DATE: August 23, 2016

TO: Center Directives Manager
Langley Research Center

FROM: Shane G. Dover
Director, Research Services Directorate

SUBJECT: MEMO Authorizing Continued Use of Expired Langley Directive
LPR 1710.16, Aviation Operations & Safety Manuel
Expiration date: May 31, 2016

REF A: NASA Requirement Waiver for NPR 1400.1 (3.5.2.6), NRW 1400-37

In accordance with reference A, I authorize the continued use of the expired subject directive.

LPR 1710.16, Aviation Operations & Safety Manuel
The subject directive has been reviewed prior to the expiration date and a summary of the required changes is: 1. No changes
The directive was also assessed for the risk of continued use after expiration versus the risk of not having the directive available after expiration. The results of that risk assessment are: 1. No risk
Justification for the delay is: Anticipating the release of NPR 7900.3D prior to submission of updated version of LPR 1710.16
The updated directive will be submitted for Center-wide review no later than January 30, 2017

Please refer any questions or concerns regarding the continued use of this directive to Shane G. Dover, RSD Director.

Director, Research Services Directorate 8/22/2016 (Date)

cc:
218/K.C.Suddreth
255A/RSD:sgj 8/23/16 (46222)

Langley Research Center

LPR 1710.16 I

Effective Date: **November 14, 2013**

Expiration Date: **May 31, 2016**

Aviation Operations & Safety Manual

National Aeronautics & Space Administration

TABLE OF CONTENTS

PREFACE

P.1 PURPOSE

a. This document sets forth general guidelines and requirements for the management and operation of aircraft assigned to the NASA Langley Research Center (LaRC) and for overall aviation safety assurance for airborne and airframe systems research flying conducted or sponsored by LaRC. This document is based upon NPD 7900.4, *NASA Aircraft Operations Management*, which establishes policy for the use of all NASA and non-NASA aircraft used to support the Agency missions and by NPR 7900.3, *Aircraft Operations Management,* which prescribes requirements for the operation of all aircraft used in NASA missions or aircraft using NASA funding or personnel. The purpose of the NASA Aircraft Operations program is to directly support the Agency's mission in aeronautical research and development, space science and applications, space flight, astronaut readiness training, and related activities by providing operational flights in both manned aircraft and unmanned aircraft systems (UASs).

b. This document does not address every contingency that may arise or every rule of safety or good practice. Specific rules, procedures, and guidelines contained herein are considered to be minimum requirements. All LaRC flight operations shall be in compliance with all applicable Federal Aviation Regulations (FAR), Federal law, and the rules set forth in this manual. The guidelines and procedures in this manual are not intended to conflict with any Aircraft Flight Manual (AFM) or Pilot's Operating Handbook (POH). This document contains the elements of the Interagency Committee for Aviation Policy (ICAP) Safety Standards Guidelines for Federal Flight Programs that shall be addressed in accordance with the interagency Memorandum of Understanding (MOU).

P.2 APPLICABILITY

a. This document is applicable to LaRC employees and to contract personnel. It is the responsibility of all personnel to comply with applicable FARs, this operations manual, and all Agency regulations that apply. In the event of conflict among the above regulations, the most restrictive regulation shall apply. This document establishes the general policies and procedures for the operation, use, and scheduling of NASA LaRC aircraft. It covers aircraft that are bought, borrowed, chartered, rented, or otherwise procured or acquired--including aircraft produced with the aid of NASA funding--regardless of cost, from any source for the purpose of conducting NASA science, research, or other missions, and that are operated by NASA or whose operation is managed by NASA. Unmanned aircraft are defined as "aircraft" by the FAA and are included in the definition of NASA aircraft, unless specified otherwise. It is not intended to replace FARs or any AFM; rather it is intended to offer additional procedures and policies to be followed by NASA Langley Research Center aviation personnel and as a means to communicate these to management. Applicable Federal Aviation Regulations and Federal law are the final authority as to Agency aircraft operations.

