STATEMENT OF WORK

FOR

C-5 RELIABILITY ENHANCEMENT AND RE-ENGINING PROGRAM (RERP)

System Development and Demonstration (SDD)

Lockheed Martin Aeronautics Company
A Division of Lockheed Martin Corporation
Marietta, Georgia 30063

C-5 RERP Development Statement of Work
Record of Document Change Notices (DCN)/Revisions

Revision & Date	DCN No.	DCN Date	Paragraph N.	Change Page No.	Reason
	SDD-002	8 October 2001	3.1.6.6	53	Removed Requirement for Hydrodynamic Ram Damage Analysis, per Govt/Contractor Agreements
	SDD-001	25 October 2001	3.1.5.1.3	44, 45	Integrated Schedule ; CDRL Amendment\
	SDD-004	8 November 2001	3.1.5.1.2 3.1.6.7	44 54, 55	ASC-directed changes to Configuration and Data Mgt Sections
	SDD-008	8 November 2001	3.1.6.13	62	Address DMS Issue
	SDD-013	8 November 2001	3.1.1.4.2	27,28	Clarify Modifications to C-5 Baseline Avionics
	SDD-015	8 November 2001	3.1.8	63	Add Potential Special Study
	SDD-017	13 November 2001	3.1.1.4.2	27, 28	Ensure Proper algorithm supplied To AFMSS
	SDD-018	13 November 2001	3.1.4.1	41	Clarify Test Instrumentation Requirements for Structural Installations
	SDD-019	14 November 2001	Appendix A	A-2	RE Item Chart Correction

C-5 RERP Development Statement of Work
Record of Document Change Notices (DCN)/Revisions

Revision & Date	DCN No.	DCN Date	Paragraph No.	Change Page No.	Reason
	SDD-021	16 November 2001	3.1.1.5.2	30	Clarification of Aerodynamic Performance analyses
	SDD-022	27 November 2001	3.1.1	6	Air Vehicle Paragraph Correction
	SDD-023	27 November 2001	3.1.2.3	36	DSO-requested clarification
	SDD-034	8 February 2002	3.1.2.5.1.6	39	SRR Action Item
	SDD-046	14 February 2002	3.1.1.2.1	11, A-3	Task is not an RE Item
	ASC Ltr L02A0085	5 February 2002	1.0, 3.1, 3.1.1, 3.1.1.1.3, 3.1.1.2.9, 3.1.2.1.2.3, 3.1.6.6	1, 5, 6, 9, 34, 52	USAF Direction on SDD Aircraft
	SDD-035	25 February 2002	3.1.2.1.1.4, 3.1.2.2.1, 3.1.2.4.23,	34, 36, 38	SRR Action Items
	SDD-048	25 February 2002	3.1.1.6.4	32	Defines C-5A Structural Repair Items

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

1.0 SCOPE

This Statement of Work (SOW) describes the Contractor work required to accomplish the System Development and Demonstration (SDD) phase of the C-5 Reliability Enhancement and Re-Engining Program (RERP). This SOW addresses the following work efforts:

a. system and subsystem design changes for the C-5 aircraft (as listed in Appendix A of this SOW). Development, procurement, manufacture, integration, and test of the pre-production C-5 RERP systems hardware and software to demonstrate airworthiness of the air vehicle

b. develop and deliver data, as required, by the Contractor Data Requirements List (CDRL)

c. integration testing, aircraft ground test, flight test, and Qualification Test and Evaluation (QT&E) activities

d. support of Government Qualification Operational Test and Evaluation (QOT&E) activities and the initial Reliability, Maintainability, and Availability (RM&A) demonstration

e. maintenance support and refurbishment of the three C-5 (one C-5A and two C-5Bs) aircraft provided for the C-5 RERP SDD effort, two of which shall be aircraft from the C-5 Avionics Modernization Program (AMP) QT&E test program with test instrumentation intact, and one of which shall be a Loads Environment Structural Survey (LESS) Aircraft.

f. provide Type 1 aircrew training, maintenance training and training services. On-wing engine maintenance training will be provided at the Engine Manufacturer's facility.

g. accomplish Phase II of the Training Systems Requirements Analysis (TSRA) to determine C-5 RERP impacts to existing maintenance trainers

h. procure, design, manufacture, test, and deliver the organizational support equipment (SE) required to conduct the SDD phase of C-5 RERP

i. develop a Logistics Support program and implement those elements required to support SDD

j. develop and implement a Reliability and Maintainability (R&M) program on C-5 RERP hardware systems

k. support to Government Live Fire Test and Evaluation (LFT&E) activities

l. identify and evaluate system safety and health hazards, define risk levels, and establish a program that manages the probability and severity of hazards associated with the C-5 RERP

m. conduct special studies and analyses to support C-5 RERP in accordance with CLIN 0003 of the SDD contract

n. Update Technical Orders to reflect RERP modifications and perform Technical Order (TO) validation and support Government verification. Aircraft Battle Damage Repair (ABDR) and Non-Destructive Inspection (NDI) manuals will be updated under a separate contracting action

o. manage C-5 RERP peculiar spares

p. Pending exercise of the contract option, modify and conduct R&M flight tests on a fourth aircraft (a C-5B).

Acronyms that are used in this SOW are defined upon initial use in the body of this document and are also provided in Appendix B to this SOW.

2.0 APPLICABLE DOCUMENTS

The following documents, of the exact issue shown, form part of this SOW to the extent specified herein. In the event of a conflict between the requirements of this SOW and the requirements of the documents referenced herein, the requirements of this SOW shall be considered the superseding requirements.

2.1 Military Standards

MIL-STD-882D 10 February 2000	Standard Practice for System Safety
MIL-STD-882C 19 Jan 1996	Standard Practice for System Safety, Notice 1
MIL-STD-1472E 31 October 1996	Human Engineering
MIL-STD-1521B 4 June 1985	Technical Reviews and Audits
MIL-STD-1661 1 August 1978	Mark and Mod Nomenclature System
MIL-PRF-49506 11 November 1996	Performance Specification Logistics Management Information (LMI)

International Standards Organization (ISO)

ISO 9001-1994	Quality Systems-Model for Quality Assurance (QA) in Design, Development, Production, Installation and Servicing
ISO 9000-3-1994	Quality Management and Quality Assurance Guidelines for the Application of ISO 9001 to the Development, Supply, and Maintenance of Software

2.3 Other Government Document

AFSC DH 1-3 25 June 1980	Human Factors Engineering, Third Edition, Revision 1
MIL-HDBK-1221 28 August 1995	Handbook for Evaluation of Commercial-Off-The-Shelf (COTS) Manuals
OSS&E 29 Oct 99	Operational Safety, Suitability, and Effectiveness Assurance and Airworthiness Certification for the Air System Product Line Guidance Document

AFI 63-107 Sept 2000	Integrated Product Support Planning and Assessment
NAS 411 5 April 94	Hazardous Material Management Program

2.4 Commercial Engineering Standards and Guidelines

RTCA DO-178B 01 December 1992	Software Considerations in Airborne Systems and Equipment
SAE ARP 4761 13 September 1997	Guidelines and Methods for conducting the Safety Assessment Process on Civil Airborne Systems and Equipment
IEEE STD 1228-1994 1994	Standard for Software Safety Plans
ANSI/EIA-649 6 August 1998	National Consensus Standard for Configuration Management

2.5 Other Documents

LG00ER0028 27 Feb 2002	C-5 Reliability Enhancement and Re-Engining Program Weapon System Functional Modification Specification
LG00ER0181 27 Feb 2002	C-5 Reliability Enhancement and Re-Engining Program Air Vehicle Functional Modification Specification
CBM-4004	Software Development Process Standard
CBM-4030	System Safety Process Standard

3.0 C-5 RELIABILITY ENHANCEMENT AND RE-ENGINING PROGRAM

3.1 WBS 1.0.0.0 C-5 Reliability Enhancement and Re-Engining Program - System Development and Demonstration (SDD)

The Contractor shall plan, direct, coordinate, and control the activities associated with development, implementation and verification of C-5 RERP modifications and their effect on the C-5 Aircraft. C-5 RERP modifications associated with this Contract are described in Appendix A to this SOW.

The Contractor shall specify, analyze, and test the C-5 RERP system to modify three C-5 aircraft (one C-5A and two C-5Bs) during the SDD phase. The Contractor shall develop an architecture/design in accordance with the C-5 RERP Weapon System Functional Modification Specification, LG00ER0028, and the C-5 RERP Air Vehicle Functional Modification SpecificationLG00ER0181. The Contractor shall also develop and deliver the required changes to Technical Manuals and Support Equipment, and determine the impact of the C-5 RERP modifications on aircraft performance and other affected Logistics Support elements. **(CDRL A015)**

The Contractor shall perform verification activities in accordance with the Weapon System and Air Vehicle Functional Modification Specifications.

The Contractor shall modify three C-5 aircraft to develop the C-5 RERP baseline. Upon receipt of each C-5, the Contractor shall inspect the aircraft and perform functional tests of systems and equipment that will remain in the aircraft after the C-5 RERP modifications have been installed. Defects found in systems, equipment or structure shall be documented on the Contractor form entitled "Modification Inspection Record (MIR)", unless specified in this SOW as an element of C-5 RERP modification effort. If the Contractor finds conditions (such as corrosion) in the aircraft that may jeopardize the C-5 RERP modification effort, the Contractor also shall document these conditions on the MIR. The Contractor shall request and the Government shall provide disposition of these discrepancies prior to beginning modification work. The Contractor's request for disposition shall include the Contractor's man-hour quote to remedy the discrepancy. All work performed to correct defects, discrepancies, or other conditions outside the C-5 RERP modification shall be negotiated and performed under the Contract Line Item Number (CLIN) entitled "Over and Above". All permanently removed equipment, systems, wiring, and related items will be reported to the Government and dispositioned in accordance with a "Disposition of Removed C-5 Equipment" Special Contract Clause. Upon the successful completion of all required tests, the Contractor shall deliver the aircraft to the Government in accordance with SOW paragraph 3.1.1.6.5. Prior to redelivery of the three SDD aircraft, the Contractor shall remove Contractor-installed instrumentation and return the aircraft to a production-representative condition. The Contractor shall functionally test the aircraft in accordance with the C-5 RERP production acceptance test procedures.

Following completion of all development, test, and verification activities, the Contractor shall conduct a system level software Physical Configuration Audit (PCA) and a System Verification Review (SVR). Government acceptance of the SVR, software PCA, delivery of formal TO's (with the exception of ABDR and NDI manuals), and execution of DD250 on the three (3) SDD aircraft shall constitute completion of the SDD program.

Option for Fourth SDD Aircraft – Pending the Government's election to exercise the contract option, the Contractor shall modify an additional C-5B aircraft to the RERP configuration as described in this Statement of Work, resulting in a four-aircraft SDD program. This aircraft shall not have test-unique instrumentation installed. The Contractor shall conduct approximately twenty-five sorties of R&M flight testing with this fourth aircraft to gather additional evidence to support the predicted improved RM&A capabilities of the RERP modernized C-5 fleet. Note: In the event this option is exercised, all references within this Statement of Work to a total number of aircraft in SDD shall be interpreted to include the fourth SDD aircraft.

3.1.1 WBS 1.1.0.0 Air Vehicle

The Contractor shall design, develop, integrate, manufacture, test, qualify, and prepare the structure and subsystems for the C-5 RERP Air Vehicle in accordance with the requirements of the C-5 RERP Air Vehicle Functional Modification Specification. The Contractor shall conduct lower-level PDRs, CDRs, and SVRs (FCAs) for subsystem and configuration items, per the guidance of MIL-STD-1521. The Contractor shall modify and deliver three C-5 SDD Air Vehicles. The Contractor shall support Government airworthiness certification activities for OSS&E requirements affected by C-5 RERP. The Contractor shall prepare factory, flight line, and check flight procedures for accepting production aircraft. Acceptance procedures shall be developed by modifying existing C-5A/B and C-5 AMP procedures to reflect the C-5 RERP modifications. **(CDRL A015)**

The Contractor shall provide engineering support to fabrication, assembly, installation, inspection, and functional and acceptance test activities for the three SDD aircraft.

3.1.1.1 WBS 1.1.1.0 Airframe

The Contractor shall design, develop, and qualify the pylon system and airframe structural modifications to comply with the airframe structural requirements of the C-5 RERP SDD Air Vehicle Functional Modification Specification. As part of these efforts, the Contractor shall accomplish the following:

a. establish subsystem-level design requirements for the pylon system and airframe structural modifications. **(CDRL A015)**

b. perform and document design trade studies for the pylon system and airframe structural modifications. These trade studies will consider cost, schedule, and system performance requirements. **(CDRL A015)**

c develop aircraft-level test requirements and evaluate the resulting test data to validate physical and functional integration of the pylon system and airframe structural modifications and to verify that all associated requirements of the Air Vehicle Functional Modification Specification have been met. **(CDRL A023)**

d The Contractor shall develop and compile the ASIP (Aircraft Structural Integrity Program) data required in Task IV of MIL-HDBK-1530 to provide uninterrupted force management of C-5 RERP-modified airframes, to include the following:

1. Appendix to the Force Structural Maintenance Plan
2. Changes to Loads Environmental Spectra Survey programs and revisions to their corresponding documentation
3. Changes to Individual Aircraft Tracking programs and revisions to their corresponding documentation
4. Appendix to current ASIP Master Plan.

3. 1.1.1 WBS 1.1.1.1 Pylons

The Contractor shall design, develop, qualify, fabricate, assemble, inspect, and prepare for production the pylon structure and systems required for the C-5 RERP (RE Items 3PY and 5461A). The Contractor shall establish interfaces with the joining structures and systems, and develop analysis tools to support the development and verification of pylon structural requirements, and to support the design development of pylon structural modifications. The Contractor shall inspect and check out the pylon subsystems prior to installation.

The Contractor shall develop and document the following:

a. external loads analyses for the C-5 RERP pylon configuration. **(CDRL A015)**

b. internal loads analyses using the C-5 RERP pylon external loads. **(CDRL A015)**

c. stress analyses using C-5 RERP pylon internal loads. **(CDRL A015)**

d. durability and damage tolerance analyses using C-5 RERP pylon repeated loads to define inspection intervals. **(CDRL A015)**

e. flutter, vibration, and acoustics analyses for the C-5 RERP pylon configuration. **(CDRL A015)**

f. interface control between systems and structural components. **(CDRL A015)**

g. design activities to define new pylon systems and structure. **(CDRL B001)**

h. detail weight and balance data. **(CDRL A015)**

i. verification, qualification, and acceptance test requirements for C-5 RERP pylon structure. **(CDRL A015)**

j. correlation of test results with analyses. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification and QT&E testing of the pylon systems and structure. The Contractor shall procure new pylons to support aircraft modifications.

3.1.1.1.2 WBS 1.1.1.2 Basic Structure (Except Pylons and Nacelles)

The Contractor shall conduct the technical activities and planning necessary to define air vehicle structural integrity and performance. These activities will support integrity programs associated with structures, propulsion, avionics, and utilities and subsystems modifications. The Contractor shall design, develop, and qualify, and shall procure new equipment to support the following airframe structural modifications:

a. new wing-to-pylon attach fitting installations,

b. empennage-to-fuselage attachment frame web modifications, and

c. modifications to the aft fuselage stringers above the troop compartment and hayloft area.

The Contractor shall develop and document the following:

a. external loads analyses for the C-5 RERP configuration. **(CDRL A006)**

b. internal loads analyses using the C-5 RERP external loads. **(CDRL A015)**

c. stress analyses on selected areas using C-5 RERP internal loads. Critical areas will be identified for analysis and modification. Areas of high stress relative to material allowables (based on part geometry and structural loading identified by Finite Element Model analysis results), and structural areas with low margins of safety that are critical load carrying members will be included in those selected for analysis. **(CDRL A015)**

d. durability and damage tolerance analyses on selected points using C-5 RERP repeated loads based on Air Vehicle Functional Modification Specification mission profile requirements. Critical structural points susceptible to fatigue failure or other damage during the projected service life of the airplane will be included in those selected for analysis. **(CDRL A015)**

e. flutter, vibration, and acoustics analyses for the C-5 RERP configuration. **(CDRL A015)**

f. interface control between systems and structural components **(CDRL A015)**

g. design activities to modify the airframe to ensure structural integrity. **(CDRL B001)**

h. detail weight and balance data. **(CDRL A015)**

i. verification, qualification, and acceptance test requirements for C-5 RERP new and modified structure. **(CDRL A015)**

j. correlation of test results with analyses. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification and QT&E testing of the basic airframe structure.

3.1.1.1.3 WBS 1.1.1.3 Other Airframe

The Contractor shall design, develop, and qualify, and shall procure new equipment to support the following airframe structural modifications:

a. slat track support rib beef-up (RE Item 333),

b. crew door and ladder beef-up (RE Item 334),

c. forward and aft ramp, and left- and right-hand pressure door cabin pressurization seal replacement (RE Item 301),

d. new aft ramp pad actuator (RE Item 5116), and

e. new forward ramp hinge fittings (RE Item 5114).

The Contractor shall perform engineering design activities, and shall procure new equipment (except for GFE noted below), to support the following Contractor manufacturing activities:

a. doubler installations to prevent cab top cracking on C-5B aircraft (RE Item CTC),

b. doubler installations to prevent aft personnel door cracking on C-5B aircraft (RE Item 206),

c. replacement of windshields with GFE preferred-spare windshields that have an improved seal design (RE Item 346).

The Contractor shall perform engineering design activities to support manufacturing planning (definition of inspection procedures and criteria to determine when repair or replacement is required), for the following structural repairs on C-5A aircraft:

a. underfloor bulkhead end fittings (RE Item 3UF),

b. contour box beam fittings (RE Item 3CB),

c. mainframes (RE Item 3MF),

d. keel beam fittings (RE Item 3KB), and

e. upper crown skins (RE Item UCS).

The Contractor shall perform engineering design activities and procure new equipment to support Contractor installation of the following C-5B components on C-5A aircraft:

a. visor hook backup fittings (RE Item 5114), and

b. aft ramp latch components (RE Item 5114).

The Contractor shall establish interfaces with joining structures and systems, and develop analysis tools to support the development and verification of airframe structural requirements and to support the design development of airframe structural modifications.

The Contractor shall develop and document the following:

a. stress analyses on the aforementioned structural modifications to ensure structural integrity is maintained. **(CDRL A015)**

b. durability and damage tolerance evaluation on the aforementioned structural modifications using C-5 RERP repeated loads based on Air Vehicle Functional Modification Specification mission profile requirements. **(CDRL A015)**

c. flutter, vibration, and acoustics evaluation on the aforementioned structural modifications. **(CDRL A015)**

d. interface control between systems and structural components **(CDRL A015)**

e. design activities to modify the airframe. **(CDRL B001)**

f. detail weight and balance data. **(CDRL A015)**

g. verification, qualification and acceptance test requirements for C-5 RERP new and modified structure. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification and QT&E testing of the identified structural modifications.

3.1.1.2 WBS 1.1.2.0 Utilities and Subsystems (U&S)

The Contractor shall design, analyze, develop, produce or procure, and qualify the hardware and software required for the following C-5 RERP utilities and subsystems (U&S) modifications: fuel, landing gear, hydraulic, environmental control subsystems, flight station and cargo bay equipment and furnishings, secondary power, flight controls, and electrical power subsystems. These utilities and subsystems modifications shall satisfy the requirements of the C-5 RERP Air Vehicle Functional Modification Specification.

In addition to the tasks defined in the following subparagraphs, the Contractor shall:

a. establish subsystem-level design requirements for the Utilities and Subsystems modifications. **(CDRL A015)**

b. perform and document design trade studies for the U&S modifications. These trade studies will consider cost, schedule, and system performance requirements. **(CDRL A015)**

c. develop integration test requirements and evaluate the resulting test data to validate functional integration of the U&S avionics-related modifications into the aircraft. **(CDRL A015)**

d. develop aircraft-level test requirements and evaluate the resulting test data to validate the physical and functional integration of utilities and subsystems modifications into the aircraft and to verify that U&S modifications meet the requirements of the Air Vehicle Functional Modification Specification. **(CDRL A023)**

3.1.1.2.1 WBS 1.1.2.1 Fuel System

The Contractor shall conduct the technical activities and planning necessary to ensure that the functional and performance capability of the C-5 RERP fuel subsystem. The Contractor shall design, develop, qualify, and integrate improved fuel level control valves. The Contractor shall overhaul existing fuel level control valves to the new configuration (RE Item 5462).

The Contractor shall perform engineering design activities to support Contractor installation of the C-5B digital fuel quantity gauges in place of the analog gauges currently on C-5A aircraft (RE Item 312).

The Contractor shall conduct the technical activities and planning to support the following Contractor maintenance activities:

a. inspection of the number 2 and 3 main and extended range tank corner fittings (RE Item 5461C)

Note: If necessary, resealing will be accomplished under the Over and Above CLIN.

b. inspection of fuel tank vent plumbing joints (RE Item 5463)

Note: If necessary, resealing will be accomplished under the Over and Above CLIN.

c. servicing of the nitrogen inerting Dewars

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified fuel subsystem component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified fuel subsystem components. **(CDRL A015)**

c. design activities related to C-5 RERP fuel subsystem modifications. **(CDRL B001)**

d. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified fuel subsystem components. **(CDRL A015)**

e. acceptance test requirements and results for C-5 RERP new and modified fuel subsystem components. **(CDRL A015)**

f. analyses to verify fuel subsystem compatibility with the new C-5 RERP propulsion and auxiliary power systems. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the fuel subsystem modifications.

3.1.1.2.2 WBS 1.1.2.2 Landing Gear

The Contractor shall conduct the technical activities and planning to ensure the functional and performance capability of the C-5 RERP landing gear subsystem. The Contractor shall design, develop, qualify, and integrate the following landing gear subsystem design modifications:

a. improved MLG High Speed Gearbox assemblies (RE Item 513M),

b. improved MLG hydraulic kneeling motors (RE Item 513K),

c. improved MLG electrical conduits (RE Item 5131), and

d. incorporation of diagnostics improvements to the anti-skid brake control (RE Item 5136).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment or overhaul of existing equipment, as noted) to support the following landing gear subsystem manufacturing activities:

a. Installation of the following new components:

1. MLG electrical conduits (RE Item 5131), and

2. Anti-skid brake control system components (RE Item 5136),

b. Replacement of the following components with overhauled components:

(Note: The contractor will substitute new components for overhauled components when it is not economically feasible to overhaul existing components or when GFE will not be available in time to support the aircraft modification schedule.)

1. MLG High Speed Gearbox assemblies (RE Item 513M), and

2. MLG hydraulic kneeling motors (RE Item 513K).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment) to support the following maintenance activities:

a. replacement of existing MLG swivel fittings with improved fittings (RE Item 5138),

b. replacement of aluminum brake pressure warning switches with preferred-spare stainless steel switches (RE Item 13EDC),

c. replacement of substandard parking brake selector valves and check valves (RE Item 5134), and rerigging of the MLG bogie roll positioners

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified landing gear subsystem component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified landing gear subsystem components. **(CDRL A015)**

c design activities related to C-5 RERP landing gear subsystem hardware modifications. **(CDRL B001)**

d. software development activities related to the C-5 RERP landing gear anti-skid controller in accordance with this Statement of Work. **(CDRL A015)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified landing gear subsystem components. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified landing gear subsystem components. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the landing gear subsystem modifications.

3.1.1.2.3 WBS 1.1.2.3 Hydraulics

The Contractor shall conduct the technical activities and planning to ensure the functional and performance capability of the C-5 RERP hydraulic subsystem. The Contractor shall design, develop, qualify, and integrate the following hydraulic subsystem design modifications:

a. new hydraulic subsystem stainless steel spider fittings (RE Item 5452),

b. new hydraulic suction boost pumps (RE Item 338),

c. new engine driven hydraulic pumps (RE Item 3HY),

d. new engine driven hydraulic pump filter manifolds (RE Item 5456), and

e. new hydraulic suction line accumulators in the engine pylons (RE Item 3HY).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment or overhaul of existing equipment, as noted) to support the following hydraulic subsystem manufacturing activities:

a. Installation of the following new components:

1. hydraulic subsystem spider fittings (RE Item 5452),
2. hydraulic suction boost pumps (RE Item 338),
3. engine driven hydraulic pumps (RE Item 3HY),
4. engine driven hydraulic pump filter manifolds (RE tem 5456),
5. hydraulic suction line accumulators in the engine pylons (RE Item 3HY), and
6. replacement of hydraulic couplings in the wing leading edges (RE Item 5453), and

b. Replacement of the following components with overhauled components:

(Note: The contractor will substitute new components for overhauled components when it is not economically feasible to overhaul existing components or when GFE will not be available in time to support the aircraft modification schedule.)

1. visor door actuators (RE Item 5111A).

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified hydraulic subsystem component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified hydraulic subsystem components. **(CDRL A015)**

c. design activities related to C-5 RERP hydraulic subsystem modifications. **(CDRL B001)**

d. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified hydraulic subsystem components. **(CDRL A015)**

e. acceptance test requirements and results for C-5 RERP new and modified hydraulic subsystem components. **(CDRL A015)**

f. load analysis of the hydraulic subsystem to verify that the subsystem design meets requirements. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the hydraulic subsystem modifications.

3.1.1.2.4 WBS 1.1.2.4 Environmental Control

The Contractor shall conduct the technical activities and planning to ensure the functional and performance capability of the C-5 RERP environmental control subsystem (ECS). The Contractor shall design, develop, qualify, and integrate the following ECS modifications:

a. new engine bleed air control subsystem that includes ECS pack, floor heat, and cabin temperature control functions (RE Items 5233 and 341),

b. improved A-41 equipment rack and AC load center avionics cooling functionality (RE Item 308),

c. new environmental control panel at the flight engineer's station (RE Item 5233),

d. new bleed air leak detection subsystem (RE Item 5417A),

e. improved ECS pack air cycle machines (RE Item 5413A),

f. improved ECS pack low limit temperature control valves and sensors (RE Item 5413C),

g. improved ECS pack flow control valves (RE Item 5413F),

h. improved ECS air exit doors (RE Item 5415),

i. improved wing isolation valves (RE Item 5413E),

j. new cabin pressurization subsystem controller (RE Item 348)

k. new cabin pressurization subsystem control panel at the flight engineer's station (RE Item 348).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment or overhaul of existing equipment, as noted) to support the following environmental control subsystem manufacturing activities:

a. Installation of the following new components:

1. engine bleed air control subsystem components (RE Items 5233 and 341),
2. A-41 equipment rack and AC load center avionics cooling components (RE Item 308),
3. environmental control panel at the flight engineer's station (RE Item 5233),
4. bleed air leak detection subsystem components (RE Item 5417A),
5. ECS pack low limit temperature control valves and sensors (RE Item 5413C),
6. ECS pack flow control valves (RE Item 5413F),
7. ECS air exit doors (RE Item 5415),
8. wing isolation valves (RE Item 5413E),
9. cabin pressurization subsystem controller (RE Item 348), and
10. cabin pressurization subsystem control panel at the flight engineer's station (RE Item 348),

b. Replacement of the following components with overhauled components:

(Note: The contractor will substitute new components for overhauled components when it is not economically feasible to overhaul existing components or when GFE will not be available in time to support the aircraft modification schedule.)

1. ECS pack air cycle machines (incorporating wheel modifications) on C-5B aircraft (RE Item 5413A).
2. ECS pack air cycle machines (incorporating air bearing retrofit and wheel modifications) and necessary ducting on C-5A aircraft (RE Item 5413A)

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified environmental control subsystem component requirements. **(CDRL A015)**

b. definition of overhaul procedures for the environmental control subsystem components that will be overhauled during C-5 RERP. **(CDRL A015)**

c. interface control of C-5 RERP new and modified environmental control subsystem components. **(CDRL A015)**

d. design activities related to C-5 RERP environmental control subsystem hardware modifications. **(CDRL B001)**

e. software development activities related to the C-5 RERP environmental control subsystem ECS pack, cabin temperature and engine bleed air subsystem controller, and bleed air leak detection system controller(s) in accordance with this Statement of Work. **(CDRL A015)**

f. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified environmental control subsystem and engine bleed air subsystem components. **(CDRL A015)**

g. acceptance test requirements and results for C-5 RERP new and modified environmental control subsystem and engine bleed air subsystem components. **(CDRL A015)**

h. analyses to verify capability of the engine bleed air subsystem to meet the aircraft pneumatic subsystem requirements. **(CDRL A015)**

i. analyses to verify capability of the auxiliary power unit bleed air subsystem to meet the aircraft pneumatic subsystem requirements. **(CDRL A015)**

j. analyses to verify capability of the environmental control subsystem to meet the avionics cooling requirements. **(CDRL A015)**

k. analyses to verify capability of the environmental control subsystem to meet the compartment temperature control and ventilation requirements. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the environmental control subsystem modifications.

3.1.1.2.5 WBS 1.1.2.5 Equipment and Furnishings

The Contractor shall conduct the technical activities and planning necessary to ensure the functional and performance capability of the C-5 RERP equipment and furnishing modifications. The Contractor shall design, develop, qualify, and integrate the following equipment and furnishings design modifications:

a. new troop compartment toilet tank cleaning and rinse lines (RE Item 513F),

b. new cargo compartment lighting system (RE Item 5441A),

c. new toilet tank drain components (RE Item 332),

d. new cargo compartment smoke detectors (RE Item 5492), and

e. new C-5B flight station crew seats for C-5A aircraft and overhaul of C-5B flight station crew seats (RE Item 5121).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment or overhaul of existing equipment, as noted) to support the following equipment and furnishings-related manufacturing activities:

a. Installation of the following new components:

1. troop compartment toilet tank cleaning and rinse lines (RE Item 513F),
2. cargo compartment lighting system components (RE Item 5441A),
3. toilet tank drain components (RE Item 332),
4. cargo compartment smoke detectors (RE Item 5492), and
5. flight station crew seats on C-5A aircraft (RE Item 5121).

b. Replacement of the following components with overhauled components:

(Note: The contractor will substitute new components for overhauled components when it is not economically feasible to overhaul existing components or when GFE will not be available in time to support the aircraft modification schedule.)

1. flight station crew seats on C-5B aircraft (RE Item 5121).

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified equipment and furnishings component requirements. **(CDRL A015)**

b. definition of overhaul procedures for the equipment and furnishings components that will be overhauled during RERP. **(CDRL A015)**

c. interface control of C-5 RERP new and modified equipment and furnishing components. **(CDRL A015)**

d. design activities related to C-5 RERP equipment and furnishings modifications. **(CDRL B001)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified equipment and furnishings components. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified equipment and furnishings components. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the equipment and furnishing modifications.

3.1.1.2.6 WBS 1.1.2.6 Secondary Power/Auxiliary Power Unit (APU)

The Contractor shall conduct the technical activities and planning necessary to ensure the functional and performance capability of the C-5 RERP secondary power subsystems. The Contractor shall design, develop, qualify, and integrate the components and installations for the following secondary power subsystems design modifications:

a. two new auxiliary power units (APU) (RE Item 3AP),

b. two new air turbine motors (ATM) (RE Item 5451),

c. new ATM-driven hydraulic pumps (RE Item 5451A),

d. APU compartment fire detection and extinguishing subsystems (RE Item 5493), and

e. APU and ATM inlet and exhaust plumbing, and pneumatic, hydraulic, fuel, and drain plumbing installations (RE Items 3AP and 5451).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment) to support manufacturing installation of the following secondary power subsystems modifications:

a. auxiliary power units (APU) (RE Item 3AP),

b. air turbine motors (ATM) (RE Item 5451),

c. ATM-driven hydraulic pumps (RE Item 5451A),

d. APU compartment fire detection and extinguishing subsystems components (RE Item 5493), and

e. APU and ATM inlet and exhaust plumbing, and pneumatic, hydraulic, fuel, and drain plumbing installation components (RE Items 3AP and 5451).

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified secondary power subsystems component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified secondary power subsystems components. **(CDRL A015)**

c. design activities related to C-5 RERP secondary power subsystems hardware modifications. **(CDRL B001)**

d. software development activities related to the C-5 RERP secondary power subsystems APU, ATM, and APU generator control unit controllers in accordance with this Statement of Work. **(CDRL A015)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified secondary power subsystems components. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified secondary power subsystems components. **(CDRL A015)**

g. analyses to verify proper ventilation of the APU / ATM compartments. **(CDRL A015)**

h. analyses to verify proper design of the APU compartment fire extinguishing subsystem. **(CDRL A015)**

i. analyses to verify proper design of the APU compartment fire detection subsystems. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the secondary power subsystems modifications.

3.1.1.2.7 WBS 1.1.2.7 Flight Controls

The Contractor shall conduct the technical activities and planning necessary to ensure the functional and performance capability of the C-5 RERP flight control subsystem. The Contractor shall design, develop, qualify, and integrate the following flight controls design modifications:

a. new slat proximity system sensor and control unit (RE Item 5141B),

b. modified rudder limiter to be compatible with new propulsion systems and improve reliability (RE Item 5146),

c. new elevator variable feel unit (EVFU) (RE Item 5143),

d. modified flap actuators (RE Item 5141D),

e. improved primary flight control actuators and manifolds (aileron, elevator, and rudder) (RE Items 14AJB and 514A),

f. improved slat actuators (RE item 5141C),

g. improved elevator attach bolt (RE Item 514A),

h. modified manual pitch trim lever control rod assembly (P/N 4C24012-103A) to ensure full range of motion capability of the manual pitch trim lever (RE Item 5149), and

i. new outboard slat panels

The Contractor shall conduct the technical activities and planning (including procurement of new equipment or overhaul of existing equipment, as noted) to support the following flight control subsystem manufacturing activities:

a. Replacement of the following components with new components:

1. slat proximity system sensor and control unit (RE Item 5141B),
2. rudder limiter assembly (RE Item 5146),
3. elevator variable feel unit (EVFU) (RE Item 5143),
4. flap actuators (RE Item 5141D),
5. worn flap system components (swing arm pins, support bearings, and adjusters) (RE Item 5141H),
6. worn slat system components (slat and moving island bushings, bearings, and seals) (RE Item 5141J),
7. new outboard slat panels on C-5A aircraft (RE Item 5141J), and
8. new C-5B flap tracks on C-5A aircraft (RE Item 5141H).

b. Replacement of the following components with overhauled components:

(Note: The contractor will substitute new components for overhauled components when it is not economically feasible to overhaul existing components or when GFE will not be available in time to support the aircraft modification schedule.)

1. primary flight control servos (RE Items 14AJB and 514A),
2. slat actuators, gearboxes, and brake assemblies (RE Item 5141C),
3. flap actuation gearboxes and brake assemblies (RE Item 5141D),
4. flap power pack hydraulic manifold (RE Item 5141K),
5. flap position transmitter (RE Item 5141E),
6. ground spoiler actuators (RE Item 5144) (Note: C-5A-configuration actuators will be replaced with C-5B-configuration actuators),
7. flight spoiler actuators (RE Item 5145) (Note: C-5A-configuration actuators will be replaced with C-5B-configuration actuators), and
8. worn C-5B flap tracks (RE Item 5141H).

The Contractor shall conduct the technical activities and planning to support the following flight control subsystem maintenance activities:

a. revisions to maintenance instructions, including rigging, as required by design changes or to improve maintenance procedures,

b. replacement of C-5A outboard slat panels with C-5B configuration panels (RE Item 5141J), and

c. replacement of worn, loose, or misaligned flap power pack assembly computer components (RE Item 5141E).

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified flight control subsystem component requirements. **(CDRL A015)**

b. definition of overhaul procedures for the flight control subsystem components that will be overhauled during RERP. **(CDRL A015)**

c. interface control of C-5 RERP new and modified flight control subsystem components. **(CDRL A015)**

d. design activities related to C-5 RERP flight control subsystem modifications. **(CDRL B001)**

e. software development activities related to the C-5 RERP slat proximity sensor subsystem controller in accordance with this Statement of Work. **(CDRL A015)**

f. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified flight control subsystem components. **(CDRL A015)**

g. acceptance test requirements and results for C-5 RERP new, modified, and overhauled flight control subsystem components. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the flight control subsystem modifications.

3.1.1.2.8 WBS 1.1.2.8 Electrical Power

The Contractor shall conduct the technical activities and planning necessary to ensure the functional and performance capability of the C-5 RERP electrical power subsystems. The Contractor shall design, develop, qualify, and integrate the following electrical power subsystems modifications:

a. new engine-driven electrical generators (RE Item 3EL),

b. new APU-driven electrical generators (RE Item 3AP),

c. new generator control units (RE Item 3EL),

d. a new electrical subsystem control panel at the flight engineer's station (RE Item 3EL),

e. a new bus power control unit (BPCU) (RE Item 3EL),

f. a new power bus assembly (PBA) (RE Item 5422),

g. a second new battery (same as battery procured under C-5 AMP) to support APU starting (RE Item 5421), and

h. new APU start battery chargers (RE Item 5421).

The Contractor shall conduct the technical activities and planning (including procurement of new equipment) to support manufacturing installation of the following electrical power subsystems modifications:

a. engine-driven electrical generators (RE Item 3EL),

b. APU-driven electrical generators (RE Item 3AP),

c. generator control units (RE Item 3EL),

d. an electrical subsystem control panel at the flight engineer's station (RE Item 3EL),

e. a bus power control unit (BPCU) (RE Item 3EL),

f. a power bus assembly (PBA) (RE Item 5422),

g. a second battery (same as battery procured under C-5 AMP) to support APU starting (RE Item 5421), and

h. APU start battery chargers (RE Item 5421).

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified electrical power subsystems component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified electrical power subsystems components. **(CDRL A015)**

c. design activities related to C-5 RERP electrical power subsystems hardware modifications. **(CDRL B001)**

d. software development activities related to the C-5 RERP electrical power subsystems generator control unit controllers in accordance with this Statement of Work. **(CDRL A015)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified electrical power subsystems components. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified electrical power subsystems components. **(CDRL A015)**

g. load analyses of the AC and DC electrical power generation and distribution subsystems to verify that the subsystem design meets requirements. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the electrical power subsystems modifications.

3.1.1.2.9 WBS 1.1.2.9 Equipment Installation Design

The Contractor shall design and develop the aircraft modifications to install the systems and equipment that are developed for the C-5 RERP. These modifications shall include equipment mounting provisions along with ducting, plumbing, and wiring necessary to integrate the equipment into the aircraft design.

The Contractor shall document the following for C-5 RERP design modifications to support installation by Contractor personnel at Contractor facilities:

a. Subsystem schematic drawings. **(CDRL B001)**

b. Electrical schematic drawings and wiring diagrams. **(CDRL B001)**

c. C-5A/B/C Mechanical component, and ducting (including supports, brackets, clips, etc.) detail drawings, **(CDRL B001)**

d. C-5A and C-5B wiring and plumbing detail drawings. **(CDRL B001)**

e. C-5A/B/C Mechanical installation drawings **(CDRL B001)**

f. C-5A and C-5B electrical and plumbing installation drawings. **(CDRL B001)**

3.1.1.3 WBS 1.1.3.0 Propulsion System (Engine, Nacelles, and Controls)

The Contractor shall design, analyze, develop, produce or procure, and qualify the hardware and software required for the C-5 RERP propulsion system modifications. The propulsion system shall include the hardware and software of the engine and nacelle assemblies. The propulsion system modifications shall satisfy the requirements of the Air Vehicle Functional Modification Specifications.

In addition to the tasks defined in the following subparagraphs, the Contractor shall:

a. establish subsystem-level design requirements for the propulsion system modifications **(CDRL A015)**

b. perform and document design trade studies for the propulsion system modifications. These trade studies will consider cost, schedule, and system performance requirements. **(CDRL A015)**

c. develop integration test requirements and evaluate the resulting test data to validate functional integration of the propulsion system avionics-related modifications into the aircraft. **(CDRL A015)**

d. develop aircraft-level test requirements and evaluate the resulting test data to validate physical and functional integration of propulsion system modifications into the aircraft and to verify that all associated requirements of the Air Vehicle Functional Modification Specification have been met. **(CDRL A023)**

3.1.1.3.1 WBS 1.1.3.1 Propulsion System Design/Development

The Contractor shall conduct the technical activities and planning necessary to ensure the functional and performance capability of the C-5 RERP propulsion system (RE Item 3PP). The Contractor shall procure new propulsion systems to support aircraft modifications. Propulsion system design modifications are the installation of new General Electric CF6-80 engines and new nacelles in place of the existing C-5 engines, nacelles, and thrust reversers. The new engine and nacelle assemblies include:

Engine System - The Engine System consists of the core gas generator, low-pressure fan/turbine, and the integral components and subsystems required for control, monitoring, and safe operation. The components and subsystems include a fuel pump, fuel metering unit, fuel flowmeter, a lubrication subsystem, an ignition subsystem, instrumentation-sensor subsystem, electrical subsystem, control and monitoring subsystem, and an accessory gearbox.

Engine Control and Monitoring Subsystem - The Engine Control and Monitoring Subsystem includes a fully integrated dual channel Engine Electronic Control system (EECS) with associated sensors and wiring harnesses. The engine control and monitoring subsystem will condition sensor signals and data from each engine and nacelle subsystems and provide output data and signals in suitable format on the avionics data bus. These signals will be utilized by the aircraft health monitoring/maintenance management system, and the cockpit display system.

Nacelle Assembly - The Nacelle Assembly includes components added to the engine system to form a complete Propulsion System (including engine powered hydraulic pumps and electrical generation system). Nacelle components include the following: air induction and exhaust subsystems; inlet anti-icing subsystem; cowling; thrust reverser; engine mounts; nacelle cooling and ventilation; engine starter subsystem; and Propulsion System segments of the engine bleed air subsystem, nacelle fire protection subsystem, fuel subsystem, aircraft electrical subsystem, and aircraft hydraulic subsystem.

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified propulsion system requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified propulsion system components. **(CDRL A015)**

c. design activities related to C-5 RERP propulsion system modifications. **(CDRL B001)**

d. software development activities related to the C-5 RERP engine control and monitoring subsystem controllers in accordance with this Statement of Work. **(CDRL A015)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified propulsion system. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified propulsion system components. **(CDRL A015)**

The Contractor shall develop the interfaces between the Contractor engine data collection system and the Government Comprehensive Engine Management System (CEMS) Reporting.

3.1.1.3.2 WBS 1.1.3.2 Propulsion System Integration

The Contractor shall conduct the technical activities and planning necessary to ensure the functional and performance capability of the C-5 RERP installed propulsion system and propulsion-related subsystem modifications. The Contractor shall design, develop, qualify, and integrate, and shall procure new equipment to support the following propulsion-related subsystem design modifications:

a. a new throttle quadrant (RE Items 5231 and 5141A),

b. new engine fire detection and extinguishing subsystem components (RE Items 3PP and 5493),

c. new flight station control panels related to the C-5 RERP propulsion system (engine start/shutdown panel, engine anti-ice control panel, and engine fuel heating subsystem control panel) (RE Item 3PP), and

d. new engine vibration monitoring subsystem components (RE Item 3PP).

The Contractor shall conduct scale-model wind tunnel testing to determine the impact of the C-5 RERP nacelle on the air vehicle drag, verify C-5 RERP nacelle and pylon aerodynamic loads, and establish a baseline C-5 RERP thrust reverser cascade configuration. The Contractor shall develop and document the test configuration and results of the scale-model wind tunnel program. **(CDRL A015)**

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified propulsion-related subsystem component requirements. **(CDRL A015)**

b. interface control of the C-5 RERP propulsion system with propulsion-related aircraft subsystems. **(CDRL A015)**

c. design activities related to C-5 RERP propulsion-related subsystem hardware modifications. **(CDRL B001)**

d. software development activities related to the C-5 RERP engine fire detection and engine vibration monitoring subsystem controllers in accordance with this Statement of Work. **(CDRL A015)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified propulsion-related subsystem components. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified propulsion-related subsystem components. **(CDRL A015)**

g. analyses to verify proper ventilation of the nacelle and pylon compartments. **(CDRL A015)**

h. analyses to verify proper design of the engine compartment fire extinguishing subsystem. **(CDRL A015)**

i. analyses to verify proper design of the engine compartment fire detection subsystem. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the propulsion system and propulsion-related subsystem modifications.

3.1.1.4 WBS 1.1.4.0 Avionics

The Contractor shall design, analyze, develop, produce or procure, and qualify the hardware and software required for the C-5 RERP avionics subsystem modifications. The avionics subsystem modifications shall satisfy the requirements of the C-5 RERP Air Vehicle Functional Modification Specifications. The Contractor shall accomplish the following:

a. establish subsystem-level design requirements for the avionics subsystem modifications. **(CDRL A015)**

b. perform and document design trade studies for the avionics subsystem modifications. These trade studies will consider cost, schedule, and system performance requirements. **(CDRL A015)**

c. develop integration test requirements and evaluate the resulting test data to validate functional integration of the avionics subsystem modifications. **(CDRL A015)**

d. develop aircraft-level test requirements and evaluate the resulting test data to validate physical and functional integration of avionics subsystem modifications and to verify that all associated requirements of the Air Vehicle Functional Modification Specification have been met. **(CDRL A023)**

3.1.1.4.1 WBS 1.1.4.1 Embedded Diagnostics System (MADARS Upgrade)

The Contractor shall conduct the technical activities and planning to ensure the functional and performance capability of the upgraded C-5 Malfunction Detection, Analysis, and Recording System (MADARS). The Contractor shall design, develop, qualify, and integrate, and shall procure new equipment to support the following embedded diagnostics subsystem design modifications:

a. update the existing MADARS (post-AMP configuration) mux processor and modify hardware and software to interface with C-5 RERP modifications (RE Items 5551A and 5551B).

b. replacement of the MADARS controller and display unit with a laptop computer (RE Item 5551A),

c. replacement of the analog Signal Acquisition Remotes (SARs) with Digital Signal Acquisition Remote (DSAR) units (RE Item 5551B),

d. replacement of Overboard Loads Monitoring System on a LESS Aircraft, and

e. installation of improved maintenance and flight data recorders (RE Item 5661).

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified embedded diagnostics subsystem component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified embedded diagnostics subsystem components. **(CDRL A015)**

c. definition of interfaces between the modified embedded diagnostics subsystem with ground-based maintenance data systems. **(CDRL A015)**

d. design activities related to C-5 RERP embedded diagnostics subsystem hardware modifications. **(CDRL B001)**

e. software development activities related to the C-5 RERP embedded diagnostics subsystem Computer Software Configuration Items (CSCI) in accordance with this Statement of Work. **(CDRL A015)**

f. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified embedded diagnostics subsystem components. **(CDRL A015)**

g. acceptance test requirements and results for C-5 RERP new and modified embedded diagnostics subsystem components. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the embedded diagnostics subsystem modifications.

3.1.1.4.2 WBS 1.1.4.2 Other Avionics

The Contractor shall design, develop, qualify, and integrate modifications to the aircraft avionics architecture developed under the C-5 AMP to properly interface with other C-5 RERP system modifications. The following is a list of CSCIs that may be changed for C-5 RERP:

a. the Display Services Computer Software Configuration Item (CSCI),

b. the Mission Integrity CSCI,

c. the Multi-Function Display Unit (MFDU) Application Client CSCI,

d. the Automatic Flight Control System (AFCS) CSCI, and

e. the Flight Management System (FMS) CSCI

The Contractor shall develop and document the following:

a. definition of C-5 RERP new and modified avionics subsystem component requirements. **(CDRL A015)**

b. interface control of C-5 RERP new and modified avionics subsystem components. **(CDRL A015)**

c. design activities related to C-5 RERP avionics subsystem hardware modifications. **(CDRL B001)**

d. software development activities related to the C-5 RERP avionics subsystem CSCIs in accordance with this Statement of Work. **(CDRL A015)**

e. qualification test requirements and results, and analyses that show compliance with design requirements for C-5 RERP new and modified avionics subsystem components. **(CDRL A015)**

f. acceptance test requirements and results for C-5 RERP new and modified avionics subsystem components. **(CDRL A015)**

The Contractor shall provide technical support for activities associated with qualification, integration, and QT&E testing of the avionics subsystems modifications. The Contractor shall procure or modify equipment to support avionics subsystem modifications.

The contractor shall interface with the Air Force Mission Support System by providing appropriate algorithms to the AFMSS vendor and verifying the interface during all phases of test.

3.1.1.5 WBS 1.1.5.0 Air Vehicle Analysis and Integration

3.1.1.5.1 WBS 1.1.5.1 Air Vehicle Requirements and Specialty Engineering

The Contractor shall perform Air Vehicle requirements analysis, requirements traceability, and specialty engineering activities to support the Air Vehicle design and qualification as defined below.

a. Develop and maintain the Air Vehicle functional, performance, and verification requirements in the Air Vehicle Functional Modification Specification.

b. Manage the allocation of Air Vehicle functional and performance requirements to Subsystem Integration Specifications and lower tier development and product specifications. **(CDRL A015)**

c. Perform analysis activities and prepare documentation to show compliance with design requirements. **(CDRL A015)**

d. Support Government preparation of Airworthiness Certification documentation that will be used to show compliance with OSS&E requirements at the conclusion of the SDD contract.

e. Establish and maintain the Technical Performance Measurement (TPM) parameters relating to the Air Vehicle development.

f. Establish Human Factors focus areas through a C-5 RERP Crew Systems/Human Factors Requirements Analysis. Plan, coordinate, and conduct the Flight Station Working Group (FSWG) meetings.

1. Document the Operator's Human Engineering Design Approach. **(CDRL A010)**
2. Perform and document an anthropometric evaluation of new and modified flight deck crew interfaces. **(CDRL A015)**
3. Manage crew workload evaluations including planning, scenario and model development, implementation, and documentation. **(CDRL A015)**
4. Develop verification procedures for human engineering requirements related to Air Vehicle operators. **(CDRL A022)**
5. Develop test reports to document the results of human engineering tests related to Air Vehicle operators. **(CDRL A023)**

g. Perform an E^3 criticality analysis, an Electromagnetic Effects (EME) immunity analysis, and an E^3 safety margin analysis. **(CDRL A015)**

1. Perform a High Intensity Radio Frequency (HIRF) and lightning protection location versus environment hardness analysis, zoning analyses, and a HIRF and lightning protection analysis. **(CDRL A015)**
2. Prepare and document test requirements and test and analysis reports for the following E^3 evaluations:

a. Self-compatibility evaluation – This includes preparation of aircraft-level test requirements, analysis of equipment data (both baseline C-5 and new C-5 RERP) and documentation of aircraft-level test results in a self-compatibility evaluation report. **(CDRL A015)**

b. HIRF evaluation – This includes analysis of new equipment data, considering equipment installation location, evaluation of aircraft bonding and cable design, and documentation of evaluation results in a HIRF analysis report. **(CDRL A015)**

c. Lightning evaluation – This includes analysis of new equipment data (immunity to conducted susceptibility), considering equipment installation location, evaluation of aircraft structural bonding design, and documentation of evaluation results in a Lightning analysis report. **(CDRL A015)**

3.1.1.5.2 WBS 1.1.5.2 Air Vehicle Analysis

The Contractor shall analyze Air Vehicle system level performance characteristics for acoustics, aerodynamics and performance, stability and control, flying qualities, and thermodynamics.

The Contractor shall develop and document the following:

a. Perform acoustic analyses and document the acoustic impacts from Air Vehicle modifications on the following:
   1. Interior noise in the flight station and crew area. **(CDRL A015)**
   2. Exterior noise during ground operations. **(CDRL A015)**
   3. Far-field noise levels. **(CDRL A015)**

b. Perform the following aerodynamic performance analyses:
   1. Provide aerodynamic performance predictions based on wind tunnel test data, flight test data, and performance expansion codes.
   2. Develop design and test requirements for FMS CSCI modifications.
   3. Generate an Aerodynamics Substantiating Data Report. **(CDRL A026)**
   4. Develop performance charts and related text that will be used to update the C-5 Flight Manual and Performance Appendix to reflect RERP modifications.
   5. Develop Flight Manual and Performance Index to reflect C-5 RERP modifications.

c. Perform the following Stability and Flight Control tasks:
   1. Provide updated stability and flight control performance predictions that reflect C-5 RERP modifications.
   2. Develop design and test requirements for the autopilot and AFCS CSCI modifications.
   3. Provide aerodynamic data for the Air Loads Report. **(CDRL A015)**
   4. Update the Stability and Control Substantiating Data Report. **(CDRL A015)**
   5. Develop charts and procedures that will be used to update the C-5 Flight Manual to reflect RERP modifications.

d. Perform the following Thermodynamics Systems Integration tasks:

1. Define performance and test requirements for modified air vehicle thermodynamic subsystems and components (APU, ATM, air conditioning, distribution, and cabin pressurization subsystems, engine bleed air subsystem, propulsion system) support test plan development, perform analyses to verify subsystem performance requirements, and document analysis and requirements verification activities. **(CDRL A015)**

2. Assess the RERP baseline avionics cooling system capacities and loads, support the verification of equipment thermal environments, support test plan development, verify performance requirements, and document analysis and requirements verification activities. **(CDRL A015)**

3. Assess the fuel system performance characteristics, support test plan development, and document analysis and requirements verification activities. **(CDRL A015)**

3.1.1.5.3 WBS 1.1.5.3 Air Vehicle Integration

The Contractor shall perform and manage the following functions relating to Air Vehicle Design Integration:

a. Establish and maintain an air vehicle weight statement. Provide technical support before and during C-5 RERP aircraft weighing, and produce an updated weight statement for each aircraft after weighing the aircraft. **(CDRL A018)**

b. Establish and maintain the following documents which will document the physical and functional configuration of the C-5 RERP air vehicle:

   Drawing Tree **(CDRL A015)**

   2. Master Equipment List **(CDRL A015)**

   3. System Description Document **(CDRL A015)**

c. Establish and maintain a problem reporting and resolution system to support air vehicle subsystem integration. The Contractor shall produce Integration Problem Reports (IPRs) to identify problems or document incorrect test results found during C-5 Systems Integration Laboratory (SIL) or aircraft testing. Issues identified in the C-5 SIL will be reviewed and addressed prior to flight-testing on the aircraft. The Contractor shall track and maintain the status of IPRs. All open IPRs will be reviewed prior to the installation of a software release on the SDD test aircraft to ensure safe and efficient use of the test aircraft.

3.1.1.6 WBS 1.1.6.0 Installation, Assembly, and Checkout

The Contractor shall control the tooling, and perform the fabrication, assembly, and installation effort for C-5 RERP modifications. These efforts include the following tasks:

a. conduct production planning,

b. provide manufacturing facilities,

c. develop a tooling concept,

d. plan, fabricate, and maintain the tooling necessary to perform SDD manufacturing tasks,

e. execute make-or-buy decisions,

f. fabricate components in accordance with make-or-buy decisions,

g. develop manufacturing techniques,

h. perform subassembly and assembly installation activities, and

i. perform checkout activities for the air vehicle upon receipt from and prior to redelivery to the Air Force.

3.1.1.6.1 WBS 1.1.6.1 Production Planning

The Contractor shall incorporate the C-5 RERP modifications using production planning, Technical Orders (TO), and Time Compliance Technical Orders (TCTO). Modification activities that are covered by existing TOs and TCTOs will be worked utilizing applicable TCTOs. Existing planning documentation shall be used for SDD fabrication, assembly, and installation activities. When appropriate, new planning shall be developed for items that are unique to C-5 RERP Production. Fabrication planning shall be developed for manufacturing detail parts and subassemblies.

3.1.1.6.2 WBS 1.1.6.2 Tooling

The Contractor shall design, analyze, develop, fabricate, test, qualify, and prepare for production the tooling required for the C-5 RERP modifications. This tooling is required for manufacturing support and check-out operations. Additional tooling may be required for the QT&E flight test program. Tooling required for modification include configuration control tooling, fabrication and mill fixtures, special cutters and drills, manufacturing aids, and functional checkout tools.

The Contractor shall determine and build the tooling required to support SDD activities. The Contractor shall use existing tooling to the maximum extent possible and identify the additional tooling required to support the Production phase.

3.1.1.6.3 WBS 1.1.6.3 Fabrication

The Contractor shall plan, organize, direct, coordinate, and control the fabrication of C-5 RERP parts, subassemblies and harnesses. This effort shall include make-or-buy studies and decisions on what to manufacture internally and what to outsource to achieve best value to the Government. The Contractor shall mock-up fabricated parts and assemblies (such as tubing and wire harnesses) during SDD to obtain data required for the Production phase.

3.1.1.6.4 WBS 1.1.6.4 Assembly/Installation

The Contractor shall plan, organize, direct, coordinate, control, and perform the assembly and installation activities to incorporate the C-5 RERP modifications. The Contractor shall define the manufacturing sequence, facilities utilized, assembly rates and number of modification positions. During the assembly/installation activity, any discrepancies found in legacy C-5 systems, equipment, structure, or departures from the legacy aircraft baseline shall be documented on Contractor's Modification Inspection Record (MIR). Those repairs and replacements not specifically cited as C-5 RERP work, covered in other paragraphs of this SOW,

shall be considered "over and above" activities. Accordingly, the MIR shall be annotated with the man-hours necessary to remedy the discrepancy and the schedule impact. The MIR shall then be submitted to the designated Government representative for authorization of the "over and above" work.

For the structural repair items that are unique to the C-5A aircraft, the Contractor shall perform both visual and non-destructive inspections (NDI) as part of the RERP contract. Any discrepancies or damage discovered during these inspections shall be documented on MIR forms for each condition and shall be considered "over and above". Due to the unknown status of each aircraft prior to input for modification, the inspections are considered a part of the RERP contract, whereas the fabrication and installation of repair parts and skins would be "over and above" the basic contract. The five particular repairs on C-5A aircraft are as follows:

1. underfloor bulkhead end fittings (RE Item 3UF),
2. contour box beam fittings (RE Item 3CB),
3. mainframes (RE Item 3MF),
4. keel beam fittings (RE Item 3KB), and
5. upper crown skins (RE Item UCS).

The Contractor shall provide secure storage for high-value and classified equipment that will be removed from the aircraft during modification or test activities and reinstalled prior to redelivery of the aircraft. The Contractor shall disposition removed equipment that will not be reinstalled as part of the RERP modification in accordance with the Special Contract Clause titled "Disposition of Removed C-5 Equipment."

Following the completion of Qualification Test and Evaluation (QT&E) activities defined in this Statement of Work, the Contractor shall remove Contractor-installed instrumentation from the three instrumented test aircraft and restore them to an operationally serviceable (production-representative) condition prior to redelivery to the Air Force.

3.1.1.6.5 WBS 1.1.6.5 Flight Operations

The Contractor shall plan, organize, direct, coordinate, control, and conduct the flight operation activities required for receipt and redelivery of the SDD aircraft. These activities will consist of initial fueling activities, engine runs, and ground and flight check-out of all air vehicle systems in accordance with the C-5 RERP production acceptance test procedures.

During the receipt and redelivery activities, any discrepancies found in legacy C-5 systems, equipment, structure, or departures from the legacy aircraft baseline shall be documented on Contractor's Modification Inspection Record (MIR). Those repairs and replacements not specifically cited as C-5 RERP work, covered in other paragraphs of this SOW, shall be considered "over and above" activities. Accordingly, the MIR shall be annotated with the man-

hours necessary to remedy the discrepancy and the schedule impact. The MIR shall then be submitted to the designated Government representative for authorization of the "over and above" work.

3.1.2 WBS 1.2.0.0 Logistics Support

3.1.2.1 WBS 1.2.1.0 Training

The Contractor shall provide Aircrew and Maintenance training to C-5 qualified Government personnel, as defined in the Logistics Support Plan (LSP).

3.1.2.1.1 WBS 1.2.1.1 Air Crew Training

3.1.2.1.1.1 WBS 1.2.1.1.1 QT&E Flight Test Aircrew Training

The Contractor shall provide the Type 1 training necessary to qualify two government flight test crews to participate in the C-5 RERP QT&E program. The training program shall be conducted using preliminary Type 1 training materials, tailored to meet QT&E requirements. Prior to aircrew training, Contractor instructors shall receive Government-provided training at agreed-upon Government sites, in order to be proficient in baseline C-5 flight operations.

3.1.2.1.1.2 WBS 1.2.1.1.2 QOT&E Type 1 Aircrew Training

The Contractor shall provide Type 1 aircrew training to qualify a cadre of ten aircrews to operate and test the new and modified C-5 RERP aircraft systems for QOT&E. The QOT&E aircrew training program shall emphasize "hands-on" use of the new or modified systems in their intended test and operational aircraft configurations. The Contractor shall provide training courseware material to the Government. **(CDRL A015)**

3.1.2.1.1.3 WBS 1.2.1.1.3 Type 1 Training Facilities

Contractor facilities shall be used for Type 1 training.

3.1.2.1.1.4 WBS 1.2.1.1.4 Aircrew Training Devices (ATD)

The Contractor shall develop an Associate Contractor Agreement (ACA) with the C-5 Aircrew Training System (ATS) Contractor in accordance with contract clause AFMC FAR 5352.217-9010, Associate Contractor Agreements, and Special Contract Requirement H-005, Associate Contractor Agreements (ACA) (C-5 RERP). The Contractor and the C-5 ATS Contractor shall identify requirements for information (e.g., engineering data, schedules, etc.), hardware (e.g., parts applicable to C-5 ATS Training devices) and/or software related to the C-5 RERP modifications for use with existing or planned C-5 ATDs. Contractor support to the Associate Contractor, as stated in the ACA, shall be accomplished pending execution of a separate contract modification to the SDD RERP Contract that will allow the provisions of the ACA to be executed.

At the times agreed to by the Contractor and C-5 ATS Contractor, all data and software items required by the C-5 ATS Contractor under the ACA shall be delivered in the same format, medium, and level of detail used by the Contractor.

3.1.2.1.2 WBS 1.2.1.2 Maintenance Training

The Contractor shall develop, and present a C-5 RERP Type 1 Maintenance Training program, suitable for qualified (5 and 7 skill level) maintenance technicians and instruction personnel. Type 1 maintenance training shall include instructions necessary to test and operate the new and modified C-5 RERP systems in the intended test and operational configurations.

3.1.2.1.2.1 WBS 1.2.1.2.1 QT&E Training

The Contractor shall allow up to 12 Government representatives to observe maintenance actions on the C-5 aircraft. These representatives will be 7-level maintenance personnel experienced on transport aircraft. The Contractor shall provide familiarization briefings and informal training for these personnel to familiarize them with the RERP modifications. The Contractor shall ensure that an effective interface with current C-5 aircraft maintenance Tech Orders is established during the QT&E period.

3.1.2.1.2.2 WBS 1.2.1.2.2 Type 1 Initial Cadre Maintenance Training

The Type 1 maintenance training program shall include new and modified C-5 RERP system and subsystem familiarization, theory of operation, interface descriptions, system and sub-system operation, troubleshooting to the Line Replaceable Unit (LRU) level, and the use of new support equipment required to support organizational-level maintenance. The Type 1 maintenance training shall also emphasize "hands-on" maintenance and operation of new/modified C-5 RERP systems in the intended test and operational aircraft configurations. The Contractor shall be available for Type 1 maintenance training consultation throughout QOT&E. **(CDRL A015)**

The Contractor shall provide at least two iterations of engine Original Equipment Manufacturer (OEM) organizational level training at the engine manufacturer's facility for Government and Contractor personnel as part of the RERP training development and implementation effort.

The Contractor shall conduct two iterations of Type 1 initial cadre maintenance training, including engine OEM training, using preliminary training materials, prior to the commencement of Technical Order Verification. For each iteration, the Contractor shall present this Type 1 training to a cadre of up to 12 students per class for each maintenance course listed in the C-5 RERP Training and Training Equipment Plan.

