplanes and MIL-D-23222, Demonstration Requirements for Helicopters; the administration of
13100.7	Release of Naval Aircraft for Trials and Fleet Use; Policy Regarding
13900.1	Special Flight Test Instrumentation of the Naval Air Test Center; Accountability and Handling Procedures for

2.2 OTHER DOCUMENTS. - The following documents form a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

American Society of Mechanical Engineers

ASA	Y10.7 - 1954 American Standard Letter Symbols for Aeronautical Sciences. (Copies of this ASME document may be obtained from American Society of Mechanical Engineers, West 39th St., New York, New York.)

Board of Inspection and Survey

INSURV	Aircraft Test Directive No. 1-6 of 17 September 1965 - INSURV Trials - Utilization of Data reported by Contractors, Federal Aviation Agency, U.S. Air Force, or other sources.

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2.2 (Cont)

Naval Air Engineering Center

NAEC - ACEL Report 533

3. REQUIREMENTS

3.1 GENERAL

3.1.1 LOCATIONS FOR TESTS. - Throughout this specification, the expression "contractor's plant" refers to the contractor's flight-test facilities. Flight-test facilities other than the contractor's may be approved by test authority for particular demonstration tests. Unless such changes in locations for certain tests are so approved all specified tests shall be performed at the contractor's plant except as follows:

(1) Dives and pull-outs with and without stores, performance guarantees, final spin tests, carrier suitability tests, automatic-carrier-landing system tests, arrested landing tests, catapult launching tests, field takeoff and landing tests, taxi tests, seaplane take-off and landing and the electromagnetic interference demonstration tests shall be performed at the NAVAIRTESTCEN.

(2) Nuclear weapons tests of 3.16.6.2 shall be performed at the NAVWPNEVALFAC (Naval Weapons Evaluation Facility), or at a location specified by COMNAVAIRTESTCEN.

(3) Guided missile tests of 3.16.5 shall be performed at the NAVMISCEN (Naval Missile Center), Pt. Mugu, California, or at a location specified by COMNAVAIRTESTCEN.

3.1.2 TEST AUTHORITY. - For the purposes of this specification, a "Test Authority" is the COMNAVAIRTESTCEN; the cognizant NAVPRO; or the Commander, Commanding Officer, or Officer-in-Charge of an activity or facility which is assigned by NAVAIR or COMNAVAIRTESTCEN under the policy of 1.1.1.3 to witness demonstrations and tests required to be performed under the terms of this specification, contractual modifications to this specification, or other contractually applicable documents. Addenda to this specification will specifically delineate the assigned Test Authorities. Test Authorities are responsible for certification of satisfactory contractor compliance with the demonstration and test requirements and for submittal of results thereof to COMNAVAIRTESTCEN who retains the over-all reporting responsibility to NAVAIR. Test Authorities shall witness or designate witnesses for the demonstrations and tests and shall approve test plans, instrumentation, data-reduction procedures, and test methods and procedures for which detailed methods and procedures are not specified herein or in other applicable documents.

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3.1.2 (Cont)

For Test Authorities other than COMNAVAIRTESTCEN, the COMNAVAIRTESTCEN shall furnish instructions, in writing with a copy to NAVAIR, concerning the duties and responsibilities of test witnesses so that the actual performance of the tests, the collection of data during the tests, the decisions made during and subsequent to the tests, and the reporting and documentation of test results will be consistent, comprehensive, and serve the best interests of the Government. Tests that are specified to be performed at one facility and that must, of necessity, be performed at some other facility, regardless of location, shall remain under the direction of the specified test authority.

3.1.3 AIRPLANE CONFIGURATION FOR DEMONSTRATION TESTS. - Except for the necessary addition of ballast to attain specified center-of-gravity locations, except for the necessary installation of special test instrumentation, and except as otherwise approved in writing by the test authority, or by NAVAIR, airplanes employed in the performance of formal demonstration tests shall be identical, within production tolerances, to airplanes of the same contract which are to be delivered or have been delivered for trials and to the Fleet. No special installation of any kind shall be undertaken without the aforementioned specific written approval. The word "formal" in the first sentence of this paragraph refers to all demonstration tests, the results of which are intended to show that a design requirement has been met in the test or that the design is suitable for fleet use, such as a test to demonstrate satisfactory operation of an item of equipment as part of the aircraft weapon system; a structural demonstration test to specified values of limit load factor, speed, altitude, and other pertinent parameters even though these values may differ from the design values; or a performance, or a flying-qualities demonstration test to demonstrate compliance with performance of flying-qualities design requirements. Distribution of variable and useful loading, and of ballast shall be satisfactory to test authorities during all demonstration tests including build-up tests.

3.1.4 APPROVAL, QUALIFICATIONS, AND INSTRUCTIONS FOR CONTRACTOR'S PILOTS. - To eliminate unnecessary delay in the performance of the demonstration, and to safeguard the interests of the Government, skilled pilots who are experienced in flight testing and in the performance of all demonstration tests and who are properly and adequately equipped to perform the required demonstrations, shall be employed in the performance of all demonstration tests. These pilots shall be satisfactory to NAVAIR and to Test Authorities concerned. NAVAIR INSTRUCTION 3710.1 provides amplifying information on this subject. Contractors shall instruct demonstration pilots thoroughly concerning the design limitations and special or unusual characteristics of demonstration airplanes. These instructions shall be sufficiently thorough and timely as to minimize damage to or loss of demonstration airplanes because of factors which are known to or are under control of contractor's design and/or demonstration personnel including pilots. These requirements

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3.1.4 (Cont)

for instructions to pilots are intended to avert critical structural loads and airplane responses resulting from sudden changes in throttle settings or control forces and during such operations as propeller-vibration-stress measurements, "dead-stick" landings, store separations and free-flight engagement of arresting wires.

3.1.4.1 FLIGHT EQUIPMENT FOR CONTRACTORS' TEST PILOTS. - Flight equipment worn by contractor's test pilots shall be the same as flight equipment worn and used by personnel of the Naval Service for corresponding flight operations. The contractor shall take necessary action to procure, through proper channels, items of Naval Service flight equipment that may be required by his test pilots for the proper performance of demonstration tests on naval aircraft. If, in the opinion of the contractor, standard Navy flight equipment is not adequate and safe for his test pilots, the facts of the case together with his recommendations shall be reported to NAVAIR.

3.1.5 RELEASE FOR FLIGHT AND OPERATING LIMITS. - Demonstration airplanes, other airplanes of the same model, and other new models of Navy airplanes shall not be operated by either contractors' or Navy pilots prior to release for flight by NAVPRO after NAVAIR has authorized release for flight and, subsequently, shall not be operated intentionally to limits more critical than those of 3.1.5.1 or 3.1.5.2 as applicable. In the determination of whether a planned limit of operation is or is not "more critical", consideration shall be given to but shall not be limited to the possibility that stalling an airplane may cause a power plant to malfunction or may impose buffeting and structural responses which may not be encountered at the same load factor at a higher speed, that sudden control movements may impose more critical loads because of the rapidity of movement of the control, and that rapid changes in power or thrust may impose more critical airplane responses that slower changes. Based on the extent to which the contractor has submitted contract design data, including the results of test and other investigations required by pertinent contractual documents, and, usually, in direct reply to a formal request from the contractor via the NAVPRO, NAVAIR will initially authorize operating limits which may be well inside (i.e., less critical than) the full contract design limits. NAVAIR will, from time to time, authorize more critical operating limits until finally, if justified by prerequisite contract design data and other available information, the operating limits authorized by NAVAIR will be either the full limits for which the contract requires the airplane to be (aerodynamically, structurally, and functionally) designed or the limits to which the airplane must be operated in order that the contractor may comply with contract demonstration requirements. It is recognized that the NAVPRO and/or the contractor may possess additional information which may justify operating limits pursuant

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3.1.5 (Cont)

to 3.1.5.1 and/or 3.1.5.2 that will be more restrictive than those authorized by NAVAIR. Normally, the initial authorization by NAVAIR will be to the limits of "normal flying" which, for demonstration purposes, shall mean that:

(1) Normal takeoffs and landings are authorized (but not catapulting, nor carrier, or simulated carrier landings); and,

(2) Flying in normal attitude is authorized with the following limitations:

(a) A normal load factor of 2 shall not be exceeded.

(b) An angle of bank of 60° shall not be exceeded.

(c) Flight controls, power-plant controls, and other systems, innovations, and/or appurtenances shall not be moved or operated so as to result in rapid or abrupt airplane responses.

(d) The speed at any altitude shall not exceed either 1.1 times the maximum speed attainable in sustained level flight at that altitude with maximum continuous power or thrust, or 0.85 times the minimum critical flutter speed at that altitude, whichever is lower. The minimum critical flutter speed for this purpose shall be that determined by analyses or data submitted to and accepted by NAVAIR.

After this initial authorization for release for flight has been granted, the NAVPRO shall release airplanes for operation to more critical limits (including spin tests, when spin tests are required) at the contractor's plant and for tests at locations other than at the contractor's plant only after the NAVPRO has determined that all contractual prerequisites to such releases have been either complied with or waived by NAVAIR and after NAVAIR has authorized such releases. The NAVPRO may release the aircraft for formal structural demonstration tests at NAVAIRTESTCEN following the conference required by 3.5.3, provided that all pertinent factors have been resolved to the satisfaction of NAVAIR, all required data resulting therefrom have been submitted to NAVAIR and NAVAIRTESTCEN, and all contractual prerequisites have been satisfactorily completed or waived by NAVAIR. Requests by contractors for release for first flight, for release for operation to more critical limits at the contractor's plant, and for release for tests at locations other than at the contractor's plant shall summarize the status of all contractual

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3.1.5 (Cont)

prerequisites to the requested release unless the required status-of-completion information is contained in the Demonstration Planning and Progress Report submitted to NAVAIR, in which case the contractor's requests shall refer to sources of the necessary information.

3.1.5.1 OPERATING LIMITS FOR CONTRACTORS' PILOTS. - The operating limits for contractors' flights shall not be more critical than any of the following:

(1) Those authorized by NAVAIR.

(2) Those authorized by the NAVPRO.

(3) Those which contractors have determined or deduced to be safe based on realistic consideration of all pertinent factors including but not limited to the following; results of analyses of the whole airplane and its component parts from the aerodynamic, structural, and functional viewpoints; status of completion of tests which may by this specification or by any of the documents listed in paragraph 2 herein, be required to be completed as a prerequisite to certain flights; and review of observations made and data recorded during prior flights reduced and extrapolated to the maximum extent practicable except that test authorities are authorized to waive reduction and extrapolation of the recorded data for tests performed pursuant to this paragraph 3.1.5.1(3) under their authority, when in their opinion, reduction and extrapolation of the data are not necessary for safety prior to further flight testing. Such waivers to expedite flight testing shall not be construed to negate other provisions of this document relating to submittal of data.

Operating limits shall be not more critical than those for which an ultimate factor of safety of 1.5 has been proven both by tests that have been performed, and by stress analyses that have been accepted by NAVAIR. In the event that such tests have not been performed and/or appropriate stress analyses have not been accepted by NAVAIR, the operating limits permitted shall be not more critical than those for which a factor of safety of 2.0 has been proven by stress analyses and other data that are acceptable to the NAVPRO.

3.1.5.2 OPERATING LIMITS FOR NAVY PILOTS. - Airplanes shall not be flown by Navy pilots prior to the issue of operating limits by NAVAIR. After issue of such operating limits by NAVAIR, the airplanes shall not be operated by Navy pilots during INSURV Trials, during special tests and evaluation flights, or during Navy preliminary evaluations to limits more critical than:

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3.1.5.2 (Cont)

(1) As authorized by NAVAIR.

(2) As authorized by NAVPRO for flights performed at the contractor's plant. Airspeeds, Mach numbers, altitudes, load factors, weights, permissible maneuvers, and other pertinent parameters affecting safety of flight set forth in these NAVPRO operating limitations shall have been previously explored and proven safe during flight tests performed by the contractor. The airplane, when flown by Navy pilots, shall be aerodynamically, structurally, and functionally identical in all significant respects to the airplane flown during the contractor's tests and used to substantiate these operating limitations.

(3) As authorized by the COMNAVAIRTESTCEN for landings at high gross weights to facilitate INSURV Trials and for special tests and evaluations at the NAVAIRTESTCEN. In the selection of these limits, the COMNAVAIRTESTCEN shall be guided by the following: Contract demonstrations usually contain requirements for take-offs and landings at maximum practicable take-off gross weights; hence, for landing tests at weights greater than the maximums demonstrated in accordance with such requirements, consideration shall be given to the technical reasons for the contractor's selection of and the approval by either NAVAIR or the COMNAVAIRTESTCEN, of the contractor's selection of the maximum practicable gross weights for the landing demonstration tests. In the absence of special technical reasons as discussed above, it is reasonable to assume that performance of safe landings should be practicable under the optimum circumstances discussed hereinafter, at all loadings and the gross weights for which it is safe to taxi the airplane into spotting positions for take-off with or without the aid of a catapult. It is assumed that the operations which necessitate the performance of these landings, will be carried out by skilled, well experienced test pilots, and that the tests will be performed only after determinations or deductions have been made that flight and handling characteristics probably will be acceptable for the planned tests at high gross weights. It is assumed also that piloting techniques will be such as to attain low sinking speeds and optimum landing attitudes, and that more than ordinary care will be exercised during subsequent roll-outs and maneuvering on runway surfaces.

3.1.6 **ANTI-SPIN DEVICE.** - Until the spinning characteristics of the airplane have been determined by NAVAIRTESTCEN, no spins shall be made without an approved anti-spin device installed ready for use. The anti-spin device shall be installed within the normal contour of the airplane, if at all practicable, and shall in no case be installed in a manner as to increase the effective fin area of the airplane. The contractor shall advise COMNAVAIRTESTCEN and COMNAVAIR promptly after determination that the installation of the anti-spin device within the normal contour of the airplane is not

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3.1.6 (Cont)

practicable. If the anti-spin device is not installed within the normal contour of the airplane, spins performed with the anti-spin device installed shall be repeated with the anti-spin device removed unless otherwise exempted by NAVAIR. The anti-spin device shall be so designed that the possibility of fouling controls before or after operation is reduced to a minimum. The anti-spin device installation shall be approved by the NAVPRO.

3.1.6.1 ANTI-SPIN DEVICE CHECK-OUT. - Prior to initiation of spin tests, the contractor shall perform ground and/or flight tests to show that the anti-spin device will function satisfactorily for emergency spin recovery. The test plan shall be approved by the NAVPRO and the installation released for spin flights by the NAVPRO upon satisfactory completion of these checkout tests. For anti-spin chute installations, these tests shall check the deployment, strength, and release characteristics to show that these will be satisfactory under the conditions to be expected when the chute is operated for spin recovery, including exposure to jet exhaust, if applicable. For anti-spin rocket installations, strength and operational characteristics shall be shown to be satisfactory, including safeguards intended to assure rocket thrust in the proper direction. The anti-spin device shall be satisfactorily demonstrated in a critical spin condition prior to conduct of the tests of paragraph 3.13.3.3.2. This critical condition shall be approved by NAVAIR.

3.1.7 FLIGHT MONITORING

3.1.7.1 MOVING PICTURE COVERAGE. - Moving picture coverage of first flights, seaplane landings, and of aircraft of non-conventional design, shall be as specified in the contract addenda to this specification or as specified herein. Termination of this requirement will be by NAVPRO. Camera equipment will be furnished by the Government, if available.

3.1.7.2 TELEMETERING COVERAGE. - Telemetering coverage shall be provided as planned in the conference of 3.5.1 and approved in the Demonstration Instrumentation Report 3.25.2.1. The use of telemetering on other demonstration flights shall be at the descretion of the contractor as approved by Test Authorities. At the Instrumentation Conference required by section 3.5.1, and prior to procurement and installation of telemetry equipment, the following shall be determined:

(1) Compatibility of proposed telemetering equipment with NAVMISCEN, NAVWPNEVALFAC and NAVAIRTESTCEN ground equipment, as applicable.

(2) Compliance with existing NAVAIRTESTCEN, NAVWPNEVALFAC or NAVMISCEN telemetry standards, as applicable.

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3.1.7.2 (Cont)

(3) Incorporation of a back-up source of power to assure continuity of transmission in the event of a power failure.

(4) The extent to which telemetering coverage will be employed during demonstration flights witnessed by the test authorities.

3.1.7.2.1 INSTRUMENTATION PACKAGE RECOVERY. - Provision shall be made for pilot jettisoning and subsequent recovery of the instrumentation records, or appropriate designed protection shall be provided for the instrumentation installations to withstand crash damage, in the event of loss of the airplane.

3.1.7.3 CHASE AIRCRAFT. - Chase aircraft shall be used for the first flight of a new model airplane. For other flights at or near the contractor's plant, determination of whether or not chase aircraft are to be used shall be made by the NAVPRO. Chase aircraft will be provided by the test authority during tests and demonstrations which test authorities determine require chase aircraft.

3.1.8 AIRCRAFT CHANGES AND ADJUSTMENTS. - Subsequent to release of airplanes for structural demonstration tests at NAVAIRTESTCEN no replacement, alterations, changes, or adjustments other than those required by normal maintenance procedures shall be made to the Structural Demonstration Airplane unless approved by the COMNAVAIRTESTCEN and/or NAVAIR subject to the requirements specified below. When a replacement, alteration, change, or adjustment, which would not be required by normal maintenance procedures, becomes necessary, or appears to the contractor or to the COMNAVAIRTESTCEN to be necessary, because of a dangerous or damaging occurrence (such as a violent response of the airplane or control surface, or yielding or failure of a region of the structure), or because of any malfunction (such as the failure of an engine or some other item of equipment to continue operating normally), or for any other reason during the dives and pull-outs at NAVAIRTESTCEN, the contractor shall submit concurrently to NAVAIR and to the COMNAVAIRTESTCEN:

(1) A realistic technical evaluation of the significance of the disclosed design deficiency.

(2) A record of tests at the contractor's plant which disclosed the design deficiency or, if applicable, an explanation as to why the design deficiency was not disclosed and/or reported during tests at the contractor's plant.

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(3) Description of proposed corrective action.

(4) Technical justification of proposed corrective action.

(5) Schedules for changes to contract design data and changes to airplanes consistent with the proposed corrective action.

(6) Submit engineering change proposal in accordance with MIL-STD-480.

3.2 FLIGHT PLAN RELEASE. - The contractor shall prepare flight plans covering tests and procedures to be followed by the contractor's flight crew during demonstration tests, for approval by the Test Authority. The flight plans shall include operating restrictions approved by NAVAIR or NAVPRO. The flight plan may cover more than one flight or extend beyond one day, provided the plan is not changed after release by the Test Authority.

3.3 TEST INSTRUMENTATION

3.3.1 GENERAL. - The contractor shall determine the kind and amount of special flight-test instrumentation necessary to comply with the demonstration requirements of this specification. Pursuant to NAVAIR Instruction 13900.1 and by conferring with representatives of NAVAIRTESTCEN, the contractor shall make maximum utilization of government-furnished equipment (GFE) as is available at the time of the conference of 3.5.1 from the Special Flight Test Instrumentation Pool (SFTIP) at NAVAIRTESTCEN. All other required instrumentation shall be furnished by the contractor as contractor-furnished equipment (CFE). The method of data acquisition, the number and type of recording devices, and the information required by items (1) through (5) of 3.25.2.1 for each demonstration shall be proposed by the contractor for NAVAIR approval and subsequent inclusion as an appendix to the addendum to this specification. NAVAIRTESTCEN participation in review and verification of suitability of the proposed instrumentation will be required.

3.3.1.1 INSTALLATION, CALIBRATION, AND MAINTENANCE. - The contractor shall install and calibrate all airplane instrumentation used in performing the demonstrations. All instruments and instrument systems shall be installed in accordance with the highest standards of mechanical and electrical installation practices. All transducers and gage installations shall be properly located, shall be properly damped, shall have flat frequency response characteristics commensurate with the frequencies of excitation of the variable to be measured, and shall be properly mounted to assure valid measurements and freedom from extraneous excitations. The maximum time lag between any two or more channels requiring time correlation shall not exceed the time constant corresponding to the channel having the lowest flat frequency response requirement. For the carrier suitability demonstration

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3.3.1.1 (Cont)

airplane the flat frequency response shall be not less than 60 CPS for all strain gages, pressure transducers and accelerometers; for displacement and velocity measuring instruments the flat frequency response shall be not less than 60 CPS unless lower response characteristics, if proposed by the contractor, are concurred with by NAVAIR. Magnetic tape recorders and telemetry equipment, if installed and used on demonstration airplanes at NAVAIRTESTCEN, must be compatible with the existing ground station equipment at NAVAIRTESTCEN. Calibration of each transducer of gage installation shall be made through the signal conditioning equipment as installed on the demonstration airplane to at least the maximum range of excitation expected during the course of the demonstration. Calibration test data shall be obtained and recorded during both increasing and decreasing values of the pertinent parameter which the instrument is intended to measure, to assure repeatability and freedom from hysteresis. All strain-gage installations on simple and complex structures shall be installed to minimize interactions or "cross-talk" during combined loadings; such interactions as do exist shall be properly accounted for during the calibration. Installation of strain-gages which are impossible or impractical to calibrate shall be resorted to only if it can be shown, prior to such installation, that the computed loads from such installations are meaningful and useful, and provided further, that the methods of gage applications and load calculations from strain-gage output, gage factor, and physical constants of the member are acceptable to the Test Authority. The instrumentation shall be operated and maintained by the contractor during the demonstration. If, during the course of the demonstration, it becomes apparent to the Test Authority that there is a change in the calibration of certain instruments, such instruments shall be recalibrated and their recalibrations shall be witnessed and accepted in accordance with 3.3.1.3 and 3.3.1.4. A detailed description of all instruments and recording devices, methods of calibration, locations of instruments, and calibration data for each demonstration airplane shall be submitted as separate appendices to the report required by 3.25.2.1. Such appendices shall be submitted at least two months prior to the time the airplane is scheduled to arrive at the test site.

3.3.1.2 CHECK-CALIBRATIONS. - In general, where practicable and feasible, all contractor-installed demonstration instrumentation shall be check-calibrated by NAVAIRTESTCEN before commencing a demonstration at NAVAIRTESTCEN. The contractor installed instrumentation system shall be so designed that such check-calibrations may be made through the airplane recording system and ground station equipment, while vibrating and/or shock loading the airplane recorder through its mounts, by removing the recorder from the airplane and suitably mounting the recorder in a test fixture. The frequency and amplitude of vibration and/or shock loading of the mounts shall be that which simulates the expected environment during the demonstration, for example for the carrier suitability airplane, those which occur during catapulting and arrested landings. In addition, for magnetic tape recording systems, dynamic response checks shall be made through the recording system and ground station equipment to assure (1) that freedom from extraneous noise or vibrations exists, (2) that each

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3.3.1.2 (Cont)

channel has flat frequency response commensurate with the parameter to be measured and (3) that the maximum time lag between any two or more channels requiring time correlation does not exceed the "time constant" corresponding to the channel having the lowest flat frequency response requirement. Where such check-calibrations show significant departures from previous calibrations, a complete re-calibration shall be made in accordance with 3.3.1.3 herein.

3.3.1.3 RE-CALIBRATIONS. - All demonstration instrumentation, if deemed practicable and feasible by the Test Authority, shall be re-calibrated every three months. The foregoing period of time may be increased or decreased by the Test Authority, depending on the number and type of flights scheduled for continuing or completing the demonstrations. All contractor-installed instrumentation shall be re-calibrated by the contractor at the conclusion of the demonstration. For demonstrations performed at NAVAIRTESTCEN, whenever re-calibration of instruments if required under the provisions of 3.3.1.1, 3.3.1.2, or 3.3.1.3, re-calibration of those instruments for which calibration facilities exist at NAVAIRTESTCEN shall be made by NAVAIRTESTCEN. All other re-calibrations required by the aforementioned paragraphs shall be made by the contractor and shall be witnessed and accepted in accordance with the procedures of 3.3.1.4. The results of all re-calibrations for each of the demonstration airplanes shall be submitted as revisions to the report required by 3.25.2.1.

3.3.1.4 ACCEPTANCE AND WITNESSING PROCEDURES. - Formal acceptance, by representatives of the Test Authority, of all instrumentation system installations for each demonstration airplane shall be performed at the location at which the demonstration tests are to be performed, as specified in 3.1.1. In lieu thereof, and subject to the approval of COMNAVAIRTESTCEN, such acceptance may be performed at the contractor's facility, or other designated location, at least two weeks prior to delivery of the airplane at the test location, to preclude serious delay in the contractor's development program. Concurrent or prior to the foregoing acceptance of instrumentation installations, contractor calibrations of all instruments shall be witnessed by representatives of the Test Authority. The Test Authority may designate other government representatives to witness instrumentation calibrations in accordance with the provisions of 3.1.2. Such witnesses shall adhere to the following minimum requirements.

(1) Installation. - The installation of transducers and gages, and signal conditioning and recording systems shall be reviewed and inspected to assure: (a) acceptable workmanship and proper location and mounting of all instruments and related systems; (b) that the signal conditioning equipment does not have any deleterious effects on measurement accuracy and data reduction; and (c) that magnetic tape recorders and telemetry equipment, if installed and intended to be used at NAVAIRTESTCEN, are compatible with NAVAIRTESTCEN ground station equipment.

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(2) Calibrations. - Where practicable, all calibrations shall be witnessed to assure that valid calibration standards are used, that calibrations are repeatable, that the instruments have no adverse hysteresis effects, and that each instrument is calibrated to at least the maximum value of the parameter expected to be attained during the demonstration.

(3) Acceptances. - The Test Authority's written acceptance of the instrumentation installation and calibrations shall be delivered to the contractor and acknowledged by the contractor prior to commencing the demonstration tests.

3.3.1.5 REMOVAL OF TEST INSTRUMENTATION. - After completion of all demonstration tests specified herein, to the satisfaction of NAVAIRTESTCEN and NAVAIR and upon request by NAVAIR, the contractor shall remove all special flight test instrumentation from those test airplanes as specified by terms of the contract and restore those airplanes to the fleet delivery configuration.

3.4 REQUIREMENTS PRIOR TO FIRST FLIGHT. - Prior to first flight the contractor shall have:

(1) Submitted an acceptable Demonstration-Instrumentation Report. (3.25.2.1)

(2) Submitted the Demonstration, Planning and Progress Report (3.25.2.2) material which is specified to be submitted concurrently with the Demonstration-Instrumentation Report.

(3) Submitted those structural design data and performed those structural tests which contract Design Data Requirements specify shall be submitted or performed prior to release for flight.

(4) Submitted a report of estimated flying qualities in accordance with Contract Design Data Requirements.

(5) Performed power-plant installation tests in accordance with Spec MIL-E-6059 and other related specifications for turbo-prop and turbo-jet engines.

(6) Performed fire-detecting-system tests in accordance with Spec MIL-F-7872 or MIL-F-23447, as applicable.

(7) Submitted acceptable weight-and-balance data in accordance with Spec MIL-W-25140 and weighed the airplane.

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(8) Satisfied the NAVPRO that safe egress from the airplane will be practicable to accomplish under emergency flight situations.

(9) Obtained release for flight from the NAVPRO.

3.5 PLANNING CONFERENCES

3.5.1 INSTRUMENTATION CONFERENCE. - To facilitate accomplishment of all demonstrations conferences shall be held between representatives of the contractor and the cognizant Test Authorities. These conferences shall start as soon as practicable but not later than 12 months prior to the scheduled release of the first airplane for flight to (1) provide satisfactory lead times for procurement of instrumentation which, at the time of the conference, may not be available as contractor-furnished equipment (CFE) or from the SFTIP as government-furnished equipment (GFE), and (2) to facilitate compliance with other related provisions of this specification.

3.5.2 CRUISE CONTROL TESTS PLANNING CONFERENCE. - A preliminary conference shall be held at least 4 months prior to the fuel consumption tests of 3.6.12.1(3). The contractor shall confer with NAVAIRTESTCEN to review preliminary test data already available, to establish the test methods, and to establish the data presentation format and data reduction procedures to be used in preparing the final flight performance data. Additional conferences between the contractor and NAVAIRTESTCEN shall be held as necessary to resolve problems as they arise during the flight test program. NAVAIR (AIR-536) shall be advised prior to each conference.

3.5.3 STRUCTURAL FLIGHT DEMONSTRATION PLANNING CONFERENCE. - At least four weeks prior to arrival of the test airplane at NAVAIRTESTCEN for the structural demonstration tests of 3.12, excluding the structural tests of 3.12.2, representatives of the contractor shall confer with NAVAIRTESTCEN personnel for the purpose of reaching agreement on the details of the airplane configuration, the test procedures, and the instrumentation to be used in these demonstration tests. The results of this conference shall be confirmed by submittal in writing by NAVAIRTESTCEN to NAVAIR and the NAVPRO of a summary thereof approved by responsible representatives of NAVAIRTESTCEN and the contractor. This summary shall delineate all of those factors affecting these demonstration tests which require resolution by NAVAIR.

3.5.4 STRUCTURAL GROUND LOADS AND CARRIER SUITABILITY DEMONSTRATION PLANNING CONFERENCE. - At least four weeks prior to the arrival of the test airplane at NAVAIRTESTCEN for the takeoff, landing, and taxi tests of 3.12.2 and 3.12.3 and the carrier suitability tests of 3.20, representatives of the contractor shall confer with NAVAIRTESTCEN personnel for the purpose of reaching agreement relative to the details of the airplane configuration, the test procedures, and the instrumentation to be used in these demonstration tests. The results of this conference shall be confirmed

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by submittal in writing by NAVAIRTESTCEN to NAVAIR and the NAVPRO of a summary thereof approved by responsible representatives of NAVAIRTESTCEN and the contractor. This summary shall delineate all those factors affecting these demonstration tests which require resolution by NAVAIR.

3.5.5 PRE-EVALUATION CONFERENCE. - Not later than one week prior to the expected start of each phase of the evaluation, a conference shall be called by NAVAIR at NAVAIRTESTCEN of representatives of the contractor, NAVPRO, NAVAIR, and NAVAIRTESTCEN concerned. The conference is to review the results of all flight tests accomplished prior to that phase of the evaluation, and to review the extent to which pre-evaluation requirements have been completed, including the required operating flight envelopes. The contractor shall define the configuration of the airplane to be utilized during the evaluation phase.

3.5.6 POST EVALUATION CONFERENCE. - Following receipt of the final NAVAIRTESTCEN Report of each phase of the evaluation a conference shall be called by NAVAIR at NAVAIR of representatives of the contractor, NAVPRO, NAVAIRTESTCEN and NAVAIR. The conference is to establish disposition of corrective action and contractor or government responsibility of each deficiency reported by the evaluation team. Recommended corrective action and possible alternatives along with schedules and production effectivity shall be provided by the Contractor for each reported deficiency to facilitate review by NAVAIR for the purpose of determining which of the deficiencies must be corrected by the contractor prior to commencing the next evaluation phase.

