STATEMENT OF WORK

P-3C SERVICE LIFE ASSESSMENT PROGRAM

PHASES II AND III

Program Executive Office
Air ASW, Assault, and Special Mission Programs
PMA-290

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Naval Air Systems Command
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P-3C SERVICE LIFE ASSESSMENT PROGRAM

PHASES II AND III

1. SCOPE

1.1 BACKGROUND

The U.S. Navy (USN) and its Foreign Military Sale (FMS) partners (Canadian Forces (CF), Royal Australian Air Force (RAAF), Royal Netherlands Navy (RNLN)) are conducting a series of programs to assess and extend the P-3C operational service life. These programs will determine structural modifications, replacements and redesigns required to extend the P-3C operational service life to meet inventory requirements through at least the year 2015. Both material condition and fatigue life are primary considerations related to achieving this goal. While the P-3C Sustained Readiness Program (SRP) corrects the material condition deficiencies for the USN fleet, the Service Life Assessment Program (SLAP) is required to assess the fatigue life. The Service Life Extension Program (SLEP) is then implemented to extend the fatigue life. The primary objectives of SLAP are to evaluate the fatigue life and damage tolerance characteristics of the P-3C airframe, and to identify structural modifications required to attain the 2015 service life goal. SLAP will be accomplished in three phases: I) Pre-Testing Analysis; II) Full-Scale Fatigue Test; and III) Post-Test Analysis. The P-3C SLAP Phase I was performed by Lockheed Martin Aeronautics Systems (Contract No. N00019-95-G-0208, Order 0005) to develop preliminary repeated loads, baseline usage and criteria, select critical areas, perform finite element and fatigue analysis, and define a preliminary list of potential SLEP kit candidates.

1.2 SYNOPSIS OF REQUIRED WORK

This Statement of Work (SOW) addresses Phases II and III of the P-3C SLAP. Phase II effort includes the design of structural parts/assemblies to be included in SLEP modification kits, development of a test spectra representative of projected P-3C USN fleet usage, testing of a P-3C SRP aircraft containing the SLEP modification kits to the equivalent of two times the desired service life as a minimum. Phase III entails a post-test destructive teardown and inspection of the test aircraft. The following is a summary of major tasks in this SOW:

PHASE II

a) Update the fleet usage, operation loads system and P-3C finite element model.

b) Develop fatigue usage and test spectra.

c) Perform static, fatigue and damage tolerance analyses.

d) Design, fabricate, prototype and install production representative SLEP kits.

e) Receive and prepare test aircraft.

f) Design, fabricate and assemble test fixtures including loading jigs.

g) Design and either manufacture or obtain test and data acquisition system.

h) Design and install instrumentation.

i) Perform baseline nondestructive inspections.

j) Perform full-scale fatigue and damage tolerance testing.

k) Perform visual, instrumental and in-situ nondestructive inspections of fatigue critical locations at periodic intervals during the fatigue test using state-of-the-art detecting and monitoring technology.

l) Design and install repairs and modifications to the test articles and test jigs as required.

PHASE III

a) Perform complete post-test destructive teardown inspections, and conduct metallurgical and fractographic failure analyses.

b) Correlate test data and verify analysis methodology.

c) Validate and verify the combined SRP and SLEP (SRP/SLEP) kits for production; generate drawing and tooling data packages. Provide source data for provisioning, publication, procedures and support equipment list (if required).

d) Develop a new fatigue life tracking algorithm. Re-baseline Fatigue Life Expended (FLE) for the entire P-3C fleet aircraft using the test results.

2. APPLICABLE DOCUMENTS

The Department of the Navy is firmly committed to minimizing the use of military specifications and standards. Contractors are encouraged to submit alternatives to military standards and specifications wherever possible. The alternatives will be evaluated to ensure they meet Government minimum requirements. At the time of contract award, if the contractor's proposed alternative standards or specifications are determined to be acceptable by Naval Air Systems Command (NAVAIR), the alternative documents will be accepted as a part of the offeror's proposal. A list of relevant documents provided in Appendix A is for information purpose only; however, the contractor may find them useful in performing the tasks in this SOW.

2.1 SYSTEM SPECIFICATIONS

SD536-2-18 Rev 1, "Detail Specification for Model P-3C Airplane Anti-Submarine Warfare (ASW) Four Engine," Department of the Navy, Military Specification, dated 30 Jul 93.

2.2 OTHER PUBLICATIONS

LG98ER0002, "Phase I - P-3C Fatigue Test Analysis, P-3C Final Operational Loads and Criteria Report," Rev. A, Lockheed Martin Aeronautical Systems, dated Sept. 1998.

LG96ER0177, "P-3C Fatigue Test Program - Phase I Fatigue Critical Area Selection," Rev. A, Lockheed Martin Aeronautical Systems, dated December 1997.

LG98ER0063, "P-3C Finite Element Model Report," Lockheed Martin Aeronautical Systems, dated March 1998.

LG98ER0125, "Phase I - P-3C Fatigue Test Analysis, Fatigue Analysis - Final Report," Lockheed Martin Aeronautical Systems, dated June 1998.

LG98ER0067, "P-3C SLEP Kit Definition Report," Rev. A, Lockheed Martin Aeronautical Systems, dated June 1998.

2.3 SOURCE OF DOCUMENTS

Copies of listed federal and military standards, specifications, handbooks and those industry association documents adopted for use by the Department of Defense and listed in DODISS, Defense Standardization Manual 4120.3-M, should be obtained from the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Ave, Philadelphia, PA 19111-5094.

3. REQUIREMENTS

The following paragraphs describe the work tasks and requirements for conducting a Full-Scale Fatigue Test (FSFT) program.

3.1 GENERAL

The contractor shall design the SLEP kit structures to allow the aircraft to withstand expected repeated loads environment without sustaining any structural defects or failures, or permanent deformation, causing interference with its mechanical operation, or affecting its aerodynamic characteristic. The SLEP kit design shall not require repair, inspection, or replacement of components during the planned service life of the airplane as specified in paragraph 3.1.1 due to fatigue damage. The aforementioned requirement applies to the planned service life of the airplane subjected to the repeated loads environment resulting from ground and flight operations, including loads and load combinations associated with maneuvers, field landings, gusts, buffeting, dynamic response, pressurization (fuel and cabin), aeroacoustics, vibration, store installation and release, taxiing, operation of devices, and exposure to a chemical or thermal environment as applicable.

3.1.1 Service Life

The planned service life of the P-3C aircraft shall not be less than the following:

Flight Hours:	30,000
No. of Flights:	8,802
Total Landings:	47,154
Intermediate Full-Stop Landings:	8,599
Final Full-Stop Landings:	8,802
Touch & Go Landings:	29,753

The above figures represent the projected NAVAIR figures for the 85th percentile aircraft (i.e., 85% of aircraft captured) corresponding to 30,000 total flight hours (LG98ER0002). All planning and/or preparation for the FSFT shall be accomplished based on the above service life goals, as a minimum.

3.1.1.1 Deleted

3.1.2 Test Objectives

The primary test objective is to demonstrate that the P-3C airframe shall reach 100% of its required fatigue life as specified in paragraph 3.1.1 above with a minimum scatter factor of two (2). The second test objective is to gather information on damage tolerance characteristics of the P-3C airframe and other crack growth data required for determination of recurring inspection intervals and inspection techniques for in-field service support. Additional testing to determine Beyond Economical Repair (BER) limit for the P-3C airframe may be deemed necessary by NAVAIR and to be conducted up to 100,000 FTSH (see also SOW paragraph 3.13).

3.1.2.1 Test Configuration

The total fatigue life capability of the P-3C aircraft fleet shall be demonstrated using a P-3C SRP production fleet aircraft (Bureau Number 156508). The contractor shall install the SLEP kit on the test article, EXCEPT for the Right Hand Side (RHS) outer wing (outboard of and including BL65). The RHS outer wing structures shall be of the basic P-3C configuration (without SLEP kits installed). The test article(s) shall consist of, but not limited to, fuselage, wing, empennage, the Nose Landing Gear (NLG) and Main Landing Gears (MLG) including back-up structures, engine nacelles and control surfaces. The contractor shall use a minimum of two (2) separate test articles to accomplish the full-scale fatigue testing for the P-3C aircraft - a) wing/fuselage test article and b) empennage test article. For the wing/fuselage test article, the contractor shall remove the P-3C SRP/SLEP empennage and replace with a "dummy" empennage, to be provided as Government Furnished Equipment (GFE). For the empennage test article, the contractor shall re-attach the P-3C SRP/SLEP empennage with a portion of the fuselage barrel (GFE) and test it in a separate fixture. The landing gear test may be conducted on either the wing/fuselage test article or in a separate test fixture with landing gear back-up structure.

3.1.2.2 Test Duration

The test duration, which includes all "aging" and testing cycles, shall be based on total accumulated fatigue damage from all loading sources rather than just from the Fatigue Test Spectrum Hours (FTSH) alone. The verification testing goal is to age each major structural component (i.e., wing, fuselage, horizontal and vertical stabilizer, landing gears and back-up structure) of the test articles to that component's fleet average fatigue damage accumulated at the time of planned SLEP kit installation, and then test the component to 100% of its calculated fatigue life with a scatter factor of two (2). Since each major component could have different critical locations that accrue fatigue damage at different rates (e.g., outer wing), the contractor shall ensure that the test duration/spectrum adequately tests the lowest calculated fatigue life location. In addition, analytical adjustment for this phenomenon shall be accomplished when: 1) determining test article fatigue damage accumulated, 2) determining test article aging required, and 3) determining total testing duration requirements including the additional FTSH required to demonstrate the unmodified structure's ability to meet the test objectives of paragraph 3.1.2.

The following EXAMPLE is a simplified general procedure for determining test duration as a function of flight hours ONLY (see Figure 3-1):

> Assume the test article will have accumulated 12,000 flight hours or less at the time of its entry into the test program. Subtract the number of actual in-service hours previously accrued on the test article from 15,000 hours (the estimated fleet average flight hours accrued at the time of SLEP induction, based on trend extrapolation from P-3 Structural Appraisal of Fatigue Effects (SAFE) data).
>
> Apply an equivalent number of FTSH to the test article, in order to "age" it to the 15,000 hour estimated fleet average at the time of SLEP induction. This "aging" time will not be subject to a scatter factor. Marker loads will be applied to the test article to identify this point in the test.
>
> When the test article "age" has reached 15,000 hours, the SLEP kits shall be installed. Then apply 30,000 FTSH to the test article (15,000 flight hours times a scatter factor of two), in order to demonstrate a total fatigue life capability of 30,000 flight hours (15,000

pre-SLEP hours and 15,000 post-SLEP hours). The test time required for an example test article with 12,000 actual flight hours is shown in the following table:

	Hours
Average Fleet Hours at SLEP Induction	15,000
Test Article Actual Flight Hours	- 12,000
"Aging" Test Time Required (no Scatter Factor)	3,000
Additional Test Time Required (15,000 times Scatter Factor of Two)	+ 30,000
Additional Testing Hrs. to Demonstrate Unmodified Structure	3,000
Total FTSH Required	36,000

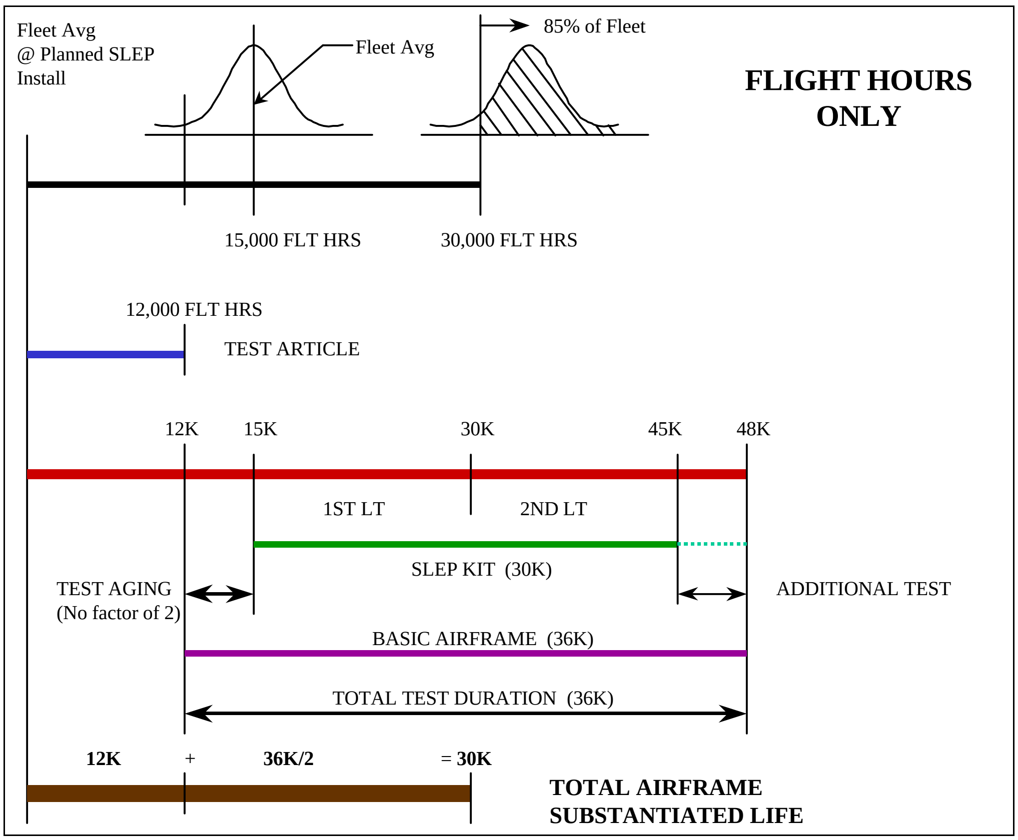

Figure 3-1

3.1.2.3 Fatigue Spectra

The airplane usage spectra for analysis and test shall include repeated loads from all types of ground and flight operations as specified in paragraph 3.1. The contractor shall design and test each airplane component to the proper repeated loadings in accordance with the requirements of this SOW. The contractor shall ensure that consideration be given to the effects of load sequence, load truncation and clipping, load induced residual stress, block size and other factors as appropriate to assure that the usage spectra for analysis and test shall yield the *most conservative* fatigue life for the purpose of SLEP kit service life substantiation as specified in paragraph 3.1.3 of this SOW. Ordering and frequency of loads within the usage spectra shall be random, consistent with flight-by-flight airplane operation, load exceedance and occurrence rates, and planned service life values as specified in paragraph 3.1.1.

3.1.3 SLEP Kit Service Life Substantiation

Compliance with paragraph 3.1 shall be demonstrated by the fatigue analysis and the full-scale fatigue tests utilizing *crack initiation* as the primary failure criterion. Specifically, the contractor shall design the SLEP kit to allow at least 85% of the USN P-3C fleet aircraft to withstand expected repeated loads environment without sustaining any structural defects (cracks, deformations, loss of modulus, etc.) or failures, within 4 times the service life based upon analysis and 2 times the service life based upon full-scale tests. If any part of the SLEP kit should fail to demonstrate compliance with the above requirements, the contractor shall redesign that defective part. The contractor shall demonstrate by analysis and test the redesigned part to be compliant. Repair of cracks on other parts other than the SLEP kit items shall be considered as Over and Above (O&A) works (see SOW paragraph 3.1.9). No recurring inspections shall be required for the SLEP kit within one test substantiated service lifetime of the airframe. For both fatigue analysis and tests, the use of fatigue life-enhancing mechanical processes (such as shot peening, roller burnishing, etc.), other than split sleeve cold working and interference fit, are prohibited in demonstrating compliance.

3.1.3.1 Fatigue

3.1.3.1.1 Fatigue Analysis

The contractor shall include all fatigue damage incurred on the P-3C primary structures due to flight control surfaces and their local attachments (i.e., applied and induced loads and cycles, etc.). For analysis purposes, the contractor shall use a sequence accountable, local strain methodology, with NAVAIR approval, as a primary tool to substantiate fatigue life. Idealization/assumption of the material stress-strain relationship to be elastic-plastic will NOT be acceptable for analysis (e.g., material properties internal to LOOPIN, SEAFAN). For approved interference fit and/or cold working enhancements, fatigue analysis shall indicate that the airplane will be free from structural defect for at least one (1) service life without the benefit of interference fit and/or cold working (including existing structures). The contractor shall use a rain-flow cycle counting method acceptable to NAVAIR. The contractor shall technically substantiate and quantify any residual local stress effects carried over between flights. The contractor also shall use Palmgren-Miner approach for comparison to ensure the effect of any residual local stress is neither excessive nor unrealistic/unconservative. The contractor shall investigate the impact of using different usage severity on the fatigue life predictions, especially on the center wing section.

3.1.3.1.2 Fatigue Testing

The contractor shall simulate the fatigue damage incurred due to all control surfaces and their local attachments on the test articles. Once successfully reaching the basic goal of two (2) times service life, testing may be continued at 10,000 FTSH increments until catastrophic failure (i.e., BER) occurs, as deemed appropriate by NAVAIR at a later date. At test conclusion, the test article shall be subjected to a complete destructive teardown inspection, including fractographic examination and metallurgical analysis, to identify and analyze all failure modes including fatigue cracks. With the EXCEPTION of the RHS wing structure, all repairs/redesigns made to the test article prior to two (2) times service life as well as repairs/redesigns for cracks or failures concluded to have been initiated prior to two (2) times service life shall be incorporated into the SLEP kit. The contractor shall demonstrate service life compliance by analysis and test for these repairs/redesigns. For the RHS wing structure, the contractor shall detect, record, monitor, and track any fatigue cracks (e.g., location, orientation, size and shape, crack growth history, etc.) which may have initiated and/or grown during the entire test duration. The contractor shall apply constant amplitude marker load cycles at 10,000 FTSH intervals as a minimum. The contractor shall determine the appropriate application and the amplitude of marker loads without influencing the test data.

3.1.3.2 Fail-safe

The basic P-3 aircraft was originally designed to withstand catastrophic failure or excessive structural deformation, which could adversely affect the flight characteristics of the airplane, after fatigue failure or partial failure of a single principal structural element. The contractor shall design the SLEP kit to possess the same capability, and shall not degrade and/or alter the basic airframe's intrinsic fail-safe characteristic as specified in SD-536-2-18 (paragraph 3.4.1). The contractor shall perform residual strength analysis to demonstrate fail-safe capability for the SLEP kit and its surrounding structures. ***(CDRL B003)***

3.1.3.3 Damage Tolerance

The design and construction of the SLEP kit, and the selection of materials to be used shall include provision for damage tolerance. Materials shall be chosen on the basis of adequate damage tolerance characteristics (i.e., fracture toughness, crack growth rate, etc.). Damage tolerance shall be in addition to, rather than in lieu of, provision for adequate structural fatigue characteristics, and shall serve as a means for preventing catastrophic structural failure or loss of control of the aircraft after a predefined limit of structural damage has occurred. For all SLEP kit primary or flight critical metallic structures, crack growth under sustained and repeated loads shall not occur at a rate such that initial flaws can reach critical size at limit loads in time periods as limited by aircraft inspection periods, accessibility or one (1) lifetime of expected service usage. For redundant structures, the contractor also shall consider the effects of multi-site damage.

3.1.3.3.1 Damage Tolerance Analysis

All areas of SLEP kit structural components established as primary or flight critical shall be analyzed using the methods of linear elastic fracture mechanics, as a minimum, to identify the character and dimension of defects which could grow to critical size in time periods as limited by aircraft inspection periods, accessibility or one required lifetime. The analysis shall take into account the effects of loading sequence, geometry (e.g., width, thickness), environment and crack growth retardation. The contractor also shall use strain energy release rate, G, and J-integral as well as crack-tip open displacement (COD) approaches, where appropriate. These analyses shall assume the presence of crack-like defects placed in the most unfavorable orientation with respect to the material properties and applied stress consistent with the aircraft loads environment, and shall predict the growth behavior when subjected to chemical, thermal, sustained and repeated-loads environment. For purposes of these analyses, the initial flaw size shall be 0.050 inches minimum in metals or the largest detectable crack length of at least 90% probability of detection (POD) with 95% confidence level for a given location and NDT/I technique, whichever is greater. At failure, the crack length shall not be less than the critical crack size of the existing part it replaces or 0.25 inches (surface length), whichever is greater. Critical flaw sizes shall be calculated using the appropriate critical fracture toughness values and threshold stress intensities determined on a valid statistical basis. The analysis shall identify plane strain, plane stress, or mixed mode conditions at the onset of rapid crack propagation, and shall include all crack growth rate and critical crack length data on which the analysis was based.

3.1.3.3.2 Damage Tolerance Testing

The contractor shall conduct coupon, component and/or full-scale testing to demonstrate compliance with the requirements of SOW paragraph 3.1.3.3. The contractor also shall gather crack growth data for analysis verification and inspection interval determination. For coupon testing, the contractor shall characterize fatigue crack growth rate behavior using standard industry procedure. Other crack growth rate behavior shall be characterized in a similar manner for such mechanisms as sustained load cracking, stress corrosion cracking, hydrogen embrittlement, liquid metal embrittlement, and creep. The contractor shall submit specimen configurations and test protocol for NAVAIR review and approval. For the full-scale test article(s), if no crack exists or is detected at the end of the fatigue/durability testing phase as determined by NAVAIR, the contractor shall embed flaw(s) to induce crack growth. The contractor shall recommend to NAVAIR the number of flaws, size, shape and orientation, etc., as well as the method(s) to insert flaw(s) in the structures. ***(CDRL AE01)***

3.1.4 Test Failure Reporting

Once any crack and/or test anomaly has been detected, the contractor shall notify NAVAIR and on-site Government representatives as soon as possible, but no later than within the next 24 hours for disposition. The contractor also shall generate P-3C FSFT Failure Notification Reports as required throughout the duration of the test ***(CDRL L001)***. Since expeditious communication is critically essential to minimize potential testing delay and cost impact, the contractor shall establish and maintain a SLAP/SLEP secured website with download capabilities, videoconference, electronic mail, digital video (MPEG-compatible format) and photographic (JPEG-compatible format) capability to ensure timely response between the contractor and the Government representatives on-site and at Patuxent River, MD. The resolution for digital photography shall be a minimum of 1.5 million pixels. (see also SOW paragraph 3.10.3)

3.1.5 Facility

In addition to full-scale fatigue and damage tolerance analysis and testing, this effort will require significant level of effort in the disassembly, teardown, repair, redesign and re-assembly of the P-3C aircraft and major airframe components (wing, empennage, fuselage). The contractor shall have full on-site engineering, manufacturing, production, modification, rework and testing capability as well as personnel with extensive expertise and experience to successfully perform all of the tasks in this SOW. The contractor also shall provide office space near the test facility for the NAVAIR on-site technical representative(s) for the entire program duration (4 years minimum after contract award (ACA)).

a) Runway. The contractor's test site shall have a paved and smooth runway with a minimum of 7,000 feet in length and 150 feet in width, so that the US Navy crew can land the P-3C aircraft safely.

b) Test facility. Due to the nature of the fatigue testing and the potential duration of the test program, the test facility shall be operated, directly controlled and/or owned by the prime contractor for a minimum of five (5) years after the contract award. The test facility shall be a permanent structure to protect the test articles from weather elements. The facility shall have at least one 5-ton overhead crane, and be large enough to contain the entire full-scale P-3C airframe including the test fixtures. The floor shall be reinforced concrete capable of reacting all applied mechanical loads. Electrical outputs, hydraulics and pneumatics pressure as well as flow rates shall be sufficient to apply to all loading actuators.

c) Bonded storeroom. Weapon replaceable assemblies (WRAs) and other equipment and items removed from the aircraft shall be identified, recorded and retained in environmentally controlled bonded storerooms, until final Government disposition or until the end of the SLAP program. The contractor also shall weigh and record all WRAs removed from the test aircraft.

d) Personnel. The following contractor personnel shall meet the minimum specific qualifications as stated below:

   i. Program Manager*: Shall have an equivalent of 15 years of program management experience with working knowledge of airframe fatigue and damage tolerance testing.

   ii. Test Director*: Shall have a minimum of 20 years of testing experience and as test director for at least one (1) full-scale airframe fatigue and damage tolerance test program. Testing experience with large transport-type aircraft is essential.

iii. Director of Engineering/Chief Engineer/Engineering Manager*: Shall have a minimum of 20 years as airframe stress analyst with at least one (1) full-scale airframe fatigue and damage tolerance testing experience. Full understanding and knowledge of NAVAIR policies and philosophy on fatigue and damage tolerance is essential. The position shall be responsible for all engineering management within this program.

iv. Senior Loads Specialist(s)*: Shall have at least 15 years of aircraft loads (flight and ground) and spectrum development experience.

v. Senior Tooling Designer(s): Shall have at least 10 years of experience specializing in flexible and modular production tooling concept design and development as well as modification of airframes.

vi. Senior Manufacturing Specialist(s): Shall have at least 10 years of experience specializing in rapid prototype, 3-D solid electronic mock-up, lean manufacturing, virtual and state-of-the-art manufacturing technology, simulation-based work instruction.

vii. Senior Fatigue and Damage Tolerance Specialist(s)*: Shall have at least 10 years of experience in the fatigue/damage tolerance analysis and testing areas. Full understanding and knowledge of NAVAIR policies and philosophy on fatigue and damage tolerance is essential.

viii. Senior Test Specialist(s)*: Shall have at least 15 years of testing experience specializing in full-scale fatigue and damage tolerance testing as well as loading fixture design and development.

ix. NDT/I Specialist(s): Shall be Level III certified in respective NDT/I areas and have a minimum of 10 years airframe experience. Knowledge of state-of-the-art remote sensing and monitoring NDT/I is essential.

x. Artisan(s): Shall have at least 10 years of airframe experience in the respective skills. Shall have appropriate up-to-date training and current certification.

The positions denoted with an asterisk are key personnel and will require NAVAIR concurrence prior to appointment in accordance with Clause H-5 of the contract.

3.1.6 Technical Data

The contractor shall develop and generate a complete P-3C SLEP Kit Technical Data Package. Government Furnished Information (GFI), including technical reports, engineering drawings, maintenance manuals and engineering specifications may not provide sufficient definition, details or coverage for the kit design/fabrication/installation/repair processes required to conduct the SLAP and SLEP. It shall be the contractor's responsibility to ascertain the shortcomings of existing documentation and processes no later than 90 days after the contract award. The contractor shall develop/regenerate necessary data and processes to accomplish the required tasks in this SOW. The use of contractor's proprietary data (e.g., computer codes, test data etc.) are strongly discouraged UNLESS a contractual arrangement can be made prior to contract award to guarantee that the proprietary data can be used by the US Government and its FMS partners with no additional non-recurring engineering (NRE) cost at a later date. The contractor shall provide NAVAIR a list identifying all proprietary data which may be and/or have been used on this program prior to and at the end of the contract as part of the P-3C SLEP Kit Technical Data Package ***(CDRL B002)***.

3.1.7 Ground Support Equipment and Tooling

Existing tooling for P-3 production and depot level maintenance is not considered suitable and will not be available for use in the performance of this program. Contractors shall procure and/or fabricate all tooling, special handling equipment and support structures necessary to accomplish the efforts described in this SOW. The contractor also shall provide a list of all GSE procured for this program in accordance with ***CDRL B007***.

3.1.8 Test and Data Acquisition Equipment

Contractor shall provide or obtain all required test and data acquisition equipment necessary to perform the tasks. The contractor also shall furnish all required test instrumentation. The method of data acquisition, number and type of recording devices, and a list of all equipment procured for this test program shall be provided by the contractor for approval by NAVAIR in accordance with ***CDRL C001***. The selection of a data acquisition system shall be an off-the-shelf item from a reputable supplier with demonstrated capability and reliability in fatigue test data acquisition.