3.1.2.1.2.3 WBS 1.2.1.2.3 Maintenance Training Devices (MTD)

The Contractor shall conduct a Training Systems Requirements Analysis (TSRA) Phase II extending the preliminary Phase I TSRA to identify the training and training equipment required to support the C-5 RERP peculiar systems and their integration into the C-5 airframe. The

Contractor shall establish Production lead time, delivery schedule, and estimated facility requirements for the equipment identified. The Contractor shall consider existing Government C-5 training devices when determining training device requirements. Trainers will be used to conduct training certification to a 3cGo qualification level for Government maintenance personnel. The TSRA shall establish recommended Master Training Task List (MTTL), course objectives, and instructional media necessary to meet the requirements of the SOW, Systems Specification, and the Logistics Support Plan (LSP). **(CDRL A036)**

3.1.2.2 WBS 1.2.2.0 Support Equipment

3.1.2.2.1 WBS 1.2.2.1 Peculiar Support Equipment (PSE)

The Contractor shall minimize the requirements for Support Equipment (SE). The Contractor shall design, develop, build and deliver the PSE required to complete the SDD program. This effort shall include the design/development of the C-5 RERP engine change package that will be deployable on a C-17 aircraft. The Contractor shall procure materials, components and standard parts required to test, validate, and deliver required PSE. The Contractor shall review, analyze, and approve applicable on-aircraft diagnostics and test equipment to ensure that they meet PSE and diagnostic technical data requirements. The Contractor shall develop test strategies, concepts, parametric information, and requirements for PSE-supported subsystems, units, and assemblies. The Contractor shall develop and deliver specifications for complex PSE. The Contractor shall identify and document calibration requirements for PSE developed under this contract. The Contractor shall develop a repair capability for PSE to meet base-level support requirements and demonstrate this capability during QT&E. The Contractor shall develop PSE and prime equipment as a system so that functional test results obtained using PSE are consistent with acceptance test procedures and results. When support equipment recommendations are implemented the Contractor shall perform a compatibility test on the first article of each item of Support Equipment with the aircraft/system. The Contractor shall prepare an Electronic Support Equipment Requirements Document (ESERD) for each PSE item not currently on the C-5 Table of Allowances (TA). Upon approval of the ESERD by the Procuring Contract Officer (PCO), the Contractor shall design, fabricate, acquire, assemble, code and debug, integrate, test, inspect, demonstrate, document, and deliver all approved O-level PSE required to support the C-5 RERP system (hardware and software) during SDD. **(CDRL A031)**

3.1.2.2.2 WBS 1.2.2.2 Common Support Equipment (CSE)

The Contractor shall screen and select CSE for Organizational and Depot maintenance levels. The Contractor shall develop, maintain, and deliver standard and modified hand tool lists, and support equipment lists. The Contractor shall conduct tests and demonstrations using common support equipment end items on C-5 RERP modified systems, to ensure system compatibility, performance and operability. **(CDRL A015)**

The Contractor shall provide support equipment planning, identification, analysis, and integration requirements for developing recommendations for RERP support equipment. When support equipment recommendations are implemented the Contractor shall perform a compatibility test on the first article of each item of Support Equipment with the aircraft/system. The Contractor shall prepare ESERDs for each Common Support Equipment item not currently in the C-5 TA. **(CDRL A031)**

3.1.2.3 WBS 1.2.3.0 Technical Publications

The Contractor shall provide operating, maintenance, and parts catalog data to support the C-5 RERP. The Contractor shall develop and deliver this data in accordance with the Technical Manual Contract Requirements (TMCR). The TMCR is an attachment to the SDD contract. **(CDRL C001)**

The Contractor shall develop and produce a one-page TCTO using the Contractor's format to identify the Top Drawing that supports each C-5 RERP modification. **(CDRL C001)**

The Contractor shall develop Job Guide Manuals and Fault Reporting/Fault Isolation Manuals (FRM/FIM) as part of the Organizational Maintenance Manual Set (OMMS) for new systems that are maintained at the organizational level. The Contractor shall develop organizational maintenance data with expanded removal and installation instructions for modified systems to be incorporated in the existing maintenance manual set. **(CDRL C001)**

The Contractor shall host a technical manual guidance conference, conduct an in-process review of new and substantially changed manuals at the 75% completion point; host a combined validation/verification; support a pre-publication review of Government selected new and updated publications, and deliver data in compliance with the negotiated schedule. Upon completion of the validation effort during QT&E, comments shall be incorporated and updated paper copies of TO manuals shall be provided for QOT&E support. Comments resulting from QOT&E shall be incorporated and updated paper copies of TO manuals shall be submitted for Pre-Publication Review (PPR). Upon completion of the PPR, comments shall be incorporated and TO manuals shall be submitted for acceptance. Final delivery shall be in the form of digital media (Indexed Portable Document Format (IPDF) and in Standard Generalized Mark-up Language (SGML) developed using LM Aero Document Type Definition (DTD). The Technical Manual Guidance Conference shall address aspects of the Publications Program focusing on the tailored Technical Manual Contract Requirement (TMCR). The Contractor shall use the C-5A/B aircraft manuals that have been updated to the C-5 AMP configuration, where applicable, as the baseline for required C-5 RERP flight, maintenance, and Illustrated Parts Breakdown (IPB) manual data. C-5 RERP technical manuals shall be produced in a similar style and format as the current manuals to maintain consistency within the C-5 Technical Manual Set. The Contractor shall monitor the C-5 RERP flight testing and shall revise the technical manuals. **(CDRL C001)**

The Contractor shall review available commercial manuals that provide maintenance instructions for complex C-5 RERP Peculiar Support Equipment (PSE). The Contractor shall submit

CFAE/CFE Notices to recommend those commercial SE manuals that are acceptable for use in accordance with MIL-HDBK-1221, and to identify the costs associated with delivering those manuals. **(CDRL C001)**

3.1.2.4 WBS 1.2.4.0 Supply Chain Management

3.1.2.4.1 WBS 1.2.4.1 Spares

The Contractor shall provide spares for ground and flight test, QT&E/QOT&E, and QOT&E/initial RM&A Assessment. The Contractor shall ensure that initial spares will be identified for the base supply system, the Readiness Spares Packages (RSP), and at the ten Forward Supply Locations to ensure that minimum levels can be obtained and will be available at the time of system delivery. The Contractor shall produce a Logistics Management Information (LMI) Data Product and Flight Test Spares Data using MIL-PRF-49506 as a guide. **(CDRL A032)**

3.1.2.4.2 WBS 1.2.4.2 Provisioning and Repairs

3.1.2.4.2.1 WBS 1.2.4.2.1 Strategic Sourcing

The Contractor shall select suppliers and repair sources for C-5 RERP modifications that provide the best overall value. The Contractor shall monitor these suppliers and repair sources to ensure that problems are identified and resolved early.

3.1.2.4.2.2 WBS 1.2.4.2.2 Supply Support

The Contractor shall provide a Field Service Representative (FSR) to the Regional Supply Squadron (RSS) at Scott AFB, as a Contractor/Government Interface.

The Contractor shall develop a plan to ensure the timely procurement and delivery of all initial and replenishment spares and repair parts for the C-5 RERP. This plan shall re-assess the quantity of spares and provide recommendations for changes in quantity of spares. This plan shall also define the process for identifying and ordering long-lead time items. In addition, the Government's wartime surge requirements and other contingency operations shall be considered.

3.1.2.4.2.3 WBS 1.2.4.2.3 Sustaining Item Management

The Contractor shall define and develop initial capability for the effort required to manage the unique C-5 RERP items after initial spares have been procured. The Contractor's responsibilities shall include item planning, replenishment execution, exception management, and supply chain pipeline monitoring and problem resolution. The Contractor shall develop the means necessary to resolve CONUS MICAP (Mission Capability) within 48 hours and CONUS Non-MICAP events within 72 hours 90 percent of the time, as described in the Logistics Support Plan for all C-5 RERP items.

3.1.2.4.2.4 WBS 1.2.4.2.4 Warranties

The Contractor shall establish an effective C-5 RERP warranty management program plan to provide warranty support on new and repaired C-5 RERP parts. The warranty program will facilitate timely, proper support to the Government and resolution of quality and performance issues.

3.1.2.5 WBS 1.2.5.0 Logistics Support Management

3.1.2.5.1 WBS 1.2.5.1 Logistics Support Planning

The Contractor shall continue to develop a Logistics Support Plan (LSP) and implement those elements required to support SDD. The LSP shall address the following elements: **(CDRL A012)**:

a. Design interface

b. Maintenance planning

c. Support Equipment

d. Supply support

e. Packaging, handling, storage, and transportation

f. Technical data

g. Facilities

h. Personnel

i. Training and training support

j. Computer resources support

Logistics information technology and an information management system shall be planned and relevant capabilities needed for SDD will be implemented. The Contractor shall define requirements, and define, test, and integrate those portions of an internal on-line supply support process necessary to accomplish SDD tasks. The Supply Chain System, Decision Support System, and Logistics Support Portal shall enable the Contractor to determine the base-level support required for the C-5 RERP Air Vehicle. The Contractor shall define the process and infrastructure necessary to maintain the spare parts identification consistent with the approved configuration baseline.

The Contractor shall analyze, assess, and make improvement recommendations to the current C-5 supply chain processes.

3.1.2.5.1.1 WBS 1.2.5.1.1 Supply Chain System

The Contractor shall define the approach required to acquire and implement a wholesale level Order and Supply Chain System that contains the following functions:

a. Order processing

b. Purchasing

c. Inventory Management

d. Planning

The Contractor shall define and build a transparent interface between the wholesale level Supply Chain System and the Standard Base Supply System (SBSS) so order processing capabilities will include the ability to exchange applicable data with the Air Force's supply system.

3.1.2.5.1.2 WBS 1.2.5.1.2 Decision Support System

The Contractor shall perform the requirements analysis, design, development, procurement, data modeling, standardization, testing, integration, and data management and transformation to support the development of C-5 decision support system (DSS) capabilities. After the C-5 DSS tool is implemented, the Contractor shall provide customer and technical support during SDD.

3.1.2.5.1.3 WBS 1.2.5.1.3 Logistics Support Portal

The Contractor shall design and implement a C-5 RERP logistics support portal so that logistics support functions can be performed from a single-point. The portal shall be designed to provide near real-time transaction capabilities and support interaction between the Government, Contractor, and the Contractor's supplier community.

3.1.2.5.1.4 WBS 1.2.5.1.4 Current Supply Chain Processes

The Contractor shall perform an initial evaluation of the Government's current C-5 supply chain processes to ensure that the C-5 RERP logistics program is supportable throughout the life of the weapon system. The Contractor shall evaluate and identify areas for potential product support improvement or replacement. The Contractor shall complete supportability analyses on new or modified systems and components to identify any impacts to facilities. Specific facility requirements will be documented in a facilities requirement plan as an appendix in the LSP.

3.1.2.5.1.5 WBS 1.2.5.1.5 Facilities

The Contractor shall develop and document design criteria for the facilities that are required for C-5 RERP modifications. The Contractor shall analyze existing Government facilities.

This task specifically excludes acquisition, design, and modification of any facility by the Contractor.

3.1.2.5.1.6 WBS 1.2.5.1.6 Packaging, Handling, Storage, and Transportation (PHS&T)

The Contractor shall provide Preservation and Packaging data to support the C-5 RERP. The Contractor shall provide Special Packaging Instructions to support the C-5 RERP and ensure component packaging is compatible with current SE and Material Handling Equipment (MHE).

3.1.2.5.2 WBS 1.2.5.2 Source of Repair Assessment

The Contractor shall provide data in support of the Government's Source of Repair Assignment Process (SORAP), using AFI 63-107 Attachment 3 as a guide (CDRL A015).

Reserved

WBS 1.4.0.0 System Test and Evaluation

3.1.4.1 WBS 1.4.1.0 Qualification Test and Evaluation (QT&E)

The Contractor shall participate in the Test Planning Working Group (TPWG), consisting of personnel involved in testing activities, which will be responsible to review overall test objectives, requirements, resources, and schedule. The TPWG will be composed of representatives from the Contractor and the Government. Regularly scheduled meetings of the TPWG (approximately quarterly) shall be held. The Contractor shall provide an agenda and minutes for the TPWG meetings. **(CDRL A015)**

In support of the Government's Airworthiness certification efforts for the RERP aircraft, the Contractor shall participate in Certification Working Group meetings. These meetings will be composed of representatives from the Contractor and the Government. Regularly scheduled meetings of the Certification Working Group (approximately quarterly) shall be held.

The Contractor shall participate as a partner with the Government in the Combined Test Force (CTF) with the charter to conduct QT&E ground/flight testing and evaluate the C-5 RERP modified aircraft. The Contractor shall provide a co-lead and technical personnel to the CTF. The CTF will perform tests in accordance with the Section 4 requirements of the C-5 RERP Air Vehicle Functional Modification Specification and the Logistics Support Plan.

The Contractor shall prepare an aircraft test plan to describe the CTF's planned air vehicle ground and flight testing. The Contractor shall, as a member of the CTF, prepare Test Information Sheets (TIS) for each test described in the aircraft test plan. Each TIS includes background rationale for the planned testing, and the detailed planning information necessary to conduct the tests, record test data, and evaluate the test results. **(CDRL A022, A029)**

The C-5 RERP QT&E flight test program shall be conducted with three C-5s with the RERP modifications. The Contractor shall instrument the first three aircraft to record the data required

for evaluating the C-5 RERP modified aircraft. C-5 RERP test instrumentation structural installations, which are designed by flight load conditions, shall have an analytical 25% strength margin of safety, unless proven by limit load proof test. The 25% strength margin of safety does not apply to crash load conditions. One of these shall be a LESS aircraft QT&E test program shall also support TO verification and validation, maintenance demonstrations, maintenance training in preparation for dedicated OT&E, human factors demonstrations, flying hours to provide additional basis for RM&A assessments, unique AF test requirements and operationally relevant missions. The operating time accumulated during these operational relevant missions are required by the AF to support certification of system readiness for dedicated OT&E. The Contractor shall provide facilities, equipment, and personnel to support QT&E flight and ground testing of the C-5 RERP-modified aircraft by the CTF. Testing will be conducted primarily at the Contractor's facility, although off-site operations are anticipated for field performance testing, hot and cold weather operations. The hot and cold weather testing shall be conducted for the C-5 RERP modifications to verify specification compliance and shall be performed at an operational location. The Contractor shall, as a member of the CTF, prepare test cards, participate in pre-test and post-test mission briefings, provide analysis of results to support test mission planning, and provide real-time data monitoring on required flights, participate in the test mission (flight test aircrews and on-board flight test engineers), and support deployment of the aircraft for off-site operations.

The Government will support the CTF with Flight Test Engineers (FTEs), Flight Test Analysis Engineers (FTAEs), and two aircraft test crews. The Contractor shall provide onsite facilities for these government members of the CTF and shall include the following:

a. Required office space

b. Basic office supplies (paper, binders, pens)

c. Office furniture (desks, chairs, bookshelves, cabinets)

d. Telephone lines (voice, fax, modem)

e Access to copy machines

f. Access to fax machines

g. Desktop computers with restricted access to 1) the LM Aero C-5 server and 2) the Flight Test Data Center common and C-5 servers.

h. Janitorial services

The Contractor shall provide maintenance of the three C-5 flight test aircraft, including the flight test instrumentation system, to support ground and flight testing during QT&E. Any maintenance action on the aircraft shall be documented using the appropriate agreed upon forms. The Contractor shall conduct normal aircraft maintenance pre-flight and post-flight briefings. The Contractor shall provide access to the aircraft maintenance records to members of the CTF.

The Contractor shall host a First Flight Readiness Review (FFRR) prior to the commencement of flying. The FFRR follows the Safety Review Board (SRB) and is held to ensure that the test vehicle is ready to be tested and that the test program is appropriate and consistent with the status of the aircraft and systems. The FFRR will be co-chaired by the Contractor and Government and consist of appropriate representatives from each. The following items shall be covered in the FFRR: description of aircraft or modification, test objectives, SRB inputs, aircraft schedule/status, instrumentation status, hardware/software qualification tests, preliminary aircraft ground test requirements, first flight plans, aircraft limitations, and the flight crew. All safety actions identified during the FFRR must be resolved prior to releasing the test vehicle for formal testing.

The Government will provide an aircraft capable of "safety chase" in support of the Flight Flutter tests.

The Contractor shall gather, analyze, and report the flight test results. The Contractor shall prepare a final test report at the end of the QT&E test program. **(CDRL A015, A023)**

The Contractor shall participate in the T&E Deficiency Review Board(s) (DRB) for QT&E by providing technical support in describing the deficiency so the Government can accurately prioritize the Deficiency Report (DR). The T&E DRB is a Government convened, sponsored, and chaired board tasked to review integration problems.

3.1.4.2 WBS 1.4.2.0 Qualification/Operational Test and Evaluation (QOT&E)

The Contractor shall provide technical support for the air vehicle systems during QOT&E. This includes technical assistance to the test personnel on anomalies encountered that impact effective test accomplishment and technical assistance to the maintenance personnel. The Contractor shall participate in the T&E DRB for QOT&E.

3.1.4.3 WBS 1.4.3.0 Live Fire Test and Evaluation (LFT&E)

The Contractor shall provide level of effort support for Government Live Fire Testing and Evaluation (LFT&E) efforts with analysis,design, and flight test information. The Contractor shall support the C-5 RERP Program Office with copies of production drawings, schematics and reference documents for use in the preparation of shotline selection, pretest predictions, fabrication and/or modification of LFT&E test articles. Data will be provided as available no later than sixty days after receipt of a formal request.

3.1.4.4 WBS 1.4.4.0 Systems Integration Laboratory (SIL) Testing

The Contractor shall design and implement the modifications to the C-5 Systems Integration Laboratory (SIL) necessary to validate the modifications to the C-5 avionics architecture that are introduced by the RERP modifications. The Contractor shall maintain the C-5 SIL components associated with the RERP avionics for the duration of the SDD phase of the RERP to support

maintenance demonstrations, human factors evaluations, display evaluations, aircrew training, and CTF support.

The Contractor shall participate in the TPWG to coordinate SIL test objectives, requirements, resources, and schedule. The TPWG will be composed of representatives from the Contractor and the Government. Regularly scheduled meetings of the TPWG (approximately quarterly) shall be held. The Contractor shall provide SIL access to the members of the CTF.

The Contractor shall verify avionics system integration in accordance with the applicable C-5 RERP specifications and interface requirements documentation. The Contractor shall perform avionics integration testing of the C-5 RERP systems using the C-5 SIL. The Contractor shall prepare a SIL test plan to describe the scope of the integration testing that will be performed. The Contractor shall prepare Integration Test Information Sheets (ITIS) for each test described in the SIL test plan. **(CDRL A022, A029)**

The Contractor shall conduct avionics systems integration tests, gather and analyze test results, and prepare test reports to document the results of design requirements verification tests. The Contractor shall highlight the SIL tests and demonstrations associated with the proof-of-design activity. The Contractor shall prepare a test report that summarizes the requirements verification tests conducted in the SIL prior to redelivery of the test aircraft to the Government. **(CDRL A015, A023)**

3.1.5 WBS 1.5.0.0 Program Management

3.1.5.1 WBS 1.5.1.0 Program and Business Management

3.1.5.1.1 Program Management

The Contractor shall perform the management tasks required to plan, organize, control, integrate, and execute the C-5 RERP SDD program to meet the requirements defined in this Statement of Work. As part of this responsibility, the Contractor shall ensure successful execution of the activities identified in the Integrated Master Plan and Integrated Master Schedule.

The Contractor shall implement and enforce a disciplined system integration effort that addresses economic and effective RERP modernization for the C-5 fleet of aircraft. The Contractor shall monitor all non-RERP changes to the C-5 and notify the Government of changes that impact C-5 RERP cost, schedule, or technical performance. The Government may elect to task the Contractor to address change conditions through the ECP process or as a Studies and Analysis task in accordance with SOW paragraph 3.1.8.

The Contractor shall support the Government by developing proposals for the C-5 RERP follow-on Production and Interim Contractor Support (ICS) program.

The Contractor shall employ an Integrated Product Team (IPT) approach in the design, development, integration and test of the C-5 RERP products. An organization matrix shall be utilized to foster the cross-IPT information flow.

The Contractor shall provide a video teleconference capability at the Contractor's site compatible with the Government DSO at Wright Patterson AFB, System Program Office (SPO) at Robins AFB, and Air Mobility Command (AMC) at Scott AFB.

3.1.5.1.2 Data Management

The Contractor shall implement a data management program for generating, acquiring, identifying, statusing, planning, and controlling technical and management data and related information. The Contractor shall flow data requirements down to subcontractors to ensure Contractor and Government access to data generated in accordance with this SOW.

The Contractor shall establish a Data Accession List (DAL) that is electronically accessible by the Government. **(CDRL A015)**

The Contractor shall plan, schedule, and control data so that the data essential for program milestones (e.g., design reviews and audits) is available consistent with the Integrated Master Schedule (IMS) and the Integrated Master Plan (IMP).

The Contractor shall provide Government access to a Contractor data system that supports electronic delivery, storage, and archiving of informal documents and formal CDRL documents.

3.1.5.1.3 Business Management

The Contractor shall use an Earned Value Management System (EVMS) to plan and control the C-5 RERP, in accordance with the applicable Advance Agreement and Joint Surveillance Agreement with the Defense Contract Management Agency (DCMA).

The Contractor shall prepare and submit Cost Performance Reports (CPR) detailing performance status, including cost variance, schedule variance and estimate-at-completion (EAC) information, and Contract Funds Status Reports (CFSRs). In addition, the Contractor shall prepare and submit Cost Data Summary Reports DD-1921 and Functional Cost-Hour Reports DD-1921-1. **(CDRL A016, A017, A027, A028)**

The Contractor shall develop and maintain the C-5 RERP IMS. The IMS shall contain specific activities and milestones associated with C-5 RERP design, development, integration, testing, installation, and support. Selected key supplier activities and milestones shall also be included in the IMS. The IMS requirements shall be integrated with the other elements of EVMS. **(CDRL A019)**

The Contractor shall maintain the Contract Work Breakdown Structure (CWBS) index and CWBS dictionary. The Contractor shall integrate the CWBS with the program IPT organizational structure to define the control account for program planning and execution.

Work package schedules developed for EVMS shall be included in the integrated schedule (CDRL A015) in the contractor's EVMS. The Contractor shall implement baseline program plans and controls immediately following program go-ahead. The integrated schedule in EVMS and the IMS will be maintained throughout SDD to ensure a proper basis for performance

management. The Contractor shall conduct an Integrated Baseline Review (IBR) of the program plans within the first six to nine months following contract award.

Estimates-At-Completion (EAC) will be maintained, and will be integrated with the Risk Management process. A total EAC update will be accomplished at least annually and appropriate, corresponding updates to the IMS and data in the contractor's EVMS will be accomplished accordingly as part of the next CDRL submittal.

The Contractor shall conduct an annual affordability assessment of the production program that updates production cost estimates throughout the SDD program. This assessment shall address the recurring cost elements, risks, learning curve, quantity and rate issues, cost reduction initiatives, and other factors which contribute to the production costs for the C-5A, C-5B, and C-5C aircraft. This assessment shall be used as a means to identify, monitor, and control cost growth to the production program.

3.1.5.2 WBS 1.5.2.0 Vendor/Subcontracts Management

The Contractor shall develop and execute a subcontract management program. Specifically, the Contractor shall perform the following tasks:

a. develop a subcontract management plan
b. select suppliers and subcontractors that best meet the program requirements
c. foster competition between alternate suppliers and subcontractors
d. negotiate subcontracts and place purchase orders with selected suppliers and subcontractors
e. implement methods of tracking supplier and subcontractor performance
f. manage suppliers and subcontractors.

The Contractor shall maintain a list of critical subcontractors and sources selected through the make-or-buy process.

3.1.6 WBS 1.6.0.0 Systems Engineering

The Contractor shall conduct a Systems Engineering program that includes the activities defined in the following paragraphs.

The Contractor shall organize, build, and execute a systems engineering process for integrating engineering activities within C-5 RERP and where those activities interface with other C-5 upgrades.

3.1.6.1 WBS 1.6.1 Reserved

3.1.6.2 WBS 1.6.2.0 Electromagnetic Environmental Effects (E^3)

The Contractor shall perform the following electromagnetic environmental effects (E^3) tasks:

a. Providing E^3 requirements for the Environmental Criteria Document.

b. Researching Ground Support Equipment (GSE) E^3 levels.

c. Analyzing GSE effects.

d. Verifying GSE compatibility with other GSE and air vehicle systems.

e. Resolving problem issues.

Note that air vehicle E^3 related activities are addressed in paragraph 3.1.1.5.1 of this document.

3.1.6.3 WBS 1.6.3.0 Environmental Compatibility

The Contractor shall perform the following tasks to ensure environmental compatibility:

a. ensure environmental compatibility in the ambient and induced, operating and non-operating environments for C-5 weapon system

b. verify environmental compatibility in accordance with the C-5 Weapon System Functional Modification Specification

c. develop an Environmental Criteria Document. **(CDRL A015)**

3.1.6.4 WBS 1.6.4.0 System Safety

The Contractor shall establish and maintain a C-5 RERP System Safety Program (SSP) that manages safety risk through a systematic approach of safety risk assessment, safety risk management and hazard analysis. The Contractor shall make SSP data available to the Government to support their C-5 RERP airworthiness effort and hazardous material management programs.

3.1.6.4.1 System Safety Program (SSP)

The SSP shall include the design, test, and operation phases of the C-5 RERP. The SSP shall encompass both new and modified systems, software and functions as well as commercial off-the-shelf (COTS) equipment. Baseline C-5 systems and functions will be examined only if they are directly affected by new or modified C-5 RERP systems, software or functions. The Contractor shall incorporate industry-accepted "best commercial practices" for aircraft system and functional safety analyses in the SSP. The details of the SSP will be documented in the System Safety Program Plan (SSPP).

The Contractor shall implement a C-5 RERP software safety process as part of the SSP. The Contractor shall establish software safety-critical requirements for the C-5 RERP and flow down such requirements to the applicable subcontractors. The Contractor shall prepare inputs to the Software Development Plan, Software Verification Plan, Software Project Plan and other documents requiring software safety tasking. The Contractor shall participate in Software Product Evaluations, Software Requirements Analysis Reviews, Software Working Groups and

other applicable software development team activities. The Contractor shall conduct software safety assessments/analyses using IEEE STD 1228 guidelines. These assessments and analyses shall be in conjunction with the Functional Hazard Assessment (FHA), Preliminary System Safety Assessment (PSSA), and System Safety Assessment (SSA) analyses processes to substantiate requirement traceability and that the safety critical software provides an acceptable level of safety risk.

3.1.6.4.2 System Safety Program Plan (SSPP)

The Contractor shall prepare a SSPP that describes in detail the tasks and activities associated with system safety management and system safety engineering. The SSPP shall address those tasks required to identify, evaluate and eliminate or control hazards and failure conditions, or to reduce the associated risk to an acceptable level throughout the C-5 RERP life cycle as identified through the safety assessment process. The SSPP shall include airworthiness and hazardous materials management tasks. **(CDRL A015)**

3.1.6.4.3 Safety Assessment Process

The Contractor shall implement a safety assessment process for safety requirements generation and verification. This process shall use Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) 4761 as guidance in preparing safety assessments and analyses. The process shall include a methodology to evaluate C-5 RERP functions and the design of systems performing these functions to determine that the associated failure conditions and hazards have been properly addressed. The process shall provide the assurance in accordance with MIL-STD-882D that the relevant failure conditions and hazards have been identified and that combinations of failures that could cause those failure conditions and hazards have been considered. The acceptable level of safety risk for equipment and systems installed on the C-5 RERP shall be established based on the relationship of failure condition probability, the consequence of the failure condition, and criteria listed in TABLE 3.1.8.5.3-1. For military unique failure conditions/functions or applications, or for systems and functions containing equipment that is certified for use by the military rather than the Federal Aviation Administration (FAA), the Government and the Contractor shall jointly establish the acceptable level of safety risk.

Effect on Airplane	No Effect on Operational Capabilities or Safety	Slight Reduction in Functional Capabilities or Safety Margins	Significant Reduction in Functional Capabilities or Safety Margins	Large Reduction in Functional Capabilities or Safety Margins	Normally with Loss of Aircraft

Effect on Flight Crew	No Effect	Slight Increase in Workload	Physical Discomfort or a Significant Increase in Workload	Physical Distress or Excessive Workload Impairs Ability to Perform Tasks	Fatalities or Incapacitation
Effect on Occupants Excluding Flight Crew	Inconvenience	Physical Discomfort	Physical Distress, Possibly Including Injuries	Serious or Fatal Injury to a Small Number of Passengers or Cabin Crew	Multiple Fatalities
Allowable Qualitative Probability	No Probability Requirement	Probable	Remote	Extremely Remote	Extremely Improbable
Allowable Quantitative Probability	No Probability Requirement	$< 10^{-3}$	$<10^{-5}$	$<10^{-7}$	$<10^{-9}$
Classification of Failure Condition	No Safety Effect	Minor	Major	Hazardous	Catastrophic

TABLE 3.1.8.5.3-1. RELATIONSHIP BETWEEN PROBABILITY AND SEVERITY OF FAILURE CONDITION

The following system safety assessments and analyses shall be performed.

3.1.6.4.3.1 Functional Hazard Assessment (FHA)

The Contractor shall perform a FHA to identify and classify the failure conditions and hazards associated with the C-5 RERP and related C-5 functions. The FHA shall establish the hardware criticality and software developmental levels. **(CDRL A024)**

3.1.6.4.3.2 Preliminary System Safety Assessment (PSSA)

The Contractor shall perform PSSA(s) to examine the C-5 RERP architecture to determine how failures can cause the failure conditions/hazards identified in the FHA. The PSSA(s) shall include:

a. Investigation of those events or influences outside the systems and items concerned, but that may violate failure independence claims (particular risk analysis),

b. Events that affect a number of elements otherwise considered to be independent (common mode)

c. Investigation of system/component separation and segregation (zonal analysis),

d. Analysis of failure effects to failure modes (fault tree analyses)

e. Effects of failure modes on the next higher system level (failure modes and effects). **(CDRL A024)**

3.1.6.4.3.3 System Safety Assessment (SSA)

The Contractor shall perform SSA(s) to verify the C-5 RERP design meets both the qualitative and quantitative safety requirements defined in the FHA and PSSA. The SSA(s) shall include:

a. Investigation of those events or influences outside the systems and items concerned, but that may violate failure independence claims (particular risk analysis),

b. events that affect a number of elements otherwise considered to be independent (common mode),

c. system/component separation and segregation (zonal analyses),

d. failure effects to failure modes (fault tree analyses),

e. effects of failure modes on the next higher system level (failure modes and effects), and

f. verification the software is traceable from the requirements through implemented design. **(CDRL A024)**

3.1.6.4.3.4 Health Hazard Assessment (HHA)

The Contractor shall perform a HHA to identify and determine quantities of potentially hazardous materials or physical agents related with the C-5 RERP. The HHA shall analyze how these materials and physical agents are used in the system and for its logistical support. The HHA shall assess only those materials and physical agents associated with the C-5 RERP. **(CDRL A025)**

3.1.6.4.4 Safety Risk Management

The Contractor shall employ the guidance in Section 4 of MIL-STD-882D, Standard Practice for System Safety, to ensure system safety management activities are accomplished. The Contractor shall derive required software assurance levels from RTCA DO-178B, Software Considerations in Airborne Systems and Equipment. The Contractor shall document, resolve, and track failure and hazard conditions, and provide this information to Government Program Management in accordance with the guidance in MIL-STD-882D. The Contractor shall perform and document safety reviews and assessments for Engineering Change Proposals (ECP), waivers, deviations,

and trade studies. Additionally, the Contractor shall review change notices and problem reports for potential safety implications. The Contractor shall integrate and provide oversight of subcontractor system safety activities. The Contractor shall participate in applicable hardware/software design reviews, technical interchange meetings, and working groups. The Contractor shall coordinate on technical orders and manuals applicable to the C-5 RERP.

3.1.6.4.5 System Safety Group/System Safety Working Group (SSG/SSWG)

The Contractor shall participate as an active member of the Government's SSG/SSWGs. These meetings will be held semiannually at either the Contractor's facility or at a mutually agreed upon facility. Participation shall include the following tasks:

a. presenting Contractor SSP status

b. summarizing hazard assessments and analyses, including status of hazard resolution and residual risk

c. responding to action items

d. supporting qualification activities

e. documenting and distributing meeting agendas and minutes from the SSG/SSWG meetings (CDRL A001)

3.1.6.4.6 Test Safety

The Contractor shall ensure that safety is considered and incorporated in test and evaluation activities through the following activities:

a. The Contractor shall participate in test planning by attending Test Plan Working Group meetings, reviewing the overall test requirements, and developing the Flight Test Plan.

b. The Contractor shall review ground and flight test requirements (test information sheets, flight test data requests, etc.) and provide a safety risk assessment of the test.

c. The Contractor shall conduct analyses of high and medium risk tests. The results of the analyses shall be presented to Safety Review Board (SRB).

d. A representative from the Contractor's Safety organization shall review and sign aircraft operating limitations and temporary operating procedures applicable to the C-5 RERP test program.

e. A representative from the Contractor's Safety organization shall be a signatory on flight test releases.

f. The Contractor shall conduct internal Contractor SRB(s) to review the test team's safety planning and assess the safety risk associated with applicable aspects of the test program. As a minimum, the Contractor shall conduct a SRB prior to commencing first article ground/flight testing. Additional SRB(s) shall be conducted as determined by a representative

from the Contractor's Safety organization with the concurrence of the SRB Chairperson. The SRB shall review identified hazards (including hazard category and probability of occurrence) and the proposed steps to mitigate the hazard. The SRB shall utilize the Safety Organization's input (Test Hazard Analyses and Test Project Safety Reviews) and inputs from other applicable organizations to determine if the level of safety risk for the test is acceptable. The SRB shall provide the approval to commence applicable test activities.

g. The Contractor shall support the Government SRBs. This support may range from meeting attendance to preparation and presentation of safety assessments.

3.1.6.4.7 Mishap/Incident Reporting

The Contractor shall implement a mishap/incident, alerting/notification, investigation and reporting process to include Government notification in accordance with the guidance in MIL-STD-882D.

3.1.6.4.8 Hazardous Material Management Program

3.1.6.4.8.1 Hazardous Material Management Program

The Contractor shall establish and maintain a C-5 RERP Hazardous Material Management Program which includes Hazardous Material (HM) and Pollution Prevention (P2) using National Aerospace Standard (NAS) 411 as a guide. Section 4.3.4 is not required. The Program shall consist of HM elimination or reduction, environmental risk assessment, database update and pollution prevention (P2). The Contractor shall comply with the applicable local, state, and federal regulatory requirements for the Marietta site, including transportation, storage, use, and disposal of HM and waste identified as part of the system or its support requirements.

The Hazardous Material Management Program shall:

a. focus on the end user including maintenance and final disposal

b. document any reduction or elimination of C-5 RERP HMs.

The Contractor shall make HM and P2 data available to the Government. **(CDRL A015)**

3.1.6.4.8.2 Hazardous Material Management Plan (HMMP).

The Contractor shall develop a C-5 RERP HMMP for new and modified C-5 RERP deliverable hardware, components and associated support equipment. This plan shall focus on the elimination of any HMs or mitigation of consequences, as appropriate. The HMMP shall address the entire life cycle of the C-5 RERP components, including disposition and disposal, to ensure optimization and balance between design parameters and HM constraints. The HMMP shall identify tasks that address the identification, evaluation and use of HM, and the disposal of hazardous waste. **(CDRL A015)**

3.1.6.4.8.3 Hazardous Material Database

The Contractor shall provide Material Safety Data Sheet updates to the Air Force database for HMs associated with the new and modified C-5 RERP equipment. The database inputs shall specify the amounts of HM that the Contractor will use at their facility due to C-5 RERP-modified aircraft and equipment.

3.1.6.4.8.4 Environmental Hazard Data.

The Contractor shall assess C-5 RERP-targeted hazardous materials identified in the HMMP and report the relative risk data using the risk assessment criteria in MIL-STD-882C, Task 207, as a guide. The Contractor shall provide risk data and reasons for using any targeted materials. **(CDRL A015)**

3.1.6.4.8.5 Pollution Prevention (P2) Network

The Contractor shall participate as a member of the Air Force C-5 RERP Environmental P2 Network (EPN) to ensure the processing of information for C-5 RERP environmental P2 issues is conducted in a timely, complete and consistent manner. The EPN shall meet approximately every twelve (12) months at the Contractor's Marietta facility (66% of meetings) or at another mutually agreed location (33% of meetings) to provide environmental pollution prevention and control management assistance, and resource infrastructure for C-5 RERP users, maintainers and other weapon system stakeholders. Environmental Hazard Data to include the status of hazard resolution and residual risk shall be reviewed to ensure cost-effective opportunities for reduction or elimination of C-5 RERP related HMs are addressed. The Contractor shall participate in discussions and information exchanges on the environmental health data.

3.1.6.5 WBS 1.6.5.0 Human Factors

The Contractor shall perform the following human engineering design and analysis tasks:

a. Document the Maintainer's Human Engineering Design Approach **(CDRL A011)**

b. Develop test procedures to verify human engineering requirements related to maintainers. **(CDRL A022)**

c. Develop test reports to document the results of human engineering tests related to maintainers. **(CDRL A023)**

d. Perform and document Maintainability Workload Analyses to include the workload evaluation plan, evaluation scenarios, conduct of the evaluation, data analyses, and the evaluation report. **(CDRL A015)**

e. Perform and document an anthropometric evaluation of new and modified support equipment. **(CDRL A015)**

Note that air vehicle human engineering related activities are addressed in paragraph 3.1.1.5.1 of this document.

3.1.6.6 WBS 1.6.6.0 Operations Analysis

The Contractor shall perform vulnerability analyses of the C-5 RERP configuration in order to support Government live fire vulnerability assessment activities. These vulnerability analyses will provide the basis from which the Government will execute its vulnerability test program. The Contractor shall upgrade the current FASTGEN database representing the C-5 to reflect the C-5 RERP configuration to a level of fidelity that includes flight critical systems and primary structure as well as secondary structure and ancillary systems and components that may provide a significant degree of shielding. The Contractor shall perform vulnerability assessments using JTCG/AS standard COVART/HEIVAM methodologies. The threats to be analyzed using the COVART4 computer program shall be the 23mm and 30mm API and 30mm HEI projectiles. The vulnerability to projectiles will be analyzed for the 26 standard views. The Contractor will provide technical assistance and support to cognizant USAF personnel in evaluating these vulnerability data to execute an effective LFT&E program.

Model development and analyses shall support the LFT activities defined by the Government-supplied schedule included as part of this contract. The Contractor shall provide level of effort support in the development of pre-test predictions. These pre-test predictions shall be completed six months prior to the test date shown in the aforementioned schedule. A final 26-view analysis will be performed at the conclusion of the model development and reported in the Vulnerability Assessment Report. All portions of the FASTGEN target model database developed under this contract will be incrementally delivered in a computer-readable format (CD or Magnetic Tape) along with the pre-test predictions they support. A complete, updated version of those portions of the FASTGEN target model database developed under this contract will be delivered at the conclusion of this contract. **(CDRL A015, A007)**

The Contractor shall perform a cascading effects analysis on the CF6 engine and C-5 RERP aircraft, using a Federal Aviation Administration (FAA) "Uncontained Engine Debris Damage Assessment Model" computer program developed by China Lake. The FAA program and existing documentation will be provided by the C-5 DSO. **(CDRL A007)**

The Contractor shall incorporate Government comments on the low power laser effects study into the draft Laser Effects study report, and incorporate the final Laser Effects report into the Vulnerability Assessment Report. **(CDRL A007)**

The Contractor shall perform an analysis on the C-5 RERP aircraft to determine the distance for Radio Frequency (RF) threats that will induce controlled flight failure. **(CDRL A007)**

3.1.6.7 WBS 1.6.7.0 Configuration Management

The Contractor shall develop a Configuration Management (CM) Plan using ANSI/EIA-649 as a guide. The Contractor shall implement configuration management in accordance with the Configuration Management Plan. The Contractor shall ensure a configuration management process to control CIs/CSCIs, processes and related documentation. The Configuration Management program shall encompass C-5 RERP hardware and software, including those

assets used in the Test and Evaluation (T&E) program. The plan shall address the change relationship between C-5 RERP and C-5 AMP. **(CDRL A015)**

The Contractor shall maintain configuration documentation to document the physical and functional characteristics of the CIs/CSCIs and establish baselines for Government and Contractor configuration control. The Contractor shall request nomenclature for newly developed or modified items in accordance with MIL-STD-1661. The Contractor shall establish and maintain an identification and numbering system which ensures that the marking or labeling of items and documentation with their applicable identifiers enables correlation between the item, configuration documentation, and other associated data. **(CDRL A008)**

The Contractor shall develop Engineering Change Proposals (ECPs). Changes impacting baselined specifications will require Specification Change Notices (SCNs) as part of the ECP. The Contractor shall develop Contract Change Proposals (CCPs) to propose changes to the contract baseline documentation. The Contractor shall submit a request for variance to depart from a CIs/CSCIs approved configuration documentation. **(CDRL A002, A003, A004 and A005)**

The Contractor shall maintain an engineering release system for as-designed documentation. The Contractor shall maintain a configuration status accounting system which includes as a minimum the as-built, as-delivered, or as-modified configuration of any serial-numbered unit of the CIs/CSCIs, until the final SDD aircraft has been DD Form 250 accepted. A configuration description (CSA listing) shall be provided with each aircraft delivered.

The Contractor shall update the record of each individual aircraft, accurately, within 90 days after each of the following: (a) the incorporation of approved Major A (Class I) change proposals, (b) the incorporation of Major B (Class II) engineering change proposals (ECPs) for which the Government has agreed are correctly classified, and (c) the interchange of hardware or software in flight test articles.

The Contractor shall host and co-chair configuration audits as required for each newly developed or modified CI/CSCI.

The Contractor shall support the Government Material Improvement Project (MIP) Review Board (MRB) to review deficiency reports (DRs) submitted during QT&E and QOT&E. The MRB will determine actions necessary to address the submitted DRs.

The Contractor shall prepare a modification documentation package to describe engineering analyses supporting the C-5 RERP test instrumentation modification utilizing AFMCI 21-126 as a guide. The Contractor shall support the Government Modification Engineering Authority (MEA) reviewing the initial C-5 RERP instrumentation modification. The Contractor shall have MRB authority to make minor deviations from the initial modification documentation package that do not affect safety or structural integrity , but must document those differences and the reasons, in the final test reports. **(CDRL A015)**

3.1.6.8 WBS 1.6.8.0 Reliability and Maintainability (R&M)

The Contractor shall establish and implement an R&M Program. This R&M program shall address the integration of the modification package into the C-5 RERP Weapon System as it applies to:

a. Mission Capable Rate
b. Break Rate
c. Fix Rate
d. Departure Reliability
e. Maintenance Man-hours per Flight Hour (MMH/FH)
f. Mean Time Between Maintenance-Total (MTBM-T)
g. Mean Time Between Failure (MTBF)
h. Mean Repair Time (MRT)
i. Cannibalization Rate
j. Maximum Utilization Rate

Additional R&M parameters contributing to the achievement of Weapon System level requirements will be developed to support other program efforts, such as determining spares provisioning levels (demand rate) and determining ways in which to reduce total ownership cost (Operations and Support Cost data).

3.1.6.8.1 Design Support

Design support shall be provided by R&M personnel assigned as members of the integrated product teams. Activities include trade study participation, specification input, monitoring/control of supplier R&M efforts, design installation evaluation, design environmental concerns, and participation in technical interchange meetings and program reviews.

3.1.6.8.2 Baseline Comparison System

The Contractor shall develop and maintain a baseline R&M comparison system that allows the proposed RERP upgrade to be compared with the in-service performance of the unmodified fleet. The in-service data shall be available down to the five digit work unit code indenture level when appropriate and cover the Weapon System level R&M parameters listed above and the primary inputs to the Reduced Total Ownership Cost (RTOC) model. The data shall be summarized in reports and made available quarterly. **(CDRL A015)**

3.1.6.8.3 Predictions and Allocations

The Contractor shall develop R&M allocations and predictions for the modification package. The Contractor shall also predict the resultant effects of the modification upon aircraft level parameters. The Contractor shall perform, maintain and update predictions throughout the SDD phase of the program, including consideration of the Joint Reliability and Maintainability Evaluation Team (JRMET) reviewed QT&E test data, for the aforesaid parameters. R&M

prediction results shall be reported as part of each major program review as defined by the Integrated Master Plan. **(CDRL A015)**

3.1.6.8.4 Failure Modes and Effects Analyses (FMEAs)

The Contractor shall develop and maintain system-level FMEAs that summarize the effects of hardware failures. The system-level FMEAs shall be developed for new and major-modified C-5 RERP systems, to support System Safety Assessments, aircraft qualification, and development of the logistics support system. MIL-STD-973's definition of a Class I change shall be used as guidance in determining whether a system is considered major-modified. The results of the FMEAs will be documented in reports. **(CDRL A015)**

3.1.6.8.5 Fault Tree Analyses (FTAs)

The Contractor shall conduct quantitative FTAs for Catastrophic and Hazardous events identified by the aircraft-level Functional Hazard Assessment (FHA) for new and major-modified C-5 RERP systems. MIL-STD-973's definition of a Class I change shall be used as guidance in determining whether a system is considered major-modified. The FTAs shall be updated to reflect design changes. The results of the FTAs will be documented in reports. **(CDRL A015)**

3.1.6.8.6 Failure Reporting, Analysis and Corrective Action System (FRACAS)

The Contractor shall implement a FRACAS for C-5 RERP items to provide a closed loop failure analysis and corrective action capability during SDD. This system shall capture failure information from both the Contractor and Contractor's suppliers, including failures occurring during QT&E and QOT&E. The Contractor shall collect, analyze, and process early operational performance data into reports. These reports shall provide an early indication of C-5 RERP R&M performance and facilitate the identification and resolution of problem areas. **(CDRL A015)**

3.1.6.8.7 Aircraft Inspection Program

The Contractor shall recommend changes to the overall maintainability inspection program that result from C-5 RERP modifications. These recommendations shall be developed using the Reliability-Centered Maintenance philosophy or Maintenance Steering Group (MSG-3) philosophy and shall be consistent with the type of inspection program in effect for the overall C-5 RERP weapon system. The recommendations shall be documented in the proceedings of the Maintenance Steering Group.

3.1.6.8.8 Repairable Items Evaluation

The Contractor shall assess and recommend reparable and non-reparable classifications of C-5 RERP equipment. These classifications shall be used to recommend Source, Material, and Recoverability (SMR) codes documented in the Illustrated Parts Breakdown (IPB).

3.1.6.8.9 Maintenance Task Analyses

The Contractor shall conduct maintenance task analyses for the modified systems to provide source data for training, initial provisioning, support equipment recommendations, and

maintenance manual modification and development. The Contractor shall analyze requirements for organizational level maintenance, including test and checkout of the modified systems, using engineering and supplier information as source data. The results of the analyses will be used to produce source data for the job guides referenced in paragraph 3.1.6.8.10.

3.1.6.8.10 Source Data for Fault Isolation and Other Manuals

The Contractor shall develop source data for updating manuals for the C-5 RERP modifications. R&M support to this effort shall consist of development of source data for: Fault Reporting/Fault Isolation Manuals, job guides, -6 inspections manual, and -06 Work Unit Code manual.

3.1.6.8.11 Testability and Integrated Diagnostics

The Contractor shall analyze the testability and integrated diagnostics features of the new development and modified systems. The Contractor shall validate/verify the built-in testability requirements defined in the C-5 RERP Weapon System Functional Modification Specification. The results of the analyses will be used to: 1) produce source data for the Fault Isolation Manuals and 2) determine whether RERP modifications in aggregate achieve fault isolation rate requirements.

3.1.6.8.12 Maintainability Demonstrations

The Contractor shall plan for and perform Maintainability Demonstrations for new and major-modified C-5 RERP systems to ensure that the maintainability/accessibility requirements from the Weapon System Functional Modification Specification and the Air Vehicle Functional Modification Specification have been designed into the systems MIL-STD-973's definition of a Class I change shall be used as guidance in determining whether a system is considered major-modified. **(CDRL A015)**

3.1.6.8.13 Joint Reliability and Maintainability Evaluation Team (JRMET) Support

The Contractor shall provide R&M evaluation and support to the JRMET. This support is limited to the Contractor's efforts to prepare for and participate in JRMET-related meetings, including closure of resultant action items.

3.1.6.8.14 QT&E/QOT&E Reliability, Maintainability, and Availability (RM&A) Evaluation

During QT&E, the Contractor shall collect unscheduled removal data and other potential failure data for C-5 RERP items from aircraft ground and flight test operations. The data shall be integrated into FRACAS and examined for repetitive and/or pattern failures in order to facilitate the identification and implementation of corrective action for high failure rate items. Reliability growth trends, based on JRMET reviewed failure data, shall be utilized to update the R&M predictions. The updated R&M predictions shall be summarized into a report and made available to the Government after QT&E has been completed. **(CDRL A015)**

For QOT&E, the Contractor shall review and provide comments to the plan developed by the Government for the QOT&E RM&A Evaluation. The Contractor shall provide R&M support in analyzing and assessing the data during the evaluation.

3.1.6.9 WBS 1.6.9.0 Quality Assurance (QA)

The Contractor shall implement and maintain a QA system that meets the requirements of International Standard ISO 9001-1994. The Contractor shall implement a C-5 RERP software QA system that meets the requirements of ISO 9000-3-1994 and Radio Technical Committee for Aeronautics (RTCA) DO-178B.

3.1.6.10 WBS 1.6.10.0 Software Integration

The Contractor shall manage software process implementation, software quality assurance, and software supplier management efforts for the C-5 RERP.

The Contractor shall produce the C-5 RERP Software Project Plan (SPP), in accordance with CBM 4004, to define the required processes for software acquisition, development, modification, and verification efforts for the C-5 RERP. The SPP will address: Software Tools, Software Metrics, Software Configuration Management (SCM), Allocation of Software Requirements, Data Repository, Software Internal Independent Verification & Validation (IIV&V), Software Supplier Management (SSM), and Software Quality Assurance. **(CDRL A015)**

The Contractor shall prepare a Software Development Plan (SDP) for individual CSCI(s) that depict the policies, procedures, methodologies, and the Software Engineering Environment (SEE) that will be deployed to manage and control software development efforts for each CSCI. For Non-Developmental Item (NDI) /COTS CSCIs, an SDP is not required. SDPs shall be prepared for Developmental Item (DI) CSCIs and Modified Non-Developmental (M-NDS) CSCIs. **(CDRL A015)**

The Contractor shall prepare and submit a Computer Program Identification Number (CPIN) request form for individual CSCIs. **(CDRL A021)**

The Contractor shall record software development activity in Software Development Folders (SDFs). The SDFs and software design data shall be maintained at the development facilities. The Contractor shall make SDFs and software design data available for Government review, on request.

The Contractor shall document software requirements for each DI or M-NDS CSCI in a Software Requirements Document (SRD), or equivalent. The Contractor shall also produce Software Verification Plans (SVP), Software Verification Cases & Procedures (SVC&P), Software Verification Reports (SVR), and Software Version Documents (SVD), or their equivalents, for each DI or M-NDS CSCI being produced. **(CDRL A015)**

The Contractor shall implement a C-5 Software Quality Assurance (SQA) program that meets the requirements of ISO 9000-3-1994 and Radio Technical Committee for Aeronautics (RTCA)

DO-178B. The Contractor shall evaluate software development and modification activity, including software products and processes, to ensure compliance and adherence to contractually agreed to standards, policies, plans and procedures. The Contractor shall evaluate subcontracted software modification and development activity, including software products and processes, to ensure compliance and adherence to contractually agreed to standards, policies, plans and procedures.

3.1.6.11 WBS 1.6.11.0 Technical Risk Analysis

The Contractor shall conduct a risk management program in accordance with a Risk Management Plan (RMP) that has been jointly agreed to by the Government and the Contractor. The Contractor shall present the status of the technical risk identification, analysis, and mitigation plans at applicable program and technical reviews.

The Contractor shall provide regular oversight and direction of the risk management effort through the following activities:

a. Identification of risk candidates

b. Presentation of risk candidates to the Risk Manager for consideration

c. Determination by the Risk Manager of whether to elevate a risk candidate to a risk

d. Development of a risk mitigation plan and fallback plan for each high and moderate risk

e. Risk Manager approval of risk mitigation plans and Risk Manager monitoring of their implementation and progress

f. Risk Manager evaluation of risk mitigation plan results and closure of risks if they are sufficiently mitigated

The results of the risk management process will be available for customer review **(CDRL A015)**

3.1.6.12 WBS 1.6.12.0 Technical Baseline Management

3.1.6.12 Systems Engineering Databases

The Contractor shall establish and maintain a requirements database in support of its systems engineering program. The Contractor shall be able to trace the C-5 RERP Weapon System Functional Modification Specification requirements to their respective parent ORD requirements. When requested by the Contracting officer, the Contractor shall make selected systems engineering database modules read-only-accessible to fifteen simultaneous Government users external to the Contractor.

3.1.6.12.2 Technical Reviews and Meetings

Design Reviews. The Contractor shall conduct the reviews and meetings defined by the Integrated Master Plan (IMP). The content and execution of the reviews shall be guided by MIL-STD-1521. The entry criteria for the reviews shall be as documented in the program IMP. The scheduling of the reviews shall be documented in the Integrated Master Schedule (IMS). All system level design reviews shall encompass all aspects of the subject design, including software.

Planning agendas shall be developed as mutually agreed with the Government no later than 14 calendar days prior to the reviews. Any participation from the Government that the Contractor considers essential shall be clearly indicated in the invitation message. The Contractor shall provide minutes for each review it hosts and shall include the action items recorded at the meetings. **(CDRL A001)**

Technical Interchange Reviews. The Contractor shall conduct technical interchange meetings (TIMs) to ensure technical activities and issues are addressed and coordinated within the program and with the Government. The Government may also call TIMs.

3.1.6.12.3 Requirements Management and Specification Management

The Contractor shall conduct a requirements management program to provide for specification development, requirements traceability, and proof-of-compliance.

Technical and verification requirements shall be upwardly- and downwardly-traceable to the extent required to show compliance with the C-5 RERP Weapon System Functional Modification Specification and the C-5 RERP Air Vehicle Functional Modification Specification.

The proof-of-compliance aspect of the requirements management program shall produce documentation that includes the Contractor's substantiating data for its proof-of-compliance claims. Documentation in support of proof-of-compliance claims shall be suitable for presentation at the System Verification Review (or predecessor incremental verification reviews).

The Contractor shall develop and maintain a C-5 RERP Weapon System Verification Plan. The plan shall provide the overall guidance and infrastructure for verification activities across the program. **(CDRL A020)**

The Contractor shall maintain a specification tree. The specification tree shall represent the hierarchical relationships among the program's technical specifications. **(CDRL A015)**

3.1.6.12.4 Deleted

3.1.6.12.5 Other Systems Engineering Requirements

The Contractor shall maintain a Systems Engineering Management Plan (SEMP). **(CDRL A015)**

The Contractor shall develop and maintain a set of technical performance measures (TPMs). **(CDRL A015)**

3.1.6.13 WBS 1.6.13.0 Diminishing Manufacturing Sources

The contractor shall develop processes and plans to minimize impacts to the RERP effort due to vanishing vendors and diminishing manufacturing sources (DMS). Accomplishment of this task will include:

- Review and monitor the Bill of Material to identify items with the potential for high DMS risk
- Classify identified items according to criticality, expected obsolescence date, and expected replacement cost
- Identify alternatives for items having high DMS risks
- Brief DMS Plan status at Design Reviews

Integrate Viable Combat Avionics Objectives into C-5 RERP Weapon System design selection criteria.

3.1.7 WBS 1.7.0.0 Data

The Contractor shall prepare and submit deliverable data required for the C-5 RERP in accordance with the Contract Data Requirements List, Section J – Exhibits A through C.

The Contractor shall provide engineering design documentation in the form of Detail and Assembly drawings, Source/Specification Control drawings, and Modification and Installation Drawings. These drawings shall be used for the structural modification of the C-5 aircraft and the installation of the equipment. **(CDRL B001)**

3.1.8 WBS 1.8.0.0 Special Studies and Analyses

The Contractor shall perform Special Studies and Analyses that are not defined under the current SOW but fall within the general scope of the C-5 RERP program. The Contractor shall conduct these Special Studies and Analyses when requested and authorized by the contracting officer. The Special Studies and Analysis include:

a. Analysis of potential changes to the program budget, schedule, and/or content, and the impacts thereof

b. Budgetary costs estimates in support of Government program planning

c. Operational use of C-5 RERP aircraft

d. Engineering/management support

e. Trade studies

f. Technical analysis

g. Independent studies

h. Simulations

i. Technical management support

j. Cost Reduction Initiatives

k. Investigation of MIPs as determined by the MRB

l. Operational Safety, Suitability and Effectiveness planning and analysis.

The Contractor shall also, at the Contracting Officer's request, provide recommendations for potential Special Studies and Analyses to the Contracting Officer or C-5 RERP Program Office.

APPENDIX A

Reliability Enhancement Items

The following table lists the modifications to be developed during the C-5 RERP. The column labeled "SDD SOW Paragraph" references the Design IPT paragraph in which each modification is called out.

RE Item Number	SOW Paragraph(s)	Title	Applicability	
			C-5A/C	C-5B
A. Engine Replacement Changes				
301		Cabin Pressurization Seals	X	X
3AP	3.1.1.2.6, 3.1.1.2.8	Auxiliary Power Unit Upgrade	X	X
3EL	3.1.1.2.8	Integrated Drive Generator Upgrade	X	X
	3.1.1.2.3	Engine Driven Hydraulic Pump Upgrade	X	X
3PP	3.1.1.3.1, 3.1.1.3.2	Engine Upgrade	X	X
3PY	3.1.1.1.1	Pylon Upgrade	X	X
5146	3.1.1.2.7	Rudder Limiter System	X	X
			X	X
5233	**1**		X	X
5421	3.1.1.2.8	Battery Upgrade	X	X
5456	3.1.1.2.3	Engine Driven Pump Filter Manifold	X	X
5461A	3.1.1.1.1	Fuel Leak, Pylon Bolts	X	X
5493	3.1.1.2.6, 3.1.1.3.2	Engine / APU Fire & Overheat Detection Control Boxes	X	X
N/A	3.1.1.4.2	VIA / AIU Modifications	X	X
B. Reliability Enhancement Items				
13EDC	3.1.1.2.2	Brake Press Warning Switch	X	X
14AJB	3.1.1.2.7	Aileron Actuators	X	X
206	3.1.1.1.3	Aft Personnel Door Longeron		X
308	3.1.1.2.4	Cooling For AC Load Central And Environmental Compartment	X	X
312		Fuel Quantity Indicator	X	
332			X	X
[illegible]	3.1.1.1.3	Crew Door/Ladder Beef-up	X	X
	3.1.1.2.3	Hydraulic Suction Boost Pump	X	X
	3.1.1.2.4	Temp Control Units	X	X
346		Windshield	X	X

RE Item Number	SOW Paragraph(s)	Title	Applicability	
			C-5A/C	C-5B
348	3.1.1.2.4	Cabin Press Controller and Selector	X	X
5111A	3.1.1.2.3	Visor Door Actuator	X	X
5116	3.1.1.1.3	Aft Ramp Assembly	X	X
5121	3.1.1.2.5	Flight Crew Seat Upgrade (C-5A upgrade)	X	
5121	3.1.1.**2.5**	Flight Crew Seat Upgrade (C-5B overhaul)		X
5131	3.1.1.2.2	MLG Electrical Conduit Upgrade	X	X
5134	3.1.1.2.2	Accumulator, Park Brake (Selector Valve)	X	X
5136	3.1.1.2.2	Anti-skid Detector	X	X
5138	3.1.1.2.2	MLG Doors, Swivel Fitting Upgrade	X	X
513F	3.1.1.2.5	Blue Water Leaks	X	X
513K	3.1.1.2.2	Hydraulic Kneel Motor	X	X
513M	3.1.1.2.2	MLG Actuator High Speed Gearbox	X	X
5141A	3.1.1.3.2	Flap System Upgrade (Flap Handle)	X	X
5141B	3.1.1.2.7	Slat System Upgrade (Proximity Sensors)	X	X
5141C	3.1.1.2.7	Slat System Upgrade (Mechanical Components)	X	X
5141D	3.1.1.2.7	Flap System Upgrade (Mechanical Actuation Components)	X	X
5141E	3.1.1.2.7	Flap System Upgrade (Flap PPA Computer)	X	X
5141H	3.1.1.2.7	TE Flap Assemblies (Structural)	X	X
5141J	3.1.1.2.7	Leading Edge Slats (Structural)	X	X
			X	X
	7		X	X
5144	3.1.1.2.7	Ground Spoiler Actuator Assembly	X	X
5145	3.1.1.2.7	Flight Spoiler Servo Assembly	X	X
5149	3.1.1.2.7	Pitch Trim	X	X
514A	3.1.1.2.7	Elevator System	X	X
5413A	3.1.1.2.4	Compress, Turbine, Air Cycle (Air bearing retrofit plus wheel modification)	X	
5413A	3.1.1.2.4	Compress, Turbine, Air Cycle (Wheel modification only)		X
5413C	3.1.1.2.4	Low Limit Temperature Valve	X	X
5413E	3.1.1.2.4	Wing Isolation Valve	X	X
	1.2.4	Flow Control Valve	X	X
5415	3.1.1.2.4	Air Exit Door	X	X
5417A	3.1.1.2.4	Bleed Air Leak Detection System	X	X
	3.1 **1.2.8**	**Bus Tie Contactor**	X	X
	1 3.1.1.2.5		X	X

RF Item Number	SOW Paragraph(s)	Title	Applicability	
			C-5A/C	C-5B
5451	3.1.1.2.6	[illegible]	X	X
			X	X
			X	X
	3.1.1.2.3	Wing Leading Edge Coupling	X	X
5461C		Fuel Tank Corner Fittings	X	X
			X	X
5463	3.1.1.2.1	Fuel Tank Venting System	X	X
5492	3.1.1.2.5	Smoke Detector Upgrade	X	X
5551A	3.1.1.4.1	MADARS Component Upgrades	X	X
5551B	3.1.1.4.1	MADARS DSAR and Software Upgrade	X	X
5661	3.1.1.4.1	Digital Flight Data Recorder Upgrade	X	X
		C. Structural Integrity Changes		
		Cabtop Cracking		X
			X	
	3.1.1.1.3		X	
	3.1.1.1.3	Keel Beams	X	
3MF	3.1.1.1.3	Main Frames Repair	X	
3UF	3.1.1.1.3	Underfloor End Fitting Repair	X	
333	3.1.1.1.3	Slat Track Support Rib Beef-Up	X	X
5114	3.1.1.1.3	Miscellaneous Structural Upgrades	X	X

APPENDIX B
ACRONYMS

ABDR	Aircraft Battle Damage	
ACA	Associate Contractor Agreement ..	..31
AFMSS		
AFSC	Air Force Systems Command	3
AMC	Air Mobility Command	36
APU	Auxiliary Power Unit	15
ARP	Aerospace Recommended Practice	3
AS	Aerospace Standard	47
ASIP		
ATD	Aircrew Training Devices	1
ATM	Air Turbine Motor	
BPCU		
CDRL	Contractor Data Requirements List	1
CFSR	Contract Funds Status Report	37
CLIN	Contract Line Item Number	5
CM	Configuration Management	48
COTS	Commercial-Off-The-Shelf	41
COVART	.....	47
CPR	Cost Performance Report	37
CSCI	Computer Software Configuration Item	23
CTF	Combined Test Force	33
DAL	Data Accession List	36
DCMA	Defense Contract Management Agency	36
DSAR		
E^3	Electromagnetic Environmental Effects	25
EAC	Estimate-at-Completion	37
ECP	Engineering Change Proposal	45
ECS	Environmental Control System	 13
EECS		

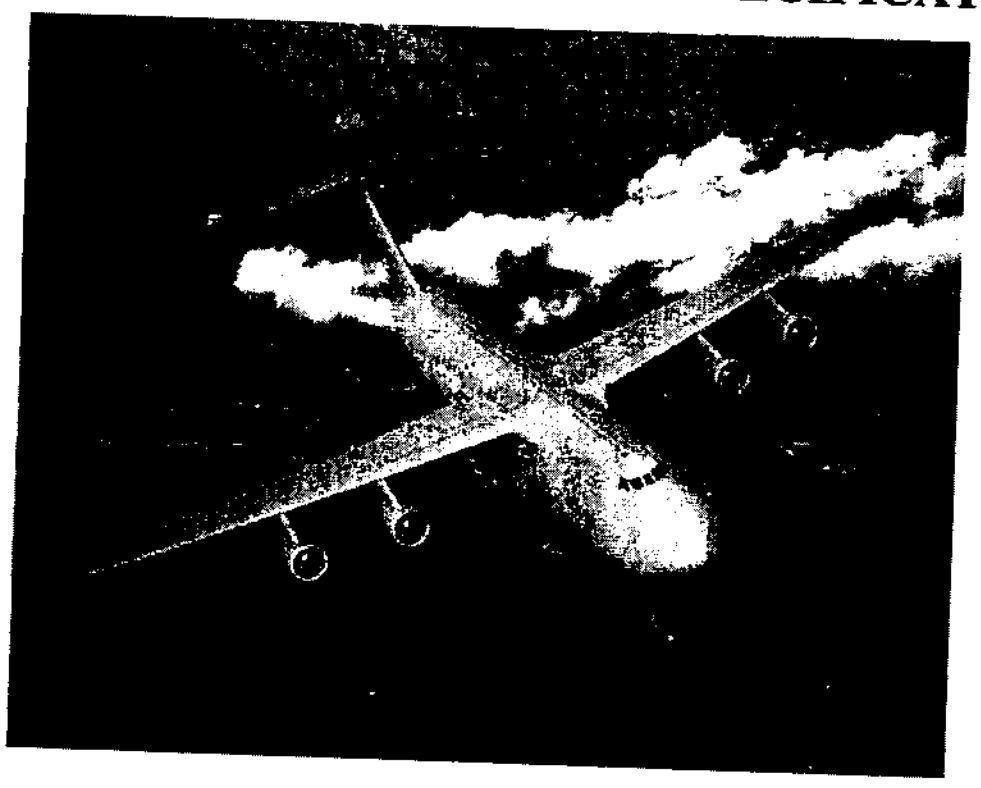
MMH/FH	Maintenance Man-hours per Flight Hour	49
MRT	Mean Repair Time	49
MSG-3	Maintenance Steering Group	50
MTBF	Mean Time Between Failure	49
MTBM	Mean Time Between Maintenance	49
MTBM-T	Mean Time Between Maintenance - Total	49
MTD	Maintenance Training Devices	32
NDI	Non-	
OEM	Original Equipment Manufacturer	17
OMMS	Organizational Maintenance Manual Set	55
OSS&E		
PBA		
PCA	Physical Configuration Audit	
PHS&T	Packaging, Handling, Storage and Transportation	40
PSE	Peculiar Support Equipment	32
PSSA	Preliminary System Safety Assessment	42
QA	Quality Assurance	3
QT&E	Qualification Test and Evaluation	1
QOT&E	Qualification Operational Test and Evaluation	1
RERP	Reliability Enhancement and Re-Engining Program	1
R&M	Reliability and Maintainability	1
RM&A	Reliability, Maintainability & Availability	1
RTCA	Radio Technical Committee for Aeronautics	3
RTOC	Reduced Total Ownership Cost	50
SAE	Society of Automotive Engineers	3
SAR		
SCM	Software Configuration Management	53
SCN	Specification Change Notice	49
SDD	System Development and Demonstration	1
SDF	Software Development Folder	53
SDP	Software Development Plan	53
SE	Support Equipment	1
SEE	Software Engineering Environment	

SIL	Systems Integration Laboratory	35
SOW	Statement of Work	1
SPP	Software Project Plan	53
SQA	Software Quality Assurance	53
SRB	Safety Review Board	34
SSA	System Safety Assessment	23
SSG	System Safety Group	46
SSM	Software Supplier Management	53
SSP	System Safety Program	42
SSPP	System Safety Program Plan	42
SSWG	System Safety Working Group	46
SVR	System Verification Review	6
TCTO	Time Compliance Technical Order	29
TMCR	Technical Manual Contract Requirement	56
TO	Technical Order	1
TPM	Technical Performance Measures	60
TSRA	Training Systems Requirements Analysis	1
U&S	Utilities and Subsystems	

LG00ER0028
27 February 2002

C-5 RELIABILITY ENHANCEMENT AND REENGINING PROGRAM (RERP)

WEAPON SYSTEM FUNCTIONAL MODIFICATION SPECIFICATION



LOCKHEED MARTIN

Signature Page

Prepared By
Lee Williams

Approved By
C-5 System Integration Team Lead
Sam Finch

Approved By
C-5 RERP Air Vehicle Development IPT Lead
Dan O'Rourke

Approved By
C-5 RERP Business Manager
Jerry Raines

Approved By
C-5 RERP Contracts Manager
Bill Borchardt

Approved By
C-5 RERP Logistics Support IPT Lead
Miles O'Brien

Approved By
C-5 RERP System Integration Team Lead
Sam Finch

Concurred By
C-5 RERP Program Integration Team Lead
Terry Kellner

Concurred By
C-5 RERP Program Director
Joe Dupcak

Important Note: A hard copy of this document may not be the document currently in effect. The current, official version is always on EDCS.