3.5.7 SPIN DEMONSTRATION PLANNING CONFERENCES. - Prior to initiation of contractor spin buildup tests, a conference shall be held among representatives of the contractor, the NAVAIR, and the NAVAIRTESTCEN to discuss the spin flight test program to ensure that critical flight conditions will be investigated. The conditions to be investigated must be acceptable to NAVAIR. Upon completion of contractor buildup spin tests, another conference will be held to review the results of the buildup tests and to redefine as necessary the tests to be formally demonstrated by the contractor at the NAVAIRTESTCEN.

3.6 NAVY PRELIMINARY EVALUATION

3.6.1 GENERAL. - After first flight but prior to initial delivery of airplanes for INSURV Acceptance Trials, pilots and maintenance personnel designated by the COMNAVAIRTESTCEN will perform, normally in five phases, the Navy Preliminary Evaluation. Reports in accordance with NAVAIR Instruction 13100.5 shall be submitted to COMNAVAIRTESTCEN. (A phase consists of one or more flights by the Evaluation Team and each phase will be terminated by COMNAVAIRTESTCEN). Phase I of the Navy Preliminary Evaluation shall be performed immediately subsequent to the inspection pursuant to 3.6.11, normally approximately 90 days after the contractor's first flight of the airplane. Additional phases, as required, will be performed at times appropriately related to the development of the design by the contractor as the allowable flight envelope is increased, or to evaluate changes incorporated in the air-

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3.6.1 (Cont)
plane to correct deficiencies. The final phase will be just prior to initial delivery of airplanes for INSURV Acceptance Trials. The evaluation flights will be made at the contractor's plant unless otherwise authorized by the COMNAVAIRTESTCEN.

3.6.2 PURPOSE. - The purpose of the Navy Preliminary Evaluation shall be as follows:

(1) To determine at the earliest possible opportunity, the combat potential and gross deficiencies of the airplane and thereby enable an estimate to be made of the degree to which operational requirements will be met.

(2) To highlight the need for and to allow early correction of deficiencies.

(3) To evaluate changes incorporated.

(4) To determine when the airplane is suitable for INSURV Acceptance Trials.

3.6.3 CONTRACTOR'S RESPONSIBILITY. - The contractor shall configure the test airplane for the final NPE, as approved for the contractor's demonstration, or as agreed upon between the contractor and the Test Authority during the pre-NPE conference. Recording instrumentation, if installed in the airplane for the contractor's flight tests, shall be in operation, but need not be specifically installed for the Navy Preliminary Evaluation unless specifically requested by COMNAVAIRTESTCEN. Cockpit instrumentation shall not be changed from that used by the contractor unless specifically requested by COMNAVAIRTESTCEN. Requests for special instrumentation shall be so submitted that necessary installations and/or changes can be made prior to scheduled date for the NPE. The contractor shall have shown by flight tests prior to the evaluation and by other data, if required, that within the allowable flight envelope, the airplane is aerodynamically, structurally, and functionally safe for the tests to be performed by Navy pilots. To meet more closely the intent of 3.6.2, the contractor shall make and evaluate modifications necessary to provide an adequate flight envelope for the Navy Preliminary Evaluation.

3.6.4 REQUIREMENTS PRIOR TO EVALUATION. - The contractor shall have performed the requirements of 3.6.3 prior to any evaluation. The extent to which the flight test, ground tests, and functional tests have been satisfactorily performed shall be included in data specified by 3.6.5 and presented during conference specified in 3.5.5.

3.6.5 PRE-EVALUATION ENGINEERING DATA. - The contractor shall submit to NAVAIR for acceptance, and to the NAVAIRTESTCEN for review, the information relating to the tests specified in 3.6.13, the data substantiating the proposed envelopes of 3.6.14, and recommended evaluation operating limits. Such information, data, and limits shall be submitted so as to be received by NAVAIR and the NAVAIRTESTCEN at least one week prior to the pre-evaluation conference of 3.5.5. Prior to departure of the

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NAVAIRTESTCEN pilots for the evaluation, NAVAIR shall have authorized the NAVPRO to release the airplane for evaluation flights and shall have informed the NAVPRO and the NAVAIRTESTCEN of the operating limits that have been established for flight by COMNAVAIRTESTCEN designated pilots during the Navy Preliminary Evaluation. (For reporting of above data see 3.25.2.5).

3.6.6 EQUIPMENT TESTS. - The carbon-monoxide tests of 3.17.2.1 and the oxygen-equipment tests of 3.17.2.4 shall have been performed satisfactorily.

3.6.7 EMERGENCY ESCAPE SYSTEM. - The contractor shall have demonstrated by test that the escape system provided for the airplane is adequate for personnel safety under conditions specified in the addendum to this specification for the particular aircraft. For escape systems utilizing jettisonable canopies, demonstration of static (zero-zero) jettisoning shall be made, with the airplane in nose-down (nose gear failed) position. The jettisoned components shall fall clear of the cockpit or cockpits.

3.6.8 POWER PLANT SURVEY

3.6.8.1 PROPELLER VIBRATION SURVEY. - For propeller driven airplanes, the airplane contractor shall conduct such flight and ground test in accordance with 4.5.3.6 of Spec MIL-P-26366 as may be necessary for the propeller manufacturer to collect the required vibration-stress-survey data on the propeller. The airplane manufacturer shall be responsible for furnishing the necessary equipment and personnel for collection of these data.

The propeller manufacturer shall prepare and submit the required report on the propeller-stress survey, via the contractor. If the results of the required propeller-vibration-stress survey indicate unsatisfactory vibration stresses in the propeller, the Government will place the responsibility for correction of this condition in each specific case, and the survey shall be repeated to demonstrate correction of the unsatisfactory vibration characteristics.

3.6.8.2 POWER PLANT VIBRATION SURVEY. - The airframe contractor shall perform flight and ground tests to collect vibration data on the power plant installation to substantiate a satisfactory installation. Sufficient vibration data shall be provided by the airframe contractor to the power plant manufacturer for use in determining the extent to which vibration of the airframe/engine combination may affect the engine. The survey shall be broad enough in scope to determine that the structural integrity of the engine and the airframe, with regard to structural fatigue of the prime load paths to and through the power plant, and of other important

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3.6.8.2 (Cont)

power plant and installation elements, is adequate in the airframe installation. Instrumentation shall be sufficient to determine vibration characteristics of the power plant and its complete installation at frequencies corresponding to all important forcing frequencies. Instrumentation installed internally in the power plant shall be furnished and installed by the power plant manufacturer.

The airframe contractor is responsible for the collection of all data. It is the intent of this specification that the airframe and power plant manufacturers work directly with each other in the determination of detailed instrumentation and test requirements. The Power Plant Installation Vibration Test Program report shall be prepared by the airframe contractor and submitted to NAVAIR for acceptance at least two months prior to the date necessary to install instrumentation to meet scheduled test dates or 90 days after the date of contract, whichever is earlier, with a copy to the power plant manufacturer. The results of all tests and analyses of data shall be compiled by the aircraft manufacturer and submitted to NAVAIR for acceptance in the Power Plant Vibration Survey Report with copy to the power plant manufacturer. Analyses of these data pertaining to the specification compliance and proof-of-design of airframe and installation components, and power plant components shall be provided by the airframe, and engine manufacturers respectively. This report shall be submitted in two phases; results of ground tests at least 2 weeks prior to first flight, and results of flight tests at least 30 days prior to the conference specified in 3.5.5 for the first phase of the evaluation. If the results of the survey, as determined by NAVAIR, indicate unsatisfactory vibration in the power plant installation, the Government will place the responsibility for correction of this condition in each specific case. The airframe contractor shall repeat the survey as is necessary to demonstrate correction of unsatisfactory conditions and shall prepare necessary corrections to submitted data. The cost of repeat survey(s) shall be borne by the airframe contractor unless the Government determines that correction of unsatisfactory vibration is not the responsibility of the airframe contractor.

3.6.8.3 POWER PLANT INSTALLATION TEMPERATURE SURVEY. - The airplane contractor shall perform flight and ground tests specified in Spec MIL-C-8678 to demonstrate that the power plant installation will meet the requirements of Spec MIL-C-8678. The results of these tests shall be submitted to NAVAIR for acceptance. Instrumentation necessary for these tests will be furnished by the Government, if available, and shall be listed as part of the Instrumentation Report by paragraph number of this specification.

3.6.8.4 COMPRESSOR INLET AND TURBINE OUTLET SURVEY. - On turbojet, turbofan and turboprop engine installations a static and total pressure survey shall be made at the compressor inlet. A total pressure

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3.6.8.4 (Cont)

survey shall also be made at the turbine outlets. These surveys shall be made for the takeoff, power approach, maximum yaw to right and to left, wave-off, near-stall to V_{max}. Air flow shall also be determined for the foregoing conditions. Instrumentation for these surveys shall be in accordance with the recommendation of the engine manufacturer as approved or modified by NAVAIR.

Inlet air pressure variation, as defined in paragraph 3.21.2 of MIL-E-5007C, shall be determined at each of the above flight conditions, and compared to the recommended values in the applicable Engine Model Specification. If the measured values exceed the Engine Model Specification maximum tolerable values, instructions shall be requested from NAVAIR.

If the airplane model being tested includes an automatic or manually variable inlet geometry system, this equipment shall be incorporated and functioning throughout these tests.

3.6.9 ARMAMENT

3.6.9.1 STRUCTURAL SAFETY. - The airplane contractor shall perform, as applicable, such ground tests and flight tests as are deemed safe by the contractor within the established flight envelope, to demonstrate the structural safety and adequacy of installations of all armament and associated equipment (Paragraph 3.16). The armament and associated equipment shall include, as applicable, guns, rockets, droppable stores, missiles, mounts, attachments, release equipment, control equipment, and bombing/navigation systems. Simulated shapes of correct weight and moment of inertia shall be used if service type equipment specified is not available.

3.6.9.2 FUNCTIONAL TESTS. - The airplane contractor shall perform functional tests as part of the tests of 3.6.9.1, to the extent that suitable operational equipment is available to demonstrate safe and proper operation of the equipment tested. Ground functional tests shall include firing of guns, missiles, and rockets as applicable; arming and rearming; fit testing; release of all droppable stores (normal and emergency release); adequacy of safety devices; adequacy of handling equipment; adequacy of installation clearances; evaluation of armament control items within the cockpit; and the operation of bombing/navigation systems. Flight functional tests shall include further evaluation of armament control items within the cockpits; tests of release and control systems; firing of guns, missiles and rockets as applicable; normal and emergency release of applicable stores; clearance of antennas by dropped or ejected stores; and the operation of bombing/navigation systems.

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3.6.10 PHOTOGRAPHIC

3.6.10.1 STRUCTURAL SAFETY. - The airplane contractor shall perform, as applicable, such ground tests and flight tests as are deemed safe by the contractor within the established flight envelope, to determine the structural safety and adequacy of installations of all photographic and associated equipment (para. 3.21). The photographic and associated equipment shall include, as applicable, cameras, mounts, camera doors and windows, viewfinders, control equipment, spare photographic equipment, and pyrotechnic illuminants. Simulated shapes of correct weight shall be used if service type equipment specified is not available.

3.6.10.2 FUNCTIONAL TESTS. - The airplane contractor shall perform functional tests as part of the tests of 3.6.10.1, to the extent that suitable operational equipment is available to demonstrate safe and proper operation of the equipment tested. Ground functional tests shall include check tests of photographic equipment listed in 3.6.10.1, check for adequacy of handling equipment, and a check for adequacy of installation clearances. Flight functional tests shall include further checks of the photographic control equipment, mounts for cameras and related equipment, accessibility and suitability of camera control panel, and the viewfinder installation.

3.6.11 INSPECTION. - A complete inspection of the airplane and components shall have been accomplished prior to the Phase I evaluation. The scope of this inspection shall be as approved by the COMNAVAIRTESTCEN during the pre-evaluation conference for that phase. The contractor shall perform the inspection under the supervision of the NAVPRO. The results of the inspection shall be reported to the NAVPRO.

3.6.12 SCOPE OF NAVY PRELIMINARY EVALUATION. - For the information and guidance of the contractor in his preparation for the Navy Preliminary Evaluation, the various phases will consist of, but not necessarily be restricted to, the following:

3.6.12.1 PHASE I. - Within the allowable flight envelope the evaluation will consist of:

(1) General.

(a) Functional checks of all installed and operating systems equipment in the test aircraft (power plant, flight control, hydraulic, electrical, avionic, instrument, armament, photographic, environmental control, and other important systems) for conformance with the design mission of the aircraft.

(b) Evaluation of equipment installations in each cockpit.

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3.6.12.1 (Cont)

(2) Flying Qualities. - Evaluation of longitudinal, lateral, and directional stability and control at a normal weight and corresponding c.g. as follows:

(a) Taxi and ground handling characteristics, hydrodynamic characteristics, including launching and beaching (as applicable).

(b) Takeoff characteristics, including cross-wind evaluation.

(c) Takeoff characteristics, including trim-angle limits and spray characteristics, for seaplanes only.

(d) Climb, cruise, maneuvering, and descent characteristics, including effects of speed brake, power, and configuration changes.

(e) Transonic and supersonic characteristics including trim and stability changes when decelerating through sonic speed at a high load factor.

(f) Buffet and vibration in flight.

(g) Control characteristics with alternate and/or emergency systems in operation.

(h) Low-speed characteristics, including stalls, wave-off, and normal and moderate crosswind landings.

(i) Carrier-approach characteristics, for carrier types.

(j) Other items that may be specifically requested by NAVAIR (e.g. spins, when applicable).

(3) Performance. - Items of paragraph 3.13.4, items specified by NAVAIR in the addendum to this specification for the particular model aircraft, and the following:

(a) Takeoff and landing distances and speeds for normal service operation.

(b) Maximum rate of climb and combat ceiling.

(c) V_{max} at high and low altitude.

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3.6.12.1 (Cont)

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(d) Acceleration and deceleration.

(e) Stall speeds in various configurations.

(f) Field carrier landing practice approach speeds (where applicable).

(g) Mission profile and preliminary cruise control.

(4) Armament. - All installed and operating armament equipment shall be tested or checked for safe and proper functioning and ability to perform the mission intended within the limitations of the established flight envelope. The applicable functional tests listed in 3.6.9.2 shall be used as a guide by COMNAVAIRTESTCEN to accomplish the desired test program.

(5) Photographic. - All installed and operating photographic equipment shall be tested and checked for proper functioning and ability to perform the mission intended within the limitations of the established flight envelope. The applicable functional tests listed in 3.6.10.2 shall be used as a guide by the COMNAVAIRTESTCEN to accomplish the desired test program.

3.6.12.2 PHASE II AND SUBSEQUENT PHASES. - Phase II and subsequent phases shall consist of:

(1) Re-evaluation of those characteristics that are affected by airplane changes installed since completion of Phase I.

(2) Evaluation of those items planned to be performed in Phase I that were not completed during that phase.

(3) Evaluation of the items of Phase I at critical combinations of airplane weight and c.g.

(4) Evaluation of the airplane for the expanded envelope and further investigation of characteristics not fully evaluated previously.

3.6.12.3 FINAL PHASE. - This phase shall consist of evaluation at critical combinations of airplane weight and c.g. to determine that the airplane is ready for INSURV Trials, including:

(1) Re-evaluation of those characteristics that are affected by airplane changes installed since completion of prior phases.

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3.6.12.3 (Cont)

(2) Evaluation of airplane to the limits of the flight envelope required for the INSURV Trials of the items of Phase I (repeating only those items affected by the larger flight envelope).

(3) During the final phase or whenever the first airplane with all systems installed and operating is in flight status and has been satisfactorily demonstrated by the contractor, an evaluation of the airplane weapons system installation shall be conducted and shall include, but not necessarily be restricted to the following:

(a) Functional and accuracy checks of gun, bomb-sight, rocket-rack, guided missile launcher, fire control, and other armament installations, systems, and equipment; photographic, electrical and electronic equipments.

(b) Flight tests of tracking characteristics and gunnery runs.

(c) Flight tests of fire control systems and firing runs at a suitable target.

(d) Flight tests of guided missile control systems including launch and guidance to intercept or impact on a suitable target.

(e) Suitability of external stores and store drops. The quantity and types of stores shall be as specified in the addendum to this specification.

3.6.13 FLYING QUALITIES TESTS (Aircraft classes and configurations shall be as defined in 6.4.3 herein).

3.6.13.1 PHASE I. - Prior to the Phase I Evaluation the contractor shall have demonstrated safety of flight under the following conditions:

(1) Takeoffs and landings at a mid-center-of-gravity position in moderate crosswinds in accordance with the procedures of tests (c) and (d) of Table 3.

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3.6.13.1 (Cont)

(2) Safe turning flight in accordance with the procedures of test (b) Table 3, at a mid c.g. position at medium and high altitude. This test shall be performed at the speeds indicated to be most critical in the estimated flying qualities report submitted by the contractor and specified in the addendum to this specification.

(3) Static longitudinal stability at a mid c.g. position in the basic and landing configurations in accordance with the procedures of test (a) Table 3.

(4) A safe simulated wave-off.

(5) Maximum yaw tests in accordance with the procedures of test (l) Table 3.

(6) For multi-engine airplanes, control for asymmetric-power flight in accordance with the procedures of test (m) Table 3.

(7) Aileron-control power in accordance with the procedures of test (n) Table 3.

(8) Aileron control at the highest equivalent airspeed specified in 3.6.14.

(9) Normal stalls in configurations PA, L and CR in accordance with the procedures of test (q) Table 3. Accelerated stall at high altitude at a speed defined in the addendum to this specification.

(10) High Mach numbers. - Within the envelope specified, the airplane shall possess safe high Mach number characteristics considering trim changes, dynamic stability, elevator power, and other pertinent parameters.

(11) Dynamic stability in accordance with the procedures of tests (j) and (k), Table 3.

(12) Air starts

(13) For multi-engine airplanes, a safe landing in accordance with the procedures of test r(2), Table 3.

3.6.13.2 PHASE II AND SUBSEQUENT PHASES. - Prior to Phase II and subsequent; Contractor's flight tests shall have demonstrated safety-of-flight for conditions of 3.6.13.1 except that the tests shall be performed over a larger flight envelope with more rapid and/or greater control deflections.

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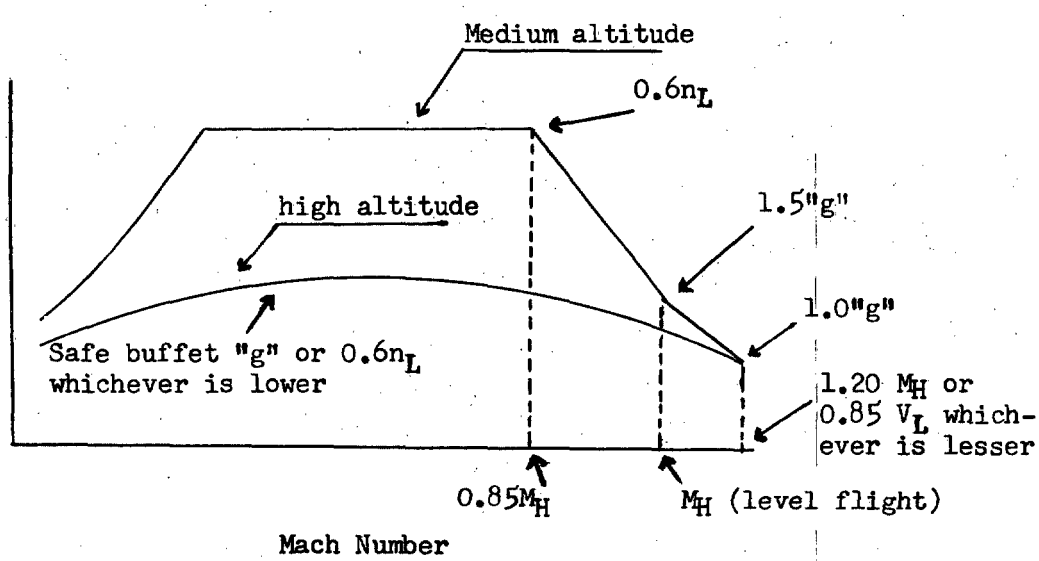
3.6.13.3 FINAL PHASE. - Prior to the final phase of the Evaluation, the requirements of 3.6.13.1 and 3.6.13.2 shall apply except that the tests shall be performed over the final phase of the flight envelope. In addition, the tests (o) and (p), of Table 3, shall have been performed by the contractor.

3.6.13.4 OTHER TESTS, FINAL PHASE. - In addition, prior to final phase of the Evaluation, the preliminary spin tests of 3.13.3.2 the applicable armament demonstration specified under 3.16 and 3.6.12.3.(3) above, and applicable equipment demonstrations of 3.17 shall have been performed by the contractor.

3.6.14 REQUIRED FLIGHT ENVELOPES. - The flight envelope required for the preliminary evaluations shall be included in the contractor's first and subsequent Demonstration Planning and Progress Reports submitted under 3.25.2.2. The contractor shall perform sufficient flight tests to substantiate minimum permissible flight envelopes as indicated below and thereby indicate safety-of-flight for evaluation by the Navy of the conditions of 3.6.13.

3.6.14.1 PHASE I (Aircraft Classes are defined in para. 6.4.3.2 herein)

(1) All aircraft except Class I aircraft.



(2) Class-I Aircraft. - The minimum required envelope shall be equal to that required for INSURV Trials as indicated in section 3.7.2.1.

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3.6.14.2 PHASE II. - The Phase I envelope shall be extended to $0.85V_L$ at least $0.6n_L$.

3.6.14.3 FINAL PHASE. - The envelope shall be expanded to V_L at n_L. Any deviation from this requirement shall be submitted to NAVAIR for approval prior to the conference of 3.5.5. Such a request shall clearly state the deviation with substantiation.

3.7 REQUIREMENTS PRIOR TO INSURV ACCEPTANCE TRIALS AND FLEET DELIVERY OF LIMITED NUMBER OF AIRPLANES

3.7.1 GENERAL

3.7.1.1 CONFIGURATION OF AIRPLANES. - All equipment and installations specified for the production aircraft shall be installed and operable except in airplanes instrumented for special tests in which the space or weight requirements for instrumentation may require the removal of certain equipment. In these special test airplanes, all applicable armament, electronic, equipment, and other items that influence aerodynamic characteristics or the center-or-gravity positions of the airplanes shall have been installed or simulated appropriately to represent airplanes scheduled for fleet delivery.

3.7.1.2 STRUCTURAL LABORATORY TESTS. - All laboratory static and dynamic tests included in contract design data requirements shall have been performed to the lower of either maximum loads and sinking speeds specified therein or to design ultimate loads or sinking speeds.

3.7.1.3 FIELD LANDING TESTS. - The tests of 3.12.2 shall have been completed.

3.7.1.4 CARRIER SUITABILITY TESTS. - For carrier type airplanes, the tests of 3.20 shall have been completed.

3.7.2 REQUIREMENTS PRIOR TO INSURV TRIALS. - The Final Phase NPE shall have been completed.

3.7.2.1 STRUCTURAL FLIGHT TESTS. - For airplanes with maximum positive limit load factors of 6 or less, the contractor shall have performed flights at his plant to the full limits specified for the tests of 3.12.4, 3.12.5, and 3.12.5.1. For other airplanes, the contractor shall have performed flights at his plant to the full limits specified for the tests of 3.12.4, 3.12.5, and 3.12.5.1, provided however, that if specifically authorized by NAVAIR in writing, after the second phase of the NPE, the required load factors specified for the tests of Table 1 other than tests (a) and (b), may be reduced to not less than 6.0 prior to INSURV Acceptance Trials. Contractors' requests for such authorizations shall include discussion of the advantages to the Government, including changes in flight-test costs of such an authorization. The contractor also shall have determined, during

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3.7.2.1 (Cont)

build-up tests at his plant, as required in 3.12.1.6, the variation of normal-force coefficient with Mach number, based on the stall, static longitudinal instability, buffet intensity, or other characteristics which limit the useful lift capabilities of the airplane.

3.7.2.2 FLYING QUALITIES. - The contractor shall have performed flight tests to demonstrate the flying qualities as specified in 3.13.2.

3.7.2.3 EQUIPMENT. - The contractor shall have performed all tests of 3.17 which have not previously been demonstrated. Electronic equipment (CFE and GFE) shall be tested as required or as specified in the addendum to this specification, to obtain the data necessary for the report of paragraph 3.25.2.8.

3.7.2.4 PERFORMANCE. - The tests of 3.13.4 shall have been completed.

3.7.2.5 HYDRODYNAMIC TESTS. - The tests of 3.14 shall have been completed.

3.7.2.6 WEAPONS SYSTEM. - The contractor shall have performed all tests required to demonstrate performance of the entire aircraft weapons system as defined by the applicable detail specification, equipment specifications and contract guarantees for conformance with the designated missions of the airplane. The Avionics tests required to accumulate the data for report of paragraph 3.25.2.8 shall have been performed by this time.

3.7.2.7 OPERATING LIMITS. - The contractor shall have submitted recommended INSURV Acceptance Trials operating limits in the Demonstration Planning and Progress Report required under 3.25.2.2.

3.7.2.8 RELIABILITY. - The tests of 3.22 shall have been completed.

3.8 REQUIREMENTS PRIOR TO INSURV NUCLEAR WEAPON TRIALS. - The requirements of 3.7.1 and 3.7.2 shall have been complied with. The armament separation tests of 3.16.6 and the applicable structural tests of 3.12.5 shall also have been performed.

3.9 REQUIREMENTS PRIOR TO FIRST DELIVERIES TO OPERATIONAL TEST AND EVALUATION FORCE(OPTEVFOR), FLEET INTRODUCTION PROGRAM(FIP), AND REPLACEMENT AIR GROUPS(RCVG). - The requirements of 3.7.1, 3.7.2, and 3.8 shall have been completed.

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3.9.1 FLIGHT MANUALS. - The contractor shall have submitted satisfactory Flight Manuals in accordance with MIL-M-7700, containing complete descriptions of flight characteristics.

3.9.2 SPINS. - The final spin tests of 3.13.3.3 shall have been performed, when applicable.

3.10 REQUIREMENTS PRIOR TO CONTINUED FLEET DELIVERIES. - The requirements of 3.7.1, 3.7.2, 3.8 and 3.9 plus all the demonstration requirements shall have been complied with. All repeated-loads tests specified in contractual documents to show compliance with minimum service life requirements shall have been performed prior to delivery to the Fleet of airplanes other than those specified in 3.9. In the event that a FIP is not scheduled, all repeated-loads tests shall have been completed prior to delivery of the first airplane to the second fleet squadron.

3.11 RESERVED

3.12 STRUCTURAL DEMONSTRATION TESTS.

3.12.1 GENERAL

3.12.1.1 ALTERNATIVE GROSS WEIGHTS. - The tests conditions specified for landplane-landing tests; seaplane takeoffs and landings; dives and pullouts; and release of stores in pull-outs, shall be attained at the airplane gross weights specified except that alternative gross weights, as approved by test authorities, may be employed for any or all of the tests provided compliance is made with both of the following:

(1) The load factors attained and the magnitudes and distributions of weight employed are such that all parts of the airplane will be loaded at least as critically as they would be loaded if the tests were made at the specified gross weights and center-of-gravity positions, and

(2) The products of load factor times gross weight attained in dives and pull-outs are not lower in absolute value than those specified.

3.12.1.2 ENGINE OPERATION DURING DIVES AND PULL-OUTS. - Dives and pull-outs shall be performed with at least maximum continuous power (or thrust) and RPM of the power plant(s) except, as specified otherwise in 3.12.4 and except that, for multi-engine airplanes, test "t" of Table 1 shall be performed with one engine inoperative. The engine that is inoperative for test "t" shall be selected by the test authority.

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3.12.1.3 OPERATION OF APPURTENANCES. - During build-up flights at the contractor's plant, appurtenances which can be put into continuous motion (such as rotation of radar antenna), which can be extended or rotated to different positions (such as an extensible radar antenna or rotating bomb-bay door), or which can be suddenly extended and suddenly retracted (such as an extensible rocket launcher), shall be operated sufficiently to determine, by a combination of test data and calculations, the effects on airplane loads and motions up to the V-n limits required for structural design of the particular item. This determination shall be discussed fully in the Demonstration-Planning and Progress Report information required by 3.25.2.2(11) after which NAVAIR will select the positions and/or motions of appurtenances required for the dives and pull-outs if such positions and/or motions are not specified in Table 1. During each flight and immediately subsequent to each flight performed in compliance with the requirements of paragraph 3.12.3 the satisfactory operation of bomb bay doors, or other appurtenances subjected to water loads, shall be demonstrated.

3.12.1.4 TRIM FOR DIVES AND PULL-OUTS. - Except as otherwise specified in 3.12.4, dives and pull-outs shall be performed with the airplane trimmed for a control force within 10 pounds of zero for each control in steady wings-laterally-level flight at the speed specified for the test. The tolerance "within 10 pounds of" is authorized to eliminate unnecessarily precise trimming during structural demonstration tests, however, it shall not be presumed that such a tolerance justifies any deviation from flying qualities design requirements.

3.12.1.5 MAXIMUM CONTROL DISPLACEMENTS. - Subject to approval of test authorities, maximum control displacements attainable as limited by normal stops in control systems or as limited by air loads which exceed maximum hydraulic system output, may be substituted for the control forces specified for dives and pull-outs.

3.12.1.6 DEVELOPMENT FLIGHT TESTING. - All of the combinations of airplane gross weight, configuration, center-of-gravity position, altitude, speed, Mach number, load factor, and cockpit control movement, including the applicable test conditions of 3.12.2, required to be demonstrated shall be attained during the contractor's development flights at the contractor's flight test facility prior to release of the airplane for structural demonstration tests at NAVAIRTESTCEN, except that those development tests applicable to the field landing requirements of 3.12.2 may be performed at NAVAIRTESTCEN. During flights in preparation for the formal demonstration tests of 3.12.2, 3.12.4, 3.12.5, and 3.12.5.1, structural loads and/or stresses in probable critical parts of the airplane, as determined by the contractor, shall be monitored to assure that the specified strength is adequate for the tests; critical limits shall be approached

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3.12.1.6 (Cont)

gradually in safe increments as approved by the cognizant test authority; the vibration and flutter tests of 4.9.1 and 4.9.2 of Spec MIL-A-8870 shall be performed as required by 3.12.6 of this document.

3.12.1.7 OPERATION OF PILOT-OVERRIDING FLIGHT CONTROL SYSTEMS. - These requirements apply to systems which can move the control surfaces independently of the pilot either by design for intended use, or because of malfunction. The influence of such systems on control-surface movements and airplane flight characteristics in dives and pull-outs shall be completely determined during the tests of 3.12.1.6, or during other applicable tests. The results of this determination shall be included in the Demonstration Data Report required by 3.25.2.5, and shall be submitted to COMNAVAIRTESTCEN and to NAVAIR at least two months prior to release of the airplane for the tests of Table 1 at the NAVAIRTESTCEN. The COMNAVAIR-TESTCEN shall determine for each of the tests of Table 1, whether the system is engaged or disengaged during the test.