3.1.9 Over and Above (CLINs 0040, 0125 and 0239)

For O&A work, the contractor shall set aside a minimum of 5,000 estimated labor hours and $250,000 (FY99) for estimated material cost at the beginning of the base period and the subsequent two option periods. The total amount for O&A work shall be part of the basic $60M program. The contractor shall use DOD or industry standard man-hour estimate for rough order of magnitude (ROM) submittal to the Government representative. For each O&A task exceeding 250 total hours and/or over $25,000 worth of material cost, the contractor shall obtain approval from the NAVAIR Procuring Contracting Officer (PCO) prior to initiation of repair. All O&A work proposals shall be submitted to NAVAIR or on-site NAVAIR representative for *technical* review and approval before proceeding. (see also SOW paragraphs 3.9.2.4 and 3.9.2.5) ***(CDRLs J001, T001 and AG01)***

3.1.10 Contractor Generated Damage

The contractor shall be fully responsible for replacement of any damaged part/sub-assembly/assembly generated by the contractor. Repair of contractor generated damage (CGD) will be considered acceptable only if NAVAIR determines it to be in its best interest, and the contractor demonstrates by analysis (static, fatigue and damage tolerance) and testing (component and/or full-scale) that the repair would not impact/influence/alter the test results.

3.1.11 Modeling and Simulation

Due to the scarcity of available test assets, and its prohibitively high replacement cost as well as potential adverse impact on the test schedule and the follow-on SRP/SLEP, the contractor shall utilize extensively state-of-the-art 3-D solid electronic modeling and simulation tools (e.g., computer-aided design, computer-aided manufacturing, virtual prototype, virtual machining, simulation-based work instructions, etc.) in the design, manufacturing and installation, etc. of the P-3C SLEP kit.

3.2 LOADS SYSTEM UPDATE (CLIN 0001)

The contractor shall update the loads system developed under SLAP Phase I (LG98ER0002) in accordance with the requirements as specified in the following paragraphs. The magnitudes and distributions of loads shall include the effects of the dynamic response of the structure resulting from the transient or sudden application of loads such as abrupt maneuvers, gusts, landings, taxiing, braking wheels in air, buffet, etc. The contractor shall use the P-3C loads system operational parameter grids provided in the SLAP Phase I (LG98ER0002, Table 2-12) as a baseline. The contractor shall update the loads system to include: a) Gross Weight, Speed, Altitude, and Center of Gravity (c.g.) as primary independent parameters, b) Maximum Zero Fuel Weight (MZFW) ranging from 77,200 to 82,000 pounds, c) Maximum Take Off Gross Weight (MTOGW) ranging from 135,000 to 142,000 pounds, and d) Expand the operational grid points to a minimum of 6,000 (from 2,928). For those exceeding weight conditions without specific mass distributions, the contractor may distribute the increased weight arbitrarily throughout the fuselage coupled with appropriate operation limitations (N_z, speed) to maintain within the P-3C structural strength envelope. The contractor shall submit a P-3C FSFT External and Internal Loads Methodology Report in accordance with ***CDRL A001***.

3.2.1 External Loads

The contractor shall document the results in the P-3C FSFT External Loads Report ***(CDRL A002)***.

3.2.1.1 Weight and Inertia Distribution

The contractor shall re-baseline the inertia properties and weight distribution for the P-3C as part of this study. The re-baselined weight configuration shall include incrementally the P-3C Update III configuration, all ECP/AFCs (Engineering Change Proposals/Airframe Changes) up to and including SRP and SLEP modifications. The contractor shall generate a P-3C FSFT External Loads Report, Vol. I – Inertia Loads ***(CDRL A002)***.

3.2.1.1.1 Explosion Suppressive Foam

The contractor shall generate additional weight and inertia distribution(s) taking into account the explosion suppressive foam (AFC 517) and its trapped fuel in the wings. The contractor also shall consider any relief to the minimum fuel requirements and zero fuel weight determination as a result of the foam and trapped fuel. The contractor shall recommend the appropriate wordings, and proper zero fuel weight (ZFW) and takeoff gross weight (TOGW) calculation methods to be incorporated into the current NATOPS manual. The contractor shall document the results as an appendix to the P-3C FSFT External Loads Report, Vol. I – Inertia Loads ***(CDRL A002)***.

3.2.1.1.2 ASUW Improvement Program (AIP)

The contractor shall generate a separate weight and inertia distribution(s) for the baseline P-3C aircraft developed in paragraph 3.2.1.1 of this SOW with the AIP mod installed (ECP/AFC 574) with and without the explosion suppressive foam (AFC 517). The contractor shall perform weight and balance analysis with different mission configurations for various P-3C missions (e.g., ASW, ASUW, transport, etc.). Using the basic P-3C as a baseline, the contractor shall identify any payloads deficiencies (e.g., fuel, stores, sonobuoy, etc.) for each P-3C mission as a result of the AIP installation. The contractor shall document the results as an appendix to the P-3C FSFT External Loads Report, Vol. I – Inertia Loads ***(CDRL A002).***

3.2.1.1.3 Deleted

3.2.1.2 Flight Loads

The contractor shall generate flight loads for all P-3C operational loads system grid points, and points-in-the-sky (PITS) as defined in LG98ER0002 as well as additional PITS identified in SOW paragraph 3.3.1. The contractor shall expand the Aerodynamics Influence Coefficients (AIC) and Stiffness Influence Coefficients (SIC) grid points to include the complete airframe. The contractor shall generate and submit a P-3C FSFT External Loads Report, Vol. II – Flight Loads (***CDRL A002)***.

3.2.1.2.1 Flight Test Support (CLIN 0029)

The contractor shall provide engineering and on-site technical support for the P-3C flight loads test program to be accomplished by RAAF at Adelaide, Australia. The contractor shall:

a) Review flight test plan including the test matrix, ballast requirements, instrumentation, locations, etc.

b) Provide on-site technical support with at least one (1) loads engineer during the flight test program (8 weeks minimum).

c) Reduce the flight test data and correlate with other analytical results (CFD, wind tunnel, etc.). Incorporate the verified flight test data into the P-3C loads system. ***(CDRL F002)***

3.2.1.2.2 Maneuver Loads

The contractor shall generate a six degrees of freedom control input time history response for all dynamic maneuvers. Dynamic maneuvers shall include, as a minimum, rolls, loaded rolls, rudder kicks, abrupt pushovers and abrupt pull ups. The contractor shall define the control inputs for the

P-3C aircraft to: a) match the loads system grid points defined in the SLAP Phase I (LG98ER0002), b) include additional grid points as stated in SOW paragraph 3.2.1.1, and c) any additional PITS as identified in SOW paragraph 3.3.1. These maneuver simulations shall be validated for flight loads through comparison with available flight test data. The contractor shall generate an updated maneuver loads analysis using the results of these time histories. This shall also include loads due to asymmetric flight conditions (e.g., lateral loads on the vertical stabilizer). Balance conditions (i.e., unaccelerated flight maneuver) such as symmetric pull ups and pushovers, and steady heading sideslips may be accomplished using trimmed solution. ***(CDRL A002)***

3.2.1.2.2.1 Deleted

3.2.1.2.3 Aerodynamics Loads.

3.2.1.2.3.1 Wind Tunnel Test Support

The contractor shall provide engineering and on-site technical support for the wind tunnel test to be performed at facilities located in Canada and England. This support shall, as a minimum, include: a) verification of the model Outer Mold Line (OML) with the actual P-3C measured loft lines (especially the nacelles), b) on-site support for the wind tunnel test with at least one (1) loads engineer during the entire test duration (6 weeks in Canada and 3 weeks in England), c) reduction of test data and correlation with CFD and flight test results, and d) incorporation of the verified wind tunnel data into the loads analysis. The contractor shall document the results as part of the P-3C FSFT External Loads Report, Vol. II – Flight Loads ***(CDRL A002)***.

3.2.1.2.3.2 Analysis

The contractor shall update the P-3C aerodynamic loads using a full three dimensional computational fluids dynamics (CFD) model for the entire V-n envelope. This shall include aerodynamic loads distribution for upper and lower lifting surfaces for the entire aircraft. As a minimum, the contractor shall use an Euler solver for the CFD analysis. For loads occurring during high angles of attack and component loads influenced heavily by viscous effects, the contractor shall use a Navier Stokes solution. The contractor shall ensure that the accuracy of the computer code proposed for usage in this program shall meet or exceed available commercial code(s) in terms of quality in the domain of force and moment predictions as well as the location of flow separation. The selected computer code shall also meet the following accuracy requirements as compared to equivalent P-3C wind tunnel test data, if available.

$$\Delta C_L \leq 5\%$$

$$\Delta C_D \leq 30\%$$

$$\Delta C_M \leq 5\%$$

Where:

$$\Delta C_X = \frac{C_{X_{CFD}} - C_{X_{WT}}}{C_{X_{WT}}}$$

The contractor shall also perform necessary sensitivity studies, including grid optimization, to ensure proper solution convergence. The contractor shall include the effects of Mach number (transonic), deformation of the flight control surfaces due to aeroelasticity effects, propeller wash, body interference, engine exhaust, and nonlinear effects such as buffet. The contractor shall validate the predicted CFD results with all available wind tunnel, ground and flight test data. The contractor shall, as a minimum, generate new aerodynamics loads for all loads system configurations (i.e., c.g., weight, speed and altitude) as defined in the SLAP Phase I study (LG98ER0002) and in SOW paragraph 3.2.1. The contractor shall submit the proposed analysis methodology, convergence criteria, software code programs, and aerodynamics loads matrix in accordance with ***CDRL A001***. The contractor shall document and provide a validated CFD model on electronic media ***(CDRL A002)***.

3.2.1.2.3.3 Deleted

3.2.1.2.4 Gust Loads

The contractor shall develop three-dimensional loads due to vertical and lateral gust using, as a minimum, the continuous turbulence (Power Spectrum Density - PSD) approach. The contractor shall document the results in the P-3C FSFT External Loads Report, Vol. II – Flight Loads ***(CDRL A002)***.

3.2.1.2.4.1 Deleted

3.2.1.2.5 Buffet Loads

The contractor shall include dynamic effects due to buffet in the P-3C loads system. The contractor shall conduct appropriate dynamic analyses to determine buffet loads. Arbitrary magnification applied to the steady state maneuver loads is not an acceptable approach. The contractor shall document the results in the P-3C FSFT External Loads Report, Vol. II – Flight Loads ***(CDRL A002)***.

3.2.1.2.5.1 Deleted

3.2.1.3 Ground Loads

The contractor shall generate ground loads, including dynamic effects, for all corresponding loads grid points as defined in LG98ER0002 and SOW paragraph 3.3.1. The contractor shall incorporate these ground loads into the current P-3C operational loads system. The contractor shall document the results in the P-3C FSFT External Loads Report, Vol. III – Ground Loads ***(CDRL A002)***.

3.2.1.3.1 Landing Loads

The contractor shall include the effect of drift landing and sudden extension of landing gear in the analysis.

3.2.1.3.1.1 Multivariate Landing Analysis

The contractor shall conduct a multivariate landing analysis using the USN P-3C landing survey data to be provided as GFI.

3.2.1.3.1.2 Deleted

3.2.1.3.1.3 Deleted

3.2.1.3.2 Ground Maneuvering Loads

The contractor shall use PSD approach to generate loads including dynamic effects for the following loads sources:

a) Taxi, including takeoff and rollout

b) Turning

c) Braking and pivoting

The contractor shall correlate with all available test data, and incorporate the above loads into the P-3C loads system.

3.2.1.3.2.1 Deleted

3.2.1.3.3 Dynamic Taxi Test Support (CLIN 0027)

The contractor shall provide engineering on-site support (6 weeks minimum) to the USN taxi testing efforts to be conducted at Naval Air Station (NAS) Patuxent River, MD. The contractor shall generate the test matrix and instrumentation plan ***(CDRL F001)***, reduce test data and generate magnification factors for dynamic taxi loads. The contractor shall correlate these data with other previous test and analysis results, and shall incorporate these magnification factors into the P-3C loads system. The contractor shall document the results of the dynamic taxi testing in the P-3C FSFT External Loads Report, Vol. III – Ground Loads ***(CDRL F001)***.

3.2.1.4 Pressurization

The contractor shall generate loads due to pressurization for all corresponding PITS and grids in the P-3C loads system. The contractor shall document the results in the P-3C FSFT External Loads Report, Vol. II – Flight Loads ***(CDRL A002)***.

3.2.1.4.1 Cabin

The contractor shall combine the pressure loads with corresponding flight loads for analysis and testing.

3.2.1.4.2 Fuel

The contractor shall include the dynamic effects of fuel inertia and hydrodynamic pressure on the aircraft loadings (especially asymmetric maneuver conditions).

3.2.1.4.3 Deleted

3.2.1.5 Miscellaneous Loads

The contractor shall generate loads for the following:

a) Bomb bay doors

b) Control surfaces (ailerons, flaps, elevators, rudder)

The contractor shall document the results in the P-3C FSFT External Loads Report, Vol. V – Miscellaneous Loads ***(CDRL A002)***.

3.2.1.5.1 Deleted

3.2.2 Balanced Loads

The contractor shall generate separate "discretized" balanced loads by combining externally applied loads and inertia loads to be applied to the P-3C FEM grids for all of the design loads conditions (as defined in LR 13167 and LR 19988). The contractor shall document the results in the P-3C FSFT External Loads Report, Vol. IV – Balanced Loads ***(CDRL A002)***.

3.2.2.1 Deleted

3.2.3 Internal Loads Generation

3.2.3.1 P-3C Finite Element Model

3.2.3.1.1 Model Update

The contractor shall modify the Phase I P-3C Finite Element Model (FEM) to include control surfaces (flap, aileron, elevator, and rudder), wing and empennage leading and trailing edges. For the fuselage section, the contractor shall develop an algorithm to automatically determine and modify the skin effectivity for individual applied load conditions. The contractor shall increase the model fidelity (double the number of mesh elements) for the center wing section including the front and aft spar caps and webs. The contractor shall also verify and document the previously unrecorded section properties for the wing (including newly modeled structure from this paragraph, spar caps and webs, and wing panels) and fuselage (including floor, pressure deck, and bomb bay sides) in a manner consistent with LG98ER0063, Appendix A. For the empennage, the contractor shall validate and verify the cross-section properties and idealization of structural parts/sub-assembly/assembly. The contractor shall refine and update the existing FEM mesh (double the number of mesh elements). The contractor shall provide a computer graphical interface between the P-3C FEM and the following:

a) Element and property ID, element type

b) X-section properties

c) Part and drawing numbers

The computer graphical interface between PATRAN and the P-3C CADAM data files shall be able to operate in the Windows NT/UNIX environment. The contractor shall modify the FEM as necessary to represent any fittings (e.g., dummy quick engine change (QEC), dummy landing gear, etc.) that may be installed on the test article for the purpose of introducing test loads. A separate FEM of the empennage test article, including appropriate sections of the fuselage with the article constraints simulating the test setup, shall be developed to verify the test loadings. The contractor shall document the results including model, description, approach, assumption, structure idealization, etc. in the P-3C FSFT Internal Loads Report, Vol. I – Finite Element Model. The contractor shall also provide the updated P-3C FEM including all bulk data and output files on electronic media. ***(CDRL A003)***

3.2.3.1.1.1 Deleted

3.2.3.1.2 Model Analysis

The contractor shall generate internal loads (i.e., stresses, strains and displacements) for all critical design loads conditions (as defined in LR 13167 and LR 19988). The contractor shall generate a computer database which includes element ID, stress, strain, displacement, critical load conditions, etc. The contractor shall document the results in the P-3C FSFT Internal Loads Report, Vol. II – Finite Element Analysis ***(CDRL A003)***.

3.2.3.1.2.1 Deleted

3.2.3.2 Load-to-Stress Ratios

The contractor shall develop load-to-stress ratios for all fatigue critical locations identified in SLAP Phase I (LG96ER0177) and any additional fatigue critical locations specified in SOW paragraph 3.3.3. The contractor shall generate the ratios for maneuver and ground loads separately including the up bending and down bending conditions. The contractor shall document the results in the P-3C FSFT Internal Loads Report, Vol. III – Loads-to-Stress Ratios ***(CDRL A003).***

3.3 SPECTRA DEVELOPMENT (CLIN 0003)

The contractor shall generate and submit a P-3C FSFT Repeated Loads Criteria Report ***(CDRL A004)***.

3.3.1 SDRS Flight Loads Survey Data Review

The USN P-3C aircraft currently has the Counting Accelerometer Group (CAG) installed. This is a single-channel system recording Nz exceedances at 4 preset levels (2.0. 2.5, 3.0, 3.5 G's). NAVAIR is currently retrofitting the AN/ASH-37 Structural Data Recording System (SDRS) into all USN P-3C aircraft as a replacement for the CAG. The SDRS is a multi-parameter recorder that stores the time history of flight parameters in a solid-state memory unit. The contractor will be provided with all available recorded SDRS data and the corresponding recording criteria (GFI). The SDRS automatically records peak and valley normal acceleration (N_z), roll acceleration ($\dot{p}$), indicated airspeed, altitude, cabin pressure, and fuel status. Weight on/off wheels are also recorded. The SDRS also receives manual entries of date, time, gross weight, total fuel weight, wing stores weights, and mission code. Manual entries are keyed prior to flight. The contractor shall review the recorded SDRS data to identify any deficiencies/anomalies due to the hardware, software as well as the firmware. The contractor shall verify and validate the data by evaluating the recording criteria, frequency intervals and the range limits. The contractor shall establish quality control (QC) criteria for each recording parameter. The contractor shall also develop a computer algorithm to automate a QC process for screening the SDRS data. The contractor shall validate the SDRS system by comparing with other data sources such as CAG, 3M, and FMS data. The contractor shall document the results **of the** P-3C SDRS **data review in the P-3C FSFT Repeated Loads Criteria Report** ***(CDRL A004)***.

3.3.2 Usage Data Update

The contractor shall utilize all available GFI data (3M, NAVFLIR, CAG, SDRS, squadron's logbook, etc.) to generate the P-3C fatigue spectra. These data shall be used to develop mission profiles, mission mix and a unique set of PITS. These PITS shall yield the *most conservative* fatigue life estimate for each fatigue critical structural component. The contractor shall use appropriate statistical data analysis to generate usage data such as Nz exceedances, speed, weight and altitude, etc.. Appendix B of this SOW provides guidelines for CAG and SDRS data reduction. Utilizing the results specified in SLAP Phase I (LG98ER0002) as a baseline, the contractor shall define additional PITS and update the current usage data using the validated P-3C production SDRS survey data. The contractor shall develop and automate a procedure to quickly optimize the aircraft usage spectrum which would produce the most fatigue damage on each critical structural component.

3.3.2.1 Deleted

3.3.2.2 Deleted

3.3.3 Critical Area Selection

In addition to the 36 locations selected in SLAP Phase I (LG96ER0177), the contractor shall select an additional 14 locations for fatigue and damage tolerance evaluation. The 36 fatigue critical areas (FCA) selected in SLAP Phase I are listed below:

FCA #	Locations
	<u>Center Wing - Lower Surface</u>
125	Center Wing Lower Crown B.L. 0 Cutout
163	B.L. 48 Skin Panel #3 Riser Runout and Skin Pad Up
170	Center Wing Lower Front Spar at B.L. 49
	<u>Outer Wing - Lower Surface</u>
301	W.S. 65 Center Wing/Outer Wing Front Spar Attachment
305	W.S. 65 Center Wing/Outer Wing Chordwise Splice
315	W.S. 124 Crown Spanwise Splices
351	W.S. 167 Front Spar Cap/Web Attachment
353	W.S. 167 MLG Rib Attachment Flanges
355	W.S. 167 Crown Spanwise Splices and MLG Rib Attachment

361 W.S. 209 Front Spar Cap/Web Attachment

365 W.S. 209 Crown Spanwise Splices and MLG Rib Attachment

375 W.S. 266 Crown Spanwise Splices

385 W.S. 346 Crown Spanwise Splices and Nacelle Attachment

<u>Outer Wing - Upper Surface</u>

451 W.S. 167 Front Spar Cap/Web Attachment

455 W.S. 167 Crown Spanwise Splices and MLG Rib Attachment

461 W.S. 209 Front Spar Cap/Web Attachment

465 W.S. 209 Crown Fuel Probe Hole

475 W.S. 266 Crown Spanwise Splices

<u>Main Landing Gear</u>

511 Axle

512 Cylinder

<u>Nose Landing Gear</u>

521 Axle

522 Cylinder

<u>Nacelle</u>

621 Nacelle Attach Plate/Front Spar Lower Cap Attachment

622 Upper Longeron Splice

<u>Fuselage</u>

702 Forward Pressure Bulkhead

711 B.L. 40 Flight Station Underfloor Beam

729 F.S. 288 Cockpit/Fuselage Production Splice

741 Main Frame to Wing Spar Attachment

759 Upper Crown Circumferential Skin/Stringer Splice

767 Longitudinal Skin Splice

775 Cutout

789 F.S. 1117 Fuselage/Empennage Production Splice

795 Aft Pressure Bulkhead

Empennage

811 Vertical Stabilizer Front Spar Root Attachment

821 Horizontal Stabilizer Front Spar Lower Cap Root

822 Horizontal Stabilizer Front Spar Upper Cap Root

For the additional 14 locations, the contractor shall consider the following as a minimum:

a) Control surfaces (flap, aileron, rudder and elevator)

b) Additional Center Wing Section locations (aft upper and lower spar caps, webs)

c) Additional Vertical Stabilizer locations

The contractor shall submit a list of the proposed locations in accordance with ***CDRL A004***.

3.3.4 Fatigue Spectra Generation

The contractor shall develop and generate fatigue spectra using mean, 70th and 85th percentile usage data for the 50 locations as specified in SOW paragraph 3.3.3 for P-3C aircraft. The contractor shall document the results in the P-3C FSFT Repeated Loads Report ***(CDRL A005).***

3.3.4.1 Maneuver Loads

The spectrum of loads shall include symmetric pull-ups and push-overs, and asymmetric rolling pull-outs, roll reversals, and level rolls. Except for level rolls, the maneuvers shall have the number of positive and negative exceedances of vertical load factor as specified in LG98ER0002 and stated below in Table I and updated in SOW paragraph 3.3.1. The percentage of asymmetric maneuvers (usage data from SOW paragraph 3.3.1 or 10% minimum) at each load level and the total number of level rolls shall be defined and recommended by the contractor in the P-3C FSFT Repeated Loads Criteria Report ***(CDRL A004)***.

Table I. Nz Cumulative Exceedances per 1000 Flight Hours

N_z Load Factor	Cumulative Exceedances per 1000 flight hours
0.0	0
0.25	5
0.5	150
0.75	441
1.0	813
1.0	4050
1.5	500
2.0	69
2.5	13
3.0	5
3.5	4

3.3.4.2 Gust Loads

The gust load spectra shall encompass the mission usage of the airplane and shall include equivalent fatigue damage of at least one (1) percent of the airplane's life at Vh at sea level. The contractor shall consider at least the dynamic response in the rigid-body modes of pitch and translation, for elastic modes as appropriate to the structural characteristics and configuration, and the modes of any autopilot or artificial stability devices. The dynamic response shall be determined for the PSD of atmospheric turbulence.

3.3.4.3 Ground Loads

3.3.4.3.1 Landing Impact Loads

Using the multivariate landing analysis in SOW paragraph 3.2.1.3.1.1, the contractor shall determine the airplane landing loads by a rational combination of the sinking speeds with variations in landing attitudes (pitch and roll) and landing speeds. The analysis shall also include drift landing loads. The distribution of sinking speeds in Table II may be used if the fleet usage data is not available.

Table II. Distribution of Sinking Speeds per 1000 Landings

FIELD LANDINGS	
SINK SPEED (FPS)	FREQUENCY
10	0.5
9	1.5
8	7
7	22
6	66
5	153
4	252*
3	271
2	170
1	57

The landing indicated by an asterisk shall include drift landing loads for which the following apply:

a) The side load shall be 0.4 times the maximum vertical load for the main gear and 0.2 times the maximum load for the nose gear.

b) The side load shall act in combination with the maximum vertical load.

c) The shock strut stroke and the drag load shall correspond to those occurring at the instant of maximum vertical load.

3.3.4.3.2 Ground Maneuvering Loads

The contractor shall include vertical, drag and lateral loads resulting from braking, turning, pivoting and taxiing. Hard braking with maximum braking effect (0.8 coefficient of friction) shall occur twice per taxi run and medium braking with half maximum effect shall occur an additional five times per run. Turning with total side loads of 0.4 times the airplane weight applied as inboard and alternately as outboard loads shall occur five times per taxi run. Pivoting with ½ limit torque load shall occur once per three taxi runs. The contractor shall use the vertical response resulting from runway roughness based on fleet usage or as specified in Table III.

Table III. Number of Times per Thousand Runway Landings

Incremental Vertical Load Factor	Occurrences per 1000 flights		
	Taxi	Takeoff	Rollout
1.0 ± 0.05	300,000	100,000	200,000
1.0 ± 0.15	165,000	5,500	16,000
1.0 ± 0.25	27,000	350	1,500
1.0 ± 0.35	2,000	35	200
1.0 ± 0.45	90	6	35
1.0 ± 0.55	4	1	8
1.0 ± 0.65	0.15	0.2	2.8
1.0 ± 0.75	0.005	0.04	1.1
1.0 ± 0.85		0.009	0.45
1.0 ± 0.95			0.18
1.0 ± 1.05			0.07

3.3.4.3.3 Miscellaneous Ground Loads

3.3.4.3.3.1 Sudden Extension

The contractor shall utilize the number of applied cycles equal to the number of touch-and-go landings. The contractor shall consider the dynamic effect of sudden extension of the landing gear.

3.3.4.3.3.2 Extension, Retraction and Braking Wheels in Air

The contractor shall use the number of applied cycles equal to the number of ground-air-ground cycles. The sequence of each cycle shall be as follows:

a) Landing gears in the extended and locked position

b) Braking wheels in air

c) Full retraction of landing gears in the locked position

d) Extension of landing gears in the locked position. Actuation shall be by a normal power system.

3.3.4.4 Cockpit or Cabin Pressurization

The contractor shall apply a minimum of 20,000 pressurized cycles to the cabin of the P-3C airplane over one service lifetime (30,000 flight hours). The pressure to be applied shall be the maximum value obtained from tests of at least 10 relief valves (CFE) of the type to be used, or the value obtained by adding the maximum relief valve setting governing acceptance of the value in its acquisition specification to the maximum permissible tolerance on this valve. The flight loads to be applied shall include those resulting from gust penetrations and maneuvers consistent with the missions.