C-5 RERP Weapon System Functional Modification Specification
Record of Specification Change Notices (SCN)/Revisions

Revision & Date	SCN No.	SCN Date	Paragraph No.	Change Page No.	Reason
R1, 10/23/01	SDD 007	10/23/01	various	various	Makes changes as a result of locking final set of open requirements.
02/25/02	NA	NA	various	various	Incorporate changes required by CR numbers SDD-026, SDD-030, SDD-037, SDD-040, SDD-042, SDD-043.
02/27/02	NA	NA	various	various	Incorporate changes required by CR number SDD-041.
02/28/02	NA	NA	various	various	Incorporate changes required by changes to CR number SDD-041.

Table Of Contents

1.0 INTRODUCTION

This specification establishes the system-level requirements for modification of the C-5 Weapon System to:

- increase the availability of the C-5 fleet
- improve aircraft performance
- decrease total ownership costs

Achievement of these objectives requires that the C-5 aircraft and its related system elements be modified to:

- install more reliable systems and equipment
- install engines having increased thrust
- improve aircraft structural characteristics

The C-5 RERP "weapon system" is defined as the air vehicle *plus* all the systems needed to support it. Therefore, all requirements in this specification necessarily have an air vehicle component and a logistics support component.

The ORD contains requirements that apply directly to various levels of design definition. For example, some ORD requirements pertain only to the air vehicle (e.g., range/payload). These ORD requirements have been flowed directly to the air vehicle specification. Similarly, some pertain only to the logistics side and have been flowed into the C-5 RERP Logistics Support Plan.

REFERENCE DOCUMENTS

Government Documents

2.1.1 Specifications, Standards, And Handbooks

The following specifications, standards, and handbooks of the exact revision listed below form a part of this specification to the extent specified herein:

Document No. Version	Document Title
MIL-STD-129N 15 May 97	Military Marking
MIL-STD-464 18 Mar 97	Interfaced Standard Electromagnetic Environmental Effects Requirements for Systems
MIL-STD-2073-1D 15 Dec 99	DoD Standard Practice For Military Packaging

2.1.2 Other Government Documents, Drawings, And Publications

The following other government documents, drawings, and publications of the exact revision level listed below form a part of this specification to the extent specified herein:

Document No. Version	Document Title
AFI 11-2C-5V3 01 Jan 00	C-5 Operations Procedures
AFI 38-201 01 Jan 99	Determining Manpower Requirements
AFI 63-1401 06 Feb 01	Aircraft Information Program
T.O. 1C-5A-06 30 Sep 91	Work Unit Code Manual USAF Series C-5A and C-5B Aircraft
T.O. 1C-5A-6WC-1 1 July 1998 through Change 2 of 1 October 2000	Workcards, Preflight, Thru-Flight Inspection, USAF Series C-5 Aircraft
ORD "Final" Release 08 Oct 00	Draft Operational Requirements Document (ORD) AMC 006-97-I/II/III C-5 Reliability Enhancement and Reengining Program (RERP)

AFPAM 10-219 Vol. 5 01 Jun 96	Bare Base Conceptual Planning Guide
AFPAM 10-1403 01 June 97	Air Mobility Planning Factors
T.O. 00-20-2 1 May 00	Maintenance Data Documentation
29 CFR Part 1910.1200	Occupational Safety and Health Standard for General Industry
AFI 10-602 20 Jun 94 Supplement 1 24 Jun 01	Determining Logistics Support and Readiness Requirements
AFI 21-103 1 Sep 97 Supplement 1 Jul 98	Equipment Inventory, Status, and Utilization Reporting
AMCI 10-202 Vol. 6 1 Jun 97	Mission Reliability Reporting System
Clean Air Act Section 602 1990	Listing of Class I and Class II substances

Non-Government Documents

The following documents of the exact revision listed below form a part of this specification to the extent specified herein:

Document No. Version	Document Title
LG98ER0072 Rev.C 29 Apr 99	C-5 Avionics Modernization Program Systems Specification

Order of Precedence

In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3 TECHNICAL REQUIREMENTS

3.1 Functional And Performance Requirements

3.1.1 (Not Used)

3.1.2 (Not Used)

3.1.3 Weapon System Capability Requirements

(WSS/1423) It shall be possible to maintain the aircraft in a bare base environment (no USAF presence, AFPAM 10-219 Vol. 5, 01 Jun 96, Bare Base Conceptual Planning Guide) without special facilities for maintenance. [WSSV/363]

3.1.4 (Not Used)

3.1.5 Reliability Requirements

(WSS/1451) THE BREAK RATE SHALL NOT EXCEED 10.5 BREAKS PER 100 SORTIES (KPP). The assumptions, conditions, and allocations in Appendix A apply. As an objective, the Break Rate should not exceed 5.7 breaks per 100 sorties. Break Rate is defined in Section 5, Technical Reference Information. [WSSV/387]

(WSS/1452) The worldwide logistics departure reliability shall be at least 92%. The assumptions, conditions, and allocations in Appendix A apply. As an objective, the worldwide logistics departure reliability should be at least 95%. Worldwide logistics departure reliability is defined in Section 5, Technical Reference Information. [WSSV/388]

(WSS/1454) The mean time between maintenance - total (MTBM-T) shall be no less than 24.0 flight minutes. The assumptions, conditions, and allocations in Appendix A apply. As an objective, MTBM-T should be no less than 33.0 flight minutes. MTBM-T is defined in Section 5, Technical Reference Information. [WSSV/390]

3.1.6 Maintainability, Maintenance, And Maintenance Concept Requirements

(WSS/1413) THE WEAPON SYSTEM SHALL ACHIEVE A 4-HOUR FIX RATE NO LESS THAN 30.1%; A 12-HOUR FIX RATE NO LESS THAN 62.9%; AND A 24-HOUR FIX RATE NO LESS THAN 82.4% (KPP). The assumptions, conditions, and allocations in Appendix A apply. As an objective, the weapon system should achieve a 4-hour fix rate no less than 34.3%; a 12-hour fix rate no less than 66.5%: and a 24-hour fix rate no less than 84.1%. Fix Rate is defined in Section 5, Technical Reference Information. [WSSV/250]

(WSS/1352) New and modified elements of the C-5 RERP weapon system shall be supportable under a two-level maintenance concept. [WSSV/286]

(WSS/1035) The weapon system corrective maintenance man-hours per flight hour (MMH/FH) shall be no greater than 17 MMH/FH. The assumptions, conditions, and allocations in Appendix A apply. As an objective, MMH/FH should not be greater than 11 hours. MMH/FH is defined in Section 5, Technical Reference Information. [WSSV/30]

(WSS/1412) The weapon system shall achieve a system mean repair time (MRT) of no greater than 162 man-minutes. The assumptions, conditions, and allocations in Appendix A apply. As an objective, the weapon system MRT should not exceed 150 man-minutes. MRT is defined in Section 5, Technical Reference Information. [WSSV/374]

3.1.7 Deployability And Basing Requirements

(WSS/1045) MIL-STD-2073 and MIL-STD-129 shall be used as guides for the source of shipping containers for new and modified RERP equipment. [WSSV/39]

(WSS/1443) The footprint, i.e, the weight and cube, of any deployable new or modified RERP equipment shall be minimized. [WSSV/385]

(WSS/1465) The training requirements associated with any deployable new or modified RERP equipment shall be minimized. [WSSV/394]

(WSS/1466) The support requirements associated with any deployable new or modified RERP equipment shall be minimized. [WSSV/395]

3.1.8 Availability Requirements

(WSS/1053) The weapon system shall achieve a mission capable rate (MCR) no less than 75% based on possessed hours. The assumptions, conditions, and allocations in Appendix A apply. As an objective, the weapon system should achieve an MCR of no less than 82%. MCR is defined in Section 5, Technical Reference Information. [WSSV/47]

(WSS/1055) The maximum surge utilization rate for the RERP weapon system shall be no less than 11.2 flight hours per aircraft per day. The assumptions, conditions, and allocations in Appendix A apply. As an objective, the maximum surge utilization rate for the RERP weapon system should be no less than 12.5 flight hours per aircraft per day. Maximum surge utilization rate is defined in Section 5, Technical Reference Information. [WSSV/372]

3.1.9 (Not Used)

3.1.10 (Not Used)

3.1.11 (Not Used)

3.1.12 Electromagnetic Environmental Effects Requirements

(WSS/1306) The installed performance of new C-5 RERP equipment shall achieve electromagnetic compatibility in accordance with the following paragraphs of MIL-STD-464: 5.2, 5.3 (Table ID, Average, to 18 GHz), 5.4, 5.6, and 5.10. [WSSV/296]

3.1.13 (Not Used)

3.1.14 (Not Used)

3.1.15 (Not Used)

3.1.16 System and Personnel Safety and Health Requirements

(WSS/1425) Hazards from new or modified RERP equipment that affect the health and effectiveness of personnel who test, operate, maintain and support systems shall be mitigated or eliminated. [WSSV/365]

(WSS/1462) The new and modified C-5 RERP equipment (i.e., both air vehicle equipment and logistics support equipment) shall recognize and reduce hazards with a probability of death, illness, injury, damage to or loss of property, equipment, or environment. Reduce the risk of mishaps occurring to a level that will preserve combat capability by minimizing loss of personnel and material resources in both peacetime operations and war. [WSSV/393]

(WSS/1424) New and modified C-5 RERP equipment shall not require the use of hazardous materials, as defined in 29 CFR 1910.1200, in its operation and maintenance that would result in an increase of Environment, Safety, and Occupational Health (ESOH) risks or costs compared to the baseline weapon system. [WSSV/364]

(WSS/1439) The new and modified C-5 RERP equipment shall not increase requirements for hazardous waste disposal over the baseline weapon system. As an objective, the new and modified C-5 RERP equipment should reduce the requirements for hazardous waste disposal over the baseline weapon system. [WSSV/381]

(WSS/1441) The new and modified C-5 RERP equipment shall not require the use of any Class II ODS, as defined in the Clean Air Act Section 602, for operations and maintenance. [WSSV/382]

3.1.17 Human Factors Engineering/ Human Systems Integration Requirements

(WSS/1426) The RERP weapon system shall be designed such that repetitive routine aircrew and maintainer tasks, excluding flight control operation, are minimized. [WSSV/366]

(WSS/1470) New and modified RERP equipment shall be accessible and maintainable by the population as described in Table 3.1.17-1 wearing current-inventory biological and chemical protective ensembles as identified in Table 3.1.17-2. This requirement applies only to thru-flight inspections identified by TO 1C-5A-6WC-1 (including changes required by air vehicle modifications), including the replenishment of safety critical fluids and gaseous charge pressurization. [WSSV/21]

Table 3.1.17-1 Anthropometric Variables Defining Maintainer Population

	Min (inches)	Max (inches)
Stature	60.0	74.0
Shoulder Height	47.5	61.9
Sitting Height	30.5	40.0
Thumb-Tip Reach	24.9	36.8
Thumb-Tip Reach Extended	28.3	41.1
Forearm Circumference Extended	7.9	13.0
Hand Circumference w/Thumb	8.5	11.5
Shoulder Breadth	12.2	17.8
Chest Depth	8.5	12.2
Hip Breadth	11.2	16.8

Table 3.1.17-2 Chem-Bio Gear as per AMC/XPRL

8470-01-092-8528	Kevlar Helmet
8470-01-092-8499	Flak Vest (L)
4240-01-415-4241	Chemical Mask
8415-01-137-1705	Chemical Ensemble
8430-01-450-0359	GVOs (Overboots)
8415-01-138-2499	Chemical Gloves
8415-01-138-2496	Cotton Inserts
4240-01-189-9423	Chemical Hoods

(WSS/1026) New and modified RERP equipment shall be operable by the population as described in Table 3.1.17-3 wearing current-inventory biological and chemical protective ensembles as identified in Table 3.1.17-2. [WSSV/396]

Table 3.1.17-3 Anthropometric Variables Defining Operator Population

	Short Sit	Short Legs	Big All	Short Sit/ Big Legs	Big Sit/Short Legs
Sitting Height	34.1	35.1	39.2	36.5	36
Eye Height Sitting	29.6	30.6	33.9	30.7	32.9
Shoulder Height	22.3	23.2	25.9	23	24.6
Buttock-Knee Length	22.6	21.7	26.5	25.9	23.3
Knee Height	19.9	19.1	23.6	22.6	21.1
Thumb-Tip Reach	26.4	27.3	34.4	33.2	30.4

(WSS/1027) New and modified RERP equipment shall be operable, accessible, and maintainable by the population as described in Table 3.1.17-1 (for maintainers) and Table 3.1.17.3 (for operators) wearing current-inventory cold weather protective ensembles as identified in Table 3.1.17-4. For the purposes of this requirement, "operable" pertains only to those operations pertaining to starting the Air Vehicle. The "maintainable" requirement applies only to thru-flight inspections identified by TO 1C-5A-6WC-1 (including changes required by air vehicle modifications), including the replenishment of safety critical fluids and gaseous charge pressurization. [WSSV/337]

3.1.17-4 Arctic Gear as per AMC/XPRL	
8415-00-376-1710	Parka L
8415-01-319-5115	Mitten Set L
8415-01-099-7847	CW Cap Sz 7 1/2
8430-00-269-0100	Mukluks L
8415-00-177-7994	Mukluk Inserts L

(WSS/1442) The workload required to operate and maintain the new and modified RERP equipment by trained aircrews and maintainers shall not threaten mission completion or safety. [WSSV/384, WSSV/383]

3.1.18 System Security And Privacy Requirements

(WSS/1335) New and modified RERP items shall not degrade the security of the baseline weapon system. The baseline weapon system security is defined in the draft C-5 Program Security Classification Guide, 1 Oct. 2001. [WSSV/399]

3.1.19 Computer Resources Requirements

(WSS/1428) The design of new RERP systems shall accommodate future upgrades by incremental technology insertion rather than by large-scale system redesign. [WSSV/368]

(WSS/1121) Weapon system computing resources that have been added or modified as part of RERP shall be compatible with the baseline weapon system computer resources. [WSSV/116]

(WSS/1434) All application software for new and modified equipment shall be written in a structured software programming language. [WSSV/376]

(WSS/1476) The following components shall not have to be removed from the aircraft for software modifications: aircraft maintenance computer, personal computer interface unit, and the engine electronic controller. [WSSV/401]

(WSS/1477) Baseline components that currently do not have to be removed from the aircraft for software modifications shall not have to be removed from the aircraft for software modifications. [WSSV/402]

(WSS/1436) Software loading and verification for field-loadable equipment shall be accomplished on the weapon system using data loaders. As an objective, operating system software uploads, including executable code and data, for field-loadable equipment should be accomplished through current data loaders. As an objective, components should not have to be removed from the weapon system for firmware modifications. [WSSV/378]

(WSS/1474) Each new RERP Line Replaceable Unit (LRU) that is field loadable shall be capable of having its Operational Flight Program (OFP) loaded in a time not greater than one hour. [WSSV/400]

(WSS/1475) Field loadable LRUs that are either part of the baseline weapon system, or are modified as part of RERP, shall retain, as a minimum, the baseline weapon system's data loading rate associated with the loading of the LRU's Operational Flight Program (OFP). It is expected that a VIA OFP data load of 24 megabytes will take approximately 4 hours. [WSSV/400]

(WSS/1437) A hardware/ software expansion capability and a reserve capacity shall be available in each new and modified hardware and software component or subsystem. [WSSV/379]

(WSS/1438) Spare memory and processing shall be allocated in scaled and consecutive blocks. [WSSV/380]

(WSS/1463) New and modified elements of the RERP weapon system that are used for transferring data necessary for trending supported items (structural health, engine health monitoring, etc.) shall use the Simple Mail Transfer Protocol (SMTP) for transferring the data. [WSSV/391]

3.1.20 Logistics Requirements

(WSS/1444) The weapon system cannibalization (CANN) rate shall be no greater than 15 CANNs per 100 sorties. The assumptions, conditions, and allocations in Appendix A apply. As an objective, the weapon system CANN rate should be no greater than 10 CANNs per 100 sorties. CANN rate is defined in Section 5, Technical Reference Information. [WSSV/386]

3.1.21 Personnel Requirements

(WSS/1356) New and modified elements of the RERP weapon system shall be operable and maintainable without requiring any additional manpower. [WSSV/182]

(WSS/1200) New and modified elements of the C-5 RERP weapon system shall be maintainable by three- and five-skill level personnel. [WSSV/189]

3.1.22 (Not Used)

3.1.23 (Not Used)

3.1.24 Testability And Diagnostics Requirements

(WSS/1431) New or modified engine trending or diagnostic equipment shall utilize current COTS/NDI technology to the extent practical. [WSSV/371]

(WSS/1430) Using a combination of BIT, Technical Orders (TOs) and manual test, three- and five-skill-level technicians shall be able to detect, isolate, and verify 99 percent of all faults in new and modified RERP equipment. [WSSV/370]

(WSS/1472) C-5 RERP fault codes shall be structured in a numerical sequence consistent with the baseline C-5 fault code numbering scheme. [WSSV/397]

(WSS/1473) C-5 RERP fault codes shall be matched to specific word profiles in tables in the aircraft fault isolation manuals and shall be displayable in conjunction with their respective specific word profiles by the Air Vehicle Embedded Diagnostic System (EDS). [WSSV/398]

3.1.25 (Not Used)

3.2 Interface Requirements

3.2.1 (Not Used)

3.2.2 (Not Used)

3.2.3 (Not Used)

3.2.4 (Not Used)

3.2.5 Aircraft Information Compliance Requirements

(WSS/1311) New and modified elements of the C-5 RERP weapon system shall accommodate Air Force Instruction 63-1401 requirements (threshold). [WSSV/278]

3.3 (Not Used)

3.4 (Not Used)

4 VERIFICATION REQUIREMENTS

4.1 Functional And Performance Verification Requirements

4.1.1 (Not Used)

4.1.2 (Not Used)

4.1.3 Weapon System Capability Verification Requirements

(WSSV/363) An analysis shall be performed to verify that it is possible to maintain the aircraft in a bare base environment (no USAF presence, AFPAM 10-219 Vol. 5, 01 Jun 96, Bare Base Conceptual Planning Guide) without special facilities for maintenance. The analysis will review the maintenance requirements of the RERP equipment to determine related O-level facilities requirements; the requirement will be considered met if no additional maintenance facilities are required. [WSS/1423]

4.1.4 (Not Used)

4.1.5 Reliability Requirements

(WSSV/387) Verification of compliance with the break rate requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1451]

(WSSV/388) Verification of compliance with the worldwide departure reliability requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1452]

(WSSV/390) Verification of compliance with the MTBM-T requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1454]

4.1.6 Maintainability, Maintenance, And Maintenance Concept Verification Requirements

(WSSV/250) Verification of compliance with the Fix Rate requirement shall be shown by analysis. The analysis shall:

1. Use the assumptions, conditions, and allocations defined in Appendix A of this specification

2. Include a predicted cumulative fix time distribution that determines the fix rate at the 4-, 12-, and 24-hour points.

3. Comprise an assessment of Direct Maintenance Time (DMT) and Administrative & Logistics Delay Time (ALDT), where:

- DMT for RERP items shall be derived from the predicted Mean Time to Repair [MTTR].

- DMT for non-RERP items shall be as defined in Appendix A of this specification.

- ALDT Parts Availability for RERP items shall be based on predicted RERP Logistics Program Issue Effectiveness and MICAP Response performance.

- ALDT Parts Availability for non-RERP items shall be as defined in Appendix A of this specification.

- All other ALDT contributors shall be as defined in Appendix A of this specification

4. Incorporate predictions that are adjusted for applicable testing during EMD. [WSS/1413]

(WSSV/286) An analysis shall be performed to verify that the new and modified RERP equipment is supportable under a two-level maintenance concept. Specifically, the analysis will review the maintainability aspects of the RERP equipment to determine if those maintenance aspects are compatible with the RERP's two-level (on-wing and off-wing) maintenance concept. The requirement will be considered met if all RERP maintenance can be performed under the RERP two-level maintenance concept. [WSS/1352]

(WSSV/30) Verification of compliance with the MMH/FH requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1035]

(WSSV/374) Verification of compliance with the MRT requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1412]

4.1.7 Deployability And Basing Verification Requirements

(WSSV/39) An analysis shall be performed to determine the extent to which containers identified in MIL-STD-2073 and MIL-STD-129 can be utilized for new and modified RERP equipment. Specifically, the shipping requirements of all new and modified RERP equipment will be reviewed and a determination will be made as to whether the items can be transported in those shipping containers identified the above military standards on a cost-effective basis. The requirement will be considered met if the selected containers are cost-effective to the government. [WSS/1045]

(WSSV/385) The total weight and cube of deployable new and modified RERP equipment shall be measured in an analysis. A qualitative determination shall be made as to whether the total weight and the total cube are as small as could reasonably be expected for the deployable

equipment. The parent technical requirement will be considered met if the analysis concludes in the affirmative. [WSS/1443]

(WSSV/394) The training requirements associated with deployable new and modified RERP equipment shall be identified in an analysis. A qualitative determination shall be made as to whether the associated training requirements are as small as could reasonably be expected for the deployable equipment. The parent technical requirement will be considered met if the analysis concludes in the affirmative. [WSS/1465]

(WSSV/395) The support requirements associated with deployable new and modified RERP equipment shall be identified in an analysis. A qualitative determination shall be made as to whether the associated support requirements are as small as could reasonably be expected for the deployable equipment. The parent technical requirement will be considered met if the analysis concludes in the affirmative. [WSS/1466]

4.1.8 Availability Verification Requirements

(WSSV/47) Verification of compliance with the MCR requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1053]

(WSSV/372) Verification of compliance with the maximum surge utilization rate requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1055]

4.1.9 (Not Used)

4.1.10 (Not Used)

4.1.11 (Not Used)

4.1.12 Electromagnetic Environmental Effects Verification Requirements

(WSSV/296) An analysis of the subsystem and system design data and test results of operation in the specified environment shall be conducted. This requirement will be considered met if the analysis concludes that the installed performance of new C-5 RERP equipment achieves electromagnetic compatibility in accordance with the following paragraphs of MIL-STD-464: 5.2, 5.3 (Table ID, Average, to 18 GHz), 5.4, 5.6, and 5.10. [WSS/1306]

4.1.13 (Not Used)

4.1.14 (Not Used)

4.1.15 (Not Used)

4.1.16 System and Personnel Safety And Health Verification Requirements

(WSSV/365) An analysis, specifically a Health Hazard Assessment, shall be performed to verify that there are no hazards from RERP modifications that affect the health and effectiveness of personnel who test, operate, maintain and support the aircraft. If hazards have not been eliminated, they shall be analyzed to verify that they have been adequately mitigated by approval by the System Safety Group. [WSS/1425]

(WSSV/393) A Health Hazard Assessment shall be performed to verify that the new and modified C-5 RERP equipment (i.e., both air vehicle equipment and logistics support equipment) recognizes and reduces hazards with a probability of death, illness, injury, damage to or loss of property, equipment, or environment. It shall also be shown that the risk of mishaps has been reduced to a level that will preserve combat capability by minimizing loss of personnel and material resources in both peacetime operations and war. [WSS/1462]

(WSSV/364) A Health Hazard Assessment shall be performed to verify that new and modified C-5 RERP equipment does not require the use of hazardous materials, as defined in 29 CFR 1910.1200, in its operation and maintenance. [WSS/1424]

(WSSV/381) A Health Hazard Assessment shall be performed to verify that new and modified C-5 RERP equipment has no additional requirements for hazardous waste disposal over the baseline weapon system. [WSS/1439]

(WSSV/382) A Health Hazard Assessment shall be performed to verify that new and modified C-5 RERP equipment does not require the use of any Class II ODS, as defined in the Clean Air Act Section 602, for operations and maintenance. [WSS/1441]

4.1.17 Human Factors Engineering/ Human Systems Integration Verification Requirements

(WSSV/366) An analysis of the verifications done at the air vehicle level and at the maintenance level shall be performed to determine overall compliance with this "repetitive routine" requirement at the weapon system level. This requirement will be considered met if the analysis concludes that the number of repetitive routine tasks is as small as could be reasonably expected. [WSS/1426]

(WSSV/21) An analysis of the verifications done at the air vehicle level and at the maintenance level shall be performed to determine overall compliance with this "bio/chem protective ensembles" requirement at the weapon system level. This requirement will be considered met if the analysis concludes that weapon system is accessible and maintainable using the referenced bio/chem protective ensembles. [WSS/1470]

(WSSV/396) An analysis of the verifications done at the air vehicle level and at the maintenance level shall be performed to determine overall compliance with this "bio/chem protective ensembles" requirement at the weapon system level. This requirement will be considered met if the analysis concludes that weapon system is operable using the referenced bio/chem protective ensembles. (NOTE: Open pending finalization of parent technical requirement.) [WSS/1026]

(WSSV/337) An analysis of the verifications done at the air vehicle level and at the maintenance level shall be performed to determine overall compliance with this "cold weather ensembles" requirement at the weapon system level. This requirement will be considered met if the analysis concludes that weapon system is operable, accessible, and maintainable using the referenced cold weather ensembles. [WSS/1027]

(WSSV/383) An analysis of the verifications done at the air vehicle level and at the maintenance level shall be performed to determine overall compliance with this "aircrew workload" requirement at the weapon system level. This requirement will be considered met if the analysis concludes that the referenced aircrew workload does not threaten mission completion or safety. [WSS/1442]

(WSSV/384) An analysis of the verifications done at the air vehicle level and at the maintenance level shall be performed to determine overall compliance with this "maintainer workload" requirement at the weapon system level. This requirement will be considered met if the analysis concludes that the referenced maintenance workload does not threaten mission completion or safety. [WSS/1442]

4.1.18 System Security And Privacy Requirements

(WSSV/399) An analysis shall be performed to determine if the new and modified RERP items have degraded the security given in the draft C-5 Program Security Classification Guide, 1 Oct. 2001 for the baseline weapon system. If not, this requirement shall be considered met. [WSS/1335]

4.1.19 Computer Resources Verification Requirements

(WSSV/368) An analysis of the hardware and software design shall be performed to assess the ability of the design of new RERP systems to accommodate reasonably-anticipated future upgrades through the application of incremental technology insertion rather than by large-scale system redesign as defined by the Viable Combat Avionics Initiative/Proven Path. [WSS/1428]

(WSSV/116) An analysis of the RERP-unique computer resources designs shall be performed to verify that hardware, software and interfaces are compatible with C-5 AMP computer resources baseline as defined by the AMP Block 2 final configuration. [WSS/1121]

(WSSV/376) An analysis shall be performed to verify whether software for new and modified RERP equipment is written in a structured software programming language. [WSS/1434]

(WSSV/401) A demonstration shall be performed to upload software to the LRU with the LRU installed in the aircraft. [WSS/1476]

(WSSV/402) An analysis shall be performed to determine whether baseline components have to be removed from the aircraft to perform software modifications. If not, this requirement shall be considered met. [WSS/1477]

(WSSV/378) A demonstration on the aircraft and during the tech order validation effort shall be performed to determine whether the software loading and verification for field-loadable software can be accomplished using the data loader(s) [WSS/1436]

(WSSV/400) A demonstration shall be performed on the aircraft using the data loaders that will be delivered to the customer. The time required to load the Operational Flight Program (OFP) of each field-loadable LRU into the LRU's Non Volatile Memory using the appropriate data loader will be measured to confirm compliance. The demonstration will be performed on each field-loadable LRU (whether new, modified or part of the baseline weapon system). As part of the demonstration, it will be necessary to ensure that the OFP currently loaded on the target LRU is different than the OFP to be loaded. The data loading time will be measured from the initiation of the download on the data loader to confirmation of a successful load into the Non Volatile Memory (NVM) of the receiving LRU as indicated by the data loader. A means that is independent of the data loader will be used to confirm that the proper version of the OFP is resident in the NVM of target LRU after the loading is complete. [WSS/1474, WSS/1475]

(WSSV/379) An analysis of the RERP-related hardware/software expansion capability and of the reserve capacity shall be performed to verify the respective capabilities and capacities are available. The usable reserve capacity requirement shall be applied to each component or subsystem and shall not be a system-wide average. [WSS/1437]

(WSSV/380) An analysis of the RERP-related spare memory and processing shall be performed to verify that they are allocated in scaled and consecutive blocks. [WSS/1438]

(WSSV/391) An analysis of the design descriptions of the new and modified elements of the RERP weapon system that are used for transferring data necessary for trending supported items (structural health, engine health monitoring, etc.) shall be performed to determine whether those elements use the Simple Mail Transfer Protocol (SMTP) for transferring the data. This requirement will be considered met if the analysis concludes in the affirmative. [WSS/1463]

4.1.20 Logistics Requirements

(WSSV/386) Verification of compliance with the CANN rate requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis includes periodically updated predictions utilizing trade study results, supplier/LM Aero test results, and applicable test information from QT&E/QOT&E through dedicated QOT&E. [WSS/1444]

4.1.21 Personnel Verification Requirements

(WSSV/182) Analyses and demonstrations shall be conducted to show that new and modified elements of the RERP weapon system are operable and maintainable without requiring any additional manpower.

For aircrew: A demonstration in the engineering simulator shall be conducted to determine that a flight crew consisting of one pilot, one copilot, and one flight engineer can perform the tasks necessary to accomplish a representative nominal mission without the need for additional personnel. The occasional use of an additional crewmember as a scanner will be allowed to meet this requirement.

For maintenance crew: An analysis using the MMH/FH model will show that on-wing manpower requirements do not increase relative to baseline levels. [WSS/1356]

(WSSV/189) Analysis and demonstration will show that new and modified elements of the C-5 RERP weapon system are maintainable by three-skill level and five-skill level personnel during maintainability demonstrations and dedicated QOT&E. [WSS/1200]

4.1.22 (Not Used)

4.1.23 (Not Used)

4.1.24 Testability And Diagnostics Verification Requirements

(WSSV/371) A review of the documentation or trade study analysis shall be performed to verify that the new or modified RERP engine trending and diagnostic equipment utilizes current COTS/NDI technology to the extent practical. [WSS/1431]

(WSSV/370) Analysis and demonstration shall be conducted to verify that, by using a combination of BIT, Technical Orders (TO's), and manual tests, three- and five-skill level technicians can detect, isolate, and verify 99 percent of all faults in new and modified RERP equipment. The analysis shall consist of incremental assessment of failure and maintainability data collected during SDD testing. A maintainability demonstration for a limited number of agreed-upon selected RERP equipment shall provide additional evidence to verify this requirement. The analysis and demonstration results, coupled with the successful verification of the new/modified C-5 RERP fault isolation manuals, will verify that compliance with the requirement has been met. [WSS/1430]

(WSSV/397) An analysis shall be performed to confirm that C-5 RERP fault codes follow the baseline C-5 fault code numbering scheme. [WSS/1472]

(WSSV/398) An analysis of C-5 RERP fault code tables and EDS displays shall be performed to confirm that the C-5 RERP fault codes are correctly matched to their respective specific word profiles. [WSS/1473]

4.1.25 (Not Used)

4.2 Interface Verification Requirements

4.2.1 (Not Used)

4.2.2 (Not Used)

4.2.3 (Not Used)

4.2.4 (Not Used)

4.2.5 Aircraft Information Compliance Verification Requirements

(WSSV/278) An analysis shall be performed to verify that new and modified RERP equipment meets the requirements of Air Force Instruction 63-1401 where applicable. [WSS/1311]

4.3 (Not Used)

4.4 (Not Used)

TECHNICAL REFERENCE INFORMATION

Definition of Terms

The following terms are used in this specification

analysis – Any analytical method/procedure. This may be a computer-based model, a computer-based simulation, an established form of analysis such as a functional hazard analysis (FHA), or an analysis (review) of data, e.g., test results from a lower-level test venue or similarity to qualification data gathered on a previous program. Rigorous substantiation of the analytical results is implicit. Results are intended to provide hard quantitative evidence of compliance with a parent technical requirement.

austere {environment/site/base/location} – An operating site at which the only support capability consists of pre-positioned spares.

availability – See "fleet availability."

bare base – Per AFPAM 10-219, Volume 5, 1 June 1996: "... a site with a usable runway, taxiway, parking areas (sic), and a source of water that can be made potable. It must be capable of supporting assigned aircraft; and providing other mission essential resources such as a logistical support and services infrastructure composed of people, facilities, equipment, and supplies. This bare base concept requires mobile facilities, utilities, and support equipment that can be rapidly deployed and installed, and be available to transform – virtually overnight – undeveloped real estate into an operational air base."

break rate – The percentage of sorties from which an aircraft lands with an inoperable mission essential system that was previously operable (confined to code 3 landings alone), consistent with current or programmed minimum equipment listing (MEL). Break Rate is calculated as the number of "code 3" events on mission critical systems per 100 sorties. A "code 3" event is an evaluation code used by the maintenance personnel which describes an aircraft returning from a mission with one or more inoperable systems or subsystems that personnel must repair before allowing it to perform "like type" missions. Guidelines for the calculation of this parameter can be found in AFI 10-602, Determining Logistics Support and Readiness Requirements.

cannibalization (CANN) event – A cannibalization is the removal of a part from one aircraft to replace a part in another aircraft.

cannibalization (CANN) rate (%) – CANN Rate, in percent, is calculated as the number of CANN events per 100 sorties. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation.

commercial-off-the-shelf (COTS) (item) – Equipment that has been previously qualified or certified under commercial specifications and standards.

computer resources – The hardware and software associated with the aircraft's avionics systems, mission planning systems, support equipment, and data collection equipment. Reference: ORD paragraph 5.4.1.

critical component – Proposed definition "Any component that is a safety of flight item is considered a 'critical component.'" The discussion pertains now to what constitutes a "safety of flight item."

demonstration – A test or an evaluation conducted in any venue (flight, ground, lab, workstation, etc.) and performed for the purpose of demonstrating compliance with a requirement. No instrumentation, special test equipment, or data gathering is necessarily involved, but may be utilized. Demonstrations typically produce subjective conclusions only.

departure reliability – The percentage of attempted sorties that depart within 14 minutes of scheduled departure time. DR is calculated as 100 minus take off delay (TOD) percent, where TOD percent consists of the number of delays greater than 14 minutes attributable to failure of a component on the airplane per 100 sorties. This parameter is coded against non-leading zero work unit codes. Guidelines for collection and reporting of this parameter can be found in AMCI 10-202 Volume 6, Mission Reliability Reporting System.

depot-level maintenance – Maintenance consisting of those on- and off-equipment tasks performed using the highly specialized skills, sophisticated shop equipment, or special facilities of a supporting command; commercial activity; or inter-service agency at a technology repair center, centralized repair facility, or, in some cases, at an operating location. Maintenance performed at a depot may also include organizational or intermediate level maintenance as negotiated between operating and supporting commands.

fault – Immediate cause of failure (e.g., maladjustment, misalignment, defect, etc.,

fix rate – The percentage of times an aircraft landing with a Code 3 failure that can be returned to mission capable status (based on current or programmed MEL) at the 4-, 12-, or 24-hour points. Historical data is used to establish a baseline fix rate distribution. Distribution is modified based on frequency of failure and fix times of items that cause breaks. Achievement of specified requirements is a Government responsibility.

fleet availability (number) – The number of mission capable aircraft out of the total or specified fleet.

flight test – A test or evaluation conducted aboard the aircraft while it is in flight or during takeoff or landing. The test is to functionally/operationally exercise the subject item/equipment/system in representative operational environments and conditions. Results are intended to provide quantitative evidence of compliance with a technical requirement.

government-furnished property (GFP) – Government-furnished property is government-owned property which is provided from Government inventory.

ground test – A test or evaluation conducted aboard the aircraft while it is on the ground. The test is to functionally/operationally exercise the subject item/equipment/system in representative operational environments and conditions. Engines need not necessarily be turning. Results are intended to provide quantitative evidence of compliance with a technical requirement.

inspection – A visual review intended to determine if a physical item matches its design descriptions or drawings.

key performance parameter (KPP) – Performance parameters designated by the USAF as the critical performance parameters that take precedence in accomplishment over other parameters.

lab test – A test or evaluation conducted in any ground-based laboratory environment. Rigorous data collection and analysis are implicit. Results are intended to provide quantitative evidence of compliance with a technical requirement.

life cycle cost (LCC) – The sum (or a subset of the sum) of all costs (from the USAF perspective associated with developing, procuring, operating, maintaining, and disposing of a weapon system. Also referred to as Total Ownership Cost (TOC).

maintenance concept – The overall notion of the levels of support to be used in aircraft maintenance for a particular aircraft. For C-5 RERP, the maintenance concept is a two-level concept consisting of "on-wing" maintenance and "off-wing" maintenance. The **on-wing** maintenance will be performed by the USAF using its own internal resources (i.e., it will be organic). It is roughly equivalent to what is otherwise referred "organizational-level" maintenance, though "organizational-level" maintenance is not necessarily 100% organic. (Thus, the use of the term "organizational-level maintenance" is technically inaccurate for C-5 RERP.) The **off-wing** maintenance may be performed by original equipment manufacturers and other contractors as may be identified for individual subsystems and equipment items. It is roughly equivalent to, in this case, "depot-level" maintenance, though "depot-level" maintenance is not necessarily 100% contractor maintenance (thus, the use of the term "depot-level maintenance" is technically inaccurate for C-5 RERP.)

maintenance man-hours per flight hour (MMH/FH) – The number of base level maintenance man hours divided by the number of flight hours. Only the man-hours that are recorded against the non-leading zero work unit codes by organizational and intermediate levels of maintenance are included. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation.

manpower – The quantity/skill-level mix of personnel required to support the aircraft through all/both levels of maintenance.

maximum utilization (UTE) rate – Maximum UTE rate = 24*(sortie length)/(sortie length + minimum turn time). This parameter is expressed in fh/ac/day. Simulation may also be used to analyze this parameter. This parameter is not allocated into RERP and non-RERP portions. See also ***utilization rate***.

mean repair time (MRT) – The average time (in minutes) required to complete an on-equipment corrective maintenance action. MRT is calculated as the on-equipment repair man-hours divided by the on-equipment repair actions. On-equipment repair actions are restricted to non-leading zero work unit codes with action taken codes P, R, G, K, L, V, or Z. The on-equipment repair man-hours are the man-hours associated with the on-equipment repair actions. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation.

mean time between failure (MTBF) – Average flight time or operating time expended for an end item, system, subsystem, or component before inherent failure occurs. MTBF is calculated

as the inverse of the inherent malfunction event rate. An inherent malfunction event is defined as a failure having a type 1 how malfunction code. One event is charged per unique job control number (JCN), and all TCTO work is excluded. This parameter only applies to non-leading zero work unit codes. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation.

mean time between failure-total (MTBF-T) – The number of flight hours divided by number of failures. Reference: ORD paragraph 4.2.5.1.

mean time between maintenance-total (MTBM-T) – Average flight time or operating time expended for an end item, system, subsystem, or component before a maintenance event occurs. MTBF is calculated as the inverse of the corrective maintenance event rate. A corrective maintenance event is defined as a failure having a type 1, 2, or 6 how malfunction code. One event is charged per unique job control number (JCN), and all TCTO work is excluded. This parameter only applies to non-leading zero work unit codes. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation.

mission capable (MC) rate (MCR) (%) – The percentage of possessed hours the aircraft is capable of performing at least one of its assigned missions. MCR is calculated as follows: total fleet hours in mission capable status divided by fleet possessed hours or 100 – not mission capable percent (NMC). NMC is the percentage of possessed hours the aircraft is not capable of performing at least one of its assigned missions, and consists of all NMC (due to maintenance, supply, or both, unscheduled or scheduled). Guidelines for collection and reporting of this parameter can be found in AFI 21-103, Equipment Inventory, Status, and Utilization Reporting.

modified (system, subsystem, equipment item) – Any item which is changed to such an extent that the part number by which it is procured is changed relative to being a COTS or NDI item.

non-developmental item (NDI) – Unmodified components that have been MIL-qualified or commercially qualified at the component level with no changes to hardware, processes, functions, form, fit, structure, or testability.

not mission capable (NMC) – See ***mission capable rate***.

objective – A technical "requirement" which the C-5 RERP design should attempt to satisfy. Failure to satisfy an objective will *not* be considered a failure to meet contractual requirements. In this document, objectives are expressed with the wording of "should."

off-wing – Maintenance performed by original equipment manufacturers and other contractors as may be identified for individual subsystems and equipment items. It is roughly equivalent to, in this case, "depot-level" maintenance, though "depot-level" maintenance is not necessarily 100% contractor maintenance. See also ***maintenance concept***.

on-wing – Maintenance performed by the USAF using its own internal resources (i.e., it will be organic). It is roughly equivalent to what is otherwise referred "organizational-level" maintenance, though "organizational-level" maintenance is not necessarily 100% organic. See also ***maintenance concept***.

operations & support cost – The sum of all costs associated with operating, maintaining, and supporting a weapon system. This cost includes personnel and material costs.

organic (maintenance/repair capability) – That maintenance/repair capability fully possessed by the Air Force (there is no dependence on any resource outside of the Air Force).

organizational-level – Maintenance consisting of those on-equipment tasks normally performed using the resources of an operating command at an operating location.

possessed hours – The total number of clock hours accumulated for a specific period for all possessed aircraft for a unit. Reference: ORD paragraph 4.2.1.

readiness – The ability of a military unit to respond to its operation plan(s) upon receipt of an operations order (a function of assigned strength, item availability, status, or supply, training, etc.).

readiness spares package (RSP) – Consists of readiness spares, repair parts, and related maintenance supplies required to support planned wartime or contingency operations of a weapon or support system for a specified period of time pending re-supply. Reference: ORD paragraph 4.2.7.2.1.

service life – The period of time, in flight cycles/hours, established at design during which the structure will be reasonably free from significant structural degradation (also known as the design service goal).

support equipment – All equipment required to perform the support functions except that which is an integral part of the mission equipment.

supportability – Characteristics of the weapon system support system, including supply support, technical publications, reliability, maintainability, training, support equipment, etc.

survivability – The capability of an aircraft to avoid and/or withstand a man-made hostile environment. Equal to one minus the probability of being hit (P_h) multiplied by the probability of being killed given a hit ($P_{k/h}$)

threshold – A technical requirement which the C-5 RERP design must satisfy. Failure to satisfy a threshold requirement will be considered a failure to meet contractual requirements. In this document, thresholds are expressed with the wording of "shall" or, less-preferred, "must."

total ownership cost (TOC) – See ***life cycle cost***.

utilization (UTE) rate – Flying hours per 24-hour period per aircraft. See also ***maximum utilization rate***.

value ("to the government") – A qualitative cost-to-benefit assessment considering an overall balance of the LCC of an item and its technical performance capabilities. The lower the cost and the greater the performance capabilities, the better the value. This term can be applied at all levels from the weapon system level through the component level.

weapon system – The air vehicle plus the support and training systems used to support the air vehicle.

weapon system baseline – the composite definition of as-received air vehicle configuration description plus the design-to configuration descriptions for logistics assets. ***See Appendix B.***

work unit code (WUC) – C-5 work unit codes are defined in TO 1C-5A-06, Aircraft Maintenance Work Unit Code Manual USAF Series C5A and C5B Aircraft.

5.2 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this specification. It is intended that these acronym and abbreviation definitions flow down through all lower-level specifications. Definition of terms are provided above and are not repeated here.

ALDT	administrative & logistics delay time
AMC	Air Mobility Command
AMP	Avionics Modernization Program
	built-in test
BR	break rate
CANN	cannibalization
COTS	commercial-off-the-shelf (equipment or software)
DMT	direct maintenance time
DR	departure reliability
EMC	electromagnetic compatibility
EMI	electromagnetic interference
ESOH	Environment, Safety, and Occupational Health
FHA	functional hazard analysis
FH/AC	flight hours/aircraft
GFP	government-furnished property
GHz	gigahertz
	initial operational capability
JCN	job code number
KPP	key performance parameter
LCC	life cycle cost
LRU	line replaceable unit
MC	mission capable
MCR	mission capable rate
MEL	minimum equipment list
MICAP	mission impaired capability awaiting parts
MMH/FH	maintenance man-hours per flight hour (a measure of maintainability)
MRT	mean repair time (a measure of maintainability)
MTBF	mean time between failure
MTBF-T	mean time between failure – total
MTBM	mean time between maintenance
MTBM-T	mean time between maintenance – total
MTTR	mean time to repair
NDI	non-developmental item
NMC	not-mission capable
ODS	ozone-depleting substance
ORD	operational requirements document
QOT&E	qualification operational test and evaluation
QT&E	qualification test and evaluation

RERP	(C-5) Reliability Enhancement and Reengining Program
RM&A	reliability, maintainability, and availability
	readiness spares package
	specification change notice
	system development and demonstration
SMTP	simple mail transfer protocol
SOLL II	special operations low level II
TCTO	time compliance technical order
TO	technical order
TOC	total ownership cost
TOD	take off delay
USAF	United States Air Force
UTE	utilization rate
WSS	weapon system specification
WSSV	weapon system specification verification
WUC	work unit code

5.3 *Units Of Measure And Conversion Factors*

The following units of measure and conversion factors are used in this specification.

In general, English units of measure are used in this program. Specifically, length measures will be English units.

It is intended that these units of measure and conversion factor definitions flow down, by reference versus by repetition, through all lower-level specifications.

APPENDIX A – ASSUMPTIONS AND CONDITIONS RELATING TO WEAPON SYSTEM SPECIFICATION RM&A METRICS

This appendix provides assumptions, conditions, and provisions for specified quantitative Reliability, Maintainability, and Availability (RM&A) metric requirements. These RM&A requirements are based on the corresponding ORD threshold requirements, which are wartime-only requirements.

1 **Applicable Parameters** – The following specified RM&A metrics must be met or bettered within an AMC operational environment under a wartime scenario by the time Initial Operational Capability (IOC) is achieved:

PARAMETER

a. Mission Capable Rate (MCR)
b. Break Rate (BR)
c. Fix Rate
d. Departure Reliability (DR)
e. Maintenance Man-hours per Flight Hour (MMH/FH)
f Mean Time Between Maintenance – Total (MTBM-T)
g. Mean Repair Time (MRT)
h. Cannibalization Rate (CANN)
i. Maximum Surge Utilization Rate

2 **Wartime Provisions** – The wartime scenario as a minimum has the following characteristics/conditions:

a. Sustained wartime utilization rate is at least 5.0 FH/AC/DAY, a little over twice the AMC C-5B peacetime rate that has averaged about 2.3 FH/AC/DAY in the 1995-2000 timeframe. Surge rate may be as high as 11.2 FH/AC/DAY, the ORD threshold.
b Wartime surge period is in the range of 30 to 45 days.
c Additional maintenance and supply manpower is available so that downtime awaiting maintenance is reduced and more maintenance concurrency can be implemented. Maintenance and supply personnel will work longer schedules (reference AFI38-201) to facilitate increased utilization so that personnel productivity increases.
d Aircraft refurbishment activities are delayed.
e. Aircraft isochronal inspections are delayed.
f. Average sorties lengths increase to above 5 hours per sortie.
g. Constants found in Air Force Pamphlet 10-1403 are used as guidelines for establishing sortie turn times, etc.
h A 90% issue effectiveness rate applies, as well as delivery of the remaining 10% within 48 hours, for RERP items as well as for those non-RERP items that, when failed, cause code three breaks and/or downing (NMC) events.

Average delay time awaiting maintenance personnel is no more than 3 hours per NMC event.

j Maintenance is accomplished in accordance with verified and approved technical orders using properly trained personnel.

k Breaks, not-mission-capable (NMC) events, and departure delays are per the applicable minimum equipment list (MEL) defined in AFI 11-2C-5V3.

C-5A and C-5B aircraft modified to the RERP configuration are flown and supported the same way.

3 **Allocation Provisions** – RERP and non-RERP allocations of the total requirement for each parameter are as follows. Contractor responsibility is to validate that the total weapon system requirements are met using these allocations as worst-case allowables in the validation process for NON-RERP and Early Go-Ahead Items. If the validation process validates numbers better than these allowables, such numbers may be used in the overall weapon system validation.

Parameter	Requirement	Allocated RERP Portion	RERP Sub-Allocation*	Allocated Non-RERP Portion
MCR (%)	75.0			
NMC (%)	25.0	4.9		20.1
Sub-Alloc			0.9	
Break Rate (%)	10.5	4.3		6.2
Sub-Alloc.			0.6	
Fix Rate				
4-hour	30.1%	30.1%	30.1%	30.1%
12-hour	62.9%	62.9%	62.9%	62.9%
24-hour	82.4%	82.4%	82.4%	82.4%
Departure Rel. (%)	92.0			
Departure Delays (%)	8.0	6.0		2.0
Sub-Alloc.			1.0	
MMH/FH	17.0	10.8		6.2
Sub-Alloc.			0.4	
MTBM-T (Flt. Min.)	24.0	66.5		37.5
Sub-Alloc.			571.0	
MRT (man-minutes)	162.0	162.0		162.0
Sub-Alloc.			133.0	
Cann Rate (%)	15.0	4.0		11.0
Sub-Alloc.			1.0	
Max Surge UTE Rate (FH/AC/DAY)	11.2	Note 1	Note 1	Note 1

* RERP Sub-allocation is to Early Go-Ahead improvements. These are C-5 Avionics Modernization Program (AMP), Hydraulic Surge Control Valves, Tire Deflation/ Anti-Skid System, Fuel Boost Pumps, Main Landing Gear Roll Pin, Manifold Flow Control, Bleed Air Overheat Loops, Nitrogen Inerting (T.O. purging procedure change), and Emergency Escape Slides.

Note 1: Max Surge UTE Rate is a function of sortie length and sortie turn time per the following equation:

$$\text{Max Surge UTE Rate} = \max \text{FH/AC/DAY} = \frac{(24) \times (\text{sortie length})}{(\text{sortie length}) + (\text{sortie turn time})}$$

The sortie length is covered by wartime provision 2.f above. The sortie turn time is a complex function of hardware malfunction (break rate, departure reliability, and fix rate), taxi time, loading/unloading time, refueling time, base congestion, flight crew availability, etc. Break rate, departure reliability, and fix rate are separately specified and allocated. The remaining elements of sortie turn time are supportability related but not separately specified or allocated.

For example, using a 5 hour sortie length and a max surge UTE rate requirement of 11.2 FH/AC/DAY yields a 5.7 hour allowable sortie turn time.

4. **Computational Formulas** – Verification of Contractor compliance with the quantitative RM&A metric requirements shall be shown by analysis using the definitions/equations contained in Section 5, Technical Reference Information, and predicated upon Government achievement or bettering allocated Non-RERP portions of the requirements.

APPENDIX B C-5 RERP WEAPON SYSTEM BASELINE

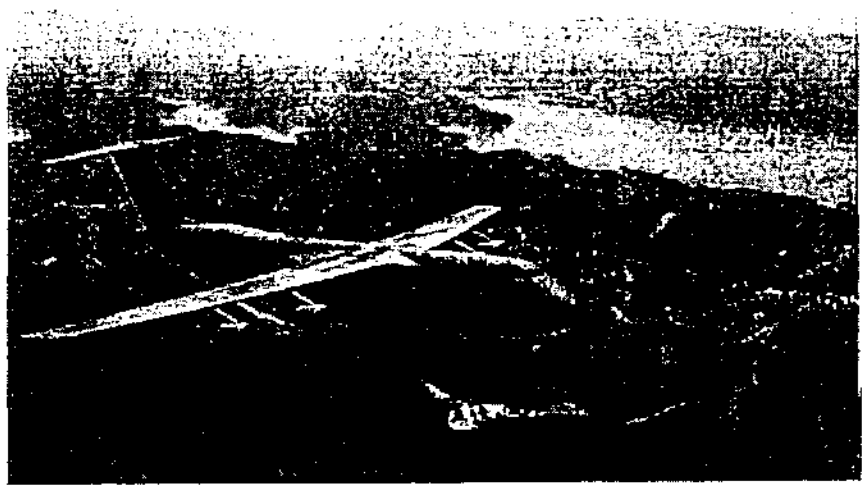
The term "weapon system baseline" has been utilized in several places in this document. The term is intended to mean the baseline against which comparisons are to be made for the "shall not degrade from existing system" type of ORD-derived requirements. The term "weapon system baseline," as referred to in this specification, is defined to consist of

(a) the "as-received" air vehicle baseline as specified in "As-Received Baseline" clause of the C-5 RERP SDD contract, *and*

(b) those logistics systems described in the C-5 RERP Logistics Support Plan.

LG00ER0181
27 February 2002

C-5
RELIABILITY ENHANCEMENT AND RE-ENGINING (RERP)
AIR VEHICLE
MODIFICATION SPECIFICATION



LOCKHEED MARTIN

This page intentionally left blank.

Approvals

Brad Dailey /s/
C-5 RERP Air Vehicle Analysis and Integration IPT Lead — Date

Dan O'Rourke /s/
C-5 RERP Air Vehicle IPT Lead — Date

Miles O'Brien, Jr., /s/
C-5 RERP Logistics Support IPT Lead — Date

Sam Finch /s/
C-5 RERP Systems Integration IPT Lead — Date

Jerry Raines /s/
C-5 RERP Business Management Lead — Date

Joe Dupcak /s/
C-5 RERP Program Manager — Date

This page intentionally left blank.

SUMMARY OF CHANGES

Revision	Date	Change Request #	Description of Change	Section
Draft	10-25-01	SDD-003	Air Vehicle Spec Changes (9/27/01 - 10/9/01)	Multiple Sections
		SDD-006	Air Vehicle Spec Changes (10/9/01 - 10/19/01)	Multiple Sections
Draft	11-16-01	SDD-009	Air Vehicle Mod Spec Change to Appendix C	Appendix C
		SDD-010	Air Vehicle Spec Changes (10/19/01 - 10/29/01)	Multiple Sections
		SDD-012	Air Vehicle Spec Changes (10/29/01 - 11/2/01)	Multiple Sections
		SDD-014	Air Vehicle Mod Spec Change to Appendix B	Appendix B
Draft	12-14-01	SDD-025	Update Air Vehicle Spec Applicable Document List	Section 2.0
Post-SRR	2-27-02	SDD-020A	Air Vehicle Mod Spec Change to Appendix D	Appendix D
		SDD-027	Restore inadvertently deleted Wind Tunnel Data Analysis paragraph to Air Vehicle Spec	4.1.3.1.2.1
		SDD-028	Stability and Flight Control Updates to the Air Vehicle Spec	3.1.3.1.2, 3.1.3.4.7, 4.1.3.1.2, 4.1.3.4.7
		SDD-029	Add Flutter Damping Coefficient to Air Vehicle Spec	3.1.3.3, 4.1.3.3
		SDD-030	Air Vehicle Fault Codes	3.1.24.1, 4.1.24.1
		SDD-031	Add Appendix E to Air Vehicle Spec	Multiple Sections, Appendix E
		SDD-032	Aircraft Backing Requirement for Air Vehicle Spec	3.1.3.1.4, 4.1.3.1.4, Appendix E
		SDD-033	One Deep Packaging	3.1.6, 4.1.6
		SDD-038	Embedded Diagnostics System (EDS) growth capability	3.1.24.1 4.1.24.1
		SDD-044	Software Load Time Limits	3.1.19, 4.1.19

This page intentionally left blank.

Table Of Contents

This page intentionally left blank.

1.0 Introduction

This specification contains the requirements for the C-5 Air Vehicle modifications performed in the C-5 Reliability Enhancement and Re-engining Program (RERP). Since the C-5 RERP is a modification program, the requirements herein are not intended to establish a full performance baseline for the C-5 Air Vehicle. Rather, they represent the required *changes* to Air Vehicle level performance that apply to the changes being introduced by the RERP modifications. Section 3 of this specification contains technical requirements and Section 4 contains the corresponding verification requirements to the Section 3 technical requirements.

1.1 Scope and Use of This Specification

The requirements in this specification apply only to changes in Air Vehicle performance resulting from systems, subsystems, and equipment that are modified, replaced or added under the C-5 RERP. The *overall aircraft performance* requirements in this specification apply to the C-5 RERP aircraft as an integrated system and, *in this context*, "existing equipment" is considered to be included as part of the aircraft. (For example, there is no way to exclude "existing equipment" from the time-to-climb requirement for the aircraft.)

In Section 3, all requirements are to be considered threshold requirements unless stated as an objective. Requirements that are KPPs are represented in ALL CAPS. Each technical requirement in Section 3 and corresponding verification requirement in Section 4 has a unique requirement identification number in the form of AVxxxx and AVVyyyy, respectively.

This page intentionally left blank.

Reference Documents

Government Documents

2.1.1 U.S Military Documents

The following specifications, standards, and handbooks of the exact revision listed below form a part of this specification to the extent specified herein:

Document No. Version	Document Title
AF Handbook 63-1402	AIRCRAFT INFORMATION PROGRAM, 19 March 2001
AFOSH-STD 48-19	Hazardous Noise Program
AIR FORCE PAMPHLET 10-219, VOLUME 5	BARE BASE CONCEPTUAL PLANNING GUIDE, 1, JUNE 1996
JSSG-2007	DEPARTMENT OF DEFENSE JOINT SERVICE SPECIFICATION GUIDE, 30 October 1998
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-210A	Climatic Extremes for Military Equipment
MIL-HDBK-454	Standard General Requirements for Electronic Equipment
MIL-STD-464	Electromagnetic Environmental Effects Requirements for Systems
MIL-STD-704C 30 December 1977	Aircraft Electric Power Characteristics
MIL-STD-882C	System Safety Program Requirements, 19 January 1993
MIL-STD-882D	System Safety
MIL-STD-1472	Human Engineering Design – Criteria for Military Systems, Equipment and Facilities
MIL-STD-3009	Lighting, Aircraft, Night Vision Imaging System (NVIS) Compatible
MIL-T-5624L	Jet Fuel, Grades JP-4 and JP-5
MIL-E-7016	Electric Load and Power Source Capacity, Aircraft, Analysis of
MIL-STD-7080 31 May 1994	Selection and Installation of Aircraft Electric Equipment
MIL-F-8785 (ASG)	Flying Qualities of Piloted Airplanes
MIL-F-9490D, 6 June 1975	FLIGHT CONTROL SYSTEMS - DESIGN, INSTALLATION AND TEST OF PILOTED AIRCRAFT, GENERAL SPECIFICATION FOR
MIL-I-27686E	Inhibitor, Fuel System Icing
MIL-T-83133A	Turbine Fuels, Aviation, Kerosene Types, NATO F-34 (JP-8), NATO F-35, and JP-8 + 100
MIL-H-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537

2.1.2 Other Government Documents

The following other government documents of the exact revision level listed below form a part of this specification to the extent specified herein:

Document No. Version	Document Title
29 CFR 1910.1000, SUBPART Z	"Air contaminants" OSHA U. S. Department of Labor
Advisory Circular 25-7A	FLIGHT TEST GUIDE FOR CERTIFICATION OF TRANSPORT CATEGORY AIRPLANES, 3/31/98
Advisory Circular 25-11	
Advisory Circular 25.939-1	
Advisory Circular 36-4B	NOISE CERTIFICATION HANDBOOK, March 23, 1988
DOT/FAA/CT-19/1	HUMAN FACTORS DESIGN GUIDE, For Acquisition of Commercial-off-the-Shelf Subsystems, January 15, 1996
FAR Part 21	Certification Procedures for Products and Parts
FAR Part 25	Airworthiness Standards: Transport Category Airplanes
FAR Part 33	Airworthiness Standards: Aircraft Engines
	Airworthiness Standards: Smoke and Emissions
	Noise Standards: Aircraft Type and Airworthiness Certification
TSO-C1c	Cargo Compartment Fire Detection Instruments
	Gas Turbine Auxiliary Power Units

2.2 *Non-Government Documents*

2.2.1 Lockheed Martin Documents

Document No. Version	Document Title
	LMAS FOD Prevention Manual, Edition 15, dated 15 Mar 98
	LMAS Safety Program Plan, dated 26 Jan 00
QM 9001, Revision No. 13	Lockheed Martin Aeronautics Company – Marietta Quality Manual
TO 1C-5A-1	FLIGHT MANUAL USAF SERIES C-5A AND C-5B AIRPLANES, 1 DECEMBER 1997, CHANGE 2 - 15 MAY 2000
TO 1C-5A-6WC-1	WORKCARDS PREFLIGHT, THRU-FLIGHT INSPECTION USAF SERIES C-5 AIRCRAFT, 1JULY 1998, CHANGE 2 - 1 OCTOBER 2000

2.2.2 Industry Documents

The following documents of the exact revision listed below form a part of this specification to the extent specified herein:

Document No. Version	Document Title
RTCA/DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment
AFSC DH 1-6	System Safety
ARINC 600-12	Air Transport Avionics Equipment Interfaces
ASTM D1655-59T	Aviation Turbine Fuels, Jet A, Jet A1, and Jet B
SAE ARP4761	Guidelines and methods for conduction the safety assessment process on civil airborne systems and equipment, Issued 1996-12
SAE AS5440	Hydraulic Systems, Aircraft, Design and Installation Requirements for

2.3 Order of Precedence

In the event of a conflict between the text of this specification and the references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

This page intentionally left blank.