3.12.1.8 VARIATION OF NORMAL FORCE COEFFICIENT WITH MACH NUMBER. - Prior to release of the airplane for the formal dives and pull-outs required to be performed by 3.12.4 and 3.12.5, the contractor shall perform flight tests at the contractor's flight test facility to determine the variation of normal force coefficient with Mach number, based on the stall characteristics of the airplane. The tests shall be performed for all combinations of loading, configuration, gross weight, and center-of-gravity position for which the performance of Test a of Table 1 is required by 3.12.4 or 3.12.5. The tests shall be performed at an altitude not greater than 20,000 feet, with engine(s) operating at that thrust which will result in the maximum lift coefficient, but not to exceed maximum continuous, and shall consist of:

(1) The airplane shall be at a speed not less than 20 knots above the stalling speed and shall be trimmed for zero control forces for unity load factor in accordance with 3.12.1.4. The speed shall be decreased at a rate not to exceed one knot per second, holding the wings laterally level until a fully developed stall is attained. A fully developed stall is attained when the airplane has developed full post stall motions and the control stick has been moved and held to the full aft position.

(2) The airplane shall be at a speed greater than the speed required for Test a of Table 1 and shall be trimmed for zero control forces for level flight in accordance with 3.12.1.4. The airplane shall enter a wind-up turn and perform an accelerated stall at a load factor of at least $0.95n_z$.

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3.12.1.8 (Cont)

(3) The airplane shall perform at least two additional accelerated stalls as described in (2), above, except that the speeds shall be incremental Mach numbers between the stalling speeds of (1) and (2), above, with corresponding incremental load factors.

The results of these flight tests shall be reported to NAVAIR in the Demonstration Data Report required by 3.25.2.5 and shall be submitted to NAVAIR and NAVAIRTESTCEN at least four weeks prior to the arrival of the airplane at NAVAIRTESTCEN for the structural demonstration tests of 3.12, excluding the structural tests of 3.12.2. (See also 3.25.2.2(10)(c).)

3.12.2 LAND-BASED AND CARRIER-BASED TAKEOFF, LANDING, AND TAXI TESTS. - For the structural demonstration tests of 3.12.2 the contractor shall provide and install instrumentation in accordance with 3.3 and to the extent necessary to comply with 3.25.2.5(12), including that necessary to determine the loads and/or accelerations acting on internal and external store stations, and on power-plant installations. The tests of 3.12.2 in combination with the analyses of 3.25.2.5(12) are required to demonstrate that the airplane has structural strength for taxiing; take-offs, including catapult launchings; and landings, including arrested landings, for the design envelope of conditions specified in Spec MIL-A-8862 for land-based airplanes and in Spec MIL-A-8863 for carrier-based airplanes. The weight distribution, including ballast as may be necessary to attain the specified gross weight and loading configurations shall be as approved by NAVAIR. Runway roughness, unprepared field, and carrier deck obstruction tests and the location for such tests shall be as specified by applicable addenda to this specification.

3.12.2.1 LAND-BASED AIRPLANES. - Taxi, including turning, braking, and pivoting, and take-off tests shall be performed at selected gross weights up to and including the maximum design gross weight specified in 6.2.2.3 of Spec MIL-S-8860 for selected critical loading configurations. The landing tests of Table 2 shall be performed at the landplane-landing design gross weight as specified in 6.2.2.6 of Spec MIL-A-8860 and at selected lesser gross weights and loading configurations that are critical and practicable. The total number of configurations to be tested shall not be less than three. The landings specified in Table 2 shall be performed for each configuration once to at least the sinking speed specified in Table 2. Alternatively, for tests 4, 5, 7, 8, and 9 only, 12 landings shall be performed at sinking speeds of at least 80 percent of the sinking speed specified in Table 2.

3.12.2.2 CARRIER-BASED AIRPLANES. - The structural demonstration requirements for catapult launchings and arrested landings are specified in 3.12.2 and in 3.20. The applicable field landing tests of

TABLE 2. - FIELD LANDING TESTS

Test	Type of Airplane	Sinking Speed (FPS)	Horizontal Speed (KN)*	Pitch Angle	Roll Angle	Roll Rate (Deg Per Sec)
1	Carrier-Based	10	$1.1V_{PAmin}$	Tail Down	Optional	Optional
2		10		Level	Optional	Optional
3		4		Optional	At least 5 Deg	Optional
4	Land-Based Trainer	17	$1.1V_{PAmin}$	Tail Down	Optional	Optional
5		17		Level	Optional	Optional
6		8.5		Optional	At least 5 Deg	Optional
7	Land-Based Except Land-Based Trainer	10	V_{PAmin}	Tail Down	Optional	Optional
8		10	V_{PAmin}	Level	Optional	Optional
9		10	$1.1V_{PAmin}$ +24	Level	Optional	Optional
10		4	$1.1V_{PAmin}$	Optional	At least 4 Deg	Optional
11		3	$1.1V_{PAmin}$	Optional	Roll-to Right-optional Angle	At least 5 to the right
12		3	$1.1V_{PAmin}$	Optional	Roll-to Right-optional Angle	At least 5 to the left

*Tolerance ±5 KN

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3.12.2.2 (Cont)

Table 2 shall be performed at the landplane landing design gross weight specified in 6.2.2.6 of Spec MIL-D-8860 at selected critical loading configurations and at selected lesser gross weights and loading configurations that are critical and practicable. The total number of configurations to be tested for these landings shall not be less than two. The landings specified in Table 2 shall be performed for each configuration once to at least the sinking speed specified in Table 2.

3.12.3 SEAPLANE TAKEOFFS AND LANDINGS. - A sufficient number of landings and takeoffs shall be performed at the design sea states under conditions of piloting techniques and sea states, as approved by the test authority, to attain 80 percent of the design sinking speed not less than 12 times. The center-of-gravity positions for all takeoffs and landings shall be the aftmost position attainable at the specified gross weight, with the spanwise distributions of mass items in or on the wing that are most critical for the wing during operation on and from the water. The speed relative to the water shall be essentially zero prior to each takeoff and shortly after each landing (that is, touch and go takeoffs and landings will not satisfy the intent of these requirements). All landings and takeoffs shall be made with progressively increasing airplane headings relative to the wave patterns to determine the extent to which selection of such a heading may become critical for any reason. For these tests, the airplane shall be instrumented to measure sinking speeds and to obtain data necessary to substantiate design loads.

3.12.4 DIVES AND PULL-OUTS WITH STORES FOR PRIMARY MISSION. - The dives and pull-outs of Table 1 shall be performed: (a) at the basic flight design gross weight. (The expression "dives and pull-outs", used here and elsewhere in this specification, is intended to refer to flights specified for the purpose of demonstrating characteristics or results which may be structurally significant). (b) The loading configuration shall include all disposable items which are intended to be carried when the airplane is performing the primary mission for which it is designed. (c) The center-of-gravity positions with landing gear retracted, shall be the maximum aft position for which limit strength is required by the structural design requirements, and, in addition, shall be the maximum forward position for which limit strength is required for all symmetrical dives and pull-outs for which the specified speed corresponds to a Mach number of 0.75 or greater. Throughout Table 1 the parameters n_z and $-n_z$ refer respectively to the maximum and minimum symmetrical flight limit load factors specified for structural design, and the parameter V_L refers to the limit speed in basic configuration specified for structural design.

3.12.5 DIVES AND PULL-OUTS WITH STORES FOR ALTERNATE MISSIONS. - With the stores for which provision is required and which are not included in the loading employed in the tests of 3.12.4, dives and

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3.12.5 (Cont)
pull-outs shall be performed as specified in this 3.12.5. The additional stores to be carried and the tests of Table 1 required in each stores-loading configuration will be specified in the applicable addendum to this specification or other contractual document by reference to the pertinent tests of Table 1. For each of the tests: (a) the airplane gross weight shall be the basic flight design gross weight plus the weight of the store(s); (b) the speed shall be the speed specified in Table 1; (c) the load factor shall be such as to attain the same product of gross weight times load factor as is specified for the corresponding test in Table 1; (d) the center-of-gravity positions shall be those resulting from loading the airplane to attain the weight and center-of-gravity positions specified for the corresponding test of Table 1 and then adding the store, thus minimizing the need for changes of ballast.

3.12.5.1 RELEASE OF STORE IN PULL-OUT. - For each of these tests, the following shall apply: (a) the airplane gross weight shall be the basic flight design gross weight plus the weight of the store; (b) the store shall be that store, for which provision is required, the release of which in accelerated flight will cause the greatest jumps in load factor; (c) the center-of-gravity positions shall be the maximum forward and the maximum aft positions for which limit strength is required, if the store is intended to be carried while the airplane is performing the primary mission for which it is designed, otherwise the center-of-gravity positions shall be the maximum forward and maximum aft positions determined as specified in 3.12.5; (d) the store shall be released while the airplane is executing a steady symmetrical pull-out at the speed, at each specified center-of-gravity position, which will result in the greatest load-factor jump; (e) the pull-out load factors, including the load-factor jumps, shall be the maximum safe load-factors.

3.12.6 FLIGHT FLUTTER AND VIBRATION TESTS. - Flight flutter and vibration tests in accordance with Spec MIL-A-8870 shall be performed to demonstrate that the airplane is free from flutter, and is free from excessive vibration affecting the structural integrity of the airplane and the safety and/or comfort of the crew. Flight flutter and vibration tests planning, instrumentation, letter, occurrence, and official reports shall be submitted in accordance with Spec MIL-A-8870 and as required by Spec MIL-D-8706 and 3.25.2.5 of this document.

3.13 AERODYNAMIC DEMONSTRATION TESTS

3.13.1 GENERAL

3.13.1.1 GROSS WEIGHT AND CENTER-OF-GRAVITY POSITIONS. - The maximum aft and maximum forward center-of-gravity positions shall be the maximum positions that can be obtained with any service loading combination attainable as defined in Spec MIL-W-25140. The gross weight for a specified center-of-gravity position shall be approximately that

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3.13.1.1 (Cont)

corresponding to a service loading which would occur with the specified center-of-gravity position. Where neither the weight nor the center-of-gravity position is specified, a combination representative of planned service use of the aircraft shall be used.

3.13.2 FLYING QUALITIES

3.13.2.1 OPERATING FLIGHT ENVELOPE. - Flying qualities tests shall consist of quantitative flight-test measurements demonstrating compliance with selected requirements of Spec MIL-F-8785 within the boundaries of the operating flight envelope defined in 3.1.3 therein, and which are outlined in Table 3 as modified by the detail spec. The terminology used in the table is that employed in Spec MIL-F-8785, or defined in 6.4.3.

3.13.2.2 MAXIMUM PERMISSIBLE SPEED ENVELOPE. - The flight characteristics within the maximum speed envelope specified in 3.1.4 of Spec MIL-F-8785 and demonstrated under Table 3(e) and (o), shall be such as to permit the limits required for the structural demonstration to be accomplished to the extent that those limits are included in contract structural design requirements.

3.13.2.3 ALTITUDES. - Altitudes under 4,000 feet in Table 3 are altitudes above terrain.

3.13.3 SPINS. - Spins shall be demonstrated to define clearly the post-stall, spin, and spin-recovery characteristics under all conditions in which such motions are likely to be encountered in fleet operations; and to provide all necessary information on which to base Flight Manual instructions regarding spin and spin-recovery characteristics. This paragraph defines certain basic spins to be demonstrated in flight upon which contractual and planning documents may be based, and also describes procedures whereby periodic review of the spin program may be accomplished. The periodic reviews are intended primarily to determine whether or not changes to the basic program are necessary in light of information obtained from model tests and flight buildup tests. Reductions or expansions to the basic spin program will be accompanied by appropriate contractual action.

3.13.3.1 REQUIREMENTS PRIOR TO DEMONSTRATION. -

(a) An acceptable Spin Demonstration Schedule Report of 3.25.2.7 shall have been submitted.

(b) The anti-spin device of 3.1.6 shall have been approved, checked out in a critical spin condition and be installed in working condition.

(c) The Spin Demonstration Planning Conference of 3.5.6 shall have been held.

TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
a(1)	Elevator Control Force Gradient Straight Flight	PA NSL (Normal Service Landing)	Max Aft	1.15 $V_{S_{PA}}$ or minimum usable approach speed	PLF	Not greater than 1000'	The airplane shall be trimmed for zero control forces in wings level flight. It shall be demonstrated that pull forces are required to maintain speeds lower than trim speed and that push forces are required to maintain speeds higher than trim speed.
a(2)		P NSL		$V_{R/C_{MAX}}$ @20,000 ft.	NRP	20,000 ft.	
a(3)		CR NSL		V for max range	Cruise	Best Cruise	
a(4)		P NSL		V_{MAX}	MRP	5000 ft.	
b(1)	Elevator Control Force Gradient Turning Flight	P NSL	Max Aft	V_{NRP}	NRP	10,000 ft.	With the airplane trimmed for zero control forces in wings laterally level flight, the elevator control force required for steady turning flight shall be measured at load factors up to $0.8n_L$ in increments of 0.5. The ratio of each measured control force, excluding break-out force, to the corresponding normal acceleration (g-1) shall be shown
b(2)				Altitude and speed where $F_{s/g}$ is expected to be minimum as indicated in the estimated flying qualities report.			
b(3)			Max Fwd	V_{NRP}	NRP	10,000 ft.	

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
b(cont) (4)			Max fwd	Altitude and speed where F_s/g is expected to be maximum as indicated in the estimated flying qualities report.			to be not less than $21/(n_L-1)$ lbs/g for Class I and III airplanes, $45/(n_L-1)$lbs/g for Class II airplanes, and not less than 3 lbs/g in any case and not greater than $56/(n_L-1)$ lbs/g for Class I and III airplanes and $120/(n_L-1)$ lbs/g for Class II airplanes.
c	Elevator Control Power-Takeoff	TO NSL	Most Critical Nose Heavy Moment for Nose Wheel or Bicycle Gear Airplanes or Most Critical Tail		Take Off	Ground Level	(1) If the take-off performance is guaranteed in the airplane contract, it shall be demonstrated that the attainment of these guarantees is not limited by elevator control effectiveness. (2) If the take-off performance is not guaranteed in the airplane contract, it shall be demonstrated that: (a) for nose-wheel and bicycle gear airplanes-the elevator effectiveness is adequate to obtain take-off attitude at speeds not greater than 1.0 V_{STO} for Class I, II, and III airplanes. (b) for tail-wheel airplanes-the elevator effectiveness is adequate to maintain

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
c(cont)			Heavy Moment For Tail Wheel Air-planes				any attitude up to thrust line level at speeds not greater than 1.0 V_{STO} for Class II and III airplanes and 0.5 V_{STO} for Class I airplanes. It shall also be demonstrated that the elevator control forces are within the following limits throughout the take-off and acceleration to 1.3 V_{STO} without changing power, trim, gear or flap settings. Nose-Wheel and Bicycle Gear Airplanes Class I, III-C 20 lb. pull to 10 lb. push Class III-L, II-C 30 lb. pull to 10 lb. push Class II-L 50 lb. pull to 20 lb. push Tail-Wheel Airplanes Class I,II-C, III 20 lb. push to 10 lb. pull Class II-L 35 lb. push to 15 lb. pull
d	Elevator Control Power-Landing	PA Normal Landing Weight	Max Fwd	1.15 $V_{S_{PA}}$ or minimum usable approach speed	Approach	Close proximity to ground	With the airplane trimmed for zero control force with flaps, slats, speed brakes, canopy, etc.; in the positions normally associated with the landing approach it shall be demonstrated that the elevator control is capable of developing the stall or the design landing speed in the landing configuration in close proximity to the ground with the elevator

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
d(cont)							control pull force not exceeding 35 lbs. for Class I, II-C or III airplanes or 50 lbs. for Class II-L airplanes.
e(1)	High Mach Number Characteristics	P NSL	Max Fwd	V_H	Max Available	Optimum cruise or combat ceiling, whichever is less	With trim held fixed, perform a dive to the highest attainable mach number within the operational envelope. Without retrimming, the longitudinal control forces required in the dive shall be shown as not exceeding the following limits: Class II 75 lb. push or 15 lb. pull Class III 50 lb. push or 10 lb. pull
e(2)							Repeat test e(1), but with trim optional following the dive entry, it shall be shown to be possible with normal piloting technique to maintain forces within the following limits: Class II 15# push or pull Class III 10# push or pull
e(3)							Perform a 50° dive with idle power to maximum operational speed (M_M), continuing the dive at the appropriate dive angle to maintain M_M until initiation of pull-out at 5000 ft. terrain clearance or min. safe altitude whichever is greater. At a trim setting at which, immediately prior to recovery, the longitudinal

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
e(3) (cont)							control force is 10 lb. or less push or pull for Class III airplanes or 15 lbs. push or pull for Class II airplanes, it shall be demonstrated that pull out of at least $.8N_L$ can be made without an elevator force per "G" exceeding the maximum allowed by the following: Class III $56/(N_L-1)$ lb./g Class II $120/(N_L-1)$ lb./g
e(4)							Perform a 50° dive to maximum permissible Mach number (M_D), continuing the dive at appropriate dive angles maintain M_D until initiation of pull-out at 4000 ft. terrain clearance or min. safe altitude, whichever is greater. With trim optional in the dive, it shall be shown to be possible to maintain the longitudinal control forces within the limits of 50 lb. push or 35 lb. pull in dives to the highest attainable Mach number within the maximum permissible speed envelope. The forces required for recovery from these dives shall not exceed 120 lb. Trim deceleration devices, etc., may be used to assist in recovery provided that no unusual pilot technique is required. Tests e(1) through e(4) shall be performed with and without speed brakes extended at time of dive entry.

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
f	Deceleration Device Effectiveness		Normal	V_H			To be demonstrated in accordance with detail specification requirements.
g(1)	Maneuvering Boundary	CR	Normal	$V_{R/C\ max}$ to V_H	PLF	Optimum Cruise	This test shall demonstrate the buffet onset characteristics of Class II and III airplanes from both wings level pullups and turning flight. Buffet onset shall be based on buffet at the airplane C.G. of ±0.05G normal acceleration.
g(2)		P	Max Fwd				With the airplane trimmed for level flight the maximum obtainable steady state load factor shall be demonstrated on Classes II and III airplanes except as limited by structural considerations.
h(1)	Trim Change Due To Power	PA NSL	Max Fwd	1.15 V_{S_L} or normal approach speed whichever is less	Approach	Not greater than 1000'	With the airplane trimmed for zero control forces, take-off power shall be applied and the elevator control force required to maintain the same altitude shall be shown to be less than 10 lbs. for Classes I and III airplanes and less than 20 lbs. for Class II airplanes.
h(2)			Max Aft attainable at permissible landing weights				

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
i	Trim Change Due To Deceleration Device	P NSL	Most Critical as Indicated in the Estimated Flying Qualities Report	V_{PLF}	MRP	25,000'	The airplane shall be trimmed for zero control forces in wings level flight. It shall be demonstrated that when the deceleration device is actuated, the elevator control force required to maintain the same point of aim shall be less than 10 lbs. for Class III planes only. Normal acceleration change, with stick fixed, if any, shall not exceed 0.25g.
j(1)	Dynamic Longitudinal Stability	P NSL	Normal	V_H	Max Available	35,000' or Critical Altitude Whichever is the Lower	It shall be demonstrated that the short period dynamic oscillation of normal acceleration produced by moving and quickly releasing the longitudinal control, damps to 1/10 amplitude in not more than one cycle. The magnitude of any residual oscillations shall not exceed ±0.05g at the pilots location. This characteristic shall be demonstrated from an initial disturbance to approximately zero-g normal acceleration and also from an initial disturbance to 2.0g. If a pitch damper is installed, the test shall be repeated with the pitch damper inoperative and the oscillations shall damp to 1/2 in one cycle. The latter test
j(2)		CR NSL		Most Critical as Indicated in the Estimated Flying	PLF		

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
j(2) (cont)				Qualities Report between $V_{R/C_{MAX}}$ and V_H			shall be demonstrated for unarmed aircraft only.
j(3)		PA NSL		1.15 V_{S_L} or Normal Approach Speed whichever is less		Not greater than 1000'	
k(1)	Dynamic Lateral Stability	P NSL	Normal	V_H	MRP	35,000' or Critical Altitude whichever is the lower	The airplane shall be placed in a steady, wings-level sideslip using moderate rudder deflection as required. The controls shall be release suddenly and it shall be shown that the resulting lateral-directional oscillation shall be such that the damping parameter $1/C_{1/2}$ has a value not less than that required by Curve A, Figure 1 of Spec. MIL-F-8785 or at least 1.73, whichever is applicable. It shall also be shown that there are no residual undamped oscillations.
k(2)		CR NSL		$V_{MAX_{R/C}}$	PLF		
k(3)		PA NSL		1.15 $V_{S_{PA}}$	PLF	Not greater than 3000'	

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
[1](1)	Maximum Yaw	G NSL	Normal	1.2 V_{S_G} for Class I-L, II-L, III-L 1.15 V_{S_G} for Class I-C, II-C, III-C	PLF	Not greater than 1000'	Apply full rudder and maintain a constant heading for at least 15 seconds by whatever angle of bank may be necessary. The rudder-pedal force required for full rudder control displacement shall be demonstrated to be such that a right pedal force accompanies nose-right sideslip and left pedal force accompanies nose-left sideslip.
[1](2)		PA NSL		1.2 $V_{S_{PA}}$ for Class I-L, II-L, III-L 1.15 $V_{S_{PA}}$ for Class I-C, II-C, III-C	Approach		

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (&MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
m(1)	Control for Asymmetric Power	TO Lightest NSL	Aft.	$1.2V_{S_{TO}}$	Take-off	Not greater than 2000 ft.	The critical engine shall be cut and no corrective action taken until two seconds has elapsed or 20 degrees bank angle has developed. It shall be demonstrated that the airplane is safely controllable throughout the ensuing motions and that, following the transients, the rudder and ailerons are capable of holding the airplane to zero yawing and rolling velocities with not more than five degrees angle of bank. The rudder pedal forces and aileron forces shall not exceed 180 pounds and 20 pounds respectively. Automatic devices that normally operate in the event of power failure, may be used. For propeller aircraft without automatic feathering, the inoperative engine shall be windmilling with the propeller at the low-pitch setting. For propeller-driven aircraft with automatic feathering, the test shall be repeated with the inoperative engine windmilling and propeller at low pitch setting except that it is required only that the airplane be safe, no bank angle or force requirements being specified.
m(2)				Minimum speed as determined from			To be demonstrated to show that capabilities meet the design requirements set forth in the detail spec for Class II-C and III airplanes.

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
m(2) (cont)				Build-up flight tests based on dynamic engine out control speed criterion specified in the Detail Specification			
m(3)		P(climb) Lightest NSL		1.4 V_{S_G}	NRP	5000'	With the most critical engine inoperative and with the other engine or engines developing normal rated power, it shall be demonstrated that the airplane can maintain a constant heading by sideslipping and banking. Trim shall be as required for wings level straight flight with symmetrical power.
n	Lateral Control (Power Approach Configuration)	PA NSL	Normal	1.1 V_{S_L}	Approach	Not greater than 2000'	At constant altitude, trimmed steady 45 degree banked turn with the rudder held fixed in its trim position, or permitted to be free in the case of aileron-rudder interconnect systems, the lateral control shall be shown to be of sufficient power to roll the

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
n(cont)							airplane with a helix angle, pb/2v, equal to the following: Class I 0.09 Class II-L 0.07 Class II-C and III Average pb/2v = 0.05 for first 30 degrees of bank, where, average pb/2v is based on an average p obtained from the time required to reach 30 degrees of bank. Note: See test "o" for stick or wheel forces.
o(1)	Lateral Control	P NSL	Normal	$.8V_H$ for Class I, $.8V_H$ or 300 knots when V_H is below 300 knots $.6V_H$ and $.8V_H$ when V_H is above 500 knots for Class II, or	As required	7500'	At constant altitude, wings level flight with the rudder control held fixed in its trim position, or permitted to be free in the case of aileron-rudder interconnect systems, the lateral control shall be shown to be sufficient to roll the airplane to helix angle valves as shown for the following classes and speeds. Class I pb/2v = .09 at 0.8 V_H where V_H is less than 500 knots.

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
°(1) (cont)				$V_{R/C\ max}$ for Class III.			Class II: pb/2v = .07 at 0.8 V_H or 300 knots, whichever is lower. Where V_H is greater than 500 knots, pb/2v = 0.07 up to $0.6V_H$ and pb/2v = 0.05 at $0.8V_H$. Bank angle = 90 degrees in 1 second at $V_{R/C_{max}}$ to M_H. Class III: Bank angle = 30 degrees in 1 second.
°(2)				$V_{R/C_{max}}$ for Class III		Combat Ceiling	It shall also be shown that the aileron control forces required for the specified rates of roll do not exceed the following: Class I: 25 lb stick force or 50# wheel force Class II: 25 lb stick force or 50# wheel force Class III: 20 lb stick force or 40# wheel force Class IIC and IIIC: 20 lb stick force or wheel force in configuration PA
°(3)				M_H		7500'	At $0.8V_H$ the peak lateral control force required to obtain the specified rolling performance shall not be less than 1/2 the above values.

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
o(cont) (4)				M_M		Not greater than 10,000'	
o(5)				V_L			It shall be demonstrated that the lateral control is capable of rolling the airplane in the proper direction without excessive control forces with a rate of roll of at least 15 degrees per second. This test shall be repeated with external stores.
P(1)	Power Control System	P NSL	Max Fwd	V_H	PLF	5000'	If the alternate system is not an independent power system, it shall be demonstrated that out-of trim conditions resulting from a transfer at the same flight conditions do not exceed the following: (a) Pitch. - With controls free, that the change in normal acceleration does not exceed ±0.5 g. (b) Roll. - With controls free, that the resulting rate-of-roll does not exceed 5 degrees per second. (c) Yaw. - That the rudder control force required to maintain zero side-slip does not exceed 100 pounds. With the airplane trimmed, it shall be demonstrated that it is possible, with the primary control system inoperative, to obtain at least

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
p(1) (cont)							3g on Class III airplanes, and at least 1.5g or $0.6n_L$, whichever is less on all other airplanes. Elevator control forces in this maneuver with the airplane trimmed for 1g flight shall not exceed the following limits: Class I - 75 lbs. Class II - 150 lbs. Class III - 120 lbs.
p(2)						7500'	It shall be demonstrated that with the primary control system inoperative, that the lateral control is sufficient to produce a rate of roll of at least 15 degrees per second with lateral forces not exceeding 30 lbs. stick force or 60 lbs. wheel force.
p(3)		PA NSL	Optional	$1.1V_{S_{PA}}$ or min. useable approach speed	Approach	1000'	It shall be demonstrated that with the primary control system inoperative, that the lateral control is sufficient to produce a rate of roll of at least 15 degrees per second or 50 per cent of the pertinent requirement of test "p", whichever is less, with lateral control forces not exceeding 30 lbs. stick force or 40 lbs. wheel force.
p(4)			Max Fwd	$1.4V_{S_L}$ for land			It shall be demonstrated that with the primary control system inoperative, that with the elevator control force trimmed to within

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
P(4) (cont)			Max Fwd	based airplanes or $1.15V_{S_L}$ for Carrier based airplanes			5 lbs., it shall be possible to execute a safe landing with elevator control forces not exceeding the following limits: Class I, II-C, III - 35 lbs. Class II-L - 50 lbs. stick force or 80 lbs. wheel force
P(5)		L Normal Landing Weight For Class II-C & Class III Airplanes Only	Optional	$1.1V_{S_{PA}}$	Idle	1000'	It shall be demonstrated that with the primary control system inoperative that the average helix angle obtainable over the first 30 degrees of bank angle shall be at least pb/2v (avg) = 0.02, where average pb/2v is based on an average p obtained from the time required to reach 30 degrees of bank, with lateral force not exceeding 20 lb. stick force or wheel force.
P(6)		D NSL		V_D	As Required	Combat Ceiling	It shall be demonstrated that it is possible to recover from a dive of 50° (or the dive angle resulting in V_D, whichever is less) with the primary control system rendered inoperative at 20,000 feet of minimum safe altitude, whichever is higher, with the elevator control forces not exceeding 120 lbs. The longitudinal trim at the start of a pull-out shall not exceed a push or pull force of 10 lbs. The use of an auxiliary dive recovery or deceleration device having an independent

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
p(6) (cont)							power supply is permissible during the recovery. During this maneuver, change in lateral and directional trim shall be at least controllable without unusual pilot manipulation.
q(1a)	Normal Stalls	L NSL	Max Fwd	At Least V_{S_L}+20	Idle	10,000	In performing stalls, the airplane shall be shown to exhibit a stall warning in the form of buffeting or shaking of the controls, a marked increase in rearward travel of the control column or marked increase in control force for speed reduction or small amplitude pitching or rolling motions. The stall warning shall occur at a speed between 1.05 and 1.15 times the stalling speed in configurations G, L, and CR and between 1.05 and 1.10 times the stalling speed in configuration PA. In addition, it shall be shown that stalling is followed by nosing over (a mild controllable pitch up is permissible) of the airplane, without excessive rolling or diving, and recovery from the stall is effected by normal use of the controls with altitude loss for stall recovery as low as possible.
q(1b)			Max Aft				
q(2a)		PA NSL	Max Fwd	At Least $V_{S_{PA}}$+20	PLF	10,000'	
q(2b)			Max Aft				
q(3a)		G NSL	Max Fwd	At Least V_{S_G}+20	Idle	10,000	
q(3b)			Max Aft				
q(4a)		P NSL	Max Fwd	At Least V_S+20	NRP	10,000	In performing the normal and inverted stalls, the airplane shall start in steady flight at a speed not less than 20 knots above the stalling speed at an altitude such as to
q(4b)			Max Aft				

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
q(cont)							insure complete recovery from the stall at not less than 5000' from the ground. The speed shall be decreased at not more than one knot per second, holding the wings laterally level until the fully developed stall is attained. The fully developed stall is considered to have been obtained when the stick has been moved and held to either the full aft, or for inverted stalls, to the full forward position.
q(5a)	Accelerated Stalls	P NSL	Max Fwd		NRP	10,000'	Accelerated stall in a 3g turn - for Class III airplanes
q(5b)			Max Aft				Accelerated stall in a 2g turn - for Classes I and II airplanes
q(6a)	Inverted Stalls	P NSL	Max Fwd	At Least V_S+20	NRP	20,000'	Inverted Stall-Class III airplanes only
q(6b)			Max Aft				
r(1)	Power-off Landing	L NSL	Normal				For Class III airplanes, it shall be demonstrated by actual test that a descent, approach and landing at 1.3 V_{S_L} in moderately rough air can be accomplished safely, under conditions of total engine failure or fuel exhaustion at altitude.
r(2)							For Class II and III jet airplanes, a safe descent, approach and landing at 1.3 V_{S_L} shall be demonstrated with a simulated

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
r(2) (cont)							single engine seizure at altitude. If the airplane is fitted with more than one engine, the seized engine shall be the one that would be most critical. Seizure may be simulated by permitting the seized engine to windmill; however, the effect of the windmilling engine on the power control systems shall be eliminated by means of a cockpit control or otherwise at the time of simulated engine failure and shall remain eliminated thereafter until the landing has been completed.
s	Landing with backup flight control	PA NSL	Normal	$1.15V_{S_{PA}}$	Approach	At least 1000' above runway	It shall be demonstrated by actual tests that a descent, approach and landing in moderately rough air can be accomplished safely using the backup flight control system.
t	Inertia-Coupling	To be specified by the contractor					Under the most critical allowable conditions of altitude, speed, rolling rate and longitudinal control input as indicated by contractor analysis and specified in the demonstration addendum, it shall be demonstrated that no uncontrollable conditions exist in 360° rolls.
u	Artificial Stability Devices	The conditions under which these failures are demonstrated, shall be the most critical and shall be defined in the addendum to this specification					If several artificial stability devices are operating simultaneously and if a single component failure can fail all artificial stability devices simultaneously, such failure

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
u(cont)							shall be simulated and it shall be demonstrated that: (1) The airplane is safely controllable at the time of failure and subsequently throughout the recovery to and during normal flight. (2) The lateral-directional oscillation is such that $1/C_{1/2}$ is equal to at least 0.24. (3) $1/C_{1/2}$ in configuration PA has a value at least as high as that required by curve B of figure 1 of Specification MIL-F-8785(ASG). (4) A safe landing at allowable landing speeds can be made without unusual piloting techniques. If the artificial stability devices are independent, each one may be failed separately.
v	Longitudinal Control System Sensitivity	Most critical conditions of aircraft loading, altitude and airspeed to be determined from analysis and flight build-ups.					It shall be demonstrated that there is no tendency for divergent or uncontrollable oscillations resulting from efforts of the pilot to maintain steady flight. The conditions for this test shall be determined from analysis and flight build-ups, and shall be shown and justified in the Demonstration Planning and Progress Report.