3.3.5 Deleted

3.3.6 Deleted

3.4 DESIGN DATA AND ALLOWABLE MATERIAL PROPERTIES DEVELOPMENT (CLIN 0005)

The contractor shall obtain or develop all required design data and allowable materials properties for static, fatigue and damage tolerance analysis including cyclic stress-strain curves, strain life curves, crack growth data, etc. The contractor shall substantiate and analyze these properties with procedures used for corresponding data in the appropriate industry standard testing handbook (e.g., ASTM). For the substantiation of structural integrity by analytical calculations, the nominal gage of material shall be the average gage between tolerances. Other sources of design allowable data are authorized for use subject to acceptance by NAVAIR. Allowable material properties shall include all applicable statistical variability, processing and environmental effects as well as effects due to defects. Where it is necessary to develop data and properties, the test materials, processes and manufacturing techniques shall be those used in the production of SLEP kits. Minimum guaranteed properties obtained from the foregoing sources shall be used for the design purposes. The relationship between specified minimum material properties used for purchasing and material design allowables shall be such that either: a) the minimum properties required by the material specification are greater than or equal to the material design allowable, or b) where specified minimum material properties are less than the material design allowable, a safety factor of the same or greater magnitude shall be employed during the design to account for the relative difference. The contractor shall document the relationship between specified minimum materials properties and material design allowables for each SLEP kit material in the P-3C FSFT Material Substantiation and Analysis Report ***(CDRL A007)***. The contractor also shall provide a detailed methodology plan for determining each material design allowable. ***(CDRL A006)***

3.4.1 New Material Selection for Replacement of Al 7075-T6

The contractor shall recommend and provide to NAVAIR for review and approval a list of potential material candidate(s) (e.g., Al 7150-T77, 7249-T74, 7055-T74) to replace Al 7075-T6 material in the P-3C FSFT New Material Selection and Materials Characterization Plan ***(CDRL***

A006). All new materials shall have a specification that meets the industry AMS requirements. The substitute SLEP kit material shall exhibit adequate mechanical properties (static, fatigue, fracture toughness, crack growth characteristics, etc.) to comply with all design requirements, maintain existing form, fit, and function, and demonstrate significant improvements (25 ksi max sustained stress, alternate immersion in a 3.5 percent NaCl solution, without failures after 20 days when tested in any test direction) in all types of corrosion resistance relative to 7075-T6. *The selection of suitable new material substitution shall also depend primarily on the material development time and availability relative to the overall test program cost, schedule and major milestones*. Upon receiving NAVAIR endorsement, the contractor shall revise the P-3C FSFT New Material Selection and Materials Characterization Plan ***(CDRL A006)*** proposing analyses and a testing program to sufficiently characterize the new SLEP kit materials for full and effective life cycle resistance to the following failure modes, as applicable.

a) Static strength

b) Fatigue strength

c) Stiffness

d) Fracture toughness

e) Crack initiation and propagation

f) Stress corrosion cracking

g) Hydrogen embrittlement

h) Creep

i) Galvanic corrosion

j) Crevice corrosion

k) Filiform corrosion

l) Exfoliation corrosion

m) Chemical, solvent, fuel, and lubricant exposure

n) Thermal exposure

o) Wear

p) Galling

q) Fretting

r) Erosion

Justification shall be provided for failure modes not proposed to be characterized. The P-3C FSFT New Material Selection and Materials Characterization Plan ***(CDRL A006)*** shall identify, and statistically substantiate, the proposed extent of testing based on design of experiments, exceedance basis and data distribution, and confidence level. Justification shall be provided for proposed confidence levels less than 95%. The contractor shall document the results of all completed analyses and testing in the P-3C FSFT Materials Substantiation and Analysis Report ***(CDRL A007)***.

3.4.1.1 Materials Producibility

As part of the materials selection process the contractor shall conduct trade studies, including risk assessments, to insure that the following factors will optimally contribute to meeting SLEP life cycle requirements.

a) Material and Process Maturity – Materials and processes shall be stable, remain fixed, and minimize unique maintenance and repair practices beyond existing USN Organization, Intermediate, or Depot capability.

b) Manufacturability – The processes used to prepare, form, and join materials shall not contribute to unacceptable degradation of the properties of the materials during manufacturing or during exposure to operational usage and support environments. The effects of manufacturing representative processing on the materials shall be accounted for in the material design allowables.

c) Process Repeatability – Processes for producing materials and material systems shall be controllable and shall be monitored in a manner appropriate for maintaining the required degree of control. Process parameters shall be sufficiently monitored and controlled such that the required product integrity is consistently achieved while minimizing defect, scrap, and Material Review Board (MRB) rates. The contractor shall establish **and document** procedures for process repeatability **in the** P-3C SLEP Kit Manufacturing and Processes Plan**, Vol. I – Quality Assurance Program Plan**. ***(CDRL B005)***

d) Supplier Control – Materials and processes shall be procured and controlled through supplier control and requirements flow down procedures. Plans and procedures shall be put in place to qualify suppliers, and ensure material availability as well as adequate lead times. The contractor shall establish **and document** such procedures **in the** P-3C SLEP Kit Manufacturing and Processes Plan**, Vol. I – Quality Assurance Program Plan**. ***(CDRL B005)***

3.5 FATIGUE AND DAMAGE TOLERANCE ANALYSIS (CLIN 0007)

The contractor shall generate and submit a P-3C FSFT Fatigue and Damage Tolerance Analysis Methodology Report ***(CDRL A008)***.

3.5.1 Fatigue Analysis

Using the mean, 70^{th} and 85^{th} percentile fatigue spectra developed in SOW paragraphs 3.2 and 3.3, the contractor shall perform fatigue analyses for all 50 locations on the P-3C airframe in accordance with SOW paragraph 3.1.3.1. The contractor shall include all fatigue damage incurred on the P-3C primary structures due to flight control surfaces and their local attachments (i.e., applied and induced loads and cycles, etc.). The results from these analyses shall provide the basis for determination of the full fatigue life capability of the P-3C airframe. The analysis for each location shall include, as a minimum, creation of a fatigue stress spectrum, generation of a fatigue notch factor and calculation of the fatigue life. The contractor shall perform crack growth analysis, as required, if actual testing or service experience data exists to determine crack initiation life and test-demonstrated fatigue notch factors. The contractor shall document the results in a P-3C FSFT Fatigue and Damage Tolerance Analysis Report ***(CDRL A009)***.

3.5.1.1 Deleted

3.5.1.2 Deleted

3.5.2 Damage Tolerance Analysis

The contractor shall perform damage tolerance analysis in accordance with SOW paragraph 3.1.3.3 for all 50 critical locations. The contractor shall validate the mathematical model for crack retardation using coupon/component testing as a minimum. The contractor shall also generate a family of crack growth curves using mean, 70 percentile and 85 percentile spectrum for each location. The contractor shall document the results in a P-3C FSFT Fatigue and Damage Tolerance Analysis Report ***(CDRL A009)***.

3.5.2.1 Deleted

3.5.2.2 Deleted

3.5.3 Additional Detailed Finite Element Models (FEMs)

The contractor shall generate ten (10) additional detailed finite element models of critical airframe locations: 1) identified as critical by the analyses conducted in SOW paragraphs 3.5.1 and 3.5.2, and 2) for which no detailed model currently exists. At least five (5) models shall be 3-D solid elements. The models shall represent every individual part and fastener in the analysis area. The mesh density should be least two elements between each fastener in the vicinity of the analysis area, and four elements between fasteners at the critical location. For solid element models using tetrahedron elements, sensitivity studies shall be conducted to show the mesh density produces accurate stress distributions at the analysis location. All models shall be integrated into the P-3C Airframe FEM for boundary conditions. The contractor shall propose a list of structural locations to be analyzed and document the results as an appendix to the P-3C FSFT Internal Loads Report, Vol. I – Finite Element Model and provide the FEMs on electronic media. ***(CDRL A003)***

3.6 SLEP KIT DEVELOPMENT (CLIN 0009)

3.6.1 Kit Concept Development

Based on the results of SOW paragraph 3.5, the contractor shall conduct comprehensive kit concept feasibility studies on the areas of the airframe requiring structural enhancements/modifications/redesigns to meet the service life goals of SOW paragraph 3.1.1 for at least 85% of the USN P-3C fleet aircraft. The purpose of these studies shall be to develop different design/manufacturing/ modification/installation concepts and strategies including the kit size, types of tooling, the degree of dis-assembly/re-assembly and accessibility required, etc. The studies shall also include, but not be limited to, cost trade-off studies between kit size versus additional fatigue life, and between various approaches such as repair, fatigue enhancement, modification, removal and replacement, etc. The contractor shall accommodate the structural component removal restrictions and limited accessibility to the fatigue test articles installed in the test fixtures (see SOW paragraph 3.9.2.2). The contractor shall utilize extensively state-of-the-art 3-D solid electronic modeling and simulation to perform these studies especially in the areas of installation and tooling development. The contractor shall conduct validation and verification of the proposed concepts for the SLEP kit, tooling and installation design using stereo lithography, physical full-size mock-ups, virtual prototype and manufacturing, etc. The contractor shall use existing designs and tooling **concepts** for kits from the P-3C SRP wherever possible (see SOW paragraph 3.21.1). The contractor shall document the study results including the recommended approach(es) in the P-3C SLEP Kit Concepts Report. ***(CDRL B001)***

3.6.2 Kit Design and Analysis

3.6.2.1 Design

For airframe locations identified in SOW paragraph 3.3.3 and 3.5, the contractor shall perform the NRE design of all enhancements/modifications/redesigns required to allow at least 85% of the USN P-3C fleet aircraft and test articles to achieve the service life goals as outlined in paragraph 3.1.1 of this SOW. The contractor shall design the SLEP kit to form, fit and function in accordance with the criteria of SD-536-2-18, except as specified in this SOW. The contractor shall use existing designs and tooling **concept**s for kits from the P-3C SRP wherever possible (see SOW paragraph 3.21). The SLEP kit and the re-assembled airframe shall not degrade or alter the basic P-3C performance, flight quality and handling characteristic as specified in SD-536-2-18. The contractor shall take into account producibility, aircraft-to-aircraft variability, old-to-new parts fit-up problems, matching drilling, drilling in-place, tolerance build-up, etc. in the design and manufacturing of the SLEP Kit. The contractor shall use production representative tooling and manufacturing techniques to fabricate and assemble the parts. For non-ferrous new, redesigned or replaced parts, the contractor shall use the new substitute material selected in SOW paragraph 3.4.1 such as Al 7150-T77 (AMS 4252A or AMS 4345) for extrusion and plate and 7055-T74 for forging, wherever possible, in lieu of 7075-T6. All parts shall receive protective conversion coatings (as applicable) providing the best possible protection against corrosion. The contractor shall be fully responsible for providing replacement of all consumable and non-reusable hardware on the test aircraft (e.g., clips, rivets, fasteners, etc.). The contractor shall obtain written approval from NAVAIR for permission to re-use any removed existing parts prior to re-installation. The contractor also shall redesign the following structures:

a) Nacelle attached plates (increase corner radii)

b) NLG lower (P/N 902389-1), MLG upper (P/N 901678-1) and lower (P/N 901676-1) drag struts (eliminate close cross-section)

c) NLG (P/N 901960) and MLG (P/N 901028) side braces (eliminate close cross-section)

d) Upper nacelle longerons (stagger splices)

The contractor shall use 3-D solid model computer-aided design and manufacturing software (e.g., CATIA) extensively to design for the SLEP kit. The contractor shall submit a complete P-3C SLEP Kit Technical Data Package for review and approval in accordance with ***CDRL B002*** (see SOW paragraph 3.6.9).

3.6.2.1.1 Deleted

3.6.2.2 Analysis

3.6.2.2.1 Update FEMs

The contractor shall revise and update the P-3C airframe FEMs and any affected detail models developed in this SOW to reflect all enhancements/modifications/ redesigns resulting from the above design effort. The contractor shall document this FEM update effort in the P-3C FSFT Internal Loads Report, Vol. I – Finite Element Model and provide the updated models on electronic media ***(CDRL A003).***

3.6.2.2.1.1 Deleted

3.6.2.2.2 Static Strength Analysis

The contractor shall perform static strength analysis on all enhancements/modifications/redesigns to verify their integrity by mathematical analysis in the following three areas: (a) the ability of the modifications/redesigns to support limit and ultimate loads; (b) the ability of the attaching structure to transfer loads from the modifications/redesigns to the existing aircraft structure; and (c) the ability of the existing structure to support both the loads due to the modification/redesign and loads already in the existing structure. The design of the new parts or modifications/redesigns shall be considered structurally adequate using the following three criteria: (1) for all design conditions, all structure shall possess sufficient strength so that material yield allowable stresses will not be exceeded at limit loads; (2) for all design conditions, all structure shall possess sufficient strength so that material ultimate allowable stresses will not be exceeded at ultimate loads; (3) for all structure, the cumulative effects of elastic, permanent, and thermal deformation which result from application of repeated loads and limit loads shall not interfere with the mechanical operation (form, fit, or function) of the aircraft nor adversely affect its aerodynamic characteristics. *The contractor shall include the maximum shim tolerance conditions in the analysis*. The contractor shall document all internal and external flight loads used to perform the stress analyses and their origin, including any methodology used to generate new loads. Limit loads are defined as the maximum loads the aircraft actually experiences during operations. Ultimate loads are defined as 1.5 of limit loads. The contractor shall document these static strength analyses in a P-3C SLEP Kit Analysis Report, Vol. I – Stress Analysis ***(CDRL B003)***.

3.6.2.2.2.1 Deleted

3.6.2.2.3 Fatigue Analysis

The contractor shall perform fatigue analysis for all enhancements/modifications/redesigns resulting from this design effort in accordance with SOW paragraph 3.1.3.1. These analyses shall show that the enhancements/modifications/redesigns will satisfy the service life goal of SOW paragraph 3.1.1 for at least 85% of the USN P-3C fleet aircraft. The analysis shall include the effects of maximum shim tolerance conditions. The contractor shall document the analysis and results in a P-3C SLEP Kit Analysis Report, Vol. II – Fatigue Analysis ***(CDRL B003).***

3.6.2.2.3.1 Deleted

3.6.2.2.4 Damage Tolerance Analysis

The contractor shall perform damage tolerance analysis and generate crack growth curves to demonstrate compliance with the requirements of SOW paragraph 3.1.3.3. The analysis shall also take into account the effects of maximum shim tolerance conditions. The contractor shall document the analysis and results in a P-3C SLEP Kit Analysis Report, Vol. III – Damage Tolerance Analysis ***(CDRL B003).***

3.6.2.2.4.1 Deleted

3.6.2.2.5 Fail-Safe Analysis

The contractor shall perform fail-safe analysis to meet the requirements of SOW paragraph 3.1.3.2. The contractor shall document the analysis and results in a P-3C SLEP Kit Analysis Report, Vol. IV – Fail-Safe Analysis ***(CDRL B003)***.

3.6.2.2.5.1 Deleted

3.6.2.3 Weight and Balance

The contractor shall perform weight and balance analyses to establish, implement, and maintain suitable weight and balance control throughout the non-recurring engineering and development of aircraft integration. Analyses shall include estimates of component weights, their distribution, and proper allocation to predict and control aircraft weight and balance as necessary to achieve/maintain the required aircraft characteristics and performance in accordance with SD-536-2-18. Analyses shall also include determination of weight and balance based on material and component designs depicted on engineering and manufacturing drawings of the aircraft and its installed equipment. The contractor shall submit a P-3C SLEP Kit Weight Prediction and Control Plan in accordance with ***CDRL B004.*** The contractor shall also revise and update the appropriate aircraft weight and balance documents (see SOW paragraph 3.6.9, ***CDRL B002***).

3.6.2.3.1 Deleted

3.6.2.4 Prototype

In accordance with the strategy established in SOW paragraph 3.6.1 and the tooling design concept developed in SOW paragraph 3.6.3.1, the contractor shall prototype the SLEP kit design from SOW paragraph 3.6.2.1 using, as minimum, 3-D solid electronic modeling and simulation, stereo lithography, physical full-size mock-ups, and simulation-based graphical work instructions. The contractor shall submit a P-3C SLEP Kit Prototype Plan **as part of the P-3C SLEP Kit Concepts Report *(CDRL B001)***.

3.6.2.4.1 Deleted

3.6.3 SLEP Kit Tooling

3.6.3.1 Tooling Design

The contractor shall perform NRE design for all tooling required for manufacturing, production and installation of the complete SLEP kit using 3-D solid model CAD/CAM. The contractor shall employ standard production techniques and practices. The contractor shall use SRP tooling concept and design wherever possible (see SOW paragraph 3.21.1). The contractor shall utilize flexible and modular tooling design concepts with adjustable hard point tie-downs to accommodate floating geometric reference datum (i.e., aircraft variability). The contractor should *not* rely solely on the use of the original P-3 production blueprints for tooling datum references. The contractor shall design the tooling and necessary shoring to assure proper wing, fuselage and empennage alignment during disassembly, modification and re-assembly for the following specific part/sub-assembly/assembly replacement:

a) Center wing, front spar web and lower cap

b) Center wing, corner fittings (inboard of BL 65's)

c) Center wing, lower wing planks

d) Fuselage Station (FS) 288 upper pressure bulkhead

e) Lower outer wing planks and spar caps

f) Upper outer wing planks and spar caps

g) Vertical stabilizer front spar caps

Since the alignment and symmetry inspection procedure as defined in NAVAIR01-75PAA-3-2 may be inadequate, the contractor shall develop a new procedure for the wing, fuselage and empennage throughout the manufacturing and assembly process to ensure proper alignment and symmetry (i.e., twist and dihedral angle) are maintained. This tooling shall lend itself directly to a typical full 20-aircraft production line without any major modification/alteration. The contractor may be required to modify or develop additional tooling to accommodate the structural component removal restrictions (SOW paragraph 3.9.2.2) and lack of accessibility to the FSFT articles installed in the test fixtures. The contractor shall submit a P-3C SLEP Kit Manufacturing and Processes Plan, Vol. VI – Production Tooling Design Concept **Plan *(CDRL B005)*** and shall provide engineering/manufacturing/production drawings for all of the required tooling in hard copy and on electronic media ***(CDRL B002)***. The contractor shall also revise and update the tooling drawing package after completion of Test Kit Fabrication and Installation (SOW paragraphs 3.6.3.4 and 3.12.2) to reflect any required changes to the tooling identified during the kit fabrication and installation effort.

3.6.3.2 Tooling Fabrication (CLIN 0011)

The contractor shall fabricate all required tooling in accordance with the engineering/manufacturing/production drawings provided under SOW paragraph 3.6.3.1. During the fabrication process, the contractor shall identify any required changes to the tooling drawings (see SOW paragraphs 3.6.2.4 and 3.12.2). The contractor shall utilize lean and advanced manufacturing techniques as well as standard production techniques and practices.

3.6.3.3 Deleted

3.6.3.4 Deleted

3.6.4 SLEP Kit Fabrication (CLIN 0012)

The contractor shall fabricate up to four (4) complete ship sets (each set comprising both left and right hand parts) of the SLEP kit to be used in the FSFT program as follows:

a) First ship set for prototype, first article, and other destructive testing. This set shall not be used on the FSFT articles.

b) Second ship set to be production representative for installation on the test articles.

c) Option for two (2) additional complete production ship sets to be fabricated and delivered **to the Government**. **(CLIN 0218)**

3.6.4.1 Deleted

3.6.5 Validation and Verification of SLEP Kit Installation

The contractor shall verify and validate all installation procedures (including training and working instructions) using electronic and virtual simulation, full-scale hard mock-ups as well as a P-3 hulk airframe, if available. The contractor shall make all appropriate corrections and adjustments to all applicable documents. After the V&V is completed, the contractor shall produce and provide training video along with working instructions (CD-ROM, DVD) for all installation procedures of the SLEP Kit Technical Data Package ***(CDRL B002)***.

3.6.5.1 Deleted

3.6.6 Quality Assurance Program

The contractor shall implement and maintain a quality system that satisfies program objectives, including reducing risks in the areas of cost, schedule and performance. The contractor shall develop and submit a P-3C SLEP Kit Manufacturing and Processes Plan, Vol. I – Quality Assurance Program Plan (QAPP) ***(CDRL B005)***. A summary of the quality system, identifying all major processes and elements considered key to meeting program objectives, shall be made as part of the required master plan. The description in the QAPP shall include controls over vendor parts, engineering flow down requirements, manufacturing process control/techniques, and approach to engineering disposition of materials review board (MRB) actions.

3.6.6.1 NDT/I

The contractor shall prepare a P-3C SLEP Kit Manufacturing and Processes Plan, Vol. II – NDT/I Production Plan ***(CDRL B005)***. The contractor shall specify NDT requirements and procedures for new and redesigned parts associated with the SLEP kits. Inspection procedures and calibrating standards shall be developed for, as a minimum, all fatigue critical areas.

3.6.6.1.1 Characterization of Defects

The contractor shall characterize the nature of the defects to be detected. This shall include size, shape, location, orientation, and any other properties which will affect detectability with the methods to be used. The contractor also shall establish accept/reject criteria.

3.6.6.1.2 Probability of Detection

For non-critical structure, the contractor shall fully substantiate reliability, probability of detection (POD) by insuring that NDT/I be performed by qualified personnel following established procedures that have been demonstrated to be adequate. For critical or primary structure the contractor's estimated POD must be substantiated by actual realistic inspection data results and not merely by following approved procedures with qualified personnel.

3.6.6.1.3 Accessibility for Inspection

The contractor shall insure that no combination of design, material, and process shall be used which precludes the practical ability to reliably perform needed inspections during manufacturing and/or in service.

3.6.6.2 Flight Critical Parts

For any SLEP Kit item that is flight critical, the contractor shall perform first article qualification testing and one destructive testing to guarantee the basic mechanical and metallurgical properties. A part is defined as flight critical if failure of that part during any operating condition could cause loss of the aircraft or one of its major components, loss of control, unintentional release or inability to release any armament store, failure of weapon installation components, or which may cause significant injury to occupants of the aircraft. The contractor also shall generate and provide a P-3C SLEP Kit Manufacturing and Processes Plan, Vol. III – Fracture Control Plan ***(CDRL B005)*** which shall ensure the proper structural strength and fracture properties for these items. If subsequent machining or processing of the incoming materials alters the structural properties, then the contractor shall also generate and provide a manufacturing inspection plan in the fracture control plan. Test methods, standards and number of test for each item shall be provided. The contractor shall document all test and inspection results in the P-3C SLEP Kit Fracture Control Report ***(CDRL B006)***.

3.6.7 Parts Control Program

The contractor shall establish a Parts Control Program for newly designed, modified equipment, and existing parts removed from the airframe at both the prime and subcontractor as stated below:

a) The contractor shall select parts and conduct a parts management program, in accordance with the contractor's standard procedures, that assures the equipment (or system) meets the specification performance requirements with the lowest life cycle cost. Also, mechanical parts selection shall be from the Government Furnished Baselines and the pre-approved lists of parts, if applicable. Parts not on these lists are nonstandard and require submittal, along with appropriate data, to the Military Parts Control Advisory Group (MPCAG), the Acquisition Activity (AA) or the agent for the AA for evaluation. The contractor shall follow the MPCAG, AA or the agent for the AA recommendation if possible and practical for the intended use. If the recommendation is not followed, the contractor shall document why the part is not used and supply that information to the MPCAG, AA, or the agent for the AA P-3C SLEP Kit Manufacturing and Processes Plan, Vol. IV – Parts Control Program Plan ***(CDRL B005)***.

b) The AA will conduct quarterly reviews of the Parts Program to assess conformance to internal procedures, application of parts for meeting equipment or system performance requirements and parts problem areas.

c) Within 120 days after design completion, the contractor shall provide to the AA and MPCAG an as-built parts list of all mechanical part numbers, including replacements, used in the final as-built configuration and the documentation for nonstandard parts.

d) Within 90 days after contract award, the contractor shall provide a copy of their documented internal Parts Control Program Plan procedures ***(CDRL B005)***.

3.6.8 Pollution/Hazardous Materials Prevention and Control Program

The contractor shall develop or have in place a P-3C SLEP Kit Manufacturing and Processes Plan, Vol. V – Pollution/Hazardous Materials Prevention Plan ***(CDRL B005)*** documenting efforts in each of the following areas.

a) Avoidance – All pollution/hazardous materials in the air vehicle shall be eliminated, substituted, and minimized using the best possible technology (i.e., pollution prevention). Material systems and materials processes shall be environmentally compliant, compliant with best occupational safety and health practices, and minimize hazardous waste generation.

b) Waste Generation Management – When pollution prevention is not possible, all hazardous materials in the design, manufacturing, repair, maintenance, and support of the air vehicle shall be identified and tracked. These remaining hazardous materials shall be recycled, treated, and disposed of properly (i.e., pollution control).

c) Regulatory Compliance – All processes used shall be consistent with applicable environmental and occupational safety regulations.

d) Production & Deployment – Prioritization and tracking shall be established to target materials and processes for reduction/elimination.

e) Operations & Support – Prioritization and tracking shall be established to target materials and processes for reduction/elimination.

f) Demilitarization & Disposal – Prioritization and tracking shall be established to target materials and processes for reduction/elimination.

3.6.9 SLEP Kit Technical Data Generation

The contractor shall provide all engineering, manufacturing and production data packages of all enhancements/modifications/redesigns (including Level III or equivalent drawings) ***(CDRL B002)***. The contractor shall revise the technical data package after completion of Test Kit Fabrication and Installation (SOW paragraph 3.6.3.2 and 3.12.2) to reflect any required changes identified during kit fabrication and installation. In addition, the contractor shall generate an ECP providing detailed installation instructions and associated data for incorporation of the enhancements/modifications/redesigns ***(CDRL B007).*** These ECP shall be provided as Source Data. The contractor shall revise the ECP after completion of Test Kit Fabrication and Installation (SOW paragraph 3.6.3.2 and 3.12.2) to reflect any required changes identified during kit fabrication and installation.

The contractor shall provide Source Data for any new or modified repair and/or installation procedures resulting from SLEP for inclusion in the NAVAIR P-3C technical publications and manuals. The Source Data can be in contractor's format but shall include all necessary data (including Support Equipment use, if applicable) for USN Organizational, Intermediate, or Depot maintenance as required. The contractor shall provide commercial manuals for any required Support Equipment ***(CDRL B007)***.

The contractor shall provide Source Data for Provisioning requirements for any new or modified components, materials or parts resulting from SLEP. This Source Data shall include Nomenclature, Part Numbers, CAGE codes, recommended SM&R codes, and quantity per aircraft required ***(CDRL B007)***.

The contractor shall provide a list of any new Support Equipment required for new or modified installations, repair methods or components resulting from SLEP. The list shall include Nomenclature, Application, Part Numbers, CAGE codes, recommended SM&R codes and recommended quantity required for each level of maintenance ***(CDRL B007)***.

3.6.9.1 Deleted

3.7 TEST SPECTRA DEVELOPMENT (CLIN 0013)

3.7.1 Test Spectra Generation

The contractor shall generate fatigue test spectra for the wing/fuselage test, the empennage test, and the landing gear test. The applied test loads shall include maneuver, gust, cabin pressure, landings, taxi (including braking, turning and pivoting), fuel internal pressure, tail buffet with appropriate mass and inertia distributions. The loads shall be applied to the fuselage and empennage to balance the wing loads. The contractor shall consider the effects of loading sequence, load truncation and clipping, load induced residual stress, block size and other factors as appropriate to assure that the test spectra provide the most conservative life to cover for at least 85% of the USN P-3C fleet. The ordering and frequency of loads within the test spectra shall be random, consistent with the flight-by-flight operation, load exceedance and occurrence rates and the planned service life values. Load points defining Ground-Air-Ground (GAG) cycles shall be accounted for in as realistic a manner as possible, and shall be preserved in developing the test spectra. The test loading for flight conditions shall be those which result in the greatest wing root bending moments and shall include a realistic combination of symmetric and rolling pull-out conditions.

a) For the wing/fuselage test, the spectra shall have, as a minimum, 2,400,000 load points for two (2) lifetimes of testing. Internal pressurization cyclic loads shall be applied in conjunction with the appropriate flight and ground loading spectrum. The contractor shall include the hydrodynamics pressures and the inertia effects (especially asymmetric maneuvers) of the fuel in the fatigue spectra. Pressure shall be applied simultaneously with airframe flight loads for each flight. The optimum pressure that can achieve the goal of preserving peak stress levels, and large cycles (e.g., the GAG cycle) that may contribute significantly to damage, shall be used in the test.

b) For the empennage test, the c.g. position shall be that which will produce critical loads in empennage and fuselage. Additional cycles over and above those applied for the wing/fuselage test shall be applied to the test article to achieve 100% of the fatigue damage for the empennage structures, as required.

c) For the landing gear test, the contractor shall include the effect of spring back and spin up.