3 Requirements

This section provides the technical requirements for the C-5 RERP Air Vehicle modifications and the technical requirements resulting from the effect of the modifications. Logistics support for the Air Vehicle is covered in the Weapon System Specification.

The requirements in this specification are functionally-oriented *performance* requirements exclusively. This specification provides the parent requirements for derived requirements which will be captured at lower specification levels. Detailed *physical* design requirements are at those lower levels of detail.

3.1 Functional And Performance Requirements

The requirements given in this section (3.1 et al.) apply solely to the Air Vehicle.

3.1.1 (Not Applicable)

3.1.2 (Not Applicable)

3.1.3 Air Vehicle Capability Requirements

3.1.3.1 Air Vehicle Performance

3.1.3.1.1 Flight Performance

3.1.3.1.1.1 Air Vehicle Range And Payload Requirements

(AV/2642) Supply Mission (2.5g, Design Cargo, Standard Day Takeoff): The Air Vehicle shall be capable of transporting, from a 10,000 foot available runway with a 2.5% OIS at standard day takeoff conditions, a cargo of 216,000 pounds, at a limit load factor of 2.5g, an unrefueled range of 2,280 nautical miles per AMC mission rules provided in Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled range in excess of 2,280 nautical miles, under the same conditions. [AVV/2058, AVV/1295, AVV/1293]

(AV/2644) Supply Mission (2.25g, Maximum Cargo, Standard Day Takeoff): The Air Vehicle shall be capable of transporting, from a 10,000 foot available runway with a 2.5% OIS at standard day takeoff conditions, a cargo of 261,000 pounds, at a limit load factor of 2.25g, an unrefueled range of 1,503 nautical miles per AMC mission rules provided in Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled range in excess of 1,503 nautical miles under the same conditions. [AVV/2058, AVV/1295, AVV/1293]

(AV/2646) Long Range Cargo Mission (2.5g, Standard Day Takeoff): The Air Vehicle shall be capable of transporting, from a 10,000 foot available runway with a 2.5% OIS at standard day takeoff conditions, a cargo of 50,500 pounds, at a limit load factor of 2.5g, an unrefueled range of 5,413 nautical miles per AMC mission rules provided in Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled range in excess of 5,413 nautical miles under the same conditions. [AVV/2058, AVV/1295, AVV/1293]

(AV/2968) Long Range Cargo Mission (2.25g, Standard Day Takeoff): The Air Vehicle shall be capable of transporting, from a 10,000 foot available runway with a 2.5% OIS at standard day conditions, a cargo of 50,500 pounds, at a limit load factor of 2.25g, an unrefueled range of 5,413 nautical miles per AMC mission rules provided in Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled range in excess of 5,413 nautical miles under the same conditions. [AVV/2058, AVV/1295, AVV/1293]

(AV/2648) Ferry Mission: The Air Vehicle shall be capable of an unrefueled ferry range of 5,581 nautical miles, from a 10,000 foot available runway with a 2.5% OIS at standard day conditions, per AMC mission rules provided in Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled ferry range in excess of 5,581 nautical miles under the same conditions. [AVV/2058, AVV/1295, AVV/1293]

(AV/3080) Supply Mission (2.5g, Design Cargo, Hot Day Takeoff): The Air Vehicle shall be capable of transporting, from a 10,000 foot available runway with a 2.5% OIS at hot day takeoff conditions, a cargo of 216,000 pounds, at a limit load factor of 2.5g, an unrefueled range of 638 nautical miles per AMC mission rules provided in

Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled range in excess of 638 nautical miles, under the same conditions. [AVV/1293, AVV/1295, AVV/2058]

(AV/3081) Ferry Mission: The Air Vehicle shall be capable of an unrefueled ferry range of 4,691 nautical miles, from a 10,000 foot available runway with a 2.5% OIS at hot day conditions, per AMC mission rules provided in Appendix B. As an objective, the Air Vehicle should be capable of an unrefueled ferry range in excess of 4,691 nautical miles under the same conditions. [AVV/2058, AVV/1295, AVV/1293]

3.1.3.1.1.2 Air Vehicle Climb Performance Requirements

(AV/1035) THE AIR VEHICLE SHALL BE CAPABLE OF CLIMBING, FROM SEA LEVEL TO 31,000 FEET, IN LESS THAN 25 MINUTES FROM BRAKE RELEASE UNDER THE FOLLOWING CONDITIONS: 769,000 LBS. TAKE-OFF WEIGHT, CLIMB CONDITION AT STANDARD DAY PLUS 18 DEGREES FAHRENHEIT. (THRESHOLD, KPP)

As an objective, the Air Vehicle should be capable of climbing, from sea level to 31,000 feet, in less than 25 minutes from brake release under the following conditions: 840,000 lbs. take-off weight; climb condition at standard day plus 18 degrees Fahrenheit. [AVV/2063, AVV/38, AVV/1296]

3.1.3.1.1.3 Air Vehicle Descent Performance Requirements

(AV/2614) The Air Vehicle shall be capable of a rapid descent initiated from cruise ceiling (not to exceed 41,000 feet) to 25,000 feet in no more than 2 minutes under the following conditions:

a. Standard day atmospheric conditions

b. Initial cruise Mach 0.77

c. Two inboard engines in reverse idle, two outboard engines in flight idle

d. Descent speed not to exceed 350 KCAS/Mach 0.825, whichever is less

e. Nose-down pitch not to exceed 15 degrees [AVV/2066, AVV/2065, AVV/1631]

3.1.3.1.1.4 Air Vehicle Airfield And Take-off Climb Gradient Performance Requirements

(AV/1044) The Air Vehicle critical field length shall be no more than 6,000 feet under the following conditions: 769,000 lbs. take-off weight; RCR 23; sea level; standard day. As an objective, the Air Vehicle critical field length should be no more than 6,000 feet under the following conditions: 840,000 lbs. take-off weight; RCR 23; sea level; standard day. [AVV/1661, AVV/48, AVV/2067]

(AV/1045) The Air Vehicle critical field length shall be no more than 8,000 feet under the following conditions: 769,000 lbs. take-off weight; RCR 23; sea level; hot day. As an objective, the Air Vehicle critical field length should be no more than 8,000 feet under the following conditions: 840,000 lbs. take-off weight; RCR 23; sea level; hot day. [AVV/1661, AVV/48, AVV/2067]

(AV/1048) As an objective, after crossing the runway threshold at an altitude of 50 feet, the Air Vehicle should be capable of landing in 5,000 feet or less under the following conditions: 769,000 lbs. landing weight; RCR 23; sea level; standard day. [AVV/1669, AVV/1634, AVV/2118]

(AV/2633) THE AIR VEHICLE ENGINE-OUT CLIMBOUT FLIGHT PATH SHALL NOT PENETRATE AN OBSTACLE IDENTIFICATION SURFACE, DEFINED BY A 2.5% GRADIENT BEGINNING AT THE DEPARTURE END OF THE RUNWAY AND ENDING 1500 FEET ABOVE THE DEPARTURE END OF THE RUNWAY, UNDER THE FOLLOWING CONDITIONS: SEA LEVEL, MIL-STD-210A HOT DAY (103 °F) ATMOSPHERIC CONDITIONS; ZERO WIND SPEED; RUNWAY WITH AN RCR OF 23, ZERO SLOPE, AND A LENGTH NO GREATER THAN 10,000 FT; 840,000 LBS. RAMP WEIGHT; THE LOSS OF THE CRITICAL ENGINE AT $V_{GO}(V_1)$; AND TAKEOFF CONFIGURATION DETERMINED BY TO 1C-5A-1, INCLUDING CHANGES REQUIRED FOR AIR VEHICLE MODIFICATIONS. (THRESHOLD, KPP) [AVV/2209, AVV/1662, AVV/1635]

3.1.3.1.2 Air Vehicle Stability and Control Performance

3.1.3.1.2.1 Stability and Control, General

(AV/2537) There shall be no buffet that detracts from the normal operation of the Air Vehicle within the operational flight envelope with all systems operating. [AVV/1677, AVV/2342]

(AV/3037) There shall be no trim changes that prevent the normal operation of the Air Vehicle with all systems operating in the operational flight envelope as defined in Appendix D. [AVV/2324, AVV/2323]

(AV/3036) There shall be no stability changes that prevent operation of the Air Vehicle within the permissible flight envelope with all systems operating. [AVV/2329, AVV/2328]

(AV/2489) The Air Vehicle shall be capable of operation with all systems operating within the permissible sideslip limitations as derived from the crosswind limitations as defined in Appendix D. [AVV/621, AVV/2380]

3.1.3.1.2.2 Longitudinal Stability and Control

(AV/2542) The Air Vehicle elevator fixed neutral points shall be aft of the cg position in the aft critical loading for the flight conditions and throughout the speed ranges listed in Table 3.1.3.1.2-1. [AVV/1679, AVV/2344]

(AV/2951) The Air Vehicle shall have no control force reversal at the design dive speed at all altitudes. [AVV/1678, AVV/2343]

Table 3.1.3.1.2-1 Conditions for Longitudinal Static Stability

Vehicle Configuration	Speed Range	Trim Speeds
Cruise (C)	1.4 V_{SG} to V_{NRP}	Speed for maximum range, two additional trim speeds
Power (P)	0.75 V_{NRP} to V_{PC}	V_{NRP}, One Additional Trim Speed
$Power_{(climb)}$ ($P_{(climb)}$)	0.85$V_{R/C}$ to 1.3 $V_{R/C}$	$V_{R/C}$
Glide (G)	V_{SG} to V_{PC}	1.4 V_{SG}, one or more additional trim speeds
Dive (D)	All speeds normally attained in configuration D dives	One or more representative configuration D dive speeds
Landing (L)	V_{SL} to limit structural speed in configuration L	1.4 V_{SL}
Power Approach (PA)	V_{SL} to limit structural speed in configuration PA	1.2 V_{SPA}
Go Around (GA)	1.1 V_{S1} to 1.4 V_{SL}	1.2 V_{S1}

Note: 1. Additional "trim speeds" shall be so selected that the trim speeds effectively span the specified speed range.

(AV/2543) The elevator-fixed static longitudinal stability with respect to angle of attack shall be positive at constant airspeed and at the aft critical loading in the flight conditions and speed ranges listed in Table 3.1.3.1.2-1. [AVV/2345, AVV/1709]

(AV/2544) The Air Vehicle phugoid mode characteristics shall be at least equivalent to the baseline Air Vehicle phugoid mode characteristics, with SAS ON, as defined in Appendix D. As an objective, the Air Vehicle phugoid

mode characteristics should be at least equivalent to the baseline Air Vehicle phugoid mode characteristics, with SAS OFF, as defined in Appendix D. [AVV/2347, AVV/1711]

(AV/2609) In the flight conditions and throughout the speed ranges listed in Table 3.1.3.1.2-1, the elevator-free neutral points shall be aft of the cg position in the aft critical loading. [AVV/1712, AVV/2348]

(AV/2545) The longitudinal trim changes caused by changes in power or thrust reversers shall not produce longitudinal control forces in excess of those found in the baseline Air Vehicle as defined in Appendix D. [AVV/1713, AVV/2349]

(AV/2612) In-flight thrust reverser deployment during normal operations (i.e. both inboard thrust reversers deployed) shall not produce control force changes in excess of those found in the baseline Air Vehicle as described in Appendix D. [AVV/1714, AVV/2350]

(AV/3062) Thrust reverser deployment after touchdown (i.e. with symmetric thrust reversers deployed) shall not result in control requirements that would prevent completion of a normal landing as defined in Appendix D. [AVV/2449, AVV/2448]

3.1.3.1.2.3 Lateral-Directional Stability and Control

(AV/2546) The lateral-directional damping of the Air Vehicle with SAS ON shall be no worse than lateral-directional damping of the baseline Air Vehicle as described in Appendix D, with both controls fixed and controls free, following excitation by rudder pulses. This requirement applies to the configurations and speed ranges defined in Table 3.1.3.1.2-2. [AVV/2351, AVV/1715]

Table 3.1.3.1.2-2 Flight Conditions for Investigation of Lateral Directional Damping

Vehicle Configuration	Altitude	Speed
Cruise (C)	Medium, High	Speed for Maximum Range
Power (P)	Low, Medium, High	Speed for Level Flight
Dive (D)	Medium, High	(a) $0.9V_H$ (b) Stabilized Speed in Dive Entered From V_H at Service Ceiling
Power Approach (PA)	Low	$1.2V_{SL}$
Landing (L)	Low	$1.4V_{SL}$

(AV/2550) Following sudden failure of the most critical engine, the Air Vehicle shall be controllable through crew corrective actions. [AVV/2352, AVV/1716]

3.1.3.1.2.4 Stall Characteristics

(AV/2552) The Air Vehicle's angle-of-attack margin between stall warning system indications and stall shall be similar to the angle-of-attack margin for the baseline Air Vehicle as shown in Appendix D. [AVV/2353, AVV/1717]

(AV/2553) In both the straight flight and turning flight stall condition, it shall be possible to recover from a stall condition, generated by a -1.0 knot/sec entry rate, with normal use of the controls. The stall recovery characteristics shall be equivalent to or better than the baseline vehicle as defined in Appendix D. [AVV/1718, AVV/2354]

(AV/2554) It shall be possible for the Air Vehicle to be recovered from a stall generated by a -1.0 knot/sec entry rate, with the critical engine inoperative, under the following conditions:

a. The remaining engines operating up to 75 percent of maximum continuous thrust, but not greater than that at which the wings can be held level with the use of maximum control travel;

b. Flaps and landing gear retracted.

It will be permissible to reduce power on the operating engines during the recovery from the stall. [AVV/1719, AVV/2355]

3.1.3.1.3 In-Flight Refueling

(AV/2616) The Air Vehicle shall have in-flight refueling characteristics which permit a successful completion of in-flight refueling from the KC-10 and KC-135 tanker systems. [AVV/1461, AVV/2369]

(AV/2922) The Air Vehicle shall have the capability to perform an emergency separation from both the KC-10 and KC-135 tanker systems. [AVV/1461, AVV/2369]

3.1.3.1.4 Ground Performance

(AV/2944) Air Vehicle modifications shall not increase the ground turning radius of the baseline Air Vehicle during taxi. [AVV/1821]

(AV/2368) The Air Vehicle shall retain the baseline Air Vehicle's capability to startup (APU starting, avionics systems power up, pre-flight checkout, and engine starting) throughout the ground starting envelope, shown in Figure 3.1.3.1.4-1. [AVV/1327, AVV/1326]

(AV/2369) The Air Vehicle shall be capable to startup (avionics systems power up, pre-flight checkout, and engine starting) throughout the ground starting envelope, shown in Figure 3.1.3.1.4-1, using two A/M 32A-95 ground carts and an external electrical power source. [AVV/2458, AVV/2457]

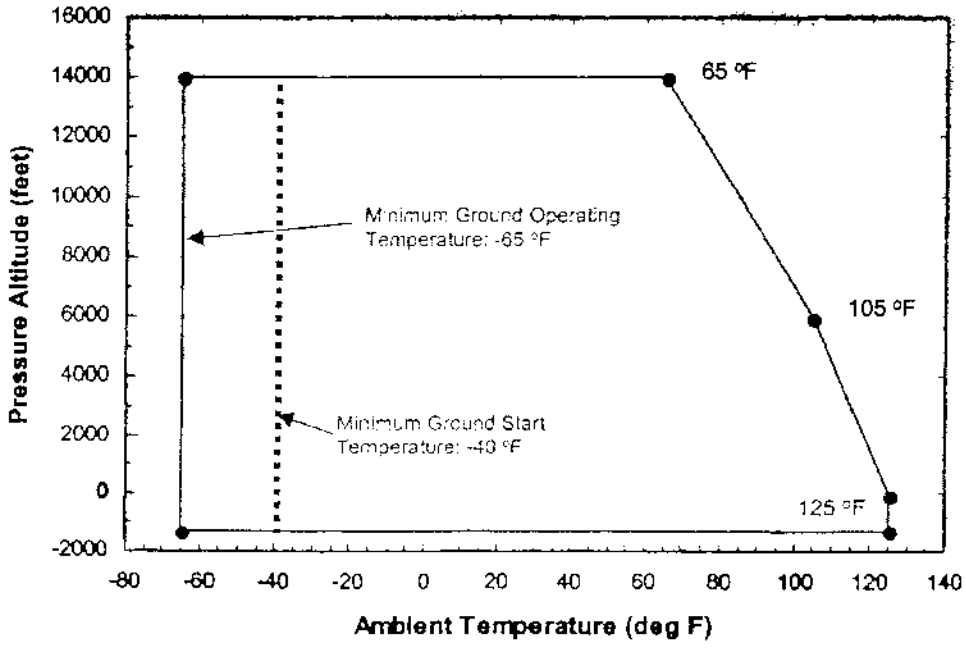


Figure 3.1.3.1.4-1. Air Vehicle Ground Start Envelope

(AV/3088) On a hard surface runway, the Air Vehicle shall be capable of backing using reverse thrust in accordance with the emergency procedures and limitations provided in Appendix E. [AVV/2478, AVV/2479]

3.1.3.1.5 Air Vehicle Noise Requirements

(AV/1052) THE AIR VEHICLE SHALL MEET STAGE 3 NOISE REQUIREMENTS AS PROVIDED IN FAR PART 36, APPENDIX C. (THRESHOLD, KPP)

As an objective, the Air Vehicle should meet future Stage 4 noise requirements. [AVV/2429, AVV/56]

(AV/2555) Ground operation of the Air Vehicle systems shall not cause hearing damage to ground or flight crews using hearing protection devices currently available in USAF inventory and the hearing protection procedures from the NOTE in Chapter 5 of AFOSH-STD 48-19. [AVV/1908, AVV/33]

(AV/2967) The interior noise level at the ear, for personnel wearing David Clark H10-76 headsets or E-A-R Classic (part number 6515-00-137-6345) earplugs at normally-occupied locations in the Air Vehicle, shall not exceed 85 dBA (based on permissible noise exposure limits from Table 2.2 in AFOSH-STD 48-19) at typical extended cruise conditions. As an objective, the interior noise level at the ear should not exceed 82 dBA for typical extended cruise conditions. [AVV/1910, AVV/1909]

(AV/3072) At typical extended cruise conditions, noise levels in the locations of the Air Vehicle that are not normally occupied (defined as the cargo compartment, avionics compartment and environmental compartment) shall not cause hearing damage to flight crews using hearing protection devices currently available in USAF inventory and the hearing protection procedures from the NOTE in Chapter 5 of AFOSH-STD 48-19. [AVV/2459, AVV/2460]

3.1.3.1.6 Fuel Type

(AV/2731) The Air Vehicle shall be capable of using MIL-T-83133A, Grade JP-8, as a primary fuel, with or without fuel system icing inhibitor, per MIL-I-27686E. [AVV/1466]

(AV/2729) The Air Vehicle shall be capable of using MIL-T-83133A, Grade JP-8+100, MIL-T-5624L, Grade JP-5; ASTM D1655-59T, Types A, A-1, and B; and equivalent NATO standards as alternate fuels, with or without fuel system icing inhibitor, per MIL-I-27686E. [AVV/1467]

3.1.3.2 Propulsion

3.1.3.2.1 Propulsion System General

(AV/2600) The propulsion systems shall be arranged and isolated from each other to allow operation, in at least one configuration, so that the failure or malfunction of any engine, or of any system that can affect the engine, will not:

(1) Prevent the continued safe operation of the remaining engines, or

(2) Require immediate action by any crew member for continued safe operation. [AVV/985, AVV/691]

(AV/2601) Design precautions shall be taken to minimize the hazard to the Air Vehicle in the event of an engine rotor failure. [AVV/692]

(AV/2602) Design precautions shall be taken to minimize the hazard to the Air Vehicle in the event of a fire originating within the engine that burns through the engine case. [AVV/693]

(AV/2383) The engine and fan exhaust thrust reverser shall comply with the requirements of Federal Aviation Regulations (FAR) Part 33, FAR Part 34 (Emissions), and appropriate sections of FAR Part 21. (Note: The FAR Part 33, 34, and 21 Amendment levels should be consistent with the original Type Certificate and/or an amended Type Certificate basis.) [AVV/887]

(AV/3047) The propulsion system and its components, not covered by the engine and fan exhaust thrust reverser FAA Type Certificate, shall comply with the requirements as specified in the applicable paragraphs of FAR 25 as defined in subsequent requirements herein or in Appendix C. (Note: The applicable FAR Part 25 Amendment level

will be consistent with the design solution; i.e., an existing previously certified design solution or a new design solution.) [AVV/2341]

(AV/2524) THE PROPULSION SYSTEM SHALL MEET THE FUEL VENTING REQUIREMENTS OF FAR PART 34, SUBPART B. (THRESHOLD, KPP) [AVV/888]

(AV/2525) THE PROPULSION SYSTEM SHALL MEET THE SMOKE EMISSION REQUIREMENTS OF FAR PART 34, SUBPART C. (THRESHOLD, KPP) [AVV/889]

(AV/2526) THE PROPULSION SYSTEM SHALL MEET THE GASEOUS EXHAUST EMISSION REQUIREMENTS OF FAR PART 34, SUBPART C. (THRESHOLD, KPP) [AVV/890]

(AV/2357) No catastrophic or hazardous malfunction of the propulsion system shall result from Air Vehicle operation at negative accelerations within its flight envelope, for durations of up to 5 seconds. [AVV/542, AVV/1672]

3.1.3.2.2 Propulsion System Thrust Reversers

(AV/2066) The Air Vehicle shall have the capability to reverse thrust on all four engines during ground operations. [AVV/883, AVV/1673]

(AV/1040) The Air Vehicle shall be capable of deploying the inboard thrust reversers at a maximum airspeed condition of at least 300 KIAS or 0.825 Mach, whichever is lower. [AVV/44, AVV/1660]

(AV/2650) The Air Vehicle shall be capable of restowing the inboard thrust reversers at a maximum airspeed condition of at least 250 KIAS or 0.77 Mach, whichever is lower. [AVV/2046, AVV/1632]

3.1.3.2.3 Propulsion System Air Inlet System

(AV/2401) The propulsion system shall operate without any severe adverse engine operating characteristics, as defined in AC 25.939-1 Appendix 1, within the Air Vehicle's envelope for normal entry rate stall. [AVV/620, AVV/2034]

(AV/2361) The propulsion system shall provide stable and stall free engine operation (steady state and normal transient) throughout the Air Vehicle ground operating envelope with crosswind components of up to 40 knots, with procedures as defined in Appendix E, section E3.1.3, including changes required by Air Vehicle modifications. [AVV/2035, AVV/619]

(AV/2385) The propulsion system shall comply with the requirements specified in FAR Part 25, paragraphs 25.1091 Air induction, and 25.1103(a) Induction system ducts and air duct systems. [AVV/2048, AVV/913, AVV/623]

(AV/2362) The propulsion system inlet anti-icing subsystem shall provide icing protection in accordance with the requirements of FAR Part 25.1093(b) Induction system icing protection. [AVV/633, AVV/634]

3.1.3.2.4 Propulsion System Thrust Control System

(AV/2393) The propulsion system shall modulate thrust in a stable, controlled, and responsive manner from maximum forward thrust to maximum available reverse thrust, without exceeding engine limits. [AVV/1319, AVV/1318, AVV/2030]

(AV/2407) During the selection of power lever positions in any sequence at any rate, the engine shall be free from any adverse engine operating characteristics as defined in Advisory Circular AC 25.939-1. [AVV/2041, AVV/1308, AVV/1309]

(AV/2513) The propulsion system transient response shall allow the Air Vehicle to execute a successful go-around. [AVV/1311, AVV/2033]

(AV/2511) The Propulsion System transient response shall allow the Air Vehicle to execute a successful aborted take-off. [AVV/2044, AVV/1856]

(AV/2409) The Air Vehicle shall retain the capability for propulsion system normal and emergency shutdown without damage to the engine. [AVV/2042, AVV/1314]

3.1.3.2.5 Propulsion System Starting System

(AV/2372) The Air Vehicle shall provide the capability to restart engines in flight. [AVV/671, AVV/2026]

(AV/2370) The Air Vehicle shall provide the capability for aborted and repeated engine start attempts without damage to the engine starting subsystem. [AVV/1330]

3.1.3.2.6 Propulsion System Installation

(AV/2364) The nacelle cooling system shall control, distribute, and exhaust the cooling air required to maintain the temperatures of engine fluids, IDG fluids, propulsion system components (including engine mounted airframe accessories) and structure within the temperature limits established for these fluids, components and structure under ground and flight operating conditions, and after normal engine shutdown. (FAR Part 25.1041) [AVV/991, AVV/676, AVV/2025]

3.1.3.2.7 Propulsion System Fire Protection

(AV/2398) The propulsion system fire protection systems shall comply with the requirements of FAR Part 25 paragraph 25.1195(b) Fire extinguishing systems. [AVV/1433, AVV/1432, AVV/2031]

(AV/3063) The propulsion system fire protection systems shall comply with the requirements of FAR Part 25 paragraph 25.1187 Drainage and ventilation of fire zones. [AVV/1431, AVV/1430, AVV/2052]

(AV/3061) The propulsion system fire protection system shall comply with applicable requirements in FAR Part 25, as identified in Table 3.1.3.2.8-1. [AVV/2453]

Table 3.1.3.2.8-1. Applicable Paragraphs in FAR Part 25 for Propulsion System Fire Protection

Paragraph Number	Paragraph Title	Amendment	Verification Method
25.865	Engine Mounts	Amdt. 25-23, April 8,1970	Analysis.
25.867	Other Components (exhaust nozzle)	Amdt. 25-23, April 8,1970	Analysis.
25.1182	Nacelle Areas Behind Firewalls...Containing Flammable Lines	Amdt. 25-11, May 8, 1967	Analysis.
25.1183	Flammable Fluid-Carrying Components	Amdt. 25-57, February 23, 1984	Analysis.
25.1185	Flammable Fluids	Amdt. 25-19, October 17,1968	Analysis.
25.1189	Shutoff Means	Amdt. 25-57, February 23, 1984	Analysis.
25.1191	Firewalls		Analysis.
25.1193	Cowling & Nacelle Skins		Analysis
25.1195(a)(c)	Fire Extinguisher System	Amdt. 25-46, October 30,1978	Analysis
25.1197	Fire Extinguishing Agents	Amdt. 25-40, March 17,1977	Analysis
25.1199	Extinguishing Agent Containers	Amdt. 25-40, March 17,1977	Analysis
25.1201	Fire Extinguishing System Materials		Analysis
25.1203	Fire Detection Systems	Amdt. 25-26, March 24,1971	Analysis
25.1207	Compliance	Amdt. 25-46, October 30,1978	Analysis

3.1.3.3 Airframe

(AV/3068) Air Vehicle structure shall be capable of withstanding limit loads without suffering detrimental deformations. [AVV/1858, AVV/1506, AVV/1905]

(AV/3069) Air Vehicle structure shall be capable of withstanding ultimate load without failure. [AVV/1906, AVV/1904]

(AV/3070) All Air Vehicle structural components (including ducts, panels, fairings, shields, barriers and their supporting ribs and stiffeners) shall endure exposure to the combined discrete-frequency and random noise environments experienced during normal operation in the Air Vehicle service environment without deterioration that renders the item unserviceable. [AVV/1657, AVV/1531]

(AV/3073) Flutter, buzz, divergence, or other related dynamic instabilities shall not occur at speeds up to 1.15 V_L at constant Mach number, and at constant altitudes up to the Mach numbers attainable in a 30° terminal dive. [AVV/1501, AVV/1503, AVV/1502]

(AV/3092) For any critical flutter mode or for any significant dynamic response mode for all altitudes and flight speeds from minimum cruising speeds up to V_L / M_L, the total (aerodynamic plus structural) damping coefficient, g,

shall be not less than 0.03, unless technical justification for an alternate criterion is provided and accepted by the USAF. [AVV/2482, AVV/1503]

(AV/3074) The airframe shall remain free of widespread fatigue damage during normal operations and maintenance throughout 45,000 hours of equivalent design usage for the baseline Air Vehicle (FY 93 Mission Profiles). [AVV/1479, AVV/2461]

(AV/3075) Pylons, pylon attach fittings, and safety of flight structural components shall be capable of maintaining adequate residual strength in the presence of material, manufacturing, and processing defects, as well as damage induced during normal usage and maintenance until the damage is detected through periodic scheduled inspections. [AVV/1907, AVV/1545]

(AV/3082) Air Vehicle structure, with the exception of the pylon and propulsion system, shall be capable of withstanding the loads resulting from the transient and steady state response of the Air Vehicle subsequent to the loss of 90 percent of an engine fan blade without suffering detrimental deformation. [AVV/1904, AVV/1506]

(AV/3083) Air Vehicle structure, with the exception of the pylon and propulsion system, shall be capable of withstanding loads resulting from the transient and steady state response of the Air Vehicle subsequent to the loss of 90 percent of an engine fan blade, multiplied by a factor of safety of 1.5, without failure. [AVV/1904, AVV/1506]

(AV/3084) The pylon and engine mounts shall be capable of withstanding the loads resulting from the transient and steady state response, of the Air Vehicle subsequent to the loss of 90 percent of an engine fan blade without failure. [AVV/1904, AVV/1506, AVV/1906]

3.1.3.4 Utilities and Subsystems

3.1.3.4.1 Fuel Subsystem Requirements

(AV/2418) The fuel subsystem shall supply fuel at engine inlet conditions required by the engine throughout the full power range and the ambient temperature and altitude envelope specified in Figure 3.1.9.1.1-1. [AVV/1680, AVV/867, AVV/1136]

(AV/3050) Suction feed capability of the aircraft fuel system shall be sufficient to provide the required fuel flow conditions from sea level to the maximum pressure altitudes as defined in Appendix E, section E3.1.4. [AVV/1278, AVV/1727]

(AV/2324) The fuel subsystem shall supply fuel at APU inlet conditions required by the APU throughout the ambient temperature and altitude envelope specified in Figure 3.1.9.1.1-1. [AVV/1733, AVV/1732, AVV/1135]

(AV/2735) Air Vehicle modifications shall maintain a minimum of 3 percent expansion space in each main tank during overwing filling. [AVV/1730]

(AV/2405) The Air Vehicle shall operate without fuel system degradation with continuous fuel contamination levels as defined in the CF6-80C2L1F Engine Type Certificate. [AVV/2061, AVV/1752]

(AV/3064) The Air Vehicle shall operate for 8.2 hours with the engine fuel filter in full bypass mode with severe fuel contamination levels per the guidance of JSSG-2007, Table A, Continuous Contamination. (Note: there may be degradation associated with severe levels of contamination.) [AVV/1280, AVV/2454]

3.1.3.4.2 Landing Gear Subsystem (Not Used)

3.1.3.4.3 Hydraulics Subsystem Requirements

(AV/2303) The hydraulic system shall provide sufficient hydraulic power and responsiveness to the using systems in all ground and flight operations. [AVV/880, AVV/2470]

(AV/2304) Hydraulic system modifications shall comply with the applicable sections of SAE AS5440 for a Type II, 3000 psi Class system as defined in Table 3.1.3.4.3-1. Non-specified sections of SAE AS5440 should be used for guidance. [AVV/110]

Table 3.1.3.4.3-1. Applicable Paragraphs in SAE AS5440

Paragraph Number	Paragraph Title	Applicable Sentences	Verification Method
3.6.1	Fluid Temp Limitations	1st, 2nd	Analysis
3.6.3	Surge Pressure	1st	Analysis
3.6.3.1	Pressure Limitations	1st	Analysis
3.6.3.4	Pressure Regulation	1st	Analysis
3.6.10	Power Pumps	1st	Analysis Lab Test

(AV/2305) New or modified hydraulic components shall be compatible with MIL-PRF-83282 hydraulic fluids. [AVV/1822]

(AV/2310) The Air Vehicle shall provide the aircrew with, as a minimum, hydraulic system functions and indications equivalent to the baseline Air Vehicle. [AVV/2411]

(AV/2312) The hydraulic system and engine-driven hydraulic pumps shall have compatible interfaces for reliable operation. [AVV/1888, AVV/1887, AVV/1825]

3.1.3.4.4 Environmental Control Subsystems

(AV/2337) New and modified elements of the RERP ECS shall meet the applicable requirements, as defined in Table 3.1.3.4.4-1, of FAR Part 25. [AVV/1574]

Table 3.1.3.4.4-1. Applicable Paragraphs in FAR Part 25 for ECS

Paragraph Number	Paragraph Title	Amendment	Verification Method
25.1301	Function & Installation		Analysis
25.1309	Equipment Systems and Installation	Amdt. 25-41 July 18, 1977	Analysis
25.1438 (b)	Pressurization and Pneumatic Systems		Analysis
25.1461	Equipment Containing High Energy Rotors	Amdt. 25-41, Sept. 9, 1977	Analysis

3.1.3.4.4.1 Engine Bleed Air Subsystem

(AV/2333) The engine bleed air subsystem shall be compatible with the bleed air system design limits for the un-modified portions of the Air Vehicle. [AVV/1684]

(AV/2335) Engine bleed air system shall provide necessary indications to the aircrew regarding the system's operating status. [AVV/1682]

(AV/2584) The engine bleed air subsystem shall meet the bleed air demands of the air conditioning, engine starting, actuation of thrust reversers, and floor heat subsystems. [AVV/2418, AVV/1687, AVV/2412]

(AV/2347) The new and modified bleed air subsystem ducting shall incorporate provisions as necessary to prevent chafing and excessive loads on adjacent components. [AVV/1688]

(AV/2659) The bleed air subsystem shall not induce subsystem instabilities or inadvertent shutdown of an engine. [AVV/1882, AVV/1874, AVV/1689]

3.1.3.4.4.2 Cabin Air Conditioning Subsystem

(AV/2667) The Air Vehicle shall retain the functions and meet the performance of the baseline Air Vehicle environmental control system. [AVV/1876, AVV/1683, AVV/2435]

(AV/2668) When supplied by the engines, the bleed airflow rates at the inlets of the flow control valves shall be at least that of the baseline Air Vehicle during similar ground and flight operations. [AVV/2420, AVV/2419, AVV/1694]

(AV/2897) When supplied by both APUs, the bleed airflow rates at the inlets of the flow control valve(s) shall be at least that of the airflow of the baseline Air Vehicle during similar ground operations. [AVV/1895, AVV/1695]

(AV/3045) Air Vehicle modifications shall provide, at a minimum, fresh air ventilation rates equal to the baseline Air Vehicle's rates for the flight station, relief crew, and aft troop compartments. [AVV/2423, AVV/2443, AVV/2444]

3.1.3.4.4.3 Equipment Cooling

(AV/2342) Air Vehicle modifications shall provide the required coolant airflow rate and temperature, as defined in paragraph 3.5.4 of ARINC 600, for both new and modified equipment and C-5 AMP-installed equipment requiring coolant air provisions. [AVV/2421, AVV/1698]

(AV/2660) Avionics equipment shall be supplied sufficient cooling air to maintain an ambient temperature for each item of equipment, in accordance with the equipment's design thermal limitations, without the use of support equipment. [AVV/1896, AVV/1699]

3.1.3.4.4.4 Cabin Pressurization

(AV/2339) At normal cruise speed and engine power, the Air Vehicle shall provide a mean cabin altitude of no greater than 8,000 feet for pressure altitudes up to and including 40,000 feet, and maintain a constant pressure differential from 40,000 feet up to the maximum Air Vehicle operating altitude. [AVV/2441, AVV/1700]

(AV/2340) With only one air refrigeration unit and the floor heat subsystem operating, the Air Vehicle shall provide a mean cabin altitude not to exceed 10,000 feet at any pressure altitude up to 38,000 feet and maintain a constant pressure differential at any altitude from 38,000 feet up to a maximum Air Vehicle operating altitude at normal cruise speed and engine power. [AVV/2442, AVV/1702]

(AV/2669) The Air Vehicle shall retain, as a minimum, the functionality and performance of the baseline Air Vehicle's cabin pressurization system. [AVV/1877, AVV/1706]

3.1.3.4.5 Equipment and Furnishings

3.1.3.4.5.1 Cargo Compartment Smoke Detection

(AV/2417) Cargo compartment smoke detectors shall be in accordance with FAA TSO-C1c, Type II. [AVV/1832]

(AV/2594) Cargo compartment smoke detectors shall be mounted to the fixed airframe structure in the same position as the previous detectors. [AVV/1833]

3.1.3.4.5.2 Lighting

(AV/2772) New and modified displays shall be constructed, arranged, and mounted so that ambient light (e.g. from the cabin lights, sunlight, floodlights,...) does not cause the display to be unreadable for non-NVIS operations. [AVV/1831]

(AV/3085) The cargo compartment lighting system (Overhead, side and curb lights) shall provide at least 15 foot-candles of illumination at 85 percent of the cargo floor tie-down and vehicle tie-down attaching points and a minimum of 2 foot-candles at all the cargo floor tie-down and vehicle tie-down attaching points, with the cargo compartment empty and the Overhead, Side and Curb lights on. [AVV/2471, AVV/2472]

(AV/3051) Air Vehicle modifications shall retain, at a minimum, the functions and illumination patterns of the baseline Air Vehicle's cargo compartment lighting subsystem. [AVV/2447, AVV/2466, AVV/2465]

3.1.3.4.5.3 Night Vision Imaging System (NVIS) Compatibility

(AV/3025) Lighting control for new and modified flight station equipment, with the exception of the Embedded Diagnostic System display, shall be incorporated into the applicable zonal controls of the baseline Air Vehicle. [AVV/1967]

(AV/2909) New or modified flight station lighting, control, and display components, with the exception of the Embedded Diagnostic System display, shall comply with all applicable requirements of MIL-STD-3009 for the usage of Type I and Type II, Class B NVIS. This requirement applies at the lighting, control, and display component level (i.e., switches, indicators, etc.), not at the panel level, such that legacy components may be incorporated into modified panels without upgrading the legacy components to be NVIS compatible. [AVV/1834]

(AV/2924) Lighting uniformity and luminance levels for new and modified flight station equipment shall conform to the uniformity and luminance levels of the baseline Air Vehicle. [AVV/1835, AVV/2473, AVV/2474]

3.1.3.4.6 Auxiliary Power

(AV/2761) The modified Air Vehicle configuration shall include two auxiliary power units (APU). [AVV/1736]

(AV/2762) The auxiliary power units shall be FAA approved to TSO-C77a. [AVV/1738]

(AV/2763) The auxiliary power units shall be installed to the intent of the applicable paragraphs, as defined in Table 3.1.3.4.6-1, in FAR Part 25. [AVV/1739]

Table 3.1.3.4.6-1. Applicable Paragraphs in FAR Part 25 for APU Installation

Paragraph Number	Paragraph Title	Amendment	Verification Method
25.363	Side load on engine mount	Amdt. 25-91, July 29, 1997	Analysis.
25.371	Gyroscopic loads	Amdt. 25-91, July 29, 1997	Analysis.
25.901	Installation	Amdt.25-46, Oct. 30, 1978	Analysis.
25.1041	Cooling, General	Amdt. 25-38 Dec. 20, 1976	Analysis.
25.1091	Air Induction	Amdt. 25-100, Sept. 14, 2000	Analysis.
25.1103	Induction system ducts and air duct systems	Amdt. 25-1103, Sept. 14, 2000	Analysis.
25.1121	Exhaust system, General	Amdt. 25-40, Mar. 17, 1977	Analysis.
25.1123	Exhaust piping	Amdt. 25-40, Mar. 17, 1977	Analysis.
25.1142	Auxiliary power unit controls	Amdt. 25-46, Oct. 30, 1978	Analysis.
25.1337	Powerplant instruments	Amdt. 25-40 Mar. 17, 1977	Analysis.

(AV/2322) The APU(s) shall provide bleed air to meet the demands of the following subsystems, operating individually: main engine start subsystems, air conditioning subsystem, air turbine motors (ATM), and thrust reversers throughout the ground operating envelope defined in Figure 3.1.3.1.4-1. [AVV/1741, AVV/1740]

(AV/2575) Each APU shall be capable of starting and operating in-flight up to a pressure altitude of 25,000 feet. [AVV/1746, AVV/1745]

(AV/3060) The APU shall provide sufficient bleed air for main engine starter assist in the event of a four engine shutdown in-flight. [AVV/2467, AVV/1742]

(AV/2604) The APU system shall provide bleed air conditions compatible with the Air Vehicle bleed air system design limits. [AVV/2414]

(AV/2606) The APU System shall provide bleed air to the cargo floor heat system for rapid warm-up of the cargo floor as defined in Appendix E, section E3.1.5. [AVV/2416]

(AV/2764) The APU System shall provide the aircrew with necessary system controls and operating status indications. [AVV/1751]

(AV/2738) The APU fire protection system shall comply with applicable requirements, as defined in Table 3.1.3.4.6-2, of FAR Part 25. [AVV/1754]

Table 3.1.3.4.6-2. Applicable Paragraphs of FAR Part 25 for APU Fire Protection

Paragraph Number	Paragraph Title	Amendment	Verification Method
25.1181	Designated Fire Zones	Amdt. 25-72 July 20, 1990	Analysis
25.1183	Flammable fluid-carrying components	Amdt. 25-101 Dec. 19, 2000	Analysis
25.1187	Drainage and ventilation of fire zones		Analysis
25.1191	Firewalls		Analysis
25.1195a,c	Fire extinguishing systems	Admt. 25-46 Oct. 30, 1978	Analysis
25.1197	Fire extinguishing agents	Amdt. 25-40 Mar. 17, 1977	Analysis
25.1199	Extinguishing agent containers	Amdt. 25-40 Mar. 17, 1977	Analysis
25.1201	Fire extinguishing system materials		Analysis
25.1203	Fire-detector system	Amdt. 25-26 Mar. 24, 1971	Analysis

(AV/3052) The APU fire extinguishing system shall comply with FAR Part 25.1195b. [AVV/2436, AVV/1755, AVV/2437]

(AV/2703) The Air Vehicle's Air Turbine Motors shall retain, at a minimum, the functions and performance of the baseline Air Vehicle's Air Turbine Motors. [AVV/1813]

3.1.3.4.7 Flight Controls Subsystem Requirements

3.1.3.4.7.1 Mechanical Characteristics

(AV/2656) The modified flight control system shall produce surface rates at least equivalent to the baseline Air Vehicle for critical maneuvers as defined in Appendix D. [AVV/2383, AVV/1720, AVV/2483]

(AV/2557) Normal operation of artificial stability systems, within the service flight envelope, shall not degrade any flight handling characteristics below the baseline aircraft as defined in Appendix D. [AVV/2381, AVV/1721]

(AV/2658) Following failure of the artificial stability systems, the Air Vehicle flying qualities shall retain the equivalent MIL-F-8785 (ASG) flying quality levels of the baseline Air Vehicle. [AVV/1722, AVV/2384]

(AV/2960) New and modified flight control mechanical equipment shall retain the same functions and meet or exceed the performance of the existing flight control mechanical equipment. [AVV/1865]

(AV/2470) The flight control systems shall withstand the loads imposed by the pilots, the automatic flight control system (AFCS), and the automatic lift distribution control system (ALDCS) during the flight and ground gust conditions. [AVV/1538, AVV/1537]

(AV/2705) The modified Air Vehicle shall indicate the position of the leading edge slats. [AVV/1815, AVV/1872]

3.1.3.4.7.2 ALDCS

(AV/2611) The ALDCS shall retain the functionality and performance characteristics of the ALDCS of the baseline Air Vehicle, and system stability minimums as defined in MIL-F-9490D. [AVV/2382, AVV/1724, AVV/2452]

3.1.3.4.7.3 Directional Control

(AV/2690) The air minimum control speed, VMCA, shall be below $1.2V_S$ for the takeoff configuration under the following conditions:

a. The most critical engine inoperative;

b. The remaining engines producing take-off thrust at all speeds;

c. The lightest normal take-off weight;

d. With trim settings normally employed in a symmetric thrust take-off;

e. Bank angle not greater than 5 degrees;

f. Automatic systems active;

g. Using a rudder pedal force not exceeding 180 pounds. [AVV/1725, AVV/2385]

(AV/2692) In take-off configuration with two engines inoperative on the same side of the aircraft, it shall be possible, to safely make heading changes in both directions up to the lesser of 15 degrees, or the point at which rudder pedal force exceeds 180 pounds, under the following conditions:

a. The wings held approximately level;

b. Speed equal to $1.4V_S$ in takeoff configuration;

c. The center of gravity in the most forward position;

d. The flaps in the most favorable climb position. [AVV/1726, AVV/2387]

(AV/2691) In take-off configuration with two engines inoperative on the same side of the aircraft, it shall be possible to make 20 degree banked turns with, and against, the inoperative engines, from steady flight at the following conditions:

a. Speed equal to $1.4V_S$ in the takeoff configuration;

b. Remaining engines at maximum continuous power;

c. The center of gravity in the most forward position;

d. The flaps in the most favorable climb position. [AVV/1759, AVV/2386]

(AV/2693) The Air Vehicle shall be able to maintain longitudinal, directional and lateral trim with the critical engine inoperative at the following conditions:

a. Climbing flight at $1.4V_S$ for the clean configuration;

b. Initial bank angle not exceeding 5 degrees;

c. The remaining engines at maximum continuous power;

d. The landing gear and flaps retracted. [AVV/1760, AVV/2388]

(AV/2694) The Air Vehicle shall be capable of maintaining trim at a constant heading with the two critical engines inoperative at the weight at which the two engine-inoperative rate of climb in feet per minute is no less than $0.013V_S$ for configuration and conditions defined below:

a. Remaining engines at maximum continuous power available at each altitude;

b. Landing gear retracted;

c. Wing flaps in the most favorable position;

d. An altitude of 5,000 feet;

e. The most unfavorable center of gravity. [AVV/2389, AVV/1761]

(AV/2695) The air minimum control speed, V_{MCA}, following the failure of the critical engine shall not exceed $1.2V_S$ under the following conditions:

a. The rudder force does not exceed 180 pounds;

b. Takeoff thrust on the remaining engines;

c. No throttle adjustment on the remaining engines;

d. Gear down;

e. Flaps at takeoff position;

f. Heading change will not exceed 20 degrees before recovery is completed. [AVV/2392, AVV/1763]

(AV/2696) The critical-engine-failure speed during the take off, V_1, shall not be less than the air minimum control speed with zero bank angle. [AVV/2390, AVV/1764]

(AV/2653) During automatic approach and landing, the Air Vehicle autoland system shall retain the same degree of repeatability as the system on the baseline Air Vehicle as defined in Appendix D. [AVV/2357, AVV/1812, AVV/2475]

3.1.3.4.7.4 Requirements for Full Power Systems

(AV/2697) The primary flight control power actuators shall have adequate hydraulic power available to provide acceptable controllability following the loss of any one hydraulic system. Acceptable controllability as used here will mean a maneuver capability sufficient for mission completion. [AVV/1770]

(AV/2700) The loss of any two flight control hydraulic systems shall not result in an operational state lower than level III. [AVV/2405, AVV/1778]

(AV/2699) Loss of power on all engines shall not result in an operational state lower than level IV. [AVV/1783]

(AV/2707) The Air Vehicle shall be capable of achieving 1.5-g at maximum level flight speed at sea level, with one hydraulic control system inoperative, and at the most forward c.g. limit. Elevator control force in this maneuver, with the Air Vehicle trimmed for 1-g flight, will not exceed 60 pounds. [AVV/2395, AVV/1807]

(AV/2710) The Air Vehicle shall have the capability of landing with a 90-degree crosswind component of at least the same as the baseline Air Vehicle, as defined in Appendix D, for the landing configuration, with a snow packed and ice covered runway, under the following conditions:

a. With one hydraulic system inoperative;

b. The elevator control force trimmed to within 5 pounds at $1.4V_{SL}$ in configuration PA;

c. Rudder control forces not to exceed 180 pounds;

d. Nominal vehicle weight. [AVV/2393, AVV/1808]

(AV/2708) With one hydraulic system inoperative, the Air Vehicle shall be capable of landing with elevator control forces not exceeding 80 pounds at $1.4V_{SL}$ in configuration PA when:

a. Loaded at the most forward cg limit and at heavy weight;

b. The elevator control force is trimmed to within 5 pounds. [AVV/2394, AVV/1810]

(AV/2706) The secondary directional trim system of the Air Vehicle shall have enough authority, with the primary trim system inoperative, to meet the Air Vehicle performance requirements under the following conditions:

a. The critical engine failed and the others at normal rated thrust;

b. A speed of $1.4V_S$ for the landing configuration;

c. Weight at the lightest normal service loading. [AVV/2407, AVV/2406]

3.1.3.4.8 Electrical Subsystem Requirements

(AV/2765) New and modified electrical power system equipment shall comply with the applicable sections of MIL-STD-7080 as defined in Table 3.1.3.4.8-1. [AVV/93]

Table 3.1.3.4.8-1. Applicable Paragraphs in MIL-STD-7080

Paragraph Number	Paragraph Title	Applicable Sentences	Verification Method
4.1.1	Selection	All	Analysis
4.1.3	Non-metals	All	Analysis
4.5	Grounding	All	Analysis
4.7.1	Mounting Hardware	All	Analysis
4.8.1	Clearance	All	Analysis
4.8.2	Physical Protection	1st	Analysis
4.9	Wiring	All	Analysis
4.9.1	Power Feeder Size	All	Analysis
4.9.3	Wire routing	All	Analysis
5.1	AC Generators	All	Analysis
5.12	Relays	All	Analysis

(AV/1092) The Air Vehicle electrical power subsystem shall provide AC and DC power at a sufficient capacity to power all existing, new, and modified systems and equipment. [AVV/551]

(AV/3065) The Air Vehicle shall provide the aircrew, at a minimum, electrical system functionality equivalent to the electrical system functionality of the baseline Air Vehicle. [AVV/2455]

(AV/3066) The electrical system shall provide the aircrew with necessary system controls and operating status indications. [AVV/2456]

(AV/2585) New electrical generating systems shall be compatible with the Air Vehicle's bus protection circuitry. [AVV/553]

(AV/2589) The Air Vehicle electrical power subsystem shall include auxiliary power unit (APU) generators of a sufficient capacity to allow self-sufficient ground operation, and to allow continued safe flight and landing in the event of a failure of all engine-driven electrical generators. [AVV/1889, AVV/980]

(AV/2321) The Air Vehicle Electrical Power Generation Subsystem shall control AC voltage, AC frequency, and AC load instability during any operating condition within the limits of MIL-STD-704C. [AVV/1891]

3.1.3.5 Avionics

3.1.3.5.1 Avionics Subsystem And Avionics Integration Requirements

(AV/2942) Avionics system modifications shall retain, as a minimum, the installed performance of the baseline Air Vehicle's system. [AVV/1978, AVV/1977, AVV/1976, AVV/1653]

(AV/1082) The C-5 RERP avionics architecture shall utilize the C-5 AMP avionics architecture as a baseline. [AVV/80]

(AV/2972) For new and modified subsystems, information necessary for operation of the Air Vehicle shall be processed and displayed consistent with the way it is processed and displayed for the baseline Air Vehicle. [AVV/1984, AVV/1983, AVV/1982, AVV/2424]

3.1.3.5.2 Cautions, Warnings and Advisories (CWA)

(AV/3078) All annunciations contained within the annunciation panel on the pilot/copilot center console shall be incorporated in the CWA system MFDU annunciation, and the annunciation panel eliminated. [AVV/2469, AVV/2468]

(AV/3012) New and modified engine displays and CWA data associated with modified systems shall be locatable by selection of the pilot or copilot, in an area consistent with the engine instrument location in the baseline Air Vehicle. [AVV/1954]

(AV/3019) No single point failure within the avionics system shall degrade the CWA function. [AVV/1989, AVV/1961]

(AV/2786) During a failure of a new or modified system, the annunciation of which is considered essential to the flight crew, the CWA format of the baseline Air Vehicle shall be used to adequately describe the nature of the failure. [AVV/1768]

(AV/3006) The CWA subsystem shall alert the operator to any change in performance of a mission-critical or safety-critical function for new and modified subsystems in a clear and timely manner. [AVV/1775, AVV/1774, AVV/1922]

3.1.3.5.3 Controls and Displays

(AV/3009) New and modified display formats shall be selectable on any pilot, copilot, flight engineer, and navigator MFDU. [AVV/1951]

(AV/3013) Primary flight data, navigation data, status, and auto-pilot mode annunciations and engine data shall be located, when selected, in the primary field of view at the pilot and copilot stations. [AVV/1955]

(AV/3015) When selected, all required engine information as specified in applicable sections of FAR 25.1305 shall be displayed within a contiguous, single display area. [AVV/1975, AVV/1957, AVV/836]

(AV/3016) Air Vehicle modifications shall not introduce any single point failure that would prevent safety-critical information from being viewed by both pilots. As an objective, Air Vehicle modifications should not introduce any single point failure that would prevent mission-critical information from being viewed by both pilots. [AVV/1990]

(AV/1227) New and modified displays shall be located so they may be read to the degree of accuracy required by personnel in the normal operating or servicing positions without requiring the operator / maintainer to assume an uncomfortable, awkward or unsafe position. [AVV/2430, AVV/237]

(AV/2902) Control/display relationships of new, modified, or relocated controls and displays shall be apparent through proximity, similarity of groupings and similar techniques. [AVV/238]

(AV/2910) New and modified controls and displays required for Air Vehicle start-up shall be operable using USAF present-inventory cold weather clothing. The use of non-peculiar tools is allowed to meet this requirement. [AVV/1945]

3.1.4 (Not Applicable)

3.1.5 Reliability Requirements

(AV/1125) The Mean Time Between Failure (MTBF) shall be no less than 31.0 flight minutes. The assumptions, conditions, and allocations in Appendix A apply. As an objective, MTBF should be no less than 44.0 flight minutes. MTBF is defined in Section 5, Technical Reference Information. [AVV/136]

3.1.6 Maintainability And Maintenance Concept Requirements

(AV/1226) The maintainer interface for new and modified equipment shall optimize compatibility with personnel and minimize conditions which can degrade human performance or contribute to human error. [AVV/901, AVV/1643, AVV/2397]

(AV/2083) Air Vehicle modifications shall be designed such that repetitive routine maintainer tasks are minimized. [AVV/902]

(AV/2906) New and modified equipment shall be accessible and maintainable by the maintainer population as described in Table 3.1.6-1. [AVV/1644, AVV/2359]

Table 3.1.6-1, Anthropometric Models

	Min (Inches)	Max (Inches)
Stature	60.0	74.0
Shoulder Height	47.5	61.9
Sitting Height	30.5	40.0
Thumb-Tip Reach	24.9	36.6
Thumb-Tip Reach Extended	28.3	41.1
Forearm Circumference Extended	7.9	13.0
Hand Circumference w/Thumb	8.5	11.5
Shoulder Breadth	12.2	17.8
Chest Depth	6.5	12.2
Hip Breadth	11.2	16.8

(AV/2904) New and modified equipment that weighs more than 37 pounds shall be prominently labeled with weight of the object and lift limitation, e.g., mechanical or two-person lift. The labels for new and modified items weighing between 38 and 64 pounds (inclusive) shall specify two person lift. The labels for new and modified items weighing more than 64 pounds shall specify mechanical lift. [AVV/2319]

(AV/2939) New and modified Air Vehicle LRUs shall be equipped with appropriately-labeled handles, grasp areas, or mechanical attach points, to aid removal and replacement. [AVV/2361]

(AV/2182) New and modified equipment shall be maintainable with USAF present-inventory biological/chemical warfare ensembles. The use of non-peculiar tools is allowed to meet this requirement. This requirement applies only to thru-flight inspections identified by Appendix E, section E3.2.1 (including changes required by Air Vehicle modifications), including the replenishment of safety critical fluids and gaseous charge pressurization. [AVV/2360, AVV/1079]

(AV/2191) New and modified equipment shall be maintainable with USAF present-inventory cold weather gear. The use of non-peculiar tools is allowed to meet this requirement. This requirement applies only to thru-flight inspections identified by Appendix E, section E3.2.1 (including changes required by Air Vehicle modifications), including the replenishment of safety critical fluids and gaseous charge pressurization. [AVV/1080, AVV/2362]

(AV/1134) New Air Vehicle equipment shall be maintainable using a 2-level maintenance concept. [AVV/144]

(AV/1142) New and modified Air Vehicle equipment shall be of LRU/LRM design. [AVV/152]

(AV/2267) Air Vehicle modifications shall adhere to a "one-deep" packaging concept for LRUs. Variances may be permissible for individual LRUs on a case by case basis. [AVV/1166]

(AV/2940) New engine pylons shall provide access panels to areas requiring periodic inspections and preventive maintenance during field and depot level maintenance activities. [AVV/1650]

(AV/2941) The Air Vehicle design shall support the capability to remove and replace each engine buildup (EBU) assembly using a bootstrap system. As an objective, the Air Vehicle should incorporate a bootstrap system for engine replacement that is integral to the primary structure. [AVV/1651]

(AV/3046) The Air Vehicle Mean Time To Repair (MTTR) shall be no greater than 85 minutes. The assumptions, conditions, and allocations in Appendix A apply. MTTR is defined in Section 5, Technical Reference Information. [AVV/2334]

(AV/2938) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to operate in a bare base environment (no USAF presence, AFPAM 10-219 Vol. 5, 01 Jun 96, Bare Base Conceptual Planning Guide) without special facilities for maintenance. [AVV/1641]

(AV/1304) New and modified Air Vehicle equipment and equipment installation shall be designed such that it can be maintained by three-skill level and five-skill level personnel. [AVV/315]

3.1.7 (Not Applicable)

3.1.8 (Not Applicable)

3.1.9 Environmental Compatibility Requirements

3.1.9.1 Operating and Non-Operating Environment

3.1.9.1.1 Ambient Temperature

(AV/2869) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to fully function within the temperature envelope defined in Figure 3.1.9.1.1-1. [AVV/2368, AVV/2367, AVV/1595]

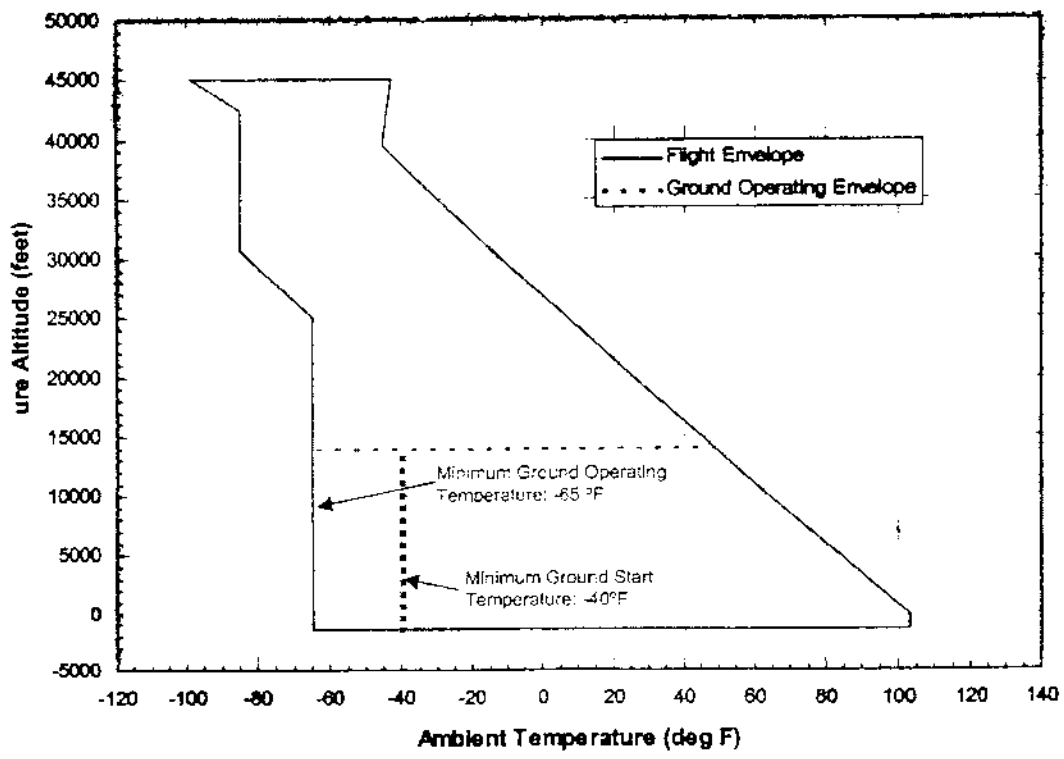


Figure 3.1.9.1.1-1 C-5 RERP Operating Temperature Envelope

(AV/3079) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to fully function after exposure to ambient temperatures ranging from –67 °F to 125 °F. [AVV/188]

3.1.9.1.2 Pressure

(AV/2871) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to fully function within the pressure altitudes from 1,300 feet below sea level to 45,000 feet above sea level. [AVV/1594]

3.1.9.1.3 Humidity

(AV/2874) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to fully function within the relative humidity ranging from zero to 100 percent, including conditions under which condensation occurs in the form of frost as well as water. [AVV/1596]

3.1.9.1.4 Salt Fog

(AV/2876) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to fully function when exposed to a salt-fog atmosphere as described in RTCA DO-160D, Section 14 for Category S equipment. [AVV/1597]

3.1.9.1.5 Sand and Dust

(AV/2878) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to fully function when exposed to blowing fine sand and dust particles as encountered in desert areas, as described in RTCA DO-160D, Section 12 for Category D equipment. [AVV/1598]

3.1.9.1.6 Atmospheric Liquid Water

(AV/2880) Air Vehicle modifications shall not inhibit the Air Vehicle's ability to operate satisfactorily throughout the flight operating envelope at any condition from idle to maximum thrust with up to 5 percent of the total air flow weight in the form of liquid water. [AVV/1599]

3.1.9.2 Induced Environment

(AV/1177) New and modified equipment and subsystems shall be designed to fully function in the environmental conditions of the Air Vehicle compartments in which they are installed, during both operating and non-operating modes. [AVV/188]

(AV/3071) Unmodified Air Vehicle equipment shall withstand exposure to acoustic noise and vibration related to the normal operation of the Air Vehicle. [AVV/1514, AVV/1512]

3.1.10 (Not Applicable)

3.1.11 Materials And Processes Requirements

(AV/1182) Air Vehicle modifications shall be designed and manufactured using materials and process specifications, as approved by the Contractor that meet the environmental requirements as specified herein. [AVV/193]

(AV/3007) Materials used in Air Vehicle modifications shall be resistant to moisture, fungus and corrosion for the specified service life of the Air Vehicle. [AVV/1949]

(AV/2962) Air Vehicle modifications shall be designed and manufactured using raw materials specified and procured on the basis of military specifications, equivalent commercial standards such as the Aerospace Materials Specification (AMS), or equivalent manufacturer specifications. [AVV/1894]