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
$^{w}(1)$	Cross-wind Take-off	TO Weight/ Inertia loading most critical	Aft		Take-off	Ground Level	It shall be demonstrated that the rudder and lateral control in conjunction with other normal means of control are adequate to maintain straight paths on the ground during take-offs and landings in a cross-wind. This shall be demonstrated at the weight/inertia loading conditions (both lateral and longitudinal) most critical for the test of minimum take-off speed and minimum landing touch-down speed. Compliance with the above requirement shall be fulfilled by submitting time histories showing aircraft attitudes and rates about all axes, pilot control inputs, altitude, distance, etc. The time histories shall start from the initial take-off roll and terminate at an altitude of 50' for take-offs and start from an altitude of 50' and terminate when the airplane has completed its landing.
$^{w}(2)$	Cross-wind landing	PA_{MIN} TO Weight/ Inertia Loading most critical	Aft	$V_{PA_{MIN}}$	Approach	At least 50' above runway	
x	Trim System Runaway	Most critical conditions of aircraft loading, altitude and airspeed determined from analysis and flight buildups.					It shall be demonstrated that longitudinal trim system runaways, to limit deflections in either direction from a level flight trimmed condition, do not result in dangerous or uncontrollable transient or steady flight conditions. Further, unless emergency override provisions are incorporated, it shall

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TABLE 3
FLYING QUALITIES

Tests No.	Tests Name	Config. and Test Gross Weight	C.G. (%MAC)	Trim Speed (KEAS)	Power Setting	Pressure Altitude (Ft.)	Description of Demonstration Required
x(cont)							be demonstrated that a descent, approach and landing at $1.3V_{SL}$ in moderately rough air can be accomplished safely. The flight conditions and configurations for these tests shall be shown and justified in the Demonstration Planning and Progress Report.

NOTE: Yaws and rolls shall be demonstrated to the right and to the left.

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3.13.3.2 PRELIMINARY SPIN TESTS. - For airplanes of Classes I and III as defined in 6.4.3.2, the contractor shall perform spins at or near the contractor's plant and submit information relative thereto as follows: Spins shall consist of at least two full turns in each direction out of unaccelerated and accelerated stalls at high altitude in the clean configuration with all controls held in the full pro-spin direction. Time histories of the altitude; control positions and forces; angles of bank, pitch, and yaw; of the three angular velocities of the airplane; and of the normal accelerations of the center-of-gravity of the airplane, shall be recorded and reported. The reported results shall contain complete descriptions of the entry, spin, and recommended recovery techniques, and shall include records of adequate telescopic photographic coverage by ground and air cameras. This report shall contain all applicable data not previously included in report of 3.25.2.7 below and shall refer to that data previously submitted.

3.13.3.3 FINAL SPIN TESTS

3.13.3.3.1 BUILD-UP FLIGHT TESTS. - A spin build-up flight test program shall be conducted to determine spin entry, spin, and spin recovery characteristics in sufficient detail to establish the spin demonstration conditions defined in paragraph 3.13.3.3.2. During the tests the critical pro-spin control positions, the critical spin direction, and recommended recovery procedures shall be determined for each entry condition, type of spin (i.e. erect or inverted), and specified loading. The results of the model tests of 3.25.2.7 shall be used as a guide in conducting the program. During the course of this program the effects of automatic stabilization and control devices shall be investigated.

3.13.3.3.2 TYPES OF SPINS, ENTRIES, CONFIGURATIONS AND LOADING CONDITIONS. - The contractor shall perform the formal spin demonstrations contained in Table 4. Center-of-gravity location, spin direction and control position shall be those necessary to produce the most critical spins. Critical spins are those requiring the maximum number of turns for recovery and/or those from which recovery is most difficult. Automatic stabilization and control devices shall be in normal operation during the spins.

3.13.3.3.3 CONTROL POSITIONS. - The most critical lateral control inputs shall be determined during model spin tests and confirmed as early as possible during the flight spin build-up program as indicated in 3.13.3.3.1 and shall be used for flight demonstration. If model tests do not reveal the critical direction of lateral control, this input shall be determined as early as possible during flight spin build-up. Only the critical lateral input so determined shall be utilized for subsequent build-up and demonstration. During all spins, the longitudinal and directional controls shall be held in full pro-spin positions for the required number of turns.

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TABLE 4

TYPE OF SPIN, SPIN ENTRY, CONFIGURATION	LOADING CONDITIONS
(a) Erect spin, cruise configuration. (1) From a 1g stall with cruise power. (2) From at least a 2.6g accelerated stall with power for constant altitude turn.	A, B, C, D, E
(b) Inverted spin, cruise configuration. (1) From a steady state inverted stall with power required to obtain spins.	A, B, E
(c) Erect spin, landing configuration, approach power (1) From a 1g stall.	A, B, C
(d) Vertical entry spin, cruise configuration. Spins from vertical entries shall be entered from attitudes between 80° and 90° and between 90° and 100° to the horizontal in the manner prescribed below. The initial speed at which the specified attitude is attained shall not be less than 1.4 V_{S_G}. The control position specified shall be held until the resulting motions are clearly defined and recognizable. Maintain specified attitudes until forward velocity equals 1.1 V_{S_G}, or minimum speed for control effectiveness, whichever is the lower, fish-tailing the airplane between +15° sideslip or that attainable by full rudder, whichever is less, while maintaining essentially zero roll. At approximately 1.1 V_{S_G} or minimum speed for control effectiveness, whichever is the lower, apply abrupt full rudder in the direction of the yawing motion, followed by abrupt full pro-spin lateral control and abrupt longitudinal control (full aft for the 80° - 90° attitudes, full forward for the 90° - 100° attitudes).	A, B, E
(e) Erect spin, dive configuration (1) From a 1g stall. (2) From at least a 2.6g accelerated stall	A, C

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TABLE 4 (Cont)

TYPE OF SPIN, SPIN ENTRY, CONFIGURATION	LOADING CONDITIONS
(f) Erect spin, asymmetric power (1) From a 1g stall holding MRP on one engine and idle on the other. Spin into direction of idle engine.	A, B

NOTES: Loading Conditions

(A) critical internal loading
(B) critical external loading + 60% internal fuel
(C) critical combined internal and external loading
(D) critical asymmetric external loading
(E) if the parameter IYMP for loadings A through D traverse from negative to positive values, an additional configuration shall be added which has an algebraic value of IYMP at or near zero.

Critical loadings and c.g. positions are those which are expected to require the greatest number of turns for recovery and/or those from which recovery is most difficult.

3.13.3.3.4 POWER. - In general, power at entry shall be maintained from entry to initiation of spin recovery procedure. Throttle may be retarded during recovery. Under special circumstances, throttle may be retarded shortly after entry to prevent damage to the engine. As appropriate, the Contractor may request such a waiver from NAVAIR.

3.13.3.3.5 NUMBER OF TURNS. - The following number of turns is required except that a lesser number of turns will be permitted if it can be shown to the satisfaction of the procuring agency or witnessing authority that (a) fully developed spins have been attained in the lesser number of turns or (b) a lesser number of turns is required for reasons of safe terrain clearance.

Erect - 5 turns

Inverted - 3 turns

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3.13.3.3.5 (Cont)

The number of turns shall be counted from the heading which exists at the time of control application to the heading which exists at the time of application of recovery control.

3.13.3.3.6 SPIN RECOVERY. - For all spins except as noted, spin recovery shall be accomplished within two turns from the initiation of recovery control application. The procedure required for recovery shall not involve unusual or difficult pilot techniques, shall be within the pilot's capability and shall be consistent and repeatable. The cockpit control forces for recovery shall not exceed the following values:

Rudder (directional control) - 250 pounds

Elevator (longitudinal control) - 75 pounds

Aileron (laterial control) - 35 pounds

The use of the primary flight controls above is preferred for spin recovery. Auxiliary devices to assist spin recovery, however, are permissible but must be specifically approved by NAVAIR.

The number of turns for recovery shall be counted from the heading which exists at the time of application of recovery control to that heading which exists at the time recovery to controlled flight is attained.

3.13.3.4 INSTRUMENTATION AND MOTION PICTURE COVERAGE REQUIRED. - Instrumentation shall be satisfactory for obtaining time histories of the following parameters starting before initiation of the spin and continuing until recovery to level flight: altitude, airspeed, control surface positions, stick and pedal positions, and angles and rates of pitch, roll and yaw, angles of attack and sideslip, positions of any devices, such as slats, which are operable during the spin, magnetic heading, and normal and lateral acceleration of the center-of-gravity.

3.13.3.5 MOTION PICTURE COVERAGE OBJECTIVES. -

(1) A camera mounted on the test aircraft with a wide angle forward view of sky or ground such that an indication of number of spins turns may be determined.

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3.13.3.5 (Cont)

(2) Indication of full directional and longitudinal control deflection on film record.

(3) Adequate time base correlation between film record and oscillograph.

3.13.4 PERFORMANCE TESTS. - Performance tests when properly performed and documented are intended for use in the determination of compliance with contract performance guarantees and to provide early flight test data to show performance capabilities. Performance shall be demonstrated as follows:

(1) The performance guarantee items specified in the applicable Detail Specification identified by paragraph number, and Detail Specification number and date in the pertinent addendum to this specification.

(2) Other items specified by NAVAIR in the addendum to this specification or other contract documents for the particular model airplane.

3.13.5 DRAG MEASUREMENTS. - The variation of drag coefficient with lift coefficient shall be determined in flight at subsonic, transonic and supersonic Mach number as applicable for the specific airplane concerned.

3.14 HYDRODYNAMIC DEMONSTRATION TESTS

3.14.1 GENERAL. - These tests shall be performed in combination with or, alternatively, in addition to the seaplane takeoffs and landings of 3.12.3 for the purpose of demonstration control effectiveness and control forces during takeoffs and landings, freedom from porpoising and skipping during calm-water takeoffs and landings, handling characteristics on the water in sheltered and open-sea operations, and freedom from objectional spray. If the airplane is designed to takeoff and land with boundary-layer control or other system of lift augmentation in operation, the demonstration specified below shall be performed with the system operative. Additional demonstrations shall be performed, when specified, with the system inoperative.

3.14.2 AIRPLANE WEIGHTS AND LOADINGS

(1) Basic sheltered-water design gross weight. - This weight shall be the maximum for which takeoff from sheltered water is practicable.

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3.14.2 (Cont)

(2) Basic rough-water design gross weight. - This weight shall be the maximum for which takeoff from rough water is practicable.

(3) Basic loading for most forward c.g. - The weight shall be the basic sheltered water design gross weight. The c.g. location shall be the most forward c.g. position specified for aerodynamic demonstration (may be obtained by use of ballast if necessary).

(4) Basic loading for most aft c.g. - The weight shall be the basic sheltered water design gross weight. The c.g. location shall be the most aft c.g. position specified for aerodynamic demonstration (may be obtained by use of ballast if necessary).

3.14.3 CALM-WATER TAKEOFFS

(1) Planning tests shall be made in calm water, sea state 0, to demonstrate freedom from porpoising as follows:

(a) Using takeoff configuration, as recommended by the contractor, repeated accelerated runs to takeoff shall be made. Each run shall be made at a fixed stick position. Stick positions shall be changed by approximately 2° for successive runs. Freedom from porpoising between upper and lower limits corresponding to not less than 5° range of hull trim angle with not less than 10° range of stick position shall be demonstrated. The trim range shall not include undesirably low or high trim angles.

(2) Takeoffs shall be conducted in calm water to demonstrate that adequate controllability exists throughout the takeoff and initial flight up to a speed of 1.3 VSTO and that the elevator control forces required are within the following limits:

Class I	20 pounds pull to 10 pounds push
Class II	30 pounds pull to 10 pounds push
Class III	50 pounds pull to 20 pounds push

During the demonstration, at speeds equal to or greater than 1.2 hump speed for hull or 1.2 unporting speed for hydro-ski, changes shall not be made in power, longitudinal trim control, alighting gear, flap settings or incidence of the wing or tail.

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3.14.3 (Cont)

(3) Demonstration of (1) and (2) shall be conducted for each of the loadings of 3.14.2(3) and (4). For airplanes designed to operate with lift augmentation devices such as boundary layer control, additional demonstration shall be made at maximum forward and aft c.g. positions and at maximum practicable gross weights in sheltered water for the augmentation system inoperative.

(4) During the demonstration of (1) and (2) records shall be taken of hull trim angle, air speed, water-speed, cockpit flight-control positions, elevator control forces, longitudinal and normal accelerations and the rectangular components or angular velocity, as a function of time.

3.14.4 CALM-WATER LANDINGS

(1) Landing tests shall be made in calm water, sea state 0, to demonstrate freedom from undesirable skipping as follows:

(a) At a sinking rate of 50 fpm or less, landings shall be made with elevator angle and power held fixed. Power may be cut, if desired, after initial touch-down. Make at least four landings at each of the loadings 3.14.2(3) and (4) and at varying angles of longitudinal trim with respect to water over a range of 5°, to demonstrate that no objectionable skipping exists.

(b) During the demonstration of (a), records shall be taken of stick position elevator angle, trim and normal acceleration as a function of time.

(2) During the tests of (a), it shall be demonstrated that throughout the landing no abrupt or uncontrollable changes in trim about any axes occur.

3.14.5 LATERAL - DIRECTIONAL STABILITY AND CONTROL

(1) It shall be demonstrated that the airplane can take off and land along a predetermined heading within 5° in calm water, sea state 0, without engine manipulation and without pedal forces exceeding 180 pounds. The loading conditions shall be as specified in 3.14.2 (3) and (4). Instrument records shall be taken of heading, aileron control, rudder control, and rudder force as a function of time.

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3.14.5 (Cont)

(2) It shall be demonstrated that the airplane can take off and land in sheltered water in 90-degree crosswinds of at least 20 knots with pedal forces not exceeding 180 pounds and maintain a predetermined heading within 10 degrees. Engine manipulation is permissible during these demonstrations. Loading condition shall be 3.14.2(3) and (4).

(3) It shall be demonstrated that the airplane can maintain a straight course during taxiing at less than hump or unporting speed in 90-degree crosswinds of at least 20 knots without exceeding a pedal force of 180 pounds. Loading condition shall be 3.14.2(1).

3.14.6 LOW-SPEED MANEUVERING. - Turning qualities shall be demonstrated while taxiing or maneuvering on the water:

(1) In a condition of calm water for the weight of 3.14.2(1), the diameter of the turning circles, both right and left, shall not be greater than that specified for the airplane design. Use of asymmetric power, water rudders and other devices is permissible.

(2) 360-degree turns, both right and left, for loading of 3.14.2(3) and (4), shall be performed in 0.8 to 1.0 times the wind and wave condition of maximum sea state and/or crosswind conditions in which the airplane is designed to operate.

3.14.7 ROUGH-WATER OPERATIONS. -

(1) Rough water characteristics shall be demonstrated by a minimum of 12 landings and 12 takeoffs in sea states ranging from 0.8 to 1.0 times the wind and wave conditions of the maximum sea state in which the airplane is designed to operate. The speed of the airplane relative to the water shall be essentially zero prior to each takeoff and shortly after each landing (that is, touch and go takeoffs and landings will not satisfy the intent of these requirements). The sea state shall be verified by measurement. Demonstration shall be made at the weight of 3.14.2 with fore and aft c.g. positions for aerodynamic demonstration (may be obtained by use of ballast if necessary). These landings and takeoffs may be made as part of the structural demonstration of 3.12.3.

(2) The demonstration shall show that during the landings and takeoffs in rough or open water the pilot is able to control the airplane to the extent that the design limit loads will not be exceeded, pitching angular accelerations about the center-of-gravity position will not become objectionable, and that a predetermined course can be maintained within 10 degrees.

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3.14.7 (Cont)

(3) Records shall be obtained showing as a function of time, the airspeed, elevator, aileron and rudder position, trim, angular acceleration in pitch, vertical accelerations at the center-of-gravity position and in the pilots' cockpit, airplane heading relative to the direction of movement of the maximum wave height, and any other measurements deemed necessary by joint agreement between NAVAIR and the contractor. Motion picture coverage of all rough water operations is required. (See paragraph 3.1.7.1)

3.14.8 SPRAY CHARACTERISTICS. - During calm water and rough water takeoff and landing tests, it shall be demonstrated that spray control is adequate to prevent objectionable water ingestion in engine intakes, pilots' canopy is reasonably free of spray so that pilots' visibility is not impaired, and propellers and control surfaces are free of spray affecting normal operation of the airplane.

(1) Compliance with this requirement for the rough water operations may be made by examination of motion picture records.

(2) Compliance with this requirement for the calm water condition may be shown by still and/or moving picture coverage.

3.15 POWER PLANT DEMONSTRATION

3.15.1 GENERAL. - The following delineation of power plant demonstration requirements is not intended to mean that the power plant demonstration data should be obtained as a separate test from structural and aerodynamic demonstrations but rather should be obtained during those demonstrations if at all possible. Any tests or demonstrations completed and properly witnessed by a test authority (see 3.1.2) in accordance with but prior to, the scheduled demonstration, should be included in reports submitted in compliance with 3.25.

3.15.1.1 DEFINITION OF POWER. - The term "power" as used in this section shall be interpreted as the parameter on which engine performance output is based as follows:

Engine	Power Parameter
Reciprocating	Brake horsepower
Turbo jet/fan	Net thrust
Turbo prop/shaft	Shaft horse power plus thrust or equivalent shaft horsepower

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3.15.1.1 (Cont)

Engine	Power Parameter
Pulse jet	Net thrust
Ram jet	Net thrust
Rocket	Thrust
Combination of power plants	Use parameters of each applicable engine involved

3.15.1.2 FLIGHT RESTRICTIONS. - None of the following tests shall be construed to require operation of the airplane under structural conditions exceeding the structural demonstration requirements set forth in 3.12.

3.15.1.3 VARIABLE INLET. - If the airplane model being tested includes an automatic or manually variable inlet geometry system, this equipment shall be incorporated and functioning throughout the following tests. In addition, instrumentation capable of adequately documenting the correct positioning of the variable geometry shall be incorporated during the applicable testing of paragraphs 3.15.3, 3.15.5, 3.15.6 and 3.15.7.

3.15.2 ENGINE POWER OUTPUT TESTS. - These tests are conducted to determine any power discrepancies and to provide accurate information on power output for a more accurate preliminary evaluation of the airplane.

3.15.2.1 RECIPROCATING ENGINES. - The level flight airplane critical altitude(s) for military power and normal-rated power (normal only if no military rating assigned) shall be determined. The altitudes for full throttle, minimum coupling slip, or closed waste gate position, as applicable to the particular engine in question, shall be determined. In the event that the measured performance does not meet specified values, complete data shall be forwarded to NAVAIR for comment. Altitude values shall be based on standard pressure altitude as defined in NASA. Technical Report Number 1235.

3.15.2.2 TURBO-PROP/SHAFT. - The intermediate-rated equivalent shaft horsepower developed by the engine in level flight at an altitude of approximately 5,000 feet and at service ceiling shall be determined. This shall be done without exceeding either intermediate-rated RPM (maximum continuous if no intermediate rating assigned) or top index temperature (that temperature, turbine inlet or tail pipe, which, for the applicable power and RPM, is the maximum permissible). The power shall be obtained by torquemeter readings. The thrust shall be determined by measurement of change in momentum of the air passing through the engine at the same time. If either the measured brake horsepower or the thrust is more than

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3.15.2.2 (Cont)

5 percent above or below the engine predicted performance charts, corrected for installation effects, instructions shall be requested from NAVAIR. Turbine inlet and/or tail pipe temperatures shall be measured as required. Provision for measuring turbine inlet temperature shall be furnished the engine manufacturer.

3.15.2.3 TURBOJET/TURBOFAN ENGINES. - The thrust output developed by the turbojet engine in level flight, shall be determined at five altitudes within the flight envelope of the airplane, for maximum continuous, intermediate, and maximum power settings as specified by the engine specification or maximum turbine temperature. The range of altitudes shall include minimum safe altitude, maximum attainable service ceiling for each of the above power settings, and maximum attainable combat ceiling for each of the above power settings. The range of speeds shall include minimum and maximum speeds attainable in level flight at the combat ceiling altitudes for each of the above power settings. The thrust shall be obtained by measurement of change in momentum of the air passing through the turbojet/turbofan engine, or by use of a calibrated thrustmeter. If the measured jet thrust of the engine is more than 5 percent above or below values shown on predicted performance charts for the engine, corrected for installation effects, instructions shall be requested from NAVAIR.

3.15.2.4 ROCKET ENGINES. - The rated thrust output shall be determined under applicable conditions on which power output is based (temperatures, fuel pressures, etc.) in level flight at an altitude of approximately 35,000 feet. When direct thrust determination cannot be made, the engine manufacturer's "Thrust vs Chamber Pressure" curves may be used to determine thrust. If the measured net thrust is more than 5% above or below the values shown on the predicted performance charts for the engine, instructions shall be requested from NAVAIR.

3.15.2.5 RAM-JET AND PULSE-JET ENGINES. - The rated thrust output shall be determined under applicable conditions on which power output is based (temperatures, fuel pressures, altitudes, etc.) in level flight. The thrust shall be obtained by the use of a calibrated thrustmeter or by any other method approved by NAVAIR for the specific application. If the measured net thrust of the engine is more than 5 percent above or below the values shown on predicted performance charts for the engine, instructions shall be requested from NAVAIR.

3.15.2.6 COMBINATION POWER PLANTS. - On airplanes where combinations of any of the above listed engines are installed, all engines shall satisfy the foregoing requirements that are applicable. In addition, the booster engine(s) shall start and operate satisfactorily at 45,000 feet and/or service ceiling (CRP) of the basic airplane. The powers

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3.15.2.6 (Cont)

and/or thrust shall be determined on each type of engine in accordance with the procedures set forth for each applicable engine in the foregoing paragraphs.

3.15.3 MILITARY-POWER RUNS. - Maximum continuous power shall be used where no military rating is assigned. These tests shall establish sufficient high power operating time on the engines to insure that no excessive power-plant deficiencies will occur and no unusual hazard will exist in operation of the airplane during the evaluation and trials. Engine operating instructions as approved by NAVAIR shall be followed.

3.15.3.1 RECIPROCATING ENGINES. - A total of one hour of military-power operation in periods of not less than 15 minutes shall be accumulated. The total operating time shall be approximately equally divided between each of the following:

(1) Level flight below 2,000 feet.

(2) Level flight at each critical altitude.

(3) Climb at airspeed for maximum rate of climb.

If torquemeters are installed, they shall be used for control purposes. In the event that engine manifold pressures required for the attainment of the specified torquemeter horsepowers are more that 2 inches Hg in excess of those indicated in the performance charts released by NAVAIR, complete data shall be forwarded to NAVAIR for comment before exceeding the 2 inch Hg tolerance. In instances where automatic manifold pressure regulators or automatic power controls with established cockpit control lever positions for various power conditions are supplied, the established cockpit control positions shall be used in lieu of torquemeter control. In the event that the nature of the controls is such that critical altitudes in the conventional sense are not obtained or if the contractor is uncertain thereof, advice shall be obtained from NAVAIR. Data obtained during the above tests shall include the following as applicable.

(4) Condition of loading.

(5) Weight at start of flight.

(6) Fuel and oil on board at start of flight.

(7) Fuel and oil on board at end of flight.

(8) Kind of fuel and oil used.

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3.15.3.1 (Cont)

(9) Propeller details, such as design, number of blades, pitch setting, constant speed, controllable pitch, etc.

(10) At five minute intervals during the run:

(a) Standard pressure altitude.
(b) Air temperature at the above altitude.
(c) Indicated airspeed.
(d) Engine RPM.
(e) Engine manifold pressure.
(f) Carburetor air temperature.
(g) Oil temperature (inlet and outlet).
(h) Engine cylinder temperatures (heads and bases).
(i) Fuel pressure.
(j) Coolant temperature.
(k) Carburetor entrance pressure (static).
(l) Torquemeter pressure.
(m) Fuel flow.

3.15.3.2 TURBO-PROP/TURBO-SHAFT ENGINES. - A total of one hour of intermediate power operation in periods of not less than 15 minutes shall be accumulated. The total operating time shall be approximately equally divided between each of the following:

(1) Level flight below 5,000 feet.

(2) Level flight at cruise ceiling.

(3) Climb at airspeed for maximum rate of climb.

Data obtained during the test shall include the following (as applicable):

(4) Condition of loading.

(5) Weight at start of flight.

(6) Fuel and oil on board at start of flight.

(7) Fuel and oil on board at end of flight.

(8) Kind of fuel and oil used.

(9) Propeller details, such as design number of blades, pitch setting, constant speed, controllable pitch, etc.

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3.15.3.2 (Cont)

(10) At five minute intervals during the run:

(a) Standard pressure altitude.
(b) RAM (Total) air temperature at above altitude.
(c) Airspeed indicator reading.
(d) Engine RPM.
(e) Tail pipe total gas temperature.
(f) Oil pressure.
(g) Engine oil inlet and outlet temperatures.
(h) Rear bearing temperature.
(i) Fuel manifold pressure.
(j) Fuel flow.
(k) Air flow.
(l) Tail pipe total pressure.
(m) Compressor inlet total temperature.
(n) Compressor inlet total pressure.
(o) Exhaust nozzle position.
(p) Torquemeter reading.
(q) Temperature of primary structural members subjected to temperatures greater than 200° F.
(r) Main fuel pump inlet pressure.
(s) Main fuel pump discharge pressure.
(t) Emergency fuel pump discharge pressure.
(u) Turbine inlet temperature.
(v) Compressor discharge pressure.
(w) Engine control lever position.
(x) Propeller blade angle.
(y) Input signal to propeller control.
(z) Main reduction gear box oil inlet and outlet temperatures.
(aa) Time.

3.15.3.3 TURBOJET/TURBOFAN ENGINES. - Same conditions as for turboprop engines except add 15 minutes continuous operation of maximum cruise ceiling attainable with maximum power. (This period may be reduced in duration to maximum allowable continuous operation at maximum power if less than 15 minutes). Data obtained during the test shall include the following, as applicable:

(1) Condition of loading.

(2) Weight at start of flight.

(3) Fuel and oil on board at start of flight.

(4) Fuel and oil on board at end of flight.

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3.15.3.3 (Cont)

(5) Kind of fuel and oil used.

(6) At five minute intervals during the run:

(a) Standard pressure altitude.
(b) Air temperature at the above altitude.
(c) Airspeed indicator readings.
(d) Engine RPM.
(e) Turbine inlet or turbine outlet total gas temperatures.
(f) Oil pressure.
(g) Engine oil inlet and outlet temperatures.
(h) Rear bearing temperature.
(i) Fuel manifold pressure.
(j) Fuel flow.
(k) Exhaust nozzle position.
(l) Thrust.
(m) Temperature of primary structural members subjected to temperatures greater than 200° F.
(n) Air flow.
(o) Tail-pipe total pressure.
(p) Compressor inlet total temperature.
(q) Compressor inlet total pressure.
(r) Main fuel pump inlet pressure.
(s) Main fuel pump discharge pressure.
(t) Emergency fuel pump discharge pressure.
(u) Compressor discharge pressure.
(v) Engine control position.
(w) Time.

3.15.3.4 RAM-JET, PULSE-JET, AND ROCKET ENGINES. - Same conditions as for turbo-prop engine except that minimum periods of operation shall be not less than 5 minutes. The total operating time shall be divided approximately equally between: (a) level flight at 45,000 feet, (b) level flight at service ceiling of basic aircraft, and (c) climb at constant Mach number. Data obtained during the test shall include the following as applicable:

(1) Condition of loading.

(2) Fuel(s) on board at start of flight.

(3) Fuel(s) on board at end of flight.

(4) Kind of fuel(s) used.

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3.15.3.4 (Cont)

(5) At one minute intervals during the run:

(a) Pressure altitude.
(b) Air temperature at above altitude.
(c) Airspeed indicator readings.
(d) Fuel pressure(s).
(e) Fuel flow.
(f) Engine operating pressures.
(g) Thrust.
(h) Temperature of primary structural members subjected to temperatures in excess of 200° F.
(i) Oxidizer flow.
(j) Any other factors peculiar to the particular engine in question which provide a basis for determining satisfactory or unsatisfactory performance.

3.15.3.5 COMBINATION OF POWER PLANTS. - On airplanes where combinations of any of the above listed engines are installed, all engines shall satisfy the foregoing requirements that are applicable. These requirements shall be recommended by the airframe contractor and concurred in by NAVAIR when the demonstration addendum is proposed. In instances where the foregoing requirements specify different altitudes of operation for a particular combination of engines, it will be acceptable to accumulate the required time on the booster engine(s) at the altitude required for the main engine(s) for purposes of combining test programs. Individual test programs and data for each applicable engine as listed in the foregoing paragraphs shall apply. In the absence of other requirements, the booster engine shall be operated to the satisfaction of NAVAIR in level flight at 45,000 feet altitude.

3.15.4 PROPELLER OPERATION

3.15.4.1 PROPELLER PITCH SETTINGS. - The following pitch settings shall be checked:

(1) Low pitch
(2) High pitch
(3) Feathering pitch
(4) Reverse pitch

3.15.4.2 PROPELLER OPERATION TESTS

3.15.4.2.1 LOW PITCH (RECIPROCATING ENGINES). - Low-pitch blade-stop setting shall be checked with airplane across wind against chocks. (Engine to have torquemeter nose.) Set governor control

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3.15.4.2.1 (Cont)

for rated takeoff RPM. Open throttle slowly, observing manifold pressure at which rated takeoff RPM is first attained (blades just leaving low-pitch stops and governor action becoming effective). Observed manifold pressure under these conditions should be the rated takeoff value within a tolerance of plus 0 inches or minus 2 inches, or as close thereto as the provided increment of angular blade stop adjustment will permit. If rated (or lower) manifold pressure is attained at an RPM higher than rated for takeoff, the governor high RPM stop is set too high and should be reduced. If the takeoff rated manifold pressure is attained at an RPM lower than rated for takeoff, the governor high RPM stop may be set too low or the blade pitch stop too high, or both. In this case, the high speed governing RPM should be checked with the airplane airborne, and adjusted as necessary, before attempting blade stop adjustments.