The contractor shall develop and submit a P-3C Test Spectrum Development Plan to NAVAIR for review and approval. The contractor shall document the results in the P-3C FSFT Fatigue Test Plan, Vol. I - Test Spectrum Development Report ***(CDRL C001)***.

3.7.1.1 Test Mission Profiles and Test Segments

Upon NAVAIR approval of the P-3C Spectra proposed in SOW paragraph 3.3.4, the contractor shall derive the test spectra mission segments, mission profiles, and mission mix from the fatigue spectra. Each flight shall be segmented to isolate significant load sources (e.g., maneuver, GAG, etc.).

3.7.1.2 Simplification and Combination of Loading

The distribution of loads during the test shall duplicate the actual distribution as closely as possible; however, simplification of the method of loading shall not be such that unrepresentative permanent deformation or failures will occur. This may be accomplished by modifying the distribution of the loads applied to regions of a structure that (1) are not critical in the loading condition being simulated in the test or (2) are identical in construction to other regions of the structure that are more highly stressed during the same or another test condition. When more than one loading condition may be applied simultaneously to different portions of the structure, the contractor shall make sure that any interaction of the separate loading conditions does not affect the critical loading on any portion of the structure.

3.7.2 Test Spectra Sensitivity Studies

The contractor shall document the results of the test spectra sensitivity studies below in the P-3C FSFT Fatigue Test Plan, Vol I – Test Spectrum Development Report ***(CDRL C001)***.

3.7.2.1 Truncation Sensitivity Studies

If the contractor truncates the test spectra by removing non-damaging lower amplitude cycles, the number of randomly ordered missions or load points within a mission shall be minimized without degrading the final truncated spectra. The proper sequence of events within each flight, namely, taxi, takeoff, climb, etc., shall be maintained. Load points defining GAG cycles also shall be preserved. The contractor shall perform analytical sensitivity studies to determine the maximum amount of truncation that can be accomplished while maintaining a goal of achieving 100% required calculated fatigue damage in all primary structure. The contractor shall also perform coupon testing to verify the analytical results (see SOW paragraph 3.16.1.2).

3.7.2.2 Test Spectra Clipping Studies

The contractor shall perform analytical evaluations to quantify potential impacts on fatigue life and crack growth characteristics resulting from peak load clipping and to optimize block size for testing. The contractor shall also perform coupon testing to verify the findings of these studies. (see also SOW paragraph 3.16.1.2).

3.7.3 Deleted

3.7.4 Deleted

3.8 TEST FACILITY SET-UP (CLIN 0015)

The contractor shall perform the following tasks in preparation of FSFT of the wing/fuselage, empennage, and landing gear test articles.

3.8.1 Jack Loads Determination

The contractor shall document the derivation and details of load application, jack loads, jack load conversion to moment/shear/torsion curves, and comparison with the analytical loads in accordance with ***CDRL D001***.

3.8.1.1 Jack Load Derivation

The contractor shall derive the test jack loads and the load application points for the test spectra developed in SOW paragraph 3.7. These jack loads shall be applied at locations which shall include, but are not limited to, the wings, fuselage, empennage, engine nacelles, NLG and MLG and its back-up structure. The jack loads shall adequately represent all fatigue loading actions due to flight (e.g., maneuver, gust and tail buffet), landing, ground operations (including taxi, braking, turning, and pivoting), cabin pressure, and internal fuel pressure.

3.8.1.2 Jack Load Validation/Verification

Upon conversion of the test spectrum of SOW paragraph 3.7 to jack loads and prior to testing, the contractor shall select at least five (5) representative load cases from the flight, landing and ground operation regimes. For the wing, fuselage, empennage structures, primary flight control surfaces, and landing gears , the contractor shall convert the corresponding jack loads to moment, shear, and torsion curves for each of the selected load cases. The contractor shall compare the above results with the analytically derived loads for the same load conditions to demonstrate equivalency for the purposes of the FSFT. The contractor shall also use the P-3C FEM to ensure that the jack loading do not cause the internal loads (i.e., stress, strain and displacement, etc.) to increase/redistribute significantly, which may adversely impact static and fatigue strength as well as fracture characteristics locally or elsewhere on the aircraft.

3.8.2 Test Fixture Design, Fabrication and Assembly

The contractor shall design, fabricate, assemble and install load reaction frames, loading fixtures, loading attachments, hardware necessary for load introduction (e.g., QEC, landing gear, etc.), hydraulic system, cabin pressurization system, fuel tank pressurization system, cabin safety relief system, and fuselage safety screen. The contractor also shall design, fabricate and install, or procure and install fuel tank bladders for pressurizing fuel tanks, if required. The contractor shall document the designs and analyses of the fixtures in accordance with ***CDRL D001***. This shall include, as a minimum, a detailed description of test fixture and test site (including sketches, figures, drawings, etc.) and documentation of stress/loads analyses on the test fixture and on test article local structure at fixture load attachment/introduction locations.

3.8.2.1 Fixture Design

The contractor shall design the FSFT loading system to include, but not limited to, loading fixtures, load reaction frames, loading attachments, substitute hardware necessary for load introduction (e.g., engines and landing gear), hydraulic system, cabin pressurization system, cabin pressure safety relief system, and fuselage safety screen. If dummy landing gear and/or some fixture arrangement (substitute hardware) is used to introduce loads into the back-up structure, the dummy gear and/or fixture arrangement shall be representative of actual P-3C landing gear in terms of stiffness and load path. Where applicable, the contractor may design modifications to existing test fixtures which will allow their use on this FSFT. These designs shall: 1) enable the test articles to be restrained in a statically determinate manner during each loading point; 2) be capable of applying and reacting the required loads up to the P-3C aircraft design ultimate loads, as a minimum; 3) be able to withstand the repeated applied loadings for entire test duration; 3) incorporate design provisions to facilitate quick and easy disassembly/re-assembly (e.g., modular design, mechanical attachments, accessibility, etc.) for periodic inspections/repairs to be conducted at various intervals throughout the duration of the FSFT; 4) incorporate provisions for quick and safe unloading of the test articles in the event of unexpected occurrences/emergencies; and 5) incorporate provisions for symmetric unloading of the test articles, when unloading is required (for inspections, etc.). The contractor shall propose and submit a P-3C FSFT Fatigue Test Plan, Vol. VII - Fixture Design Concept Report in accordance with ***CDRL D001***.

3.8.2.2 Test Site Design

The contractor shall design all required test site modifications; including, but is not limited to, reaction frame, caissons and floor tie-downs, hydraulic and pneumatic piping, instrumentation cable ways, and test site utilities. These designs shall: 1) enable the test article to be restrained in a statically determinate manner during each loading condition; 2) be capable of applying and reacting the required loads up to ultimate loads; and 3) incorporate provisions to facilitate periodic inspections (i.e., assembly/disassembly, accessibility, etc.) to be conducted at various intervals throughout the duration of the FSFT.

3.8.2.3 Fixture Analysis

The contractor shall specify load attachment points and derive test actuator loads for all discrete load points. A stress analysis shall be performed to verify the loading fixture arrangement. This analysis shall include, but is not be limited to, stress analysis on the test fixture itself and examination of test article local structure at fixture load attachment/introduction locations to verify that local load introduction will not precipitate static or fatigue failures. The contractor shall also investigate, including analysis and mechanical testing as required, the attachment methods and reactions of loading pads, whiffle trees, jacks, etc. to each other and to the test articles in order to ensure that no portion of the fixture arrangement will inadvertently separate during the entire testing.

3.8.2.4 Fabrication (CLIN 0017)

The contractor shall fabricate new test fixture items and modify existing test fixture items (as applicable) in accordance with the test fixture designs accomplished under SOW paragraph 3.8.2.1.

3.8.2.5 Assembly (CLIN 0018)

The contractor shall assemble the FSFT loading system and test fixture in accordance with the test fixture designs accomplished under SOW paragraphs 3.8.2.1 and 3.8.2.2.

3.8.3 Loads Control and Data Acquisition Systems

The method of data acquisition, and the number and type of recording devices for each test article shall be proposed by the contractor for approval by NAVAIR ***(CDRL D001)***. The contractor shall provide a loads control system with a minimum of 128 control channels, and a data acquisition system with a minimum of 512-channel capacity. These systems will be dedicated to the wing/fuselage test and the follow-on tests of the NLG, MLG. The empennage test shall run concurrently with the wing/fuselage test, and shall therefore require a separate contractor-furnished loads control system, with a minimum of 36 control channels, and a data acquisition system with a minimum of 216-channel capacity.

3.9 TEST ARTICLE ASSESSMENT AND PREPARATION (CLIN 0019)

3.9.1 Fatigue Test Articles Assessment

3.9.1.1 Determine Fatigue Damage Accumulated on Test Articles

The contractor shall review the aircraft logbooks and all available usage information related to the aircraft history in order to support assessments of the fatigue damage accumulated on the test aircraft. The contractor shall develop quality control criteria to screen the good usage data, and determine the appropriate gap filling procedure for the bad and/or missing usage data. For the purpose of re-baselining fatigue damage, the gap filling procedures used shall NOT result in the most conservative estimate of accrued fatigue damage for the test aircraft. Using the results of the test article inspection and the aircraft data evaluation, the contractor shall develop fatigue spectrum for all critical locations, and perform fatigue analyses to calculate the fatigue damage accumulated to date on the test aircraft. The contractor shall submit these analyses and associated assessments of test article accumulated fatigue damage in the P-3C FSFT Fatigue Test Plan, Vol. III – Test Article Assessment Report ***(CDRL D002)***.

3.9.1.2 Determine Aging Requirements for Test Articles

3.9.1.2.1 Estimate Average Fleet Aircraft Fatigue Damage at SLEP Kit Installation

The contractor shall determine the estimated level of fatigue damage accumulated on the average fleet aircraft at the time of the earliest planned SLEP kit installation (FY04). This assessment shall be based on current P-3C usage trends and projection in number of flight hours, number of landings, mission mix, N_z exceedances, etc.. The contractor shall also take into account the overall schedule of the entire FSFT effort as to when the SLEP kit could be "life certified" for fleet installation, since the SLEP kit installations will not begin prior to completion of the FSFT and post-test teardown and analysis. The contractor shall document the results in P-3C FSFT Fatigue Test Plan ***(CDRL D002)***.

3.9.1.2.2 Calculate Test Article Age Requirements

Once the estimated level of fatigue damage of SOW paragraph 3.9.1.2.1 is established, the contractor shall determine the amount of additional fatigue damage required for each of the test articles in order to accumulate damage equivalent to the average fleet aircraft fatigue damage at SLEP kit installation. The contractor shall document the results in P-3C FSFT Fatigue Test Plan ***(CDRL D002)***.

3.9.2 Test Articles Preparation

The contractor shall specify all aircraft equipment which are not required for the fatigue test. The contractor shall prepare and maintain a test article configuration top drawing and remove all non-test related structure and equipment (e.g., QEC, wiring, plumbing, etc.) ***(CDRL D002)***. The contractor shall comply with all local, state and federal environmental and safety regulations while performing the following tasks.

3.9.2.1 Receive Test Aircraft

Upon arrival at the contractor's facility, the contractor shall prepare the aircraft for safe ground handling/operations. The contractor shall perform the following: 1) defuel and purge the fuel tanks; 2) weigh the test aircraft (the mass distributions of SOW paragraph 3.2.1.1 shall be evaluated based on the test aircraft weight); 3) remove and preserve engines and propellers, and return to Government custody; 4) remove all equipment that is not required for the fatigue test, and return to Government custody (see also SOW paragraph 3.9.1); 5) pressurize the aircraft, establish leak rates, identify any leakage sites; and, 6) secure the aircraft in a hangar and provide external access. While waiting for aircraft disassembly, re-assembly or prior to installing into the test fixtures, the contractor shall ensure proper preservation for the test aircraft.

3.9.2.2 Disassembly and Reassembly of Test Articles

The contractor shall not disassemble/remove any primary structures of the P-3C test aircraft without prior NAVAIR written approval EXCEPT as specified in this SOW. The contractor shall use the most highly qualified artisans, minimize the frequency and degree of disassembly/re-assembly as much as possible, and shall exercise extreme care and caution in performing this task to avoid incurring any potential damage to the test articles. The contractor shall provide adequate and sufficient supporting shoring to ensure no damage to the structure as well as the structure's local hardware and attachments.

3.9.2.2.1 Wing/Fuselage Test Article

The contractor shall remove the empennage from the test aircraft. The remaining structure shall be used as the test article to test the wing and the fuselage. (NOTE: Do not remove outer wing panels from the fuselage without NAVAIR authorization.) The contractor shall install a P-3 empennage supplied by the Navy (GFE) onto the test article at FS 1117, and utilize this "dummy" structure to introduce/react loads into the aft fuselage. The contractor shall provide sufficient shoring support to ensure no damage to the removed structures as well as structure's local hardware and attachments. The local attachments shall be inspected and/or replaced prior to re-installation. The contractor shall remove the QEC and replace it with loading structure to introduce loads into the nacelle, if applicable. The contractor shall keep the wing leading edge and trailing edge control surfaces on the aircraft. These surfaces shall be utilized for load introduction into the wing. The contractor shall repeat pressurization checks of the fuselage. If the landing gears are to be tested separately, the contractor shall remove and replace with "dummy" gears (see SOW paragraph 3.9.2.2.3). The contractor shall design these test fixtures to be able to properly transmit the loads to the back-up/mounting structures, and to ensure that the strength and rigidity of the actual structure are properly maintained.

3.9.2.2.2 Empennage Test Article

The contractor shall utilize the empennage structure removed from the test aircraft for testing of the empennage. This empennage shall be mounted onto a section of fuselage supplied by the Navy (GFE). The length of non-test fuselage structure required forward of FS 1117 should be no less than two to three frame stations away from the pressure bulkhead, but shall be long enough to react the loads into the testing fixtures. The leading edge, rudder, and elevator shall be retained on the empennage, and shall be used for load introduction.

3.9.2.2.3 Landing Gear Test Article

The contractor may utilize the wing/fuselage test article's landing gear for the testing of the landing gear. If the contractor chooses to test the landing gear separately, the landing gear shall be removed from the wing/fuselage test article and installed into a separate test fixture. Landing gear backup structure must be included in this test to accurately react loads into the test fixture.

3.9.2.3 Detailed Inspection

The contractor shall conduct a detailed inspection of all test articles, supplemented by standard instrumented non-destructive inspection (NDI) methods and other state-of-the-art NDI techniques approved for this program. The contractor shall accomplish, as a minimum, the following:

a) The contractor shall review aircraft logbook, SRP inspection records, etc. and document all structural significant findings. The contractor shall identify the material condition, any structural damage, and existing repairs required to be addressed for all test articles. The contractor shall recommend disposition for all findings ***(CDRL D002)***.

b) The contractor shall identify and document any significant structural differences between test article configuration and the P-3C UPDATE III production configuration for all test articles. (see also SOW paragraph 3.9.2.8).

c) The contractor shall identify by specific locations, weight and document any equipment installed on the test articles that will be removed prior to test (including, but not limited to, the engines), as well as any repair/modification/rework/ replacement required due to removal of this equipment.

d) The contractor shall identify any other repair/modification/rework/replacement which must be accomplished on the test articles prior to testing. This shall include, but not be limited to, any repair/modification/rework/replacement required to prepare the test articles for installation into the test fixtures ***(CDRL D002)***.

3.9.2.4 Design of Repairs and Development of Rework Procedures (O&A) (CLINs 0040, 0125 and 0239)

Upon receipt of Navy approval, the contractor shall design, analyze all repairs, and generate all rework procedures (e.g., part replacement, cold-working of fastener holes, etc.) required to address all issues identified in SOW paragraph 3.9.2.3, as well as during the conduct of the test (see SOW paragraphs 3.1.9 and 3.10.3). As part of this design effort, the contractor shall perform all necessary static strength, stress, loads, fatigue, damage tolerance and weight and balance analyses, component testing, and any tooling design required to support the repair/modification/rework/replacement effort. The contractor shall document all analyses, drawings etc. in accordance with ***CDRLs J001, T001 and AG01***.

3.9.2.5 Fabrication and Installation of Repairs, Modifications and Reworks (O&A) (CLINs 0040, 0125 and 0239)

The contractor shall fabricate, install and perform all repairs, reworks and modifications identified in SOW paragraph 3.9.2.4 upon NAVAIR approval.

3.9.2.6 Cabin Pressurization Re-Check

The contractor shall repeat the cabin pressurization check of the wing/fuselage test article (conducted in SOW paragraph 3.9.2.2.1) in order to verify that repairs conducted were effective in bringing test article cabin leakage rates within acceptable limits.

3.9.2.7 Markings

Prior to test, a number of buttock lines, water lines, fuselage stations, and wing stations shall be painted on the test structures. These should be clearly defined and of sufficient number to facilitate determining all desired reference points on the test articles.

3.9.2.8 Test Article Configuration Control

The contractor shall document the results of SOW paragraphs 3.9.2.1 through 3.9.2.7, including a description of all repair/modification/rework/replacement required on the test articles, and submit to the Navy for review and approval ***(CDRL D002)***. This report shall also include a list of any GFE/GFM/GFI required to accomplish the repair/modification/rework. The contractor shall continue to update the test article configuration reports throughout the test program to reflect any repairs, modifications, reworks and replacements.

3.9.2.9 Test Articles Instrumentation

The contractor shall provide a detailed description (i.e., drawings, digital photographs, etc.) of the instrumentation locations, types, actual set-up, calibration plan, loads control and data acquisition systems, etc. for the wing/fuselage, empennage, and landing gear test articles (P-3C FSFT Fatigue Test Plan***, CDRL D002)***.

3.9.2.9.1 Determination

The contractor shall determine the instrumentation requirements for all test articles to enable collection of the necessary strain and deflection data for test load verification and test interpretation analyses. The contractor shall determine the appropriate sensor types (strain, force, deflection, position, pressure and temperature) to be used at each location. The wing/fuselage test article shall utilize a minimum of 700 axial strain gages and 100 rosettes. The empennage test article shall utilize a minimum of 250 axial strain gages and 50 rosettes. The nose and main landing gear test articles shall each have a minimum of 25 axial strain gages. The contractor shall ensure that appropriate back-up gages are installed and working properly in the event the primary gages fail. All required instrumentation and associated hardware shall be provided as contractor-furnished equipment (CFE). The contractor shall submit a list of all instrumentation and their locations in accordance with ***CDRL D002***.

3.9.2.9.1.1 Instrumentation Location Criteria

The selection of instrumentation locations shall be assessed under the following criteria for the left and right outer wings, center wing, fuselage, empennage, landing gears and their back-up structure:

a) Critical Locations. The contractor shall select instrumentation to monitor the primary strains that drive fatigue damage at the fatigue critical locations. Instrumentation of the test articles critical locations, as defined in paragraph 3.3.3 shall receive the highest priority.

b) Loading Accuracy. The contractor shall propose instrumentation to verify the loading distribution (i.e., axial, shear, bending and torsion) throughout the test articles and at important structural interfaces. These locations shall include, but not be limited to, the fuselage, horizontal and vertical stabilizer, and a minimum of five (5) outer wing station (OWS) locations on each wing. These data will be used to assess the accuracy of the applied loading. Under this criterion, the contractor shall duplicate all USN and FMS on-board fatigue usage monitoring systems strain gauge locations. The contractor shall also duplicate a sufficient number (to be proposed by the contractor) of flight test loads program load gauges and other transducers, if available, to allow comparison of flight test loads to fatigue test loads on the fuselage, horizontal and vertical stabilizer, center wing, both outer wings, and landing gears.

c) Previous Testing. The contractor shall propose instrumentation of locations replicated from previous P-3 or Electra fatigue testing to allow correlation of the P-3 SLAP test results with previous significant test results.

d) FEM Validation/Verification. The contractor shall propose instrumentation to allow validation/verification of the FEMs, previously defined in paragraph 3.2.3.1.2. Instrumentation shall consider both strain gauge and displacement transducer requirements.

e) Test Articles and Transition Structure Safety. The contractor shall select instrumentation that will be continuously monitored to ensure that the history of the structure during abnormal shutdown is recorded and the introduction of non-representative damage to the test article is minimized.

3.9.2.9.1.2 Outer Wing Test Articles

The instrumentation proposed for the LHS outer wing test article shall be duplicated on the RHS outer wing test article, except for SLEP kit-specific instrumentation.

3.9.2.9.1.3 Pre/Post Aging Instrumentation

The contractor shall delineate the instrumentation required for the aging phase of the FSFT and the final instrumentation required after installation of the SLEP kit on all test articles.

3.9.2.9.1.4 Data Acquisition Strategy

The contractor shall provide a data acquisition strategy for monitoring the instrumentation requirements stated in paragraph 3.9.2.9.1.1. The data acquisition strategy shall list the instrumentation to be continuously monitored, selectively monitored and the data capture rates. The contractor shall also define the periods at which full blocks of data will be collected for all instrumentation installed on the test articles. As a minimum, a full test block shall be collected directly after test start (after the test rig has settled), directly before the SLEP kit installation, directly after SLEP kit incorporation (after the test rig has settled), and at the end of the first and second lifetimes. Full blocks of data shall also be recorded following significant changes to the structure of the test articles through modification or repair action. The data acquisition strategy shall also define instrumentation switching criteria should the number of instrumentation channels exceed the number of channels available on the data acquisition system. ***(CDRL D002)***

3.9.2.9.1.5 Instrumentation Database

The contractor shall create a database to provide a comprehensive record of the instrumentation selection and installation information. Instrumentation selection information shall include instrumentation type, location and origin. Instrumentation installation information shall include post installation quality control and installation verification data. The database shall be compatible with the databases to be used for test data storage and damage recording and disposition. ***(CDRL D002)***

3.9.2.9.2 Installation, Calibration and Maintenance

The contractor shall install and calibrate all instrumentation used in performing the tests. All instruments and instrument systems shall be installed in accordance with the highest industry standards of mechanical, electrical and electronic installation practices. All transducers and gage installations shall be properly located, be properly damped, have flat frequency response characteristics commensurate with the frequencies of excitation for the variable measured, and be properly mounted to assure valid measurements and freedom from extraneous excitations. Calibration of each transducer or gage installation shall be made through the signal-conditioning equipment as installed in the laboratory to at least the maximum range of excitation expected during the course of the tests. Calibration test measurements shall be obtained and recorded during both increasing and decreasing values of the pertinent parameter which the instrument is intended to measure, to assure repeatability and freedom from hysteresis. All strain-gage installations on simple and complex structures shall be installed to minimize interactions or "cross-talk" during combined loadings; however, if such interactions do exist, they shall be properly accounted for during the calibration. The instrumentation shall be operated and maintained by the contractor during the test program. A detailed description of all instruments, methods of calibration, locations of instruments and calibration data for each test and test article shall be documented and submitted prior to installation in accordance with ***CDRL D002***.

3.9.2.9.2.1 Initial Instrumentation Installation

Prior to commencement of the test, the contractor shall instrument the test article locations determined in SOW paragraph 3.9.2.9.1 for the aging phase of the FSFT.

3.9.2.9.2.2 Final Instrumentation Installation

After completion of aging of the test articles and installation of the SLEP kit on the test articles, the contractor shall instrument the test article locations affected by SLEP kit installation as determined in SOW paragraph 3.9.2.9.1.

3.10 TEST PLANNING (CLIN 0021)

The contractor shall perform the following test planning tasks in preparation of FSFT of the wing/fuselage, empennage, and landing gear test articles.

3.10.1 Test Conduct

The contractor shall develop a comprehensive, detailed and integrated plan outlining the actual conduct of the wing/fuselage, empennage, and landing gear tests. The contractor shall determine the duration of the tests, appropriate sequencing of significant test events, inter-discipline coordination as well as any other details required for conducting the tests in its entirety. The contractor may propose a tailored SLEP kit installation for items that are overlapping with the SRP kits and/or have been pre-emptively replaced. The plan shall include, but not be limited to, 1) aging of the test articles as determined in SOW paragraph 3.9.1.2, 2) installation of the tailored SLEP kit on the test articles (SOW paragraph 3.12.2), 3) installation of instrumentation on the test articles before and after SLEP kit installation (SOW paragraph 3.9.2.9.2), 4) full-scale testing required to demonstrate the ability of the P-3 airframe to achieve the service life goals of SOW paragraph 3.1.1 as well as any additional testing requirements, 5) application of marker loads to the test articles to delineate the various phases of testing accomplished, 6) disposition action/procedure for unexpected and premature airframe failures including manpower management during potential extensive test downtime, and 7) contingency provision for back-ups/spares in the event of test system malfunction ***(CDRL D003)***.

3.10.2 Test Inspections

The purpose of applying non-destructive inspection (NDI) techniques to the P-3C fatigue test articles is two-fold. First and foremost, NDI provides critical information about where and when crack initiation occurs prior to ultimate or catastrophic failure of the part. Once a crack is identified, NDI can provide information on crack severity and growth rates, thus providing data which will be useful in validating analysis methodology, correlating with predicted results, and determining fleet in-service inspection intervals. The second purpose for applying NDI to this fatigue test program is to assess/validate/verify emerging NDI technologies which may be capable of remotely monitoring inaccessible fatigue critical structures in real time, and which may detect hidden damage due to stress corrosion and exfoliation. For this reason, the contractor shall investigate, assess, obtain/procure and incorporate a variety of state-of-the-art remote crack monitoring technologies into the test program. As a minimum, the contractor shall consider the following:

a) Pulsed and Superconductive Quantum Interference Device (SQUID) eddy current

b) Laser-based Ultrasonic, Mobile Automated Ultrasonic System

c) Acoustic Emission

d) Thermal Imaging

e) Meandering Winding Magnetometer

f) Digital and real time X-ray

g) Fiber Optics Bragg Gratings

The contractor shall submit a NDT/I plan which includes a list of proposed inspection locations, a description of proposed crack detection techniques, instrumentation, inspection techniques, detection accuracy, calibration standards, and plan for detailed inspection as well as state-of-the-art technology assessment plan in accordance with ***CDRL D003***. The contractor shall make available to the Government the NDI equipment and standards for a period of 365 days for their evaluation. All equipment and standards procured on this contract shall be delivered to the Government at the completion of the program **(CLIN 0011)**.

3.10.2.1 Periodic Inspections

The contractor shall determine the periodic inspections required and conduct these inspections during aging of the test articles, full-scale test, additional full-scale testing, damage tolerance testing and residual testing in order to adequately monitor test progress. This determination shall include, but not be limited to, the type of inspection to be conducted (i.e., minor, major, conditional, etc.), the level of disassembly/removal required for accessibility, frequency/interval of inspections, estimated duration of each inspection, inspection methods (type of NDT/I, etc.), test article locations to be inspected during each inspection. The periodic inspections conducted during the fatigue test shall include, as a minimum, the following:

a) Daily test fixture/set-up inspection in order to ensure test system integrity.

b) General visual inspections in areas accessible without requiring extensive removals conducted every 250 FTSH. All visually suspect areas shall be inspected with instrumental or chemical NDI for confirmation of the indication.

c) Remotely queried and in-situ monitoring systems queried every 250 FTSH as a minimum. Areas which indicate crack growth, as detected by the remote monitoring systems, shall be disassembled to the degree necessary to gain access to inspect them using conventional NDI methods during the next scheduled inspection or extended test down time, whichever occurs first.

d) As a minimum, a major test article inspection on each test article, including instrumental NDI on all fatigue critical areas identified in SOW paragraph 3.3.3 and any crack indications detected during the test, at the completion of aging of the test articles (prior to and/or during SLEP kit installation on the test articles), at the completion of one (1) lifetime, one and one half (1½) lifetimes, and two (2) lifetimes.

The contractor shall document and report all findings as well as maintaining all records of NDI results on digital format (CD-ROM, DVD) ***(CDRL L002 and L003)***.