(AV/1474) Air Vehicle modifications shall incorporate measures defined in the LMAS FOD Prevention Manual, Edition 15 and the LMAS Safety Program Plan to prevent introduction of Foreign Object Damage (FOD) in the Air Vehicle during the manufacturing process. [AVV/230]

3.1.11.1 Toxic Chemicals, Hazardous Substances, And Ozone-Depleting Chemicals

(AV/1185) New and modified Air Vehicle subsystems shall not require the use of hazardous materials in their operation and maintenance that would result in an increase of Environment, Safety, and Occupational Health (ESOH) risks and costs. [AVV/196]

(AV/2956) New and modified Air Vehicle subsystems shall not require the use of any Class II ODS for operations and maintenance. [AVV/1880]

(AV/2957) There shall be no additional requirements for hazardous waste disposal over the baseline system. [AVV/1881]

3.1.12 Electromagnetic Environmental Effects

3.1.12.1 Electromagnetic Compatibility

(AV/1451) The Air Vehicle shall be electromagnetically compatible with itself. [AVV/425, AVV/1897]

3.1.12.2 External EME Immunity

(AV/1453) New and modified safety-critical equipment installed in the Air Vehicle shall function when the Air Vehicle is in the presence of the External EME as defined by MIL-STD-464, Section 5.3, Table ID, Average (from 10 kHz to 18 GHz, and at a threat standoff that is no worse than the threat standoff for the baseline Air Vehicle.) [AVV/1899]

3.1.12.3 Indirect-Effects Lightning Protection

(AV/1454) New and modified safety-critical equipment installed in the Air Vehicle shall function in a lightning environment as defined in RTCA/DO-160D, section 22 or equivalent. [AVV/1900]

3.1.12.4 Direct-Effects Lightning Protection

(AV/1455) New and modified Air Vehicle equipment and components installed in an area vulnerable to direct lightning attachment shall prevent lightning currents, as defined in RTCA/DO-160D, section 23 or equivalent, from entering Air Vehicle wiring and maintain physical integrity necessary to ensure flight safety. [AVV/1901]

3.1.12.5 Bonding

(AV/1456) New and modified Air Vehicle equipment and structures shall be electrically bonded, as defined by MIL-STD-464. [AVV/1903, AVV/1902, AVV/428]

3.1.13 Nameplates Or Product Markings Requirements

(AV/1196) New and modified equipment shall have identifications and markings in accordance with the provisions of MIL-STD-130, or an equivalent standard. [AVV/207]

3.1.14 (Not Applicable)

3.1.15 Interchangeability, Standardization, Interoperability, And Commonality Requirements

(AV/1023) Modified C-5A and C-5B aircraft shall be the same configuration except where unavoidable. [AVV/21]

(AV/2711) Modified C-5C aircraft shall be of the same configuration as the C-5A and C-5B, except where unavoidable, while maintaining the unique features required for mission accomplishment. [AVV/1629]

(AV/2265) New and modified LRU/LRM components shall be interchangeable between modified Air Vehicles. [AVV/1165]

(AV/2384) All engine buildup units shall be interchangeable without exchanging any accessories or installed equipment. [AVV/686]

(AV/2430) The pylons, except for the pylon-to-wing fairings, shall be interchangeable between the two outboard locations and between the two inboard locations. [AVV/1648]

(AV/2926) The engine fan cowl, thrust reverser (except for the thrust reverser cascade arrangement), and core cowl shall be interchangeable between all four engine locations. [AVV/1649]

3.1.16 System Safety And Health Requirements

3.1.16.1 General Requirements

(AV/1459) Air Vehicle modifications shall be designed such that no single component failure, common mode failure, human error, or design feature can cause a Catastrophic or Hazardous failure condition/hazard. [AVV/431]

(AV/1460) Air Vehicle modifications shall be designed such that dual independent component failures, dual independent human errors, or a combination of a component failure and a human error involving safety critical command and control functions that could result in a Catastrophic or Hazardous failure condition/hazard meet the associated probability criteria. [AVV/432]

(AV/1218) New and modified Air Vehicle safety critical items shall incorporate damage tolerance or redundancy. [AVV/444]

3.1.16.2 Personnel Safety

(AV/1220) Air Vehicle modifications shall incorporate design measures (e.g. shielding, safety guards, barriers, and/or warning markings) for protection from personnel injury resulting in contact with moving parts, extreme temperatures, high voltages, sharp edges, or other hazards resulting from Air Vehicle modifications. [AVV/435]

(AV/1464) New and modified equipment shall not result in personnel exposure to unacceptable concentrations of toxic substances defined in 29 CFR 1910.1000, Subpart Z for the materials comprising the equipment. [AVV/436, AVV/2333]

3.1.16.3 Flight Safety

(AV/2275) New and modified equipment shall incorporate safety features to prevent Catastrophic or Hazardous failure conditions/hazards by reason of its mode of failure or by the direct effect of such a failure on the Air Vehicle, related equipment or personnel. [AVV/439]

(AV/2274) For systems incorporating new and modified equipment, the failure of one redundant component shall not result in a failure of other system components or degrade their operation. [AVV/1765]

(AV/1470) Emergency modes of operation shall be provided for automatic safety critical systems incorporating new and modified equipment. [AVV/1766]

(AV/2788) Audible verbal warnings for new and modified systems shall reflect calmness and urgency. [AVV/1771]

(AV/2789) The ability to override prolonged, non-flight-safety-critical audible warnings associated with modified systems shall be provided. [AVV/1772]

(AV/2608) Air Vehicle modifications shall not create additional dangerous conditions (relative to the baseline Air Vehicle) for personnel participating in aerial delivery missions. [AVV/1646]

(AV/3008) The probability of loss of cockpit electronic display data shall not be greater than the probability for the baseline Air Vehicle. As an objective, the loss of cockpit electronic display data should meet the criteria in FAA Advisory Circular 25-11, paragraph 4. [AVV/1950]

(AV/3038) The probability of the hazardously misleading display of data shall not be greater than the probability for the baseline Air Vehicle. As an objective, the probability of the hazardously misleading display of data should meet the criteria in FAA Advisory Circular 25-11, paragraph 4. [AVV/2023]

3.1.16.4 Software Safety

(AV/2808) New and modified software shall not cause faults leading to catastrophic or hazardous failure conditions/hazards. [AVV/1854]

3.1.16.5 Crashworthiness

(AV/2820) New and modified systems shall be designed to prevent occupant fatalities and to minimize the number and severity of injuries during crash impacts by utilizing general crash survivability design factors (occupant acceleration environments, occupant environment hazards, and post crash hazards). [AVV/1615]

(AV/2821) New and modified equipment shall be installed such that personnel egress routes are not compromised in the event of a survivable crash. [AVV/1779]

(AV/2824) New and modified equipment shall be installed so as to provide personnel with unimpeded normal or emergency egress. [AVV/1782]

3.1.16.6 Electrical Safety

(AV/2810) New electrical equipment, modifications, rearrangements, or new interfaces for existing electrical equipment shall provide, as a minimum, an equivalent level of safety with the baseline Air Vehicle. [AVV/1616]

(AV/2811) New or modified systems shall comply with the criteria in MIL-HDBK-454, Guideline 1; AFSC DH 1-6, Section 3H; and the safety design criteria in MIL-STD-882D, paragraph A.4.3.3. [AVV/1784]

(AV/2812) New and modified electrical wiring shall be routed above and away from flammable fluid lines and heat sources. [AVV/1785]

(AV/2813) New and modified electrical wiring that must be routed near flammable fluid tanks shall be shrouded to prevent arcing. [AVV/1786]

(AV/2814) New and modified electrical wiring shall be supported to prevent abrasion. [AVV/1787]

(AV/2815) New and modified electrical connections and wiring shall be protected against short circuit caused by chafing from the movement of personnel, cargo, or equipment. [AVV/1788]

(AV/2816) New and modified bare conductors, connections, terminals, and exposed electrical current-carrying parts shall be protected against short circuits. [AVV/1789]

(AV/2819) New and modified safety critical system electrical circuits shall not be supplied from the same power bus or circuit breaker. [AVV/1792]

(AV/3076) Thermal overload protection, or current sensing which is appropriately sized or rated for the equipment involved, shall be provided for cooling fans installed in new and modified equipment. [AVV/2462]

3.1.16.7 General Equipment

(AV/2826) The placement of new and modified equipment shall avoid hazards by permitting physical access as required for operating, cleaning, inspecting, testing, fault detecting, repairing, and replacing components without interfering with adjacent components or assemblies. [AVV/1793]

(AV/2827) New and modified equipment shall be located where it will not be damaged during maintenance. [AVV/1794]

(AV/2830) New and modified equipment shall incorporate mechanical, self-locking features for all nuts, bolts, and fittings where a loose fastener could cause a Catastrophic or Hazardous failure condition/hazard. [AVV/1797]

(AV/2831) Fasteners associated with new and modified equipment installations adjacent to composite panels shall not come in contact with graphite fiber surfaces. [AVV/1798]

(AV/2832) For new and modified equipment, positive means shall be provided to prevent inadvertent reversing or mismatching of fittings; couplings; fuel, oil, hydraulic and pneumatic lines; mechanical linkages; instrument leads and electrical/electronic connections. [AVV/1799]

(AV/2834) Shielding shall be provided to protect new and modified equipment from being penetrated or penetrating adjacent equipment during installation/removal. [AVV/1801]

(AV/2835) New and modified equipment shall have a means to remove electrical power to allow for maintenance or removal. [AVV/1802]

3.1.16.8 Fire Protection

(AV/2845) Air Vehicle modifications shall not result in grease, oil, electrical components (buses, circuit breakers, etc.), or heat producing items in the vicinity of oxygen system components. [AVV/1840]

(AV/2846) Installation of new and modified equipment, in pressurized areas of the Air Vehicle, shall include ready access for handheld fire extinguisher discharge. [AVV/1841, AVV/2064]

(AV/3077) An optical fire or smoke detection system shall be provided in compartments that contain new and modified equipment and are not normally visible to crew members. [AVV/2463]

3.1.16.9 Explosive Atmosphere

(AV/2847) New and modified equipment shall produce no more than a negligible risk (RTCA DO-160) of causing an explosion of a flammable gas or vapor within the declared environment. [AVV/1621]

3.1.17 Human Factors/ Human Systems Integration Requirements

(AV/1229) Flight crew interfaces on new and modified equipment shall optimize compatibility with personnel and minimize conditions which can degrade human performance or contribute to human error. [AVV/898, AVV/2400, AVV/2401]

(AV/2901) New and modified primary flight controls, emergency controls, and emergency egress controls shall be accessible and operable by the crew population as described in Table 3.1.6-1, with the restraint harness locked. [AVV/2370, AVV/239]

(AV/2900) New and modified controls that are not primary flight controls, emergency controls, or emergency egress controls shall be accessible and operable by the crew population as described in Table 3.1.6-1, with the restraint harness unlocked. [AVV/2371, AVV/900]

(AV/2905) New and modified equipment shall not degrade the existing interior acoustical environment to the point that it will interfere with voice or other communications for personnel wearing headsets. [AVV/2373, AVV/2372, AVV/243]

(AV/2908) Air Vehicle modifications shall be in accordance with the applicable guidelines of MIL-STD-1472 in the areas of control/display integration, visual and audio displays, controls, anthropometry, workspace design, environment, design for maintainers, hazards and safety, user/computer interface, and labeling. [AVV/2377, AVV/2376, AVV/2375, AVV/2374]

(AV/2907) New and modified equipment shall be operable with USAF present-inventory biological/chemical warfare ensembles. The use of non-peculiar tools is allowed to meet this requirement. [AVV/1944]

(AV/1228) Air Vehicle modifications shall be designed such that repetitive routine aircrew tasks, excluding flight control operation, are minimized. [AVV/1946]

(AV/1232) Air Vehicle modifications shall be designed such that the operational workloads imposed on a trained aircrew will not threaten its ability to complete missions or to operate the Air Vehicle safely. [AVV/1947, AVV/2438, AVV/2439]

3.1.18 (Not Applicable)

3.1.19 Computer Resources Requirements

(AV/2989) Newly developed systems shall facilitate future hardware and software upgrades. [AVV/1934]

(AV/2992) All application software for new and modified Air Vehicle equipment shall be written in a structured software programming language. [AVV/1937]

(AV/1246) Software loading and verification for field-loadable equipment shall be accomplished on the Air Vehicle using data loaders. As an objective, operating system software uploads, including executable code and data, for field-loadable equipment should be accomplished through current data loaders. As an objective, components should not have to be removed from the Air Vehicle for firmware modifications. [AVV/257]

(AV/3090) Each new field-loadable LRU shall be capable of having its Operational Flight Program loaded in a time not greater than one hour. [AVV/2481]

(AV/3091) Each modified LRU that is field-loadable shall retain, as a minimum, the baseline Air Vehicle's data loading rate associated with the loading of the LRU's Operational Flight Program (OFP). [AVV/2481]

3.1.20 Logistics And Supportability Requirements

3.1.20.1 (Not Applicable)

3.1.20.2 (Not Applicable)

3.1.20.3 Support Equipment Requirements

(AV/1287) New and modified Air Vehicle equipment and equipment installations shall be designed such that the need for O-level support equipment, both common and peculiar, is minimized. As an objective, new and modified Air Vehicle equipment and equipment installations should be designed such that the need for any type of support equipment across all maintenance levels is minimized. [AVV/298]

3.1.20.4 (Not Applicable)

3.1.21 (Not Applicable)

3.1.22 (Not Applicable)

3.1.23 Survivability & Vulnerability Requirements

(AV/1319) The IR signature of the Air Vehicle shall be no greater than the IR signature of the baseline Air Vehicle. As an objective, the IR signature of the Air Vehicle should be less than the IR signature of the baseline Air Vehicle. [AVV/330]

3.1.24 Testability And Diagnostics Requirements

3.1.24.1 Diagnostics

(AV/2974) The Embedded Diagnostic System shall incorporate automated fault isolation techniques. As an objective, the Embedded Diagnostic System should, on selected systems, employ a knowledge-based expert system that allows accurate, rapid fault isolation to the LRU and configuration management by tail number and LRU. [AVV/1992, AVV/1915, AVV/1991, AVV/2425]

(AV/2997) The EDS shall provide a graphical user interface, using DOT/FAA/CT-9611 (Human Factors Design Guide for Acquisition of Commercial-Off-The-Shelf Subsystems, Non-Developmental Items, and Developmental Systems, dated 15 January 1996) as a guide. [AVV/1914]

(AV/3004) The EDS shall create and maintain a fault history in NVM that can be modified only by maintenance personnel. [AVV/345, AVV/2426]

(AV/3003) The EDS shall allow maintenance data transfer using a standard interface compatible with C-5 ground maintenance equipment. The selection of the interface will consider commercially-available standards, government standards and technology trends. [AVV/348]

(AV/3002) The EDS shall present diagnostic information that will be readily-understandable to the operators and preclude the use of cross-referencing of any codes. [AVV/159, AVV/2464]

(AV/3001) The EDS shall collect engine data required for performance evaluation and trending. [AVV/2062, AVV/1993]

(AV/3035) The EDS shall utilize COTS/NDI technology as applicable. [AVV/2019]

(AV/2998) The EDS shall transfer all downloadable fault data from a single point. [AVV/1919]

(AV/3086) The EDS shall structure fault codes in a numerical sequence consistent with the baseline Air Vehicle fault code numbering scheme. [AVV/2476]

(AV/3087) C-5 RERP fault codes shall be displayable by the EDS in conjunction with their respective specific word profiles. [AVV/2477]

(AV/3005) During Air Vehicle operations and maintenance activities, all fault data collected by the EDS shall be provided at the flight engineer's station. [AVV/1920]

(AV/2977) Data required for trending (structural health, engine monitoring, etc.) shall be capable of being transferred electronically using a standard format (e.g. Simple Mail Transfer Protocol (SMTP)). [AVV/1924, AVV/2000]

(AV/3089) The EDS design shall accomodate potential growth in the areas of data processing, data recording, data acquisition and conditioning and data presentation and control. This includes, but is not limited to, computer memory resources, onboard data storage provisions, data transfer (media data rate) and data processing capacity. The EDS design will also consider technology upgrades and improvements. [AVV/2480]

3.1.24.2 Built-In Test (BIT)

(AV/1325) New and modified Air Vehicle subsystems with electronic controllers shall incorporate a BIT function for fault detection and isolation to the LRU within the subsystem. [AVV/2002, AVV/336, AVV/2428]

(AV/2982) New and modified subsystem BIT shall incorporate a "continuous" operating mode, functioning in a non-obtrusive manner, that is automatically initiated upon application of power. [AVV/339, AVV/343]

(AV/1422) The Air Vehicle BIT shall have the capability to accurately detect and isolate faults in new and modified equipment to the particular LRU 95% of the time. As an objective, the Air Vehicle BIT should have the capability to accurately detect and isolate faults to the LRU 95% of the time. [AVV/2431, AVV/2432, AVV/2003, AVV/337]

(AV/1329) Air Vehicle BIT shall be capable of detecting 100% of all critical faults. [AVV/2005, AVV/341, AVV/2004]

(AV/2966) A false or incorrect declaration of a critical fault shall not occur more than 1% of total instances where critical faults are indicated. [AVV/2007, AVV/1928, AVV/2006]

(AV/1330) BIT result presentations shall provide sufficient data to accurately describe the failure condition. [AVV/342]

(AV/2984) BIT information shall be available for review by both the flight crew and maintainer. [AVV/1929]

(AV/3022) For new and modified equipment with processors, an indication of continuous or initiated BIT failure shall be reported to the operators in English text. [AVV/1965, AVV/1964]

3.1.24.3 Data Recorder

(AV/2985) Air Vehicle modifications shall include a digital flight data recorder with solid state non-volatile memory to store aircraft state data. [AVV/2009]

(AV/2986) The modified Digital Flight Data Recorder shall incorporate current C-5 data and use AF Handbook 63-1402 as a guide for selecting additional parameters. [AVV/2011, AVV/1931, AVV/2010, AVV/2012]

3.1.25 (Not Applicable)

3.2 Interface Requirements

3.2.1 (Not Applicable)

3.2.2 (Not Applicable)

3.2.3 (Not Applicable)

3.2.4 (Not Applicable)

3.2.5 Design And Construction Requirements

(AV/1359) The exterior finish system of new and modified Air Vehicle sections shall be consistent with the existing Air Vehicle finish system. [AVV/371]

3.2.6 (Not Applicable)

3.2.7 (Not Applicable)

3.2.8 Workmanship And Quality Requirements

(AV/1378) Modifications to the Air Vehicle, including operations such as detail fabrication, assembly, and equipment installation, shall be in compliance with QM 9001. [AVV/390]

3.2.9 (Not Applicable)

3.2.10 (Not Applicable)

This page intentionally left blank.

4 Verification Requirements

analysis – Any analytical method/procedure. This may be a computer-based model, a computer-based simulation, an established form of analysis such as a functional hazard analysis (FHA), or an analysis (review) of data, e.g., test results from a lower-level test venue or similarity to qualification data gathered on a previous program. Rigorous substantiation of the analytical results is implicit. Results are intended to provide hard quantitative evidence of compliance with a parent technical requirement.

demonstration – A test or an evaluation conducted in any venue (flight, ground, lab, workstation, etc.) and performed for the purpose of demonstrating compliance with a requirement. No instrumentation, special test equipment, or data gathering is necessarily involved, but may be utilized. Demonstrations typically produce subjective conclusions only.

flight test – A test or evaluation conducted aboard the aircraft while it is in flight or during takeoff or landing. The test is to functionally/operationally exercise the subject item/equipment/system in representative operational environments and conditions. Results are intended to provide quantitative evidence of compliance with a technical requirement.

ground test – A test or evaluation conducted aboard the aircraft while it is on the ground. The test is to functionally/operationally exercise the subject item/equipment/system in representative operational environments and conditions. Engines need not necessarily be turning. Results are intended to provide quantitative evidence of compliance with a technical requirement.

inspection – A visually review intended to determine if a physical item matches its design descriptions or drawings.

lab test – A test or evaluation conducted in any ground-based laboratory environment. Rigorous data collection and analysis are implicit. Results are intended to provide quantitative evidence of compliance with a technical requirement.

4.1 Functional And Performance Requirements

4.1.1 (Not Applicable)

4.1.2 (Not Applicable)

4.1.3 Air Vehicle Capability Requirements

4.1.3.1 Air Vehicle Performance

4.1.3.1.1 Flight Performance

4.1.3.1.1.1 Air Vehicle Range And Payload Requirements

(AVV/1293) Flight Test. Flight test shall be performed to obtain engine parameter data and specific fuel consumption data to support subsequent payload/range analysis. [AV/2648, AV/2646, AV/2644, AV/2642, AV/2968, AV/3080, AV/3081]

(AVV/1295) Analysis. Analyses shall be conducted using Air Vehicle performance flight test codes to determine the high speed drag polar, engine data and aerodynamic coefficients. The analyses shall use flight test data corrected to standard day conditions and a standard Air Vehicle configuration (e.g. reference center of gravity). The analyses results shall be used for subsequent payload/range analysis. [AV/2648, AV/2646, AV/2644, AV/2642, AV/2968, AV/3080, AV/3081]

(AVV/2058) Analysis. Analyses shall be conducted using Air Vehicle performance expansion codes to determine mission payload/range capability. The analyses shall use cruise ceiling, cruise speed, specific range and endurance performance parameters. The performance parameters, obtained by analysis, shall be based initially on corrected

(e.g. Reynolds number) wind tunnel test data (high speed drag polar and aerodynamic coefficients) and subsequently from flight test derived data (high speed drag polar, engine data and aerodynamic coefficients). The mission payload/range capability shall be verified when analysis results are at least that specified by the requirement. [AV/2648, AV/2646, AV/2644, AV/2642, AV/2968, AV/3080, AV/3081]

4.1.3.1.1.2 Air Vehicle Climb Performance Requirements

(AVV/38) Flight Test. Flight test shall be performed to obtain engine parameter data and specific fuel consumption data in support of subsequent time to climb analysis. [AV/1035]

(AVV/1296) Analysis. Analyses shall be conducted using Air Vehicle performance flight test codes to determine the low speed drag polar, engine data and aerodynamic coefficients. The analyses shall use flight test data corrected to standard day plus 18 degree F conditions and a standard Air Vehicle configuration (e.g. reference center of gravity). The analyses results shall be used for subsequent climb performance analysis. [AV/1035]

(AVV/2063) Analysis. Analyses shall be conducted using Air Vehicle performance expansion codes to determine the climb performance from brake release at sea level to 31,000 ft at standard day plus 18 degrees F conditions for a takeoff weights of 769,000 and 840,000 pounds. The analyses shall use an optimum climb speed schedule based on the maximum rate of climb. The schedule, obtained by analysis, shall be based initially on corrected (e.g. Reynolds number) wind tunnel test data (low speed drag polar and aerodynamic coefficients) and subsequently from flight test derived data (low speed drag polar, engine data and aerodynamic coefficients). The time to climb requirement shall be verified when the analysis result at a takeoff weight of 769,000 pounds is 25 minutes or less. [AV/1035]

4.1.3.1.1.3 Air Vehicle Airspeed Reduction And Descent Performance Requirements

(AVV/1631) Flight Test. Flight test shall be performed to obtain engine parameter data, reverse thrust (in-flight) data and specific fuel consumption data in support of subsequent rapid descent performance analysis. [AV/2614]

(AVV/2066) Analysis. Analyses shall be conducted using Air Vehicle performance flight test codes to determine the high speed drag polar, engine data and aerodynamic coefficients. The analyses shall use flight test data corrected to standard day conditions and a standard Air Vehicle configuration (e.g. reference center of gravity). The analyses results shall be used for subsequent rapid descent performance analysis. [AV/2614]

(AVV/2065) Analysis. Analyses shall be conducted using Air Vehicle performance expansion codes to determine the rapid descent time from cruise ceiling. The descent performance analysis shall be based initially on corrected (e.g. Reynolds number) wind tunnel test data (high speed drag polar, aerodynamic coefficients and approximate installed reverse thrust) and subsequently from flight test derived data (high speed drag polar, engine data, and aerodynamic coefficients). The analysis shall confirm compliance. [AV/2614]

4.1.3.1.1.4 Air Vehicle Airfield And Take-off Climb Gradient Performance Requirements

(AVV/1661) Flight Test. Flight test shall be performed to obtain takeoff event speeds (refusal, rotation, obstacle, minimum control authority in air, minimum control authority on ground); event distances (accelerate-stop, ground roll distance, air distance to 50 ft obstacle); engine performance parameters at takeoff thrust and takeoff reduced thrust; and reverse thrust (ground) data. Data shall be obtained at dry runway conditions in support of subsequent takeoff analysis. [AV/1045, AV/1044]

(AVV/48) Analysis. Analyses shall be conducted using Air Vehicle performance flight test codes to determine flight test correlation parameters (normalized to all temperatures), installed forward and reverse thrust, low speed drag polars (in/out of ground effects) and ground and air minimum control speeds. The analyses shall use flight test engine performance parameters at takeoff forward and reverse thrust, event speeds and event distances. The flight test data shall be corrected to sea level standard and hot day conditions and a standard Air Vehicle configuration (e.g. reference center of gravity). The analyses results shall be used for subsequent takeoff analysis. [AV/1045, AV/1044]

(AVV/2067) Analysis. Analyses shall be conducted using Air Vehicle performance expansion codes to determine critical field length at takeoff/takeoff reduced thrust at sea level standard and hot day conditions for takeoff weights of 769,000 and 840,000 pounds while meeting an OEI 2.5% climb gradient. The critical field length analyses shall be based initially on corrected (e.g. Reynolds number) wind tunnel test data (low speed drag polar, aerodynamic

coefficients and approximate installed reverse thrust) and subsequently from flight test derived data (correlation parameters, installed forward and reverse thrust, low speed drag polars and ground/air minimum control speeds). The critical field length requirements shall be verified when analyses results at a takeoff weight of 769,000 pounds are no greater than that specified by the requirement. [AV/1045, AV/1044]

(AVV/1669) Flight Test. Flight test shall be performed to obtain landing event speeds (approach and touchdown), event distances (air distance, ground roll), engine performance parameters at landing thrust and reverse thrust (ground), spoiler effects and flap effects. Data shall be obtained at dry runway conditions in support of subsequent landing distance analysis. [AV/1048]

(AVV/1634) Analysis. Analyses using Air Vehicle performance flight test codes shall be conducted to determine flight test correlations parameters (normalized to all temperatures), installed forward and reverse thrust, low speed drag polars (in/out ground effects) and air minimum control speed. The flight test data shall be corrected to sea level standard day conditions and a standard Air Vehicle configuration (e.g. reference center of gravity). The analyses results shall be used for subsequent landing distance analysis. [AV/1048]

(AVV/2118) Analysis. Analyses shall be conducted using Air Vehicle performance expansion codes to determine the landing distance (from 50 ft altitude) at sea level, standard day conditions for a landing weight of 769,000 pounds. The landing distance (including event speeds and distances) shall be based initially on corrected (e.g. Reynolds number) wind tunnel test data (low speed drag polar and approximate installed reverse thrust) and subsequently from flight test derived data (correlation parameters, installed forward and reverse thrust, low speed drag polars and air minimum control speeds). The requirement shall be verified when analyses results show that the landing distance is no greater than 5000 ft. [AV/1048]

(AVV/1662) Flight Test. Flight test shall be performed to obtain engine parameters at takeoff in support of subsequent one engine inoperative (OEI) climb gradient analyses. [AV/2633]

(AVV/1635) Analysis. Analyses using Air Vehicle performance flight test codes shall be conducted to determine the 3-engine low speed drag polar (with flap effects, out of ground effects and landing gear up) and engine takeoff thrust parameters. The flight test data shall be corrected to sea level hot day conditions and a standard Air Vehicle configuration (e.g. reference center of gravity). The analyses results shall be used for subsequent one engine inoperative (OEI) climb gradient analysis. [AV/2633]

(AVV/2209) Analysis. Analyses shall be conducted using an Air Vehicle performance expansion code to determine the one engine inoperative (OEI) climb gradient at sea level, hot day conditions for a takeoff weight of 840,000 pounds The OEI climb gradient shall be based initially on corrected (e.g. Reynolds number) wind tunnel data (low speed drag polar and aerodynamic coefficients) and subsequently from flight test derived data (3-engine low speed drag polar and engine takeoff thrust parameters). The requirement shall be verified when analyses results show that the climb gradient is at least 2.5%. [AV/2633]

4.1.3.1.2 Air Vehicle Stability and Control Performance

4.1.3.1.2.1 Stability and Control, General

(AVV/1677) Flight Test. Flight tests shall be conducted at forward and aft centers of gravity and at heavy and light weights. Tests will involve maneuvering the aircraft until buffet is reached throughout the operational speed range modified by wind tunnel test results. Buffet with in-flight thrust reversing will also be performed. ALDCS and SAS will both be ON for these tests. [AV/2537]

(AVV/2342) Analysis. Analyses of CFD and wind tunnel data shall initially estimate if the buffet boundaries are expected to change from the current buffet boundaries prior to flight test. Analyses of flight test data will be conducted to define the buffet boundary. This analysis will be used to confirm that the buffet boundary does not restrict the operational flight envelope. [AV/2537]

(AVV/2324) Flight Test. Flight tests shall be conducted to evaluate trim and trim capability at critical centers of gravity and weights. This testing will include evaluation of the ability to maintain, and return to trim, at extremes of center of gravity and power setting, the ability to trim out changes in center of gravity, power, and aircraft configuration. This task will be accomplished with ALDCS and SAS ON. The test matrix will include the critical points taken from the operational flight envelope. [AV/3037]

(AVV/2323) Analysis. Preliminary analyses using wind tunnel data shall be used in conjunction with a C-5 six degree-of-freedom simulation program to estimate expected trim changes prior to flight test. Analyses of flight test data will confirm that no stability and control related changes have been imposed by the Air Vehicle modifications which might prevent the normal operation of the Air Vehicle. [AV/3037]

(AVV/2328) Flight Test. Flight tests shall be conducted at critical centers of gravity and weights. Flight testing within the permissible flight envelope will include evaluation of operation across the angle of attack range or to the buffet boundary at high speeds. ALDCS and SAS will be ON for these tests. [AV/3036]

(AVV/2329) Analysis. Analyses using stability and control data that have been updated from CFD and wind tunnel test results shall be used to initially define changes in the stability boundaries prior to flight test. Analyses of flight test data will be performed to evaluate stability and control parameters to confirm compliance. [AV/3036]

(AVV/2380) Flight Test. Flight tests to evaluate sideslip limitations shall be conducted at critical centers of gravity and weights. Flight tests will include overswing yaw maneuvers, crosswind landings, crosswind takeoffs, and sideslip evaluations at high angles of attack. The test matrix will include critical flight conditions within the permissible flight envelope as defined in Appendix D. [AV/2489]

(AVV/621) Analysis. Wind tunnel data, at a range of sideslip angles, shall be used to update the stability and control database to evaluate the sideslip capability of the airplane. Stability and control analyses of flight test data shall confirm the sideslip capability of the Air Vehicle to show compliance. [AV/2489]

4.1.3.1.2.2 Longitudinal Stability and Control

(AVV/1679) Flight Test. Flight tests shall be conducted for critical aft centers of gravity at heavy and light weights. Control requirements to trim and vehicle response at these centers of gravity will be analyzed to support development of the Air Vehicle neutral point. The test matrix will include critical flight conditions within the service flight envelope as defined in Appendix D. [AV/2542]

(AVV/2344) Analysis. Analyses of wind tunnel data shall provide initial estimates of the effect of the Air Vehicle modifications on the neutral point prior to flight test. Stability and control analyses of flight test data will be performed to determine modification effects on the Air Vehicle neutral point. This will establish the static margin and neutral point, to confirm compliance. [AV/2542]

(AVV/2343) Flight Test. Flight tests shall be conducted at both forward center of gravity and heavy weight, and at aft center of gravity and light weight. Controls for the pitch axis will be excited to evaluate the control effectiveness and force requirements during high speed testing. The test matrix will include critical flight conditions within the permissible flight envelope. Pitch maneuvers during dive flight tests will provide data for evaluation of control force gradients. [AV/2951]

(AVV/1678) Analysis. Analyses using stability and control data that have been updated from wind tunnel test results, and output from simulation programs, shall be performed to provide a preliminary evaluation of aerodynamic and control force characteristics prior to flight testing. Analyses of the flight test data shall be performed to confirm compliance. [AV/2951]

(AVV/1709) Flight Test. Flight tests shall be conducted at critical aft centers of gravity and weights. Control surface deflections required to trim the Air Vehicle, and the Air Vehicle response, will be measured to support determination of the Air Vehicle neutral point. The test matrix will include critical flight conditions within the service flight envelope as defined in Appendix D. [AV/2543]

(AVV/2345) Analysis. Analyses of wind tunnel data shall provide initial estimates of the effect of the Air Vehicle modifications on the neutral point prior to flight test. Stability and control analyses of flight test data will be performed to determine modification effects on the Air Vehicle neutral point. This will establish the static margin and neutral point, and confirm compliance. [AV/2543]

(AVV/1711) Flight Test. Flight tests shall be conducted at forward and aft centers of gravity at heavy and light weights. These tests will be accomplished in takeoff, landing, and cruise configurations with SAS ON and OFF. The test matrix will include critical points taken from the operational flight envelope as defined in Appendix D. [AV/2544]

(AVV/2347) Analysis. Analyses of flight test data shall be performed to ensure the frequency and damping are acceptable to at least Level 2 flying qualities with SAS ON. This analysis shall confirm compliance with this requirement. An additional analysis shall be performed to assess flying qualities with SAS OFF. [AV/2544]

(AVV/1712) Flight Test. Flight tests shall be conducted at aft centers of gravity at heavy and light weights. Control forces required to perform the maneuvers defined in Table 3.1.3.1.6-1, and the Air Vehicle response, will be measured to support determination of the Air Vehicle neutral point. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. [AV/2609]

(AVV/2348) Analysis. Analyses using wind tunnel data and control system models shall provide initial estimates of the effect of the Air Vehicle modifications on the elevator-free neutral point prior to flight test. Stability and control analyses of flight test data will be performed to determine modification effects on the Air Vehicle elevator-free neutral point, to confirm compliance. [AV/2609]

(AVV/1713) Flight Test. Tests shall be conducted at a heavy weight with a forward center of gravity and at a light weight with an aft center of gravity. Control force data will be measured in takeoff, landing, and cruise configurations with SAS ON. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. [AV/2545]

(AVV/2349) Analysis. Analyses using powered wind tunnel data and manufacturer engine data shall be used to predict the longitudinal trim changes due to in-flight thrust reverser deployment and forward thrust modes. Simulations will provide an initial estimate of the effect on control forces resulting from these configuration changes. Analyses of flight test data will be performed to determine actual control force changes due to changes in power or thrust reversers and compared to requirements in MIL-F-8785 (ASG), to confirm compliance. [AV/2545]

(AVV/1714) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. Control forces shall be measured during in-flight thrust reverser deployment in the clean configuration. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. [AV/2612]

(AVV/2350) Analysis. Stability and control analyses of wind tunnel and flight test data shall be performed to determine the flight handling characteristics with thrust reversers deployed, and confirm compliance. [AV/2612]

(AVV/2448) Ground Test. Taxi tests shall be performed at a range of initial speeds and power settings to assess the control characteristics with symmetric thrust reversers deployed. [AV/3062]

(AVV/2449) Analysis. Stability and control analyses of wind tunnel and ground test data shall be performed to determine the ground handling characteristics with thrust reversers deployed, and confirm compliance. [AV/3062]

4.1.3.1.2.3 Lateral-Directional Stability and Control

(AVV/1715) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. Rudder pulses will be used to induce lateral-directional oscillations with controls fixed and free. These tests shall be conducted with SAS ON. The Air Vehicle damping will be measured. The test matrix will include critical flight conditions within the service flight envelope as defined in Appendix D. [AV/2546]

(AVV/2351) Analysis. Analyses and simulation, using stability and control data as revised by wind tunnel test results, shall provide an initial estimate of the effect on the lateral-directional stability characteristics for critical points in the flight envelope. Analyses of flight test data shall be performed to determine the Air Vehicle's lateral-directional damping to confirm compliance. [AV/2546]

(AVV/1716) Flight Test. Flight tests shall be conducted at an aft center of gravity at both heavy and light weights. Tests simulating a failure of the most critical engine shall be conducted for the clean, takeoff, and landing configurations. The test matrix will include critical flight conditions within the service flight envelope. [AV/2550]

(AVV/2352) Analysis. Analyses shall provide an initial estimate of the Air Vehicle's controllability following a sudden failure of the most critical engine at critical points in the service flight envelope. These analyses shall use manufacturer-supplied engine decks, and stability and control data as revised by wind tunnel test results. Analyses of flight test data shall be performed to verify the Air Vehicle's controllability and confirm compliance. [AV/2550]

4.1.3.1.2.4 Stall Characteristics

(AVV/1717) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. These tests will be conducted for the clean, takeoff, and landing configurations. The angle of attack margin between stall warning system indications and stall will be derived from flight test measurements. The test matrix will include critical flight conditions within the permissible flight envelope. [AV/2552]

(AVV/2353) Analysis. Analyses and simulation, using stability and control data as revised by wind tunnel test results, shall be conducted to provide an initial evaluation of the Air Vehicle's stall-warning margins relative to the baseline Air Vehicle. Flight test data shall be analyzed to determine the stall-warning angle-of-attack margins relative to the baseline Air Vehicle's margins, and confirm compliance. [AV/2552]

(AVV/1718) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. These tests will be conducted for the clean, takeoff, and landing configurations. Stall entry rates ranging from -3 knots/second to -1 knot/second will be utilized in both the straight and turning flight. The test matrix will include critical points in the permissible flight envelope. [AV/2553]

(AVV/2354) Analysis. Analyses shall be conducted to evaluate the stall recovery characteristics of the Air Vehicle. These analyses will be used to show compliance with this requirement. [AV/2553]

(AVV/1719) Flight Test. Flight tests shall be conducted in the clean configuration at the critical center of gravity and weight. Stall and recovery characteristics shall be recorded. The test matrix will include critical flight conditions within the permissible flight envelope. [AV/2554]

(AVV/2355) Analysis. Analyses and simulation, using stability and control data as revised by wind tunnel test results, shall be conducted to predict the control inputs for Air Vehicle stall recovery. Flight test data will be analyzed to evaluate control inputs required for recovery, the Air Vehicle response following stall, and confirm compliance. [AV/2554]

4.1.3.1.3 In-Flight Refueling

(AVV/1461) Flight Test. Flight tests shall be conducted at the critical center of gravity at heavy and light weights. Separate flight tests shall be conducted using the KC-135 and KC-10. Aerial refueling tests will include evaluation of tracking, capture, handling while refueling, and separation. Emergency separation shall be performed with and without inboard thrust reverser deployment to reverse idle power following decoupling from the tanker aircraft. The test matrix will include critical flight conditions within the operational flight envelope. [AV/2922, AV/2616]

(AVV/2369) Analysis. Analyses of flight test data shall be performed to evaluate the flight handling characteristics for the in-flight refueling test, to define the operational envelope and confirm compliance. [AV/2922, AV/2616]

4.1.3.1.4 Ground Performance

(AVV/1821) Demonstration. Demonstration of the Air Vehicle ground turning radius shall be performed to determine the effects of the Air Vehicle modification. Compliance is confirmed if the Air Vehicle is capable of turning 180 degrees on a surface 150 feet wide, per Figure in Appendix E, section E3.1.6. [AV/2944]

(AVV/1326) Ground Test. Ground tests shall be performed for a range of hot day and cold day conditions to acquire data for assessing the performance of the APU start system, secondary power systems, electrical system, engine start systems (APU bleed and cross-bleed), and avionics cooling systems. [AV/2368]

(AVV/1327) Analysis. The measured ground test data will be utilized to correlate the analytical models of the APU start system, secondary power systems, bleed air system, engine start system, electrical system, and avionics cooling systems. These models shall then predict the subsystem performance and component environmental conditions for the critical ground conditions to confirm compliance. [AV/2368]

(AVV/2457) Ground Test. Ground tests shall be performed for a range of hot day and cold day conditions to acquire data for assessing the performance of the secondary power systems (excluding APU), electrical system, engine start systems (ground cart bleed and cross-bleed), and avionics cooling systems. [AV/2369]

(AVV/2458) Analysis. The measured ground test data will be utilized to correlate the analytical models of ground cart performance, secondary power systems (excluding APU), bleed air system, engine start system, electrical system, and avionics cooling systems. These models shall then predict the subsystem performance and component environmental conditions for the critical ground conditions to confirm compliance. [AV/2369]

(AVV/2478) Ground Test. A ground test shall be conducted in which the Air Vehicle is backed in a straight line (no turning) using reverse thrust, at one of the combinations of gross weight and ground slope for backing provided in Appendix E, in accordance with the emergency procedures and limitations for backing provided in Appendix E. The test will be performed at an Air Vehicle configuration (e.g. center of gravity and tire pressure) that is necessary to confirm compliance. The Air Vehicle configuration will be determined from an analysis of existing data from emergency backing ground tests that were performed on the baseline Air Vehicle. [AV/3088]

(AVV/2479) Analysis. An analysis will be performed using Air Vehicle and baseline Air Vehicle emergency backing test data to show that the Air Vehicle is capable of backing under the criteria shown in Appendix E. This analysis will utilize similarity between the Air Vehicle and baseline Air Vehicle to show the backing capability for those points in Appendix E that were not tested. Results of this analysis shall confirm compliance. [AV/3088]

4.1.3.1.5 Air Vehicle Noise Requirements

(AVV/2429) Flight Test. Flight testing shall be conducted in accordance with the procedures and requirements of FAR Part 36, Appendices A, B, and C, including approved equivalent procedures. [AV/1052]

(AVV/56) Analysis. Flight test results shall be analyzed to confirm compliance with the noise level requirements of FAR Part 36. This analysis will use the procedures and requirements of FAR Part 36, Appendices A, B, and C, and the FAA Noise Certification Handbook, AC No. 36-4B as a guide. [AV/1052]

(AVV/33) Ground Test. A ground test shall be performed to measure noise levels at locations outside and inside the Air Vehicle, including normally-occupied locations for ground crew and flight crew. Noise levels in dBA will be measured for the following test conditions: all engines operating (without APUs or ATMs) at full power and at idle power, APUs operating alone, and APUs and ATMs operating. [AV/2555]

(AVV/1908) Analysis. Ground test data shall be analyzed to determine the noise levels at the ear, for normally-occupied locations for ground crew and flight crew members. Existing laboratory test data for the acoustic attenuation of hearing protection devices currently in the USAF inventory will be used for this purpose. For normally-occupied locations of ground crew and flight crew members, the required hearing protection will be determined per the NOTE in the first paragraph of Chapter 5 in AFOSH-STD 48-19, dated 31 March 1994. This analysis shall confirm compliance. [AV/2555]

(AVV/1909) Flight Test. A flight test shall be performed with all Air Vehicle systems operating normally at two typical extended cruise conditions, one representing a start of cruise (lower altitude) condition and another representing an end of cruise (higher altitude) condition. Interior noise levels in dBA will be measured throughout the normally-occupied areas of the Air Vehicle. [AV/2967]

(AVV/1910) Analysis. Using the measured interior noise levels for the extended cruise conditions, separate analyses shall be performed to determine the noise levels at the ear for personnel wearing headsets and for personnel wearing earplugs. These analyses will be performed for both the start of cruise point and the end of cruise point. For this purpose, existing laboratory test data for the acoustic attenuation of the David Clark H10-76 headset and the E-A-R Classic (part number 6515-00-137-6345) earplugs will be used. The analyses will confirm that the noise level at the ear for personnel wearing headsets or earplugs does not exceed 85 dBA at any of the normally-occupied locations in the Air Vehicle. [AV/2967]

(AVV/2459) Flight Test. A flight test shall be performed with all Air Vehicle systems operating normally at two typical extended cruise conditions, one representing a start of cruise (lower altitude) condition and another representing an end of cruise (higher altitude) condition. Interior noise levels in dBA will be measured in the areas of the Air Vehicle that are not normally occupied (cargo compartment, avionics compartment, and environmental compartment). [AV/3072]

(AVV/2460) Analysis. In-flight interior noise data shall be analyzed to determine the noise levels at the ear for the locations that are not normally occupied. Existing laboratory test data for the acoustic attenuation of hearing protection devices currently in the USAF inventory will be used for this purpose. Required hearing protection and, if necessary, exposure time limits will be determined for the cargo compartment, avionics compartment and environmental compartment per the NOTE in the first paragraph of Chapter 5 in AFOSH-STD 48-19. This analysis shall confirm compliance. [AV/3072]

4.1.3.1.6 Fuel Type

(AVV/1466) Analysis. Analysis of the Engine Type Certificate and the auxiliary power unit Technical Standard Order shall confirm compliance. [AV/2731]

(AVV/1467) Analysis. Analysis of the Engine Type Certificate and the auxiliary power unit Technical Standard Order shall confirm compliance. [AV/2729]

4.1.3.2 Propulsion

4.1.3.2.1 Propulsion System General

(AVV/691) Analysis. Analyses (e.g. Failure Modes and Effects Analyses, Fault Tree Analysis, etc.) will be included or referenced in the System Safety Assessment that shall confirm that the propulsion systems are arranged and isolated from each other to allow operation so that the failure or malfunction of any engine or of any system that can affect the engine, will not prevent the continued safe operation of the remaining engines. [AV/2600]

(AVV/985) Analysis. Analyses (e.g. Failure Modes and Effects Analyses, Fault Tree Analysis, etc.) will be included or referenced in the System Safety Assessment that shall confirm that the propulsion systems are arranged and isolated so that the failure or malfunction of any engine or of any system that can affect the engine will not require immediate action by any crew member for continued safe operation. [AV/2600]

(AVV/692) Analysis. A rotor burst analysis, based on trajectory patterns, shall ensure that design precautions have been taken to minimize the hazards to the Air Vehicle in the event of an engine rotor failure. The analysis will be included in or referenced in the System Safety Assessment. [AV/2601]

(AVV/693) Analysis. A zonal analysis of the affected nacelle area shall be done to ensure that design precautions have been taken to minimize the hazards to the Air Vehicle in the event of a fire originating within the engine that burns through the engine case. The analysis will be included in or referenced in the System Safety Assessment. [AV/2602]

(AVV/887) Analysis. Analysis of the engine Type Certificate Data Sheet shall confirm that the engine is type certified by the Federal Aviation Administration. [AV/2383]

(AVV/2341) Analysis. The verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/3047]

(AVV/888) Analysis. The propulsion system installation drawings shall be reviewed to confirm that the propulsion system design does not include features that would intentionally discharge fuel into the atmosphere following engine shutdown. All type certified engines are required to comply with this FAR 34 fuel venting requirement. [AV/2524]

(AVV/889) Analysis. Compliance with the propulsion system smoke exhaust emission requirements of FAR Part 34 shall be verified by analysis of the engine Type Certificate Data Sheet. All type certified engines are required to comply with this FAR 34 smoke emission requirement. [AV/2525]

(AVV/890) Analysis. Compliance with the propulsion system gaseous exhaust emission requirements of FAR Part 34 shall be verified by analysis of the engine Type Certificate Data Sheet. All type certified engines are required to comply with this FAR 34 gaseous emission requirement. [AV/2526]

(AVV/542) Flight Test. Flight test at negative vertical acceleration at test conditions as described in AC 25 - 7A shall be conducted to show that no catastrophic or hazardous malfunction of the propulsion system will result from Air Vehicle operation at negative vertical accelerations within its flight envelope. [AV/2357]

(AVV/1672) Analysis. Analysis of flight test data (flight data and engine parameters), taken during negative acceleration testing, shall confirm that no catastrophic or hazardous malfunction of the propulsion system occurs. [AV/2357]

4.1.3.2.2 Propulsion System Thrust Reversers

(AVV/883) Ground Test. Ground tests shall be performed to show that each of the engine thrust reversers are suitable for ground use and shall not result in adverse engine or Air Vehicle operating characteristics. [AV/2066]

(AVV/1673) Analysis. Analysis of ground test data (airspeed and engine paramenters), taken during thrust reverser ground operation, shall be done to confirm that the propulsion system fan exhaust thrust reverser is suitable for ground use. [AV/2066]

(AVV/44) Flight test. Flight test shall perform a rapid descent from maximum cruise ceiling with flaps and gear retracted, by maintaining the two outboard engines in flight idle and deploying two inboard thrust reversers to achieve reverse idle thrust. The inboard thrust reversers shall be deployed at an airspeed condition of 350 KIAS or 0.825 Mach, whichever is lower. (Note: The test will be conducted at 350 KIAS instead of 300 KIAS, in order to reflect the baseline Air Vehicle's descent capability.) [AV/1040]

(AVV/1660) Analysis. The analysis of the test data (flight data and engine parameters), obtained during thrust reverser deployment, shall confirm the ability to deploy the inboard thrust reversers in-flight at the design conditions. [AV/1040]

(AVV/1632) Flight test. Flight test shall be performed to restow the inboard thrust reversers at the critical high-altitude condition (e.g. 40,000 feet) and at a moderate altitude (e.g. 10,000 feet). Each restow is to be accomplished at an airspeed of at least 250 KIAS or 0.77 Mach, whichever is lower. [AV/2650]

(AVV/2046) Analysis. The analysis of the test data (flight data and engine parameters), obtained during thrust reverser restow operation, shall confirm the ability to restow the inboard thrust reversers in-flight at the design conditions. [AV/2650]

4.1.3.2.3 Propulsion System Air Inlet System

(AVV/620) Flight Test. Flight testing shall be conducted to demonstrate the engine inlet design compatibility for operation at the high inlet inflow angles associated with the Air Vehicle's stall angle-of-attack. [AV/2401]

(AVV/2034) Analysis. Flight test data (flight data, inlet instrumentation data, and engine parameters), taken during Air Vehicle stall testing, shall be analyzed to confirm that the propulsion system operates without any severe adverse operating characteristics during normal entry rate stall maneuvers. Adverse operating characteristic include engine stall, surge, and engine limit exceedances. During high entry rate stall maneuvers, the engine can experience adverse characteristics as long as it recovers power during Air Vehicle stall recovery. [AV/2401]

(AVV/619) Ground Test. Ground testing in various wind conditions, including crosswind conditions, shall demonstrate that cockpit-indicated engine operating parameters remain within their respective limits (as defined by the engine manufacturer) and that no adverse characteristics (such as stall, surge, flameout, or harmful vibrations) are present to a hazardous degree. Test data will be acquired during steady state, throttle transient, and start and shutdown test conditions. [AV/2361]

(AVV/2035) Analysis. Analysis of ground test data (test conditions and engine parameters), taken during crosswind testing, shall confirm that the engine inlet design provides stable and stall free engine operation with crosswinds up to 40 knots, with limitations and acceptable operational procedures (e.g. rolling takeoffs) defined as necessary. [AV/2361]

(AVV/623) Ground Test. A nacelle drainage ground test shall be performed to show that hazardous amounts of fluid cannot enter the engine inlet or accumulate within the pylon or nacelle. Water will be used as the test fluid, with a fluid retrieval system to recover the amount of fluid recovered from the nacelle during the ground drainage test. [AV/2385]

(AVV/913) Flight Test. A nacelle drainage flight test shall be performed

to show that hazardous amounts of fluid cannot enter the engine inlet, accumulate in the pylon or nacelle, or impinge on engine or aircraft surfaces in a manner that would create a hazard. A dyed water solution will be used as the test fluid. [AV/2385]

(AVV/2048) Analysis. The nacelle drainage ground and flight test data shall be analyzed to verify that hazardous amounts of fluid cannot enter the engine inlet, accumulate in the nacelle or pylon, or impinge on engine or aircraft surfaces in a manner that would create a hazard. [AV/2385]

(AVV/634) Analysis. Ground operating capability of the engine and the nacelle ice protection system in icing conditions have been demonstrated and documented during previous certification programs on other aircraft.

Results of these previous certifications shall be reviewed and analyzed to compare to the Air Vehicle's operational conditions in icing encounters to confirm compliance. [AV/2362]

(AVV/633) Analysis. In-flight engine and nacelle ice protection system capability under continuous maximum and intermittent maximum icing conditions have been demonstrated and documented during previous certification programs on other aircraft. Results of this previous certification program shall be reviewed and analyzed to compare to the Air Vehicle's operational conditions in icing encounters to confirm compliance. [AV/2362]

4.1.3.2.4 Propulsion System Thrust Control System

(AVV/1319) Flight Test. Flight tests shall be conducted, concurrent with other planned testing, to demonstrate that each propulsion system thrust control provides positive and immediately responsive means of controlling its engine and the direction of the thrust produced. [AV/2393]

(AVV/2030) Analysis. Analysis of flight test data (flight data and engine parameters), taken concurrently with aircraft performance testing and during dedicated engine transient testing, shall show that thrust is modulated in a stable, controlled, and responsive manner from maximum forward thrust to reverse idle thrust without exceeding engine limits. Analysis of ground test data (ground conditions and engine parameters), taken during dedicated engine transient testing, shall show that thrust is modulated in a stable, controlled, and responsive manner from maximum forward thrust to maximum reverse thrust without exceeding engine limits. The results of these analyses shall show compliance. [AV/2393]

(AVV/1318) Ground Test. Ground tests shall be conducted to demonstrate that each propulsion system thrust control provides positive and immediately responsive means of controlling its engine and the direction of the thrust produced. [AV/2393]

(AVV/1308) Ground Test. A ground test shall be conducted to ensure that for selection of power lever positions in any sequence at any rate, the engine shall be free from any adverse engine operating characteristics as defined in Advisory Circular AC 25.939-1. [AV/2407]

(AVV/1309) Flight Test. A flight test shall be conducted to ensure that for selection of power lever positions in any sequence at any rate, the engine shall be free from any adverse engine operating characteristics as defined in Advisory Circular AC 25.939-1. [AV/2407]

(AVV/2041) Analysis. Ground and flight test data (ground conditions or flight data as appropriate, and engine parameters), obtained during engine transient testing, shall be analyzed to show that the engine will be free of any adverse operating characteristics as a result of power lever position selection in any sequence at any rate. Adverse operating characteristics include engine stall, surge, and engine limit exceedances. The analysis shall show compliance. [AV/2407]

(AVV/1311) Flight Test. Flight tests, including go-around testing, shall be performed to show that engine transient response and thrust stability are adequate to accomplish a successful go-around. [AV/2513]

(AVV/2033) Analysis. Flight test data (flight data and engine parameters), taken during a go-around maneuver, shall be analyzed to confirm that the propulsion system transient response ensures a successful go-around maneuver. [AV/2513]

(AVV/1856) Ground Test. Ground tests, including aborted take-off tests, shall be performed to show that engine transient response and thrust stability are adequate to accomplish a successful aborted take-off. [AV/2511]

(AVV/2044) Analysis. Ground test data (ground conditions and engine parameters), taken during an aborted take-off maneuver, shall be analyzed to confirm that the propulsion system transient response ensures a successful aborted take-off maneuver. [AV/2511]

(AVV/1314) Ground Test. A ground test shall show that a means to accomplish a normal shutdown and means to accomplish an emergency shutdown of each installed engine is provided on the flight deck, and that both shutdown modes can be accomplished without damage to the engine. [AV/2409]

(AVV/2042) Analysis. Analysis of ground test data (ground conditions and engine parameters) shall confirm that the engine can be shut down by normal and emergency modes without damage to the engine. [AV/2409]

4. .3.2.5 Propulsion System Starting System

(AVV/671) Flight Test. Air Vehicle flight testing shall be accomplished to establish altitude and airspeed envelopes for starter-assisted (crossbleed and APU) and for unassisted (windmilling) engine in-flight restarts. Test points will be of a limited quantity because of the well-established database that exists for the CF6-80C2 engine in-flight starting envelopes. [AV/2372]

(AVV/2026) Analysis. Test data (flight data and engine parameters) gathered during engine airstarts shall be analyzed to confirm that successful engine starts can be accomplished within designated portions of the flight envelope. [AV/2372]

(AVV/1330) Analysis. Analysis of supplier data for the COTS starter shall confirm that the starting system meets more stringent commercial starter duty cycle than the requirement for 5 consecutive starts on any engine with a maximum interval of 60 seconds between the completion of one cycle and the beginning of the next cycle. [AV/2370]

4.1.3.2.6 Propulsion System Installation

(AVV/676) Ground Test. Ground testing shall be performed at prevailing warm weather test ambient temperatures, in accordance with FAR Part 25.1043 and 25.1045 procedures with engines running and after engine shutdown. [AV/2364]

(AVV/991) Flight Test. Flight testing shall be performed at prevailing warm weather test ambient temperatures, in accordance with FAR Part 25.1043 and 25.1045 procedures. [AV/2364]

(AVV/2025) Analysis. The nacelle cooling system flight test data (flight data and nacelle temperature data), shall be analyzed using the propulsion system ventilation system model. The nacelle cooling system ground test data shall be analyzed using the propulsion system ventilation system model and corrected to a 125 F ambient temperature. Results of the analyses shall confirm compliance. [AV/2364]

4.1.3.2.7 Propulsion System Fire Protection

(AVV/1432) Ground Test. Ground test shall be conducted at the critical operating condition to measure agent concentrations in the nacelle fire zone. [AV/2398]

(AVV/1433) Flight Test. Flight test shall be conducted at the critical nacelle compartment airflow condition to measure agent concentrations in the nacelle fire zone. [AV/2398]

(AVV/2031) Analysis. Ground test and flight test data (ground data or flight data as appropriate, and fire extinguishing agent concentration) shall be analyzed to confirm that the discharge of the fire extinguishing agent in each propulsion system designated fire zone will provide an agent concentration capable of extinguishing fires in that zone and of minimizing the probability of re-ignition of the engine fire. [AV/2398]

(AVV/1431) Flight Test. Flight tests shall be conducted to ensure that the propulsion system incorporates adequate drain and vent system to drain flammable fluids from the appropriate areas of the propulsion system during in-flight operation. A dyed water solution will be used as the test fluid. [AV/3063]

(AVV/2052) Analysis. The nacelle drainage ground test and flight test data shall be analyzed to confirm adequate drainage of flammable fluids from the appropriate areas of the propulsion system (pylon and nacelle) during ground and flight operation. [AV/3063]

(AVV/1430) Ground Test. Ground tests shall be conducted to ensure that the propulsion system incorporates adequate drain and vent system to drain flammable fluids from the appropriate areas of the propulsion system during ground operation. A dyed water solution will be used as the test fluid. [AV/3063]

(AVV/2453) Analysis. The verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/3061]

4.1.3.3 Airframe

(AVV/1905) Lab Test. Enveloping external limit loads computed with new performance and mass data shall be applied to the pylon structure. [AV/3068]

(AVV/1858) Flight Test. Flight testing shall be performed to acquire pylon structural loads data at critical design conditions. [AV/3068]

(AVV/1506) Analysis. External loads for the airframe shall be computed with new performance and mass properties data. Updated internal loads shall be generated with an airframe level finite element model. These data shall correlate the global structure deformation response of the airframe to existing C-5A and C-5B full scale test data, pylon static test data and flight test data. The analysis shall verify the capability of structure in local areas with deviations from static test experience and confirm compliance. [AV/3068, AV/3082, AV/3083, AV/3084]

(AVV/1906) Lab Test. Selected external ultimate loads computed with new performance and mass data shall be applied to the pylon structure. [AV/3069, AV/3084]

(AVV/1904) Analysis. External loads for the airframe shall be computed with new performance and mass properties data. Updated internal loads shall be generated with an airframe level finite element model. LM approved stress analysis methods shall compute analytical margins of safety. These data shall correlate the global structural response of the airframe to existing C-5A and C-5B full scale test data and pylon static test data. The analysis shall verify the capability of structure in local areas with deviation from static test experience and confirm compliance. [AV/3069, AV/3082, AV/3083, AV/3084]

(AVV/1657) Flight Test. Flight testing shall be performed to acquire acoustic loads and strain data at critical design conditions and locations. [AV/3070]

(AVV/1531) Analysis. A sonic fatigue analysis, incorporating flight test data, shall verify that the Air Vehicle structure is capable of withstanding sonic fatigue without deterioration that renders it unserviceable. This analysis shall confirm compliance. [AV/3070]

(AVV/1502) Ground Test. A ground vibration test shall be conducted on the Air Vehicle to determine the frequencies and modes of vibration of the primary structure. Excitation points shall be limited to the wing and engines. [AV/3073]

(AVV/1503) Flight Test. A flight flutter test shall be conducted to demonstrate freedom from flutter, and to acquire the test data necessary to calculate the aircraft damping coefficient for critical flutter modes and for significant dynamic response mode, up to the limit speed envelope. Selection of test conditions shall be based on flutter analysis results. Excitation shall be induced by pilot control inputs. [AV/3073, AV/3092]

(AVV/1501) Analysis. An aeroelastic stability analysis shall be conducted for an intact Air Vehicle, and also for failed pylon conditions. The analysis shall be correlated to the ground vibration test results. Re-analysis of structure, conditions, and failures not affected by the engine and pylon modifications will not be performed. The aeroelastic stability analysis shall be validated by flight test data and shall confirm compliance. [AV/3073]

(AVV/2482) Analysis. Data from the flight flutter testing shall be analyzed to demonstrate compliance with aircraft structural damping requirements. [AV/3092]

(AVV/1479) Lab Test. Tailored repeated loads reflecting new performance and mass data shall be applied to pylon structure for a minimum duration equivalent to 66,000 hours of design usage, or 2x the design service life requirement for new structure. [AV/3074]

(AVV/2461) Analysis. New airframe repeated loads shall be computed with new performance and mass data. Analytical spectra for selected airframe locations shall be derived from the new repeated loads. Crack initiation and crack growth evaluations shall be correlated to existing full scale C-5A, C-5A Wing Modification, and C-5C durability test data and pylon durability test data, thereby confirming compliance. [AV/3074]

(AVV/1907) Lab Test. Spectra generation methods shall create analytical spectra for pylon repeated loads, computed with new performance and mass data. After tailoring, these repeated loads shall be applied to pylon structure with representative damage. [AV/3075]

(AVV/1545) Analysis. New airframe repeated loads shall be computed with new performance and mass data. Spectra generation methods shall create analytical spectra for selected airframe locations. Analysis of the pylon structure shall include crack growth data from pylon structural testing. Crack growth methodology will compute residual strength, crack growth data, and periodic inspection intervals (if required) to confirm compliance. [AV/3075]

4.1.3.4 Utilities and Subsystems

4.1.3.4.1 Fuel Subsystem Requirements

(AVV/867) Ground Test. Ground test shall be performed to measure engine fuel pump inlet flow rates, pressures, and temperatures during ground operation with fuel tank boost pumps ON and OFF. Test data shall be used to validate fuel system models. [AV/2418]

(AVV/1136) Flight Test. Flight test shall be performed to measure engine fuel pump inlet flow rates, pressures, and temperatures during normal in-flight operation with fuel tank boost pumps ON and OFF. Test data shall be used to validate fuel system models. [AV/2418]

(AVV/1680) Analysis. Ground and flight test data shall be used to validate fuel system flow models. The fuel system shall be analyzed to confirm that the minimum required engine fuel inlet pressure is provided for each of the following cases, throughout the ambient temperature and altitude envelope specified in Figure 3.1.9.1.1-1:

a. During ground operation with fuel tank boost pumps ON and OFF;

b. During normal in-flight operation throughout the appropriate power range

c. Both boost pumps in one main fuel tank feeding two engines operating with maximum fuel flow demand;

d. One boost pump operating in the associated engine main fuel tank with the engine operating at maximum fuel flow demand. [AV/2418]

(AVV/1278) Flight Test. Flight test shall be performed to measure engine fuel pump inlet flow rates, pressures, and temperatures during hot weather flight operations. The test particulars are defined in FAR Part 25.961. Test data shall be used to calibrate fuel system models. [AV/3050]

(AVV/1727) Analysis. Flight test data shall be analyzed to confirm compliance to the climb and cruise altitude limits and assess the maximum climb and cruise altitudes during hot weather flight operations and other standard conditions with the test particulars defined in FAR Part 25.961 and boost pumps OFF. [AV/3050]