3.15.4.2.2 LOW PITCH (TURBO-PROP ENGINES). - Low pitch blade stop setting shall be checked in the manner provided by the propeller manufacturer to demonstrate proper setting and operation.

3.15.4.2.3 HIGH PITCH (APPLICABLE TO NON-FEATHERING PROPELLER). - High-pitch (normal) blade-stop setting shall be checked at critical altitude. (Engine to have torquemeter nose.) See that selected governing RPM can be maintained for cruising and for full throttle high speed conditions. For Class VF and dive bomber airplanes, see that blade pitch is sufficiently high to prevent excessive engine overspeeding in limit speed dives. Also, on propellers which can be locked in the normal high-pitch position, a check shall be made to see that the airplane can be kept in the air (blades locked in normal high pitch) within the manifold pressure and RPM limitations of the engine. If not, the high-pitch stop setting shall be reduced to the maximum at which the airplane can be kept in the air within safe engine operating conditions.

3.15.4.2.4 FEATHERING PITCH. - Feathering-pitch blade-stop settings shall be checked on multi-engine airplanes to see that no feathered propeller windmilling occurs on the stopped engine at the maximum level flight speed obtainable with operating engines.

3.15.4.2.5 REVERSE PITCH. - Reverse-pitch blade-stop (negative) settings shall be checked to see that engine rated takeoff RPM is not exceeded at full throttle when blades are against negative stops. For this check the airplane shall be fixed by chocks across wind.

3.15.4.2.6 CONTROL LEVERS. - Control/condition/power levers shall be free from automatic slippage under vibration. Sensitivity of controls shall be such that easy and accurate adjustments can be made over the entire speed or power range.

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3.15.4.3 SYNCHRONIZATION AND SYNCHROPHASING. - With the synchronizing or with the synchrophasing system in operation, while engines are operating at takeoff RPM, when the master engine power lever is retarded to flight idle, the RPM on the slave engines shall drop not more than 2%.

3.15.4.4 HUNTING AND SURGING. - Hunting and surging of propeller-engine combinations shall be eliminated (See Note below).

NOTE. - (Cause of hunting and surging shall be determined by moving all auto-engine controls to manual one at a time. If surging still persists, note if fuel pressure is fluctuating. If not, cause will probably be found in the propeller governor. If hunting persists with propeller in fixed or locked pitch, the propeller governor is definitely not the cause.)

3.15.5 GROUND TESTS. - Data listed in the applicable sub-paragraphs of 3.15.3 shall be recorded for these tests. The thrust available at idle RPM shall not cause excessive taxi speeds. For augmented engines, the following additional data shall be obtained:

(a) Fuel manifold pressure
(b) Fuel flow
(c) Fuel pump discharge pressure.

3.15.5.1 STARTING CHARACTERISTICS. - The following starts shall be performed:

(1) Automatic. - Three starts in accordance with the engine manufacturer's specified starting procedure. On multi-engine aircraft, three starts per engine on one side only.

(2) Emergency. - If a manual (emergency) control system is provided on the engine, two starts on this control in accordance with the engine manufacturer's specified procedure. On multi-engine aircraft, two starts on each engine on one side only.

Data at one-half second intervals shall be recorded for starting characteristics.

3.15.5.2 STEADY STATE CHARACTERISTICS. - Tests with the following control lever settings on the primary control and on the manual (emergency) control, if provided, shall be performed:

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3.15.5.2 (Cont)

(1) Reciprocating Engines

(a) Idle
(b) 40 percent military power.
(c) 60 percent military power.
(d) 80 percent military power.
(e) 100 percent military power.
(f) 100 percent military power to maximum power, if applicable.

(2) Turbojet/turbofan and Turbo-propeller/shaft Engines

(a) Idle
(b) 50 percent intermediate thrust
(c) 65 percent intermediate thrust
(d) 90 percent intermediate thrust
(e) 100 percent intermediate thrust
(f) 100 percent intermediate thrust to maximum thrust if applicable.
(g) Minimum Booster Engine Power
(h) Maximum Booster Engine Power

Data shall be recorded at five-second intervals. On multi-engine aircraft, required for two engines, one side only. Tests after reaching specified power ratings, at each control lever setting, shall be of four-minute duration. A minimum of five data points, or sufficient data to show control system transients, shall be reported for the first minute of each test after reaching specified power ratings.

3.15.5.3 ACCELERATION CHARACTERISTICS. - Slow, intermediate and snap accelerations and decelerations shall be performed with the primary control with slow and intermediate accelerations and decelerations in the manual (emergency) control, if provided, over the following ranges:

(1) Reciprocating Engines

(a) Idle to 60 percent military power.
(b) 60 percent to 100 percent military power.
(c) Idle to 100 percent military power.
(d) Idle to takeoff power.
(e) Normal rated to takeoff power.
(f) Military to takeoff power.

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3.15.5.3 (Cont)

(2) Turbojet/turbofan and Turbo-propeller/shalft Engines

(a) RPM for power approach to intermediate thrust.
(b) RPM for power approach to maximum thrust.
(c) Idle to 100 percent intermediate thrust.
(d) Idle to maximum thrust.
(e) Maximum continuous to maximum power (A/B).
(f) Intermediate to maximum thrust.
(g) Minimum A/B thrust to maximum thrust.
(h) Minimum booster engine power to maximum booster engine power.

On multi-engine aircraft, required for two engines on one side only. This test shall be performed by starting with slow acceleration and deceleration rates then increasing to an intermediate rate and finally increasing to a snap rate (idle to intermediate throttle advancement in one second). Snap rate need not be performed with the manual control in (d), (e), (f), (g) and (h). Data shall be recorded at one-fourth second intervals. A minimum of 10 data points shall be reported, or sufficient data to show control system transients shall be reported for each acceleration and deceleration.

3.15.5.4 NOISE LEVEL MEASUREMENTS. - (Turbo-Props/Turbo-Shaft) - With all engines operating at military ratings, noise level measurements shall be taken on the ground on one side of the aircraft only, at 30° intervals on 25-foot or 50-foot radii, on lines originating at the centerline of the airplane in the plane of the propeller. Instrumentation shall be reported in the Instrumentation Report, Item (1) of paragraph 3.4.

3.15.5.5 NOISE LEVEL MEASUREMENTS. - (Turbojet/Turbofans) - With all engines operating at maximum power, noise level measurements shall be taken at radii at 12½, 25, and 50 feet centered at the nozzle or midway between nozzles of the tail pipes in intervals of 30 degrees around the aircraft. Instrumentation shall be reported in the Instrumentation Report, item (1) of paragraph 3.4.

3.15.6 ENGINE CHARACTERISTICS AT VARYING POWER LEVER SETTINGS. - Data shall be recorded at five-second intervals during the tests in paragraphs 3.15.7, 3.15.7.1 and 3.15.7.2. A minimum of 20 sets of data (or sufficient data to show control system transients) listed in the applicable sub-paragraphs of 3.15.3 shall be reported on one engine only during the tests of 3.15.7.1 and 3.15.7.2. For augmented engines, the following additional data shall be obtained:

(a) Fuel mainfold pressure
(b) Fuel flow
(c) Fuel pump discharge pressure.

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3.15.6.1 CONSTANT MACH NUMBER CLIMBS. - Three climbs at three different power lever settings, including intermediate thrust and maximum afterburning, at three different Mach numbers (a total of nine climbs) shall be performed from 2000 feet pressure altitude to the combat ceiling for each of the Mach number power lever setting combinations selected. In those cases where maximum aircraft Mach No. is not achievable at 2000 feet, additional constant Mach No. climbs at maximum power shall be performed at speeds increasing in 0.5 Mach No. increments throughout the Mach No. envelope of the aircraft. These climbs shall be initiated at minimum allowable altitude for the particular speed and terminated at maximum power combat ceiling.

3.15.6.2 ALTITUDE IDLE SCHEDULE AT LOW AIRSPEEDS. - A low speed descent from service ceiling to 2000 feet pressure altitude with power lever in idle position (flight idle for turbojets and turboprops) shall be performed.

3.15.7 ALTITUDE POWER CONTROL PERFORMANCE

3.15.7.1 ACCELERATIONS AND DECELERATIONS. - Slow, intermediate and snap accelerations and decelerations shall be performed through the following ranges at 10,000 feet pressure altitude at 10,000 feet increments to military power service ceiling. Data shall be recorded at one-fourth second intervals:

(1) Idle to 60 percent military power (Reciprocating Engines).
(2) Idle to 100 percent intermediate power or thrust (All engines).
(3) 60 percent to 100 percent military power or thrust. (Reciprocating Engines)
(4) Idle to maximum power (afterburner). (Turbojet/turbofan Engines)
(5) Intermediate to maximum thrust (afterburner). (Turbojet/turbofan Engines)
(6) Minimum afterburner thrust to maximum thrust. (Turbojet/turbofan Engines)
(7) One acceleration and one deceleration of the booster engine from minimum rated thrust to full thrust at main engine military power service ceiling. (Throttle movement during acceleration and deceleration shall be compatible with engine limitations).
(8) A simulated wave-off shall be performed and recorded at pressure altitude of 5000 feet, from power approach thrust to intermediate thrust.

A soak time of not less than one minute for reciprocating engines and 15 seconds for turbojet/turbofan and turbo-prop engines at the point of accelerations shall precede the power lever movement. A minimum of 10 data points (or

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3.15.7.1 (Cont)

sufficient data to show control system transients) listed in the applicable sub-paragraphs of 3.15.3 shall be reported on one engine only during each acceleration and deceleration.

3.15.7.1.1 ENGINE STALL CHECKS. - Engine stall checks shall be performed at 10,000 feet pressure altitude at 10,000 feet increments to military service ceiling as follows:

Five engine stall checks at each altitude level shall be made by retarding the power lever from the intermediate thrust position and then advancing the power lever again to the intermediate thrust position as soon as the engine reaches the anticipated condition of minimum stall margin (i.e. rpm or gas temperature). Adverse engine performance shall not result.

3.15.7.2 EMERGENCY PROTECTION. - If a manual (emergency) control is provided, switchovers from primary control to manual control during normal rated thrust or power level flight runs at 10,000 feet intervals from 10,000 feet altitude to service ceiling shall be performed (on one engine only on multiple engine aircraft).

3.15.7.3 AFTERBURNER OPERATION. - If an afterburner, or similar power augmentation is provided, afterburner light-off shall be demonstrated at minimum sustaining airspeeds for successful re-light at altitudes from 10,000 feet, at 10,000 feet intervals, to the critical operational altitude of the engine, as defined by the engine model specification. Flame retention of the afterburner shall be demonstrated to the absolute engine altitude as installed in the aircraft, if applicable. Minimum afterburner operation shall be demonstrated at minimum sustaining airspeed up to the aircraft engine(s) afterburner combat ceiling, and, in addition; minimum afterburner operation at minimum sustaining airspeed shall be demonstrated at the extreme engine(s) altitude and Mach number.

3.15.7.4 OPERATION WITH MISSILE FIRING. - Engine operation during guided missile and rocket firing shall be demonstrated in accordance with 3.16.4 and 3.16.5.

3.15.7.5 INFRARED RADIATION. - The contractor shall arrange for infrared radiation measurement in flight of the aircraft engine combustion with the cognizant infrared measuring activity in sufficient time to permit scheduling of a government aircraft equipped for measurement of infrared. This measurement shall not interfere with the demonstration, but shall be scheduled when level flight demonstrations at operational altitude are scheduled. The results of the demonstration shall be reported.

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3.15.7.6 ANTI-ICING. - Demonstrate that the engine-airframe combination operates satisfactorily through all altitudes and Mach number ranges, within the design envelope of the aircraft, without adverse effect from ice ingestion. Demonstrate that the anti-icing system will anti-ice to the design parameters.

3.15.8 FLAME DAMPING. - Satisfactory flame damping shall be demonstrated in accordance with the test procedure outlined in Spec MIL-D-6728. All phases of flame damping effectiveness shall be reported, with particular emphasis on hazards of night landing approach and takeoffs both for land and for aircraft carriers.

3.15.9 EMERGENCY POWER TESTS. - When emergency power equipment is intended for use in a particular airplane maneuver such as takeoff, wave-off, etc., a total of three tests, using the applicable emergency power, shall be performed for each applicable maneuver. The time of operation at emergency power for each of these tests shall be as required for successful execution of the maneuver. When emergency power equipment is intended in normal flight conditions such as climb, level flight, etc., a five minute emergency power run shall be conducted for each of the following:

(1) Reciprocating engines

(a) Climb.
(b) Level flight at approximately 2,000 feet altitude.
(c) Level flight at each critical altitude.

(2) All other engines

(a) Climb.
(b) Level flight at approximately 5,000 feet altitude.
(c) Level flight at approximately 20,000 feet altitude.

3.15.10 AIR STARTS. - Three satisfactory air starts on one engine shall be demonstrated at the maximum altitude and minimum speed, corrected for installation, as set forth in the engine model specification. If starts cannot be made at this altitude, the maximum altitude at which satisfactory air starts can be made shall be determined. Air starts shall also be demonstrated with manual (emergency) controls, if provided.

3.15.11 FUEL DUMPING. - Operation in flight of fuel dumping arrangements shall be demonstrated in accordance with MIL-F-17874 (as applicable). Fluids other than fuel may be used.

3.15.12 FUEL VENTING. - The fuel vent system and impingement tests shall be demonstrated in accordance with Spec MIL-F-17874 for compliance with the design requirements of the detail specification. Fuel tank venting shall also be demonstrated in accordance with MIL-F-17874 for adequacy. Fluids other than fuel may be used.

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3.15.13 ENGINE FUEL FEED. - Tests shall be conducted on the engine fuel feed system(s) to determine compliance with the design requirements of Spec MIL-F-17874.

3.15.14 FUELING AND DEFUELING. - Fueling and defueling tests shall be conducted to determine compliance with the design requirements of the detail specification and Spec MIL-F-17874.

3.15.15 FUEL TRANSFER SYSTEM. - Tests shall be conducted on the fuel transfer system to determine compliance with the design requirements of Spec MIL-F-17874.

3.16 ARMAMENT DEMONSTRATION.

3.16.1 GENERAL. - Firing of guns, launching of rockets or guided missiles, and/or dropping of stores shall not cause either the airplane structure or stores that are retained to be damaged by blast or by debris such as links, casings, "pig-tails", static lines, parachute packs, or diaphragms. The vibration, shock, impact loading conditions, acceleration, temperature rise, electromagnetic emission and other effects of the aircraft operational and handling spectrum shall be checked to ascertain that the environmental limitations of each item of armament complement will not be exceeded with possible resultant premature release, firing or other system malfunction. The time required to rearm the aircraft shall be ascertained and shall be within the time specified in the detail specification or the applicable portions of the specifications listed below. The applicable portions of specs MIL-A-8591, MIL-I-8670, MIL-L-8671, MIL-I-8673, MIL-I-8675, and MIL-I-8677 shall apply. Any tests or demonstrations completed and properly witnessed by a test authority (see 3.1.2) in accordance with, but prior to, the scheduled point of demonstration, shall be included in reports submitted in compliance with 3.25.

3.16.2 ARMAMENT INSTALLATION. - All applicable armament demonstrations specified herein shall be performed unless reference can be made to an identical installation which has been satisfactorily demonstrated by the contractor on a previous model. Also, any armament installation which represents a departure from existing design, that is, which embodies major features not used in at least one previous armament installation in a naval airplane shall be satisfactorily demonstrated in flight.

3.16.3 GUNS.

3.16.3.1 HEAVY ATTACK AND PATROL AIRPLANES. - The satisfactory operation of gun installations, both fixed and turret mounted, including accessories and directly associated equipment, shall be demonstrated. This demonstration shall include simulated operation in the

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3.16.3.1 (Cont)

air. The ground demonstration shall further include ground firing for dispersion characteristics. Satisfactory air operation of the gun installation shall consist of firing two complete loads of ammunition in bursts of not less than 100 rounds or six seconds (whichever takes longer) from each gun, with all guns firing simultaneously, with three seconds maximum interval between bursts. In no case shall the burst exceed one normal load of ammunition per gun. Firing shall be performed under the following conditions:

(1) Altitude: The airplane shall be flown through the following altitude cycle prior to firing:

(a) Climb to within 2000 feet of the design service ceiling (intermediate thrust) and remain at this altitude not less than five minutes.

(b) Descend to any altitude under 7000 feet and remain at this altitude not less than five minutes.

(c) Climb to within 2000 feet of design service ceiling (intermediate thrust) and remain at this altitude for not less than 10 minutes and then commence firing.

(2) Speed: The first load shall be fired at a minimum stabilized level airspeed. The second load shall be fired during indicated airspeed within 0.8 V_{max} to V_{max}.

(3) Load Factor: The first load shall be fired at a normal load factor of one "G". The second load shall be fired at a normal load factor of $0.9n_z$ or 0.9 maximum safe load factor at the specified altitude.

(4) Gun gas concentration: At no time during the firing demonstration shall the gun gas concentration anywhere in the airplane except in the blast tubes and the immediate vicinity of the breech and vent plug exceed 90 percent of the lower explosive limit as indicated on equipment approved by NAVAIR.

(5) Equipment operation: All applicable sighting equipment and radar control equipment shall be operating satisfactorily and in accordance with the equipment specifications throughout the firing demonstration.

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3.16.3.1 (Cont)

(6) Engine operation: At no time during the firing demonstration shall the tail pipe temperature in turbojet/turbofan airplanes rise over the allowable transient over-temperature conditions specified by the engine manufacturer and indicated on appropriate aircraft instruments; and there shall be no other evidence of compressor stall or engine flame-out.

3.16.3.2 FIGHTER, TRAINER AND LIGHT ATTACK AIRPLANES. - The satisfactory operation of gun installations, both fixed and turret mounted, including accessories and directly associated equipment, shall be demonstrated. This demonstration shall include simulated operating, rearming, boresighting, and maintenance on the ground, and actual operation in the air. The ground demonstration shall further include ground firing for dispersion characteristics. Satisfactory air operation of fixed gun installations shall consist of firing three or four complete loads of ammunition in bursts of not less than 100 rounds or six seconds (whichever takes longer) from each gun, with all guns firing simultaneously, with three seconds maximum interval between bursts. In no case will the burst exceed one normal load of ammunition per gun. Firing of the first two loads shall be performed under the conditions stated in 3.16.3.1. Firing of additional loads, as required, shall be conducted under the following conditions:

(1) Altitude: The airplane shall be flown through the following altitude cycle prior to firing:

(a) Climb to within 2000 feet of the highest service ceiling and remain at this altitude for 10 minutes and then fire approximately one-half load. The 10 minute dwell at altitude may be curtailed as necessary contingent on the amount of fuel available. (Highest service ceiling is defined as that ceiling obtained with the use of afterburner or similar power augmentation.)

(b) Descend to any altitude under 7000 feet and remain at this altitude not less than five minutes.

(c) Climb to 20,000 feet altitude and remain at this altitude for not less than 15 minutes and then fire the remainder of the load in short intermittent bursts.

(2) Speed: The firing shall be performed as follows:

(a) Low speed firing tests. - The guns shall be continuously fired while the airplane is maneuvered rapidly from unaccelerated flight to at least $0.9n_z$

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3.16.3.2 (Cont)

(2) (Cont)

(a) (Cont)

and back to unaccelerated flight. The airspeed at the time $0.9n_z$ is attained shall be within 10 kts above the corresponding stall speed. The altitude at which the test maneuver is initiated shall be an altitude not exceeding 7500 feet.

(b) High speed firing tests. - The guns shall be fired continuously while the airplane is maneuvered from 1g flight to at least 0.9 times the maximum load factor and back to 1g flight. The speed throughout the maneuver shall be not less than $0.9V_L$ at the altitude at which the tests are conducted. The altitudes of this test shall not exceed 7500 feet.

(c) High altitude firing tests. - The guns shall be fired continuously while the airplane is maneuvered rapidly to at least 0.9 times the maximum safe load factor at the specified altitude. In addition, all guns shall be fired simultaneously for a duration of four seconds or a full load whichever is the lesser, at an airspeed no greater than $1.1V_S$ (CR) at the specified altitude. The altitude at which the tests are performed shall be 3000 ± 1000 feet below the maximum altitudes attainable at subsonic speed and at supersonic speed by the airplane at combat weight and combat power.

(3) Gun gas concentration: At no time during the firing demonstration shall the gun gas concentration anywhere in the airplane, except in the blast tubes and the immediate vicinity of the breech and vent plug, exceed 90 percent of the lower explosive limit as indicated on equipment approved by NAVAIR.

(4) Equipment Operation: All applicable sighting equipment and radar control equipment shall be operating satisfactorily and in accordance with equipment specifications throughout the firing demonstration.

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3.16.3.2 (Cont)

(5) Engine Operation: At no time during the firing demonstration shall the tail pipe temperature in turbojet/turbofan airplanes rise over the allowable transient over temperature conditions specified by the engine manufacturer, and there shall be no other evidence of compressor stall or engine flame-out.

(6) Boresight Retention: Boresight retention by fixed guns shall be demonstrated in accordance with Spec MIL-I-8670.

3.16.4 ROCKETS. - The satisfactory operation of rocket installations shall be demonstrated. This demonstration shall include simulated operation, rearming, boresighting, and maintenance on the ground, and actual operation in the air. At no time during the rocket firing demonstration shall the tail pipe temperature in turbojet airplanes rise over the allowable transient overtemperature conditions specified by the engine manufacturer, and there shall be no other evidence of compressor stall or engine flame-out. Adequate air operation of air-to-air and air-to-ground rockets shall consist of firing two complete loads of inert warhead rockets of each type required for the airplane, under the following conditions:

3.16.4.1 AIR-TO-AIR ROCKETS

(1) Altitude: The airplane shall be flown through the following altitude cycle prior to firing:

(a) Climb to within 2000 feet of the design service ceiling (military power) and remain at this altitude not less than five minutes.

(b) Descend to any altitude under 7000 feet and remain at this altitude not less than five minutes.

(c) Climb to within 2000 feet of highest service ceiling and remain at this altitude for 10 minutes and then commence firing: The 10 minute dwell at altitude may be curtailed as necessary contingent on the amount of fuel available. (Highest service ceiling is defined as that ceiling obtained with the use of afterburner or similar power augmentation).

(2) High altitude firing tests: The airplane shall be maneuvered rapidly to at least 0.9 times the maximum safe load factor at the specified altitude. The altitude at which the tests are performed shall be 3000 ± 1000 feet below the maximum altitudes attainable at subsonic speed and at supersonic speed by the airplane at combat weight and combat power. The rockets shall be fired just prior to attainment of the specified load factor.

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3.16.4.1 (Cont)

(3) High speed firing tests: The rockets shall be fired in unaccelerated (level or diving) flight at:

(a) 0.9 times the structural design limit speed at 15,000 ± 1000 feet, and

(b) The sustained level flight Mach number at combat power and combat weight at the altitude for maximum attainable Mach number.

(4) Rocket gas: At no time during the required firing shall the rocket gas concentration exceed 90 percent of the lower explosive limit anywhere in the airplane as indicated on equipment approved by NAVAIR.

(5) Equipment Operation: All applicable sighting equipment and radar control equipment shall be operating satisfactorily and in accordance with equipment specifications throughout the firing demonstration.

3.16.4.2 AIR-TO-GROUND ROCKETS

(1) Altitude: The airplane shall be flown through the following altitude cycle prior to firing:

(a) Climb to within 2000 feet of the design service ceiling (military power) and remain at this altitude not less than five minutes.

(b) Descend to any altitude under 7000 feet and remain at this altitude not less than five minutes.

(c) Climb to within 2000 feet of design service ceiling (military power) and remain at this altitude for not less than 15 minutes.

(d) Descend to within ground target range and then commence firing.

(2) Speed: The first load shall be fired at a minimum stabilized level flight airspeed. The second load shall be fired during indicated airspeed within $0.8V_{max}$ to V_{max}.

(3) Load Factor: The first one-half load shall be fired at 0.5 "G" and the second one-half load at a normal load factor of one "G". The second load shall be fired at a normal load factor of $0.9n_z$ or 0.9 maximum safe load factor at the specified altitude.

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3.16.4.2 (Cont)

(4) Rocket gas: At no time during the required firing shall the rocket gas concentration exceed 90 percent of the lower explosive limit anywhere in the airplane as indicated on equipment approved by NAVAIR.

(5) Equipment operation: All applicable sighting equipment and radar control equipment shall be operating satisfactorily and in accordance with equipment specifications throughout the firing demonstration.

3.16.5 GUIDED MISSILES. - The satisfactory operation of the specified guided missile installations shall be demonstrated in accordance with individual equipment specification requirements. This demonstration shall include loading, unloading, boresighting, maintenance, and all the necessary system preflight checks as well as actual operation in the air. Adequate air operation shall consist of launching two loads of specified missiles in such a manner that the missiles are not subjected to forces beyond those specified for the missile, and that the missiles are launched in the attitude necessary for performance of their mission. Live missiles less warhead shall be used in the demonstration, except that for demonstrations of jettisoning and safety of separation, inert missiles may be used. The exact configuration of the missiles (including warhead, telemetry, motor, etc.) shall be as specified in the addendum to this specification or as agreed upon between the contractor and NAVAIR. The first load shall be fired at a minimum stabilized level flight airspeed. The second load shall be fired during indicated airspeed to V_{max}. Additional missile launchings to cover conditions found to be most critical in the contractor's analysis may be required. Jettisoning shall also be demonstrated under conditions consistent with the class and mission of the airplane. At no time during the missile firing demonstration shall the tail pipe temperature in turbojet/turbofan airplanes rise over the allowable transient over-temperature conditions specified by the engine manufacturer, there shall be no other evidence of compressor stall or engine flame out, nor shall there be any evidence of stability degradation demonstrated in accordance with 3.13.2.

3.16.6 DROPPABLE STORES.

3.16.6.1 CONVENTIONAL STORES. - The satisfactory operation of applicable conventional store installations and release equipment associated therewith shall be demonstrated. Conventional stores include bombs, mines, torpedoes, flares, float-lights, sonobuoys, searchlights, fuel tanks, etc. This demonstration shall include loading, unloading within the time specified, and maintenance procedures as well as checking out the control and monitor circuits on the ground and in the air for all delivery modes. Adequate air operation of conventional stores shall consist of dropping of one complete load of the stores specified in (7) below, under the following conditions:

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3.16.6.1 (Cont)

(1) Separation: Positive separation shall occur immediately upon actuation of the release system with no interference between the released store(s) and any part of the airplane and adjacent stores, and with no damage to the released store or to the aircraft. The attitude of store(s) during separation shall be such that each store can perform its intended function and that it shall not hinder the pilot in the performance of appropriate escape maneuvers for the type of delivery performed.

(2) Release control: Both primary and emergency method of store release shall be demonstrated.

(3) Structural integrity: No loss of the store, no evidence of deterioration, nor damage to the airplane structure, adjacent stores or the store itself shall occur within the specified flight conditions.

(4) Speed: The release of stores shall be demonstrated at the applicable maximum permissible speed for the airplane, or for the store, (whichever is smaller). The maximum release speed shall be reported.

(5) Altitude: For stores capable of being dropped from high altitudes, the release shall be accomplished at 2000 feet below the service ceiling after remaining at this altitude for 30 minutes. For other droppable stores (torpedoes, mines, flares, etc.) the release shall be made at appropriate altitude below 3000 feet.

(6) Release tactics: A tactical release shall be demonstrated for each of the delivery modes planned for the individual aircraft. The flight tactics to be utilized for release of the various types of specified stores shall be in conformance with the mission and bomb control equipment of the individual airplane. When specific tactics are not applicable, sufficient releases may be required under varied conditions to afford an envelope of conditions of satisfactory release. The demonstration shall include store separations at the most critical mach number and load factor combination of the specified flight envelope of the airplane-store combination. The following parameters should be measured and recorded at the time of release: airspeed, altitude, attitude in pitch, yaw rate, roll rate, vertical acceleration, longitudinal acceleration, and lateral acceleration. All separation tests should have adequate photographic coverage showing safe item separation from the aircraft. This photographic coverage should be correlated with the above instrumentation. In addition to the requirements of 3.5, the contractor shall calibrate the airplane instrumentation and forward the calibration data to COMNAVAIRTESTCEN. The required airplane instrumentation shall be operated and maintained by the contractor during the

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3.16.6.1 (Cont)

(6) (Cont)

demonstration. It is particularly important that the contractor is demonstrating the tactics that are expected to be used. This is especially necessary for the steep dive deliveries.

(7) Type of Stores: External stores, selected from those delineated in the applicable detail specification, and set forth in the addendum to this specification, shall be dropped from the most critical stations in the more critical configurations, including "mixed" loadings, for each demonstration of release tactics and bomb control equipment. Only inert stores shall be used.

(8) Aircraft guidance and store release system: Satisfactory operation of the aircraft guidance and the store release system shall be demonstrated to the extent that the accuracy of the store drop shall be within the limits specified in the contract and related specifications.

3.16.6.2 NUCLEAR WEAPONS. - Operation of nuclear-store installations, including missiles with nuclear warheads, and the suspension and release equipment associated therewith shall be demonstrated as specified in the addendum to this specification. The tests shall be performed in accordance with the applicable requirements of 3.16.5 and 3.16.6.1. Tests of nuclear weapons in addition to those specified in the addendum to this specification and which are recommended by the Naval Air Special Weapons Facility, shall also be performed as approved by NAVAIR.

3.16.7 ARMAMENT CONTROL. - Operation of the armament control installations shall be demonstrated to show compliance with individual equipment specification requirements. The demonstration shall include simulated operational checks and accessibility for servicing and removal, and including boresighting. Satisfactory air operation of armament controls shall be demonstrated in conjunction with applicable aircraft weapon demonstrations. The Airborne Monitor and Control System as applicable to Nuclear Weapons shall be installed with appropriate system resistance and power requirements as specified in the detail specification.

3.16.7.1 ACCURACY. - The contractor shall demonstrate accuracy by expending specified ordnance at a suitable target or by use of release-point-in-space technique as required, using the installed aircraft weapons control system. The armament Section of the Demonstration Addendum to this specification will specify the accuracy required for the particular aircraft involved. The method used to determine accuracy shall be acceptable to the test authority.

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3.16.8 MISCELLANEOUS. - Operation of miscellaneous armament installations shall be demonstrated to show compliance with applicable specification requirements. There shall be no deleterious effects from the operation of the armament items, such as corrosion resulting from smoke or blast, or damage from ejected debris. These miscellaneous installations include the following: armor, smoke screen equipment, target towing gear, chemical dispersal gear, magnetic airborne detection gear, etc. Installation and removal of special field conversion kits shall also be demonstrated as applicable. Any demonstrations completed and properly witnessed by a test authority (See 3.1.2) in accordance with, but prior to, the scheduled point of demonstration shall be included in reports submitted in compliance with 3.25.