3.10.3 Test Anomalies Disposition

The contractor shall generate a plan for classifying (i.e., minor, major, critical), documenting, reporting and disposition procedure of failures, cracks, anomalies and defects discovered during testing and inspections. Repair of cracks on parts other than the SLEP kit items shall be considered as O&A works (see SOW paragraph 3.1.9). The plan shall contain provisions and methods (e.g., email, video-conference, telephone, secured website, digital photograph, etc.) for the contractor to report each failure/anomaly to NAVAIR in the most expeditious manner as possible, but no later than 24 hours after occurrence (see also SOW paragraph 3.1.4). The plan also shall detail the circumstances under which the contractor requires or does not require NAVAIR approval prior to proceeding with disposition of the failure and continuing the test. (see also SOW paragraph 3.1.9) ***(CDRL D003)***

3.11 RIG/TEST ARTICLE COMMISSIONING (CLIN 0101)

3.11.1 Test Assembly

The contractor shall install the test articles into the FSFT loading fixture, perform hook up and check out all loading systems and instrumentation. The contractor shall perform pre-test strain surveys using selected loading conditions (see also SOW paragraph 3.11.3.1). The contractor shall document the entire installation procedure in accordance with ***CDRL K001***.

3.11.2 System Verification and Work-up

3.11.2.1 Applied Jack Loads Verification

The contractor shall convert the applied jack loads and the commanded jack loads to airframe shears, moments and torques, and compare with the required analytical spectra of SOW paragraph 3.3.4 to confirm compliance. The contractor shall perform this procedure at the start of testing; after 100 FTSH, 500 FTSH, and 1000 FTSH; and every 1000 FTSH until the end of testing. The contractor shall make appropriate adjustments to the applied test loads.

3.11.2.2 Fatigue Test Loads Correlation

Using stress-to-load ratios, the test jack loads and test pressures (fuselage and fuel) developed in SOW paragraph 3.8.1.1, the contractor shall perform fatigue analysis for each critical location to ascertain the goal of achieving 100% fatigue damage in all primary structure. The contractor also shall perform crack growth analysis for all critical locations using the test spectra to correlate with analytical crack growth results, coupon and component testing data to make sure that the crack retardation effect is not excessive, and the crack growth characteristic as well as associated failure mode is consistent. The contractor shall make appropriate adjustments to the applied test spectra. The contractor shall document all analysis and test spectra adjustments, and submit in accordance with ***CDRL K001***.

3.11.3 Initial Strain Survey

The contractor shall perform a strain survey at least once before the aging phase, and upon completion of the SLEP kit installation. The contractor shall document the results of the below paragraphs in accordance with ***CDRL K001***.

3.11.3.1 Strain Survey Loads Selection

The contractor shall select a minimum of five (5) load cases for each major component (wing, fuselage, horizontal stabilizer, vertical stabilizer, and landing gears) from the loads data as updated in SOW paragraph 3.2 to perform the pre-test strain surveys. (see SOW paragraph 3.8.1.2)

3.11.3.2 Strain Survey Loads Correlation

The contractor shall apply the test jack loads and test pressures (fuselage and fuel) developed in SOW paragraphs 3.7.1 and 3.8.1 to the P-3C FEM. The contractor shall correlate the strains predicted with the analytical loads and the strains predicted for the test loads and pressures for each of the strain survey loads cases identified in the above SOW paragraph 3.11.3.1.

3.11.3.3 Test Article Strain Survey

The contractor shall apply test jack loads and test pressures from the selected loads cases of SOW paragraph 3.11.3.1 to the test article, measure and record the resulting strains. The contractor shall compare the measured strains to those predicted using the P-3C FEM. The contractor shall make appropriate adjustments to the test jack loads and test pressure to correlate with the analytical results.

3.12 FULL-SCALE FATIGUE TEST (CLIN 0104)

The contractor shall conduct full-scale fatigue testing on the test articles to demonstrate the ability of the P-3C airframe to meet the service life goals of SOW paragraph 3.1.1. This testing shall be subject to a scatter factor of two (2). The contractor also shall apply constant amplitude marker load cycles at 10,000 FTSH intervals as a minimum. The contractor shall generate and provide P-3C FSFT Failure Notification Reports ***(CDRL L001)*** as required throughout the conduct of the test. The contractor shall perform failure analyses for all unexpected failures. Failure analysis of structures other than SLEP kit items shall be considered O&A work. The contractor shall document this failure analysis in ***CDRL U003***. The contractor also shall provide a P-3 FSFT Periodic Inspection Results Report (with revisions as required for each inspection) ***(CDRL L002)*** documenting the results of all periodic inspections required (see also SOW paragraph 3.9.2.3).

3.12.1 Aging of Test Articles

The contractor shall age the test articles to the estimated level of fatigue damage accumulated on the average fleet aircraft at the time of the planned SLEP kit installation. Aging of the test articles shall <u>not</u> be subject to any scatter factor. The contractor shall apply marker loads to the test articles to identify this point in the test.

3.12.2 SLEP Kit Installation (CLIN 0103)

After completion of the aging of the test articles, the contractor shall install the tailored SLEP kit (see SOW paragraph 3.10.1) on the test articles using the ECP provided under SOW paragraph 3.6.9. The contractor shall install the remaining SLEP kit (including kit items for the center wing), with NAVAIR approval, when the corresponding part/sub-assembly/assembly fails prematurely during the fatigue test, or at the end of two lifetimes, whichever occurs first. Installation on the test articles may require modification or a separate set of tooling to accommodate the test fixtures and the lack of accessability. All enhancements/modifications/replacements required on the fuselage and wing structures shall be installed on the wing/fuselage test article EXCEPT for the RHS outer wing, and all enhancements/modifications/replacements required on the empennage structures shall be installed on the empennage test article (see also SOW paragraph 3.1.2.1). All required planning tickets and working instructions shall be completed, validated and verified with Government review and approval prior to installing the SLEP kit on the test articles ***(CDRL B002)***. During the installation of the kit, the contractor shall identify any required changes resulting from the installation (see SOW paragraphs 3.6.3 and 3.6.2.3.1). The contractor shall install additional instrumentation on the areas of the test articles modified by the SLEP kit in accordance with SOW paragraph 3.9.2.9.2.2.

3.12.3 Testing

Repair of cracks on parts other than the SLEP kit items shall be considered as Over and Above (O&A) work (see SOW paragraph 3.1.9).

3.12.3.1 Wing/Fuselage

The contractor shall perform fatigue testing on the test article by applying the fatigue test spectrum. The contractor shall conduct scheduled inspection of the test article in accordance with the inspection schedule developed under SOW paragraph 3.10.2.1. The contractor shall perform minor repairs as required, with Government approval, to permit completion of testing.

3.12.3.2 Empennage

The contractor shall perform fatigue testing on the test article by applying the fatigue test spectrum. The contractor shall conduct scheduled inspection of the test article in accordance with the inspection schedule developed under SOW paragraph 3.10.2.1. The contractor shall perform minor repairs as required to permit completion of testing.

3.12.3.3 Landing Gear

The contractor shall conduct a landing gear test for the NLG and MLG (LHS only), as well as their associated backup structure, either with a separate test fixture or with the wing/fuselage test article. If the later approach is preferred, the contractor shall reinstall the landing gear (if the dummy gear was used) on the fuselage and wing for testing upon completion of the fuselage/wing test as determined by NAVAIR. The contractor shall perform fatigue testing on the test article by applying the fatigue test spectrum for a total of 47,154 landings with a scatter factor of two (2). The contractor shall conduct scheduled inspection of the test article in accordance with the inspection schedule developed under SOW paragraph 3.10.2.1. The contractor shall perform minor repairs as required to permit completion of testing to 47,154 landings with a scatter factor of two (2).

3.13 EXTENDED FATIGUE TESTING

The contractor shall perform additional full-scale fatigue testing and ensure that all testing and loading fixtures shall not fail prematurely during any of the extended testing. The contractor shall be responsible for replacement/rework/repair of all testing fixtures and equipment to achieve the tasks listed below. The contractor shall also be responsible for planning the additional testing and providing the hardware to conduct the test. All repairs of cracks shall be considered as O&A for this phase of testing.

3.13.1 Wing/Fuselage Test Article (CLIN 0111 and 0221)

Upon test completion of the first two lifetimes, the contractor shall continue to conduct the wing/fuselage fatigue test for:

a) Three (3) additional 10,000 FTSH blocks **(CLIN 0111) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL Q001*** (see also SOW paragraph 3.17.2.1).

b) Additional 10,000 FTSH **(CLIN 0221AA) –** The contractor shall remove the LHS wing (outboard of BL 65) and replace with a "dummy" LHS outer wing (GFE). Prior to installation, the contractor shall replace the "dummy" LHS outer wing lower wing planks, forward upper and lower spar caps and corner fittings with the new material parts and disposition all detected cracks and/or defects, with NAVAIR approval. The contractor shall also remove and replace the LBL65 splices, "paddle" fittings and corner fittings inboard of BL65 with the new material replacements. The contractor shall use the SLEP kit "production" installation tooling to perform these above tasks. After re-installing the loading pads, fixtures and instrumentation, the contractor shall perform a strain survey prior to resuming any additional testing. Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AB01*** (see also SOW paragraph 3.17.2.1).

c) Additional 10,000 FTSH **(CLIN 0221AB)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AB01*** (see also SOW paragraph 3.17.2.1).

d) Additional 10,000 FTSH **(CLIN 0221AC)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AB01*** (see also SOW paragraph 3.17.2.1).

e) Additional 10,000 FTSH **(CLIN 0221AD)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AB01*** (see also SOW paragraph 3.17.2.1).

3.13.2 Empennage Test Article (CLIN 0113 and 0223)

The contractor shall continue to conduct the empennage fatigue test for:

a) Three (3) additional 10,000 FTSH blocks **(CLIN 0113) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL R001*** (see also SOW paragraph 3.17.2.1).

b) Additional 10,000 FTSH **(CLIN 0223AA) –** The contractor shall severe HSS spar caps at B.L. 20's (8 places total) and install repairs prior to test re-initiation. Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AC01*** (see also SOW paragraph 3.17.2.1).

c) Additional 10,000 FTSH **(CLIN 0223AB) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AC01*** (see also SOW paragraph 3.17.2.1).

d) Additional 10,000 FTSH **(CLIN 0223AC) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AC01*** (see also SOW paragraph 3.17.2.1).

e) Additional 10,000 FTSH **(CLIN 0223AD) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document and disposition all detected defects in accordance with ***CDRL AC01*** (see also SOW paragraph 3.17.2.1).

3.13.3 Landing Gear Test (CLIN 0115 and 0225)

The contractor shall continue to test the landing gears for:

a) **Three (3) additional** 25,000 landings blocks **(CLIN 0115) –** Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document and disposition all detected defects in accordance with ***CDRL S001*** (see also SOW paragraph 3.17.2.1).

b) Additional 25,000 landings **(CLIN 0225AA) –** The contractor shall remove and replace the LHS MLG main cylinder pistol with a High Velocity Oxygen Fuel (HVOF) coated part (GFE), and the NLG and MLG drag struts and side braces with the redesigned parts prior to test re-initiation. Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document and disposition all detected defects in accordance with ***CDRL AD01*** (see also SOW paragraph 3.17.2.1).

c) Additional 25,000 landings **(CLIN 0225AB) –** Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document and disposition all detected defects in accordance with ***CDRL AD01*** (see also SOW paragraph 3.17.2.1).

3.14 DAMAGE TOLERANCE TESTING (CLIN 0227)

Upon completion of the fatigue/durability test phase to be determined by NAVAIR, the contractor shall conduct full-scale damage tolerance testing to demonstrate compliance with the requirements of SOW paragraph 3.1.3.3. The contractor also shall gather crack growth data for analysis verification and inspection interval determination. If no crack existed or is detected at the end of the fatigue/durability testing phase, the contractor may be required to embed flaw(s) at hot spot(s) and/or multiple sites to induce crack growth. The contractor shall develop a plan for this damage tolerance test effort and document in the P-3C FSFT Damage Tolerance Test Plan ***(CDRL AE01)***.

3.14.1 Wing/Fuselage Test Article (CLIN 0227AA)

The contractor shall recommend to NAVAIR the number of flaws, size, shape and orientation etc., as well as the method(s) to insert a flaw(s) in the structures. The contractor shall conduct 10,000 FTSH of full-scale damage tolerance testing on the wing/fuselage test article. The contractor shall be responsible for the planning and the conduct of the entire test. The contractor shall monitor, digitally video and photographically record all crack growths. The contractor shall document all results in a P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

3.14.1.1 Additional Wing/Fuselage Testing

The contractor shall continue to test the wing/fuselage for an:

a) Additional 10,000 FTSH **(CLIN 0227AB)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

b) Additional 10,000 FTSH **(CLIN 0227AC)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

c) Additional 10,000 FTSH **(CLIN 0227AD)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

d) Additional 10,000 FTSH **(CLIN 0227AE)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

e) Additional 10,000 FTSH **(CLIN 0227AF) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

f) Additional 10,000 FTSH **(CLIN 0227AG) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

3.14.2 Empennage Test Article (CLIN 0227AH)

The contractor shall recommend to NAVAIR the number of flaws, size, shape and orientation etc., as well as the method(s) to insert a flaw(s) in the structures. The contractor shall conduct 10,000 FTSH of full-scale damage tolerance testing on the empennage test article. The contractor shall be responsible for the planning and the conduct of the entire test. The contractor shall monitor, digitally video and photographically record all crack growths. The contractor shall document all results in a P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

3.14.2.1 Additional Empennage Testing

The contractor shall continue to test the empennage for an:

a) Additional 10,000 FTSH **(CLIN 0227AJ) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

b) Additional 10,000 FTSH **(CLIN 0227AK) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

c) Additional 10,000 FTSH **(CLIN 0227AL) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

d) Additional 10,000 FTSH **(CLIN 0227AM) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

e) Additional 10,000 FTSH **(CLIN 0227AN) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

f) Additional 10,000 FTSH **(CLIN 0227AP)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

3.14.3 Landing Gear (CLIN 0227AQ)

The contractor shall recommend to NAVAIR the number of flaws, size, shape and orientation etc., as well as the method(s) to insert a flaw(s) in the structures. The contractor shall conduct 25,000 landings of full-scale damage tolerance testing on the landing gear test article. The contractor shall be responsible for the planning and the conduct of the entire test. The contractor shall monitor, digitally video and photographically record all crack growths. The contractor shall document all results in a P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

3.14.3.1 Additional Landing Gear Testing

The contractor shall continue to test the landing gear for an:

a) Additional 25,000 landings **(CLIN 0227AR)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

b) Additional 25,000 landings **(CLIN 0227AS)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

c) Additional 25,000 landings **(CLIN 0227AT)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

d) Additional 25,000 landings **(CLIN 0227AU)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Damage Tolerance Test Report ***(CDRL AE02).***

3.15 RESIDUAL TESTING (CLIN 0229)

The contractor shall apply additional loading cycles and/or increased spectra severity to the test articles in order to determine the level of residual strength/fatigue life remaining on the test articles after all other full-scale testing has been completed. The contractor shall be responsible for the planning and the conduct of the entire test. The contractor shall develop a plan for this residual test effort and document in a revision to the P-3 FSFT Residual Test Plan ***(CDRL AF01)***.

3.15.1 Wing/Fuselage Test Article (CLIN 0229AA)

The contractor shall conduct 10,000 FTSH of full-scale residual testing on the wing/fuselage test article. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

3.15.1.1 Additional Wing/Fuselage Testing

The contractor shall continue to test the wing/fuselage for an:

a) Additional 10,000 FTSH **(CLIN 0229AB) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

b) Additional 10,000 FTSH **(CLIN 0229AC) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

c) Additional 10,000 FTSH **(CLIN 0229AD) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

d) Additional 10,000 FTSH **(CLIN 0229AE) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

e) Additional 10,000 FTSH **(CLIN 0229AF) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

f) Additional 10,000 FTSH **(CLIN 0229AG) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

3.15.2 Empennage Test Article (CLIN 0229AH)

The contractor shall conduct 10,000 FTSH of full-scale residual testing on the empennage test article. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

3.15.2.1 Additional Empennage Testing

The contractor shall continue to test the empennage for an:

a) Additional 10,000 FTSH **(CLIN 0229AJ) –** Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

b) Additional 10,000 FTSH **(CLIN 0229AK)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

c) Additional 10,000 FTSH **(CLIN 0229AL)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

d) Additional 10,000 FTSH **(CLIN 0229AM)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

e) Additional 10,000 FTSH **(CLIN 0229AN)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

f) Additional 10,000 FTSH **(CLIN 0229AP)** – Detailed visual inspections shall be conducted every 5,000 FTSH with major schedule NDI inspections at the completion of every 10,000 FTSH block. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

3.15.3 Landing Gear Testing (CLIN 0229AQ)

The contractor shall conduct 25,000 landings of full-scale residual testing on the landing gear test article. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

3.15.3.1 Additional Landing Gear Testing

The contractor shall continue to test the landing gear for an:

a) Additional 25,000 landings **(CLIN 0229AR)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

b) Additional 25,000 landings **(CLIN 0229AS)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

c) Additional 25,000 landings **(CLIN 0229AT)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

d) Additional 25,000 landings **(CLIN 0229AU)** – Detailed visual inspections shall be conducted every 5,000 landings with major schedule NDI inspections at the mid-point and completion of each test block increment. The contractor shall document all results in a revision to the P-3C FSFT Residual Test Report ***(CDRL AF02).***

3.16 OTHER TESTING

3.16.1 Coupon Testing (CLIN 0023)

The contractor shall design, fabricate test specimens and fixtures, and conduct coupon testing. The contractor shall provide all planning, instrumentation, testing equipment and facility required to perform this task.

3.16.1.1 Material Allowable Development for Replacement of Al 7075-T6

The contractor shall perform coupon testing on a minimum of 400 test specimens to generate and substantiate design allowables for the substitute material replacing 7075-T6 including basic mechanical properties, cyclic stress-strain curves, strain versus life curves, crack growth rate data, etc. (see also SOW paragraph 3.4.1). The contractor also shall conduct constant amplitude and spectrum fatigue and crack growth testing including environmental effects. The contractor shall develop and propose a test matrix in accordance with ***CDRL A006***. The contractor shall document the results in the P-3C FSFT Material Substantiation and Analysis Report ***(CDRL A007)***.

3.16.1.2 Sensitivity Studies

The contractor shall perform coupon testing to study the spectrum sensitivity on a minimum of 400 test specimens. This testing shall be used to assess the effects of test spectra truncation, clipping, spectrum severity, marker load determination, and to obtain crack growth data as well as any other potential deviations from the usage spectra to the P-3C FSFT test spectra. The contractor shall develop and propose a test matrix in accordance with ***CDRL E001***. Based on these test results, the contractor shall update/revise the P-3C FSFT Test Spectra accordingly and prior to commencement of testing. The contractor shall document the results in a**ccordance with** ***CDRL E001***.

3.16.1.3 Additional Coupon Testing (CLIN 0219)

The contractor shall design and fabricate additional 200 test specimens, and conduct additional coupon testing, as required. The contractor shall provide all planning, instrumentation, testing equipment and facility required to perform this task ***(CDRL AA01)***. The contractor shall document the results in **accordance with** ***CDRL AA02***.

3.16.1.4 Deleted

3.16.1.5 Deleted

3.16.2 Component Testing (CLIN 0025)

The contractor shall fabricate, design, and conduct component fatigue and damage tolerance testing for the following structural components to verify analytical predictions, and generate fatigue and crack growth data/allowables for the SLEP kit design effort.

Items	No. of Tests
a) Joints	5
b) Splices (spar)	5
c) Panels (including wing planks)	5
d) Fittings	3

This effort shall also be used to certify existing and/or new proposed repair concepts, as a minimum, for the spar cap, wing plank, and flap track rib. The contractor shall recommend a list of candidates for testing in the P-3C FSFT Component Test Plan ***(CDRL E002)***. The contractor shall develop the test matrix, test spectra and fixtures to accomplish this task. The contractor shall document in the P-3C FSFT Component Test Report ***(CDRL E003)***.

3.16.2.1 Additional Component Testing (CLIN 0109)

The contractor shall fabricate, design, and conduct additional component fatigue and damage tolerance testing for locations other than those selected in SOW paragraph 3.16.2 for the following structural components:

Items	No. of Tests
a) Joints	5
b) Splices	5
c) Panels	5
d) Fittings	3

The contractor shall propose a list of candidates for testing in accordance with ***CDRL P001***. The contractor shall develop the test matrix, test spectra and fixtures to accomplish this task. The contractor shall document the results in a**ccordance with** ***CDRL P002***.

3.17 POST-TEST TEARDOWN AND INSPECTION (CLIN 0201)

At the completion of the fatigue testing to be determined by NAVAIR, the contractor shall perform a destructive teardown and inspection of the test articles. The results of these inspections and post-test analysis shall be used to certify the P-3C airframe for the SLEP goal of SOW paragraph 3.1.1. The contractor may use NADEP JAX Project Number P3-181 Report and NRL's P-3 Wing Teardown Report for guidance. The contractor shall develop, fabricate or obtain all special tooling required to perform these tasks below.

3.17.1 Teardown and Inspection Planning

The contractor shall prepare a P-3C FSFT Post-Test Teardown and Inspection Plan detailing approaches and methods to be used in conducting all post-test teardown and inspection activities. As a minimum, the contractor shall:

a) Provide overall planning and coordination with all engineering disciplines involved. Develop removal and disassembly procedures for the wing/fuselage, empennage and landing gear test articles.

b) Identify all critical areas for NDI inspection. Submit a list of proposed locations and inspection methods including the hole cleaning procedure in accordance with ***CDRL U001*** prior to the teardown initiation.

c) Prepare appropriate drawings/sketches/electronic database to map the disassembled wing/fuselage/empennage/landing gear components, and to denote the specific inspection areas, inspection methods and procedures. In addition, drawings shall have sufficient details to identify the location of any cracks and corroded areas (e.g., BL, WL, and WS etc.)

d) Develop the numbering scheme for fastener holes and structural parts. Develop and verify special tooling and procedures to remove different types of fasteners without destroying any potential physical evidence of fatigue damage.

e) Develop and verify NDT/I procedures and calibration standards specially for the planned inspected areas on the P-3C test articles. Ensure that all NDI equipment required be available on-site before starting the teardown.

f) Design/fabricate/assemble all necessary tooling and supporting fixtures for the teardown.

The contractor shall submit this plan for NAVAIR review and approval prior to commencing the teardown and inspection effort. ***(CDRL U001)***

3.17.2 Teardown and Inspection

The contractor shall perform a destructive teardown and comprehensive inspection of the FSFT articles to validate analytical predictions, confirm the existence of any cracks/defects detected during the tests, verify adequacy of the existing and/or new, innovative NDT/I techniques being used on this program, and determine if any hidden cracking or defects occurred in inaccessible areas during routine inspections. The teardown shall require removal and total disassembly of the wings, portions of the fuselage, horizontal and vertical tail, and main and nose landing gear as well as sectioning of the structure to facilitate the inspection. This effort also shall include a comprehensive visual and instrumental inspection of all primary structures. The contractor shall use appropriate NDI methods to detect and confirm fatigue cracks and corrosion damages such as: Eddy Current (ET), Fluorescent Penetrant (PT), Magnetic Particle (MT), Ultrasound (UT) and Radiography (RT). All fatigue critical locations, as identified in paragraph 3.3.3, and its surrounding adjacent structures (at least 12 inch radius) shall be 100% inspected using, as a minimum, the appropriate current NDT/I technology. Fasteners in fatigue critical locations and surrounding adjacent structures (at least 12 inch radius) shall be carefully removed and retained, and the bore of the holes shall be inspected using an electromagnetic technique(s). The contractor shall use state-of-the-art methods in addition to using conventional NDI techniques to detect incipient fatigue damage, as well as any pre-existing damage due to any type of corrosion. Emphasis should be placed on utilizing any state-of-the-art method which can quantify fatigue damage within 15% accuracy, as a minimum. Parts, which have indication of crack(s), shall be sectioned and examined metallurgically and fractographically. In performing the teardown inspection, the contractor shall:

a) Clean and remove paint from exterior surfaces.

b) Remove and totally disassemble the entire outer and center wing box, horizontal and vertical stabilizers, and identified critical sections of the fuselage (e.g., flight station, over the center wing, aft pressure bulk head, etc.). Carefully remove fasteners so that fastener holes and fractured surfaces are not damaged or destroyed.

c) Number the holes/parts on the structural components using vibra-etch method.

d) Mark and save the removed fasteners from critical areas.

e) Vibra-etch or tag all components for later identification.

f) Strip all sealant and paint from interior surfaces.

g) Mark and digitally photograph the critical fatigue areas identified previously.

h) Identify, mark, digitally photograph and document any additional detected damage areas.

i) Cut wing/fuselage/empennage components into sections to expedite large scale inspection (see item 18 below). Do not cut through suspected cracked or damaged areas. Consult on-site engineering before proceeding.

j) Clean and degrease all components, as required.

k) Clean fastener holes in accordance with the approved procedure. Calibrate NDT/I equipment to reliably detect cracks of minimum size of as least 0.030 inch. Inspect a total of at least 10,000 fastener holes around critical and suspected areas using as a minimum in-hole ET. The contractor shall allocate these inspections, with NAVAIR approval, among major structural components including LHS and RHS wings, fuselage, empennage and landing gears.

l) Visually inspect all holes which show indication of cracks from NDI inspection. Document and digitally photograph any anomaly.

m) Inspect all planks, fittings, joints, splices, truss ribs, spar caps, webs, web stiffeners, and bulkheads, etc. using appropriate large area NDI methods, as a minimum, fluorescent penetrant. Digitally photograph and document all defects.

The contractor shall document the teardown inspection results in accordance with ***CDRL U002***. The contractor shall digitally video-record, photograph and document the teardown and inspection procedures. The contractor shall provide all documentation to the Navy in electronic (CD-ROM, DVD-ROM) and digital format (video and image) ***(CDRL U002 and L003).***

3.17.2.1 LHS Outer Wing Teardown and Inspection (CLIN 0214)

After the end of two lifetimes of testing, the Government may direct the contractor to remove the LHS outer wing only (from BL 65 and outboard including corner fittings and spliced straps) from the test fixture. The contractor shall perform a destructive teardown and thorough inspection of the removed LHS outer wing including the in-hole inspection in accordance with SOW paragraph 3.17.2. The contractor shall conduct limited teardown, and in situ visual and instrumental NDI on the remained test article around the previously identified fatigue critical locations and any areas where cracks were detected during the test, especially the center wing box. The contractor may remove some fasteners and/or parts, with NAVAIR approval, for accessibility to facilitate the inspection. The contractor shall identify, mark, digitally photograph and document all defects ***(CDRL Y001)***.

3.17.2.2 Wing/Fuselage Teardown and Inspection

At the conclusion of the testing phase to be determined by NAVAIR, the contractor shall remove the test article from the test fixture and perform a complete destructive teardown and thorough inspection of the wing/fuselage test article as specified in SOW paragraph 3.17.2 above. This teardown and inspection shall include both the LHS and RHS outer wing panels. The contractor shall identify, mark, digitally photograph and document any cracks found ***(CDRL U002)***.

3.17.2.3 Empennage Teardown and Inspection

At the conclusion of the testing phase to be determined by NAVAIR, the contractor shall remove the test article from the test fixture, and perform a destructive teardown and thorough inspection as specified in SOW paragraph 3.17.2. The contractor shall identify, mark, digitally photograph and document any cracks found ***(CDRL U002)***.

3.17.2.4 Landing Gear Teardown and Inspection

At the conclusion of the testing phase, to be determined by NAVAIR, the contractor shall remove the landing gears from the test fixture and perform a thorough teardown as specified in SOW paragraph 3.17.2 above. The contractor shall perform visual and NDI of the landing gear test article. The contractor shall identify, mark and document all cracks found. ***(CDRL U002)***

3.18 POST-TEST ANALYSIS (CLIN 0201)

The contractor shall perform failure analysis for all cracks found in SOW paragraph 3.17.2. Using these results, the contractor shall re-baseline the analytical predictions to demonstrate service life compliance for the P-3C airframe including the SLEP Kit.