(AVV/1733) Flight Test. Flight test shall be performed to measure APU fuel pump inlet pressures and temperatures during in-flight operation. Test data shall be used to validate fuel system models. [AV/2324]

(AVV/1732) Ground Test. Ground test shall be performed to measure APU fuel pump inlet pressures and temperatures during ground operation. Test data shall be used to validate fuel system models. [AV/2324]

(AVV/1135) Analysis. Ground and flight test data shall be used to validate fuel system flow models. The fuel system shall be analyzed to confirm that the minimum required APU fuel inlet pressure is provided during ground and in-flight operation, throughout the ambient temperature and altitude envelope specified in Figure 3.1.9.1.1-1. [AV/2324]

(AVV/1730) Analysis. A stress analysis shall be performed to assess the changes in wing droop due to Air Vehicle modifications. An analysis shall then be performed to determine the changes in the expansion space due to the increased wing droop, and confirm compliance. [AV/2735]

(AVV/2061) Analysis. Engine supplier contaminated fuel lab test results shall be analyzed to confirm compliance. [AV/2405]

(AVV/1752) Analysis. APU supplier contaminated fuel lab test results shall be analyzed to confirm compliance. [AV/2405]

(AVV/1280) Lab Test. The engine supplier shall conduct Design Assurance Testing to the level of contamination indicated in the requirement. [AV/3064]

(AVV/2454) Analysis. Analysis of engine supplier contaminated fuel lab test results shall confirm compliance. [AV/3064]

4.1.3.4.2 Landing Gear Subsystem (Not Used)

4.1.3.4.3 Hydraulics Subsystem Requirements

(AVV/880) Analysis. The TF-39 engine and the new engine performance decks shall be used to determine hydraulic pump power in a thrust-normalized comparison between the two engines. This analysis shall confirm compliance to power requirements for those conditions where the power output of the modified hydraulic system is at least equivalent to the power output on the baseline Air Vehicle for equivalent conditions. A hydraulic system loads analysis and a review of demonstration results shall be performed to confirm compliance for conditions where the modified hydraulic system power output is less than the baseline Air Vehicle's, as defined by the thrust-normalized comparison. The baseline Air Vehicle hydraulic system loads shall be determined from C-5A/B design and analysis reports. Analysis of the hydraulic pump supplier qualification reports shall confirm the responsiveness of the hydraulic pumps. [AV/2303]

(AVV/2470) Demonstration. A flight demonstration shall be performed to demonstrate the power output of the modified hydraulic system for the conditions, identified by analysis, where the power output of the modified hydraulic system is less than the power output on the baseline Air Vehicle for equivalent conditions. [AV/2303]

(AVV/110) Analysis. An analysis of the verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2304]

(AVV/1822) Analysis. Qualification test data of new and modified hydraulic components shall be analyzed to confirm compatibility. [AV/2305]

(AVV/2411) Demonstration. Ground demonstration shall be performed to confirm that the hydraulic system provides the functionality and indications at least equivalent to the baseline Air Vehicle. [AV/2310]

(AVV/1888) Ground Test. Ground test shall be performed to measure engine-driven hydraulic pump inlet pressures during ground operation. [AV/2312]

(AVV/1887) Flight Test. Flight test shall be performed to measure engine-driven hydraulic pump inlet pressures during in-flight operation. [AV/2312]

(AVV/1825) Analysis. An analysis, correlated with ground test and flight test data, shall be performed to confirm compatibility between the hydraulic system and engine-driven hydraulic pumps. This analysis will consider operation within the altitude-temperature envelope defined in Figure 3.1.9.1.1-1. [AV/2312]

4.1.3.4.4 Environmental Control Subsystem Requirements

(AVV/1574) Analysis. An analysis of the verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2337]

4.1.3.4.4.1 Engine Bleed Air Subsystem

(AVV/1684) Analysis. A system analysis using a validated bleed air system model shall be used to determine the pressure and temperature ranges of the air flow exiting downstream of the precooler for normal operation and single component failure cases. The bleed air model will be validated using lab test data and analysis from the engine bleed air system supplier. Review of analytical results shall confirm compliance. [AV/2333]

(AVV/1682) Demonstration. The necessary indications, as defined by the Flight Station Working Group, shall be demonstrated on the Air Vehicle on the ground. Review of demonstration results shall confirm compliance. [AV/2335]

(AVV/2412) Ground Test. Ground testing shall be performed to collect the required Air Vehicle bleed air system data for steady-state systems analysis. Bleed air pressures and temperatures shall be measured during normal operation. [AV/2584]

(AVV/2418) Flight Test. Flight testing shall be performed to collect the required Air Vehicle bleed air system data for steady-state systems analysis. Bleed air pressures and temperatures shall be measured during normal operation at critical flight conditions. [AV/2584]

(AVV/1687) Analysis. The validated steady-state analysis model for the Air Vehicle pneumatic system shall be used to show that the bleed air demands of the air conditioning, engine starting, actuation of thrust reversers, and floor heat subsystems are satisfied throughout the ground and flight envelope. The model will be validated using ground and flight test data. The analysis will confirm compliance. [AV/2584]

(AVV/1688) Analysis. Bleed air subsystem installation drawings and design data shall be reviewed to confirm that provisions for preventing chafing and excessive loads on adjacent components are incorporated. [AV/2347]

(AVV/1689) Ground Test. Ground testing shall be performed to collect the required engine bleed air system data for a dynamic systems analysis. Ground testing shall include engine throttle transients and various bleed air system configuration transitions (such as air conditioning systems from ON to OFF). [AV/2659]

(AVV/1874) Flight Test. Flight testing shall be performed to collect the required engine bleed air system data for a dynamic systems analysis. Flight testing shall include engine throttle transients and various bleed air system configuration transitions (such as air conditioning systems from ON to OFF) at various flight conditions. [AV/2659]

(AVV/1882) Analysis. A dynamic analysis model, validated to ground and flight test data, shall be developed to predict system stability. Test data and analytical model results shall be analyzed to confirm that the engine bleed air subsystem will not create any subsystem instabilities or inadvertent shutdown of an engine. [AV/2659]

4.1.3.4.4.2 Cabin Air Conditioning Subsystem

(AVV/1876) Ground Test. Ground testing shall be performed to collect the required data to assess the dynamic stability and performance of the environmental control system. Ground testing shall include engine throttle transients, various bleed air system configuration transitions, changes in air conditioning system operating modes, and APU bleed air conditions. [AV/2667]

(AVV/1683) Flight Test. Flight testing shall be performed to collect the required data to assess the dynamic stability and performance of the environmental control system. Flight testing shall include engine throttle transients, various bleed air system configuration transitions, and changes in air conditioning system operating modes at various flight conditions. [AV/2667]

(AVV/2435) Analysis. Analysis of the ground and flight test data shall verify that the modified environmental control system is dynamically stable and provides each zone with air flow and air temperature control comparable to the baseline Air Vehicle. The baseline performance of the environmental control system shall be based on analytical models developed from the C-5A program, with changes to reflect the baseline Air Vehicle configuration. Review of the analytical results shall confirm compliance. [AV/2667]

(AVV/2420) Ground Test. Ground testing shall be performed to collect the required Air Vehicle bleed air system data for steady-state systems analysis. [AV/2668]

(AVV/2419) Flight Test. Flight testing shall be performed to collect the required Air Vehicle bleed air data for steady-state systems analysis. [AV/2668]

(AVV/1694) Analysis. Engine bleed air flow supplied to the flow control valve interface shall be analyzed using Air Vehicle bleed air system models to confirm that it meets or exceeds the airflow for the baseline Air Vehicle during similar ground and flight operations. The bleed air model shall be validated using ground and flight test data. Bleed airflow shall be extrapolated to the corners of the ground and flight operational envelopes using the model. The baseline performance of the bleed air system shall be determined by an analytical model of the baseline Air Vehicle configuration, calibrated using available data from the C-5A and C-5B development programs. [AV/2668]

(AVV/1695) Ground Test. Ground testing shall be performed to collect the required Air Vehicle bleed air data for steady-state systems analysis. [AV/2897]

(AVV/1895) Analysis. APU bleed air flow supplied to the flow control valve interface shall be analyzed using Air Vehicle bleed air system models to confirm that it meets or exceeds the airflow for the baseline Air Vehicle during

similar ground operations. The bleed air model shall be validated using ground test data. Bleed airflow shall be extrapolated to the corners of the ground operational envelopes using the model. The baseline performance of the bleed air system shall be determined by an analytical model of the baseline Air Vehicle configuration, calibrated using available data from the C-5A and C-5B development programs. [AV/2897]

(AVV/2443) Ground Test. Ground testing shall be performed to collect the flow rate data for new and modified avionics cooling systems that draw their supply air from the flight station, crew relief compartment, or the troop compartment. [AV/3045]

(AVV/2444) Flight Test. Flight testing shall be performed to collect the flow rate data for new and modified avionics cooling systems that draw their supply air from the flight station, crew relief compartment, or the troop compartment. [AV/3045]

(AVV/2423) Analysis. An analysis using an ECS cabin model shall confirm compliance. The avionics cooling system elements of the ECS cabin model shall be calibrated with ground and flight test data. The baseline performance shall be determined by an analytical model of the baseline Air Vehicle configuration, calibrated using available data from the C-5A and C-5B development programs. [AV/3045]

4.1.3.4.4.3 Equipment Cooling

(AVV/1698) Ground Test. Ground testing shall be performed at an ambient condition approaching a MIL-STD-210A Hot Day to collect the required Air Vehicle avionics forced air cooling system temperature and pressure data for use in a thermal analysis of the equipment cooling systems. [AV/2342]

(AVV/2421) Analysis. An analysis using a thermal model of the equipment, compartment, and related cooling systems shall be performed to assess the avionics cooling system performance. The model will be validated using ground test data. Review of analytical results shall confirm compliance. [AV/2342]

(AVV/1699) Ground Test. Ground testing shall be performed at an ambient condition approaching worst case to collect the required Air Vehicle avionics compartment temperature data for use in a thermal analysis of the equipment environment. [AV/2660]

(AVV/1896) Analysis. An analysis using a thermal model of the equipment, compartment, and related cooling systems shall be performed to assess the temperature environment, for a 103°F ambient temperature using baseline Air Vehicle support equipment. The model will be validated using ground test data. Review of analytical results shall confirm compliance. [AV/2660]

4.1.3.4.4.4 Cabin Pressurization

(AVV/1700) Flight Test. Flight testing shall be performed at pressure altitudes of 40,000 feet and above to collect cabin pressure and pressure altitude data, with both air conditioning packs ON. [AV/2339]

(AVV/2441) Analysis. A cabin pressurization analysis, calibrated with flight test data, shall be performed to confirm the pressurization capability of the Air Vehicle. [AV/2339]

(AVV/1702) Flight Test. Flight testing shall be performed at pressure altitudes of 38,000 feet and above to collect cabin pressure and pressure altitude data, with one air conditioning pack and the floor heating subsystem ON. [AV/2340]

(AVV/2442) Analysis. A cabin pressurization analysis, calibrated with flight test data, shall be performed to confirm the pressurization capability of the Air Vehicle. [AV/2340]

(AVV/1706) Demonstration. Flight demonstration shall be performed to demonstrate that the cabin pressurization system provides the functionality and performance of the baseline system. Additional functionality, resulting from the use of COTS equipment, shall also be demonstrated in flight. [AV/2669]

(AVV/1877) Analysis. An analysis of the verification of requirements at the integration specification level and flight demonstration results shall confirm compliance. [AV/2669]

4.1.3.4.5 Equipment and Furnishings

4.1.3.4.5.1 Cargo Compartment Smoke Detection

(AVV/1832) Analysis. Compliance shall be confirmed by an analysis of the smoke detector qualification or review of the FAA letter granting approval to TSO-C1c, Type II. [AV/2417]

(AVV/1833) Analysis. Engineering drawings shall be reviewed to confirm that the smoke detectors are installed in the same positions as the current detectors. Review of drawings shall confirm compliance. [AV/2594]

4.1.3.4.5.2 Lighting

(AVV/1831) Demonstration. Ground and flight demonstrations of the displays installed in the Air Vehicle shall be conducted to show the effect of ambient light on the display surface. A representative set of crew members will be surveyed to confirm that the displays are legible as installed in all lighting conditions, excluding NVIS operations. The demonstration will be considered successful if the results indicate that the displays are legible as installed. [AV/2772]

(AVV/2471) A ground test shall be conducted to measure illumination of the cargo compartment lighting system (Overhead, Side and Curb) at all of the cargo floor tie-down and vehicle tie-down attaching points with the cargo compartment empty and all Overhead, Side and Curb lights ON. [AV/3085]

(AVV/2472) Analysis. An analysis of the ground test data shall confirm compliance. [AV/3085]

(AVV/2447) Demonstration. Ground demonstration shall be performed to demonstrate that the cargo compartment lighting system provides the same functionality of the baseline system. [AV/3051]

(AVV/2465) Ground Test. Ground test shall be performed to collect the cargo compartment lighting system illumination pattern data using the same locations and instrumentation that was performed on the baseline Air Vehicle. [AV/3051]

(AVV/2466) Analysis. An analysis of the ground test data shall include a comparison of the modified illumination patterns with the baseline Air Vehicle. This analysis and the results of the demonstration shall confirm compliance. [AV/3051]

4.1.3.4.5.3 Night Vision Imaging (NVIS) Compatibility

(AVV/1967) Demonstration. A demonstration shall be conducted on the Air Vehicle while on the ground to show that the baseline Air Vehicle's zonal lighting controls also controls the lighting for new and modified flight station equipment. [AV/3025]

(AVV/1834) Lab Test. Lab testing shall be performed in the Lighting Lab on all new or modified controls and displays, with the exception of the Embedded Diagnostic System display, per MIL-STD-3009 lighting first article test procedure. The testing will be considered successful if the success criteria of MIL-STD-3009 are met by new and modified individual flight station components. [AV/2909]

(AVV/1835) Lab Test. Laboratory testing shall be performed on all new and modified RERP control panels and displays to determine uniformity and luminance levels. [AV/2924]

(AVV/2473) Ground Test. Ground test shall be performed to measure maximum luminance levels of all new and modified equipment edge lighting under dark ambient lighting conditions and daylight lighting conditions at various brightness levels. [AV/2924]

(AVV/2474) Analysis. Analysis of lab and ground test data shall be performed to compare new and modified equipment data to that of the baseline Air Vehicle to confirm compliance with the requirement. [AV/2924]

4.1.3.4.6 Auxiliary Power System

(AVV/1736) Analysis. The APU drawings shall be reviewed to verify that two APUs are installed on the aircraft. [AV/2761]

(AVV/1738) Analysis. The FAA letter granting TSO-77a approval shall be reviewed to confirm compliance. [AV/2762]

(AVV/1739) Analysis. The verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2763]

(AVV/1741) Ground Test. The APU shall be tested with various demands and various ambient conditions. The test data will be used to validate the analytical models for the bleed air subsystem for APU operation. [AV/2322]

(AVV/1740) Analysis. Using ground test data for validation, the APU bleed air capability shall be analyzed by the bleed air system model to confirm that an adequate supply of bleed air is available throughout the ground operating envelope. [AV/2322]

(AVV/1746) Flight Test. Flight test shall be performed to test APU in-flight starting and operation at selected critical flight conditions. [AV/2575]

(AVV/1745) Analysis. Analysis of flight test data shall determine the corners of the APU in-flight starting and operating envelope. Review of analytical results shall confirm compliance. [AV/2575]

(AVV/1742) Flight Test. Flight test shall be performed to determine the in-flight main engine starter assist capability using APU bleed air. [AV/3060]

(AVV/2467) Analysis. Analysis of flight test data shall determine the corners of the APU in-flight main engine starter assist envelope. Review of analytical results shall confirm compliance. [AV/3060]

(AVV/2414) Analysis. A system analysis using a validated bleed air system model shall be used to determine the pressure and temperature ranges of the air flow exiting the APU. Review of analytical results shall confirm compliance. The bleed air model will be validated using lab test data and analysis from the APU supplier. [AV/2604]

(AVV/2416) Analysis. A system analysis using a validated bleed air system model shall be used to determine the heat content at the floor heat control valve interface. The bleed air model shall be calibrated using lab test data and analysis from the APU supplier. The analysis shall be for ground operation on a cold day as defined in Figure 3.1.9.1.1. [AV/2606]

(AVV/1751) Demonstration. The necessary system controls and operating status indications, as defined by the Flight Station Working Group, shall be demonstrated on the Air Vehicle. Review of demonstration results shall confirm compliance. [AV/2764]

(AVV/1754) Analysis. An analysis of the verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2738]

(AVV/2436) Ground Test. Ground test shall be conducted to determine the APU fire extinguishing agent concentration, as a function of time, in various locations of the APU compartment. The ground test plan shall consider the sequence of events leading up to the initiation of agent discharge. Tests shall include critical ambient temperature conditions as defined in Figure 3.1.9.1.1-1. [AV/3052]

(AVV/1755) Flight Test. Flight test shall be conducted under the critical ventilating airflow conditions to determine the APU fire extinguishing agent concentration, as a function of time, in various locations of the APU compartment. The flight test plan shall consider the sequence of events leading up to the initiation of agent discharge. [AV/3052]

(AVV/2437) Analysis. Ground and flight test data shall be analyzed to evaluate the fire extinguishing agent concentration, as a function of time, in the designated fire zone relative to the appropriate standard for the fire extinguishing agent. Analysis shall confirm compliance. Instrumentation, instrumentation location definition, analysis support, and test recommendations will be provided by an established fire extinguishing system supplier. [AV/3052]

(AVV/1813) Analysis. An analysis of the verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2703]

4.1.3.4.7 Flight Controls Subsystem Requirements

4.1.3.4.7.1 Mechanical Characteristics

(AVV/2383) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. Control surface deflections will be measured during critical flight maneuvers that produce the highest

flight control system demands for the clean, takeoff, and landing configurations with SAS ON. The test matrix will include critical flight conditions within the permissible flight envelope. [AV/2656]

(AVV/2483) Ground Test. A no-load ground test shall be performed where control surface deflections will be measured. [AV/2656]

(AVV/1720) Analysis. Analyses using stability and control data that have been updated to reflect wind tunnel test results, hydraulics system lab test data, and predicted AFCS performance shall be conducted to provide an initial evaluation of flight control system capability prior to flight testing. Stability and control analyses using flight test and lab test data shall be performed to confirm compliance. [AV/2656]

(AVV/1721) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. These tests will be conducted for the clean, takeoff, and landing configurations. Control deflections on all axes will be input to induce oscillations for system evaluation. The test matrix will include the critical points taken from the service flight envelope. [AV/2557]

(AVV/2381) Analysis. A systems analysis combined with simulation analyses using updated aerodynamic models will provide an initial evaluation of the performance of the artificial stability systems for critical points across the service flight envelope. These analyses will be used to show compliance with this requirement. [AV/2557]

(AVV/1722) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. SAS will be OFF for these tests. Aileron, elevator, and rudder surface deflections will be input to induce oscillations for flight control system evaluation for the clean, takeoff, and landing configurations. The Air Vehicle damping will be measured. The test matrix will include critical flight conditions within the service flight envelope as defined in Appendix D. [AV/2658]

(AVV/2384) Analysis. Analysis using stability and control data updated to reflect wind tunnel test results and flight control system performance predictions shall be conducted for critical points in the flight envelope to provide an initial evaluation of handling qualities following SAS system failures with a probability greater than 10^{-9} failures per flight hour. Stability and control analyses of flight test data shall be conducted, using available C-5A data for comparison, to confirm compliance. [AV/2658]

(AVV/1865) Analysis. An analysis of the verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2960]

(AVV/1537) Analyses. Analyses. Analyses of the ALDCS and AFCS control surface deflection requirements and a comparison of those hinge moments with the available system power shall provide an initial estimate of these systems capability to withstand the expected loads across the permissible flight envelope. This flight envelope will include critical areas of the permissible flight envelope. A comparison against these initial analyses with flight test data will confirm compliance. [AV/2470]

(AVV/1538) Flight Test. Flight testing of the ALDCS and AFCS shall be conducted at high and low speed at both a forward and aft centers of gravity. This testing will cover critical areas of the permissible flight envelope. SAS will be ON for all testing. [AV/2470]

(AVV/1815) Demonstration. In-flight demonstrations shall be performed to show functionality of slat position indication during critical flight conditions. [AV/2705]

(AVV/1872) Analysis. The in-flight demonstration results and the verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2705]

4.1.3.4.7.2 ALDCS

(AVV/2382) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. Configurations including cruise, takeoff, and landing will be evaluated. Control inputs will be made to evaluate the ALDCS function in conjunction with control inputs. The test matrix will include critical points taken from the permissible flight envelope as defined in Appendix D. [AV/2611]

(AVV/2452) Ground Test. Ground vibration and structural mode interaction testing shall be conducted with both ALDCS and pitch SAS ON and OFF. Data shall be recorded to provide adequate information for evaluation of the ALDCS. [AV/2611]

(AVV/1724) Analysis. Analyses using updated stiffness and mass data shall be used to develop initial system modification. ALDCS models shall then be further updated as required, using ground vibration test and structural mode interaction test data from ground testing. Flight test data shall then be analyzed to confirm compliance. [AV/2611]

4.1.3.4.7.3 Directional Control

(AVV/2385) Flight Test. Flight tests shall be conducted at an aft center of gravity. These tests will be conducted for all takeoff configurations. Control surface deflections, control forces, and aircraft performance shall be measured. The test matrix will include critical flight conditions within the flight envelope as defined in Appendix D. The conditions for this test will include:

a. The most critical engine inoperative;

b. The remaining engines producing take-off thrust at all speeds;

c. The lightest normal take-off weight;

d. With trim settings normally employed in a symmetric thrust take-off;

e. Bank angle not greater than 5 degrees. [AV/2690]

(AVV/1725) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results and manufacturer supplied engine decks shall be conducted at critical points in the flight envelope to provide an initial estimate of the Air Vehicle stability and control characteristics following a sudden engine failure. Analyses of flight test data shall be conducted to confirm compliance. [AV/2690]

(AVV/1726) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results and manufacturer supplied engine decks shall be conducted to provide an initial estimate of the Air Vehicle stability and control characteristics following failure of the two most critical engines. Analyses of the flight test data shall be conducted to verify the ability of the Air Vehicle to make 15 degree heading changes in both directions, or heading changes as limited by pedal force, to confirm compliance. [AV/2692]

(AVV/2387) Flight Test. Flight tests shall be conducted at the most forward center of gravity to evaluate the Air Vehicles ability to make up to 15 degree heading changes, or heading changes as limited by pedal forces up to 180 lbs. These tests will be conducted for the takeoff configuration with the flaps in the most favorable climb configuration. Control forces, control surface deflections and Air Vehicle performance shall be measured. The test matrix will include critical flight conditions within the flight envelope defined in Appendix D. The conditions for this test will include:

a. The two most critical engines will be simulated as failed by shutting down the critical outboard engine with the remaining engine at flight idle thrust;

b. The remaining engines producing maximum continuous power;

c. Speed equal to $1.4V_S$ for the flap configuration producing the most favorable climb. [AV/2692]

(AVV/1759) Flight Test. Flight tests shall be conducted at the most forward center of gravity to evaluate the Air Vehicle's ability to make up to 20 degree banked turns in both directions. These tests will be conducted for the takeoff configuration with the flaps in the most favorable climb configuration. Control forces, control surface deflections and Air Vehicle performance shall be measured. The test matrix will include critical flight conditions within the flight envelope defined in Appendix D. The conditions for this test will include:

a. The two most critical engines will be simulated as failed by shutting down the critical outboard engine with the remaining engine at flight idle thrust;

b. The remaining engines producing maximum continuous power;

c. Speed equal to $1.4V_S$ for the flap configuration producing the most favorable climb. [AV/2691]

(AVV/2386) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results and manufacturer supplied engine decks shall be conducted to provide an initial estimate of the Air Vehicle stability and control characteristics following failure of the two most critical engines. Analyses of the flight test data shall be

conducted to verify the ability of the Air Vehicle to make 20 degree banked turns in both directions, to confirm compliance. [AV/2691]

(AVV/1760) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results and manufacturer supplied engine decks shall be conducted to provide an initial estimate of the Air Vehicle's trim capability following failure of the critical engine. Analyses of the flight test data shall be conducted to verify the Air Vehicle's ability to trim following a critical engine failure, to confirm compliance. [AV/2693]

(AVV/2388) Flight Test. Flight tests shall be conducted at the critical aft center of gravity and light weight. These tests will be conducted in the clean configuration. Control forces, control surface deflections and Air Vehicle performance shall be measured. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. The conditions for this test will include:

a. The most critical engine inoperative;

b. The remaining engines producing maximum continuous power;

c. Bank angle not greater than 5 degrees;

d. SAS ON. [AV/2693]

(AVV/2389) Flight Test. Flight tests shall be conducted at an aft center of gravity. Control deflections, air data including angle of attack and sideslip, spatial position and orientation shall be measured. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. The conditions for this test will include:

a. The climb speed, configuration and power required for the purpose of establishing the rate of climb;

b. The most unfavorable center of gravity;

c. The weight at which the two-engine-inoperative rate of climb in feet per minute is equal to at least $0.013V_{SL2}$ at an altitude of 5,000 feet;

d. Landing gear retracted;

e. Wing flaps in the most favorable position;

f. Remaining engines at maximum continuous power available at each altitude. [AV/2694]

(AVV/1761) Analysis. Analyses using wind tunnel test results and manufacturer supplied engine decks shall be conducted to provide an initial estimate of the Air Vehicle trim capability following a failure of the two most critical engines. An updated analysis using flight test data shall be conducted to confirm compliance. [AV/2694]

(AVV/2392) Flight Test. Flight tests shall be conducted at an aft center of gravity. Simulated engine-failure tests will be conducted for all takeoff configurations. Control forces, control surface deflections and Air Vehicle performance shall be measured. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. The conditions for this test will include:

a. Rudder force shall not exceed 180 pounds;

b. Throttle adjustments on the remaining engines are not allowed;

c. Exceptional skill, strength or alertness on the part of the pilot to prevent a change in heading in excess of 20 degrees before recovery is complete is not required. [AV/2695]

(AVV/1763) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results and manufacturer supplied engine decks shall be conducted at critical points in the flight envelope to provide an initial estimate of the Air Vehicle stability and control characteristics following a sudden engine failure. Analyses of the flight test data shall be conducted to determine the Air Vehicle minimum control speed following a sudden failure of the critical engine, to confirm compliance. [AV/2695]

(AVV/1764) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results shall be conducted to provide an initial estimate of the Air Vehicle's air minimum control speed, V_{MCA}, prior to flight test.

Analyses of the flight test data shall be conducted to determine the relationship of the Air Vehicle's air minimum control speed to V_1, to confirm compliance. [AV/2696]

(AVV/2390) Flight Test. Flight tests shall be conducted at the critical aft center of gravity. Simulated engine-failure tests will be conducted for all takeoff configurations. Control forces, control surface deflections and Air Vehicle performance shall be measured. The test matrix will include critical flight conditions within the operational flight envelope as defined in Appendix D. [AV/2696]

(AVV/2357) Flight Test. Flight tests shall be conducted at both forward and aft centers of gravity at heavy and light weights. These tests will be conducted for all applicable landing configurations. SAS will be on for these tests. Flight testing of this system will be conducted using a build up method to validate the system's capability. The test matrix will include the critical points taken from the operational flight envelope. [AV/2653]

(AVV/2475) Lab Test. The autoland system capability and repeatability will be tested prior to flight test using both engineering and manned simulations. [AV/2653]

(AVV/1812) Analysis. Analyses of simulation and flight test data will be used to confirm compliance. [AV/2653]

4.1.3.4.7.4 Requirements for Full Power Systems

(AVV/1770) Analysis. Analyses of wind tunnel test revised stability and control data, hydraulic system performance data, and simulation shall provide an estimate of the Air Vehicle controllability with the loss of one hydraulic system at critical points in the flight envelope. This analysis will confirm compliance. [AV/2697]

(AVV/1778) Analysis. Analyses using stability and control data updated to reflect measured hydraulic system performance, and simulation models validated by flight test shall be conducted at critical points in the permissible flight envelope to confirm the Air Vehicle's controllability with the loss of two hydraulic systems. [AV/2700]

(AVV/2405) Demonstration. A demonstration will be conducted to verify these characteristics at representative points in the permissible flight envelope to provide substantiation. [AV/2700]

(AVV/1783) Analysis. Analyses using stability and control data updated to reflect measured hydraulic system performance, and simulation models validated by flight test shall be conducted at critical points in the permissible flight envelope to determine the Air Vehicle's controllability following the failure of all engines. [AV/2699]

(AVV/2395) Flight Test. Flight tests shall be conducted at the most forward center of gravity at maximum level speed. One hydraulic system will be failed and a 1.5-g maneuver will be performed. Column forces will be measured. The test matrix will include critical flight conditions within the permissible flight envelope. [AV/2707]

(AVV/1807) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results, hydraulic system performance data, and simulation shall be conducted to provide an initial estimate of the Air Vehicle capability to achieve 1.5-g at maximum level flight speed at sea level with the loss of one hydraulic system. Analyses of flight test data shall be conducted to confirm compliance. [AV/2707]

(AVV/2393) Flight Test. Flight testing shall be conducted on the Air Vehicle at a nominal takeoff weight, landing on a representative day on a runway with a known RCR less than 23. The most critical hydraulic system will be shut down during this test, and the elevator control force will be trimmed to within 5 lbs at 1.4VS for the landing configuration. The Air Vehicle will be in the PA configuration. Rudder control forces will be measured during this test. The test matrix will include critical flight conditions within the operational flight envelope. [AV/2710]

(AVV/1808) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results, hydraulic system performance data, and simulation shall be conducted to provide an estimate of the Air Vehicle's capability to land with a 90-degree crosswind component of at least the same as the baseline Air Vehicle, as defined in Appendix D, for the landing configuration with a snow packed and ice covered runway. Analyses of flight test data shall be conducted to confirm compliance. [AV/2710]

(AVV/2394) Flight Test. Flight tests shall be conducted at the most forward center of gravity at $1.4V_S$ for the landing configuration, in configuration PA. The most critical hydraulic system will be failed and a landing will be performed with the elevator control force initially trimmed to within 5 pounds of zero. Column forces required during landing, and Air Vehicle performance, will be measured. The test matrix will include critical flight conditions within the operational flight envelope. [AV/2708]

(AVV/1810) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results, hydraulic system performance data, and simulation shall be conducted to provide an initial estimate of the Air Vehicle to land with the loss of one hydraulic system. Analyses of flight test data shall be conducted to confirm compliance. [AV/2708]

(AVV/2407) Flight Test. Flight tests shall be conducted at the most aft center of gravity at $1.4V_S$ for the landing configuration and in configuration PA. The primary directional trim system will be failed and a simulated go around with the most critical engine inoperative and the remaining engine powers at NRT will be performed with the elevator control force initially trimmed to within 5 lbs of zero. Column forces, engine power, and rudder deflection required to trim during simulated go-around and Air Vehicle performance will be measured. The test matrix will include critical flight conditions within the service flight envelope. [AV/2706]

(AVV/2406) Analysis. Analyses using stability and control data updated to reflect wind tunnel test results and manufacturer supplied engine decks shall be conducted to provide an initial estimate of the Air Vehicle trim capability following a failure of the critical engine using the secondary directional trim system. Analyses of the flight test data shall be conducted to verify that the Air Vehicle can be trimmed following failure of the critical engine with the others at normal rated thrust, to confirm compliance. [AV/2706]

4.1.3.4.8 Electrical Subsystem Requirements

(AVV/93) Analysis. The verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/2765]

(AVV/551) Analysis. An Electrical Power load analysis, containing the data and operating states defined in MIL-E-7016, shall be performed to show that the Air Vehicle electrical power subsystem provides AC and DC power at a sufficient capacity to power all existing, new, and modified systems and equipment. The analysis shall confirm compliance. [AV/1092]

(AVV/2455) Analysis. The verification results of all descendant requirements at the integration specification level shall be evaluated to confirm compliance. [AV/3065]

(AVV/2456) Demonstration. The necessary system controls and operating status indications, as defined by the Flight Station Working Group, shall be demonstrated on the Air Vehicle on the ground. Review of demonstration results shall confirm compliance. [AV/3066]

(AVV/553) Analysis. An analysis shall be performed using the generating system qualification test data to confirm that each generator is capable of supplying a minimum of 540A single-phase line-to-neutral short circuit current and 540A/phase for a 3-phase fault current for 5 seconds to the load bus at normal IDG inlet oil temperatures (28-285°F). The analysis shall also confirm that the maximum fault current from each generator is limited to 760A/phase of rated current at the load bus. [AV/2585]

(AVV/980) Analysis. An Electrical Power load analysis, containing the data and operating states defined in MIL-E-7016, shall be performed to show that each Air Vehicle auxiliary power unit (APU) generator provides sufficient capacity to allow self-sufficient ground operation, and to allow continued safe flight and landing in the event of a failure of all engine-driven electrical generators. Ground test data shall be analyzed to validate the Electrical Power load analysis. This analysis shall confirm compliance. [AV/2589]

(AVV/1889) Ground Test. Ground testing shall be performed to collect the required APU electrical loads data representing ground and flight operations, to validate the electrical load analysis. [AV/2589]

(AVV/1891) Analysis. The vendor's qualification test report shall be reviewed to confirm compliance with AC characteristics specified in MIL-STD-704C. [AV/2321]

4.1.3.5 Avionics

4.1.3.5.1 Avionics Subsystem And Avionics Integration Requirements

(AVV/1653) Lab Test. Baseline Air Vehicle Avionics functions (as defined by the most recent AMP PIDS) shall be confirmed using a tailored version of the most recent AMP SIL Test Plan to be approved by the customer. [AV/2942]

(AVV/1976) Ground Test. Baseline Air Vehicle Avionics functions shall be ground tested using a tailored version of the most recent AMP Ground Test TISs and applicable Functional Test Procedures. [AV/2942]

(AVV/1977) Flight Test. Baseline Air Vehicle Avionics functions shall be flight tested using a tailored version of the most recent AMP Flight Test TISs and applicable Functional Test Procedures. [AV/2942]

(AVV/1978) Analysis. Results from the System Integration Lab tests shall be compared to the original AMP results from the same subset of tests. Results from the Ground Tests shall be compared to the original AMP results from the same subset of tests. Results from the Flight Tests shall be compared to the original AMP results from the same subset of tests. Results from the Functional Test Procedure shall be evaluated against the pass/fail criteria of the Functional Test Procedures. These subsets of System Integration Lab test results, ground test results, flight test results and Functional Test Procedure results from the Air Vehicle shall show that system modification has not degraded the baseline Air Vehicle Avionic performance. [AV/2942]

(AVV/80) Analysis. Drawings, software documentation and interface control documentation shall be reviewed and compared to the baseline Air Vehicle's avionics architecture to show compliance. [AV/1082]

(AVV/1982) Lab Test. In the System Integration Lab, tests at the Air Vehicle level shall be performed in which a randomly-selected sample of 20% of all cockpit information for new and modified systems shall be simulated to show that information necessary for operation of the Air Vehicle for new and modified subsystems are processed and displayed consistent with baseline Air Vehicle processing and displays. These tests will include fault insertion. [AV/2972]

(AVV/2424) Lab Test. The verification results of all descendant requirements at the integration specification level that are verified by lab test shall be evaluated to ensure verification, by lab test, of the parent requirement in this specification. [AV/2972]

(AVV/1983) Ground Test. Ground tests shall be performed in which a selected sample of 5% of all cockpit information for new and modified systems shall be simulated to show that information necessary for operation of the Air Vehicle for new and modified subsystems are processed and displayed consistent with baseline Air Vehicle processing and displays. These tests will include fault insertion. [AV/2972]

(AVV/1984) Analysis. The System Integration Lab test results, ground test results, and data gathered during QT&E ground testing and flight testing shall be analyzed to confirm that information necessary for operation of the Air Vehicle for new and modified subsystems is processed and displayed consistent with baseline Air Vehicle processing and displays. [AV/2972]

4.1.3.5.2 Cautions, Warnings, and Advisories

(AVV/2468) Demonstration. A demonstration shall be performed where applicable on the Air Vehicle while on the ground to show that the applicable annunciations on the annunciation panel that were located at the pilot/copilot center console are incorporated in the CWA system MFDU annunciation. [AV/3078]

(AVV/2469) Lab Test. A lab test shall be performed in the SIL to show that all annunciations on the annunciation panel that were located at the pilot/copilot center console are incorporated in the CWA system MFDU annunciation. [AV/3078]

(AVV/1954) Demonstration. A demonstration shall be performed on the Air Vehicle while on the ground to show that new and modified engine displays and CWA data associated with modified systems are locatable by pilot selection in an area consistent with the engine instrument location in the baseline Air Vehicle. [AV/3012]

(AVV/1961) Lab Test. Requirements-based software testing shall be performed in which faults are inserted into the system to represent each single-point failure in the avionics system. The tests will show that the CWA function is fail-operational for any single-point failure in the avionics system. [AV/3019]

(AVV/1989) Analysis. The ground test results shall be analyzed to confirm that the CWA function is fail-operational for any single point failure. [AV/3019]

(AVV/1768) Analysis. A System Safety Analysis (SSA), and an FMEA (for new and modified equipment only), shall be performed to provide analytical evidence verifying the caution and display system during failures of new and modified equipment. The level of detail of the analyses will be dependent on the classification of the failure

condition/hazard from the Functional Hazard Assessment (FHA), the degree of integration, and the complexity of the system implementation. The analyses will provide the necessary assurance that all relevant failure conditions/hazards have been identified and that all significant combinations of failures that could result in these failure conditions/hazards have been considered. When applicable, the SSA will include an analysis of data obtained during the lab, ground and flight test of the new and modified components on the Air Vehicle. [AV/2786]

(AVV/1922) Analysis. The list of mission-critical and safety-critical functions and the software, and the lab and ground test results shall be analyzed to confirm that the CWA subsystem alerts the operator to any change for new and modified subsystems in performance of a mission-critical or safety-critical function in a clear and timely manner. [AV/3006]

(AVV/1774) Lab Test. A test shall be performed in the System Integration Lab to measure the latency between the onset of the CWA condition and the display of the CWA. This test shall be performed for all safety critical and mission critical CWA. [AV/3006]

(AVV/1775) Ground Test. A test shall be performed on the Air Vehicle while on the ground to measure the latency between the onset of the CWA condition and the display of the CWA. This test shall be performed for a subset of safety critical and mission critical CWA. [AV/3006]

4.1.3.5.3 Controls and Displays

(AVV/1951) Demonstration. A demonstration shall be performed in the Systems Integration Lab to show that new and modified display formats are selectable on any pilot, copilot, flight engineer, and navigator MFDU. [AV/3009]

(AVV/1955) Demonstration. A demonstration shall be performed on the Air Vehicle while on the ground to show that primary flight data, navigation data, status, and mode annunciations are locatable in the pilot's and copilot's primary fields of view. [AV/3013]

(AVV/1957) Demonstration. A demonstration shall be performed in the Systems Integration Lab to show that all required engine information as specified in applicable sections of FAR 25.1305 is displayed within a contiguous, single display area. [AV/3015]

(AVV/1975) Ground Test. The propulsion system cockpit displays shall be operated to show that they meet the applicable requirements of FAR Part 25.1305, Powerplant Instruments. [AV/3015]

(AVV/836) Analysis. The requirements of FAR Part 25.1305, Powerplant Instruments, shall be examined and compared to the propulsion system cockpit displays to confirm that the displays conform to FAR Part 25.1305. Ground test data and lab data shall be analyzed to confirm that displayed parameters are within expected ranges. [AV/3015]

(AVV/1990) Analysis. The Functional Hazard Assessment and Failure Modes and Effects Analysis shall be used to confirm that no single point failure introduced by Air Vehicle modifications prevents safety-critical information from being viewed by both pilots. [AV/3016]

(AVV/237) Analysis. An analysis shall be performed to identify all new, modified, or relocated displays. An analysis shall also be performed to determine the degree of accuracy necessary for accomplishing operational tasks using these displays, as well as the required position of the operating personnel which allows him/her to derive the necessary information from the display. This analysis will be used to determine whether the operator can adequately read the display without assuming an uncomfortable, awkward or unsafe position. Hazard analysis will be referenced to determine potential hazards that exist in the area surrounding the display. The analysis will be considered successful if it concludes that all new and modified displays can be used by the operator as necessary to accomplish the required tasks for which they were designed. These tasks are determined to be accomplishable without placing the operator in uncomfortable or awkward positions, or exposing him/her to hazardous conditions. "Awkward or uncomfortable position" is defined as a position that is not easily accommodated by the normal movement range of the human body, or a position that causes undue fatigue. [AV/1227]

(AVV/2430) Analysis. An analysis shall be performed to identify all new, modified, or relocated maintenance-related displays. An analysis shall also be performed to determine the degree of accuracy necessary for accomplishing maintenance-tasks using these displays, as well as the required position of the maintenance personnel which allows him/her to derive the necessary information from the display. This analysis will be used to determine

whether the maintainer can adequately read the display without assuming an uncomfortable, awkward or unsafe position. Hazard analysis will be referenced to determine potential hazards that exist in the area surrounding the display. The analysis will be considered successful if it concludes that all new and modified maintenance related displays can be used as necessary to accomplish the required maintenance tasks for which they were designed. These tasks are determined to be accomplishable without placing the maintainer in uncomfortable or awkward positions, or exposing him/her to hazardous conditions. "Awkward or uncomfortable position" is defined as a position that is not easily accommodated by the normal movement range of the human body, or a position that causes undue fatigue. [AV/1227]

(AVV/238) Analysis. Functional analysis shall be conducted to determine the functional relationships between new, modified, and relocated controls and displays. This analysis will be used to determine the desired control display grouping. Grouping will be accomplished using MIL-STD-1472 para. 5.1.2 as a guide. Analysis oof aircraft drawings shall be conducted to determine that the control/display grouping identified by the functional analysis has been implemented in the design. The analysis will be considered successful if it concludes that MIL-STD-1472 para. 5.1.2 guidelines have been applied to the design to the extent possible to ensure adequate control/display relationships. Functional relationships have been identified and preserved in the design. Functionally related controls and displays are located close to each other, arranged in functional groups, and marked to emphasize the grouping. Exceptions will be made where: functional grouping is compromised to maintain location for transfer of training purposes, space does not allow collocation, or markings did not exist in the aircraft design prior to RERP. [AV/2902]

(AVV/1945) Demonstration. Demonstration shall be conducted with the Air Vehicle on the ground wherein operators attired in cold weather clothing operates the new and modified controls and displays required for Air Vehicle start-up. Univariate demonstration will be conducted for each anthropometric variable identified in Table 3.8-1. Demonstration will consist of testing each anthropometric variable (identified in Table 3.8-1) using test subjects seated in each crew station position to determine their ability to reach new, modified, and relocated crew station controls identified by the analysis, while attired in cold weather clothing, seated with the restraint harness unlocked, within the limits of the cockpit equipment that is not modified by the C-5 RERP program. The demonstration will be considered successful if an operator attired in cold weather clothing gear can:

a) See all new and modified controls and displays required for start-up

b) Reach all new and modified controls required for Air Vehicle start-up

c) Actuate all new and modified controls required for Air Vehicle start-up throughout their full actuation range. A tool may be used to accomplish this objective. This tools will be deemed acceptable if it has been chosen from the current manifest of tools available within the Air Force and does not require the procurement of a unique tool. [AV/2910]

4.1.4 (Not Applicable)

4.1.5 Reliability Requirements

(AVV/136) Analysis. Verification of compliance with the MTBF requirement in section 3 shall be shown by analysis using the assumptions, conditions, and allocations in Appendix A. The analysis shall be periodically updated to reflect equipment selections and failure data gathered during supplier/LM Aero/USAF testing, including QT&E/QOT&E through dedicated QOT&E. [AV/1125]

4.1.6 Maintainability And Maintenance Concept Requirements

(AVV/1643) Demonstration. Demonstration of the C-5 RERP system, in conjunction with other flight and maintenance demonstrations shall be performed to support the ground test. [AV/1226]

(AVV/901) Ground Test. Testing of selected new and modified C-5 RERP maintainer interfaces shall be conducted through the use of subjective surveys designed to measure maintainer acceptance of functionality. The selected maintainer interfaces shall be documented in the Maintainability Demonstration Plan. The test will be considered successful if it indicates that a majority of the maintainers surveyed concur that the new and modified C-5 RERP interfaces are optimized as defined by the questionnaire. The questionnaires will include questions regarding the likelihood of the maintainer to make mistakes using this interface. [AV/1226]

(AVV/2397) Analysis. An analysis of all ground test data shall be performed to confirm compliance with the requirement. [AV/1226]

(AVV/902) Analysis. A functional analysis shall be conducted to determine where in the maintenance of the Air Vehicle repetitive maintainer tasks exist. An analysis shall be conducted to confirm that these tasks have been minimized, either by the application of automation or the reduction of steps to accomplish the task. A repetitive task is defined as a task that must be accomplished three or more times consecutively. Such tasks will be considered appropriate in cases where no alternative designs exist that would allow reduction or such designs are considered to be cost prohibitive. The analysis will be considered successful if it shows that repetitive tasks (defined above) are eliminated from the maintenance of the Air Vehicle either by the application of automation or the reduction of steps to accomplish the task. Where repetitive tasks are found to remain, only those where no alternative designs are available, or the alternatives identified are cost prohibitive or are out of scope, will be accepted. [AV/2083]

(AVV/2359) Analysis. An analysis shall be performed with a multivariate anthropometric human modeling software application, considering the accessibility and operability of new, modified, and relocated equipment with maintainer interfaces for the cases specified in Table 3.1.6-1. [AV/2906]

(AVV/1644) Demonstration. Univariate demonstration shall be conducted for each anthropometric variable identified in Table 3.1.6-1. Where analysis is considered marginal or inconclusive, or demonstration is considered more cost effective, demonstration will be used to verify the requirement. Demonstration will consist of testing each anthropometric variable (identified in Table 3.1.6-1) using test subjects positioned as necessary to do the task at hand to determine their ability to reach new, modified, and relocated equipment, within the limits of the C-5 equipment that is not modified by the C-5 RERP program. The verification will be considered successful if the analysis and demonstration results indicate:

New, modified, and relocated equipment components are reachable for each model specified in Table 3.1.6-1, within the limits of the equipment that is not modified by the C-5 RERP program.

Test subjects can reach new, modified, and relocated equipment for the specified anthropometric variables. [AV/2906]

(AVV/2319) Inspection. Inspection of new and modified LRUs shall be performed to confirm that the correct labeling is present. The labels for new and modified items weighing between 38 and 64 pounds (inclusive) will specify two person lift. The labels for new and modified items weighing more than 64 pounds will specify mechanical lift. [AV/2904]

(AVV/2361) Analysis. Analysis of new and modified LRUs shall be performed to confirm compliance regarding handles and grasp areas. The analysis shall be considered successful if the results indicate that the LRUs provide two handles or grasp areas that can be used for the removal and replacement of the LRU. For verification, "grasp area" is defined as a region of the LRU surface that can support the weight of the LRU by which the LRU can be lifted without damaging the LRU or exposing the operator to a hazard. [AV/2939]

(AVV/2360) Analysis. Analysis shall be conducted to determine tasks that are marginal with regard to maintainability in biological/chemical warfare ensembles. This analysis considers only thru-flight inspections identified by Appendix E, section E3.2.1 (including changes required by Air Vehicle modifications), including the replenishment of safety critical fluids and gaseous charge pressurization. [AV/2182]

(AVV/1079) Demonstration. For the limited subset of tasks defined by the analysis, demonstrations shall be conducted with the Air Vehicle on the ground, wherein a typical maintainer attired in biological/chemical warfare ensembles maintains equipment associated with the identified tasks. Univariate demonstration will be conducted for each anthropometric variable identified in Table 3.1.6-1. Demonstration will consist of testing each anthropometric variable (identified in Table 3.1.6-1) using test subjects positioned as necessary to accomplish the tasks at hand while attired in biological/chemical warfare ensembles, within the limits of the C-5 equipment that is not modified by the C-5 RERP program. The demonstration will be considered successful if an operator attired in biological/chemical warfare gear can maintain all new, modified, and repositioned equipment associated with maintenance tasks. [AV/2182]

(AVV/2362) Analysis. Analysis shall be conducted to determine maintainability tasks that are necessary in an arctic gear environment. This analysis considers only thru-flight inspections identified by Appendix E, section

E3.2.1 (including changes required by Air Vehicle modifications), including the replenishment of safety critical fluids and gaseous charge pressurization. [AV/2191]

(AVV/1080) Demonstration. For the limited subset of tasks defined by the analysis, demonstrations shall be conducted with the Air Vehicle on the ground, wherein a typical maintainer attired in cold weather clothing maintains equipment associated with the identified tasks. Univariate demonstration will be conducted for each anthropometric variable identified in Table 3.1.6-1. Demonstration will consist of testing each anthropometric variable (identified in Table 3.1.6-1) using test subjects positioned as necessary to accomplish the tasks at hand while attired in cold weather clothing, within the limits of the C-5 equipment that is not modified by the C-5 RERP program. The demonstration will be considered successful if an operator attired in cold weather clothing can maintain all new, modified, and repositioned equipment associated with maintenance tasks that are required to be performed in a cold weather environment. [AV/2191]

(AVV/144) Analysis. A review of the C-5 RERP Maintenance Concept shall be conducted to show that new Air Vehicle equipment conforms to the 2-level maintenance concept. [AV/1134]

(AVV/152) Analysis. A review of drawings and/or TOs shall be performed to verify new and modified Air Vehicle equipment is of LRU/LRM design. [AV/1142]

(AVV/1166) Analysis. A review of drawings and/or verified TOs shall be performed to verify that Air Vehicle modifications adhere to a "one-deep" packaging concept for LRUs. The analysis may identify items that do not conform to the "one-deep" concept. Justification for their exclusion must be submitted as a variance. [AV/2267]

(AVV/1650) Analysis. A review of the engineering drawings shall verify that access panels are provided for areas requiring periodic inspections and preventive maintenance during field and depot level maintenance activities. [AV/2940]

(AVV/1651) Demonstration. Demonstration shall be performed to verify the capability to remove and replace engine buildup (EBU) assemblies using a bootstrap system. [AV/2941]

(AVV/2334) Analysis. Verification shall be shown by analysis using the assumptions, conditions and allocations in Appendix A. The analysis shall be periodically updated to reflect equipment selections and maintainability data gathered during supplier/LM Aero/USAF testing, including QT&E/QOT&E through dedicated QOT&E. [AV/3046]

(AVV/1641) Analysis. An analysis shall be performed to verify that it is possible to maintain the aircraft in a bare base environment (no USAF presence, AFPAM 10-219 Vol. 5, 01 Jun 96, Bare Base Conceptual Planning Guide) without special facilities for maintenance. The analysis will review the maintenance requirements of the RERP equipment to determine related O-level facilities requirements; the requirement will be considered met if no additional maintenance facilities are required. [AV/2938]

(AVV/315) Analysis. Maintenance task analysis shall be conducted to verify that new and modified Air Vehicle equipment and equipment installation is designed to be maintained by three-skill and five-skill level personnel. The analysis will be supplemented by the results of maintainability demonstrations. [AV/1304]

4.1.7 (Not Applicable)

4.1.8 (Not Applicable)

4.1.9 Environmental Requirements

4.1.9.1 Operating and Non-Operating Environment

4.1.9.1 Ambient Temperature

(AVV/1595) Ground Test. Hot and Cold Day ground tests shall be performed on the Air Vehicle to measure compartment and component environmental, and cooling air exhaust temperatures. The Air Vehicle shall be instrumented with thermocouples, pressure transducers and hot wire anemometer probes. [AV/2869]

(AVV/2367) Flight Test. Hot and Cold Day flight tests shall be performed on the Air Vehicle to measure compartment and component environmental, and cooling air exhaust temperatures. The Air Vehicle shall be instrumented with thermocouples, pressure transducers and hot wire anemometer probes. [AV/2869]

(AVV/2368) Analysis. The measured ground and flight test data will be utilized to correlate the analytical thermal model which will be used to predict compartment and component environmental, and cooling air exhaust temperatures. The model will predict component environmental temperatures for the critical ground and flight conditions in the flight envelope, in Figure 3.1.9.1.1-1, to confirm compliance. [AV/2869]

4.1.9.1.2 Ambient Pressure

(AVV/1594) Analysis. An analysis shall establish the pressure altitude limits for each Air Vehicle modification. An analysis shall be performed by comparing environmental qualification reports from the RERP Air Vehicle vendors and appropriate sections of RTCA/DO-160D to confirm compliance. [AV/2871]

4.1.9.1.3 Humidity

(AVV/1596) Analysis. An analysis shall be performed by comparing the suppliers' environmental qualification documentation for new and modified equipment to the criteria in RTCA/DO-160D, Category A for equipment installed in environmentally controlled areas, Category B for equipment installed in non-controlled environments within the Air Vehicle, and Category C for externally mounted equipment. This analysis will confirm compliance. [AV/2874]

4.1.9.1.4 Salt Fog

(AVV/1597) Analysis. An analysis shall be performed by comparing the components' environmental qualification reports for new and modified equipment to the criteria in RTCA DO-160D, Section 14 for Category S equipment, to confirm compliance. [AV/2876]

4.1.9.1.5 Sand and Dust

(AVV/1598) Analysis. An analysis shall be performed by comparing the components' environmental qualification reports for new and modified equipment to the criteria in RTCA DO-160D, Section 12 for Category D equipment, to confirm compliance. [AV/2878]

4.1.9.1.6 Atmospheric Liquid Water

(AVV/1599) Analysis. The engine supplier's documentation that confirms compliance with NPA-E-27 shall be analyzed. This analysis will confirm compliance with the requirement. [AV/2880]

4.1.9.2 Induced Environment

(AVV/188) Analysis. An analysis shall be performed by comparing the components' environmental qualification reports for new and modified equipment with the appropriate induced environment to confirm compliance. [AV/1177, AV/3079]

(AVV/1514) Flight Test. Flight testing shall be performed to acquire vibration data at critical design conditions and locations. [AV/3071]

(AVV/1512) Analysis. A vibration analysis, incorporating flight test data, shall verify that the unmodified Air Vehicle equipment is capable of withstanding the vibration environment. This analysis shall confirm compliance. [AV/3071]

4.1.10 (Not Applicable)

4.1.11 Materials And Processes

(AVV/193) Analysis. The Contractor's and subcontractors' design drawings and specifications shall be reviewed by the Contractor to confirm that the specified materials and processes are compliant to the requirement. [AV/1182]

(AVV/1949) Analysis. All drawings and specifications shall be reviewed by the Contractor to confirm that the modifications incorporate accepted materials that are resistant to moisture, fungus and corrosion. [AV/3007]

(AVV/1894) Analysis. All design drawings and specifications shall be reviewed and inspected by the Contractor to confirm compliance. [AV/2962]

(AVV/230) Analysis. A System Safety Analysis (SSA) shall be performed by the Contractor to confirm compliance. [AV/1474]

4.1.11.1 Toxic Chemicals, Hazardous Substances, And Ozone-Depleting Chemicals

(AVV/196) Analysis. A review of the design drawings, invoked processes, and specifications shall be performed to identify the required use of hazardous materials in the operation and maintenance of the Air Vehicle modifications. A safety risk and cost assessment shall then be performed to confirm that the ESOH risks and costs have not increased due to the identified hazardous materials. [AV/1185]

(AVV/1880) Analysis. Review drawings and specifications of new and modified Air Vehicle subsystems shall confirm compliance. [AV/2956]

(AVV/1881) Analysis. Review drawings, invoked processes, and specifications of new and modified Air Vehicle subsystems shall confirm compliance. [AV/2957]

4.1.12 Electromagnetic Environmental Effects

4.1.12.1 Electromagnetic Compatibility

(AVV/425) Ground Test. Aircraft-level, matrix-type electromagnetic compatibility (EMC) functionality testing of all equipment installed on the aircraft shall be performed to assess aircraft-level electromagnetic compatibility (EMC). [AV/1451]

(AVV/1897) Analysis. Analysis of supplier EMI test data for all LRUs and ground test data shall confirm that no conditions exist that prevent mission accomplishment. [AV/1451]

4.1.12.2 External EME Immunity

(AVV/1899) Analysis. Analysis of equipment-level Radiated Susceptibility qualifications and/or tests shall confirm immunity to the External EME environment. [AV/1453]

4.1.12.3 Indirect-Effects Lightning Protection

(AVV/1900) Analysis. Analysis of equipment-level Conducted Susceptibility qualifications and/or tests as defined in RTCA/DO-160D, section 22 or equivalent, shall confirm immunity to the Indirect-Effects Lightning environment. [AV/1454]

4.1.12.4 Direct-Effects Lightning Protection

(AVV/1901) Analysis. Analysis of equipment-level qualification test data shall confirm immunity against catastrophic damage from the Direct-Effects Lightning environment, as defined in RTCA/DO-160D, section 23 or equivalent. Aluminum structure is inherently immune to direct-effects lightning and shall not be analyzed. [AV/1455]

4.1.12.5 Bonding

(AVV/428) Ground Test. Testing of each bond installation for electrical equipment and major structural parts shall be conducted to show compliance to the bonding requirement in accordance with MIL-STD-464. [AV/1456]

(AVV/1902) Analysis. Interface drawings of new structural components and new and modified equipment installations shall be reviewed to confirm proper bonding techniques are employed in accordance with MIL-STD-464. [AV/1456]

(AVV/1903) Analysis. Analysis of ground test data shall confirm compliance and confirm proper operation of equipment and immunity to the EMI environment in accordance with MIL-STD-464. [AV/1456]

4.1.13 Nameplates Or Product Markings Requirements

(AVV/207) Analysis. New and modified equipment drawings shall be reviewed to confirm compliance with MIL-STD-130, or an equivalent standard. [AV/1196]

4.1.14 (Not Applicable)

4.1.15 Interchangeability, Standardization, Interoperability, And Commonality Requirements

(AVV/21) Analysis. Assessments shall be presented in the design reviews where unavoidable configuration differences between the modified C-5A and B models are identified and reviewed for approval by the USAF. Review of the drawing trees and drawings shall confirm compliance. [AV/1023]

(AVV/1629) Analysis. Assessments shall be presented in the design reviews where unavoidable configuration differences between the modified C-5C and the C-5A/B models are identified and reviewed for approval by the USAF. Review of the drawing trees and drawings shall confirm compliance. [AV/2711]

(AVV/1165) Analysis. Drawings of new and modified Air Vehicle component installations shall be reviewed to confirm identical interfaces and acceptable envelopes of LRU/LRM components with identical part numbers. [AV/2265]

(AVV/686) Analysis. Analysis of drawings shall confirm that the EBU is configured to allow interchangeability from position-to-position and from modified Air Vehicle to modified Air Vehicle. This analysis shall include C-5A, C-5B, and C-5C models. [AV/2384]

(AVV/1648) Demonstration. Demonstration shall provide verification for pylon interchangeability, except for the pylon-to-wing fairings, between the two outboard locations and between the two inboard locations. [AV/2430]

(AVV/1649) Analysis. Analysis of drawings shall confirm interchangeability, between all four engine locations, of the engine fan cowl, thrust reverser (except for the thrust reverser cascade arrangement), and core cowl. [AV/2926]

4.1.16 System Safety And Health Requirements

4.1.16.1 General Requirements

(AVV/431) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/1459]

(AVV/432) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/1460]

(AVV/444) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/1218]

4.1.16.2 Personnel Safety

(AVV/435) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/1220]

(AVV/2333) Ground Test. Ground tests with the engines and APU running shall be performed to determine if applicable Permissible Exposure Limits (PEL) are exceeded. [AV/1464]

(AVV/436) Analysis. A Health Hazard Assessment (HHA) shall be performed, based on the ground test data, in accordance with MIL-STD-882C to confirm compliance with the requirement. [AV/1464]

4.1.16.3 Flight Safety

(AVV/439) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2275]

(AVV/1765) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2274]

(AVV/1766) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/1470]

(AVV/1771) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2788]

(AVV/1772) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2789]

(AVV/1646) Analysis. A System Safety Analysis (SSA) shall be performed to provide analytical evidence verifying the applicable portions of the aerial delivery system do not introduce additional dangerous conditions (relative to the baseline Air Vehicle) for personnel participating in aerial delivery missions are not introduced. This analysis will involve comparing the engine wake from the baseline Air Vehicle to the modified Air Vehicle. These wake profiles will be generated utilizing compuational fluid dynamic techniques. The level of detail of the SSA will be dependent on the classification of the failure condition/hazard from the Functional Hazard Assessment (FHA), the degree of integration, and the complexity of the system implementation. The SSA will provide the necessary assurance that all relevant failure conditions/hazards have been identified and that all significant combinations of failures that could result in these failure conditions/hazards have been considered. When applicable, the SSA will include an analysis of data obtained during the flight test of the new and modified components on the aircraft. These analyses shall confirm compliance with this requirement. [AV/2608]

(AVV/1950) Analysis. Hardware and software safety hazard analyses shall be included in the System Safety Assessment (SSA) to verify the design provides the appropriate probabilities of cockpit electronic display for engine performance parameters. The level of detail of the analysis will be dependent on the classification of the failure condition/hazard and software developmental level from the Functional Hazard Assessment (FHA), the degree of integration, and the complexity of the system implementation. The analysis will provide the necessary assurance that all relevant failure conditions/hazards have been identified and that all significant combinations of failures that could result in these failure conditions/hazards have been considered. When applicable, the analysis will include an analysis of data obtained during the flight test of the new and modified components on the aircraft. [AV/3008]

(AVV/2023) Analysis. Hardware and software safety hazard analyses shall be included in the System Safety Assessment (SSA) to verify the design provides the appropriate probabilities of cockpit electronic display for engine performance parameters. The level of detail of the analysis will be dependent on the classification of the failure condition/hazard and software developmental level from the Functional Hazard Assessment (FHA), the degree of integration, and the complexity of the system implementation. The analysis will provide the necessary assurance that all relevant failure conditions/hazards have been identified and that all significant combinations of failures that could result in these failure conditions/hazards have been considered. When applicable, the analysis will include an analysis of data obtained during the flight test of the new and modified components on the aircraft. [AV/3038]

4.1.16.4 Software Safety

(AVV/1854) Analysis. A software safety hazard analysis shall be included in the System Safety Assessment (SSA) to verify software does not initiate hazardous events in component powered/unpowered states. The level of detail of the analysis will be dependent on the classification of the failure condition/hazard and software developmental level from the Functional Hazard Assessment (FHA), the degree of integration, and the complexity of the system implementation. The analysis will provide the necessary assurance that all relevant failure conditions/hazards have been identified and that all significant combinations of failures that could result in these failure conditions/hazards have been considered. When applicable, the analysis will include an analysis of data obtained during the flight test of the new and modified components on the aircraft. [AV/2808]

4.1.16.5 Crashworthiness

(AVV/1615) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2820]

(AVV/1779) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2821]

(AVV/1782) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2824]

4.1.16.6 Electrical Safety

(AVV/1616) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2810]

(AVV/1784) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2811]

(AVV/1785) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2812]

(AVV/1786) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2813]

(AVV/1787) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2814]

(AVV/1788) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2815]

(AVV/1789) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2816]

(AVV/1792) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2819]

(AVV/2462) **Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement.** [AV/3076]

4.1.16.7 General Equipment

(AVV/1793) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2826]

(AVV/1794) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2827]

(AVV/1797) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2830]

(AVV/1798) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2831]

(AVV/1799) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2832]

(AVV/1801) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2834]

(AVV/1802) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2835]

4.1.16.8 Fire Protection

(AVV/1840) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. [AV/2845]

(AVV/2064) Demonstration. A demonstration shall be performed to show ability of required fire extinguisher equipment to access new and modified equipment for the purpose of agent discharge. The level of detail of the demonstration will not include actual agent discharge. [AV/2846]

(AVV/1841) Analysis. A System Safety Analysis (SSA) shall be performed in accordance with SAE ARP 4761 to confirm compliance with the requirement. The SSA will include data obtained from the fire extinguisher equipment demonstration. [AV/2846]

(AVV/2463) Demonstration. A ground demonstration shall be performed on the Air Vehicle to confirm the ability of the detection system to detect smoke or fire in compartments containing new and modified equipment. This demonstration shall be conducted only in compartments where a new detection system has been installed, and the fire will be simulated (no actual fire will be used). The demonstration shall confirm compliance. [AV/3077]

4.1.16.9 Explosive Atmosphere

(AVV/1621) Analysis. A System Safety Analysis (SSA) shall be performed to provide analytical evidence verifying the risk of installed components causing an explosion in a declared environment. The level of detail of the SSA will be dependent on the classification of the failure condition/hazard from the Functional Hazard Assessment (FHA), the degree of integration, and the complexity of the system implementation. The SSA will provide the necessary assurance that all relevant failure. [AV/2847]

4.1.17 Human Factors/ Human Systems Integration Requirements

(AVV/898) Demonstration. Demonstrations shall be performed on the Air Vehicle in conjunction with other ground and flight demonstrations to perform this verification. The testing will be considered successful if the results indicate that a majority of the flight crew surveyed concur that the new and modified operator interfaces are optimized. In areas where there is concern regarding the likelihood of reduced human performance or operator error, more quantitative testing may be necessary (measurement of operator performance parameters). [AV/1229]

(AVV/2401) Lab Test. Lab testing of the new and modified operator interfaces shall be conducted in the engineering simulator through the use of subjective surveys designed to measure flight crew acceptance of functionality. The testing will be considered successful if the results indicate that a majority of the flight crew surveyed concur that the new and modified operator interfaces are optimized. In areas where there is concern regarding the likelihood of reduced human performance or operator error, more quantitative testing may be necessary (measurement of operator performance parameters). [AV/1229]

(AVV/2400) Analysis. Analysis shall be performed on the results of the demonstration and lab test to confirm compliance. [AV/1229]

(AVV/2370) Analysis. An analysis shall be performed with a multivariate anthropometric human modeling software application, considering the accessibility and operability of new, modified, and relocated flight controls, emergency controls, and emergency egress controls for the models specified in Table 3.1.6-1 with the restraint harness locked. [AV/2901]

(AVV/239) Demonstration. Univariate demonstration shall be conducted for each anthropometric variable identified in Table 3.1.6-1. In areas where analysis results are inconclusive, demonstrations will be conducted. Demonstration will consist of testing each anthropometric variable (identified in Table 3.1.6-1) using test subjects seated in each crew station position to confirm their ability to reach new, modified, and relocated flight controls, emergency controls, and emergency egress controls while seated with the restraint harness locked, within the limits of the cockpit equipment that is not modified by the C-5 RERP program. The verification will be considered successful if analysis and demonstration results indicate:

New, modified, and relocated flight controls, emergency controls, and emergency egress controls are reachable from each affected crew station for each model specified in Table 3.1.6-1 when the restraint harness is locked, within the limits of the equipment that is not modified by the C-5 RERP program.