3.17 EQUIPMENT DEMONSTRATION REQUIREMENTS

3.17.1 GENERAL. - All specified equipment actually installed in or specifically required shall be demonstrated on the ground or in flight as applicable for demonstration airplanes. However, any demonstrations completely and properly witnessed by the test authority (See 3.1.2) in accordance with, but prior to, the scheduled point of demonstration, shall be included in reports submitted in compliance with 3.25. Any requests for specification deviations shall be made to NAVAIR, with copy to NAVAIRTESTCEN, by the contractor prior to completion of the pertinent flight test program.

3.17.2 COCKPIT AND CABIN CONDITIONING

3.17.2.1 CONTAMINATION. - Ground and flight tests shall be performed to determine the extent of concentration of any contaminant such as carbon monoxide, fuel vapors, gun and rocket gasses, gaseous products of combustion, oil mists, etc. The limits for carbon monoxide are specified in MIL-STD-800. The limits for concentration of fuel vapors are specified in Spec MIL-H-18325. The limits for any other contaminant which causes a perceptible odor or irritation or interferes with visibility are specified in Spec MIL-E-18927.

3.17.2.2 PRESSURIZED AIRCRAFT. - Cockpit and cabin pressurizing, air conditioning and defogging systems shall be demonstrated to show compliance with Spec MIL-E-18927 and MIL-T-5842. The test procedure shall be as specified in Spec MIL-T-18606.

3.17.2.3 NON-PRESSURIZED AIRCRAFT. - Cockpit and cabin heating, ventilating and defogging systems shall be demonstrated to show compliance with Spec MIL-H-18325. The test procedure shall be as specified in Spec MIL-T-18606.

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3.17.2.4 OXYGEN EQUIPMENT. - With the oxygen system, gaseous or liquid, filled to normal capacity, and with full operating equipment aboard, the airplane shall be flown at the minimum and maximum operational altitudes at which oxygen is required. Under simulated tactical conditions at those altitudes, the oxygen system shall be evaluated to determine proper functioning in accordance with Spec MIL-I-8683 or MIL-I-19326, as applicable, and also to determine adequate freedom of movement for performance of required duties.

3.17.2.5 PRESSURE SUIT AND VENTILATED TYPE ANTI-EXPOSURE SUIT SYSTEM. - The pressure suit air conditioning system shall be demonstrated to meet the requirements of Spec MIL-E-18927. Maximum air flow at the specified differential pressure shall be measured in flight at altitudes from sea level to service ceiling of the aircraft and at engine power settings from idle to maximum cruise power. Maximum range of temperature control of the air delivered to the suit shall be evaluated. Operation of the flow control shall be assessed from the standpoint of convenience to the wearer. With the appropriate member(s) of the crew wearing pressure suit(s) or ventilated type anti-exposure suit(s) and necessary control systems and equipment, the system shall be demonstrated to provide the required amount of ventilation pressurization air for both inflight and ground operating conditions. Servicing of the airplane while on the ground in a ready condition, shall be demonstrated.

3.17.2.6 ACOUSTICAL NOISE LEVEL. - It shall be demonstrated that the acoustical noise level in occupied spaces does not exceed the maximum allowable values listed in Spec MIL-S-8806. The canopy shall be closed during the survey.

3.17.3 FIRE WARNING SYSTEM. - Ground and flight operation of the fire warning system shall be demonstrated to show compliance with Spec MIL-F-7872 or Spec MIL-F-23447, as applicable.

3.17.4 HYDRAULIC AND PNEUMATIC SYSTEMS. - Operation of all hydraulic and pneumatic system installations in the airplane shall be demonstrated in accordance with Spec MIL-T-5522.

3.17.4.1 HYDRAULIC AND PNEUMATIC EXTERNAL POWER CONNECTIONS. - The accessibility and suitability of external hydraulic and pneumatic power connections shall be demonstrated.

3.17.5 ANTI-ICING SYSTEMS

3.17.5.1 THERMAL. - The system shall be demonstrated to show compliance with Spec MIL-T-18607.

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3.17.5.2 PNEUMATIC. - The system shall be demonstrated to show compliance with Spec MIL-D-8804.

3.17.5.3 FLUID. - The system shall be demonstrated to show compliance with applicable contract requirements.

3.17.6 EXTERNAL MOVABLE EQUIPMENT. - Operation of all movable external equipment items such as flaps, inclosures, wing folding, slats, speed reduction devices, etc., shall be demonstrated at the design limits required for such items. The time required for operation shall be reported.

3.17.7 LANDING GEAR SYSTEM

3.17.7.1 RETRACTION AND EXTENSION. - The following operations of the landing gear shall be demonstrated:

(1) Retracted and locked within time specified after takeoff.

(2) Extended and locked at maximum airspeed specified for design.

(3) Emergency extension system.

(4) Gear warning system functioning properly.

3.17.7.2 NOSE GEAR STEERING. - The nose gear steering system shall be demonstrated to show compliance with the requirements of MIL-S-8812.

3.17.7.3 BRAKES. - The ability of the brakes to prevent rotation of the wheels under the conditions of full military power/maximum thrust and maximum takeoff gross weight, with the airplane parked on a dry concrete surface, shall be demonstrated. The ability of the brakes to retard the airplane to a safe stop after high-speed landings, without tire and/or wheel explosion, shall be demonstrated with anti-skid both "ON" and "OFF". With anti-skid "ON", the ability of the brakes to retard the airplane to a safe stop after high-speed landings shall be demonstrated on a concrete runway with each alternate 50 foot length of runway thoroughly soaked with water. Runway length shall be compatible with mission requirements. The ability of the brakes to conform to a turn-around time as specified in the detail specification shall be demonstrated. Power off braking capability shall be demonstrated for carrier deck spotting and maneuvering. The emergency brake control system shall be demonstrated. The term brakes includes auxiliary devices which are normally used during landing.

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3.17.8 ACCESSORY EQUIPMENT. - All accessories shall be demonstrated to show compliance with contract requirements.

3.17.8.1 WINCHES AND HOISTS. - Winches and hoists shall be operated through at least six cycles at their maximum rated capacity. The operation of installed remote controls shall be demonstrated.

3.17.8.2 CARRYING AND HANDLING. - All cargo carrying, handling, and securing equipment shall be demonstrated to their respective rated capacities.

3.17.8.3 ANCHORING, TIE-DOWN AND TOWING. - Anchoring, mooring, tie-down, beaching and towing provisions shall be demonstrated to show compliance with contract requirements.

3.17.8.4 HOISTING SLING. Operation of the hoisting sling shall be demonstrated to show compliance with contract requirements.

3.17.9 EXTERNAL AUXILIARY FUEL TANKS. - Compliance with MIL-T-18847 shall be demonstrated. Also, it shall be demonstrated that the external auxiliary fuel tanks can be jettisoned in the full, partially full, and empty condition between an EAS equal to $1.2V_S$ at sea level and an EAS equal to $0.9V_H$ at sea level. The partially full condition shall be that condition which causes the most critical separation characteristics with regard to possible damage to the aircraft or any retained stores. It shall be demonstrated that the tanks will not hang up on the aircraft and that the aircraft or any retained stores will not be damaged. The tanks shall be jettisoned with the aircraft in level flight and with the aircraft in the basic configuration. Liquids other than fuel may be used in the fuel tanks.

3.17.10 AIR REFUELING. - The capability and the suitability of donor and receiver provisions of air refueling systems shall be demonstrated in accordance with the requirements of Spec MIL-A-19736.

3.17.11 AUTOMATIC LIFE RAFT RELEASE SYSTEM. - Operation of the automatic life raft release system on the ground shall be demonstrated to show compliance with Spec MIL-I-18370.

3.17.12 AIR REFUELING TANKER EQUIPMENT. - The following features of air refueling tanker equipment shall be demonstrated and evaluated when tanker capabilities are required by the aircraft detail specification:

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3.17.12 (Cont)

(a) Hose and drogue stability.
(b) Reel response.
(c) Effects of wake of the tanker and its external stores upon the drogue and upon the receiver aircraft.
(d) Engagement envelope.
(e) Static electricity and other environmental effects are not of a degrading nature.

3.17.13 PARACHUTE SURVIVAL EQUIPMENT ASSEMBLY. - It shall be demonstrated that adequate stowage provisions are made in the airplane seats or other accessible spaces for all required parachutes, pararafts or other survival kits, and emergency oxygen equipment. Both ground and appropriate inflight demonstrations shall show that such stowage precludes loss or mislocation of equipment, does not interfere with flight operations, and facilitates utilization of equipment in emergencies. This demonstration shall include utilization of emergency oxygen supply during flight, and appropriate egress during simulated ditching ejection and bail-out conditions. If the configuration of this equipment so provides, personnel restraint during arrested landing, and adequate and proper release features shall be completely demonstrated. Accommodations for all automatic oxygen and/or parachute actuation devices shall be demonstrated.

3.17.14 ESCAPE HATCHES. - A ground demonstration shall be made to show the ease with which escape hatches may be opened and to show the accessability and adequacy of the opening for escaping personnel wearing flight gear as required for the specified missions of the aircraft.

3.17.15 HUMAN ENGINEERING, COCKPIT AND ESCAPE SYSTEM DESIGN. -

(1) In conducting the demonstrations under this paragraph, the sizes of personnel used shall include extremes at the upper and lower limits of the appropriate anthropometric parameters specified in this and all other applicable documents. Anthropometric limits shall be the 3rd through the 98th percentile aircrewman in accordance with NAEC-ACEL Report No. 533. The body dimensions of the pilots used shall be included in the test reports and shall include the following parameters:

(a) Stature
(b) Weight
(c) Sitting Height
(d) Shoulder Height Sitting
(e) Eye Height Sitting
(f) Bideltoid Diameter

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3.17.15 (Cont)

(1) (Cont)

(g) Functional Arm Reach
(h) Chest Circumference
(i) Waist Circumference
(j) Buttock Circumference
(k) Hip Breadth - Sitting
(l) Buttock - Knee Length
(m) Knee Height Sitting

(2) The contractor shall demonstrate, or shall have demonstrated, that the aircraft meets the following requirements as applicable to the particular aircraft:

(a) The cockpit cabin arrangement, seat adjustment, plugs and connections shall be compatible with all service personnel flight equipment (including full pressure suit, anti-exposure suit, life vests, etc.) planned for use in the aircraft when in actual service.

(b) Cockpit dimensional requirements and ejection clearances shall be in accordance with MIL-STD-203 and MIL-S-18471.

(c) Location, actuation, and ease and accuracy of operating all controls essential to flight operations shall be in accordance with MIL-STD-203.

(d) External forward, lateral and aft visibility at all aircrew stations shall conform to MIL-STD-850.

(e) Design and placement of escape system controls shall be in accordance with MIL-S-18471.

(f) Compatibility between the cockpit or other aircrew stations and the aircrew escape system seat shall conform to the requirements of MIL-S-18471.

(g) Manual egress capability and underwater ejection escape performance shall be in accordance with MIL-S-18471.

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3.17.16 ANTI-FOGGING AND RAIN REMOVAL SYSTEMS. - The systems shall be demonstrated to show compliance with contract requirements and with the requirements of MIL-T-5842.

3.17.17 WING FOLDING, SWEEPING, SPREADING. - Wing folding and spreading operations shall be demonstrated in winds up to 60 knots, if practical, from any direction between +45° from ahead.

3.17.18 THERMAL PROTECTIVE SYSTEM. - The nuclear thermal radiation pilot/cockpit protective system shall be demonstrated to show satisfactory operation in accordance with the requirements of MIL-T-81571(AS).

3.18 ELECTRICAL DEMONSTRATION

3.18.1 GENERAL. - All applicable electrical demonstrations shall be performed by the contractor. Any demonstrations completed and properly witnessed by a test authority (See 3.1.2) in accordance with, but prior to the scheduled point of demonstration, shall be included in reports submitted in compliance with 3.25.

3.18.2 PERFORMANCE. - The contractor shall demonstrate the performance of the complete electric system. The demonstration consisting of flight and ground tests, shall determine the capability of the system to perform the functions dictated by the required missions of the aircraft. The contractor shall include a demonstration of the accessibility of units for test and adjustment, and removal and handling for servicing. It shall be demonstrated that the installation meets the requirements of MIL-E-7080 and MIL-W-5088.

3.18.2.1 TEMPERATURE. - The contractor shall demonstrate that the operating temperatures of all electric, power and conversion equipments are within the specification design limitations of this equipment as demonstrated in the qualification tests of the equipment. Input and exit temperature of equipment coolant in addition to the operating temperatures shall be determined at the full rated output of the equipment, or with loads which the contractor is applying to the equipment, whichever temperature is the greater.

3.18.2.2 PRIME MOVER CAPACITY. - The contractor shall demonstrate that the prime mover has adequate capacity to maintain rated generator load and overloads to specified limits of the applicable specifications.

3.18.2.3 POWER. - The generation and conversion of electric power plus the excess power based upon the preliminary load analysis, the electrical power required to support the aircraft, or the rating

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3.18.2.3 (Cont)

of the power producing equipment as applied to the aircraft, whichever is greater, shall be demonstrated as conforming to the applicable approved performance specification for all operating conditions of the aircraft. The contractor shall also demonstrate that electric power at the terminals of load equipment conforms to MIL-STD-704 by recording power steady state and transient characteristics for voltage (both DC and AC), frequency, harmonic wave distortion DC ripple, voltage and frequency modulation at the terminals of at least ten representative load equipments under all operating conditions of the aircraft.

3.18.2.4 EMERGENCY POWER. - The contractor shall demonstrate that the alternate and emergency power systems deliver power conforming to MIL-STD-704 at the terminals of electrically powered equipment under all specified flight conditions down to ten (10) knots below a stall speed in a power approach configuration. The contractor shall demonstrate that the emergency power available and the alternate and emergency electric circuits are adequate and satisfactory under all flight conditions of the aircraft. Performance in accordance with MIL-STD-704 shall be demonstrated.

3.18.2.5 PROTECTION. - The contractor shall demonstrate that the performance of the fault protection system meets the requirements of MIL-E-7080.

3.18.2.6 LIGHTING. - The contractor shall demonstrate the interior and exterior lighting systems to show compliance with applicable issues of specifications MIL-L-006730 and MIL-L-18276.

3.19 AVIONICS DEMONSTRATION TESTS

3.19.1 PERFORMANCE. - The contractor shall demonstrate the performance and the compatibility of the complete Avionics System as installed in the aircraft. It shall be demonstrated that Specification MIL-I-8700, each applicable equipment specification and the specifications covering the accessories used with the equipment are complied with. Flight and ground tests shall be conducted to determine the capability of the entire system to meet each mission required of the aircraft. The equipment shall be given special attention in the conducting of the Maintainability Demonstration, and of the reliability of the aircraft. Particular attention shall be given to determining whether the equipment is being properly cooled under ground operating conditions, under takeoff conditions, under all altitude conditions and under the range of the aircraft speeds and other operating conditions. It shall be determined that the equipment mounts do not "bottom" or otherwise cause greater shocks to reach the equipment than the equipment design permits. Numerous flights will be required to properly evaluate the electronic equipments.

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3.19.1.1 INTERFERENCE. - The contractor shall demonstrate that the electrical and electronic systems of the aircraft meet the requirements of Spec MIL-E-6051. Upon completion of the ground general acceptance evaluation, the airplane shall be test-flown at an altitude and airspeed commensurate with the mission capability of the aircraft. All interferences noted during the ground evaluation shall be corrected prior to flight test. Any changes in the intensity of interference between the two tests shall be reported.

3.19.1.2 INTERCOMMUNICATION SYSTEM. - The contractor shall demonstrate that the intercommunication system meets the requirements of all applicable specifications, and performs within specified values over the entire mission capability of the aircraft.

3.19.1.3 TEMPERATURE AND VIBRATION. - The contractor shall demonstrate that the ambient temperature, the temperature of the air used for cooling, and the volume of the air used, in all compartments containing or with provisions to contain electronic equipment is within the values of the individual equipment specifications. These conditions must be checked under all operating conditions of the aircraft. A thermal demonstration shall be made of all the major electronic units of the equipments. The temperature of one or more critical parts within each unit shall be monitored by a thermocouple or similar sensor attached thereto and records kept of the temperature with simultaneous recordings of compartment ambients, forced air temperatures and flow rates at the equipment air inlets. These recordings shall be made over all flight conditions. The recorded data shall be summarized in the Avionics report. The contractor shall demonstrate that the vibration mounts or the mounting system used satisfactorily isolates the equipment from vibration and shock so that the equipment sees no vibration or shock more severe than that to which the equipment was designed as indicated by the specific equipment specification.

3.19.1.3.1 CONDENSATION. - The contractor shall demonstrate that air ducts to equipment are free of moisture after flights so that the proper operation of water separators, etc., is indicated. Any free moisture found inside equipment whether forced-air cooled or not shall be reported. Equipment failures, either permanent or temporary in nature, resulting from moisture or high humidity shall be investigated and reported.

3.19.1.4 ANTENNAS. - The contractor shall demonstrate that the antennas as installed on the aircraft meet the requirements of Spec MIL-A-7772, and the specifications for the individual electronics equipment. The results of laboratory tests on mock-up and scale model radiation measurements shall be furnished for approval of the basic antenna design as early as possible. Flight demonstrations to substantiate

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3.19.1.4 (Cont)

model radiation patterns and other laboratory results shall be performed under conditions designed to prove the capability of the electronics systems to fulfill the requirements of the airplane mission. The demonstrations shall show that:

(1) The azimuth and elevation coverage of antennas of the various configurations of the airplane at the required frequencies, is within specified values and in accordance with the laboratory results.

(2) The gain of the antennas, with reference to the isotropic radiator, is adequate for accomplishment of the mission.

(3) Isolation between antennas and between electronics systems using a common antenna is such that no significant or unreasonable impariment of the operation of either system results.

(4) The mechanical operation of rotatable and other antennas having moving parts, and antennas with other controllable features, provides satisfactory operation and coverage within specified values.

3.19.1.5 NAVIGATION EQUIPMENT. - The contractor shall demonstrate that the installation and performance of the navigation equipment conform with applicable test specifications listed in the detail specifications. The contractor shall further demonstrate satisfactory performance of the navigation equipments within the accuracies required by the mission of the aircraft, as well as satisfactory system integration, overall compatibility and indicator display under operational conditions. The accessibility of the navigation equipments for maintenance and field testing, as well as satisfactory maintenance, techniques including "go" and "no go" type pre-flight performance checking, shall also be demonstrated.

3.19.1.6 IDENTIFICATION EQUIPMENT. - The contractor shall demonstrate that the operation of the identification equipment, including transponders, interrogator-responsors, coders, and decoders meets the requirements of the applicable specifications, and, that within the designed mission of the aircraft, the operation is within specified values.

3.19.1.7 COMMUNICATIONS EQUIPMENT. - The contractor shall demonstrate that the installation and the performance of the communications equipment are in accordance with applicable specifications. The contractor shall further demonstrate that the installed communication equipment and its performance are adequate for the accomplishment of the design missions of the aircraft. Accessibility of communication controls

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3.19.1.7 (Cont)

for operation and read-out, and the accessibility of the communications equipment for maintenance and field testing, as well as satisfactory maintenance technique including pre-flight "go" and "no go" performance testing, shall also be demonstrated.

3.19.1.8 RADAR AND INFRARED EQUIPMENTS. - The contractor shall demonstrate that the operation of all radar and/or infrared equipment is in accordance with applicable specifications. All radiation tests shall be conducted at properly instrumented facilities for control of position and flight path, in addition to electrical measurements. The contractor shall include, within the designed mission of the aircraft, demonstration of satisfactory performance of all equipments in the following area:

(1) Detection and lock-on ranges, mapping capabilities, acquisition features, and tracking methods employed at service altitude and at the lowest practicable altitude.

(2) Antenna stabilization in pitch, roll, and yaw to prescribed limits compared to an appropriate reference.

(3) Flight control and/or guidance integration.

(4) Accessory integration and compatibility.

(5) Countermeasures vulnerability.

(6) Antenna pattern coverage in the proper polarization field and the cross polarization field.

(7) Indicator display in the search and lock-on mode under all ambient light levels and flight tactics within the specified performance envelope.

(8) Dot flyability and snap-up features, if any.

(9) Counter-countermeasures-procedure and circuitry.

3.19.1.9 COUNTERMEASURES. - The contractor shall demonstrate that the operation of all countermeasures equipment is in accordance with the applicable specifications. The contractor shall include, within the designed mission of the aircraft, demonstration of performance within specified values of all equipments in the following areas where appropriate:

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3.19.1.9 (Cont)

(1) Frequency spectrum coverage, including facilities for changing antennas and tuners.

(2) Detection ranges, azimuth coverages, and cross over points.

(3) Analysis of signal characteristics, i.e. - pulse width, pulse rate frequency, wave form, etc.

(4) Accuracy of bearing indication for direction finding, homing and localization of signal sources.

(5) Recording of signals and other required data for post flight analysis.

(6) Effectiveness of electronic jamming in the various modes and types of modulation.

(7) Mechanical dispersal of countermeasures confusion reflectors at required speeds and altitudes of the aircraft.

3.19.1.10 ASW EQUIPMENT. - The contractor shall demonstrate that the operation of the ASW equipment is in accordance with the applicable specifications. The contractor shall include, within the designed mission of the aircraft, demonstration of performance within specified values in the areas of detection, classification, and localization as applicable, to include the following:

(1) Detection ranges, mapping, navigation, and applicable acquisition features and tracking methods.

(2) Antenna stabilization characteristics in pitch, roll, and yaw.

(3) System integration, conducted and radiant interference, and overall compatibility.

(4) Indicator displays in an operational environment.

(5) Inflight antenna patterns to determine airframe shadowing effects during maximum tactical maneuvering.

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3.19.1.11 RADIO RELAY EQUIPMENT. - The contractor shall demonstrate that the operation of the radio relay equipment is in accordance with the applicable specifications. The contractor shall demonstrate performance compatible with the designed mission of the aircraft. The equipment shall be capable of receiving and transmitting information at the required signal strengths. It shall provide the required data handling capabilities. The turn-around time shall be within specified limits. The specified modulation characteristics shall be obtained. Speech processing shall be provided as required. Relay squelch change control shall be provided as specified.

3.19.1.12 INDICATING EQUIPMENT. - The contractor shall demonstrate that the operation of all indicator equipment is in accordance with applicable specifications.

3.19.2 INSTRUMENTS

3.19.2.1 PITOT AND PITOT STATIC SYSTEMS (ALTIMETER AND AIRSPEED INDICATOR). - The system shall be demonstrated to show compliance with Spec MIL-I-5072, MIL-I-6115 or MIL-I-26292 as applicable.

3.19.2.2 AUTOMATIC PILOT. - The automatic pilot shall be demonstrated to show compliance with Spec MIL-C-18244.

3.19.2.3 FUEL QUANTITY GAGE SYSTEMS. - The system shall be demonstrated to show compliance with Spec MIL-G-7940.

3.19.2.4 COMPASS SYSTEMS. - The system shall be demonstrated to show compliance with Spec MIL-C-7188 and Spec MIL-C-7762.

3.19.2.5 ATTITUDE INDICATING SYSTEMS (REMOTE). - The system shall be demonstrated to show compliance with applicable contract requirements.

3.19.2.6 ENGINE POWER PARAMETER SYSTEMS. - The system shall be demonstrated to show compliance with applicable contract requirements.

3.19.2.7 ANGLE OF ATTACK SYSTEMS. - The system shall be demonstrated to show compliance with Spec MIL-I-18079.

3.19.2.8 PERFORMANCE. - The contractor shall demonstrate that the operation of all flight and engine instruments is in accordance with applicable specifications or procedures approved by NAVAIR.

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3.19.2.9 ENGINE AND FLIGHT INSTRUMENT TRANSMITTER MOUNTINGS, TEMPERATURE AND VIBRATION LIMIT TESTS. - The airplane contractor shall perform ground and flight tests to demonstrate that the mounting provisions made for the engine and flight instrument transmitters do not exceed the specified temperature and vibration limits of the transmitter.

3.19.2.10 APPROACH POWER COMPENSATOR. - The approach power compensator (APC) shall be demonstrated to show compliance with the requirements of Spec MIL-C-23866.

3.20 CARRIER SUITABILITY DEMONSTRATION TESTS

3.20.1 GENERAL. - The specified carrier suitability demonstration tests shall be performed to show that the airplane can meet carrier suitability contract guarantees.

3.20.1.1 DEMONSTRATION SCHEDULE. - In order to document the test conditions and the end points to be met during the demonstration, a carrier suitability demonstration schedule shall be prepared and forwarded to NAVAIR (AIR-537, AIR-530) via the cognizant NAVPRO and NAVAIRTESTCEN. Authority to commence the demonstration will be granted after NAVAIR has approved the demonstration schedule with NAVAIRTESTCEN endorsement. The demonstration schedule shall be submitted to the cognizant NAVPRO at least three months prior to the expected commencement date of the demonstration.

3.20.1.2 FACILITIES FOR CARRIER SUITABILITY TESTS. - The Government will furnish the facilities required for the carrier suitability demonstration specified herein and for the build-up tests, and will retain full control of the facilities during these tests.

3.20.1.3 CENTER OF GRAVITY POSITIONS. - The center of gravity positions for the tests shall be those which are critical for the particular test under consideration.

3.20.2 CATAPULTING. - Catapult launches shall be made to demonstrate that the airplane can be suitably launched from the catapults of the aircraft carriers from which it is designed to operate. Provision for changing the extension of landing gear shock struts to

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3.20.2 (Cont)

facilitate catapult launching, the subsequent retraction, and extension of these struts, and absence of perceptible shimmying and hunting characteristics of the nose gear shall be satisfactorily demonstrated.

3.20.2.1 CATAPULT ACCESSORIES. - Catapult accessories shall be demonstrated to have required structural integrity, to have satisfactory service life, and to be suitable for hook-up, shedding, adequate airplane and store clearance, and arrestation.

3.20.2.2 GROSS WEIGHTS AND LOADING CONFIGURATIONS. - Catapult launches shall be made in each of the following configurations:

(1) Without bombs, rockets, guided missiles, mines, ammunition, external fuel, tip-tank fuel, or other disposable load items, but with full internal fuel.

(2) Maximum fuel: Same as (1) above plus the maximum fuel carried in internal and external stores.

(3) Maximum fuel with stores: Maximum fuel plus ammunition, bombs, rockets, guided missiles, mines, torpedoes and other stores. Critical store configurations shall be demonstrated.

(4) Maximum design gross weight with normal landing gear servicing and alternately with the most critical servicing within the limits of MIL-A-8863.

(5) Partial fuel: Fuel loadings so selected as to cover all particable gross weights with and without stores.

(6) All other critical store loadings configurations.

3.20.2.3 CATAPULT SPOTTING (PRIOR TO TENSIONING). - Approach to the catapult shall be demonstrated to assure operational suitability for spotting aboard aircraft carriers. The catapult spotting conditions of Fig. 1 shall be demonstrated in critical combination with the loading of 3.20.2.2. The distance "T" shall be one-half of the tread. The distance "d" shall be six inches unless a greater distance is specified for design in which case "d" shall be the design value. Conditions a, b, c, d, and e shall be demonstrated for nose-wheel-type airplanes. Conditions a, b, c, d, h, i, and j shall be demonstrated for tail-wheel-type airplanes and nose-wheel-type airplanes which are launched essentially as tail-wheel-types.

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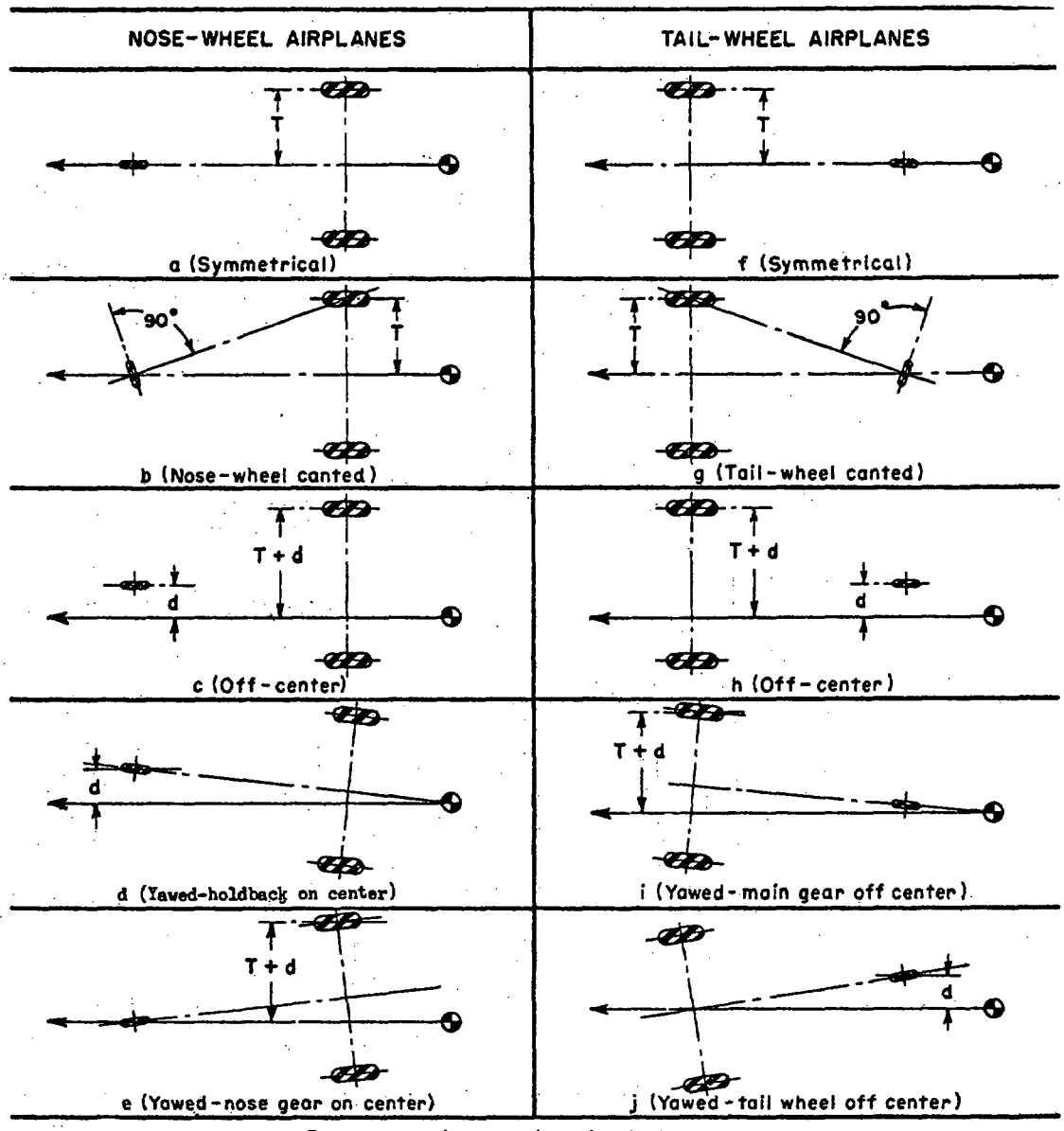

FIGURE 1

AIRCRAFT OFF-CENTER SPOTTING REQUIREMENTS

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3.20.2.3 (Cont)

Airplanes having nose-gear catapult-towing provisions shall be demonstrated for conditions a and e of Fig. 1. For condition e the main landing gear off-center position shall be as specified in MIL-L-22589. Each of the spotting conditions herein shall be demonstrated for each of the loadings of 3.20.2.2.