3.18.1 Fractographic Examination

The contractor shall remove all confirmed cracks and all NDI holes (total of 10,000 holes) in SOW paragraph 3.17.2 from the test articles, saw-notch and expose the fracture surfaces, and optically examine the fracture surfaces to determine crack origins and crack growth characteristics using 30X microscopy and other appropriate methods. The contractor shall document and report the site of initiation, crack length, region of stable growth, striation counts relative to known test benchmarks, and other pertinent findings. ***(CDRL U003)***

3.18.2 Scanning Electron Microscopy (SEM)

The contractor shall examine, as a minimum, 500 cracks/holes using SEM to obtain data on the nature of the failure mode, site of initiation, crack length, region of stable growth, crack growth striations, and other pertinent data required to support service life assessment analyses. The contractor shall document all findings in accordance with ***CDRL U003***.

3.18.3 Re-baseline Analysis

The contractor shall perform a re-baseline analysis using the metallurgical and fractographic findings from SOW paragraphs 3.18.1 and 3.18.2 for all fatigue critical locations identified previously, and for cracks found during the FSFT as well as the subsequent teardown inspections. For each location/crack, the analysis shall include, as a minimum, crack growth analysis to determine the initiation of the crack during fatigue testing, the development of fatigue notch factor, and the calculation of new fatigue life based on the FSFT results. For the purpose of this re-baseline analysis, the crack initiation shall be defined as the time for a crack to grow to 0.01 inch. The fatigue life shall be determined by subtracting the crack growth time from 0.01 inch crack to the detected length from the total test time when the crack was detected on the test article(s). The contractor shall confirm the crack time history fractographically using beach mark counting and marking load benchmarks. For critical locations which cracked during testing, the contractor shall determine the test-demonstrated K_n using the time to crack initiation. For critical locations which no cracks were found, the contractor shall use the test end life as crack initiation time. The contractor shall compare these K_n's values with the corresponding theoretical geometric stress concentration factors, K_t, as well as the values derived from coupon and component test data. The contractor shall use the K_n's values which would yield the most conservative fatigue life estimate. The contractor shall compare these results with the analytical predictions in SOW paragraph 3.5, and shall make appropriate adjustment(s) to the analytical models. These analyses shall be documented in revisions to the P-3C FSFT Fatigue and Damage Tolerance Analysis Report ***(CDRL A009)*** and the P-3C SLEP Kit Analysis Report ***(CDRL B003)***. In the event that the re-baseline fatigue life (i.e., crack initiation life) using the FSFT test results for any SLEP kit part does not meet the service life goal of SOW paragraph 3.1.1, the contractor shall re-design, re-analyze and re-test the part/component/sub-assembly to demonstrate life compliance. The contractor shall make necessary revisions to all of the impacted documentation including the P-3C FSFT Fatigue and Damage Tolerance Analysis Report ***(CDRL A009)*** and the P-3C SLEP Kit Analysis Report ***(CDRL B003)***, tooling and drawings, TD, etc. For any other parts elsewhere on the airframe, the contractor shall provide the Government with technical proposal(s) for rework/redesign/replacement concept for these parts in order to meet the service life goal. ***(CDRLs J001, T001 and AG01)***

3.19 ADDITIONAL POST-TEST ANALYSIS (CLIN 0216)

3.19.1 Additional Fractographic Examination

The contractor shall remove an additional 1,000 cracks/holes from the test articles, saw-notch and expose the fracture surfaces, and optically examine to determine crack origins and crack growth characteristics. ***(CDRL Z001)***

3.19.2 Additional SEM

The contractor shall examine an additional 100 cracks/holes using SEM to obtain crack growth data required to support service life assessment analyses. ***(CDRL Z001)***

3.19.3 Additional Re-baseline Analysis

The contractor shall perform crack growth and fatigue analysis for an additional 10 locations. ***(CDRL Z001)***

3.19.3.1 Deleted

3.19.3.2 Deleted

3.19.3.3 Deleted

3.19.3.4 Deleted

3.20 TEST SITE DISASSEMBLY (CLIN 0203)

The contractor shall take down the load reaction frame, store equipment and clear the test site.

3.20.1 Test Article Disposition

The contractor shall remove the test articles or its remains from the load reaction frame and place it in storage with necessary supports at the test contractor's facility for a minimum of 5 years after completion of all tasks in this SOW, or until final Government disposition.

3.20.2 Rig Decommissioning

The contractor shall decommission the test fixture upon completion of all testing.

3.20.3 Strain Gage Data Disposition

The contractor shall retain all raw strain gage data (calibrated to numerical equivalent values) accumulated during all portions of testing for a period of five (5) years, as a minimum, after completion of all tasking in this SOW. ***(CDRL V001)***

3.21 SRP/SLEP KIT AND TOOLING INTEGRATION (CLIN 0205)

3.21.1 SRP/SLEP Kit and Tooling Integration Study

The contractor shall perform a concept development study to integrate both the SRP and SLEP kits into one. The contractor shall assess the feasibility of combining, eliminating and streamlining the tooling for manufacturing, production and installation for both kits at the same time. The contractor shall propose to NAVAIR new tooling integration concepts including any recommended redesign and modification required for the existing SLEP and SRP tooling. The contractor shall use 3-D solid model CAD/CAM for virtual prototyping to validate and verify proposed concepts. The contractor shall document the results in a P-3C SRP/SLEP Kit and Tooling Integration Study Report ***(CDRL W001)***.

3.21.2 Deleted

3.22 SDRS TRACKING ALGORITHM DEVELOPMENT (CLIN 0207)

The Fatigue Life Expended (FLE) for the P-3C fleet is currently tracked using an obsolete unit damage approach originally developed by Lockheed Aircraft Corporation that relies on a few inputs to the program from the monthly summary of Maintenance and Material Management (3M) flight hour and landing data. Normal acceleration (N_z) exceedances, point-in-the-sky variations, and more realistic mission profiles and weights for individual aircraft are not taken into account with the existing tracking methodology. These factors, along with the ongoing transition from the Counting Accelerometer Group (CAG) to the Structural Data Recording Set (SDRS) and the new P-3C fatigue life benchmark resulting from the full-scale fatigue test necessitate the development of a different and improved Individual Aircraft Tracking (IAT) algorithm. The contractor shall document the results in a P-3C IAT Methodology Report ***(CDRL X002)***. This report shall include, as a minimum, the following:

a) An overview of the tracking algorithm and processes, gap-filling method(s), sample calculations for each critical location including spectrum truncation sensitivity studies.

b) Complete source code listing, flowchart, functional description of all software modules and subroutines. The contractor also shall provide to NAVAIR an uncompiled source code version on electronic format.

The contractor shall generate and provide to NAVAIR a P-3C IAT User's Manual with a step by step IAT procedures, troubleshooting guidelines, and sample input and output ***(CDRL X003)***.

3.22.1 Tracking Algorithm Development

The contractor shall develop all computer programs necessary to accurately calculate accrued FLE values and incremental crack growth (Δa) for all critical locations for <u>each</u> aircraft on a flight-by-flight basis using all available data sources (3M, CAG, SDRS, NAVAIR Form 13920/1, NAVAIR Form 4790/21, SRCs, and full-scale fatigue test findings) in accordance with Appendix C of this SOW. The algorithm shall also be able to generate and update the recurring inspection intervals for all critical locations recommended for each aircraft based on its actual usage. The contractor shall submit a P-3C IAT Development Plan ***(CDRL X001)***.

3.22.2 Training

The contractor shall provide training and training materials to NAVAIR in the operation of all computer programs developed in SOW paragraph 3.22.1. The contractor shall document and provide all training materials as part of the P-3C IAT User's Manual ***(CDRL X003)***.

3.23 FATIGUE LIFE RE-BASELINING (CLIN 0209)

3.23.1 Re-baselining of 240 P-3C Aircraft

Using the results of the full-scale fatigue tests and the IAT algorithm developed in SOW paragraph 3.22.1, the contractor shall determine the accumulated FLE for each of the 240 P-3C BUNOs for each tracking location up to the SDRS installation date. The contractor shall generate these individual re-baselined FLEs in monthly increments using the following GFI for each BUNO:

a) Definition of Flight Purpose Codes (FPCs)

b) CAG data

c) 3M Data

d) Naval Flight Records (NAVFLIR) Data

The contractor shall document the results including the re-baselined FLEs in a P-3C Fatigue Life Expended (FLE) Re-Baseline Report ***(CDRL X004)***.

3.23.1.1 Gap-fill Procedure Development

The contractor shall develop appropriate criteria to quality control the data above. The contractor shall develop an automated gap-fill procedures to account for missing data using fleet usage and SDRS data as well as supplemental pilot survey data as appropriate. The contractor shall conduct sensitivity studies to determine the appropriate level of severity/conservatism for gap-filling purposes.

3.23.2 Deleted

3.23.3 Deleted

3.24 PROGRAM MANAGEMENT (CLINS 0031, 0106 AND 0211)

3.24.1 Program Plan/Master Schedule

The contractor shall provide program, engineering, and test management for the duration of the P-3C FSFT program. The contractor shall establish and maintain a P-3C FSFT Program Plan ***(CDRLs G001 and M001)*** to reflect the tasking of this SOW. The plan/master schedule shall include the program's milestones and all significant tasks, events, and activities required to effectively manage program progress, technical performance, and cost. The contractor shall also develop and update, as necessary, a schedule of works to fit in with the funding profile of the program ***(CDRLs G001 and M001)***. Upon receiving NAVAIR approval, the contractor shall incorporate the schedule of works into the overall program budget and planning. The contractor shall conduct critical path analysis throughout the program to identify and mitigate any potential programmatic and technical risks proactively. The contractor shall develop and maintain a P-3C FSFT Risk Reduction and Implementation Plan ***(CDRLs G001 and M001)***. The contractor shall identify and provide to the Government a list of all long-lead items as well as a detailed provisional plan to ensure timely and adequacy of stock parts and supplies no later than 60 days after contract award ***(CDRLs G001 and M001)***. The contractor shall develop a list of pertinent technical measurable performance parameters (e.g., weight target, number of released drawings, number of fabricated parts, etc.), track, monitor and report to the Government at every major program review as well as at the request of the Government representative ***(CDRLs G001 and M001)***. The contractor shall be solely responsible for the performance and quality of all subcontractor work performance in response to the requirements of this contract. The contractor shall identify and monitor technical, quality, schedule, and milestones achievement on a continuing basis, according to the contractor's own established subcontract management techniques. The contractor shall ensure contractual requirements are allocated down to the subcontract level.

3.24.2 Program Reviews and Technical Interchange Meetings

The contractor shall conduct, as a minimum, two program reviews for each contract year throughout the program. Half of these reviews will take place at Patuxent River, MD and the other half at the contractor's plant. For each program review, the contractor shall provide an agenda (including proposed review package) and minutes (including final review package) ***(CDRLs G001 and M001 respectively***). Program reviews shall be conducted, as a minimum, when the following are complete:

a) FSFT Usage Spectra Development

b) FSFT Fatigue Analysis, including detailed FEMs

c) FSFT Test Spectra Development

d) SLEP Kit Design – at 10% drawing release and at 90% drawing release

e) FSFT Test Fixture and Loading Jigs Design

f) Completion of one (1) lifetime

g) Completion of two (2) lifetimes

In addition to the above, the contractor shall conduct, as a minimum, six (6) technical interchange meetings (TIMs) for each contract year at points in the program to be determined by the Navy. Half of these meetings will take place at Patuxent River, MD and the other half at the contractor's plant. For these meetings, the contractor shall provide an agenda (including review package) and meeting minutes ***(CDRLs G001 and M001)***.

3.24.2.1 Technical Presentations

During the course of the program, the contractor shall prepare, submit and present a minimum of four (4) separate technical papers on the scope, progress, achievements and significant findings of the SLAP at the following professional engineering society conferences within the United States of America ***(CDRLs G001 and M001)***:

a) ASIP/NASI&AAC/Aging Aircraft Symposium

b) ICAF

c) AIAA Structures and Materials Conference

d) P-3 IOSC

3.25 FINANCIAL MANAGEMENT (CLINS 0033, 0108 AND 0213)

3.25.1 Contractor Cost and Schedule Reporting

The Contractor shall provide regular reports detailing the integrated cost and schedule status of work progress on the contract. The report shall be prepared using procedures for planning work, controlling costs, measuring performance using earned value techniques, and generating timely and reliable information as required by DFARS clause 252.242-7005, Cost/Schedule Status Report (C/SSR). The Contractor shall also relate technical accomplishment with cost and schedule accomplishment in contract performance reports and meetings. The C/SSR's format and contents shall conform with requirements set forth in the C/SSR CDRL. Electronic and disk copies shall be provided in a format consistent with the ANSI X12 standard for electronic data interchange (Transaction Set 839). ***(CDRLs H001 and N001)***

3.25.2 Contract Funds Status Report

The Contractor shall provide a Contract Funds Status Report (CFSR). The CFSR's format and contents shall conform with requirements set forth in the CFSR CDRL. ***(CDRLs H002 and N002)***

3.25.3 Subcontractor Cost and Schedule Reporting

Integrated cost and schedule reporting is required on subcontracts which, based on risk, schedule criticality or dollar value, have the potential to impede the successful completion of the prime contract. The prime Contractor shall obtain appropriate cost data for subcontractor's efforts, and shall be incorporated into the prime Contractor's C/SSR for submission to the government.

3.25.4 Contract Work Breakdown Structure

The Contractor shall extend the Government-provided Contract Work Breakdown Structure (CWBS) provided in Appendix D to lower levels which represent how the Contractor plans to accomplish the entire contract work scope and which are consistent with internal organizations and processes. The extended CWBS will serve as the framework for contract planning, budgeting, and reporting of cost and schedule status to the Government. The Contractor shall identify major elements of subcontracted work in the extended CWBS. The Contractor may propose changes to the CWBS to enhance its effectiveness in satisfying program objectives and are subject to government approval.

The Contractor shall prepare and deliver a CWBS Index that relates CWBS elements with Statement of Work paragraphs and contract line items. The Contractor shall also prepare and deliver a CWBS Dictionary describing the efforts and tasks associated with each CWBS element. The CWBS Index and Dictionary shall conform with the requirements set forth in the CWBS CDRL. ***(CDRL H003)***

3.25.5 Integrated Baseline Review

The Contractor shall present its performance measurement baseline plan to the government within six months after contract award, and subsequently, when required, following major changes to the baseline. The government will verify during the IBR that the Contractor has established and maintains a reliable contract performance measurement baseline. The Contractor will ensure that the baseline includes the entire contract technical scope of work consistent with contract schedule requirements, and has adequate resources assigned. In addition, the Contractor will assure the government that appropriate earned value methods are used to status contract cost, schedule, and technical progress.

4. GOVERNMENT FURNISHED EQUIPMENT/INFORMATION

4.1 PHASE I DATA

a) LG96ER0174, “P-3C Preliminary Operational Loads and Criteria,” Lockheed Martin Aeronautical Systems, dated December 1996.

b) LG98ER0002, "Phase I - P-3C Fatigue Test Analysis, P-3C Final Operational Loads and Criteria Report," Lockheed Martin Aeronautical Systems, dated July 1998

c) LG96ER0177, “P-3C Fatigue Test Program - Phase I Fatigue Critical Area Selection,” Rev. A, Lockheed Martin Aeronautical Systems, dated December 1997.

d) LG98ER0063, “P-3C Finite Element Model Report,” Lockheed Martin Aeronautical Systems, dated March 1998.

e) LG98ER0066, “P-3C Fatigue Analysis Report,” Lockheed Martin Aeronautical Systems, dated March 1998.

f) LG98ER0125, "Phase I - P-3C Fatigue Test Analysis, Fatigue Analysis - Final Report," Lockheed Martin Aeronautical Systems, dated June 1998.

g) LG98ER0067, "P-3C SLEP Kit Definition Report," Lockheed Martin Aeronautical Systems, dated March 1998.

4.2 TEST ARTICLES

a) P-3C test article aircraft (BUNO 156508)

b) P-3 aft fuselage structure – The Government will provide the contractor with the aft portion of P-3A Bureau Number 150517 to be used as "dummy" empennage and fuselage structures for the P-3C Full Scale Fatigue Test (FSFT) wing/fuselage and empennage test articles. Specifically, it is the airframe aft of the center of the main cabin door at approximately FS 844 including the entire empennage minus the MAD boom.

c) P-3C dummy wing – The Government will provide a dummy LHS wing to the contractor at a later date only if the extended testing options are exercised.

d) P-3C dummy MLG cylinder – The Government will provide a MLG cylinder with HVOF to the contractor at a later date only if the extended testing options are exercised.

4.3 OTHERS

a) P-3C SRP Data Package

b) SOW for P-3C Sustained Readiness Program

c) SRP SOW for BUNO 156508

d) Aircraft logs for test article aircraft

e) Inspections, modifications and repair records for test article aircraft

f) All available 3M data (flight-by-flight records of aircraft BUNO, date, squadron, flight duration, flight purpose code, and number of landings) for the P-3C fleet

g) All available NAVAIR form 13920/1 data (monthly summary of total flight hours, landings, and CAG data) for the P-3C fleet

h) All available SDRS data

5. DELETED

APPENDIX A

List of Relevant Documents

1. MILITARY SPECIFICATIONS

MIL-A-8861B(1), "Airplane Strength and Rigidity Flight Loads," dated 5 December 1995.

MIL-A-8863C(AS), "Airplane Strength and Rigidity Ground Loads for Navy Acquired Airplanes," dated 19 July 1993.

MIL-A-8866C(Notice 1), "Airplane Strength and Rigidity Reliability Requirements, Repeated loads, Fatigue and Damage Tolerance," dated 20 May 1987.

MIL-A-8867C(AS), "Airplane Strength and Rigidity Ground Tests," dated 3 October 1994.

MIL-DTL-31000A, "Technical Data Package"

MIL-S-5002, "Surface Treatments and Inorganic Coating for Metal Surfaces of Weapons Systems," dated 30 December 1994.

MIL-PRF-22750, "Coating: Epoxy, High Solids"

MIL-PRF-23377, "Primer Coatings: Epoxy, High Solids"

MIL-I-25135E, "Inspection Materials, Penetrants," dated 26 Jun 1989.

MIL-P-46195 (1), "Program Requirements, Nondestructive Inspection, For Weapons Systems Subsystem, Parts and Material," dated 18 Aug 1988.

MIL-PRF-85285, "Coating: Polyurethane, High Solids"

MIL-PRF-85382, "Coating Elastomeric, Polyurethane, Rain Erosion"

MIL-PRF-85582, "Primer Coatings: Epoxy, Waterborne"

TT-P-2760, "Polyurethane Coating: Self-priming Topcoat, Low Volatile Organic Compounds (VOC) Content"

2. MILITARY STANDARDS

SD-24L, "General Specification for Design and Construction of Aircraft Weapon Systems,"

MIL-STD-100G, "Engineering Drawing Practice," dated 9 June 1997.

MIL-STD-1907 (Reinstitution Notice 3), "Inspection, Liquid Penetrant and Magnetic Particle Soundness Requirements for Materials, Parts and Weldments," dated 29 Jul 1996.

MIL-STD-867A (1), "Temper Etch Inspection," dated 9 December 1996.

MIL-STD-973 (3), "Configuration Management," dated 13 January 1995.

MIL-STD-1515A Notice (3), "Fastener Systems for Aerospace Vehicles," dated 24 June 1983.

MIL-STD-2154, "Inspection, Ultrasonic, Wrought Metals, Process for," dated 30 September 1982.

MIL-STD-7179, "Finishes, Coatings and Sealants For the Protection of Aerospace Weapons Systems," dated 30 September 1997.

3. MILITARY HANDBOOKS

MIL-HDBK-5G, "Aerospace Vehicle Structures, Metallic Materials and Elements for"

MIL-HDBK-728, "Nondestructive Testing"

MIL-HDBK-965, "Acquisition Practices for Parts Management"

MIL-HDBK-6870, "Inspection Program Requirements, Nondestructive for Aircraft and Missile Materials and Parts"

AFWAL-TR-82-3073, "USAF Damage Tolerance Handbook: Guidelines for the Analysis and Design of Damage Tolerant Aircraft Structures," Revision B, dated 15 May 1984.

WL-TR-94-4052, 4053, 4054, 4055, 4056, "Damage Tolerance Design Handbook"

DEF STAN 00-970, "Design and Airworthiness Requirements for Service Aircraft," Volume 1, dated December 1994 (Amdt 13).

4. INDUSTRY STANDARDS

ASTM E 1444, "Standard Practice for Magnetic Particle Examination," American Society for Testing and Materials, 1994.

ASTM E 1417A, "Standard Practice for Liquid Penetrant Examination," American Society for Testing and Materials, 1995.

ASTM E 1742, "Standard Practice for Radiographic Examination," American Society for Testing and Materials, 1995.

ASTM E 399, "Test for Plane Strain Fracture Toughness of Metallic Materials," American Society for Testing and Materials, 1990.

ASTM E561, "Standard Practice for R-Curve Determination," American Society for Testing and Materials, 1994.

ASTM E647, "Standard Test Method for Measurement of Fatigue Crack Growth Rates," American Society for Testing and Materials, 1995.

NAS 410, "National Aerospace Standard Certification and Qualification of Nondestructive Test Personnel," Aerospace Industries Association, 1996.

ANSI/ASQC-Q9001, "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing"

ANSI/ASQC-Q9002, "Quality Systems - Model for Quality Assurance in Production and Installation"

ANSI/ASQC-Q9003, "Quality Systems - Model for Quality Assurance in Final Inspection and Test"

Society of Allied Weight Engineers, Recommended Practice Number 7, "Weight and Balance Control System (for Aircraft and Rotorcraft)," dated September 1, 1995.

5. OTHER PUBLICATIONS

LR 13168 Rev J, "P3V-1 Fatigue and Fail-Safe Policies," Lockheed Aircraft Corporation, dated September 1968.

LR 13667, "Wing Fail Safe Analysis," Lockheed Aircraft Corporation

LR 13674, "Fuselage Fail Safe Analysis," Lockheed Aircraft Corporation

LR 13678, "Empennage Fail Safe Analysis," Lockheed Aircraft Corporation

LR 13167, "Structural Design Loads," Lockheed Aircraft Corporation

LR 19988, “Structural Design Loads for Model P-3B Gross Weights Increase,” Lockheed Aircraft Corporation

LR 27982, “P-3 SLEP Part I Fatigue Life Evaluation,” Lockheed Aircraft Corporation

LR 29748, “Service Life Extension Program (SLEP) for P-3B Heavyweight and P-3C Aircraft,” Lockheed Aircraft Corporation

TR 91001A, “P-3C Tracking Update -’94 (Revised 1997),” Aerostructures, Inc., dated April 1995 (Revised 1997).

LG94ER0142-1, “S-3B Flight Loads Survey Program,” dated April 1995.

Project Number P3-181, “P-3 Wing Teardown Final Report,” Naval Aviation Depot, Jacksonville, FL, dated May 1993.

“P-3 Wing Teardown Report,” U. S. Naval Research Laboratory, dated December 1993.

NA 01-1A-16, “Technical Manual, Nondestructive Inspection Methods,” dated 3 June 1997.

NA 01-75PAA-3-2, “P-3 Structural Repair Manual Nondestructive Inspection Testing”

NA 15-01-500, “Preservation of Naval Aircraft for Shipment and Stowage”

NA 01-75PAA-2, “Series, Maintenance Instruction Manuals (MIMs)”

NA 01-75PAA-3-1, “Series, Structural Repair Manuals”

NAEC-MISC-52-0385, “List of Nondestructive Testing and Inspection (NDT/I) Equipment Approved by Naval Air Systems Command”

APPENDIX B

Guidelines

for

Counting Accelerometer Group and SDRS Data Reduction

A. CAG. The contractor shall review the CAG data as follows:

a) Develop/establish data quality control (QC) criteria, and perform QC checks to target data lines as being in error.

b) Develop the valley exceedance spectrum within the remaining N_Z data. Utilize NAVAIR-provided report SEI-102-89-03 to assist with the determining of the valley load values.

c) Determine the maneuver exceedances by accounting for the contribution of gust loads within the remaining N_Z data using the spectra developed in paragraph 3.3.4.2.

d) Generate the weighted mean and standard deviation for each load level for the entire database in terms of Nz counts at 1000 hours. Equations for the mean and standard deviation (for a given load level) are

$$\bar{x} = (1000 hours)\left(\frac{\sum_{i=1}^{n}(counts_i \times hours_i)}{\sum_{i=1}^{n}(hours_i)^2}\right)$$

and

$$S = \sqrt{\left(\frac{1000 hours}{\bar{h}}\right)\left(\frac{\sum_{i=1}^{n}(counts_i - (b \times hours_i))^2}{(N-1)}\right)}$$

where

$$b = \frac{\sum_{i=1}^{n}(counts_i \times hours_i)}{\sum_{i=1}^{n}(hours_i)^2} \qquad \bar{h} = \frac{\sum_{i=1}^{n} hours_i}{N}$$

and N is the number of months in the calculations.

e) Given the flight hours for the lines in error, estimate the bad counts using a $\mu+\sigma$'s criteria.

f) Generate the μ and $\mu+\sigma$'s exceedance curves.

B. SDRS Data. The contractor shall review all available SDRS data as follows:

a) Establish data quality control criteria, and perform QC checks to target flights as being in error. Quality control checks should be primarily concerned with N_Z but the other recording parameters shall be included also. The contractor shall recommend corrective actions for any recording anomalies in the SDRS data.

b) Determine the maneuver exceedances by taking into account for the gust contribution using time duration (e.g., greater than 2 seconds) as a distinguishing criteria.

c) Generate the weighted mean (μ) and standard deviation (σ) for each load level (determined from the maximum resolution of the SDRS), including valley loads, for the remaining flights in terms of N_Z counts per 1000 hours.

d) Generate the μ and $\mu+\sigma$'s exceedance curves.

e) Analyze the good SDRS flight data using the CAG-recording criteria for comparison. Generate the weighted mean (μ) and standard deviation (σ) for each load level (determined from the maximum resolution of the SDRS), including valley loads, for the remaining flights in terms of counts per 1000 hours. Generate the μ and $\mu+\sigma$'s exceedance curves.

APPENDIX C

Detail Specification

for

Individual Aircraft Tracking (IAT)

A. Software Development

The IAT software shall construct individual aircraft flight by flight mission loading spectra using both the CAG and SDRS data separately, and convert aircraft loading parameters to local stresses and strains at each critical location to calculate fatigue life expended (FLE). The local stress time histories shall be used in a sequence-accountable fatigue crack initiation program to calculate FLE with respect to the FSFT spectrum flight hours at crack initiation. The option to maintain/carry-over residual stress and strain between flights shall be available for all critical locations. Cycle counting shall be based on a rainflow counting criteria. The methodology shall calculate a FLE value for a specific increment of loads identifying and include any residual stress and strain effects from previous aircraft utilization.

For periods when the CAG was installed, local stress time histories shall be computed while considering the following requirements:

a) Monthly N_z peak exceedances will be based on individual aircraft NAVAIR Form 13920/1 data;

b) Valley exceedance spectra must be developed and correlated to the monthly CAG peak exceedances;

c) The effects of gust loads must be accounted for;

d) The effects of roll acceleration must be accounted for; and

e) Aircraft configuration (flap and gear positions, fuel status, airspeed, altitude, and stores configuration (wing, sonobuoys, bomb bay) and fuselage pressurization must be assumed for each flight.