Test subjects can reach new, modified, and relocated flight controls, emergency controls, and emergency egress controls for the specified anthropometric variables with the restraint harness locked. [AV/2901]

(AVV/2371) Analysis. An analysis shall be performed with a multivariate anthropometric human modeling software application, considering the accessibility and operability of new, modified, and relocated controls that are not flight controls, emergency controls, or emergency egress controls for the models specified in Table 3.1.6-1 with the restraint harness unlocked. [AV/2900]

(AVV/900) Demonstration. In areas where analysis results are inconclusive, demonstrations shall be conducted. Univariate demonstrations will be conducted for each anthropometric variable identified in Table 3.1.6-1. Demonstrations will consist of testing each anthropometric variable (identified in Table 3.1.6-1) using test subjects seated in each crew station position with the restraint harnesses unlocked to determine their ability to reach new, modified, and relocated controls that are not flight controls, emergency controls, or emergency egress controls, within the limits of the cockpit equipment that is not modified by the C-5 RERP program. The verification effort will be considered successful if analysis and demonstration results indicate:

a. New, modified, and relocated controls that are not flight controls, emergency controls, or emergency egress controls are reachable from each affected crew station when the restraint harness is unlocked, for each model specified in Table 3.1.6-1, within the limits of the equipment that is not modified by the C-5 RERP program;

b. Test subjects can reach new, modified, and relocated controls that are not flight controls, emergency controls, or emergency egress controls for the specified anthropometric variables with the restraint harness unlocked. [AV/2900]

(AVV/243) Ground Test. A Modified Rhyme Test (MRT) shall be conducted at typical maintenance stations during a normal engine run on the ground for both the baseline Air Vehicle and the modified Air Vehicle using identical subjects (to the extent practicable) wearing headsets. [AV/2905]

(AVV/2372) Flight Test. A Modified Rhyme Test (MRT) shall be conducted in flight (cruise) under normal operating conditions for both pre-RERP and post-RERP configurations, using identical subjects (to the extent practicable) wearing headsets. [AV/2905]

(AVV/2373) Analysis. Analysis shall include the review of flight test and ground test data. If the mean pre-RERP Modified Rhyme Test (MRT) scores are 91% or greater and the mean MRT scores conducted on the RERP configuration are not lower than 91%, then the verification will be considered successful. If the mean pre-RERP MRT scores are lower than 91%, then the RERP configuration MRT scores must be greater than the mean pre-RERP MRT scores minus one standard deviation. [AV/2905]

(AVV/2374) Lab Test. Lab Test shall be performed to collect the required Human Factors data to show compliance. [AV/2908]

(AVV/2375) Demonstration. A demonstration shall be performed to collect the required Human Factors data to show compliance. [AV/2908]

(AVV/2376) Ground Test. Ground Test shall be performed to collect the required Human Factors data to show compliance. [AV/2908]

(AVV/2377) Analysis. The review of the lower level integration analysis, lab test results, ground test results, and demonstrations shall be evaluated to confirm compliance. [AV/2908]

(AVV/1944) Demonstration. Demonstration shall be conducted with the Air Vehicle on the ground, wherein a typical operator attired in biological/chemical warfare ensembles operates the new and modified controls and displays. Univariate demonstrations will be conducted for each anthropometric variable identified in Table 3.1.6-1. Demonstrations will consist of testing each anthropometric variable (identified in Table 3.1.6-1) using test subjects seated in each crew station position to determine their ability to reach new, modified, and relocated crew station controls while attired in biological/chemical warfare ensembles, seated with the restraint harness unlocked, within the limits of the cockpit equipment that is not modified by the C-5 RERP program. The verification will be considered successful if an operator attired in biological/chemical warfare gear can:

a) See all new and modified controls and displays;

b) Reach all new and modified controls;

c) Actuate all new and modified controls throughout their full actuation range. A tool may be used to accomplish this objective. This tool will be deemed acceptable if it has been chosen from the current manifest of tools available within the Air Force and does not require the procurement of a unique tool. [AV/2907]

(AVV/1946) Analysis. A functional analysis shall be conducted to determine where in the operation of the Air Vehicle repetitive aircrew tasks exist. An analysis shall be conducted to determine that these tasks have been minimized, either by the application of automation or the reduction of steps to accomplish the task. A repetitive task is defined as a task that must be accomplished three or more times consecutively. Such tasks will be considered appropriate in cases where no alternative designs exist that would allow reduction, or such designs are considered to be cost prohibitive. The verification will be considered successful if analysis shows that repetitive tasks (defined above) are eliminated from the operation of the aircraft either by the application of automation or the reduction of steps to accomplish the task. Where repetitive tasks are found to remain, either no alternative designs are available, or the alternatives identified are cost prohibitive or out of scope. [AV/1228]

(AVV/1947) Lab Test. A test shall be conducted in the LM Aero engineering simulator to confirm that a trained aircrew can complete a representative set of mission scenarios without experiencing workload that would compromise the safe accomplishment of the mission. The scenarios will be designed to represent worst case workload conditions. Workload will be measured using subjective questionnaires that utilize the Modified Cooper-Harper Scale. The verification will be considered successful if the test shows that the mission scenarios used can be accomplished successfully by a trained aircrew without creating unsafe conditions. [AV/1232]

(AVV/2438) Flight Test. Flight testing shall be conducted to confirm that a trained aircrew can complete mission scenarios that cannot be accomplished in the simulator, without experiencing workload that would compromise the safe accomplishment of the mission. Workload will be measured using subjective questionnaires that utilize the Modified Cooper-Harper Scale. The verification will be considered successful if the test shows that the mission scenarios used can be accomplished successfully by a trained aircrew without creating unsafe conditions. [AV/1232]

(AVV/2439) Analysis. The flight test and lab test data shall be analyzed to confirm compliance. [AV/1232]

4.1.18 (Not Applicable)

4.1.19 Computer Resources Requirements

(AVV/1934) Analysis. An analysis of the design of the new developed subsystems and systems, including the reserve capacities of key technical performance parameters (i.e. memory, throughput, etc.), shall be performed. This analysis will be used to determine if future upgrades can be introduced through the application of incremental technology insertion rather than by large-scale system redesign as defined by the Viable Combat Avionics Initiative/Proven Path. The results of the analysis will confirm compliance. [AV/2989]

(AVV/1937) Analysis. Each CSCI (categorized as DI or M-NDS per the SPP) shall be reviewed to confirm that the source code for that CSCI was written in a structured software programming language. [AV/2992]

(AVV/257) Demonstration. A demonstration shall be performed to confirm that software loading of field-loadable equipment can be performed on the Air Vehicle using data loaders. [AV/1246]

(AVV/2481) Demonstration. A demonstration shall be performed in the lab to confirm compliance. The time required to load the Operational Flight Program of each new and modified field-loadable LRU into the LRU's Non Volatile Memory using a data loader will be measured in the lab. For each LRU, confirmation that the load was successful will be obtained using a means that is independent of the data loader. [AV/3090, AV/3091]

4.1.20 Logistics And Supportability Requirements

4.1.20.1 (Not Applicable)

4.1.20.2 (Not Applicable)

4.1.20.3 Support Equipment Requirements

(AVV/298) Analysis. An analysis of drawings and/or TOs shall be performed to confirm that the design of new and modified equipment and its installation has minimized the need for support equipment. [AV/1287]

4.1.20.4 (Not Applicable)

4.1.21 (Not Applicable)

4.1.22 (Not Applicable)

4.1.23 Survivability & Vulnerability Requirements

(AVV/330) Analysis. The IR signatures of the Air Vehicle and the baseline Air Vehicle shall be calculated using an IR signature prediction tool, and compared to confirm compliance. [AV/1319]

4.1.24 Testability And Diagnostics Requirements

4.1.24.1 Diagnostics

(AVV/2425) Lab Test. Requirements-based testing shall be performed in which each fault condition is exercised to confirm that the EDS subsystem accurately identifies each fault and isolates it to the correct LRU. [AV/2974]

(AVV/1915) Lab Test. In the System Integration Lab a subset of all faults processed by the EDS shall be inserted to show that the EDS detects each fault and reports a description of and a location of each fault. The subset of faults to be tested will be randomly selected by the customer and the sample size will be large enough to ensure 95% confidence level of system performance. [AV/2974]

(AVV/1991) Ground Test. During ground test a subset of all faults processed by the EDS shall be inserted to show that the EDS detects each fault and reports a description of and a location of each fault. The fault conditions that will be tested on the Air Vehicle will be selected by the customer and will also be selected to ensure equipment is not damaged and personnel are not endangered. This test is to be used to support the confirmation of the Requirements-based testing and the System Integration Lab tests. [AV/2974]

(AVV/1992) Analysis. All of the Systems Integration Lab test results, ground test results, and naturally occurring faults prior to dedicated QOT&E shall be analyzed to confirm that the EDS correctly detects and reports the description and location of each fault. [AV/2974]

(AVV/1914) Analysis. An analysis shall be conducted to confirm that the EDS graphical user interface has been designed to the guidelines of DOT/FAA/CT-9611. [AV/2997]

(AVV/345) Demonstration. In the Systems Integration Lab a subset of all system faults shall be inserted into the fault history file. This file will be examined to confirm that a record of each fault exists. The fault data shall be accessed by each member of the flight crew and maintenance personnel to show that only maintenance personnel are able to modify the fault data to confirm compliance. [AV/3004]

(AVV/2426) Lab Test. Requirements-based testing in the Systems Integration Lab shall be performed in which fault conditions are simulated to confirm that the EDS subsystem accurately creates and maintains an accurate fault history file in NVM. [AV/3004]

(AVV/348) Analysis. Maintenance data gathered during integration testing in the Systems Integration Lab, ground testing, and flight testing shall be analyzed to confirm that data are successfully transferred from the EDS to a

standard interface device, and that it follows the format defined by the EDS Interface Control Document. [AV/3003]

(AVV/2464) Lab Test. Lab testing on the EDS user interface shall be conducted through the use of subjective surveys designed to measure operator acceptance of functionality. The testing will be considered successful if the results indicate that the majority of the operators surveyed concur that the EDS diagnostic information is presented in a way that is readily-understandable. [AV/3002]

(AVV/159) Analysis. Analysis shall be performed on the results of the lab test to confirm compliance. [AV/3002]

(AVV/2062) Ground Test. Ground tests shall be performed with both the EDS and the engines operating so that the EDS collects engine data. [AV/3001]

(AVV/1993) Analysis. The ground test data required for performance evaluation and trending shall be analyzed to confirm that the EDS accurately collects engine data, as defined by the appropriate Interface Control Document. [AV/3001]

(AVV/2019) Analysis. Diagnostic system drawings and software documentation shall be reviewed to confirm that the EDS utilizes COTS/NDI technology. [AV/3035]

(AVV/1919) Analysis. System fault data gathered during QT&E ground and flight testing shall be analyzed to confirm that the data collected by the EDS is downloadable from a single point. [AV/2998]

(AVV/2476) Analysis. An analysis shall be performed to confirm that fault codes used by the EDS follow the baseline Air Vehicle fault code numbering scheme. [AV/3086]

(AVV/2477) Analysis. An analysis of EDS displays shall be performed to confirm that the C-5 RERP fault codes are correctly matched to their respective specific word profiles. [AV/3087]

(AVV/1920) Demonstration. In the Systems Integration Lab, it shall be shown that all EDS display formats and data can be provided on equipment that will be located at the flight engineer's station. Additional demonstrations shall be conducted on the Air Vehicle during QT&E ground testing, flight testing, and maintenance activities to confirm that EDS fault data are provided at the flight engineer's station. [AV/3005]

(AVV/1924) Demonstration. Trending data gathered during QT&E ground and flight testing shall be transferred electronically using a standard format (e.g. Simple Mail Transfer Protocol (SMTP)). [AV/2977]

(AVV/2000) Analysis. Trending data gathered during QT&E ground and flight testing shall be analyzed to confirm that it contains the data required for trending (structural health, engine monitoring, etc.), as jointly agreed to by LM Aero and the USAF. [AV/2977]

(AVV/2480) Analysis. EDS technology and growth capability shall be quantified through analytical methods to confirm compliance. Design criteria and computations of allocated computer memory resources, onboard data storage provisions, data transfer media, data processing capacity, etc. will be evaluated, bench-marked, documented and presented at program design reviews. Rationale for approaches and component sizing will be clearly stated with regard to growth potential. [AV/3089]

4.1.24.2 Built-In Test (BIT)

(AVV/2002) Lab Test. In the Systems Integration Lab while BIT is running, faults shall be inserted into or simulated for each LRU in each new and modified Air Vehicle subsystem that has an electronic controller. This testing shall demonstrate that the BIT function detects and isolates each fault to the appropriate LRU. [AV/1325]

(AVV/2428) Ground Test. In cases where lab test results are inconclusive, faults shall be induced into LRUs on the Air Vehicle on the ground. This testing will supplement the lab testing to demonstrate that the BIT function detects and isolates each fault to the appropriate LRU. [AV/1325]

(AVV/336) Analysis. For each new and modified Air Vehicle subsystem with an electronic controller, all appropriate test results (e.g. supplier qualification, Systems Integration Lab, ground testing) shall be analyzed to confirm the ability of the BIT function to detect and isolate inserted faults to the appropriate LRU. [AV/1325]

(AVV/339) Analysis. The results of supplier qualification and System Integration Lab tests shall show that when power is applied BIT operates continuously and automatically. The analysis of these test results will demonstrate that the BIT function does not adversely affect the Air Vehicle subsystem. [AV/2982]

(AVV/343) Lab Test. Testing shall be conducted in the System Integration Lab to show that upon application of power, BIT operates continuously and automatically. These tests will demonstrate that the BIT function does not adversely affect the Air Vehicle subsystem. [AV/2982]

(AVV/337) Analysis. The results of supplier lab tests, System Integration Lab tests, and Air Vehicle ground tests, in which faults are inserted shall be used to show that the fault detection and isolation accuracy of BIT for new subsystems is at least 95% of the reported events. [AV/1422]

(AVV/2003) Lab Test. In the System Integration Lab, a subset of subsystem faults shall be inserted to show that the fault detection accuracy for BIT for new subsystems is at least 95% of the reported events. The subset of test conditions will be defined jointly by LM Aero and the USAF, and is expected to represent approximately 20% of the total number of fault conditions for the new and modified subsystems. [AV/1422]

(AVV/2432) Lab Test. All subsystem faults shall be inserted during qualification testing at the suppliers facilities to show that the fault detection accuracy for BIT for new subsystems is at least 95%. [AV/1422]

(AVV/2431) Ground Test. In ground tests, a subset of subsystem faults shall be inserted to show that the fault detection and isolation accuracy for BIT for new subsystems is at least 95% of the reported events. The subset of test conditions will be defined jointly by LM Aero and the USAF, and is expected to represent approximately 5% of the total number of fault conditions for the new and modified subsystems. [AV/1422]

(AVV/341) Lab Test. In the System Integration Lab testing shall be performed in which each fault that is defined as critical is inserted into its respective subsystem to confirm that subsystem BIT detects 100% of these critical faults. [AV/1329]

(AVV/2004) Ground Test. Ground tests shall be performed in which each fault that is defined as critical is inserted into its respective subsystem to confirm that subsystem BIT detects 100% of these critical faults. Tests that could result in damage to equipment and or endanger personnel will be tailored to eliminate risk. [AV/1329]

(AVV/2005) Analysis. All sets of the System Integration Lab test results and ground test results shall be analyzed to confirm that subsystem BIT detects 100% of all critical faults. [AV/1329]

(AVV/1928) Lab Test. In the System Integration Lab testing shall be performed in which each fault that is defined as critical is inserted into its respective subsystem to confirm that a false or incorrect declaration of a critical fault does not occur more than 1% of the time. [AV/2966]

(AVV/2006) Ground Test. Ground tests shall be performed in which each fault that is defined as critical is inserted into its corresponding subsystem to show that a false or incorrect declaration of a critical fault does not occur more than 1% of the time. Tests that could result in damage to equipment and or endanger personnel will be tailored to eliminate risk. [AV/2966]

(AVV/2007) Analysis. All sets of the System Integration Lab test results and all sets of ground test results shall be analyzed to confirm that a false or incorrect declaration of a critical fault does not occur more than 1% of the time. [AV/2966]

(AVV/342) Demonstration. In the System Integration Lab faults shall be inserted and BIT results examined to show that BIT result presentations provide the minimum information needed to accurately describe the failure condition. [AV/1330]

(AVV/1929) Demonstration. In the System Integration Lab faults shall be inserted to show that BIT information is available for review by both the flight crew and maintainer. [AV/2984]

(AVV/1964) Demonstration. In the System Integration Lab continuous and initiated BIT failures shall be inserted to show that for new and modified equipment with processors, an indication of continuous or initiated BIT failure is provided to the operator. [AV/3022]

(AVV/1965) Demonstration. In the System Integration Lab it shall be shown that for new and modified equipment with processors, BIT indication is reported to the operators in English text (not code). [AV/3022]

4.1.24.3 Data Recorder

(AVV/2009) Analysis. Supplier data shall be reviewed to verify that the digital flight data recorder's recording media consists of solid state non-volatile memory. [AV/2985]

(AVV/1931) Demonstration. In the System Integration Lab it shall be shown that the new Digital Flight Data Recorder stores all of the parameters defined jointly by LM Aero and the USAF. [AV/2986]

(AVV/2010) Ground Test. Ground tests shall be performed to show that the new Digital Flight Data Recorder stores all of the parameters defined jointly by LM Aero and the USAF. [AV/2986]

(AVV/2011) Flight Test. Flight tests shall be performed to show that the new Digital Flight Data Recorder stores all of the parameters defined jointly by LM Aero and the USAF. [AV/2986]

(AVV/2012) Analysis. The data from the ground and flight tests shall be analyzed to confirm that the new Digital Flight Data Recorder stores all of the parameters defined jointly by LM Aero and the USAF. [AV/2986]

4.1.25 (Not Applicable)

4.2 Interface Requirements

4.2.1 (Not Applicable)

4.2.2 (Not Applicable)

4.2.3 (Not Applicable)

4.2.4 (Not Applicable)

4.2.5 Design And Construction Requirements

(AVV/371) Analysis. An analysis of component design drawings shall be performed to confirm that the exterior finish system of new and modified Air Vehicle sections is consistent with the existing Air Vehicle finish system. [AV/1359]

4.2.6 (Not Applicable)

4.2.7 (Not Applicable)

4.2.8 Workmanship And Quality Requirements

(AVV/390) Inspection. Compliance with the QM 9001 during modifications to the Air Vehicle shall be verified by inspection and documentation. Documentation in accordance to the requirements of the LM Aero Quality Manual during fabrication, assembly, and equipment installation shall confirm that all operations are controlled by process specifications and standards. [AV/1378]

4.2.9 (Not Applicable)

4.2.10 (Not Applicable)

5.0 Technical Reference Information

5.1 *Definitions of Terms*

The following terms are used in this specification. These definitions are considered contractual. It is intended that these definitions flow down through all lower-level specifications by reference, not through in-line inclusion or repetition.

bare base – Per AFPAM 10-219, Volume 5, 1 June 1996: "... a site with a usable runway, taxiway, parking areas (sic), and a source of water that can be made potable. It must be capable of supporting assigned aircraft; and providing other mission essential resources such as a logistical support and services infrastructure composed of people, facilities, equipment, and supplies. This bare base concept requires mobile facilities, utilities, and support equipment that can be rapidly deployed and installed, and be available to transform – virtually overnight – undeveloped real estate into an operational air base."

baseline Air Vehicle – the "as-received aircraft baseline" as defined in contract section H(x) Contract Special Requirements.

cold weather clothing – Large parka (8415-00-376-1710), Large mitten set (8415-01-319-5115), Cold weather cap size 7 1/2 (8415-01-099-7847), Large mukluks (8430-00-269-0100), and Large mukluk inserts (8415-00-177-7994)

commercial-off-the-shelf (COTS) (item) – Equipment that has been previously qualified or certified under commercial specifications and standards.

computer resources – the hardware and software associated with the aircraft's avionics systems, mission planning systems, support equipment, and data collection equipment. Ref. ORD paragraph 5.4.1.

critical fault – a degradation or failure, either indicated or actual, that will prevent the subject system from performing its function or will jeopardize the flight worthiness of the aircraft of the safety of its crew. Ref. ORD para. 5.1.1.1, slightly reworded.

depot-level maintenance – Maintenance consisting of those on- and off-equipment tasks performed using the highly specialized skills, sophisticated shop equipment, or special facilities of a supporting command; commercial activity; or inter-service agency at a technology repair center, centralized repair facility, or, in some cases, at an operating location. Maintenance performed at a depot may also include organizational or intermediate level maintenance as negotiated between operating and supporting commands.

design eye point – The point in the flight station located at the following coordinates: FS. 384.64, BL. 26.0, WL. 361.50 (Reference: "C-5A Crew Station Subsystem Design Analysis and Descriptive Data" number LG1US33-1-1 page 3-3).

detrimental deformations - Deformations which:

a. Inhibit or degrade the mechanical operation of the air vehicle or cause bindings or interferences in the control system or between the control surfaces and adjacent structures.
b. Affect the aerodynamic characteristics of the air vehicle to the extent that performance guarantees or flying qualities requirements cannot be met.
c. Result in buckling, delamination, or exceedance of the yield point of any part, component or assembly which would result in subsequent maintenance actions.
d. Require repair or replacement of any part, component or assembly.
e. Reduce the clearances between movable parts of the control system and adjacent structures or equipment to values less than the minimum permitted for safe flight.

Engine buildup unit – The engine buildup unit includes the engine and all propulsion system components and accessories (e.g., electrical generator, hydraulic pumps, wiring harnesses) that remain attached to the engine following removal from the Air Vehicle pylon via the engine mounts. Items attached and/or hinged to the pylon are not part of the engine buildup unit.

engine information format – The multi-function display format that displays engine information to the crew.

fault – Immediate cause of failure (e.g., maladjustment, misalignment, defect, etc.).

key performance parameter (KPP) – Performance parameters designated by the USAF as the critical performance parameters that take precedence in accomplishment over other parameters.

maintenance concept – The overall notion of the levels of support to be used in aircraft maintenance for a particular aircraft. For C-5 RERP, the maintenance concept is a two-level concept consisting of "on-wing" maintenance and "off-wing" maintenance. The **on-wing** maintenance will be performed by the USAF using its own internal resources (i.e., it will be organic). It is roughly equivalent to what is otherwise referred "organizational-level" maintenance, though "organizational-level" maintenance is not necessarily 100% organic. (Thus, the use of the term "organizational-level maintenance" is technically inaccurate for C-5 RERP.) The **off-wing** maintenance may be performed by original equipment manufacturers and other contractors as may be identified for individual subsystems and equipment items. It is roughly equivalent to, in this case, "depot-level" maintenance, though "depot-level" maintenance is not necessarily 100% contractor maintenance (thus, the use of the term "depot-level maintenance" is technically inaccurate for C-5 RERP.)

Mean Time to Repair (MTTR) – Mean Time To Repair (MTTR): The average elapsed time (in minutes) required to complete an on-equipment corrective maintenance action. Corrective maintenance includes all actions necessary to correct any inherent, induced, or no-defect malfunction. MTTR is computed as the total on-equipment repair elapsed time hours multiplied times 60 and divided by the total number of associated on-equipment repair actions. On-equipment repair actions are restricted to non-leading zero work unit codes with action taken codes P, R, G, K, L, V, or Z. MTTR is a measure of direct maintenance time and excludes administrative and logistics delay time. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation. MTTR is related to Mean Repair Time (MRT) as follows:

(MTTR)(Average Maintenance Crew Size) = MRT

Mean Time Between Failure (MTBF) – Mean Time Between Failure (MTBF): The average flight time expended for an end item, system, subsystem, or component before inherent failure occurs (as defined in AMCPAM21-102 and Appendix G of TO 00-20-2). MTBF is calculated as the inverse of the inherent malfunction event rate. An inherent malfunction event is defined as a failure having a type 1 how malfunction code. One event is charged per unique job control number (JCN), and all TCTO work is excluded. This parameter only applies to non-leading zero work unit codes. Guidelines for collection and reporting of this parameter can be found in TO 00-20-2, Maintenance Data Documentation.

mission-critical function – TBD

modified (system, subsystem, equipment item) – any design which is changed to such an extent that the part number by which it is procured is changed relative to being a COTS or NDI item.

non-developmental item (NDI) – Unmodified components that have been MIL-qualified or commercially qualified at the component level with no changes to hardware, processes, functions, form, fit, structure, or testability.

objective – A technical "requirement" which the C-5 RERP design should attempt to satisfy. Failure to satisfy an objective will *not* be considered a failure to meet contractual requirements. In this document, objectives are expressed with the wording of "should."

plain English – Conversational English that does not make reference to fault codes. Acronyms are acceptable.

primary field of view – The region +/- 20 degrees above or below the normal line of sight, and within +/- 35 degrees of the centerline of the normal line of sight. The normal line of sight is defined at the line of sight 15 degrees below the horizontal line of sight emanating from the design eye.

repetitive task – A task that must be accomplished three or more times consecutively.

safety critical items - An item, component or assembly whose failure to perform or incorrect performance may cause a catastrophic or hazardous failure condition/hazard.

Safety of flight structure - That structure whose failure would cause direct loss of the air vehicle or whose failure, if it remained undetected, would result in loss of the air vehicle.

service life – The period of time, in flight cycles/hours, established at design during which the structure will be reasonably free from significant structural degradation (also known as the design service goal).

support equipment – All equipment required to perform the support functions except that which is an integral part of the mission equipment.

threshold – A technical requirement which the C-5 RERP design must satisfied. Failure to satisfy a threshold requirement will be considered a failure to meet contractual requirements. In this document, objectives are expressed with the wording of "shall" or, less-preferred, "must."

timely manner – The period of time that passes between the onset of the event and the annunciation of the event allows the operator to respond to the event quickly enough to prevent damage to the aircraft or crew.

Work Unit Code (WUC) - C-5 work unit codes are defined in TO 1C-5A-06, Aircraft Maintenance Work Unit Code Manual USAF Series C5A and C5B Aircraft.

5.2 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this specification. It is intended that these acronym and abbreviation definitions flow down through all lower-level specifications. Definition of terms are provided above and are not repeated here.

	automatic flight control system
AMP	Avionics Modernization Program
APU	Auxiliary Power Unit
	Air Turbine Motor
BIT	built-in test
CFR	Code of Federal Regulations
CWA	Caution, Warning, and Advisories
COTS	commercial-off-the-shelf (equipment or software)
EMD	engineering & manufacturing (phase of a program)
EME	electromagnetic ? **[Adam Odak]**
EMI	electromagnetic interference
FAA	Federal Aviation Administration
GATM	Global Air Traffic Management
ICAO	International Civil Aviation Organization
IR	infrared
KIAS	knots indicated airspeed
KPP	key performance parameter
LRM	line-replaceable module
LRU	line-replaceable unit
MTBF	mean time between failure (a measure of reliability)
MTTR	mean time to repair (a measure of maintainability)
	non-developmental item
NDS	non-developmental software
O-level	organizational level of maintenance
PCMCIA	Personal Computer Memory Card International Association
RERP	(C-5) Reliability Enhancement And Reengining Program
RTCA	Radio Technical Commission of America
SMTP	simple mail transfer protocol
SPP	software project plan
TO	technical order
USAF	United States Air Force

This page intentionally left blank.

6.0 Verification Cross-Reference Matrix

Requirement Paragraph	Requirement Identifier	Verification Method
3.0 Requirements		
3.1 Functional And Performance Requirements		
3.1.1 (Not Applicable)		
3.1.2 (Not Applicable)		
3.1.3 Air Vehicle Capability Requirements		
3.1.3.1 Air Vehicle Performance		
3.1.3.1.1 Flight Performance		
3.1.3.1.1.1 Air Vehicle Range And Payload Requirements		
	AV/2642	**Analysis Flight Test**
	AV/2644	**Analysis Flight Test**
	AV/2646	**Analysis Flight Test**
	AV/2968	**Analysis Flight Test**
	AV/2648	**Analysis Flight Test**
	AV/3080	Analysis Flight Test
	AV/3081	**Analysis Flight Test**
3.1.3.1.1.2 Air Vehicle Climb Performance Requirements		
	AV/1035	**Analysis Flight Test**
3.1.3.1.1.3 Air Vehicle Descent Performance Requirements		
	AV/2614	Analysis Flight Test
3.1.3.1.1.4 Air Vehicle Airfield And Take-off Climb Gradient Performance Requirements		
	AV/1044	Analysis Flight Test
	AV/1045	**Analysis Flight Test**
	AV/1048	Analysis Flight Test
	AV/2633	**Analysis Flight Test**
3.1.3.1.2 Air Vehicle Stability and Control Performance		
3.1.3.1.2.1 Stability and Control, General		
	AV/2537	**Analysis Flight Test**
	AV/3037	**Analysis Flight Test**
	AV/3036	Analysis Flight Test

Requirement Paragraph	Requirement Identifier	Verification Method
	AV/2489	Analysis Flight Test
3.1.3.1.2.2 Longitudinal Stability and Control		
	AV/2542	Analysis Flight Test
	AV/2951	Analysis Flight Test
	AV/2543	Analysis Flight Test
	AV/2544	Analysis Flight Test
	AV/2609	Analysis Flight Test
	AV/2545	Analysis Flight Test
	AV/2612	Analysis Flight Test
	AV/3062	Analysis Ground Test
3.1.3.1.2.3 Lateral-Directional Stability and Control		
	AV/2546	Analysis Flight Test
	AV/2550	Analysis Flight Test
3.1.3.1.2.4 Stall Characteristics		
	AV/2552	Analysis Flight Test
	AV/2553	Analysis Flight Test
	AV/2554	Analysis Flight Test
3.1.3.1.3 In-Flight Refueling		
	AV/2616	Analysis Flight Test
	AV/2922	Analysis Flight Test
3.1.3.1.4 Ground Performance		
	AV/2944	Demonstration
	AV/2368	Analysis Ground Test
	AV/2368	Analysis Ground Test
	AV/3088	Analysis Ground Test
3.1.3.1.5 Air Vehicle Noise Requirements		
	AV/1052	Analysis Flight Test
	AV/2555	Analysis Ground Test
	AV/2967	Analysis

Requirement Paragraph	Requirement Identifier	Verification Method
		Flight Test
	AV/3072	Analysis Flight Test
3.1.3.1.6 Fuel Type		
	AV/2731	Analysis
	AV/2729	Analysis
3.1.3.2 Propulsion		
3.1.3.2.1 Propulsion System General		
	AV/2600	Analysis
	AV/2601	Analysis
	AV/2602	Analysis
	AV/2383	Analysis
	AV/3047	Analysis
	AV/2524	Analysis
	AV/2525	Analysis
	AV/2526	Analysis
	AV/2357	Analysis Flight Test
3.1.3.2.2 Propulsion System Thrust Reversers		
	AV/2066	Analysis Ground Test
	AV/1040	Analysis Flight Test
	AV/2650	Analysis Flight Test
3.1.3.2.3 Propulsion System Air Inlet System		
	AV/2401	Analysis Flight Test
	AV/2361	Analysis Ground Test
	AV/2385	Analysis Flight Test Ground Test
	AV/2362	Analysis
3.1.3.2.4 Propulsion System Thrust Control System		
	AV/2593	Analysis Flight Test Ground Test
	AV/2407	Analysis Flight Test Ground Test
	AV/2513	Analysis Flight Test
	AV/2511	Analysis Ground Test
	AV/2409	Analysis Ground Test
3.1.3.2.5 Propulsion System Starting System		
	AV/2372	Analysis

Requirement Paragraph	Requirement Identifier	Verification Method
		Flight Test
	AV/2370	Analysis
3.1.3.2.6 Propulsion System Installation		
	AV/2364	Analysis Flight Test Ground Test
3.1.3.2.7 Propulsion System Fire Protection		
	AV/2398	Analysis Flight Test Ground Test
	AV/3063	Analysis Flight Test Ground Test
	AV/3061	Analysis
3.1.3.3 Airframe		
	AV/3068	Analysis Flight Test Lab Test
	AV/3069	Analysis Lab Test
	AV/3070	Analysis Flight Test
	AV/3073	Analysis Flight Test Ground Test
	AV/3092	Analysis Flight Test
	AV/3074	Analysis Lab Test
	AV/3075	Analysis Lab Test
	AV/3082	Analysis
	AV/3083	Analysis
	AV/3084	Analysis Lab Test
3.1.3.4 Utilities and Subsystems		
3.1.3.4.1 Fuel Subsystem Requirements		
	AV/2418	Analysis Flight Test Ground Test
	AV/3050	Analysis Flight Test
	AV/2324	Analysis Flight Test Ground Test
	AV/2735	Analysis
	AV/2405	Analysis
	AV/3064	Analysis

Requirement Paragraph	Requirement Identifier	Verification Method
		Lab Test
3.1.3.4.2 Landing Gear Subsystem (Not Used)		
3.1.3.4.3 Hydraulics Subsystem Requirements		
	AV-2303	Analysis Demonstration
	AV-2304	Analysis
	AV-2305	Analysis
	AV-2310	Demonstration
	AV-2312	Analysis Flight Test Ground Test
3.1.3.4.4 Environmental Control Subsystems		
	AV-2337	Analysis
3.1.3.4.4.1 Engine Bleed Air Subsystem		
	AV-2333	Analysis
	AV-2335	Demonstration
	AV-2584	Analysis Flight Test Ground Test
	AV-2347	Analysis
	AV-2659	Analysis Flight Test Ground Test
3.1.3.4.4.2 Cabin Air Conditioning Subsystem		
	AV-2667	Analysis Flight Test Ground Test
	AV-2668	Analysis Flight Test Ground Test
	AV-2897	Analysis Ground Test
	AV-3045	Analysis Flight Test Ground Test
3.1.3.4.4.3 Equipment Cooling		
	AV-2342	Analysis Ground Test
	AV-2660	Analysis Ground Test
3.1.3.4.4.4 Cabin Pressurization		
	AV-2339	Analysis Flight Test
	AV-2340	Analysis Flight Test
	AV-2669	Analysis Demonstration
3.1.3.4.5 Equipment and Furnishings		
3.1.3.4.5.1 Cargo Compartment Smoke Detection		

Requirement Paragraph	Requirement Identifier	Verification Method
	AV 2417	Analysis
	AV 2594	Analysis
3.1.3.4.5.2 Lighting		
	AV 2772	Demonstration
	AV 3085	Analysis Ground Test
	AV 3051	Analysis Ground Test Demonstration
3.1.3.4.5.3 Night Vision Imaging System (NVIS) Compatibility		
	AV 3025	Demonstration
	AV 2909	Lab Test
	AV 2924	Analysis Ground Test Lab Test
3.1.3.4.6 Auxiliary Power		
	AV 2761	Analysis
	AV 2762	Analysis
	AV 2763	Analysis
	AV 2322	Analysis Ground Test
	AV 2575	Analysis Flight Test
	AV 3060	Analysis Flight Test
	AV 2604	Analysis
	AV 2606	Analysis
	AV 2764	Demonstration
	AV 2738	Analysis
	AV 3052	Analysis Flight Test Ground Test
	AV 2703	Analysis
3.1.3.4.7 Flight Controls Subsystem Requirements		
3.1.3.4.7.1 Mechanical Characteristics		
	AV 2656	Analysis Ground Test Flight Test
	AV 2557	Analysis Flight Test
	AV 2658	Analysis Flight Test
	AV 2960	Analysis
	AV 2470	Analysis Flight Test
	AV 2705	Analysis Demonstration
3.1.3.4.7.2 ALDCS		
	AV 2611	Analysis Flight Test

Requirement Paragraph	Requirement Identifier	Verification Method
		Ground Test
3.1.3.4.7.3 Directional Control		
	AV/2690	Analysis Flight Test
	AV/2692	Analysis Flight Test
	AV/2691	Analysis Flight Test
	AV/2693	Analysis Flight Test
	AV/2694	Analysis Flight Test
	AV/2695	Analysis Flight Test
	AV/2696	Analysis Flight Test
	AV/2653	Analysis Flight Test Lab Test
3.1.3.4.7.4 Requirements for Full Power Systems		
	AV/2697	Analysis
	AV/2700	Analysis Demonstration
	AV/2699	Analysis
	AV/2707	Analysis Flight Test
	AV/2710	Analysis Flight Test
	AV/2708	Analysis Flight Test
	AV/2706	Analysis Flight Test
3.1.3.4.8 Electrical Subsystem Requirements		
	AV/2765	Analysis
	AV/1092	Analysis
	AV/3065	Analysis
	AV/3066	Demonstration
	AV/2585	Analysis
	AV/2589	Analysis Ground Test
	AV/2321	Analysis
3.1.3.5 Avionics		
3.1.3.5.1 Avionics Subsystem And Avionics Integration Requirements		
	AV/2942	Analysis Flight Test Ground Test Lab Test

Requirement Paragraph	Requirement Identifier	Verification Method
	AV/1082	Analysis
	AV/2972	Analysis Ground Test Lab Test
3.1.3.5.2 Cautions, Warnings and Advisories (CWA)		
	AV/3078	Demonstration Lab Test
	AV/3012	Demonstration
	AV/3019	Analysis Lab Test
	AV/2786	Analysis
	AV/3006	Analysis Lab Test Ground Test
3.1.3.5.3 Controls and Displays		
	AV/3009	Demonstration
	AV/3013	Demonstration
	AV/3015	Demonstration Analysis Ground Test
	AV/3016	Analysis
	AV/1227	Analysis
	AV/2902	Analysis
	AV/2910	Demonstration
3.1.4 (Not Applicable)		
3.1.5 Reliability Requirements		
	AV/1125	Analysis
3.1.6 Maintainability And Maintenance Concept Requirements		
	AV/1226	Analysis Demonstration Ground Test
	AV/2083	Analysis
	AV/2906	Analysis Demonstration
	AV/2904	Inspection
	AV/2939	Analysis
	AV/2182	Analysis Demonstration
	AV/2191	Analysis Demonstration
	AV/1134	Analysis
	AV/1142	Analysis
	AV/2267	Analysis
	AV/2940	Analysis
	AV/2941	Demonstration
	AV/3046	Analysis
	AV/2938	Analysis
	AV/1304	Analysis
3.1.7 (Not Applicable)		
3.1.8 (Not Applicable)		

Requirement Paragraph	Requirement Identifier	Verification Method
3.1.9 Environmental Compatibility Requirements		
3.1.9.1 Operating and Non-Operating Environment		
3.1.9.1.1 Ambient Temperature		
	AV/2869	Analysis Flight Test Ground Test
	AV/3079	Analysis
3.1.9.1.2 Pressure		
	AV/2871	Analysis
3.1.9.1.3 Humidity		
	AV/2874	Analysis
3.1.9.1.4 Salt Fog		
	AV/2876	Analysis
3.1.9.1.5 Sand and Dust		
	AV/2878	Analysis
3.1.9.1.6 Atmospheric Liquid Water		
	AV/2880	Analysis
3.1.9.2 Induced Environment		
	AV/1177	Analysis
	AV/3071	Analysis Flight Test
3.1.10 (Not Applicable)		
3.1.11 Materials And Processes Requirements		
	AV/1182	Analysis
	AV/3007	Analysis
	AV/2962	Analysis
	AV/1474	Analysis
3.1.11.1 Toxic Chemicals, Hazardous Substances, And Ozone-Depleting Chemicals		
	AV/1185	Analysis
	AV/2956	Analysis
	AV/2957	Analysis
3.1.12 Electromagnetic Environmental Effects		
3.1.12.1 Electromagnetic Compatibility		
	AV/1451	Analysis Ground Test
3.1.12.2 External EME Immunity		
	AV/1453	Analysis
3.1.12.3 Indirect-Effects Lightning Protection		
	AV/1454	Analysis
3.1.12.4 Direct-Effects Lightning Protection		
	AV/1455	Analysis
3.1.12.5 Bonding		
	AV/1456	Analysis Ground Test
3.1.13 Nameplates Or Product Markings Requirements		
	AV/1196	Analysis

Requirement Paragraph	Requirement Identifier	Verification Method
3.1.14 (Not Applicable)		
3.1.15 Interchangeability, Standardization, Interoperability, And Commonality Requirements		
	AV/1023	Analysis
	AV/2711	Analysis
	AV/2265	Analysis
	AV/2384	Analysis
	AV/2430	Demonstration
	AV/2926	Analysis
3.1.16 System Safety And Health Requirements		
3.1.16.1 General Requirements		
	AV/1459	Analysis
	AV/1460	Analysis
	AV/1218	Analysis
3.1.16.2 Personnel Safety		
	AV/1220	Analysis
	AV/1464	Analysis Ground Test
3.1.16.3 Flight Safety		
	AV/2275	Analysis
	AV/2274	Analysis
	AV/1470	Analysis
	AV/2788	Analysis
	AV/2789	Analysis
	AV/2608	Analysis
	AV/3008	Analysis
	AV/3038	Analysis
3.1.16.4 Software Safety		
	AV/2808	Analysis
3.1.16.5 Crashworthiness		
	AV/2820	Analysis
	AV/2821	Analysis
	AV/2824	Analysis
3.1.16.6 Electrical Safety		
	AV/2810	Analysis
	AV/2811	Analysis
	AV/2812	Analysis
	AV/2813	Analysis
	AV/2814	Analysis
	AV/2815	Analysis
	AV/2816	Analysis
	AV/2819	Analysis
	AV/3076	Analysis
3.1.16.7 General Equipment		
	AV/2826	Analysis
	AV/2827	Analysis
	AV/2830	Analysis
	AV/2832	Analysis
	AV/2834	Analysis

Requirement Paragraph	Requirement Identifier	Verification Method
	AV/2835	Analysis
3.1.16.8 Fire Protection		
	AV/2845	Analysis
	AV/2846	Analysis Demonstration
	AV/3077	Demonstration
3.1.16.9 Explosive Atmosphere		
	AV/2847	Analysis
3.1.17 Human Factors/ Human Systems Integration Requirements		
	AV/1229	Analysis Demonstration Lab Test
	AV/2901	Analysis Demonstration
	AV/2900	Analysis Demonstration
	AV/2905	Analysis Flight Test Ground Test
	AV/2908	Analysis Demonstration Ground Test Lab Test
	AV/2907	Demonstration
	AV/1228	Analysis
	AV/1232	Analysis Flight Test Lab Test
3.1.18 (Not Applicable)		
3.1.19 Computer Resources Requirements		
	AV/2989	Analysis
	AV/2992	Analysis
	AV/1246	Demonstration
	AV/3090	Demonstration
	AV3091	Demonstration
3.1.20 Logistics And Supportability Requirements		
3.1.20.1 (Not Applicable)		
3.1.20.2 (Not Applicable)		
3.1.20.3 Support Equipment Requirements		
	AV/1287	Analysis
3.1.20.4 (Not Applicable)		
3.1.21 (Not Applicable)		
3.1.22 (Not Applicable)		
3.1.23 Survivability & Vulnerability Requirements		
	AV/1319	Analysis
3.1.24 Testability And Diagnostics Requirements		
3.1.24.1 Diagnostics		
	AV/2974	Analysis Ground Test Lab Test

Requirement Paragraph	Requirement Identifier	Verification Method
	AV/2997	Analysis
	AV/3004	Demonstration Lab Test
	AV/3003	Analysis
	AV/3002	Analysis Lab Test
	AV/3001	Analysis Ground Test
	AV/3035	Analysis
	AV/2998	Analysis
	AV/3086	Analysis
	AV/3087	Analysis
	AV/3005	Demonstration
	AV/2977	Analysis Demonstration
	AV/3089	Analysis
3.1.24.2 Built-In Test (BIT)		
	AV/1325	Analysis Ground Test Lab Test
	AV/2982	Analysis Lab Test
	AV/1422	Analysis Ground Test Lab Test
	AV/1329	Analysis Ground Test Lab Test
	AV/2966	Analysis Ground Test Lab Test
	AV/1330	Demonstration
	AV/2984	Demonstration
	AV/3022	Demonstration
3.1.24.3 Data Recorder		
	AV/2985	Analysis
	AV/2986	Analysis Demonstration Flight Test Ground Test
3.1.25 (Not Applicable)		
3.2 Interface Requirements		
3.2.2 (Not Appl		
3.2.3 (Not Applicable)		
3.2.4 (Not Applicable)		
3.2.5 Design And Construction Requirements		
	AV/1359	Analysis
3.2.6 (Not Applicable)		
3.2.7 (Not Applicable)		

Requirement Paragraph	Requirement Identifier	Verification Method
3.2.8 Workmanship And Quality Requirements		
	AV/1378	Inspection
3.2.9 (Not Applicable)		
3.2.10 (Not Applicable)		

This page intentionally left blank.

Appendix A: Assumptions and Conditions Relating to Air Vehicle Specification RM&A Metrics

This appendix provides assumptions, conditions, and provisions for specified quantitative Reliability, Maintainability, and Availability (RM&A) metric requirements. These RM&A requirements are based on the corresponding ORD threshold requirements, which are wartime only requirements.

Applicable Parameters - The following specified RM&A metrics must be met or bettered within an AMC operational environment under a wartime scenario by the time Initial Operational Capability (IOC) is achieved.

PARAMETER

a. Mean Time Between Failure (MTBF)
b. Mean Time to Repair (MTTR)

2 **Wartime Provisions** The wartime scenario as a minimum has the following characteristics/conditions:

a. Sustained wartime utilization rate is at least 5.0 FH/AC/DAY, a little over twice the AMC C-5B peacetime rate that has averaged about 2.3 FH/AC/DAY in the 1995-2000 timeframe. Surge rate may be as high as 11.2 FH/AC/DAY, the ORD threshold.
b. Wartime surge period is in the range of 30 to 45 days.
Additional maintenance and supply manpower is available so that downtime awaiting maintenance is reduced and more maintenance concurrency can be implemented. Maintenance and supply personnel will work longer schedules (reference AFI38-201) to facilitate increased utilization so that personnel productivity increases.
d. Aircraft refurbishment activities are delayed.
e. Aircraft isochronal inspections are delayed.
f. Average sorties lengths increase to above 5 hours per sortie.
g. Constants found in Air Force Pamphlet 10-1403 are used as guidelines for establishing sortie turn times, etc.
h. A 90% issue effectiveness rate applies, as well as delivery of the remaining 10% within 48 hours, for RERP items as well as for those non-RERP items that, when failed, cause code three breaks and/or downing (NMC) events.
i. Average delay time awaiting maintenance personnel is no more than 3 hours per NMC event.
j Maintenance is accomplished in accordance with verified and approved technical orders using properly trained personnel.
k. Breaks, not-mission-capable (NMC) events, and departure delays are per the applicable minimum equipment list (MEL) defined in AFI 11-2C-5V3.
C-5A and C-5B aircraft modified to the RERP configuration are flown and supported the same way.

3 **Allocation Provisions** - RERP and Non-RERP allocations of the total requirement for each parameter are as follows. Contractor responsibility is to validate that the total air vehicle requirements are met using these allocations as worst-case allowables in the validation process for NON-RERP and Early Go-Ahead Items. If the validation process validates numbers better than these allowables, such numbers may be used in the overall air vehicle validation.

Parameter	Requirement	Allocated RERP Portion	RERP Sub-Allocation*	Allocated Non-RERP Portion
MTBF (Flt. Min.)	31.0	50.6		80.0
Sub-Alloc.			1143.0	
MTTR (minutes)	85.0	85.0		85.0
Sub-Alloc.			70.0	

RERP Sub-allocation is to Early Go-Ahead improvements. These are C-5 Avionics Modernization Program (AMP), Hydraulic Surge Control Valves, Tire Deflation/ Anti-Skid System, Fuel Boost Pumps, Main Landing Gear Roll Pin, Manifold Flow Control, Bleed Air Overheat Loops, Nitrogen Inerting (T.O. purging procedure change), and Emergency Escape Slides.

5. **Computational Formulas** - Verification of Contractor compliance with the quantitative RM&A metric requirements shall be shown by analysis using the definitions/equations contained in Section 5, Technical Reference Information, and predicated upon Government achievement or bettering allocated Non-RERP portions of the requirements.

Appendix B: AMC Mission Rules with Global Air Traffic Management (GATM) Constraints

SEGMENT 1 Start-up, Taxi and Takeoff Fuel

SEGMENT 2: Fuel to Climb at 250 KCAS (speed due to ATC restriction) up to FL 100 and 270 KCAS until reaching 0.70 MACH then climb at 0.70 MACH until reaching initial cruise altitude (T.O. 1C-5A-1, Current climb speed schedule). For the RERP C-5 the climb speed from FL 100 to the initial cruise altitude determined by LMAS.

SEGMENT 3, CRUISE:

- Standard Day Temperature and Altimeter
- Initial Cruise Altitude is calculated at 300 FPM Rate of Climb
- Constant Speed: 0.77 MACH/300 KCAS which ever is less (AMC Pamphlet 11-2, optimized fuel conservation vs. time speed) For the RERP C-5 the optimized speed determined by LMAS.
- GATM Constraints (Typical)
  - -- If initial Cruise Altitude is less than FL 290, Optimum Step Climb Profile (2000 ft increments, last increment maybe 1000 ft)until reaching FL 290 then Constant Alt/Constant Speed for remainder of cruise period
  - -- If initial Cruise Altitude is Between FL 290 and FL 300, Constant Alt/Constant Speed at FL 290 for entire cruise period.
  - -- If initial Cruise Altitude is FL 310 or above, Constant Alt/Constant Speed at the initial cruise altitude for the entire cruise period.

NOTE: Initial altitudes will be rounded down to the nearest 1000 feet.

SEGMENT 4, EN ROUTE RESERVES

10 % of the cruise segment time
-- N/A if cruise time is less than 60 minutes
-- No distance credit

SEGMENT 5, DESCENT: 5,000 lbs. (AMC Pamphlet 11-2)

SEGMENT 6, HOLDING: 45 minutes at FL 100 (AMC Pamphlet 11-2 and T.O. 1C-5A-1-1)

- Calculated using 20 degrees of bank
- Speed based on 1.3 V Stall (Nominal 3 degree Angle-of Attack)

SEGMENT 7, APPROACH AND LANDING FUEL: 2,000 lbs. (AMC Pamphlet 11-2)

SEGMENT 8, MINIMUM LANDING FUEL: 18,000 lbs. (T.O. 1C-5A-1 and AMC Pamphlet 11-2, required for hydraulic cooling).

ADDITIONAL INFORMATION: In an effort to capture the 840,000 lbs. legacy C-5 vs. the 840,000 lbs. RERP C-5 HQ AMC/DOV submits the following:

Premise: It is unrealistic to compare an 840,000 lbs. legacy C-5 with a 840,000 lbs. RERP C-5. At present the C-5 is incapable of performing an 840,000 takeoff from any C-5 Main Operating Base.

Justification:

Conditions:

- Standard Day: Sea Level, 15 degrees C (59 degrees F).
- Hot Day: Sea Level, 40 degrees C (103 degrees F).
- Winds: Calm
- Runway Conditions: Dry
- Runway Length: 10,000 ft
- Line-up Distance: 250 ft
- Runway Available: 9750
- No obstacles
  - Maximum Takeoff Gross Weight (MTGW) limited by 3-engine climb, (T.O. 1C-5A-1-1, Fig A3-12) and/or Critical Field Length (CFL) (T.O. 1C-5A-1-1, FIG A3-8)
  - MTGW limited by the 40:1 OIS (152 ft/nm, 2.5 % net climb gradient)

NOTE: Published minimum climb gradients and/or obstacles will reduce MTGWs.

Maximum Takeoff Gross Weights (MTGW)

Standard Day

MTGW limited by 3-Engine Climb and/or CFL: 802,000
MTGW limited by 40:1 OIS: 757,000

Hot Day

MTGW limited by 3-Engine Climb and/or CFL: 697,000
MTGW limited by 40:1 OIS: 657,000

Appendix C: Applicable Paragraphs in FAR Part 25 for the Propulsion Subsystem

Paragraph Number	Paragraph Title	Amendment	Verification Method
25.1011(b)(1)(c)	General (Performance)	Amdt. 25-92 Feb. 18,1998	Analysis
25.301	Loads	Amdt. 25-23 April 8, 1970	Analysis
25.303	Factors of Safety	Amdt. 25-23 April 8, 1970	Analysis
25.305	Strength and Deformation	Amdt. 25-54 September 11, 1980	Analysis
25.307	Proof of Structure	Amdt. 25-54 September 11, 1980	Analysis
25.361	Engine Torque	Amdt. 25-46 October 30, 1978	Analysis
25.363	Side Load on Engine Mount	Amdt. 25-23 April 8, 1970	Analysis
25.367	Unsymmetrical Loads due to Engine Failure		Analysis
25.371	Gyroscopic Loads		Analysis
25.561	General	Amdt. 25-23 April 8, 1970	Analysis
25.571	Damage – Tolerance and Fatigue Evaluation of Structure	Amdt. 25-54 September 11, 1980	Analysis
25.581	Lightning Protection		Analysis
25.603	Materials		Analysis
25.605	Fabrication Methods		Analysis
25.607	Fasteners		Analysis
25.609	Protection of Structure		Analysis
25.611	Accessibility Provisions		Analysis
25.613	Material Strength Properties and Design Values		Analysis
25.615	Design Properties		Analysis
25.619	Special Factors		Analysis
25.621	Casting Factors		Analysis
25.623	Bearing Factors		Analysis
25.625	Fitting Factors		Analysis
25.629	Aeroelastic Stability Requirements		Analysis
25.777	Cockpit Controls	Amdt. 25-46 October 30, 1978	Analysis
25.779	Motion and Effect of Cockpit Controls	Amdt. 25-72 July 20,1990	Analysis
25.863	Flammable Fluid Fire Protection	Amdt. 25-46 October 30, 1978	Analysis
25.869	Fire Protection: Systems		Analysis
25.903	Installation	Amdt. 25-46	Analysis

Paragraph Number	Paragraph Title	Amendment	Verification Method
		October 30, 1978	
25.903	Engines	Amdt 25-95 March 26, 1998	Analysis
25.934	Turbojet Engine Thrust Reverser System Tests	Amdt. 25-23 April 8, 1970	Lab Test Analysis.
25.952(b)	Fuel System Analysis & Test	Amdt. 25-40 March 17,1977	Analysis.
25.993	Fuel System Lines & Fittings	Amdt. 25-15 September 20, 1967	Analysis.
25.994	Fuel System Components	Amdt.25-57 February 23, 1984	Analysis.
25.1011	General		Lab Test Analysis.
25.1013	Oil Tanks	Amdt.25-57 February 23, 1984	Analysis.
25.1015	Oil Tank Tests	Amdt. 25-36 October 1 1974	Analysis.
25.1017	Oil Lines and Fittings		Analysis.
25.1019	Oil Strainer or Filter	Amdt. 25-36 October 1 1974	Analysis.
25.1021	Oil System Drains	Amdt.25-57 February 23, 1984	Analysis.
25.1023	Oil Radiators		Analysis.
25.1045	Cooling Test Procedures	Amdt.25-57 February 23, 1984	Analysis
25.1091(b)(2)(e)	Air Induction	Amdt.25-57 February 23, 1984	Analysis
25.1093(b)	Induction System Icing Protection	Amdt.25-57 February 23, 1984	Analysis
25.1103	Induction System Ducts and Air Duct Systems	Amdt.25-46 October 30,1978	Analysis
25.1121	(Exhaust System) General	Amdt. 25-40 March 17,1977	Analysis
25.1123	Exhaust Piping	Amdt. 25-40 March 17,1977	Analysis
25.1141	Powerplant Controls: General	Amdt.25-72 July 20, 1990	Analysis
25.1142	Auxiliary Power Unit Controls (adapted to Engine Control herein)	Amdt. 25-46 October 30, 1978	Analysis
25.1143	Engine Controls	Amdt.25-57 February 23, 1984	Analysis
25.1155	Reverse Thrust and Propeller Pitch Settings Below the Flight Regime	Amdt. 25-11 May 5, 1967	Analysis
25.1163	Powerplant Accessories	Amdt.25-57 February 23, 1984	Analysis
25.1165	Engine Ignition Systems	Amdt.25-72 July 20, 1990	Analysis
25.1301	Function & Installation		Analysis
25.1305	Powerplant Instruments	Amdt. 25-72 July 20, 1990	Analysis

Paragraph Number	Paragraph Title	Amendment	Verification Method
25.1309	Equipment, Systems, and Installations	Amdt. 25-41 July 18, 1977	Analysis
25.1316	System Lightning Protection	Amdt. 25-80 April 28, 1994	Analysis
25.1321	Arrangement and Visibility		Analysis
25.1322	Warning, Caution, and Advisory Lights	Amdt 25-38 December 20, 1976	Analysis
25.1337	Powerplant Instruments		Analysis
25.1351	General	Amdt. 25-72 July 20, 1990	Analysis
25.1353	Electrical Equipment & Installations	Amdt. 25-42 January 16, 1978	Analysis
25.1435	Hydraulic System		Analysis
25.1438	Pressurization and Pneumatic Systems		Analysis
25.1461	Equipment Containing High Energy Rotors		Analysis
25.1521	Powerplant Limitations		Analysis
25.1527	Maximum Operating Altitude		Analysis
25.1529	Instructions for Continued Airworthiness	N/A	
25.1541	General		Analysis
25.1549	Powerplant and Auxiliary Power Unit Instruments		Analysis
25.1551	Oil Quantity Indication		Analysis
25.1557(b)(2)	Misc. Markings & Placards	Amdt. 25-72 July 20, 1990	Analysis

This page intentionally left blank.

Appendix D: C-5 Pre-RERP Flight Control Baseline

Scope

This appendix provides reference data establishing the pre-RERP baseline for specific RERP stability and flight control Air Vehicle Specification (AVS) requirements and verification descriptions as listed in this document. The purpose of Appendix D is to clarify baseline characteristics as required and to reduce the need to refer to other documentation.

Reference Documents

Appendix D was developed using the following references:

1. MIL-F-8785 (ASG): Military Specification, Flying Qualities of Piloted Airplanes, dated 1 September 1954.
2. FAA AC 20-57a: Automatic Landing Systems (ALS), dated 12 January 1971
3. MIL-F-9490D: Military Specification, Flight Control Systems— General Specifications for Design, Installation and Test of Piloted Aircraft, dated 1975
4. AFFDL-TR-75-3: Evaluation of the Flying Qualities Requirements of MIL-F-8785B (ASG) Using the C-5A Airplane, dated 20 March 1975.
5. LG1US42: Flight Control Report (Aerospace Vehicle) – Stability and Control, Rev P, dated 24 April 1981.
6. TO 1C-5A-1: Flight Manual - USAF Series C-5A and C-5B Airplanes, dated 1 December 1997 Change 2 - 15 May 2000.

D3.0 Introduction

The RERP originally assumed that the C-5 Avionics Modernization Program (AMP) would be completed before RERP upgrades are incorporated. At the time of RERP SDD contract award the AMP flight test program had not started and the verification documents were not available. With AMP flight test not underway as yet, much of the AMP data needed to establish the flight control baseline will not be available until later in RERP SDD. Since many of these characteristics will therefore be finalized later, updates of those characteristics necessary to identify or clarify specifications have been associated with AMP milestones. The following sections in this appendix provide the data categories and sources for each of these items. A cross-reference matrix is also provided to identify which the association of these items with relevant AVS requirements and verification descriptions.

Descriptions

D4.1 Flight Envelopes

D4.1.1 Operational

These data will include charts or data from the baseline Air Vehicle Flight Manual, which will be cross checked against contractor report AFFDL-TR-75-3.

D4.1.2 Service

These data will include charts or data from the baseline Air Vehicle Flight Manual, which will be cross checked against contractor report AFFDL-TR-75-3.

D4.1.3 Permissible

These data will include charts or data from the baseline Air Vehicle Flight Manual, which will be cross checked against contractor report AFFDL-TR-75-3.

D4.1.4 Permissible Sideslip Limitations

These data will include charts or data from the baseline Air Vehicle Flight Manual, which will be cross checked against contractor report AFFDL-TR-75-3.

Service Loading

D4.2.1 Heavy

These data will include charts or data from contractor report AFFDL-TR-75-3, which will be cross checked against the baseline Air Vehicle Flight Manual.