3.20.2.4 CONTROLLABILITY. - The catapult launches shall be made at the minimum safe launching airspeed and at least at 40 knots above the minimum safe airspeed, or at the maximum airspeed attainable if the 40-knot margin cannot be achieved. Trim shall be optional, but shall remain fixed during each launch until an airspeed is reached at which high-lift devices may safely be retracted or turned off (25 knots above the trim speed for catapult and airspeeds in the range above when no high-lift devices are employed). Under these conditions it shall be demonstrated that:

(1) Adequate longitudinal control effectiveness exists to prevent pitch up or pitch down to undesirable attitudes.

(2) The longitudinal control forces shall be within 20 pounds pull and 10 pounds push.

(3) Predetermined control programming or unusual control manipulation by the pilot is not required.

(4) Directional oscillations under all combinations of gross weight, catapult accelerations, and required spotting conditions, shall be convergent.

3.20.2.5 BOOST OR POWER SYSTEMS. - During the catapult-launching tests, the effectiveness of the control surface boost or power systems in the normal and emergency conditions, including the switch-over to and from the normal and emergency systems, shall be demonstrated.

3.20.3 ARRESTING. - Arrested landings shall be made to demonstrate that the airplane can consistently engage the arresting gear successfully and that airplane motions during the arrested run-out are conducive to safe carrier arrestments. Satisfactory 360-degree swiveling of the nose and/or tail gear for roll back in the arresting gear shall be demonstrated. Satisfactory anti-hunting characteristics of the nose gear and/or tail gear shall be demonstrated. Abrupt application of brakes during the post arresting roll-back shall be demonstrated.

3.20.3.1 LOADING CONDITIONS. - Arrested landings shall be made in each of the following loadings:

(1) Clean airplane.

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3.20.3.1 (Cont)

(2) The airplane shall be loaded so as to attain the weight specified in 6.2.2.5 of Spec MIL-A-8860 in critical combination with stores, and other mass items including external tank fuel, for which strength for arrested landings is required and alternate critical combinations of lesser gross weights and loading configurations. The weight distribution, including ballast as may be necessary to attain the specified airplane gross weights shall be as approved by NAVAIR. For at least one of the loadings herein, the landing gear servicing shall be the most critical within the limits specified in 3.2.2 of MIL-A-8863.

3.20.3.2 ARRESTING CONDITIONS. - All of the arrested landing tests of Table 5 shall be demonstrated for each of the loading conditions of 3.20.3.1. The parameters not specified in Table 5 shall be as approved by NAVAIR. The nomenclature and symbolism of Table 5 are defined in MIL-A-8863.

3.20.3.3 APPROACH SPEEDS. - A range of approach speeds from V_{PA} min. to 15 knots above 1.1 V_{PA} min. shall be demonstrated for the gross weights specified. V_{PA} min. shall be the minimum usable airspeed for carrier landings and for field-carrier landing practice as specified in 6.2 of MIL-A-8860.

3.20.3.4 WAVE-OFF CAPABILITY. - Adequate wave-off capability under the most stringent approach conditions shall be demonstrated.

3.20.3.5 AUTOMATIC APPROACH AND LANDING CAPABILITY. - Automatic approach and landing, including wave-off and transition when the aircraft system is instrumented for these functions, shall be demonstrated.

3.20.4 CENTER-OF-GRAVITY POSITIONS. - The center-of-gravity positions for the tests herein shall be those which are critical for the particular test under consideration.

3.20.5 TEST LIMITS. - The carrier suitability demonstration shall be performed to attain the parameters of Table 5, design catapult and arresting hook loads, and design load factors where applicable for the catapluting and arresting phases. When demonstrating the design load factors, the airplane gross weight may be reduced as required in order to avoid exceeding the design limit catapult or arresting hook loads. Where attainment of both limit load and limit load factor in any one test condition is limited by the capacity of the facilities furnished by the Government for the tests, the gross weight may be reduced at the discretion of the test authority in order to attain limit load factor.

TABLE 5 - ARRESTED LANDING TESTS

Test No.	Type of Landing	Sinking Speed (FPS)	Pitch Angle (DEG)	Roll Angle (DEG)	Off-Center Distance	Remarks
1	On Center	Not less than $\bar{V}_{V_c}$	Optional	Optional	0	Attain limit hook load
2	Off Center	Not less than $\bar{V}_{V_c}$	Optional	Optional	25 feet	Attain limit hook load
3	Rolled	Not less than $\bar{V}_{V_c}$	Mean ±1	Not less than 6	Optional	Attain limit hook load
4	Rolled and Yawed	Not less than $\bar{V}_{V_c}$	Optional	Not less than 5	Optional	Perform twice, once with roll in same direction as yaw and once with roll in opposite direction to the yaw. The yaw angle shall not be less than 5 degrees.
5	Tail Down	See Note 1	Not less than mean +3	Optional	1/2 main gear wheel tread See Note 2	Perform once to the conditions specified or, alternatively three times but with sinking speed not less than 0.8 times the sinking speed of Note 1.
6	Nose Down	See Note 1	Not greater than mean -3	Optional	Optional	" " "
7	Mean Attitude	See Note 1	Mean ±1.5	Optional	Optional	" " "
8	Free Flight	See Note 3	Not less than that angle corresponding to 1.3W lift at $1.1V_{PA_{min}}$ at wire engagement	Optional	See Note 2	Perform once to the conditions specified or, alternatively 3 times but with the specified sinking speed increased by 2 FPS and the specified pitch angle reduced by 2 degrees. The hook load for all free flight engagements shall not be less than 85 per cent of limit.

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TABLE 5 (Cont)

Notes:

1. For test numbers 5, 6 and 7 the required sinking speeds shall be not less than the maximum design sinking speed corresponding to airplane pitch angles of mean +3, mean -3, and mean respectively.

2. For each of tests 5 and 8, one third of the total number of landings performed to satisfy the requirements of this Table, or three landings, whichever is less, shall result in the landing gear rolling over a deck obstruction. For test 5 the main gear shall roll over a centerline light and for test 8 the nose gear shall roll over a PLAT head. For each of these landings the vertical load on the landing gear, just prior to contact with obstruction, shall not be less than 75 per cent of the peak load attained without the superposition of the incremental deck obstruction load.

3. For test number 8, the sinking speed shall not be greater than the minimum specified in MIL-A-8863.

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3.20.6 BUILD-UP TESTS. - In the tests herein, critical conditions shall be approached gradually in build-up tests in order that the pilot may familiarize himself with the airplane and enable the contractor to correct dangerous or undesirable characteristics that may be observed during the tests. The number of build-up tests shall be included in the demonstration schedule and are subject to approval by NAVAIR. Any subsequent change in the extent of build-up tests may be made with the approval of the test authority.

3.20.7 REDEMONSTRATION. - In the event that, subsequent to a test in accordance with 3.20 having been performed, there are structural, aerodynamic, or other changes which may affect the carrier suitability of the airplane, the contractor shall redemonstrate those tests which are considered necessary by the test authority.

3.21 PHOTOGRAPHIC DEMONSTRATION REQUIREMENTS

3.21.1 GENERAL. - The photographic equipment listed for installation and operation in the detail specification shall be demonstrated at altitudes and power settings specified in the addendum to this specification.

3.21.2 GROUND CHECK. - All the cameras, magazines, and associated equipment listed for installation in the detail specification for the airplane shall be demonstrated to show:

(1) Adequate installation clearances including access for loading and unloading installed cameras, and/or magazines; testing, operation, and removal of units and components of photographic equipment.

(2) Rotatability of cameras and/or mounts, if specified.

(3) Functional checks of cameras, camera control systems, viewfinders and other installations, systems and equipment associated with photography.

(4) Operational checks of flight line and/or bench-check equipment, if specified.

(5) Proper and safe operation of camera doors, related bomb bay doors and illuminant release system.

(6) Adequate stowage and security of spare photographic equipment, if applicable.

(7) Suitability of handling equipment, if applicable.

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3.21.3 FLIGHT CHECK. - The flight program shall demonstrate the following:

(1) Camera platform suitability.

(2) Satisfactory operation of the camera control system throughout the designed range of the camera control system, but within the design flight envelope of the airplane and for the cameras being installed.

(3) Suitability and operability of the viewfinder, oblique sights and/or other sighting equipment for properly positioning photographic targets.

(4) Adequacy of camera doors and windows to afford the camera a view unobstructed by the airframe, dirt, oil film, water condensation, reflection or other deleterious effects.

(5) Suitability of camera compartment temperature, pressurization and vacuum supply; accessibility to and operability of doors, windows, cameras, and associated equipment as applicable.

(6) Usability of the photographs from all installed cameras operated in accordance with paragraph (2) above, including radar recording, and night photography as applicable.

(7) Adequacy of camera initiating, operating, and indicator mechanisms of the camera control systems.

(8) Adequacy of recording equipment, as applicable.

(9) Suitability of the automatic pilot to maintain photographic flight line requirements as applicable.

3.22 RELIABILITY AND MAINTAINABILITY TEST

3.22.1 GENERAL. - The reliability and maintainability test shall be performed to show that the airplane can meet the specified reliability and maintainability requirements. This test shall be performed in combination with or, if necessary, in addition to aerodynamic, hydrodynamic, power plant, armament, equipment, electrical, avionics, carrier suitability and photographic demonstration tests. Any reliability and maintainability test completed and properly witnessed by a test authority (see 3.1.2) in accordance with the approved test plan, but prior to the scheduled point of test, shall be included in reports submitted in compliance with 3.25.2.19.

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3.22.2 TEST PLAN. - To document the test conditions and the end points to be met during the test, a reliability and maintainability test plan shall be prepared and forwarded to COMNAVAIR (Attention: AIR-5205) via the cognizant NAVPRO. Authority to commence the test will be granted after NAVAIR has approved the test plan. The test plan shall be submitted to the cognizant NAVPRO at least three months prior to the expected commencement date of the demonstration.

3.22.3 AIRCRAFT CHANGES. - Subsequent to release of airplanes for reliability and maintainability test no changes shall be made unless approved by NAVAIR subject to the requirements of 3.1.8.

3.22.4 TEST FLIGHTS. - The specified mission profiles shall be flown for reliability test. The maintenance generated by each uncensored reliability flight shall be used for maintainability measurement. The specified number of mission profile flights shall be flown for the reliability and maintainability test.

3.22.5 MAINTENANCE. - In-flight maintenance on equipment shall not be conducted during a test flight except when necessary to restore the aircraft to a minimum acceptable condition as specified for crew safety, or as permitted by established Navy operator maintenance procedures. All maintenance between flights shall be conducted by the maintenance crew which shall be limited to the quantities and equivalent skills specified. All support equipment used during the reliability and maintainability test shall be those planned for use with the aircraft in its service environment.

3.22.6 ACCEPTANCE CRITERIA. - The quantitative reliability and maintainability requirements have been met if the maximum permissible values of failure, downtime, and maintenance man-hours have not been exceeded. A serial number shall be assigned to each flight. At the completion of each flight the serial number of the aircraft, the result (success, failure, or censored), and the flight duration, shall be recorded. Prior to the next flight elapsed maintenance downtime at the organizational level shall be recorded for corrective maintenance, turn-around, and operational readiness test. During the test a record shall be kept of the direct maintenance man-hours for corrective maintenance and preventive maintenance performed on the aircraft and the support equipment at the organizational and intermediate levels. Only those data associated with uncensored flights shall be used in determining compliance with the quantitative reliability and maintainability requirements. A flight may be censored when the "no test" definition of MIL-STD-757 applies. However, if the number of censored flights exceeds 20%, the quantitative requirements have not been met.

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3.22.7 SUPPORT EQUIPMENT. - Demonstration of the compatibility between the Airplane Weapon System and all recommended support equipment is required. Demonstration of performance, operability, reliability, and maintainability is required for all special support equipment.

3.22.8 LOGISTIC SUPPORT. - Demonstration of logistic support characteristics shall be in accordance with WR-30. Output data from the Reliability and Maintainability Test of 3.22.1 shall be used as a starting point for determination of maintenance support characteristics.

3.23 RESERVED

3.24 RESERVED

3.25 REPORTS

3.25.1 GENERAL. - Demonstration reports and the prescribed distribution of the reports are delineated herein to facilitate development of report coverage as related to the test requirements established in compliance with the specification. The contract addendum to Spec MIL-D-8706 (applicable issue) will establish the requirement for submittal of data generated during a demonstration program.

3.25.1.1 FORMAT AND GENERAL REQUIREMENTS. - Reports delineated by this specification shall conform with the format and general requirements of Spec MIL-R-18136 amplified as follows:

(1) Reports of test results shall describe how and to what extent the tests were observed by representatives of the Government.

(2) Revised material shall bear the same page numbers as the pages which are to be replaced, plus the word "revised" and the date of the revision. The revised subject matter shall be identified. Added pages shall bear the same number as the preceding page followed by a lower case letter unless the additional pages follow the last page of the report.

(3) Symbols, abbreviations, and units, if they do not appear in standard lists of airplane nomenclature, or in documents listed in Paragraph 2, herein pertaining to the material in the report, shall be defined in a separate table of definitions.

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3.25.1.1 (Cont)

(4) Documents referred to in a report shall be limited to those known to be available in NAVAIR if reference to such documents is necessary for clarity; otherwise the contractor shall furnish two copies of the reference documents to NAVAIR along with the material which refers to them.

(5) Reports shall be bound in flexible pronged metallic paper fasteners or other means which will facilitate removal, addition, or replacement of pages without resort to mechanical devices for disassembly and reassembly of the reports.

(6) Reports of more than 10 pages shall be indexed.

(7) Contents of the report of 3.25.2.5 shall be presented appropriately sectionalized so that all data concerning each principal category (such as Aerodynamic, Hydrodynamic, Carrier Suitability, Equipment, Power Plant, or Nuclear Weapons) are submitted on consecutive pages that may be separated from the data concerning all other categories. This requirement does not apply to the index.

(8) The reports of 3.25.2.1 and 3.25.2.6 may be combined provided that the data of 3.25.2.6 are presented on consecutive pages that may be separated from all other contents of the combined reports.

(9) The report of 3.25.2.7 may be combined with the report of 3.25.2.2 provided that the data of 3.25.2.7 are presented on consecutive pages that may be separated from all other contents of the combined reports.

(10) Reports covering development tests performed by the contractor but which are not specifically required by this specification shall be prepared and submitted as specified herein.

3.25.1.2 ACTION ON REPORTS. - The planning for, progress of, and the data obtained during the entire demonstration shall be documented and submitted by the contractor via the NAVPRO except as otherwise specified herein or in the addendum to this specification. All reports shall be submitted for action or information as specified in 3.25.2.22. Acceptance of contractor's reports, or revisions or additions thereto, and/or the waiving of compliance with a specified demonstration test by COMNAVAIR or by the COMNAVAIRTESTCEN, shall not, with respect to the rights of the Government under the correction of defects provisions of the contract, be construed to be a waiver of any failure of the contractor to comply with the

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3.25.1.2 (Cont)

guarantees set forth in the contract, or any failure to comply with the specifications or documents attached to or incorporated therein. (For distribution of reports, see 3.25.2.20).

3.25.1.3 RESPONSIBILITY FOR REPORTS AND DATA

3.25.1.3.1 NAVPRO. - It shall be the responsibility of NAVPRO to: (Ref. NAVAIR Inst. 13100.4)

(1) Monitor the contractor's preparation and submission of all reports delineated in paragraph 3.25.2 of this specification to assure prompt submittal thereof to the Naval Air Systems Command in accordance with established procedures and time schedules.

(2) Examine required demonstration reports for completeness and return to the contractor for correction all data not conforming to applicable requirements.

(3) For those demonstrations for which the NAVPRO is the designated test authority, examine all demonstration reports for compliance with specifications and contract demonstration addenda and verify the data as to accuracy and completeness.

(4) Endorse Demonstration Instrumentation Reports, and Performance Data-Reduction Reports to the Naval Air Systems Command via COMNAVAIRTESTCEN and the Commander Naval Weapons Evaluation Facility (when special weapons are involved) for review and comment.

3.25.1.3.2 NAVAIRTESTCEN-NAVWPNEVALFAC. - It shall be the responsibility of COMNAVAIRTESTCEN, except for special weapons demonstration tests and the COMNAVWPNEVALFAC (when special weapons are involved) to: (Ref. NAVAIR Inst. 13100.4)

(1) Review Demonstration Instrumentation Reports, Demonstration Progress Reports, Avionics Systems Demonstration Data Reports, and Performance Data - Reduction Reports, and forward one copy to each of the COMNAVAIR, attention of the organizational code having cognizance of the AIRTASK/Work Unit Assignment, with recommendation as to their suitability.

(2) Submit a "report of test results" summarizing the results of the Navy Preliminary Evaluation immediately after completion of each phase. This report shall be followed by a detailed report shortly thereafter. Assign Report Symbol NAVAIR 13000.3 to message and detailed letter reports.

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3.25.2 REQUIRED REPORTS

3.25.2.1 DEMONSTRATION INSTRUMENTATION REPORT. - This report shall be submitted via COMNAVAIRTESTCEN not later than three months prior to the last date at which it will be practicable to install in demonstration airplanes, items or components of test instrumentation which must be installed therein during manufacture. The report shall be sufficiently complete to indicate the need for the instrumentation in fulfilling the demonstration requirements, shall comply with the requirements of 3.3 and shall contain:

(1) Complete list of the demonstration specification and/or its contract addendum paragraphs for which each instrument will be used.

(2) Complete list of variables to be measured with each demonstration airplane and the expected overall accuracy of measurement of each variable.

(3) *Complete list of GFE instruments.

(4) *Complete list of CFE instruments.

(5) Estimated dates for completing installation of instrumentation in each demonstration airplane.

(6) Detailed description of all instrumentation and related systems and all final calibration data for each demonstration airplane.

*These lists shall completely identify the instrumentation as to purpose, function intended, location, and response characteristics required.

When requested, the representatives of the contractor shall confer with government personnel at the NAVAIRTESTCEN to reach agreement on details that are determined to be necessary for inclusion in subsequent revisions to the report.

3.25.2.2 DEMONSTRATION PLANNING AND PROGRESS REPORT. - This report shall be submitted via COMNAVAIRTESTCEN and shall contain comprehensive, up-to-date information concerning the planning for the performance of the entire demonstration program as well as the relationships between demonstrations and other "proof-of-design" requirements, and planned airplane deliveries. The parts of the report containing the information specified in (1) through (5) below shall be submitted concurrently with the submittal of the Demonstration Instrumentation Report. Subsequently, at intervals not exceeding two months, additional and/or revised pages shall be submitted as are necessary to furnish as much as possible of the information specified in (6) through (12) below and to keep submittal material up-to-date. If, at the end of any two-month period added and/or revised pages are not necessary to make the report up-to-date, a statement to that effect shall be submitted. The report shall include the following:

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3.25.2.2 (Cont)

(1) A copy or facsimile of the applicable addendum to this specification or other contractual document which defines the demonstration.

(2) Planned dates for performance of proof-of-design tests and for submittal of contract design data, the performance of and/or the submittal of which are contractual prerequisites of proceeding with various demonstration tests.

(3) Planned dates for performance of demonstration tests with each of the demonstration airplanes.

(4) Planned dates for evaluation by Navy pilots at the contractor's plant.

(5) Demonstration schedule for each phase of the demonstration (i.e. Structural, Aerodynamic, Hydrodynamic, Carrier Suitability, etc.). This schedule shall describe in sufficient detail the tests that the contractor plans to perform in order to fulfill the demonstration requirements and also the paragraph relationship between tests and demonstration requirements.

(6) Schedule of delivery of airplanes for trials and to the Fleet.

(7) Dates of actual performance of the various takeoff, flight, landing, carrier suitability, and ground demonstration tests including build-up tests.

(8) Operating limits for flight by the contractor's pilots and for flight by Navy pilots, including the recommended operating limits required by 3.6.5 and 3.7.2.8. If these limits differ from those applicable at the time of submittal of the previous periodic revision to the report, the added and/or revised pages shall summarize the basis for the changes.

(9) The following information as applicable to the design:

(a) All structural design gross weights.

(b) Aerodynamic, hydrodynamic, and structural design envelopes and limits of airplane gross weight versus center-of-gravity position.

(c) Level-flight and limit dive speeds.

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3.25.2.2 (Cont)

(9) (Cont)

(d) Catapult limit load factor and limit tow load.

(e) Arresting limit load factor, limit drag load, and envelope of design sinking speeds, pitch angles, and roll angles for carrier-based airplanes.

(f) Design sinking speeds and pitch angles for land based airplanes.

(g) Maximum design rough-water limit load factor.

(h) Stall speeds, power-on and power-off, versus gross weight in basic, landing, and other pertinent configurations.

(i) Demonstration speeds for tests "p" of table 3 with indications of whether the speeds are limited by actual strength, control power, flight characteristics, or other significant parameters.

(j) Planned flight envelopes for Navy Preliminary Evaluation.

(k) Landing gear strength envelopes and source or method of derivation. Such envelopes shall be based on existing strength as substantiated by tests and supplemented, if necessary, by analytical methods.

(l) Curves of airplane gross weight versus center of gravity position for extreme aft and forward loadings and demonstration test loadings.

(10) Summaries of safe boundaries of flight conditions performed during the contractor's flight tests including, as a minimum, the following information:

(a) The test data of equivalent airspeed and Mach number for the report period shall be denoted as points with appropriate corrections plotted on design V-n diagrams for sea level and every ten-thousand-foot increment of altitude up to the service ceiling. Information previously reported for each of the altitudes shall be indicated by shaded areas connecting their outer boundaries.

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3.25.2.2 (Cont)

(10) (Cont)

(b) Information regarding high-speed and low-speed rolling pull outs (equivalent airspeed and load factor) and high-speed and low-speed steady side-slips (equivalent airspeed and rudder-pedal force) shall be presented in tabular form indicating the most severe maneuvers that have been shown by flight test to date can be safely achieved.

(c) A curve indicating the flight tested variation of lift coefficient with Mach number based on the stall, static longitudinal instability, undesirable buffet intensity, or other characteristics which limit the useful lift capabilities of the airplane. In a like manner information for the airplane with stores shall be included.

(11) Discussion of any required demonstration tests which the contractor has concluded cannot be performed in the manner or to the conditions specified, with amplifying information regarding design deficiencies involved or other reason for the contractor's conclusions. This information shall summarize action taken or contemplated by the contractor to eliminate the deficiencies and whether or not the contractor is able to solve pertinent design problems posed by the disclosed design deficiencies.

(12) Description of airplane which the contractor proposes to use in the performance of the structural demonstration (takeoff, landing, and taxi tests for land-based and carrier-based airplanes, seaplane takeoff and landing tests, and dives and pull-outs) - if structurally, aerodynamically, and functionally identical with airplanes delivered or planned to be delivered for trials and to the Fleet, a statement to that effect should be submitted in lieu of detailed descriptions; otherwise the structural, aerodynamic, and functional differences shall be completely described and the effects of these differences on the proof-of-design aspects of the structural demonstration shall be summarized. This applies particularly to special provisions in demonstration airplanes which are not to be in service airplanes such as special cockpit control restrictors; special escape provisions; ballast in lieu of useful load, modification to standard stores mounts; and those affecting strength and rigidity, flying qualities, and/or performance.

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3.25.2.2 (Cont)

(13) Report of the progress made and/or action planned to:

(a) Correct descrepancies disclosed during any phase of the Navy Preliminary Evaluation, contractor's exploratory flights, or any flights which are not necessarily covered by specific test requirements.

(b) Investigate various aerodynamic characteristics of the aircraft not necessarily covered by specific test requirements. This would include build-up flights normally performed prior to the demonstration tests required by paragraph 3.13.4 of this specification.

3.25.2.3 DAILY FLIGHT REPORTS. - Daily reports shall be submitted for at least the first 20 takeoffs and landings of each of the first two demonstration airplanes at which time they may be discontinued by the NAVPRO upon the contractor's request, or as otherwise directed by the NAVPRO. These reports shall be submitted within 48 hours after completion of flights, except when additional delay is essential to the presentation of data. Reports shall be submitted as expeditiously as possible. These reports may be brief and informal and need not be forwarded by formal correspondence, and shall include the following information:

(1) Daily flight report number.
(2) Airplane model designation.
(3) NAVAIR serial number.
(4) Contract number.
(5) Date of flight.
(6) Pilot's name.
(7) Duration of flight.
(8) Loading condition.
(9) Gross weight.
(10) Purpose of flight (and program if a series of flights are involved).
(11) Center of gravity location.
(12) Changes prior to flight.
(13) Discussion, including pilot observations concerning any phenomena encountered such as unusual or unexpected flight characteristics, yielding or failure of a region of the structure, flutter including control-surface buzz, or any other unusual occurrence shall be included.
(14) Discussion, including pilot observations of the operation of the installed aircraft weapons system equipment.
(15) Enclosures (if any).

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3.25.2.4 BI-WEEKLY SUMMARY REPORTS. - Bi-Weekly Summary Reports shall be submitted for the duration of the period the contractor has custody of the airplane. These reports shall be brief and informal and shall contain qualitative and preliminary quantitative data (quantitative data for Aerodynamic tests only) obtained during the reporting period. In some instances time will not permit quantitative data obtained during the latter part of the two week reporting period to be included. These data must be included in the next Bi-Weekly Summary Report, and final data shall be submitted in the Bi-Monthly Report. The Bi-Weekly Report shall summarize the purposes of the tests and significant results obtained from the tests, including pilot comments where applicable. Quantitative data shall be included to cover typical aerodynamic test results sufficient to define problem areas and/or aerodynamic characteristics not previously reported. The Bi-Weekly Report shall also describe the configuration of the airplane including photographs and/or sketches of aerodynamic modifications tested during the reporting period. The report shall be submitted not later than seven calendar days following the end of the reporting period directly to NAVAIR and NAVAIRTESTCEN.

3.25.2.5 DEMONSTRATION DATA REPORT. - This report shall be submitted periodically at intervals of not greater than two months, beginning with the first periodic revision of the Demonstration, Planning and Progress Report submitted after the first airplane has been flown. The data and the quantitative comparisons of 3.25.2.5(12) in the report at the time of submittal of each periodic revision shall be up to date with respect to all tests performed up to not later than one month prior to each periodic revision. If at the end of any two-month period, added and/or revised pages are not required to comply with the intent of the foregoing sentence, a statement to that effect shall be submitted. For tests performed in compliance with test requirements and procedures which are contained in documents listed in 2.1.1, and provided that the pertinent documents of 2.1.1 require the submittal of reports of the tests, the identity and date of submittal of the pertinent reports shall be included in lieu of including pertinent test data; otherwise the following information concerning demonstration tests performed shall be submitted to the extent that the various items of information listed below are applicable to the airplane design and to the particular test performed:

(1) A discussion of how and to what extent the test was observed and accepted by representatives of the Government.

(2) Photographs showing basic features of the airplane with and without external loading and equipment installed (in flight, during takeoffs including catapulting, during landing approaches, and during landings including arresting). These photographs shall include typical three-quarter-front and three-quarter-rear views from opposite sides of the airplane.

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3.25.2.5 (Cont)

(3) Pertinent data observed and/or recorded during the test. For dives and pull-outs, comparisons shall be made of the values of all significant parameters employed in the definition of the specified dives and pull-outs with corresponding measured values for each dive and pull-out including plotted time-history data, from time of initiation of the test to complete recovery there-from, as follows: altitude, airspeed and Mach number, load factor, control forces and positions, pitching acceleration, pitching velocity for pull-ups, and positions of trimming devices. Complete discussions shall be included of any buffeting, flutter, excessive vibration, control-surface buzz, or unusual response of the airplane or component thereof encountered during the test. For tests relating to flying qualities, only significant data for typical tests conditions shall be presented. The data presented shall be sufficient to depict trends or to support stated conclusions. Summary data showing variations of important stability and control parameters with Mach number, altitude, etc. and comparisons with predicted derivatives shall be presented if available. The data shall be presented so as to clearly separate demonstration data from other data. With respect to paragraph 3.6.5, if the bulk of the required data has been submitted in the Demonstration Data Report, then only a supplemental data report is required. Otherwise a separate report entitled "Pre-Evaluation Engineering Data" shall be submitted.

(4) Conditions of loading.

(5) Catapult spotting conditions, when applicable.

(6) Arresting conditions, when applicable.

(7) Approach speeds, when applicable.

(8) Engaging speeds, when applicable.

(9) Changes incorporated.

(10) All pertinent data obtained during performance demonstration tests shall be included in the Demonstration Data Report. Methods and procedures for determination of each performance item as well as related information such as airspeed position error, ambient temperature engine thrust etc. shall be adequately described. Methods and calculations used in the reduction of observed data to standard conditions, and in the adjustment of these data to specification conditions shall be presented.

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3.25.2.5 (Cont)

(11) A compilation of the test points and methods employed in calibrating (to 110 percent of design limit or maximum expected values) all structural load, load factor, stress, or temperature measuring devices.

(12) Quantitative comparison of the results of dynamic analyses required by the specification MIL-D-8706 for predicting time histories of loads and motions, and the maximum loads for taxiing; landings, including arrested landings; and takeoffs, including catapult launchings, shall be made with typical time histories of loads and motions, and with maximum loads, including the superposition of deck-obstruction loads; all as measured in the land-based and carrier-based takeoff, landing and taxi tests of 3.12.2; in the carrier-suitability demonstration tests of 3.20; and in airplane and landing-gear jig drop tests. Where necessary for making these quantitative comparisons, additional dynamic analyses shall be made for the initial conditions as measured in the demonstration tests, including the build-up tests of 3.20.6. The analytical variation in the critical and in the maximum loads and accelerations with initial conditions shall be shown separately from the time histories and shall be compared with the loads and accelerations as measured in the demonstration tests, including the build-up tests, as extrapolated if necessary, to the design envelope of conditions specified. The foregoing comparison shall be shown in relation to the strength envelope of the airplane, such envelopes to be determined by a combination of analysis and static test results. In addition, these comparisons shall be summarized to show that the airplane has structural reliability for the design envelope of conditions contractually specified.

(13) Quantitative comparisons of the measured loads and/or stresses obtained during the development flight tests of 3.12.1.6 shall be made with design loads and stresses for the purpose of substantiating critical design loads.

(14) Quantitative test results and a discussion of the methods used to determine the accuracy of the airplane weapons system.

(15) Quantitative comparisons of loads and motions measured during the tests of 3.12.3 with design loads and motions and supplemental information to demonstrate by a combination of test data and calculations that successful seaplane takeoffs and landings within the design envelope of MIL-A-8864(ASG) are reasonably assured.

3.25.2.6 FLYING QUALITIES DEMONSTRATION DATA REPORT. - Submit for acceptance - This report shall be submitted not later than 2 weeks prior to commencement of INSURV Trials and shall contain quantitative data and qualitative information as appropriate, documenting compliance with requirements of 3.13.2.