The above must be used to develop a stress-per-G conversion constants necessary to convert acceleration time histories to stress time histories at each tracked location. The stresses developed must be verified through the finite element model and the full-scale fatigue test loads.

For periods when the SDRS was installed, the recorded flight-by-flight time history data (N_Z, $\dot{p}$, fuel, airspeed, altitude, gear and flap positions) must be examined to compute the stress-per-G conversion constants to obtain local stress time histories. Additional parameters such as take-off gross weight and stores weights can be obtained from the SDRS data and used to calculate the conversion constants.

B. Software Modules

All software modules shall be written to maximize the benefits from relational database environments (Microsoft Access or Oracle version 6.0) using Visual Basic or C++ language. The software shall be designed to run on DEC Alpha/PC-based computers. POSIX protocol will be used for transportability to other systems. The contractor shall develop and write the IAT software code to:

a) Read available monthly individual aircraft usage data (3M, CAG, SDRS, NAVAIR Form 13920/1, NAVAIR Form 4790/21, SRCs) and store the results in a database.

b) Determine the percentage of data recovered by 3M and by SDRS on a monthly basis with respect to the NAVAIR Form 13920/1 data. The percentage of SDRS data recovered must address the difference between pilot-reported flight time and weight-off-wheels time.

c) Quality Control (QC) aircraft usage input data (from above) by identifying bad data and excluding it from damage computations. All sources of data have unique, inherent areas where discrepancies can be interjected, including data transmission and submission. QC shall be done on each data source independently and jointly when applicable. QC shall account for aircraft physical limitations, operational activity requirements, and (where needed) statistical probabilities. QC shall account for individual aircraft usage requirements, with appropriate knowledge of organizational trends and mission changes over the history of the P-3C. QC quantity/quality results relative to known baselines shall be available for dissemination to operational activities.

d) Account for missing data (gap-filling). The contractor shall explore alternatives (e.g., data vs. damage gapfill) and justify the recommended gap-filling methodology. For gapfilling, utilization of known aircraft usage parameters (e.g., total landings to date) along with physical and/or statistical limitations shall be used to develop appropriate, conservative methods for estimation. Gapfilling shall account for individual aircraft usage requirements, with appropriate knowledge of organizational trends and mission changes over the history of the P-3C.

e) Account for changes in the airframe configuration due to replacement and swapping of major airframe assemblies.

f) Generate individual aircraft/assembly load spectra based on available data for both CAG and SDRS-equipped aircraft. Store these spectra in a database.

g) Use the load-to-stress ratios to convert the load spectra to stress spectra for each critical location.

h) Compute and store in a database the incremental FLE, residual stress, residual strain, software version number, etc. each month for each aircraft's critical locations. Damages shall be computed using NAVAIR-approved fatigue damage algorithm.

i) Provide monthly increments and cumulative totals of FLE, flight hour data, landing data, custodian data, SDRS operation data, etc. obtained from all sources.

j) Ensure repeatable results from routine and ad-hoc data processing.

k) Predict crack growth rates for damage tolerance monitoring.

l) Utilize information available to monitor and adjust FLE based on unique, aircraft configurations (e.g., flight testing of a new wing store).

C. IAT Implementation. The contractor shall propose the methods to best implement the IAT. Implementation shall consist of the following:

a) How to maintain and upgrade user documentation and program source code.

b) How to utilize automated software routine processes.

c) How to provide access to ad-hoc queries for data analysis and results summaries.

d) How to deploy, maintain, and upgrade the computing environment.

e) How to maintain data and programming files for reference and retrieval.

f) How to best integrate with the SDRS so that on-site fatigue life expended values can be produced at the operational level before submission to NAVAIR.

g) How to improve data submission techniques and percent data recovery for the P-3 fleet while considering the availability of equipment at the operational, intermediate, and depot levels and NAVAIR. Consideration shall also be made with regard to current and future of the Naval Aviation Logistics Command Management Information System (NALCOMIS) for Organizational/Intermediate Maintenance Activities (O/IMA).

h) How to schedule implementation such that data acquisition, data processing (including fatigue life expended calculations), and data dissemination occurs routinely, not exceeding 3 months (with monthly as the desired cycle time).

APPENDIX D

Work Breakdown Structure and CLINs Cross-Reference Matrix

WBS	CLIN	LEVEL 1	2	3	4	5	6	7
000000		P-3 Full-Scale Fatigue Test						
100000			PRE-TEST					
110000	0001			Loads System Update				
111000					External Loads			
111200						Weight And Inertia Distribution		
111210							Explosion Suppressive Foam	
111220							ASUW Improvement Program (AIP)	
111300						Flight Loads		
111310	0029						Flight Test Support	
111320							Maneuver Time History	
111330							Aerodynamic Loads	
111331								Wind Tunnel Support
111332								CFD
111340							Gust Loads	
111350							Buffet Loads	
111400						Ground Loads		
111410							Landing Loads	
111411								Multivariate Landing Analysis
111420							Ground Maneuvering Loads	
111430	0027						Dynamic Taxi Test Support	
111500						Pressurization		
111510							Cabin	
111520							Fuel	
111600						Miscellaneous Loads		
112000					Balanced Loads			
113000					Internal Loads Generation			
113100						P-3C Finite Element Model		
113110							Model Update	
113120							Model Analysis	
113200						Load-to-Stress Ratio Generation		
120000	0003			Spectra Development				
121000					SDRS Flight Loads Survey Data Review			
122000					Usage Data Update			
123000					Critical Area Selection			
124000					Fatigue Spectra Generation			
124100						Maneuver Loads		
124200						Gust Loads		
124300						Ground Loads		
124310							Landing Impact Loads	
124320							Ground Maneuvering Loads	
124330							Miscellaneous Ground Loads	
124331								Sudden Extension
124332								Extension, Retraction and Braking Wheels in Air
124400						Cockpit or Cabin Pressurization		
130000	0005			Design Data & Allowable Material Properties Development				
131000					New Material Selection for Replacement of Al 7075-T6			
140000	0007			Fatigue and Damage Tolerance Analysis				
141000					Fatigue Analysis			
142000					Damage Tolerance Analysis			
143000					Additional Detailed Finite Element Models (FEMs)			

WBS	**CLIN**	**LEVEL**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
150000	0009			Service Life Extension Program (SLEP) Kit Development				
151000					SLEP Kit Concept Development			
152000					SLEP Kit Design and Analysis			
152100						Design		
152200						Analysis		
152210							Update FEMs	
152220							Static Strength	
152230							Fatigue	
152240							Damage Tolerance	
152250							Fail-Safe	
152300						Weight and Balance		
152400						Prototype		
153000					SLEP Kit Tooling			
153100						Design		
153200	0011					Fabrication		
154000	0012, 0218				SLEP Kit Fabrication			
155000					Validation and Verification of SLEP Kit Installation			
156000					Quality Assurance Program			
156100						NDT/I		
156200						Flight Critical Parts		
157000					Parts Control Program			
158000					Pollution/Hazardous Materials Prevention and Control Program (CDRL)			
159000					SLEP Kit Technical Data Generation			
160000	0013			Test Spectra Development				
161000					Test Spectra Generation			
161100						Test Mission Profiles and Test Segments		
161200						Simplification and Combination of Loading		
162000					Test Spectra Sensitivity Studies			
162100						Truncation Sensitivity Studies		
162200						Test Spectra Clipping Studies		
170000	0015			Test Facility Set-Up				
171000					Wing/Fuselage Test			
171100						Jack Loads Determination		
171110							Jack Load Derivation	
171120							Jack Load Validation/Verification	
171200						Test Fixture Design/Fabrication/Assembly		
171210							Fixture Design	
171220							Test Site Design	
171230							Fixture Analysis	
171240	0017						Fabrication	
171250	0018						Assembly	
171300						Loads Control and Data Acquisition System		
172000					Empennage Test			
172100						Jack Loads Determination		
172110							Jack Load Derivation	
172120							Jack Load Validation/Verification	
172200						Test Fixture Design/Fabrication/Assembly		
172210							Fixture Design	
172220							Test Site Design	
172230							Fixture Analysis	
172240	0017						Fabrication	
172250	0018						Assembly	
172300						Loads Control and Data Acquisition System		

WBS	CLIN	LEVEL 1	2	3	4	5	6	7
173000					Landing Gear Test			
173100						Jack Loads Determination		
173110							Jack Load Derivation	
173120							Jack Load Validation/Verification	
173200						Test Fixture Design/Fabrication/Assembly		
173210							Fixture Design	
173220							Test Site Design	
173230							Fixture Analysis	
173240	0017						Fabrication	
173250	0018						Assembly	
173300						Loads Control and Data Acquisition System		
180000	0019			Test Article Assessment and Preparation				
181000					Fatigue Test Articles Assessment			
181100						Determine Fatigue Damage Accumulated on Test Articles		
181200						Determine Aging Requirements for Test Articles		
181210							Average Fleet Aircraft Fatigue Damage at SLEP Kit Installation	
181220							Aging of Test Articles	
182000					Test Articles Preparation			
182100						Receive Test Aircraft		
182200						Disassemble and Reassemble of Test Articles		
182210							Wing/Fuselage Test Article	
182220							Empennage Test Article	
182230							Landing Gear Test	
182300						Detailed Inspection		
182400	0040, 0125, 0239					Design of Repairs and Development of Rework Procedures (O&A)		
182500	0040, 0125, 0239					Fabrication and Installation of Repairs, Modifications and Reworks (O&A)		
182600						Cabin Pressurization Re-Check		
182700						Markings		
182800						Test Article Configuration Control		
182900						Test Article Instrumentation		
182910							Wing/Fuselage	
182911								Determination
182912								Installation, Calibration and Maintenance
182920							Empennage	
182921								Determination
182922								Installation, Calibration and Maintenance
182930							Landing Gear	
182931								Determination
182932								Installation, Calibration and Maintenance
190000	0021			Test Planning				
191000					Wing/Fuselage			
191100						Test Conduct		
191200						Test Inspections		
191210							Periodic Inspections	
191300						Test Anomalies Dispositions (CDRL)		
192000					Empennage			
192100						Test Conduct		
192200						Test Inspections		
192210							Periodic Inspections	
192300						Test Anomalies Dispositions (CDRL)		

WBS	CLIN	LEVEL 1	2	3	4	5	6	7
193000					Landing Gear			
193100						Test Conduct		
193200						Test Inspections		
193210							Periodic Inspections	
193300						Test Anomalies Dispositions (CDRL)		
200000			TEST					
210000	0101			Rig/Test Article Commissioning				
211000					Wing/Fuselage Test			
211100						Test Assembly		
211200						System Verification and Work-up		
211210							Applied Jack Loads Verification	
211220							Fatigue Test Loads Correlation	
211300						Initial Strain Survey		
211310							Strain Survey Loads Selection	
211320							Strain Survey Loads Correlation	
211330							Test Article Strain Survey	
212000					Empennage Test			
212100						Test Assembly		
212200						System Verification and Work-up		
212210							Applied Jack Loads Verification	
212220							Fatigue Test Loads Correlation	
212300						Initial Strain Survey		
212310							Strain Survey Loads Selection	
212320							Strain Survey Loads Correlation	
212330							Test Article Strain Survey	
213000					Landing Gear			
213100						Test Assembly		
213200						System Verification and Work-up		
213210							Applied Jack Loads Verification	
213220							Fatigue Test Loads Correlation	
213300						Initial Strain Survey		
213310							Strain Survey Loads Selection	
213320							Strain Survey Loads Correlation	
213330							Test Article Strain Survey	
220000	0104			Full-Scale Fatigue Test				
221000					Wing/Fuselage			
221100						Aging of Test Article		
221200	0103					SLEP Kit Installation		
221300						Test		
222000					Empennage			
222100						Aging of Test Article		
222200	0103					SLEP Kit Installation		
222300						Test		
223000					Landing Gear			
223100						Aging of Test Article		
223200	0103					SLEP Kit Installation		
223300						Test		

WBS	**CLIN**	**LEVEL**						
		1	**2**	**3**	**4**	**5**	**6**	**7**
230000				Extended Fatigue Testing				
231000	0111, 0221				Wing/Fuselage			
231100	0111					Additional 10,000 FTSH		
231200	0111					Additional 10,000 FTSH		
231300	0111					Additional 10,000 FTSH		
231400	0221AA					Additional 10,000 FTSH		
231500	0221AB					Additional 10,000 FTSH		
231600	0221AC					Additional 10,000 FTSH		
231700	0221AD					Additional 10,000 FTSH		
232000	0113, 0223				Empennage			
232100	0113					Additional 10,000 FTSH		
232200	0113					Additional 10,000 FTSH		
232300	0113					Additional 10,000 FTSH		
232400	0223AA					Additional 10,000 FTSH		
232500	0223AB					Additional 10,000 FTSH		
232600	0223AC					Additional 10,000 FTSH		
232700	0223AD					Additional 10,000 FTSH		
233000	0115, 0225				Landing Gear			
233100	0115					Additional 25,000 landings		
233200	0115					Additional 25,000 landings		
233300	0115					Additional 25,000 landings		
233400	0225AA					Additional 25,000 landings		
233500	0225AB					Additional 25,000 landings		
240000	0227			Damage Tolerance Testing				
241000					Wing/Fuselage			
241100	0227AA					Additional 10,000 FTSH		
241200	0227AB					Additional 10,000 FTSH		
241300	0227AC					Additional 10,000 FTSH		
241400	0227AD					Additional 10,000 FTSH		
241500	0227AE					Additional 10,000 FTSH		
241600	0227AF					Additional 10,000 FTSH		
241700	0227AG					Additional 10,000 FTSH		
242000					Empennage			
242100	0227AH					Additional 10,000 FTSH		
242200	0227AJ					Additional 10,000 FTSH		
242300	0227AK					Additional 10,000 FTSH		
242400	0227AL					Additional 10,000 FTSH		
242500	0227AM					Additional 10,000 FTSH		
242600	0227AN					Additional 10,000 FTSH		
242700	0227AP					Additional 10,000 FTSH		
243000					Landing Gear			
243100	0227AQ					Additional 25,000 landings		
243200	0227AR					Additional 25,000 landings		
243300	0227AS					Additional 25,000 landings		
243400	0227AT					Additional 25,000 landings		
243500	0227AU					Additional 25,000 landings		

WBS	CLIN	LEVEL						
		1	2	3	4	5	6	7
250000	0229			Residual Testing				
251000					Wing/Fuselage			
251100	0229AA					Additional 10,000 FTSH		
251200	0229AB					Additional 10,000 FTSH		
251300	0229AC					Additional 10,000 FTSH		
251400	0229AD					Additional 10,000 FTSH		
251500	0229AE					Additional 10,000 FTSH		
251600	0229AF					Additional 10,000 FTSH		
251700	0229AG					Additional 10,000 FTSH		
252000					Empennage			
252100	0229AH					Additional 10,000 FTSH		
252200	0229AJ					Additional 10,000 FTSH		
252300	0229AK					Additional 10,000 FTSH		
252400	0229AL					Additional 10,000 FTSH		
252500	0229AM					Additional 10,000 FTSH		
252600	0229AN					Additional 10,000 FTSH		
252700	0229AP					Additional 10,000 FTSH		
253000					Landing Gear			
253100	0229AQ					Additional 25,000 landings		
253200	0229AR					Additional 25,000 landings		
253300	0229AS					Additional 25,000 landings		
253400	0229AT					Additional 25,000 landings		
253500	0229AU					Additional 25,000 landings		
260000				Other Tests				
261000	0023				Coupon			
261100						Material Allowable Development for Replacement of Al 7075-T6		
261200						Sensitivity Studies		
261300	0219					Additional Coupon Testing		
262000	0025				Component			
262100	0109					Additional Component Testing		
300000			POST-TEST					
310000	0201			Post-Test Teardown and Inspection				
311000					Teardown and Inspection Planning			
312000					Teardown and Inspection			
312100	0214					LHS Outer Wing Teardown and Inspection		
312200	0201AA					Wing/Fuselage Teardown and Inspection		
312300	0201AB					Empennage Teardown and Inspection		
312400	0201AC					Landing Gear Teardown and Inspection		
320000				Analysis				
321000					Fractographic Examination			
322000					Scanning Electron Microscopy (SEM)			
323000					Re-baseline Analysis			
323100						Fatigue		
323200						Crack Growth		
330000	0216			Additional Analysis				
331000	0216AA				Additional Fractographic Examination			
332000	0216AB				Additional SEM			
333000	0216AC				Additional Re-baseline analysis			
333100						Fatigue		
333200						Crack Growth		

WBS	CLIN	LEVEL 1	2	3	4	5	6	7
340000	0203			Test Site Disassembly				
341000					Wing/Fuselage			
341100						Test Article Disposition		
341200						Rig Decommissioning		
342000					Empennage			
342100						Test Article Disposition		
342200						Rig Decommissioning		
343000					Landing Gear			
343100						Test Article Disposition		
343200						Rig Decommissioning		
344000					Strain Gage Data Disposition			
350000	0205			SRP/SLEP Kit and Tooling Integration				
360000	0207			SDRS Tracking Algorithm Development				
370000	0209			Fatigue Life Re-baselining				
371000					Re-baselining of 240 P-3C Aircraft			
371100						Gap-fill Procedure Development		
400000	0031, 0106, 0211		PROGRAM MANAGEMENT					
410000				Program Plan/Master Schedule				
420000				Program Reviews and Technical Interchange Meetings				
421000					Technical Presentations			
500000	0033, 0108, 0213		FINANCIAL MANAGEMENT					

APPENDIX E

CLINs and Cost Structure Cross-Reference Matrix

CLIN	Supplies or Services	Basic $60M Contract	Not Part of Basic $60M Contract Priced Options
0001	Loads System Update	✓	
0002	*Deleted*	✓	
0003	Spectra Development	✓	
0004	*Deleted*	✓	
0005	Design Data & Allowable Material Properties Development	✓	
0006	*Deleted*	✓	
0007	Fatigue & Damage Tolerance Analysis	✓	
0008	Data for Items 0001, 0003, 0005 & 0007	✓	
0009	Service Life Extension Program (SLEP) Kit Development	✓	
0010	Data for Item 0009	✓	
0011	SLEP Kit Tooling Fabrication	✓	
0012	SLEP Kit Fabrication	✓	
0013	Test Spectra Development	✓	
0014	Data for Item 0013	✓	
0015	Test Facility Set-Up	✓	
0015AA	*Deleted*	✓	
0015AB	*Deleted*	✓	
0015AC	*Deleted*	✓	
0016	*Deleted*	✓	
0017	Test Fixture Fabrication	✓	
0017AA	*Deleted*	✓	
0017AB	*Deleted*	✓	
0017AC	*Deleted*	✓	
0018	Test Fixture Assembly	✓	
0018AA	*Deleted*	✓	
0018AB	*Deleted*	✓	
0018AC	*Deleted*	✓	
0019	Test Article Assessment and Preparation	✓	
0019AA	*Deleted*	✓	
0019AB	*Deleted*	✓	
0019AC	*Deleted*	✓	
0020	*Deleted*	✓	
0021	Test Planning	✓	
0021AA	*Deleted*	✓	
0021AB	*Deleted*	✓	
0021AC	*Deleted*	✓	
0022	Data for Items 0015, 0019 & 0021	✓	
0023	Coupon Testing	✓	
0024	*Deleted*	✓	
0025	Component Testing	✓	
0026	Data for Item 0023 & 0025	✓	
0027	Dynamic Taxi Test Support	✓	
0028	*Deleted*	✓	
0029	Flight Test Support	✓	
0030	Data for Items 0027 & 0029	✓	
0031	Project Management	✓	
0032	Data for Item 0031	✓	
0033	Administrative/Financial Data	✓	

CLIN	Supplies or Services	Basic $60M Contract	Not Part of Basic $60M Contract Priced Options
0034	*Deleted*		
0035	*Deleted*		
0036	*Deleted*		
0037	*Deleted*		
0038	*Deleted*		
0039	*Deleted*		
0040	Design, Fabricate, and Install Repairs, Modifications and Reworks	✓*	
0041	Data for Item 0040	✓*	
0042	Material for Item 0040	✓*	
0101	Rig/Test Article Commissioning	✓	
0101AA	*Deleted*	✓	
0101AB	*Deleted*	✓	
0101AC	*Deleted*	✓	
0102	Data for Item 0101	✓	
0103	SLEP Kit Install	✓	
0103AA	*Deleted*	✓	
0103AB	*Deleted*	✓	
0103AC	*Deleted*	✓	
0104	Full Scale Fatigue Testing	✓	
0104AA	*Deleted*	✓	
0104AB	*Deleted*	✓	
0104AC	*Deleted*	✓	
0105	Data for Item 0104	✓	
0106	Project Management	✓	
0107	Data for Item 0106	✓	
0108	Administrative/Financial Data	✓	
0109	Additional Component Testing		✓
0110	Data for Item 0109		✓
0111	Extended Wing/Fuselage Fatigue Testing		✓
0111AA	*Deleted*		✓
0111AB	*Deleted*		✓
0111AC	*Deleted*		✓
0112	Data for Item 0111		✓
0113	Extended Empennage Fatigue Testing		✓
0113AA	*Deleted*		✓
0113AB	*Deleted*		✓
0113AC	*Deleted*		✓
114	Data for Item 0113		✓
115	Extended Landing Gear Fatigue Testing		✓
115AA	*Deleted*		✓
115AB	*Deleted*		✓
115AC	*Deleted*		✓
0116	Data for Item 0115		✓
0117	*Deleted*		
0118	*Deleted*		
0119	*Deleted*		
0120	*Deleted*		
0121	*Deleted*		
0122	*Deleted*		
0123	*Deleted*		
0124	*Deleted*		

			Not Part of Basic $60M Contract
CLIN	**Supplies or Services**	**Basic $60M Contract**	**Priced Options**
0125	Design, Fabricate, and Install Repairs, Modifications and Reworks	✓*	
0126	Data for Item 0125	✓*	
0127	Material for Item 0125	✓*	
0201	Post-Test Teardown and Inspection	✓	
0201AA	*Deleted*	✓	
0201AB	*Deleted*	✓	
0201AC	*Deleted*	✓	
0202	Data for Item 0201	✓	
0203	Test Site Disassembly	✓	
0203AA	*Deleted*	✓	
0203AB	*Deleted*	✓	
0203AC	*Deleted*	✓	
0204	Data for Item 0203	✓	
0205	SRP/SLEP Kit and Tooling Integration Study	✓	
0206	Data for Item 0205	✓	
0207	SDRS Tracking Algorithm Development	✓	
0208	*Deleted*	✓	
0209	Fatigue Life Expended Re-baselining	✓	
0210	Data for Items 0207 & 0209	✓	
0211	Project Management	✓	
0212	Data for Item 0211	✓	
0213	Administrative/Financial Data	✓	
0214	Left Hand Side (LHS) Wing Only		✓
0215	Data for Item 0214		✓
0216	Additional Post-Test Analysis		✓
0216AA	*Deleted*		✓
0216AB	*Deleted*		✓
0216AC	*Deleted*		✓
0217	Data for Item 0216		✓
0218	Additional SLEP Kit(s) Fabrication		✓
0219	Additional Coupon Testing		✓
0220	Data for Item 0219		✓
0221	Extended Wing/Fuselage Fatigue Testing		✓
0221AA	Additional 10,000 FTSH		✓
0221AB	Additional 10,000 FTSH		✓
0221AC	Additional 10,000 FTSH		✓
0221AD	Additional 10,000 FTSH		✓
0222	Data for Item 0221		✓
0223	Extended Empennage Fatigue Testing		✓
0223AA	Additional 10,000 FTSH		✓
0223AB	Additional 10,000 FTSH		✓
0223AC	Additional 10,000 FTSH		✓
0223AD	Additional 10,000 FTSH		✓
0224	Data for Item 0223		✓
0225	Extended Landing Gear Fatigue Testing		✓
0225AA	Additional 25,000 Landings		✓
0225AB	Additional 25,000 Landings		✓
0226	Data for Item 0225		✓

CLIN	Supplies or Services	Basic $60M Contract	Not Part of Basic $60M Contract Priced Options
0227	Damage Tolerance Testing		✓
0227AA	Wing/Fuselage Test Article 10,000 FTSH		✓
0227AB	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0227AC	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0227AD	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0227AE	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0227AF	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0227AG	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0227AH	Empennage Test Article 10,000 FTSH		✓
0227AJ	Empennage Test Article Additional 10,000 FTSH		✓
0227AK	Empennage Test Article Additional 10,000 FTSH		✓
0227AL	Empennage Test Article Additional 10,000 FTSH		✓
0227AM	Empennage Test Article Additional 10,000 FTSH		✓
0227AN	Empennage Test Article Additional 10,000 FTSH		✓
0227AP	Empennage Test Article Additional 10,000 FTSH		✓
0227AQ	Landing Gear Test Article 25,000 Landings		✓
0227AR	Landing Gear Test Article Additional 25,000 Landings		✓
0227AS	Landing Gear Test Article Additional 25,000 Landings		✓
0227AT	Landing Gear Test Article Additional 25,000 Landings		✓
0227AU	Landing Gear Test Article Additional 25,000 Landings		✓
0228	Data for Item 0227		✓
0229	Residual Testing		✓
0229AA	Wing/Fuselage Test Article 10,000 FTSH		✓
0229AB	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0229AC	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0229AD	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0229AE	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0229AF	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0229AG	Wing/Fuselage Test Article Additional 10,000 FTSH		✓
0229AH	Empennage Test Article 10,000 FTSH		✓
0229AJ	Empennage Test Article Additional 10,000 FTSH		✓
0229AK	Empennage Test Article Additional 10,000 FTSH		✓
0229AL	Empennage Test Article Additional 10,000 FTSH		✓
0229AM	Empennage Test Article Additional 10,000 FTSH		✓
0229AN	Empennage Test Article Additional 10,000 FTSH		✓
0229AP	Empennage Test Article Additional 10,000 FTSH		✓
0229AQ	Landing Gear Test Article 25,000 Landings		✓
0229AR	Landing Gear Test Article Additional 25,000 Landings		✓
0229AS	Landing Gear Test Article Additional 25,000 Landings		✓
0229AT	Landing Gear Test Article Additional 25,000 Landings		✓
0229AU	Landing Gear Test Article Additional 25,000 Landings		✓
0230	Data for Item 0229		✓
0231	*Deleted*		
0232	*Deleted*		
0233	*Deleted*		
0234	*Deleted*		
0235	*Deleted*		
0236	*Deleted*		
0237	*Deleted*		
0238	*Deleted*		

CLIN	Supplies or Services	Basic $60M Contract	Not Part of Basic $60M Contract Priced Options
0239	Design, Fabricate, and Install Repairs, Modifications and Reworks	✓*	
0240	Data for Item 0239	✓*	
0241	Material for Item 0239	✓*	
0301	*Deleted*		
0302	*Deleted*		
0303	*Deleted*		
0304	*Deleted*		
0305	*Deleted*		
0306	*Deleted*		
0307	*Deleted*		
0308	*Deleted*		
0401	*Deleted*		
0402	*Deleted*		
0403	*Deleted*		
0404	*Deleted*		
0405	*Deleted*		
0406	*Deleted*		
0407	*Deleted*		
0408	*Deleted*		

APPENDIX F

Acronyms

3M	Maintenance and Material Management
AA	Acquisition Activity
ACA	After Contract Award
AFC	Airframe Change
AIC	Aerodynamic Influence Coefficients
AIP	ASUW Improvement Program
ASUW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
BER	Beyond Economical Repair
BL	Butt Line
BUNO	Bureau Number
CAD	Computer Aided Design
CAG	Counting Accelerometer Group
CAGE	Commercial and Government Entity
CAM	Computer Aided Manufacture
CDRL	Contract Data Requirements List
CF	Canadian Forces
CFD	Computational Fluids Dynamics
CFE	Contractor Furnished Equipment
CG	Center of Gravity
CGD	Contractor Generated Damage
CLIN	Contract Line Item Number
COD	Crack-tip Open Displacement