D4.2.2 Normal

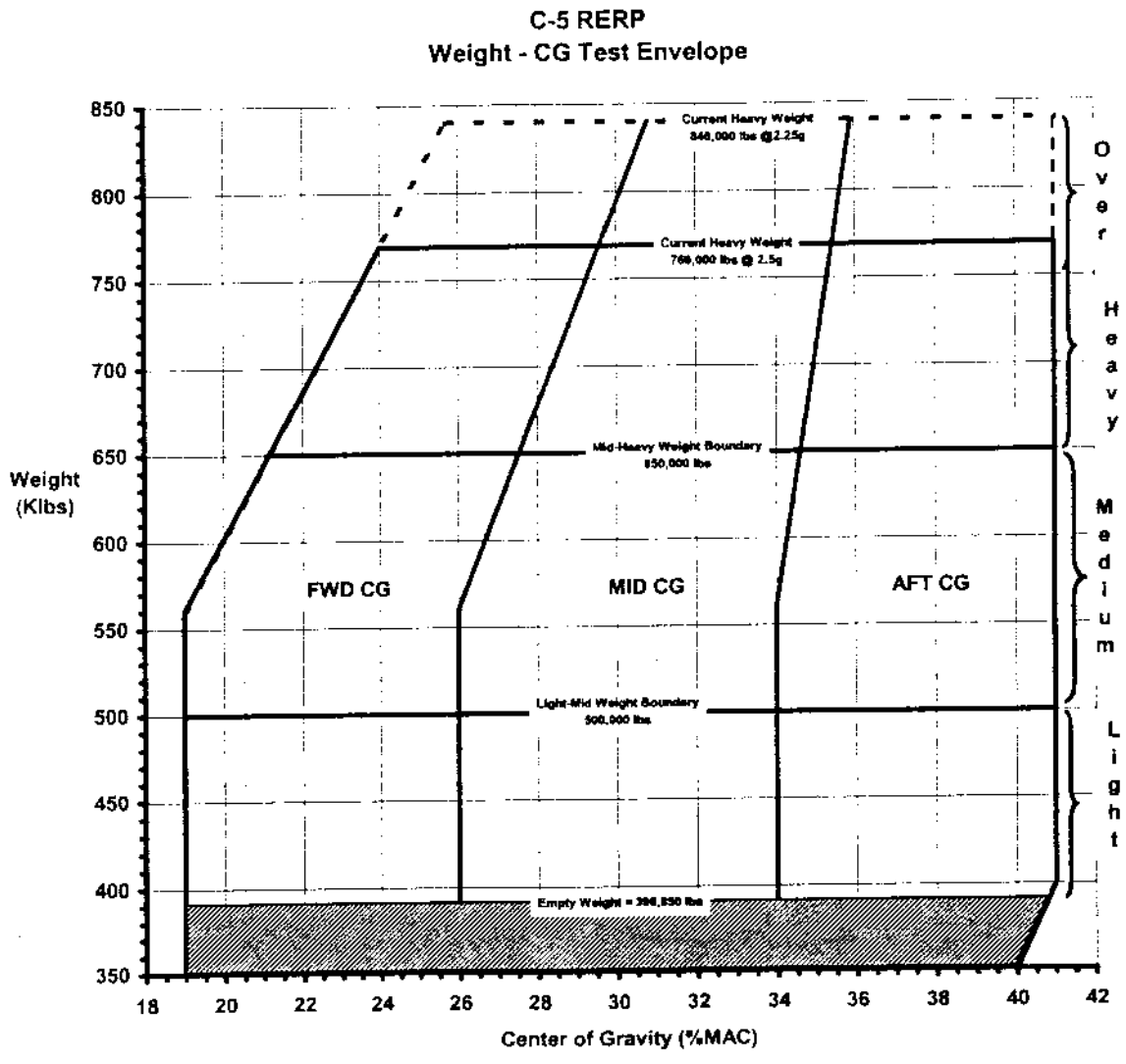
These data will include charts or data from contractor report AFFDL-TR-75-3, which will be cross checked against the baseline Air Vehicle Flight Manual.

D4.2.3 Light

These data will include charts or data from contractor report AFFDL-TR-75-3, which will be checked against the baseline Air Vehicle Flight Manual.

D4.3 Weight-CG Test Envelope

This envelope below was derived using a baseline Air Vehicle weight vs. center of gravity envelope partitioned to describe the regions defined as forward, mid, and light weights as well as forward, mid, and aft centers of gravity for the flight test program.



D4.4 Loads/Hinge Moments Envelope

These data will include charts or data from developed or drawn directly from contractor report LG1US42.

D4.5 Vehicle Flying Qualities (SAS On & Off)

D4.5.1 Phugoid Mode Description

These data will include charts or data from contractor report AFFDL-TR-75-3, MIL-F-8785 (ASG), and LG1US42 for specific representative flight conditions. These data will provide bounds for acceptable Air Vehicle phugoid mode characteristics.

D4.5.2 Lateral Directional Damping

These data will include charts or data from contractor report AFFDL-TR-75-3, MIL-F-8785 (ASG), and LG1US42 for specific representative flight conditions. These data will provide bounds for acceptable Air Vehicle lateral-directional damping characteristics for the baseline Air Vehicle with SAS ON. Similar data for the baseline Air Vehicle with SAS OFF will be shown for objective goals.

D4.5.3 Power/Thrust Reverser Control Force Change

These data will include charts or data from contractor report AFFDL-TR-75-3, MIL-F-8785 (ASG), and LG1US42 for specific representative flight conditions. These data will provide bounds for acceptable Air Vehicle control forces changes caused by changes in power or by in-flight thrust reverser extension based on data for the baseline Air Vehicle.

D4.5.4 Artificial Stability System Failure

These data will include charts or data from contractor report AFFDL-TR-75-3, MIL-F-8785 (ASG), and LG1US42 for specific representative flight conditions. These data will adequate to describe the baseline Air Vehicle handling quality levels, as described in MIL-F-8785 (ASG), following failure of the artificial stability systems (SAS OFF).

D4.6 Flight Handling (Qualities) Characteristics

These data will include charts or data from contractor report AFFDL-TR-75-3, MIL-F-8785 (ASG), and LG1US42 for specific representative flight conditions. These data will adequate to describe the effect on handling characteristics of the baseline Air Vehicle with the artificial stability systems active (SAS ON), at representative conditions, for comparison to the Air Vehicle.

D4.7 Crosswind Landing

D4.7.1 Capability

These data will include charts or data from TO 1C5A-1 to describe the crosswind landing capability for the baseline Air Vehicle flight manual under the conditions described in AV/2710.

D4.7.2 Weight

These data will include charts or data from TO 1C5A-1 to describe the crosswind landing weights for the baseline Air Vehicle flight manual under the conditions described in AV/2710 and D4.8.1.

D4.8 Stall Warning System

These data will include angle of attack margins between the stallimiter activation and stall for various flap/slat settings for the baseline Air Vehicle as defined in LG1US42.

D4.9 Stall Recovery

This section will contain a description of acceptable stall recover characteristics until relevant baseline Air Vehicle flight test has been completed. Following release of the relevant flight test data report (FTDR) the normalized data will be inserted for the stall regions evaluated. (It should be noted that baseline Air Vehicle will not be tested beyond the stall point for performance, AOA = ~22°, therefore no data will be available for this condition on the baseline aircraft.)

D4.10 ALDCS Function/Performance

These data will include charts or data describing stability minimums from MIL-F-9490D. These data will be updated following the release of relevant AMP verification results for the baseline Air Vehicle and will include the performance and stability minimums from AMP ALDCS tests.

D4.11 Automatic Approach Repeatibility

These data will include charts or data from FAR AC 20-57a. These data will be updated with AMP flight test verification results.

D4.12 Control Surface Rates

These data will include charts or data from contractor report LG1US42. These data will be checked against the relevant baseline Air Vehicle test data.

D4.13 Mechanical Equipment Baseline

These data will include charts or data from the Elevator Variable Feel Unit, Rudder Limiter, and Slat Proximity Sensor component specifications (if changes are made to these units). These data will be of sufficient detail that an assessment of the functional performance of these components may be made.

D4.14 Definitions

D4.14.1 Normal Landing Definition

This section will comprise a narrative of flight conditions, vehicle configuration, and flight characteristics that will define a normal landing for the Air Vehicle.

D4.14.2 Operational State III

These data will comprise a narrative and charts or data from MIL-F-9490D sufficient to describe this characteristic.

D4.14.3 Operational State IV

These data will comprise a narrative and charts or data from MIL-F-9490D sufficient to describe this characteristic.

D4.14.4 Operational Flight Envelope

These data will comprise a narrative and charts or data from MIL-F-8785 (ASG) and AFFDL-TR-75-3 sufficient to describe this characteristic.

D4.14.5 Service Flight Envelope

These data will comprise a narrative and charts or data from MIL-F-8785 (ASG) and AFFDL-TR-75-3 sufficient to describe this characteristic.

D4.14.6 Permissible Flight Envelope

These data will comprise a narrative and charts or data from MIL-F-8785 (ASG) and AFFDL-TR-75-3 sufficient to describe this characteristic.

D4.14.7 Flying Qualities

These data will comprise a narrative and charts or data from MIL-F-8785 (ASG) sufficient to describe what is meant by a flying quality level.

D5.0 C-5 RERP AIR VEHICLE SPECIFICATION
APPENDIX D – CROSS REFERENCE MATRIX

ITEM #	BASELINE ELEMENT	CATEGORY	AVS SECTIONS	AIR VEHICLE SPECIFICATION REFERENCE *		APPENDIX D DATA SOURCE	SPECIFIC DATA SOURCE TO ADDRESS AVS REQUIREMENT
				Requirement - Section 3	Verification - Section 4		
D4.1.1	Flight Envelopes	Operational	Numerous	AV/2537, AV/2699, AV/2700, AV/3037	AVV/1677, AVV/1711, AVV/1712, AVV/1713, AVV/1714, AVV/2342, AVV/2324, AVV/1461, AVV/2357, AVV/2388, AVV/2389, AVV/2390, AVV/2392, AVV/2393, AVV/2394	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.1.2		Service	Numerous	AV/2557	AVV/1679, AVV/1709, AVV/1715, AVV/1716, AVV/1721, AVV/1722, AVV/2381, AVV/1722, AVV/2407, AVV/2352	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.1.3		Permissible	Numerous	AV/2469, AV/2554, AV/3036	AVV/1537, AVV/1538, AVV/1717, AVV/1718, AVV/1719, AVV/1778, AVV/1783, AVV/2326, AVV/2343, AVV/2353, AVV/2382, AVV/2383, AVV/2395, AVV/2406	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.1.4		Permissible Sideslip		AV/2469	AVV/2380	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.2.1	Service Loading	Heavy	Numerous	Term Not Referenced	Term Not Referenced	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.2.2		Normal	Numerous	Term Not Referenced	Term Not Referenced	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.2.3		Light	Numerous	AV/2706 (Ref: "lightest normal")	Term Not Referenced	AFFDL-TR-75-3 TO 1-C-5A	Charts or Data in Flight Manual.
D4.3	Weight-CG Test Envelope		Numerous	AV/2691, AV/2692, AV/2694	AVV/1713, AVV/2324, AVV/2343, AVV/1713, AVV/1716, AVV/1719, AVV/1461, AVV/2385, AVV/2387, AVV/1759, AVV/2388, AVV/2389, AVV/2392, AVV/2390, AVV/2395, AVV/2394, AVV/2407	LM - USAF	Data has been provided to USAF at Pre SRR II.

D5.0 C-5 RERP AIR VEHICLE SPECIFICATION APPENDIX D – CROSS REFERENCE MATRIX

ITEM #	BASELINE ELEMENT	CATEGORY	AVS SECTIONS	AIR VEHICLE SPECIFICATION REFERENCE *		APPENDIX D DATA SOURCE	SPECIFIC DATA SOURCE TO ADDRESS AVS REQUIREMENT
				Requirement - Section 3	Verification - Section 4		
D4.4	Loads/Hinge Moments Envelope			AV/2470	AVV/1537, AVV/1538	LG1US42	Data from specification as to hinge moment capability. If maneuvers completed successfully, combined with component qualification tests will confirm retention of capability. (Vehicle will not be instrumented to measure these loads in flight test; control surface deflections will be measured.)
D4.5.1	Vehicle Flying Qualities	Phugoid Mode Description		AV/2544	AVV/2347, AVV1711	AFFDL-TR-75-3 LG1US42 MIL-F-8785 (ASG)	Data referenced from AFFDL-TR-75-3 report and description of spec from MIL F-8785 (ASG). A region will be mutually defined by LM and USAF, using the existing data; to bound the acceptable characteristics for previously tested conditions.
D4.5.2		Lateral Directional Damping		AV/2546	AVV/2351, AVV/1715	AFFDL-TR-75-3 LG1US42 MIL-F-8785 (ASG)	Data referenced from AFFDL-TR-75-3 report and description of spec from MIL F-8785 (ASG). A region will be mutually defined by LM and USAF, using the existing data; to bound the acceptable characteristics for previously tested conditions.
D4.5.3		Power/Thrust Reverser Control Force Change		AV/2545, AV/2612	AVV/2349, AVV/1713	LG1US42 MIL-F-8785 (ASG)	Data referenced from AFFDL-TR-75-3 report and description of spec from MIL F-8785 (ASG). A region will be mutually defined by LM and USAF, using the existing data; to bound the acceptable characteristics for previously tested conditions.
D4.5.4		Artificial Stability System Failure		AV/2656	AVV/2384, AVV/1722	AFFDL-TR-75-3 LG1US42 MIL-F-8785 (ASG)	Data referenced from AFFDL-TR-75-3 report and description of spec from MIL F-8785 (ASG). A region will be mutually defined by LM and USAF, using the existing data; to bound the acceptable characteristics for previously tested conditions.
D4.6	Flight Handling (Qualities) Characteristics			AV/2557	AVV/2381, AVV/1721	AFFDL-TR-75-3 LG1US42	AMP's SAS performance and stability criteria will be obtained and used for the initial Appdx D input. These data will be updated following relevant AMP FTDR release.

D5.0 C-5 RERP AIR VEHICLE SPECIFICATION
APPENDIX D – CROSS REFERENCE MATRIX

ITEM #	BASELINE ELEMENT	CATEGORY	AVS SECTIONS	AIR VEHICLE SPECIFICATION REFERENCE *		APPENDIX D DATA SOURCE	SPECIFIC DATA SOURCE TO ADDRESS AVS REQUIREMENT
				Requirement - Section 3	Verification - Section 4		
D4.7.1	Crosswind Landing	Capability		AV/2710	AVV/1808, AVV/2393	TO 1-C-5A	Crosswind capability vs. RCR from Flt Manual. Confer with customer on latest revision.
D4.7.2		Weight					Definition of "Normal Vehicle Weight" to be provided.
D4.8	Stall Warning System			AV/2552	AVV/2353, AVV/1717	LG1US42	Angle of Attack Margins between stallimiter activation and stall for various flap/slat settings.
D4.9	Stall Recovery			AV/2553	AVV/2354, AVV/1718	C-5B Functional. Flt. Test Man. or Equivalent	No quantifiable value is currently available or used. Variables on this issue include A/C configuration (e.g. flap/slat, CG, Weight), Pilot technique (e.g., entry rate, control inputs), and recovery techniques and atmospheric conditions. Use narrative description of acceptability until AMP flight test and then use these data, normalized. (It should be noted that AMP will not be testing beyond the stall point for performance AOA = ~22°, therefore no data will be available for this condition on the baseline aircraft.)
D4.10	ALDCS Functional Performance & Stability			AV/2811	AVV/1724, AVV/2452, AVV/2382	MIL-F-9490D AMP Data	Data directly from MIL spec and current . To be updated from AMP data initially, updated later.
D4.11	Automatic Approach System Repeatability			AV/2853	AVV/1812, AVV/2475, AVV/2357	FAR AC 2057	Data directly from MIL spec and current . To be updated from AMP data initially, updated later.
D4.12	Control Surface Rates			AV/2856	AVV/1720, AVV/2383	LG1US42	Data defining the surface rates will be defined from LM reports.
D4.13	Mechanical Equipment Baseline			AV/2960	AVV/1866	Component level specifications for EVFU, Rudder Limiter, and Slat Proximity Sensor.	Specific data to address AVS requirement will be extracted from relevant component specifications.
D4.14.1	Normal Landing Definition		Numerous	AV/3082	AVV/2449, AVV/2448	LM - USAF	Narrative to describe what envelopes are in relation to the Air Vehicle

D5.0 C-5 RERP AIR VEHICLE SPECIFICATION APPENDIX D – CROSS REFERENCE MATRIX

ITEM #	BASELINE ELEMENT	CATEGORY	AVS SECTIONS	AIR VEHICLE SPECIFICATION REFERENCE *		APPENDIX D DATA SOURCE	SPECIFIC DATA SOURCE TO ADDRESS AVS REQUIREMENT
				Requirement - Section 3	Verification - Section 4		
D4.14.2	General Definitions	Operational State III	Numerous	AV/2700	AVV/1778, AVV/2405	MIL-F-9490D	Narrative to describe what envelopes are in relation to the Air Vehicle
D4.14.3		Operational State IV	AV/2499	AV/2699	AVV/1783	MIL-F-9490D	Narrative to describe what envelopes are in relation to the Air Vehicle
D4.14.4		Operational Flight Envelope	Numerous	AV/2537, AV/2699, AV/2700, AV/3037	AVV/1677, AVV/1711, AVV/1712, AVV/1713, AVV/1714, AVV/2342, AVV/2324, AVV/1461, AVV/2367, AVV/2393, AVV/2394	TO 1C5A-1	Narrative to describe what envelopes are in relation to the Air Vehicle
D4.14.5		Service Flight Envelope	Numerous	AV/2557	AVV/1679, AVV/1715, AVV/1716, AVV/1721, AVV/1722, AVV/2381, AVV/1722, AVV/2407, AVV/2352	TO 1C5A-1	Narrative to describe what envelopes are in relation to the Air Vehicle
D4.14.6		Permissible Flight Envelope	Numerous	AV/2489, AV/2564, AV/3036	AVV/1537, AVV/1538, AVV/1717, AVV/1718, AVV/1719, AVV/1778, AVV/1783, AVV/2328, AVV/2343, AVV/2353, AVV/2382, AVV/2383, AVV/2395, AVV/2406	TO 1C5A-1	Narrative to describe what envelopes are in relation to the Air Vehicle
D4.14.7		Flying Quality Level's	Numerous	AV/2544, AV/2545, AV/2546, AV/2612, AV/2658	AVV/2347	MIL-F-8785 (ASG)	Narrative to describe what envelopes are in relation to the Air Vehicle

Appendix E: Baseline Air Vehicle Data

Scope

This appendix provides baseline Air Vehicle data relevant to requirements and verifications in this specification, except for the flight control characteristics that are addressed in Appendix D.

Reference Documents

There are two references included here in appendix E. The first is TO 1C-5A-1, Flight Manual - USAF Series C-5A and C-5B Airplanes, dated 1 December 1997 Change 5 - 15 May 2001. The second is TO 1C-5A-6WC-1, Workcards Preflight, Thruflight Inspection, USAF series C-5 Aircraft, dated 1 July 1998, Change 2 - 1 October 2000.

E3.0 Introduction

The next two sections include excerpts from the documents listed above that specifically apply to the references made in this Air Vehicle Specification. The next section contains sections of the Flight Manual about various specifications and procedures of the aircraft that are pertinent to this Air Vehicle Specification document. The last section of this appendix contains work cards for thruflight inspection requirements for the C-5 airplane.

E3.1 TO 1C-5A-1

E3.1.1 Take-off Flap Setting (page 2C-123) DELETED

~~The takeoff calculations assume the following types of takeoff:~~
~~RRED - Rolling reduced takeoff at 40% flaps~~
~~SRED - Standing reduced takeoff at 40% flaps~~
~~RTRT - Rolling takeoff rated thrust takeoff at 40% flaps~~
~~STRT - Standing takeoff rated thrust takeoff at 40% flaps~~
~~SOF - Operator inserted A/C On and calculation automatically set A/C Off for a standing takeoff rated thrust take-off at 40% flaps.~~
~~S62 - Standing takeoff rated thrust takeoff at 62.5% flaps~~
~~S62OF - Operator inserted A/C On and calculation automatically set A/C Off for a standing takeoff rated thrust takeoff at 62.5% flaps~~

E3.1.2 Engine failure during take-off, take-off continued (page 3-36A) DELETED

~~**ENGINE FAILURE DURING TAKE-OFF, TAKE-OFF CONTINUED.**~~
~~If an engine failure/fire occurs after passing go-speed, the take-off should be continued. The pilot should evaluate the engine failure/fire indications, thrust available from the affected engine, and take-off conditions prior to initiating the Emergency/Pre-cautionary Engine Shutdown checklist. After an engine failure, the pilot flying shall ensure the throttles are at the planned take-off inflight N_1 RPM as a minimum, but they may be advanced further, not to exceed engine limits.~~

~~**Flight Characteristics After Loss of an Engine**~~
~~When loss of an engine occurs near minimum control speed, the more lateral control is used, the more drag is induced, and the less the climb performance will be. Minimum control speed is based on a bank angle of 5 degrees away from the failed engine.~~

~~**Landing Gear**~~
~~If an engine failure occurs during or immediately after take-off at heavy gross weights, climb performance may be marginal. The landing gear should be retracted as soon as practical under these conditions because climb gradient is reduced 1.3 percent with gear down. For example, if the predicted climb gradient is 2.3 percent it will be reduced to 1.0 per cent. Do not retract the landing gear before a definite rate of climb is indicated by the vertical velocity indicator and the altimeter.~~

~~**Flaps**~~
~~If an engine failure occurs during or immediately after take-off, the flaps shall be left at TAKE-OFF while climbing at minimum climbout speed or as commanded by the go-around pitch command bar until reaching at least 1,000 feet above the runway altitude or higher if terrain features dictate. If an engine failure occurs while climbing at or above minimum climbout speed, continue climbing at the indicated airspeed existing when the engine failed. Bank angles up to 30 degrees may be utilized for obstacle clearance; however, it must be noted that rate of climb is reduced by approximately 200 feet/ minute. Accelerate to flap retraction speed, retract the flaps, and accelerate to at least 15 knots above flap retract speed prior to exceeding 10 degrees of bank. Continue to desired maneuvering airspeed or three engine enroute climb speed, as required.~~

E3.1.3 Engine crosswind/tailwind limits (page 5-10)

ENGINE CROSSWIND/TAILWIND LIMITS.

Engine operating limits in crosswind and tailwind conditions are shown in figure 5-3. For ease of operational use, these limits may be summarized as follows:

NOTE: These limits apply to all ground operations except rolling take-offs.

Wind from the two rear quadrants.
Up to 30 knots - No restriction.
30 to 40 knots - Taxi permitted with N_1 RPM limited to 77 percent.
Above 40 knots - Do not exceed 39 percent N_1 RPM setting.

ENGINE OPERATING LIMITATIONS

IN CROSSWIND AND TAILWIND CONDITIONS

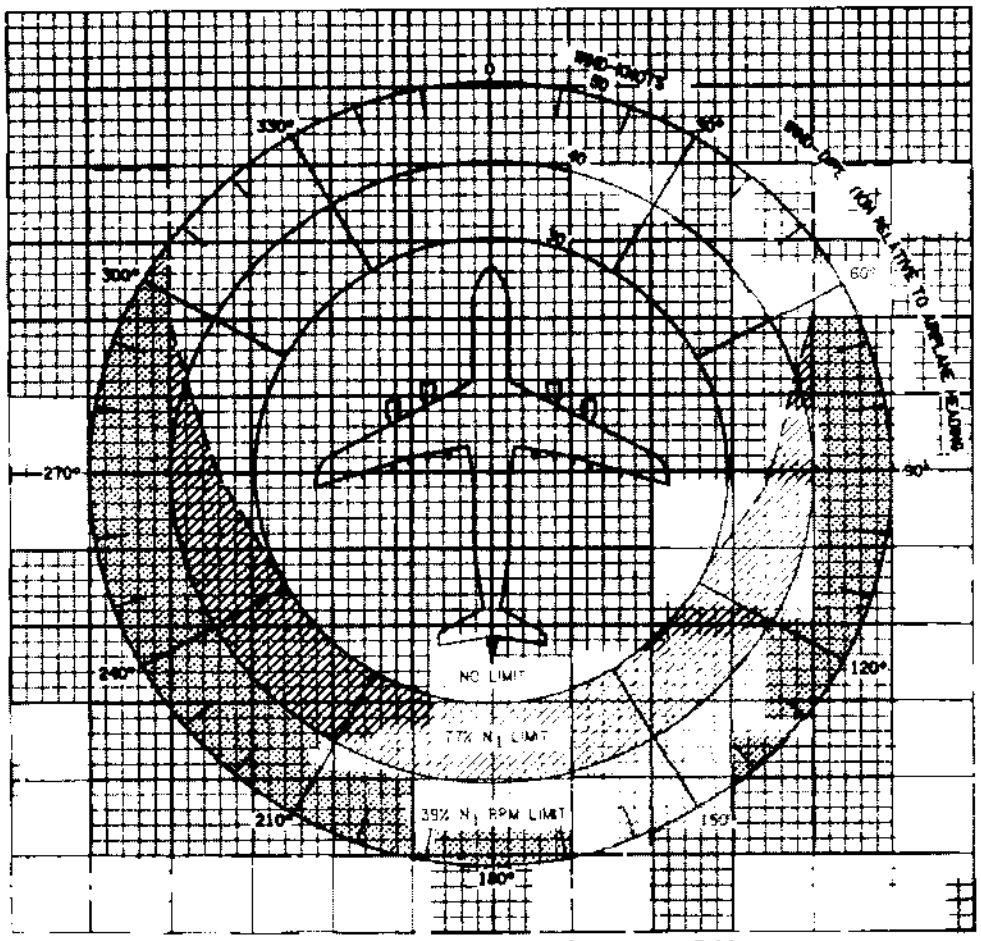


Figure 5-3

E3.1.4 Engine suction feed limitations; main tank to engine feed (page 5-10)

ENGINE SUCTION FEED LIMITATIONS (MAIN TANK TO ENGINE FEED)

WARNING

Fuel crossfeed and isolation valves should be closed during suction feed operation Recommended and Alternate Fuels.

During Climb

Outboard Engines 12,600 feet maximum
Inboard Engines 20,000 feet maximum

During Cruise

Outboard Engines 32,000 feet maximum
Inboard Engines 40,000 feet maximum

E3.1.5 Rapid Warmup of Cargo Compartment Floor (7-8)

For rapid warmup of the cargo compartment floor, operate just the floor heat system. This system alone will utilize most of the output of two APUs until the floor heat temperature control valves begin to modulate. The floor will be heated up in 15 to 20 minutes, then other system selections can be made. Never place the FLOOR HEAT switch to "FANS ONLY" when attempting to warm up the cargo compartment or the floor.

E3.1.6 Turning Radius and Ground Clearance (pages 2A-97,98)

The following two figures describe turning radius and ground clearance taken from the C-5 flight manual, TO 1C-5A-1.

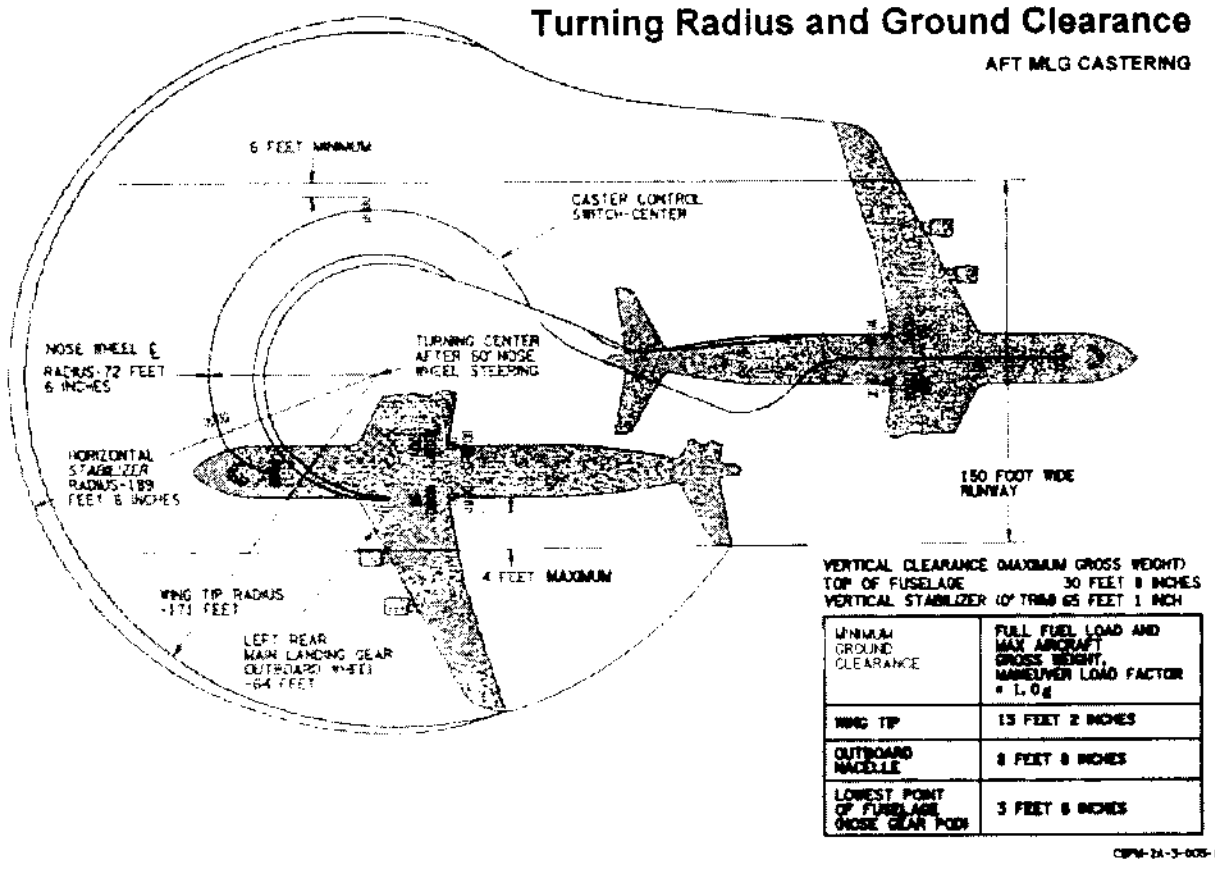


Figure 2A-5 (Sheet 1 of 2) Aft MLG castering (page 2A-97)

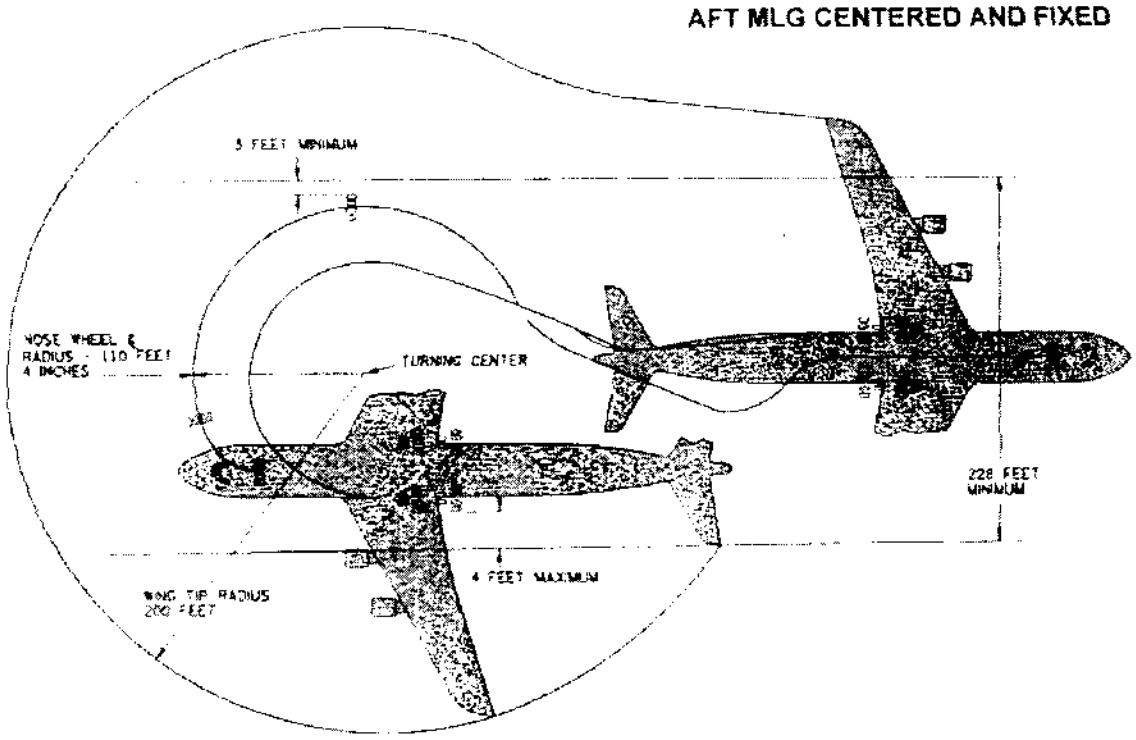


Figure 2A-5 (Sheet 2 of 2) Aft MLG centered and fixed (page 2A-98)

E3.1.7 Backing Procedures (page 3-163)

Backing the C-5 with reverse thrust is an option to consider only under emergency circumstances in order to preserve the airplane (i.e., severe weather evacuation, contingency, or wartime) and then only when no other means of backing are available. MAJCOM approval should be obtained if time permits.

A marginal backing capability has been demonstrated. Variables such as slope, cold tires, wind, power limitations, and taxiway surface conditions will affect backing capability. The following factors must be considered if backing is attempted:

a. Ensure that the area behind the airplane is clear and will remain clear while backing.
b. Ensure that the area is free of foreign objects that could be ingested into the engines.
c. Refer to figure 3-20 for danger areas associated with backing.
d. Set the reverse thrust limiter.
e. Retract flaps, close spoilers, close ramp and all doors not necessary to be open.
f. Scanners should be posted in the troop doors. Use personnel restraint harnesses.

CAUTION

Interphone communications with

the scanners may not be possible
due to high engine noise levels.

g. Backing may not be successful above the following weights:
772,000 lbs on level surfaces
600,000 lbs on up slopes of 0.5 percent
500,000 lbs on up slopes of 1.0 percent
h. Initial breakout may not be possible if tires are cold. In this event, taxiing forward a short distance prior to commencing backing is recommended.

CAUTION
N_1, N_2, and TIT may tend to
exceed limits during extended
reverse thrust operations.

i. Recommended taxi speed is 5 knots or less. Do not exceed a 10-knot taxi speed. Backward movement can be stopped by forward thrust and/or lightly applying the brakes.
j. Turning is not recommended unless absolutely essential for placing the airplane in a position from which forward taxi is possible. Turns while backing require additional thrust and a large turning radius (up to 300 feet). Stalling will occur unless a speed of 3 to 4 knots is attained prior to initiating a turn and NLG steering angle is limited to 20 degrees or less.
k. After backing, make the following Form 781 entry:
(1) All engine cowlings require an inspection for loose panels, fasteners, or damage.
(2) The following engine inspections are required:
(a) All engine fan blades require a visual inspection for damage.

NOTE
If time and circumstances permit, the
above inspection should be completed
prior to take-off. If this is not feasible,
the inspection will be accomplished
prior to the next flight.

(b) All Stage 2 fan blade midspan platforms require an ultrasonic inspection.

NOTE
This inspection will be accomplished at
an enroute station. If inspection support is
not available, the airplane may be flown
on a one-time flight to a station with
inspection capability.

TO 1C-5A-1

Backing Danger Areas

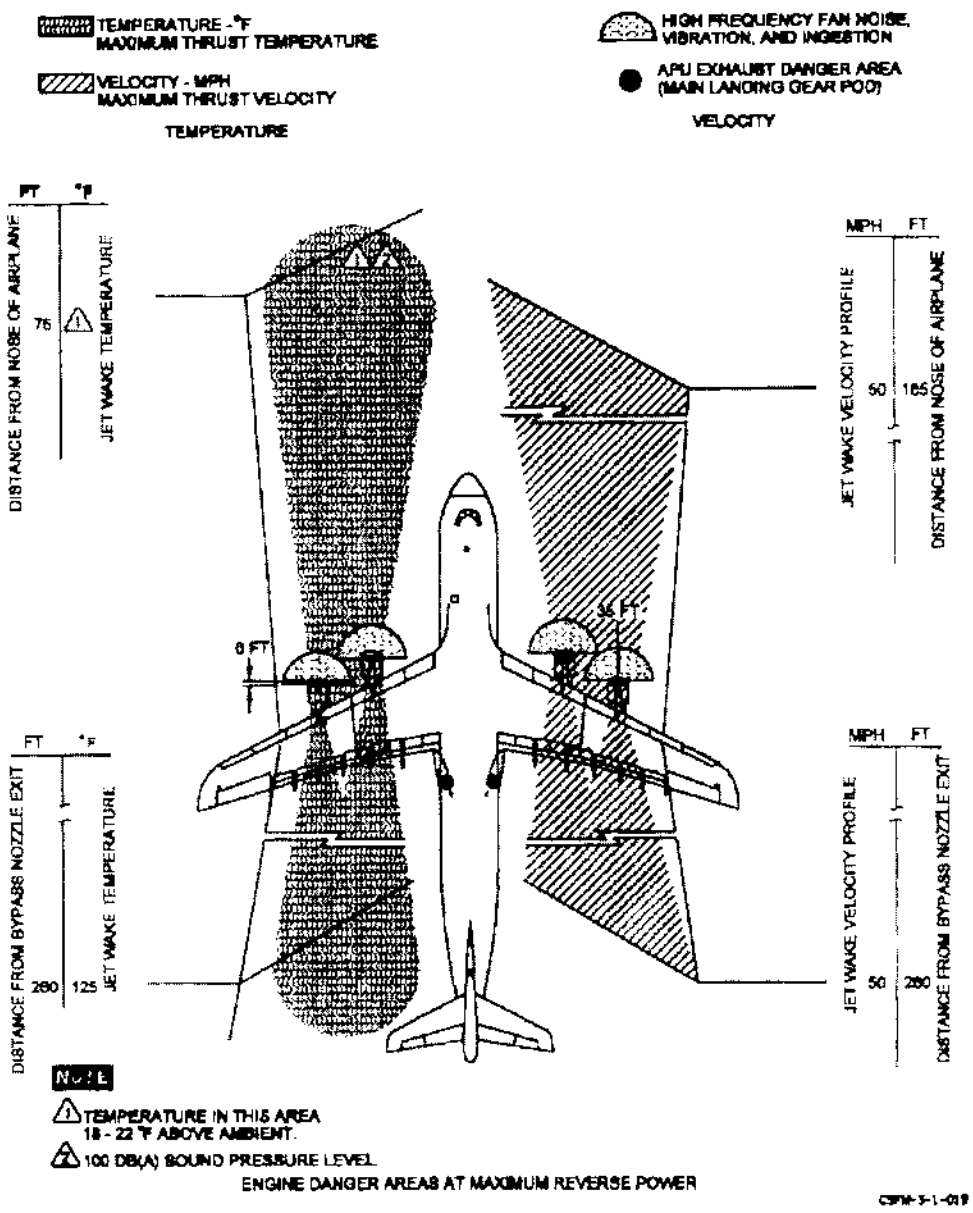


Figure 3-20.

E3.2 TO 1C-5A-6WC-1

E3.2.1 Thruflight Inspection Cards; 2-001 through 2-017

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-001	AIRCRAFT				TO 1C-5A-6WC-1	

MSN NO	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB		INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	PHASE	CARD NO.
				THRUFLIGHT		OFF			2-001

INTRODUCTION

1. THIS DECK OF THRUFLIGHT INSPECTION WORK CARDS PROVIDES THE MANDATORY THRUFLIGHT INSPECTION REQUIREMENTS FOR THE C-5 AIRPLANE. THESE WORK CARDS, PREPARED IN CHECKLIST FORM, WILL BE USED IN PERFORMING INSPECTIONS TO ENSURE THAT NO ITEM IS OVERLOOKED. TO AFFORD EFFICIENT MAINTENANCE PLANNING AND ASSIGNMENT OF WORK, THESE INSPECTION REQUIREMENTS ARE ARRANGED BY WORK ZONES, AND SEPARATE WORK CARDS ARE USED FOR THOSE REQUIREMENTS TO BE ACCOMPLISHED BY EACH TYPE MECHANIC OR SPECIALIST.

2. GENERAL INSTRUCTIONS FOR THE USE OF THESE -6 WORK CARDS, AND THE DESCRIPTION AND APPLICATION OF OTHER FORMS TO BE USED IN CONJUNCTION WITH THESE CARDS, ARE CONTAINED IN THE 00-00 SERIES TECHNICAL ORDERS.

3. THE THRUFLIGHT INSPECTION WILL BE ACCOMPLISHED BETWEEN FLIGHTS WHEN THE GROUND TIME IS MORE THAN FIVE HOURS. THE INSPECTION CONSISTS OF CHECKING THE AIRPLANE TO DETERMINE ITS SUITABILITY FOR ANOTHER FLIGHT BY PERFORMING VISUAL OBSERVATIONS AND SPECIFIED CHECKS OF CERTAIN COMPONENTS, AREAS, AND SYSTEMS THAT ARE SUBJECT TO DAMAGE BY OUTSIDE FORCES (SUCH AS GROUND EQUIPMENT, MAINTENANCE CREWS, ETC.). THE THRUFLIGHT INSPECTION ALSO COVERS ITEMS THAT REQUIRE SERVICING OR VERIFICATION (SUCH AS FUEL, OXYGEN, HYDRAULIC SYSTEMS, ETC.).

4. THESE THRUFLIGHT INSPECTION REQUIREMENTS ARE APPLICABLE TO ALL CLASSES OF OPERATION, UNLESS OTHERWISE INDICATED BY A SPECIAL NOTE RELATED TO THE REQUIREMENT.

5. THIS THRUFLIGHT INTRODUCTION SUPPLEMENTS THE PREFLIGHT INTRODUCTION CARDS 1-02, 1-03 AND 1-04.

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-001	AIRCRAFT				TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-002	AIRCRAFT				TO 1C-5A-6WC-1	

MSN NO	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB		INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	PHASE	CARD NO.
				THRUFLIGHT		OFF			2-002

WARNING

WHEN PERFORMING INSPECTIONS IN THE RELIEF CREW COMPARTMENT OR AFT TROOP COMPARTMENT, IF EMERGENCY ESCAPE/SERVICE DOOR NO. 5 OR NO. 6 IS OPEN, ENSURE THAT SERVICE DOOR RESTRAINT GATES HAVE BEEN INSTALLED IN ACCORDANCE WITH INSTRUCTIONS IN TO 1C-5A-2-2, SECTION III. IF THE RESTRAINT GATE CANNOT BE INSTALLED FOR ANY REASON, ENSURE THAT A WORK STAND HAS BEEN PLACED OUTSIDE AND LEVEL WITH THE OPEN DOOR. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

ANY TIME THE FLOOR HATCH IN THE RELIEF CREW COMPARTMENT IS OPENED OR REMOVED, A LOCALLY MANUFACTURED AND APPROVED BARRIER MUST BE INSTALLED OR A GUARD MUST BE STATIONED AT THE OPENING UNTIL THE HATCH IS REPLACED. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-002	AIRCRAFT				TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-002	AIRCRAFT				TO 1C-5A-6WC-1	

MAIN WORK AREA	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER OFF	SERVICE	FIGURE	CARD NO. 2-002

WARNING

WHEN PERFORMING INSPECTIONS IN THE RELIEF CREW COMPARTMENT OR AFT TROOP COMPARTMENT, IF EMERGENCY ESCAPE/SERVICE DOOR NO. 5 OR NO. 6 IS OPEN, ENSURE THAT SERVICE DOOR RESTRAINT GATES HAVE BEEN INSTALLED IN ACCORDANCE WITH INSTRUCTIONS IN TO 1C-5A-3-2, SECTION III. IF THE RESTRAINT GATE CANNOT BE INSTALLED FOR ANY REASON, ENSURE THAT A WORK STAND HAS BEEN PLACED OUTSIDE AND LEVEL WITH THE OPEN DOOR. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

ANY TIME THE FLOOR HATCH IN THE RELIEF CREW COMPARTMENT IS OPENED OR REMOVED, A LOCALLY MANUFACTURED AND APPROVED BARRIER MUST BE INSTALLED OR A GUARD MUST BE STATIONED AT THE OPENING UNTIL THE HATCH IS REPLACED. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY TO PERSONNEL.

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-002	AIRCRAFT				TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-004	AIRCRAFT	APG		30	TO 1C-5A-6WC-1	

MAIN WORK AREA	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER OFF	SERVICE	FIGURE	CARD NO. 2-004

PREPARATION

1 WZ * WHEEL CHOCKS INSTALLED

* LG * NOSE LANDING GEAR CONTROLLER PIN INSTALLED

1 * PORTABLE FIRE EXTINGUISHERS PROPERLY POSITIONED

NOTE

CHECK ENGINE OIL WITHIN 15 MINUTES AFTER SHUTDOWN OR PLAN TO RUN ENGINE FIVE MINUTES THEN CHECK OIL LEVEL.

* 4 ALL ENGINE AREA OIL CAPS ARE IN PROPER SERVICING AND SECURE (FILLER CAPS FOR SAFETY)

* 5 AVIATION FUEL QUANTITY IS AS REQUIRED FOR MISSION

2 A 6 IF ELECTRICAL POWER IS REQUIRED APPLY PER TO 1C-5A-2

* N 7 AFTO FORM 781 SERIES REVIEWED FOR AIRCRAFT STATUS AND DISCREPANCIES

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-004	AIRCRAFT	APG		30	TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-006	FUS INT	APG		:48	TO 1C-5A-6WC-1	

MAN MIN	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO.
						OFF			2-006

MAN MIN	WORK AREA	SYS	SUB	
				1. AVIONICS/CREW REST COMPARTMENT - INTERNAL
15	8H	--	BA0	A. OBSERVE - AVIONICS AND ELECTRICAL EQUIPMENT, FURNISHINGS, FLOORS, DOORS, AND EMERGENCY EQUIPMENT
				2. RELIEF CREW/COURIER COMPARTMENT - INTERNAL
15	8F	12	BA0	A. OBSERVE - FURNISHINGS, FLOORS, DOORS, AND EMERGENCY EQUIPMENT.
				3. FLIGHT DECK COMPARTMENT - INTERNAL
15	8L	--	BA0	A. OBSERVE - INSTRUMENTS, FURNISHINGS, WINDSHIELDS, CONTROLS, FLOOR, LADDER AND EMERGENCY EQUIPMENT.
2	8L	49	A--	B. ENGINE AND APU FIRE HANDLES FOR FREEDOM OF MOVEMENT (138) PRIOR TO FLIGHT WHEN TEMPERATURE IS BELOW ZERO DEGREE C.
1	8L	49	BCD	C. FE1301 CARGO VOLUME SELECTOR SWITCH SET FOR PROPER VOLUME (138).

CARD NO.	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-006	FUS INT	APG		:48	TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-007	NLG/FWD FUS	APG		1:00	TO 1C-5A-6WC-1	

MAN MIN	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO.
						OFF			2-007

MAN MIN	WORK AREA	SYS	SUB	
				1. NOSE LANDING GEAR ASSEMBLY
[illegible]	5A	13	BAC	A. OBSERVE - SHOCK STRUT, BALLSCREWS, STEERING ACTUATORS, GEARBOXES, WHEELS, TIRES, PLUMBING AND WIRING.
				NOTE IF NLG TIRES ARE HOT TO TOUCH, NO PRESSURE REDUCTION IS NECESSARY UNTIL TIME PERMITS TIRES TO REACH AMBIENT TEMPERATURE.
1	5A	13	[illegible]	B. NLG TIRES FOR WEAR (12), CUTS (16), PUNCTURES (17), AND PROPER INFLATION (32). REFERENCE TO 1C-5A-2-1, SECTION [illegible] TO [illegible].
				2. NOSE LANDING GEAR WHEEL WELL - INTERNAL
[illegible]	5B	13	[illegible]	A. OBSERVE - DOOR STRUCTURE, DOOR-MOUNTED HYDRAULIC AND MECHANICAL COMPONENTS, GEAR AND DOOR SUPPORT STRUCTURE, GEAR KNEELING AND DOOR RETRACTION MECHANISMS, EXPOSED FUSELAGE STRUCTURE, PLUMBING AND WIRING.
				3. VISOR - EXTERNAL
[illegible]	6A	11	[illegible]	A. OBSERVE - [illegible] ACCESS DOOR, ATTACHMENTS, AND VISOR SKIN.
				4. [illegible] FORWARD LOWER AND MID FUSELAGE (VISOR DOOR TO FS994) - EXTERNAL
[illegible]	MZ	11	[illegible]	A. OBSERVE - [illegible] SKIN, DOORS AND LATCHES, VENTS, DRAINS, PROBES, AND ANTENNAS.
2	[illegible]	11	[illegible]	B. FORWARD [illegible] HATCH FOR DAMAGE (76) AND INSURE DOOR IS PROPERLY CLOSED AND LATCHED [illegible].
1	5D	12	[illegible]	C. ANGLE OF ATTACK VANES FOR ICE (30) WHEN OPERATING IN ICING ENVIRONMENT.
				5. [illegible] CENTER LOWER AND MID FUSELAGE (FS994 TO FS[illegible]) - EXTERNAL
[illegible]	MZ	11	[illegible]	A. OBSERVE - IN ZONES [illegible] AND [illegible], SKINS, DOORS AND LATCHES, VENTS, DRAINS, INLETS, OUTLETS, MLG POD AND ANTENNAS.
	[illegible]	11	[illegible]	B. [illegible] HATCH FOR DAMAGE (76) AND INSURE DOOR IS PROPERLY CLOSED AND LATCHED [illegible].

CARD NO.	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-007	NLG/FWD FUS	APG		1:00	TO 1C-5A-6WC-1	

CARD NO	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-008	RH AFT MLG	APG		.40	TO 1C-5A-6WC-1	

	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO
THRUFLIGHT		OFF			2-008

MAN MIN	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	TASK
				1. RH AFT MLG ASSEMBLY
	[illegible]	13	AAC	A. OBSERVE: SHOCK STRUT, CROSSHEAD, KNEELING AND ROTATION MECHANISMS, BOGIE ASSEMBLY, WHEELS, TIRES, BRAKES AND ALL GEAR MOUNTED ACTUATORS, PLUMBING AND WIRING.
	[illegible]	13	AAK	B. BOGIE PITCH STOP FOR DAMAGE ([illegible]) AND SECURITY ([illegible]).
	[illegible]	13	ABA	C. BOGIE PITCH POSITIONER ACTUATOR FOR PROPER PRESSURE (525). REFERENCE TO TO 1C-5A-2-[illegible] SECTION [illegible].
[illegible]	[illegible]	13	ABB	D. BOGIE PITCH POSITIONER MASTER CYLINDER FOR PROPER SERVICING (302). REFERENCE TO TO 1C-5A-2-[illegible] SECTION [illegible].
				NOTE IF MLG TIRES ARE HOT TO TOUCH, NO PRESSURE REDUCTION IS NECESSARY UNTIL TIME PERMITS TIRES TO REACH AMBIENT TEMPERATURE.
[illegible]	[illegible]	13	AD[illegible]	E. MLG TIRES FOR WEAR ([illegible]), CUTS ([illegible]), PUNCTURES ([illegible]) AND PROPER INFLATION ([illegible]). REFERENCE TO TO 1C-5A-2-[illegible] SECTION [illegible] AND TO 4T-1-3.
				2. RH AFT MLG WHEEL WELL - INTERNAL
[illegible]	[illegible]	13	AA[illegible]	A. OBSERVE: DOOR STRUCTURE, DOOR MOUNTED HYDRAULIC AND MECHANICAL COMPONENTS, MLG AND DOOR SUPPORT AND GUIDE STRUCTURE, MLG AND DOOR RETRACTION MECHANISMS, EXPOSED FUSELAGE STRUCTURE, PLUMBING AND WIRING.
				3. RH AFT MLG POD APU COMPARTMENT - INTERNAL
[illegible]	[illegible]	[illegible]	A[illegible]	A. CHECK APU FOR PROPER SERVICING (302), MIL-L-7808, AND EVIDENCE OF LEAKAGE ([illegible]). REFERENCE TO TO 1C-5A-2-4 SECTION [illegible].

CARD NO	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-008	RH AFT MLG	APG		.40	TO 1C-5A-6WC-1	

CARD NO	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-009	RH MLG/WING	APG		48	TO 1C-5A-6WC-1	

	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO
THRUFLIGHT		OFF			2-009

MAN MIN	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	TASK
				1. RH FORWARD MLG ASSEMBLY
[illegible]	5E	13	AAC	A. OBSERVE: SHOCK STRUT, CROSSHEAD, KNEELING AND ROTATION MECHANISMS, BOGIE ASSEMBLY, WHEELS, TIRES, BRAKES, AND ALL GEAR MOUNTED ACTUATORS, PLUMBING AND WIRING.
[illegible]	5E	13	AAK	B. BOGIE PITCH STOP FOR DAMAGE ([illegible]) AND SECURITY ([illegible]).
[illegible]	5E	13	ABA	C. BOGIE PITCH POSITIONER ACTUATOR FOR PROPER PRESSURE (525). REFERENCE TO TO 1C-5A-2-[illegible] SECTION [illegible].
[illegible]	[illegible]	13	ABB	D. BOGIE PITCH POSITIONER MASTER CYLINDER FOR PROPER SERVICING (302). REFERENCE TO TO 1C-5A-2-[illegible] SECTION [illegible].
				NOTE IF MLG TIRES ARE HOT TO TOUCH, NO PRESSURE REDUCTION IS NECESSARY UNTIL TIME PERMITS TIRES TO REACH AMBIENT TEMPERATURE.
[illegible]	[illegible]	11	[illegible]	E. MLG TIRES FOR WEAR ([illegible]), CUTS ([illegible]), PUNCTURES ([illegible]) AND PROPER INFLATION ([illegible]). REFERENCE TO TO 1C-5A-2-[illegible] SECTION [illegible] AND TO 4T-1-3.
				2. RH FWD MLG WHEEL WELL - INTERNAL
[illegible]	[illegible]	13	A[illegible]	A. OBSERVE: DOOR STRUCTURE, DOOR MOUNTED HYDRAULIC AND MECHANICAL COMPONENTS, MLG AND DOOR SUPPORT AND GUIDE STRUCTURE, MLG AND DOOR RETRACTION MECHANISMS, EXPOSED FUSELAGE STRUCTURE, PLUMBING AND WIRING.
				3. RH WING INBOARD AND OUTBOARD LOWER SURFACE - EXTERNAL
[illegible]	[illegible]	[illegible]	[illegible]	A. OBSERVE: [illegible] AND ATTACHMENTS, LEADING EDGE, [illegible], AILERON, [illegible] VENTS AND [illegible].

CARD NO	WORK AREA(S)	TYPE MECH REQ	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-009	RH MLG/WING	APG		48	TO 1C-5A-6WC-1	

CARD NO	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-010	NO. 3 ENG.	APG		:11	TO 1C-5A-6WC-1	

MAN MIN	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FRAME	CARD NO
						OFF			2-010

1. NO. 3 ENGINE FORWARD AND AFT NACELLE AND PYLON - EXTERNAL

10	MZ	11	209	A. OBSERVE - IN ZONES 3A, 3D, AND 3F, SIGN, DOORS AND ATTACHMENTS, LEADING EDGES, VENTS, INLETS, OUTLETS AND DRAINS.
1	3F	85	EAE	B. INLET COWL FOR ICE (230) OR WATER (880) WHEN FREEZING CONDITION EXISTS.

CARD NO	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-010	NO. 3 ENG.	APG		:11	TO 1C-5A-6WC-1	

CARD NO	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-011	NO. 4 ENG	APG		:11	TO 1C-5A-6WC-1	

MAN MIN	WORK AREA	WORK UNIT CODE SYS	WORK UNIT CODE SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FRAME	CARD NO
						OFF			2-011

1. NO. 4 ENGINE FORWARD AND AFT NACELLE AND PYLON - EXTERNAL

10	MZ	11	209	A. OBSERVE - IN ZONES 4A, 4D, AND 4F, FAN DOORS AND ATTACHMENTS, LEADING EDGES, VENTS, INLETS, OUTLETS AND DRAINS.
1	4F	85	EAE	B. INLET COWL FOR ICE (230) OR WATER (880) WHEN FREEZING CONDITION EXISTS.

CARD NO	WORK AREA(S)	TYPE MECH INSP	MECH NO	CARD TIME	PUBLICATION NUMBER	CHANGE NO
2-011	NO. 4 ENG	APG		:11	TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH INSP	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-012	AFT FUS/WG	APG		:30	TO 1C-5A-6WC-1	

BASIC SEQ	WORK AREA	WORK UNIT CODE SYS	SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER OFF	SERVICE	FINISH	CARD NO. 2-012
				1. RH AFT MID AND UPPER FUSELAGE (FS2101 TO TIP OF TAIL CONE) - EXTERNAL					
5	6D	11	000	A. OBSERVE - SKIN, DOORS AND ATTACHMENT, VENTS AND DRAINS.					
				2. EMPENNAGE - EXTERNAL					
10	MZ	11	000	A. OBSERVE - IN ZONES 9A, 9G, AND 9N, SKINS, DOORS AND ATTACHMENTS, LEADING EDGES OF THE VERTICAL STABILIZER AND RUDDER (BOTH SIDES), THE LOWER SURFACES OF THE HORIZONTAL STABILIZER AND ELEVATORS (LH AND RH) AND THE EMPENNAGE BULLET.					
				3. LH AFT MID AND UPPER FUSELAGE (FS2101 TO TIP OF TAIL CONE) - EXTERNAL					
5	6D	11	000	A. OBSERVE - SKINS, DOORS AND ATTACHMENTS, VENTS, DRAINS AND TAIL CONE.					
				4. LH WING INBOARD AND OUTBOARD LOWER SURFACE - EXTERNAL					
10	MZ	11	000	A. OBSERVE - IN ZONES 7B AND 7J, SKINS, DOORS AND ATTACHMENTS, LEADING EDGE, FLAPS, AILERON, TIP, VENTS AND DRAINS.					

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH INSP	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-012	AFT FUS/WG	APG		:30	TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH INSP	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-013	NO. 1 ENG	APG		:08	TO 1C-5A-6WC-1	

BASIC SEQ	WORK AREA	WORK UNIT CODE SYS	SUB	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER OFF	SERVICE	FINISH
				1. NO 1 ENGINE FORWARD AND AFT NACELLE AND PYLON - EXTERNAL				
5	MZ	11	000	A. OBSERVE - IN ZONES 1A, 1D, AND 1F, SKIN, DOORS AND ATTACHMENTS, LEADING EDGES, VENTS, INLETS, OUTLETS AND DRAINS.				
1	1F	23	EAE	B. INLET COWL FOR ICE (230) OR WATER (WE) WHEN FREEZING CONDITION EXISTS.				

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH INSP	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-013	NO. 1 ENG	APG		:08	TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH ID	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-014	NO. 2 ENG	APG		:06	TO 1C-6A-6WC-1	

MAN HRS	WORK AREA	WORK UNIT CODE WC	WUC	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	PNEUM	CARD NO.
						OFF			2-014
5	MZ	11	009	1. NO. 2 ENGINE FORWARD AND AFT NACELLE AND PYLON - EXTERNAL A. OBSERVE - IN ZONES 5A, 5D, AND 5F, SKIN, DOORS AND ATTACHMENTS, LEADING EDGES, VENTS, INLETS, OUTLETS AND DRAINS.					
1	5F	23	EAE	B. INLET COWL FOR ICE (238) OR WATER (988) WHEN FREEZING CONDITION EXISTS.					

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH ID	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-014	NO. 2 ENG	APG		:06	TO 1C-6A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH ID	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-015	LH FWD MLG	APG		:38	TO 1C-6A-6WC-1	

MAN HRS	WORK AREA	WORK UNIT CODE WC	WUC	THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	PNEUM	CARD NO.
						OFF			2-015
20	5C	13	AAG	1. LH FORWARD MLG ASSEMBLY A. OBSERVE - SHOCK STRUT, CROSSHEAD, KNEELING AND ROTATION MECHANISMS, BOGIE ASSEMBLY, WHEELS, TIRES, BRAKES, AND ALL GEAR-MOUNTED ACTUATORS, PLUMBING AND WIRING.					
1	5C	13	ABL	B. BOGIE PITCH STOP FOR DAMAGE (799) AND SECURITY (730).					
1	5C	13	ABA	C. BOGIE PITCH POSITIONER ACTUATOR FOR PROPER PRESSURE (885) (REFERENCE TO 1C-6A-2-1, SECTION III).					
1	5C	13	ABB	D. BOGIE PITCH POSITIONER MASTER CYLINDER FOR PROPER SERVICING (608) (REFERENCE TO 1C-6A-2-10, SECTION II).					
				NOTE IF MLG TIRES ARE HOT TO TOUCH, NO PRESSURE REDUCTION IS NECESSARY UNTIL TIME PERMITS TIRES TO REACH AMBIENT TEMPERATURE.					
5	5C	13	AAB	E. MLG TIRES FOR WEAR (888), CUTS (116), PUNCTURES (111) AND PROPER INFLATION (838) (REFERENCE TO 1C-6A-2-1, SECTION III AND TO 4T-1-3).					
				2. LH FORWARD MLG WHEEL WELL					
10	5D	13	AAB	A. OBSERVE - DOOR STRUCTURE, DOOR-MOUNTED HYDRAULIC AND MECHANICAL COMPONENTS, MLG AND DOOR SUPPORT AND GUIDE STRUCTURE, MLG AND DOOR RETRACTION MECHANISMS, EXPOSED FUSELAGE STRUCTURE, PLUMBING AND WIRING.					

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH ID	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-015	LH FWD MLG	APG		:38	TO 1C-6A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH HR	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-016	LH AFT MLG	APG		:40	TO 1C-5A-6WC-1	

WORK UNIT CODE			THRUFLIGHT	INSPECTOR REQUIREMENTS	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO.
SYS	SUB				OFF			2-016
		1.	LH AFT MLG ASSEMBLY					
13	AAA	A.	OBSERVE - SHOCK STRUT, CROSSHEAD, KNEELING AND ROTATION MECHANISMS, BOGIE ASSEMBLY, WHEELS, TIRES, BRAKES, AND ALL GEAR-MOUNTED ACTUATORS, PLUMBING AND WIRING.					
13	ABL	B.	BOGIE PITCH STOP FOR DAMAGE (709) AND SECURITY (730).					
13	ABA	C.	BOGIE PITCH POSITIONER ACTUATOR FOR PROPER PRESSURE (525) (REFERENCE TO 1C-5A-2-1, SECTION III).					
13	ABB	D.	BOGIE PITCH POSITIONER MASTER CYLINDER FOR PROPER SERVICING (002) (REFERENCE TO 1C-5A-2-10, SECTION III).					
			NOTE					
			IF MLG TIRES ARE HOT TO TOUCH, NO PRESSURE REDUCTION IS NECESSARY UNTIL TIME PERMITS TIRES TO REACH AMBIENT TEMPERATURE.					
13	AAD	E.	MLG TIRES FOR WEAR (020), CUTS (116), PUNCTURES (111) AND PROPER INFLATION (525) (REFERENCE TO 1C-5A-2-1, SECTION III AND TO 4T-1-3).					
		2.	LH AFT MLG WHEEL WELL.					
13	AAB	A.	OBSERVE - DOOR STRUCTURE, DOOR-MOUNTED HYDRAULIC AND MECHANICAL COMPONENTS, MLG AND DOOR SUPPORT AND GUIDE STRUCTURE, MLG AND DOOR RETRACTION MECHANISMS, EXPOSED FUSELAGE STRUCTURE, PLUMBING AND WIRING.					
		3.	LH AFT MLG POD (APU COMPARTMENT) - INTERNAL.					
[illegible]	AAB	A.	LEFT APU FOR PROPER SERVICING (002) (MIL-L-7808) AND EVIDENCE OF LEAKAGE (077) (REFERENCE TO 1C-5A-9-4, SECTION XI).					

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH HR	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-016	LH AFT MLG	APG		:40	TO 1C-5A-6WC-1	

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH HR	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-017	LH FUS EXT	APG		:11	TO 1C-5A-6WC-1	

WORK UNIT CODE			THRUFLIGHT	INSPECTION REQUIREMENTS	ELECTRICAL POWER	SERVICE	FIGURE	CARD NO.
SYS	SUB				OFF			2-017
		1.	LH CENTER LOWER AND MID FUSELAGE (FS664 TO FS910) - EXTERNAL.					
11	000	A.	OBSERVE - IN ZONES 6C AND 6D, SKIN, DOORS, LATCHES, VENTS, DRAINS, INLETS, OUTLETS, MLG POD AND ANTENNAS.					
		2.	LH FORWARD LOWER AND MID FUSELAGE (MINOR DOOR TO FS664) - EXTERNAL.					
11	000	A.	OBSERVE - IN ZONES 6C AND 6D, SKIN, DOORS, AND LATCHES, DRAINS, PROBES AND ANTENNAS.					
02	0AG	B.	ANGLE-OF-ATTACK VANES FOR ICE (030) WHEN OPERATING IN ICING ENVIRONMENT.					

CARD NO.	WORK AREA(S)	TYPE MECH INSP	MECH HR	CARD TIME	PUBLICATION NUMBER	CHANGE NO.
2-017	LH FUS EXT	APG		:11	TO 1C-5A-6WC-1	