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3.25.2.7 SPIN DEMONSTRATION SCHEDULE AND DATA REPORTS. - Maximum use shall be made of the dynamic model spin tests, static and dynamic wind tunnel tests, and analytical calculations in order to reduce the flight test spin program to a minimum. Model tests shall be conducted to determine the effects of various combinations of control positions, loading distribution, and significant aerodynamic configuration changes. Testing shall provide maximum information for the loadings specified in Table 4. Other significant configurations shall be model tested for comparison with the results of the primary test configurations.

3.25.2.7.1 SPIN DEMONSTRATION SCHEDULE REPORT. - After completion of the model spin tests and analyses, and at least two weeks prior to initiation of the spin flight test program the contractor shall submit an acceptable spin demonstration schedule report. This report shall include anticipated spinning characteristics based on model tests and analyses and shall present details of the contractor's proposed spin testing program. In cases where the contractor considers modification to the basic spin program to be necessary it shall be discussed in this report.

3.25.2.7.2 SPIN DEMONSTRATION DATA REPORT. - Upon completion of the spin test demonstration the Contractor shall submit a report summarizing the results of the flight program and including proposed wording for the spin information to be presented in the NATOPS Flight Manual. The spin report shall contain the following information for each demonstrated maneuver: gross weight, general arrangement of loading, center-of-gravity, moments of inertia, locations of principle axes, gear and flap position, etc., starting altitude, method of entry, power conditions, turns of spin executed before applying recovery controls, nature of the steady spin, time per turn, altitude loss per turn, control positions and maximum forces during recovery, altitude loss in recovery, time histories (starting force initiation of spin and continuing through recovery to level flight) of control positions and forces, airspeed, altitude, normal acceleration, angles and rates of pitch, roll and yaw, angles of attack and sideslip. Additional time histories of significant build-up maneuvers which the Contractor considers to be of value to the report shall be included. The report shall also describe the emergency spin recovery device including photographs.

3.25.2.8 PERFORMANCE DATA-REDUCTION REPORT AND CONFERENCE. -

(1) At least six months prior to the performance tests of 3.13.4, representatives of the contractor shall confer with NAVAIRTESTCEN personnel to discuss the procedures and methods for reduction of data to be used by the contractor during these performance tests.

(2) A report describing data reduction methods to be used during the performance tests of 3.13.4 shall be submitted to NAVAIR via COMNAVAIRTESTCEN not later than three months prior to performance demonstration.

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3.25.2.9 GUARANTEED PERFORMANCE DATA REPORT. - This report shall be submitted via NAVAIRTESTCEN not later than one month prior to release of the airplane for the performance demonstration tests of 3.13.4 or not later than one month prior to the release of the airplane for INSURV Acceptance Trials, whichever is first, and shall summarize the individual and cumulative effects on contract performance guarantees for the performance demonstration airplane of:

(1) Each change covered by change order or other contract document and all other pending changes which are under negotiation but are not yet covered by final contractual action, including all changes each of which individually has been determined to have "negligible effects" on contract performance guarantees. The ACCB number (if applicable) and nature of change shall be indicated for each separately listed change.

(2) Any change in engine rating.

(3) Any overweight or underweight of government furnished equipment.

3.25.2.10 AVIONIC SYSTEMS DEMONSTRATION DATA REPORTS. - These reports shall be submitted via COMNAVAIRTESTCEN. They shall be submitted as soon as practicable but not later than 60 days prior to release of the airplane for INSURV electronic and armament trials. Data may be obtained during the preliminary evaluation of 3.6.12. The reports shall include the following:

(1) Master electronic installation drawings, information on changes or modifications to the electronic configuration which are to be incorporated prior to production delivery of the airplane and pertinent corrections to the electronic section of the preliminary handbook of maintenance instructions.

(2) Description of the composite electronic system including antenna placements with a discussion of the design parameters and considerations which influenced the installation.

(3) Laboratory test data shall be provided in accordance with paragraph 3.19.1, prior to demonstration test flights and at frequent intervals during the demonstration flights to assure that the avionics equipments meet their individual specification requirements.

(4) A graphical presentation of the intercommunication system (ICS) audio power output analysis, covering the range of audio interphone control facilities available to the crew, including frequency response measurements, to show acceptable quality of audio response in the system.

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3.25.2.10 (Cont)

(5) Results of the interference survey tests of paragraph 3.19.1.1. The report shall include a description of the test airplane, listing of all installed and operating electronic-electrical equipment, a statement as to the extent the tests were witnessed and approved by government authorities, and a discussion of those items indicated in paragraph 3.19.1.1.

(6) The flight performance of the identification system, including the accessory units and integration with other parts of the aircraft weapons system.

(7) A survey of the ambient temperatures and air flow at numerous appropriate positions within the electronic compartment, packages, and equipments with supporting data. Tests shall be conducted, where practicable, in accordance with Spec MIL-T-5422 or in an environment where the air pressure, airflow, air friction, temperature, humidity, etc., duplicate conditions at the service ceiling of the airplane.

(8) Antenna radiation patterns. The radiation patterns shall be made in flight for all applicable antennas to confirm model antenna measurements with proper allowances made for cable losses and all significant propagation factors to assure repeatability and determination of absolute values of signal level. The field-intensity measurements shall be referred to the isotropic antenna signal levels. The isotropic signal level shall include a factor to account for gain due to ground reflected signal. Evaluations conducted with and without external stores shall be reported. A discussion of the operational envelope in terms of maximum ranges versus altitude at significant frequencies shall be included. Ground facilities shall be completely described on other airplane antenna systems and with the model range antenna studies.

(9) Bearing accuracy curves of the navigational system including boundary limits for position-indicating equipment shall be presented to indicate the degree of compliance with the accuracy requirements of applicable specifications. For navigational type equipments normally used during penetrations, letdowns and instrument landings, sufficient discussion of actual flights shall be included to clearly demonstrate distance and accuracy capabilities near the terminal stations as well as at maximum range and altitude.

(10) The flight performance of the automatic control and stabilization system as required by 3.19.2.2.

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3.25.2.10 (Cont)

(11) A report of the flight performance and operational accuracy of the countermeasures systems at various ranges from appropriately described signal sources on the ground. This evaluation shall be made on representative frequencies within each frequency band covered by the antennas and equipment installed.

(12) The laboratory evaluation and flight test results showing the performance of the radar and/or fire control system shall be reported in graphic and/or statistical form where applicable. Comments on the operational capability shall also be reported.

(13) The flight performance and operational accuracy of the electronic altimeter systems and an assessment of the adequacy of the system for the intended mission of the airplane. Critical factors affecting the installation of the altimeters shall be reported in detail.

(14) A discussion of the flight performance of all electronic systems during any of the simulated missions specified for the airplane, including a qualitative analysis of the overall system integration with details of any peculiarities that may exist which might affect the designed mission of the aircraft.

(15) The recommended maintenance and test procedures using standard or special contractor furnished equipments. This shall include test setup, procedures, special handling equipment, bench check and line maintenance procedures as analyzed in a man-hour maintenance time study. Any information regarding reliability or failure of components should also be reported. This report shall also include utilization and efficiency of any special test or auxiliary equipment to be supplied by the contractor.

(16) The instrumentation used by the contractor and installed in the airframe during the electronics and armament demonstration. These reports shall include a complete, detailed description of the airborne electronic systems, terminal equipments, procedures, test conditions, and terrain over which tests were made. Reference shall be made to sections of the applicable specifications which governed the evaluations. The report shall contain comprehensive discussion of the results obtained and emphasize any operational limitations imposed by hardware design. Any contractor request for a waiver of the applicable specification or portions thereof shall reference and be supported by the discussions contained in these reports. The discussion and data shall be sufficient to judge the validity of the conclusions reached by the contractor.

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3.25.2.11 MOVING PICTURE COVERAGE REPORT. - When significant events occur during the moving picture coverage, the film shall be processed and forwarded with complete flight data concerning the significant events to NAVAIR as soon as practicable.

3.25.2.12 PROPELLER VIBRATION SURVEY REPORT. - See 3.6.8.1.

3.25.2.13 POWER PLANT TEMPERATURE SURVEY REPORT. - See 3.6.8.3.

3.25.2.14 COMPRESSOR INLET AND TURBINE OUTLET SURVEY REPORT. - See 3.6.8.4.

3.25.2.15 ELECTRICAL SYSTEM DEMONSTRATION DATA REPORT. - This report shall be submitted as soon as practicable but not later than 60 days prior to release of the airplane for INSURV electrical and electronic trials. Data may be obtained during the Navy Preliminary Evaluation of 3.6.12. The report shall include the following:

(1) Up-to-date copies of all electrical wiring diagrams showing cable designations and lengths.

(2) A description of the electrical system operation during normal, emergency, and ditching procedures.

(3) An electrical load analysis (AC and DC) compiled in accordance with Specification MIL-E-7016. A description of the instrumentation and procedures used in conducting the analysis and measurements.

(4) Data, methods, and instrumentation pertaining to the contractor's flight and ground evaluations of the capabilities of the electrical system as prescribed in paragraphs under 3.18. These reports shall contain comprehensive discussion of the results obtained and emphasize any operational limitations imposed by the system design. Any contractor request for a waiver of the applicable specifications or portions thereof shall be referenced and supported by the discussions contained in these reports. The discussion and data shall be sufficient to judge the validity of the conclusions reached by the contractor.

3.25.2.16 AIRPLANE WEAPONS SYSTEM ACCURACY REPORT. - Final (complete) report on the Airplane Weapons System Accuracy Demonstration Tests (3.16.7.1) shall be submitted not later than 60 days prior to release of the airplane for the INSURV Acceptance Trials. The report shall contain quantitative test results and a discussion of the methods used to determine the accuracy of the airplane weapons system.

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3.25.2.17 INSTRUMENT SYSTEMS DEMONSTRATION REPORT. - This report shall be submitted as soon as practicable but not later than 60 days prior to release of the airplane for INSURV Acceptance Trials. The report shall encompass demonstration accomplished in compliance with 3.19.2.

3.25.2.18 POWER PLANT INSTALLATION VIBRATION TEST PROGRAM REPORT. - This report shall be submitted in accordance with 3.6.8.2 and shall include a description of the test programs planned to investigate the characteristics of and to demonstrate that the power plant and power plant installation will be satisfactory in the airplane. The initial submittal shall include the detail plans for all ground and flight tests.

3.25.2.19 POWER PLANT VIBRATION SURVEY REPORT. - See 3.6.8.2.

3.25.2.20 RELIABILITY AND MAINTAINABILITY TEST PLAN. - See 3.22.2.

3.25.2.21 RELIABILITY AND MAINTAINABILITY TEST REPORT. - This report shall be submitted as soon as possible but not later than 60 days prior to release of the aircraft for INSURV Acceptance trials. This report shall contain comprehensive discussion of the results obtained and emphasize any operational limitations imposed by the aircraft design. The report shall include data, a description of instrumentation, and methods pertaining to the flight evaluations of the capabilities of the aircraft as prescribed in 3.22. Any contractor request for waiver of the applicable specifications or portions thereof shall be referenced and supported by the discussion contained in this report. The discussion and data shall be sufficient to judge the validity of the conclusions presented in the report.

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3.25.2.22 MILITARY SPECIFICATION AIRCRAFT DEMONSTRATION REPORTS - DISTRIBUTION OF

Paragraph	Title	To ATTN:	Action	Number and Kind of Copies	Type of Report	Submittal Time and Remarks
3.7.2.2 & 3.7.2.3	Preliminary Spin Tests Flying Qualities	NAVAIR (AIR5301) (a)(b)(c)	Accept. Comment	2 Nonrepro. 1 "	Non-recurring	Prior to INSURV-initial trials Phase Aerodynamic Demonstration
3.25.2.1	Demonstration Instrumentation Report	NAVAIR (AIR5354) (b) (a)(c)(d)	Accept. Comment Info.	4 Nonrepro. 5 " 1 "	Non-recurring	As specified in 3.25.2.1
3.25.2.2	Demonstration Planning and Progress Report	NAVAIR (AIR510, AIR530, AIR531, AIR532, AIR533, AIR536, AIR537, AIR539) via (b) (b) (a)(c)(d) (e)(f)(g) (h)(i)	Accept. Comment Info. Info. Info.	10 Nonrepro. 5 " 1 " 1 " 1 "	Recurring " " " "	Concurrently with 3.25.2.1 above and subsequently, at intervals not exceeding two months, additional pages and/or revised pages shall be submitted as necessary to keep report up to date. The schedule of each phase of the demonstration shall be submitted at least 3 months prior to its commencement. Operating limits shall be submitted as required by 3.6.5, 3.7.2.8 and 3.25.2.2(8). Portions of report accepted by cognizant NAVAIR Divisions.

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3.25.2.22 (Cont)

Paragraph	Title	To ATTN:	Action	Number and Kind of Copies	Type of Report	Submittal Time and Remarks
3.25.2.3	Daily Flight Reports	NAVAIR (AIR510, AIR530, AIR531, AIR532, AIR533, AIR536, AIR537, AIR539)	Info.	5 Nonrepro.	Recurring	Submitted for at least the first 20 takeoffs and landings of each demonstration airplane. Reports can then be discontinued at contractor's request, by NAVPRO. Shall be submitted to NAVAIR within 48 hours, after completion of flights.
		(b)	Info.	5 "	"	
		(a)(c)(d)	Info.	1 "	"	
		(j)(n)	Info.	1 "	"	
3.25.2.4	Bi-Weekly Summary Reports	NAVAIR (AIR510, AIR530, AIR531, AIR532, AIR533, AIR536, AIR537, AIR539)	Info.	5 Nonrepro.	Recurring	Submitted not later than three working days following the period being reported, for period when contractor has custody of airplane. Quarterly index of test subject matter shall be submitted by end of the week following the end of the calendar quarter.
		(b)	Info.	5 "	"	
		(a)(c)(d)	Info.	1 "	"	
		(j)(k)(l)	Info.	1 "	"	
		(n)	Info.	1 "	"	

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3.25.2.22 (Cont)

Paragraph	Title	To ATTN:	Action	Number and Kind of Copies	Type of Report	Submittal Time and Remarks
3.25.2.5	Demonstration Data Report	NAVAIR (AIR510, AIR530, AIR531, AIR532, AIR533, AIR536, AIR537, AIR539) via (b)	Accept.	10 Nonrepro.	Recurring	Submitted periodically at intervals not greater than two months, beginning with first revision of 3.25.2.2 above after first airplane has flown. Portions of report accepted by cognizant NAVAIR Divisions except data showing compliance with 3.13.2 will be accepted by 3.25.2.6 only.
		(b)	Comment	5 "	"	
		(a)(c)(d)	Info.	1 "	"	
		(e)(f)(g)	Info.	1 "	"	
		(h)(i)(n)	Info.	1 "	"	
3.25.2.6	Flying Qualities Demonstration Data Report	NAVAIR AIR53011 via (b)	Accept.	10 Nonrepro.	Non-recurring	Not later than 2 weeks prior to commencement of INSURV Trials.
		(b)	Comment	2 "	"	
3.25.2.7.1	Spin Demonstration Schedule Report	NAVAIR AIR53011	Accept.	10 Nonrepro.	Non-recurring	As specified in 3.25.2.7.1.
		(b)	Info.	2 "	"	
3.25.2.7.2	Spin Demonstration Data Report	NAVAIR AIR53011 via (b)	Accept.	10 Nonrepro.	Non-recurring	As specified in 3.25.2.7.2.
		(b)	Comment	2 "	"	
3.25.2.8	Performance Data Reduction Report and Conference	NAVAIR (AIR5301) via (b)	Accept.	3 Nonrepro.	Non-recurring	At least 6 months prior to the performance tests of 3.13.4 for conference. At least 3 months prior to performance test of 3.13.4 for the report.
		(b)	Comment	2 "	"	
		(a)(c)	Info.	1 "	"	

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3.25.2.22 (Cont)

Paragraph	Title	To ATTN:	Action	Number and Kind of Copies	Type of Report	Submittal Time and Remarks
3.25.2.9	Guaranteed Performance Data	NAVAIR (AIR5301) via (b)	Accept.	5 Nonrepro.	Non-recur-ring	This report shall reach NAVAIR at least one month prior to release of the airplane for the perform-ance demonstra-tion tests of 3.13.4, or one month prior to release of air-plane for INSURV trials, whichever is first.
		(b)	Info.	2 "	"	
		(a)(c)	Info.	1 "	"	
3.25.2.10	Avionics Systems Demonstra-tion Data Report	NAVAIR (AIR533) via (b)	Accept.	5 Nonrepro.	Non-recur-ring	At least 60 days prior to release for INSURV elec-tronic and arma-ment trials.
		(b)	Comment	2 "	"	
		(a)(c)	Info.	1 "	"	
3.25.2.11	Moving Picture Coverage	NAVAIR (AIR510)	Info.	1 Copy	Non-recur-ring	As soon as prac-ticable following occurrence of significant events.
3.25.2.12	Propeller Vibration Survey	NAVAIR (AIR536)	Info.	2 Nonrepro.	Non-recur-ring	Prior to NPE (See 3.6.8.1)
		(a)(b)	Info.	1 "		
3.25.2.13	Power Plant Temperature Survey	NAVAIR (AIR536)	Accept.	3 Nonrepro.	Non-recur-ring	Prior to INSURV (See 3.6.8.3)
		(a)(b)	Info.	1 "		
3.25.2.14	Compressor inlet and turbine outlet Sur-vey Report	NAVAIR (AIR536)	Accept.	3 Nonrepro.	Non-recur-ring	This report shall reach NAVAIR prior to NPE (See 3.6.8.4)
		(a)(b)	Info.	1 "		
		(m)	Info.	2 "		
3.25.2.15	Electrical System Demonstra-tion Data Report	NAVAIR (AIR536) via (b)	Accept.	3 Nonrepro.	Non-recur-ring	At least 60 days prior to initial INSURV electrical and electronic Trials
		(b)	Comment	2 "	"	

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3.25.2.22 (Cont)

Paragraph	Title	To ATTN:	Action	Number and Kind of Copies	Type of Report	Submittal Time and Remarks
3.25.2.16	Airplane Weapon System Accuracy Report	NAVAIR (AIR532) (b)	Info. Comment	2 Nonrepro. 5 "	Non-recur-ring	At least 60 days prior to release of the airplane for INSURV Acceptance Trials
3.25.2.17	Instrument Systems Demonstra-tion Report	NAVAIR (AIR533) (a)(b)	Accept. Info.	3 Nonrepro. 2 "	Non-recur-ring	At least 60 days prior to initial INSURV electrical and electronic trials.
3.25.2.18	Power Plant Installation Vibration Test Pro-gram Report	NAVAIR (AIR530) (a) (m)	Accept. Info. Info.	3 Nonrepro. 1 " 2 "	Non-recur-ring "	At least 60 days prior to date necessary to install instru-mentation to meet test schedule or 90 days after date of contract whichever is earlier.
3.25.2.19	Power Plant Vibration Survey Report	NAVAIR (AIR530) (m)	Accept. Info.	3 Nonrepro. 2 "	Non-recur-ring	Two phases (See 3.6.8.2)
3.25.2.20	Reliability and Main-tainability Test Plan	NAVAIR (AIR5205) via (a) (b)	Accept. Info.	3 Nonrepro. 1 "	Non-recur-ring "	As specified in 3.25.2.20
3.25.2.21	Reliability and Main-tainability Test Report	NAVAIR (AIR5205) (a)(b)(c)	Accept. Info.	3 Nonrepro. 3 "	Non-recur-ring	As specified in 3.25.2.21

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3.25.2.22 (Cont)

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(e) NASA, Langley Field, Va.

(f) NASA, Ames Research Center, Moffett Field, Calif. 94022

(g) NASA, Lewis Research Center, Cleveland, Ohio

(h) NASA, Edwards High Speed Flight Station, Edwards Air Force Base, Calif.

(i) Scientific & Technical Information Facility (ATTN: NASA Rep.(S-AK/DL)) Box 5700, Bethesda, Md.

(j) NAVAIRDEVCEN, Johnsville, Warminster, Pa. 18974

(k) Air Force Systems Command (SCOT), Andrews AFB, Washington, D.C. 20331

(l) Air Force Flight Test Center (FTTE), Edwards AFB, Calif. 93523

(m) Power Plant Manufacturer

(n) Test Authority

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4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION. - The NAVPRO shall examine and evaluate all demonstration data other than daily flights reports for completeness, and for compliance with applicable specifications. Data not conforming to applicable requirements shall be returned to the contractor for revision prior to submittal to NAVAIR. The NAVPRO shall forward his comments on the data by endorsement on the contractor's forwarding letter at the earliest practicable date after receipt of data from the contractor.

5. DELIVERY

5.1 REPORTS. - Reports shall be delivered, in the quantities, within the times, and to the addressees, specified in 3.25.2.22 via the cognizant NAVPRO. Classified reports and related data shall be handled in accordance with existing security instructions.

6. NOTES

6.1 RESPONSIBILITY FOR APPLICABLE SPECIFICATIONS AND PUBLICATIONS. - NAVPRO's are furnished copies of the latest issue of all applicable specifications and publications as they become available. The responsibility for ascertaining and following the revisions of specifications applicable to a specific contract rests with the contractor. NAVAIR or NAVPRO's office will inform contractors of the number and date of the latest issue of any specification upon request.

6.2 RESTRICTION ON USE OF DEMONSTRATION DATA AND REPORTS. - Demonstration data reports and related information shall not bear any notation limiting or restricting its use by the Government in any manner whatsoever.

6.3 DEVIATIONS. - Deviations from this specification shall not be permitted unless specified in addenda to this specification, in contract amendments, or by other written authorization of NAVAIR.

6.4 REFERENCES, DEFINITIONS, AND SYMBOLS

6.4.1 GENERAL. - The definition of some references, terms and symbols used herein are given in this section. Definitions of symbols, and terms not included in this section shall conform with the definitions included in ASA Y10.7 - 1954 American Standard Letter Symbols for Aeronautical Sciences.

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6.4.2 REFERENCES. - Any reference to "NAVAIR" herein shall mean the "Naval Air Systems Command". Any reference to "NAVPRO" herein shall mean the "Naval Plant Representative Office","Air Force Representative Office", or the "Commander, Defense Contract Administration Services Region".

6.4.3 DEFINITIONS. - The following terms and symbols are defined for use or reference herein.

6.4.3.1 CONFIGURATIONS. - Airplane configurations are described below. Items of configuration not specified, such as cockpit enclosures, cowl flaps, oil cooler flaps, gun turrets, blast tube covers, or bomb bay doors shall be in their normal settings for the particular configuration.

Configuration CR: Cruise: Power for level flight at trim speed, flaps in cruise position, gear up.

Configuration D: Dive: 25 percent normal rated power or minimum operable power, whichever is greater, flaps and gear up (unless normally used as speed brakes), speed brakes extended.

Configuration G: Glide: Idle Power, unless otherwise specified; gear and flaps up.

Configuration L: Landing: Idle Power, gear down, flaps or other high lift device at landing setting.

Configuration P: Power on, Clean; Normal rated power, flaps and gear up.

Configuration PA: Power approach: Gear down; flaps, other high lift device, canopy, and approach brake in normal approach position; power for level flight at 1.15 V_{SL} or normal approach speed, whichever is lower.

Configuration TO: Takeoff: Gear down, flaps or other high lift device at takeoff setting, takeoff power, including assist or augmentation used in normal takeoff.

Configuration WO: Waveoff: Configuration PA except power for waveoff.

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6.4.3.2 CLASSES OF AIRPLANES. - Airplanes are divided into the following classes:

Class I - Primary trainer, observation, and other light airplanes specifically designated by the procuring activity.

Class II - Horizontal bomber, cargo, transport, glider, patrol, anti-submarine, early warning, mine-layer, heavy attack, and trainers for Class II airplanes.

Class IIC - Carrier-based version of Class II airplane.

Class IIL - Landbased version of Class II airplane.

Class III - Fighter, intercepter, general purpose attack, and trainers for Class III airplane.

Class IIIC - Carrier-based version of Class III airplane.

Class IIIL - Landbased version of Class III airplane.

6.4.3.3 DIVE. - The term "dive" in a broad sense refers to a flight executed for the purpose of demonstrating strength and rigidity.

6.4.3.4 STORES. - The term "stores" means all missiles, rockets, bombs, mines, torpedoes, detachable fuel and spray tanks, pods (refueling, thrust augmentation, gun, ECM, etc.) targets, and similar items intended for carriage internally or externally by aircraft, including the racks, launchers, adapters, and pylons used for such carriage. This definition applies whether the items are, or are not, to be separated from the aircraft in flight.

6.4.3.5 MAXIMUM LONGITUDINAL-CONTROL FORCE. - This expression means a longitudinal pull force applied to the grip of the control stick (wheel) which varies linearly with control position from a value not less than 60 pounds (120 for wheel control) for control in its most rearward position, to a value not less than 200 pounds for stick (wheel) in mid-position and has a value not less than 200 pounds for all positions of the stick (wheel) forward of mid-position.

6.4.3.6 MAXIMUM LATERAL-CONTROL FORCE. - For stick control, this expression means a force in the lateral direction applied normal to the control stick not less than 60 pounds; for wheel control, a couple in the plane of the wheel equal to magnitude to not less than 96 pounds times the distance from the center of the wheel to the outermost point of its periphery.

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6.4.3.7 LIMIT. - The term "limit" used in such phrases as "limit load factor", "limit side load factor", and "limit dive speed" refers to the design limit as specified in applicable design specifications.

6.4.3.8 MAXIMUM SAFE. - The expression "maximum safe load factor (or speed)" means the maximum load factor (or speed) at the specified speed (or load factor) which can be obtained without exceeding the specified limit strength or limits for satisfactory stability and control or without experiencing dangerous buffet effects.

6.4.3.9 AIRCRAFT/STORE COMPATIBILITY. - The term aircraft/store compatibility means the ability of the aircraft and stores carried to coexist under specified conditions without detrimental or adverse effects of either upon the aerodynamic, structural, or functional characteristics of the other, including operational or emergency separation of the stores from the aircraft. The specified conditions are usually those conditions normally experienced, or expected to be experienced, by the aircraft involved.

6.4.3.10 PORPOISING. - The term "porpoising" means motion in calm water in which the combined oscillation in heave and pitch is of a sustained or increasing amplitude, and the oscillation in pitch is equal to or greater than 2 degrees.

6.4.3.11 SKIPPING. - The term "skipping" means an unstable oscillation of hydrodynamic origin which can occur just after landing or just prior to takeoff. "Skipping" is associated with conditions whereby the forebody carries most of the waterborne load and at the same time a large amount of water flows over the afterbody bottom.

6.4.3.12 BOUNCING. - "Bouncing" results in a motion similar to "skipping", but is caused by an excessively large angle between the flight path and the water surface, or excessive vertical velocity, or both.

6.4.3.13 UNPORTING SPEED. - The term "unporting speed" is that speed during the waterborne phase of takeoff of a seaplane at which the airplane experiences a sudden increase in trim.

6.4.3.14 STALLING SPEED. - (See MIL-F-8785).

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6.4.3.15 SYMBOLS AND ABBREVIATIONS. - The following symbols and abbreviations are used herein:

A/B	Afterburner
ASW	Antisubmarine-warfare
b	Wing span, feet
$C_{\frac{1}{2}}$	Number of cycles for the lateral oscillations to damp to half amplitude. The inverse of damping parameter.
C_{N_a}	Airplane normal force coefficient
CRT	Combat rated thrust
EAS	Equivalent airspeed
M	Mach number
M_H	Maximum level flight Mach number
M_M	Maximum operational Mach number, as defined by the maximum operational speed envelope.
MRP	Military rated power
NRP	Normal rated power
n_y	Side load factor
n_L	Maximum symmetrical flight limit load factor(i.e. the upper boundary of the design V_{-n} diagram).
$-n_L$	Minimum symmetrical flight limit load factor(i.e. the lower boundary of the design V_{-n} diagram).
p	Rolling velocity
$\frac{pb}{2V}$	The helix angle described by a wing tip during a rolling maneuver, where: p = rate of roll about the body axis b = wing span, feet V = true airspeed feet per second
M_T	True Mach number
V_{EAS}	Equivalent airspeed
V_E	Engaging speed in arresting operation
V_H	Maximum level flight speed (For the demonstration tests of 3.12, V_H as used in this specification is the V_H specified for structural design in the applicable detail specification.)
V_M	Maximum operational speed, as defined by the maximum operational speed envelope.
V_L	Limit speed parameter in basic configuration specified for structural design
V_S	Stalling speed
V_{S_G}	Stalling speed in glide configuration
V_{S_L}	Stalling speed in landing configuration
$V_{S_{PA}}$	Stalling speed in power approach configuration
$V_{S_{TO}}$	Stalling speed in takeoff configuration

6.4.3.16 SPECIAL DEFINITIONS. - IYMP (Inertial Yawing Moment Parameter). The terms of IYMP, $I_x - I_y/mb^2$ are defined as follows:

I_x and I_y are airplane moments of inertia about the x and y axis respectively (slug-ft^2); m is airplane mass(slugs); b is wing span(feet).

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6.5 ADDENDA TO THIS SPECIFICATION. - This specification will be used as the standard form for the preparation of addenda by NAVAIR for specific model Naval Aircraft in accordance with NAVAIR Instruction 13001. Addenda will conform to the following:

(1) Agree with this specification in paragraph arrangement, numbering, and headings, except that where a paragraph is listed in the addendum as "not applicable" or "not required" subsequent subparagraphs will be omitted provided numbering sequence is not affected.

(2) Unless paragraphs of addenda completely supersede corresponding paragraphs of this specification, paragraphs will be listed as "applicable" (with or without specific deviations or supplementary requirements), "not applicable", or "not required". General requirements or instructions will be designated as "applicable", or "not applicable", however, requirements for specific data or action shall be designated "required" or "not required" as applicable.

(3) Subparagraphs will be added as required.

(4) In cases of discrepancies between this specification and addenda, the addenda will govern.

6.5.1 REVISION OF ADDENDA. - Revisions to addenda to this specification will be prepared and promulgated by NAVAIR.

6.5.1.1 ADDENDA REVISION APPROVAL. - Unpredictable changes to systems, mission requirements, etc., may dictate revision to basic demonstration requirements during the course of a demonstration program. In the event this occurs immediate action shall be initiated to obtain official NAVAIR approval of the proposed revision to avoid demonstration schedule disruption and resultant program delay.

6.6 DUPLICATION OF DATA. - Duplication of data shall be avoided. Data previously submitted under an addendum may be referenced when applicable to data subsequently submitted in the same addendum.

6.7 REVISION OF DATA. - Data submitted under an addendum to this specification shall be revised whenever new information invalidates such data.

6.8 SECURITY CLASSIFICATION. - Classified data and reports shall contain the proper security classification on each page of reports, photographs,etc., in accordance with existing security regulations.

6.9 SUPERSESSION OF THIS SPECIFICATION. - The specification supersedes Spec MIL-D-8708A(WEP) dated 13 September 1960, for the Demonstration Requirements for Airplanes.

Preparing Activity
Navy - AS
Project No. 1510-N001

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