DLL	Design Limit Loads
ECP	Engineering Change Proposal
ET	Eddy Current
FCA	Fatigue Critical Areas
FEM	Finite Element Model
FLE	Fatigue Life Expended
FMS	Foreign Military Sale
FPC	Flight Purpose Code
FS	Fuselage Station
FSFT	Full-Scale Fatigue Test
FTSH	Fatigue Test Spectrum Hours
GAG	Ground-Air-Ground
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GFM	Government Furnished Material
HSS	Horizontal Stabilizer Structure
HVOF	High Velocity Oxygenated Fuel
IAT	Individual Aircraft Tracking
ICAF	International Conference of Airframe Fatigue
JSAF	Joint Airborne Sigint Family
LHS	Left Hand Side
MLG	Main Landing Gear
MPCAG	Military Parts Control Advisory Group
MRB	Materials Review Board
MT	Magnetic Particle
MTOGW	Maximum Take Off Gross Weight
MZFW	Maximum Zero Fuel Weight

NADEP JAX	Naval Air Depot, Jacksonville, FL
NAS	Naval Air Station
NATOPS	Naval Air Training and Operating Procedures Standardization
NAVAIR	Naval Air Systems Command
NAVFLIR	Naval Flight Records
NDI	Non-Destructive Inspection
NDT	Non-Destructive Test
NLG	Nose Landing Gear
NRE	Non-Recurring Engineering
O&A	Over and Above
OML	Outer Mold Line
OWS	Outer Wing Station
IOSC	International Operators Systems Conference
PITS	Points-In-The-Sky
POD	Probability Of Detection
PSD	Power Spectrum Density
PT	Fluorescent Penetrant
QAPP	Quality Assurance Program Plan
QC	Quality Control
QEC	Quick Engine Change
RHS	Right Hand Side
RNLN	Royal Netherlands Navy
RT	Radiography
SAFE	Structural Appraisal and Fatigue Effects Report
SDLM	Structural Depot Level Maintenance
SDRS	Structural Data Recording System
SEAFAN	Sequence Accountable Fatigue Analysis

SEM	Scanning Electron Microscopy
SIC	Stiffness Influence Coefficients
SLAP	Service Life Assessment Program
SLEP	Service Life Extension Program
SM&R	Source Maintenance and Recoverability
SOW	Statement of Work
SQUID	Superconductive Quantum Interference Device
SRP	Sustained Readiness Program
SSIP	Sensor System Improvement Program
STA	Station
TD	Technical Directives
TIM	Technical Interchange Meetings
TOGW	Takeoff Gross Weight
USAF	United States Air Force
USN	U.S. Navy
UT	Ultrasound
V&V	Validation and Verification
WRA	Weapon Replaceable Assembly
ZFW	Zero Fuel Weight

APPENDIX G

Potential NDT Equipment Vendors

Thermal Wave Imaging (Infrared/Thermography)
Steven M. Shepard, Ph.D.
18899 West Twelve Mile Road
Latthrup Village, MI 48076
Phone: (248) 569-4960
Fax: (248) 569-4252

FUJI N.D.T. SYSTEMS (Digital Radiography)
Ron Bliwernitz
14007 Silver Oak Circle
Largo, FL 33774-2027
Phone: (813) 593-7370
Fax: (813) 593-9596
Voice Mail: (800) 446-5450 1.D. 6174
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Physical Acoustics Corp. (Acoustical Emission)
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Blue Road Research (Bragg Gratings)
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APPENDIX H

CLINs and CDRLs Cross-Reference Matrix

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0001	Loads System Update				
0002	Deleted				
0003	Spectra Development				
0004	Deleted				
0005	Design Data & Allowable Material Properties Development				
0006	Deleted				
0007	Fatigue & Damage Tolerance Analysis				
0008	Data for Items 0001, 0003, 0005 & 0007	A001	P-3C FSFT External & Internal Loads Methodology Report	3.2, 3.2.1.2.3.2	Preliminary 90 days after date of contract. Final 12 months after contract.
0008		A002	P-3C FSFT External Loads Report	3.2.1, 3.2.1.2.1	Preliminary no later than 9 months after contract. Final 60 days prior to submittal of Repeated Loads report.
			Vol. I - Inertia Loads	3.2.1.1, 3.2.1.1.1, 3.2.1.1.2	
			Vol. II - Flight Loads	3.2.1.2, 3.2.1.2.2, 3.2.1.2.3.1, 3.2.1.2.4, 3.2.1.2.5, 3.2.1.4	
			Vol. III - Ground Loads	3.2.1.3, 3.2.1.3.3	
			Vol. IV - Balanced Loads	3.2.2	
			Vol. V - Miscellaneous Loads	3.2.1.5	
0008		A003	P-3C FSFT Internal Loads Report		Preliminary 12 months after contract. Final 45 days prior to submittal of fatigue analysis.
			Vol. I - Finite Element Model	3.2.3.1.1, 3.5.3, 3.6.2.2.1	
			Vol. II - Finite Element Analysis	3.2.3.1.2	
			Vol. III - Loads-to-Stress Ratios	3.2.3.2	
0008		A004	P-3C FSFT Repeated Loads Criteria Report	3.3, 3.3.4.1	Preliminary 90 days after contract. Final 12 months after contract.
			SDRS Data Review	3.3.1	
			Critical Area Selection	3.3.3	
0008		A005	P-3C FSFT Repeated Loads Report	3.3.4	Preliminary 12 months after contract. Final 45 days prior to submittal of fatigue analysis.
0008		A006	P-3C FSFT New Material Selection and Materials Characterization Plan	3.4, 3.4.1, 3.16.1.1	Preliminary 90 days after contract. Final no later than 12 months after contract.
0008		A007	P-3C FSFT Material Substantiation and Analysis Report	3.4, 3.4.1, 3.16.1.1	Preliminary 60 days prior to SLEP Kit Design Program Review at 90% drawing release. Final 24 months after contract.
0008		A008	P-3C FSFT Fatigue and DTA Methodology Report	3.5	Preliminary 90 days after contract. Final 12 months after contract.
0008		A009	P-3C FSFT Fatigue and Damage Tolerance Analysis Report	3.5.1, 3.5.2, 3.18.3	Preliminary 120 days prior to start of FSFT, but no later than 15 months after contract. Final no later than 36 months after contract.

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0009	Service Life Extension Program (SLEP) Kit Development				
0010	Data for Item 0009	B001	P-3C SLEP Kit Concepts Report	3.6.1	Preliminary 90 days after contract. Final 45 days prior to SLEP Kit Design Program Review at 90% drawing release.
			Prototype Plan	3.6.2.4	
0010		B002	P-3C SLEP Kit Technical Data Package	3.1.6, 3.6.2.1, 3.6.2.3, 3.6.3.1, 3.6.5, 3.6.9, 3.12.2	Preliminary 45 days prior to SLEP Kit Design Program Review at 90% drawing release, but no later than 24 months after contract. Final 36 months after contract.
			Aircraft Weight and Balance		
			Installation		
			Training Manual		
0010		B003	P-3C SLEP Kit Analysis Report	3.18.3	Preliminary 45 days prior to SLEP Kit Design Program Review at 90% drawing release. Final 24 months after contract.
			Vol. I - Stress Analysis	3.6.2.2.2	
			Vol. II - Fatigue Analysis	3.6.2.2.3	
			Vol. III - Damage Tolerance Analysis	3.6.2.2.4	
			Vol. IV - Fail Safe Analysis	3.1.3.2, 3.6.2.2.5	
0010		B004	P-3C SLEP Kit Weight Prediction and Control Plan	3.6.2.3	90 days after contract
0010		B005	P-3C SLEP Kit Manufacturing and Process Plan	3.4.1.1	
			Vol. I - Quality Assurance Program Plan	3.6.6	Preliminary 90 days after contract. Final no later than 12 months after contract.
			Process Control Plan		
			Materials and Processes Supplier Control Plan		
			Vol. II - NDT/I Production Plan	3.6.6.1	Preliminary 90 days after contract. Final no later than 12 months after contract.
			Vol. III - Fracture Control Plan	3.6.6.2	Preliminary 90 days after contract. Final no later than 12 months after contract.
			Vol. IV - Parts Control Program Plan	3.6.7	Preliminary 90 days after contract. Final no later than 12 months after contract.
			Vol. V - Pollution/Hazardous Materials Prevention Plan	3.6.8	Preliminary 90 days after contract. Final no later than 12 months after contract.
			Vol. VI - Production Tooling Design Concept Plan	3.6.3.1	Preliminary 180 days after contract. Final 45 days prior to SLEP Kit Design Review at 90% Drawing Release.
0010		B006	P-3C SLEP Kit Fracture Control Report	3.6.6.2	45 days after first article qualification testing, but no later than 36 months after contract.
0010		B007	P-3C SLEP Kit Integrated Logistics Support Report		Preliminary 45 days prior to SLEP Kit Design Program Review at 90% drawing release. Final no later than 36 months after contract.
			Source Data Report	3.6.9	
			Support Equipment	3.1.7, 3.6.9	
0011	SLEP Kit Tooling Fabrication	Item			
0012	SLEP Kit Fabrication	Item			

CLIN	Supplies or Services	CDRL	CDRL Title				SOW Paragraph Ref.	Submittal Date
0013	Test Spectra Development							
0014	Data for Item 0013	C001	P-3C FSFT Fatigue Test Plan				3.9.1.2.1, 3.9.1.2.2, 3.9.2, 3.9.2.8, 3.10.1, 3.11.3, 3.12.2	Preliminary 6 months after contract. Final 90 days prior to start of FSFT.
				Vol. I - Test Spectrum Development				
					Plan		3.7.1	
					Coupon Test Plan		3.16.1.1, 3.16.1.2	
					Spectrum Severity and Fatigue Analyses		3.7.2	
					Results Report		3.7.1	
				Vol. II - Test Article Configuration			3.9.2	
				Vol. III - Test Article Assessment Report			3.9.1.1, 3.9.2.3	
				Vol. IV - Jack Loads and Fatigue Test Loads Correlation			3.8.1, 3.11.2.2	
				Vol. V - Test Instrumentation			3.9.2.9, 3.9.2.9.1, 3.9.2.9.1.4, 3.9.2.9.1.5, 3.9.2.9.2	
				Vol. VI - Test Inspection Procedures			3.10.2, 3.10.3	
				Vol. VII - Fixture Design Concept Report			3.8.2, 3.8.2.1	
					Test Setup		3.11.1	
					Loads Control and Data Acquisition System		3.1.8, 3.8.3	
0015	Test Facility Set-Up							
0015AA	Deleted							
0015AB	Deleted							
0015AC	Deleted							
0016	Deleted							
0017	Test Fixture Fabrication	Item						
0017AA	Deleted	Item						
0017AB	Deleted	Item						
0017AC	Deleted	Item						
0018	Test Fixture Assembly	Item						
0018AA	Deleted	Item						
0018AB	Deleted	Item						
0018AC	Deleted	Item						
0019	Test Article Assessment and Preparation							
0019AA	Deleted							
0019AB	Deleted							
0019AC	Deleted							
0020	Deleted							
0021	Test Planning							
0021AA	Deleted							
0021AB	Deleted							
0021AC	Deleted							

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0022	Data for Items 0015, 0019 & 0021	D001	P-3C FSFT Fatigue Test Plan (revision to C001)	3.8.1, 3.8.2, 3.8.2.1, 3.8.3	Preliminary 90 days prior to FSFT start. Final 24 months after contract.
0022		D002	P-3C FSFT Fatigue Test Plan (revision to C001)	3.9.1.1, 3.9.1.2.1, 3.9.1.2.2, 3.9.2, 3.9.2.3, 3.9.2.8, 3.9.2.9, 3.9.2.9.1, 3.9.2.9.1.4, 3.9.2.9.1.5, 3.9.2.9.2	Preliminary 60 days after receipt of test article. Final 90 days prior to FSFT start.
0022		D003	P-3C FSFT Fatigue Test Plan (revision to C001)	3.10.1, 3.10.2, 3.10.3	Preliminary 6 months after contract. Final 90 days prior to FSFT start.
0023	Coupon Testing				
0024	Deleted				
0025	Component Testing				
0026	Data for Item 0023 & 0025	E001	P-3C FSFT Fatigue Test Plan (revision to C001)	3.16.1.2	Preliminary 90 days prior to FSFT start. Final 24 months after contract.
0026		E002	P-3C FSFT Component Test Plan	3.16.2	Preliminary 6 months after contract. Final 90 days prior to component testing start.
0026		E003	P-3C FSFT Component Test Report	3.16.2	60 days after completion of testing.
0027	Dynamic Taxi Test Support				
0028	Deleted				
0029	Flight Test Support				
0030	Data for Items 0027 & 0029	F001	P-3C FSFT External Loads Report (revision to A002)	3.2.1.3.3	Preliminary 45 days after completion of Taxi Test. Final 90 days after completion of Taxi Test.
0030		F002	P-3C FSFT External Loads Report (revision to A002)	3.2.1.2.1	Preliminary 60 days after completion of Flight Test. Final 120 days after completion of Flight Test.
0031	Project Management				
0032	Data for Item 0031	G001	P-3C FSFT Program Plan	3.24.1, 3.24.2, 3.24.2.1	45 days after contract. (revs quarterly)
			P-3C FSFT Risk Reduction and Implementation Plan		
0033	Administrative/Financial Data	H001	Cost/Schedule Status Report (C/SSR)	3.25.1	The first submission is due within 25 calendar days after the first full monthly accounting period following contract award. Subsequent submissions are due within 25 calendar days after the close of the contractor's monthly accounting period.
0033		H002	Contract Funds Status Report (CFSR)	3.25.2	The initial submission is required within twenty-five (25) days after the end of the calendar quarter in which the contract award. Subsequent submissions required twenty-five (25) days after the end of each quarter.
0033		H003	Contract Work Breakdown Structure (CWBS)	3.25.4	The initial submission is required within thirty (30) days of the date of contract award. Provide updates to previously approved CWBS, as required.

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0034	Deleted				
0035	Deleted	--			
0036	Deleted				
0037	Deleted	--			
0038	Deleted				
0039	Deleted	--			
0040	Design, Fabricate, and Install Repairs, Modifications and Reworks				
0041	Data for Item 0040	J001	P-3C FSFT O&A Work Proposal	3.1.9, 3.9.2.4, 3.18.3	No later than 7 days after work identification.
0042	Material for Item 0040				
0101	Rig/Test Article Commissioning				
0101AA	Deleted				
0101AB	Deleted				
0101AC	Deleted				
0102	Data for Item 0101	K001	P-3C FSFT Fatigue Test Plan (revision to C001)	3.11.1, 3.11.2.2, 3.11.3	90 days prior to FSFT start
0103	SLEP Kit Install	Item			
0103AA	Deleted	Item			
0103AB	Deleted	Item			
0103AC	Deleted	Item			
0104	Full Scale Fatigue Testing				
0104AA	Deleted				
0104AB	Deleted				
0104AC	Deleted				
0105	Data for Item 0104	L001	P-3C FSFT Failure Notification Reports	3.1.4, 3.12	No later than 24 hours after failure identification.
0105		L002	P-3C FSFT Periodic Inspection Results Report	3.10.2.1, 3.12	Preliminary 7 days after completion of first periodic inspection. Final 30 days after completion of first periodic inspection.
0105		L003	P-3C FSFT NDI Test Inspection Results Report	3.10.2.1, 3.17.2	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.
0106	Project Management				
0107	Data for Item 0106	M001	P-3C FSFT Program Plan	3.24.1, 3.24.2, 3.24.2.1	30 days after exercise of option CLIN.
			P-3C FSFT Risk Reduction and Implementation Plan		
0108	Administrative/Financial Data	N001	Cost/Schedule Status Report (C/SSR)	3.25.1	The first submission is due within 25 calendar days after the first full monthly accounting period following contract award. Subsequent submissions are due within 25 calendar days after the close of the contractor's monthly accounting period.
0108		N002	Contract Funds Status Report (CFSR)	3.25.2	The initial submission is required within twenty-five (25) days after the end of the calendar quarter in which the contract award. Subsequent submissions required twenty-five (25) days after the end of each quarter.

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0109	Additional Component Testing				
0110	Data for Item 0109	P001	P-3C FSFT Component Test Plan (rev. to E002)	3.16.2.1	Preliminary 90 days prior to the start of additional component testing. Final 30 days prior to start of additional component testing.
0110	Data for Item 0109	P002	P-3C FSFT Component Test Report (rev. to E003)	3.16.2.1	Preliminary 90 days after the start of additional component testing. Final 90 days after the completion of additional component testing.
0111	Extended Wing/Fuselage Fatigue Testing				
0111AA	Deleted				
0111AB	Deleted				
0111AC	Deleted				
0112	Data for Item 0111	Q001	P-3C FSFT NDI Test Inspection Results Report (revision to L003)	3.13.1	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.
0113	Extended Empennage Fatigue Testing				
0113AA	Deleted				
0113AB	Deleted				
0113AC	Deleted				
0114	Data for Item 0113	R001	P-3C FSFT NDI Test Inspection Results Report (revision to L003)	3.13.2	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.
0115	Extended Landing Gear Fatigue Testing				
0115AA	Deleted				
0115AB	Deleted				
0115AC	Deleted				
0116	Data for Item 0115	S001	P-3C FSFT NDI Test Inspection Results Report (revision to L003)	3.13.3	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.
0117	Deleted				
0118	Deleted	--			
0119	Deleted				
0120	Deleted	--			
0121	Deleted				
0122	Deleted	--			
0123	Deleted				
0124	Deleted	--			
0125	Design, Fabricate, and Install Repairs, Modifications and Reworks				
0126	Data for Item 0125	T001	P-3C FSFT O&A Work Proposal	3.1.9, 3.9.2.4, 3.18.3	No later than 7 days after work identification.
0127	Material for Item 0125				

CLIN	Supplies or Services	CDRL	CDRL Title		SOW Paragraph Ref.	Submittal Date
0201	Post-Test Teardown and Inspection					
0201AA	Deleted					
0201AB	Deleted					
0201AC	Deleted					
0202	Data for Item 0201	U001	P-3C FSFT Teardown and Inspection Plan		3.17.1	Preliminary 6 months prior to initiation of teardown. Final 45 days prior to initiation of teardown.
0202		U002	P-3C FSFT Teardown and Inspection Results Report		3.17.2	Preliminary 60 days after teardown and inspection initiation. Final 90 days after teardown and inspection completion.
				Vol. I - Wing/Fuselage	3.17.2.1, 3.17.2.2	
				Vol. II - Empennage	3.17.2.3	
				Vol. III - Landing Gear	3.17.2.4	
0202		U003	P-3 FSFT Test Failure Analysis Report		3.12, 3.18.1, 3.18.2	Preliminary 120 days after teardown and inspection completion. Final 12 months teardown and inspection completion.
0203	Test Site Disassembly					
0203AA	Deleted					
0203AB	Deleted					
0203AC	Deleted					
0204	Data for Item 0203	V001	P-3C FSFT Fatigue Test Raw Data Report		3.20.3	Preliminary 45 days after completion of FSFT. Final 6 months after completion of FSFT.
0205	SRP/SLEP Kit and Tooling Integration Study					
0206	Data for Item 0205	W001	P-3C SRP/SLEP Kit and Tooling Integration Study Report		3.21.1	Preliminary 6 months after exercise of option CLIN. Final 18 months after exercise of option CLIN.
0207	SDRS Tracking Algorithm Development					
0208	Deleted					
0209	Fatigue Life Expended Re-baselining					
0210	Data for Items 0207 & 0209	X001	P-3C IAT Development Plan		3.22.1	Preliminary 60 days after exercise of option CLIN. Final 12 months after exercise of option CLIN.
0210		X002	P-3C IAT Methodology Report		3.22	Preliminary 24 months after exercise of option CLIN. Final 36 months after exercise of option CLIN.
0210		X003	P-3C IAT User's Manual		3.22, 3.22.2	Preliminary 12 months after exercise of option CLIN. Final no later than 36 months after exercise of option CLIN.
0210		X004	P-3C Fatigue Life Expended (FLE) Re-Baseline Report		3.23.1	Preliminary 24 months after exercise of option CLIN. Final 36 months after exercise of option CLIN.
0211	Project Management					
0212	Data for Item 0211	M001	P-3C FSFT Program Plan		3.24.1, 3.24.2, 3.24.2.1	30 days after exercise of option CLIN.
				P-3C FSFT Risk Reduction and Implementation Plan		

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0213	Administrative/Financial Data	N001	Cost/Schedule Status Report (C/SSR)	3.25.1	The first submission is due within 25 calendar days after the first full monthly accounting period following contract award. Subsequent submissions are due within 25 calendar days after the close of the contractor's monthly accounting period.
0213		N002	Contract Funds Status Report (CFSR)	3.25.2	The initial submission is required within twenty-five (25) days after the end of the calendar quarter in which the contract award. Subsequent submissions required twenty-five (25) days after the end of each quarter.
0214	Post-Test Teardown and Inspection of Left Hand Side (LHS) Wing Only				
0215	Data for Item 0214	Y001	P-3C FSFT Teardown and Inspection Results Report (rev. to U002)	3.17.2.1	Preliminary 60 days after teardown and inspection initiation. Final 90 days after teardown and inspection completion.
0216	Additional Post-Test Analysis				
0216AA	Deleted				
0216AB	Deleted				
0216AC	Deleted				
0217	Data for Item 0216	Z001	P-3 FSFT Test Failure Analysis Report (rev. U003)	3.19.1, 3.19.2, 3.19.3	Preliminary 120 days after teardown and inspection completion. Final 12 months teardown and inspection completion.
0218	Additional SLEP Kit(s) Fabrication	Item			
0219	Additional Coupon Testing				
0220	Data for Item 0219	AA01	P-3C FSFT Fatigue Test Plan (rev. E001)	3.16.1.3	Preliminary 90 days prior to the start of additional coupon testing. Final 30 days prior to start of additional coupon testing.
0220	Data for Item 0219	AA02	P-3C FSFT Fatigue Test Plan (rev. E001)	3.16.1.3	Preliminary 90 days after the start of additional coupon testing. Final 90 days after the completion of additional coupon testing.
0221	Extended Wing/Fuselage Fatigue Testing				
0221AA	Additional 10,000 FTSH				
0221AB	Additional 10,000 FTSH				
0221AC	Additional 10,000 FTSH				
0221AD	Additional 10,000 FTSH				
0222	Data for Item 0221	AB01	P-3C FSFT NDI Test Inspection Results Report (revision to L003)	3.13.1	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.
0223	Extended Empennage Fatigue Testing				
0223AA	Additional 10,000 FTSH				
0223AB	Additional 10,000 FTSH				
0223AC	Additional 10,000 FTSH				
0223AD	Additional 10,000 FTSH				
0224	Data for Item 0223	AC01	P-3C FSFT NDI Test Inspection Results Report (revision to L003)	3.13.2	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0225	Extended Landing Gear Fatigue Testing				
0225AA	Additional 25,000 Landings				
0225AB	Additional 25,000 Landings				
0226	Data for Item 0225	AD01	P-3C FSFT NDI Test Inspection Results Report (revision to L003)	3.13.3	Preliminary 7 days after completion of inspection. Final 45 days after completion of inspection.
0227	Damage Tolerance Testing				
0227AA	Wing/Fuselage Test Article 10,000 FTSH				
0227AB	Wing/Fuselage Test Article Additional 10,000 FTSH				
0227AC	Wing/Fuselage Test Article Additional 10,000 FTSH				
0227AD	Wing/Fuselage Test Article Additional 10,000 FTSH				
0227AE	Wing/Fuselage Test Article Additional 10,000 FTSH				
0227AF	Wing/Fuselage Test Article Additional 10,000 FTSH				
0227AG	Wing/Fuselage Test Article Additional 10,000 FTSH				
0227AH	Empennage Test Article 10,000 FTSH				
0227AJ	Empennage Test Article Additional 10,000 FTSH				
0227AK	Empennage Test Article Additional 10,000 FTSH				
0227AL	Empennage Test Article Additional 10,000 FTSH				
0227AM	Empennage Test Article Additional 10,000 FTSH				
0227AN	Empennage Test Article Additional 10,000 FTSH				
0227AP	Empennage Test Article Additional 10,000 FTSH				
0227AQ	Landing Gear Test Article 25,000 Landings				
0227AR	Landing Gear Test Article Additional 25,000 Landings				
0227AS	Landing Gear Test Article Additional 25,000 Landings				
0227AT	Landing Gear Test Article Additional 25,000 Landings				
0227AU	Landing Gear Test Article Additional 25,000 Landings				
0228	Data for Item 0227	AE01	P-3C FSFT Damage Tolerance Test Plan	3.1.3.3.2, 3.14	Preliminary 60 days after exercise of option CLIN. Final 45 days prior to test.
0228		AE02	P-3C FSFT Damage Tolerance Test Report	3.14.1, 3.14.1.1, 3.14.2, 3.14.2.1, 3.14.3, 3.14.3.1	Preliminary 45 days after test completion. Final 120 days after test completion.
0229	Residual Testing				
0229AB	Wing/Fuselage Test Article Additional 10,000 FTSH				
0229AC	Wing/Fuselage Test Article Additional 10,000 FTSH				
0229AD	Wing/Fuselage Test Article Additional 10,000 FTSH				
0229AE	Wing/Fuselage Test Article Additional 10,000 FTSH				
0229AF	Wing/Fuselage Test Article Additional 10,000 FTSH				
0229AG	Wing/Fuselage Test Article Additional 10,000 FTSH				
0229AH	Empennage Test Article 10,000 FTSH				
0229AJ	Empennage Test Article Additional 10,000 FTSH				
0229AK	Empennage Test Article Additional 10,000 FTSH				
0229AL	Empennage Test Article Additional 10,000 FTSH				
0229AM	Empennage Test Article Additional 10,000 FTSH				
0229AN	Empennage Test Article Additional 10,000 FTSH				
0229AP	Empennage Test Article Additional 10,000 FTSH				
0229AQ	Landing Gear Test Article 25,000 Landings				
0229AR	Landing Gear Test Article Additional 25,000 Landings				
0229AS	Landing Gear Test Article Additional 25,000 Landings				
0229AT	Landing Gear Test Article Additional 25,000 Landings				
0229AU	Landing Gear Test Article Additional 25,000 Landings				

CLIN	Supplies or Services	CDRL	CDRL Title	SOW Paragraph Ref.	Submittal Date
0230	Data for Item 0229	AF01	P-3C FSFT Residual Test Plan	3.15	Preliminary 60 days after exercise of option CLIN. Final 45 days prior to test.
0230		AF02	P-3C FSFT Residual Test Report	3.15.1, 3.15.1.1, 3.15.2, 3.15.2.1, 3.15.3, 3.15.3.1	Preliminary 45 days after test completion. Final 120 days after test completion.
0231	Deleted				
0232	Deleted				
0233	Deleted				
0234	Deleted	--			
0235	Deleted				
0236	Deleted	--			
0237	Deleted				
0238	Deleted	--			
0239	Design, Fabricate, and Install Repairs, Modifications and Reworks				
0240	Data for Item 0239	AG01	P-3C FSFT O&A Work Proposal	3.1.9, 3.9.2.4, 3.18.3	No later than 7 days after work identification.
0241	Material for Item 0239				
0301	Deleted				
0302	Deleted	--			
0303	Deleted				
0304	Deleted	--			
0305	Deleted				
0306	Deleted	--			
0307	Deleted				
0308	Deleted	--			
0401	Deleted				
0402	Deleted	--			
0403	Deleted				
0404	Deleted	--			
0405	Deleted				
0406	Deleted	--			
0407	Deleted				
0408	Deleted	--			