P.3 AUTHORITY

a. 49 USC 40102, Definition of "civil aircraft" and "public aircraft"

b. 14 CFR Parts 1, 21, 23, 25, 61, 91, and 105. "Federal Aviation Regulations"

c. 19 CFR Part 122, Subpart C. "Private aircraft"

d. 19 CFR Part 122, Subpart N. "Flights to and from the U.S. Virgin Islands"

e. 49 CFR Chapter I, Subchapter C. "Hazardous Materials Regulations."

f. IMO document, SAR.8/Circ.1

g. ICAO Annexes 12, 13, & 18.

h. ICAO Doc. 9574

i. FAA AC 91-57: Model Aircraft Operating Standards

j. FAA AC 91-70A: Oceanic and International Operations

k. FAA AC 91-85: Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum Airspace

l. FAA UAS Certification Status: Unmanned Aircraft Systems Certification Status

m. FAA UAS Policy 05-01: Unmanned Aircraft Operations in the National Airspace System {Federal Register Notice – Clarification of FAA Policy }

n. FAA-S-8081-14A: Private Pilot Practical Test Standards for Airplane

o. FAA ARP5707, Aerospace Recommended Practice - Pilot Training Recommendations for Unmanned Aircraft Systems (UAS) Civil Operations: UAV working group

P.4 APPLICABLE DOCUMENTS AND FORMS

a. NPD 4200.1, "Equipment Management"

b. NPD 7900.4, "NASA Aircraft Operations Management"

c. NPR 1620.3, "Physical Security Requirements for NASA Facilities and Property"

d. NPR 4200.1, "NASA Equipment Management Procedural Requirements"

e. NPR 7120.7, “NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements”

f. NPR 7120.8, “NASA Research and Technology Program and Project Management Requirements”

g. NPR 7900.3, “Aircraft Operations Management Manual”

h. NPR 8621.1, “NASA Procedural Requirements for Mishap and Close Call Reporting, Investigating, and Recordkeeping”

i. NPR 8715.3, “NASA General Safety Program Requirements”

j. NPR 8715.5, “Range Flight Safety Program”

k. LAPD 1150.2, “Councils, Boards, Panels, Committees, Teams, and Groups”

l. LAPD 1700.2, “Safety Assignments and Responsibilities”

m. LAPD 1700.5, “NASA Langley Research Center Maximum Work Time Policy”

n. LAPD 1710.1, “Langley Research Center Aviation Safety Policy”

o. LAPD 9700.3, “Travel Requirements, Officials and Redelegations”

p. LPR 1046.1, “Emergency Management Plan”

q. LPR 1710.12, Potentially Hazardous Materials - Hazard Communication Standard

r. LPR 1740.3, “Facility Safety Head and Facility Coordinator Guide”

s. LAFB 11-250, “Airfield Operations and Base Flying Procedures”

t. LAFB 11-251, “Quiet Hours”

u. LMS-OUP-D1, “Research Services Directorate Organizational Unit Plan”

v. LMS-CP-0902, “Unilateral Stop Authority for Flight Operations and Related Activities”

x. LMS-CP-0904, “Authorizing Flight Aboard Non-LaRC Aircraft”

y. LMS-CP-0905, “Authorizing Flight Requests for LaRC Aircraft”

z. LMS-CP-0910, “Process Aircraft Work Orders”

aa. LMS-CP-0960, “Conducting Flight Experiments Utilizing Research Services Directorate (RSD) Aircraft”

bb. LMS-CP-5580, “Airworthiness and Safety Review Board (ASRB)”

cc. LMS-OP-0911, “Review and Implementation of Aircraft Directives”

dd. LMS-OP-0912, “Aircraft Maintenance, Inspection and Flight Release”

ee. LMS-OP-0939, “Aviation Accident Reporting, Investigation and Site Management Plan”

ff. LMS-TD-0940, “Langley Research Center General Aircraft Maintenance Manual for Research Services Directorate”

gg. LF 123, “Aircraft Emergency Egress / Equipment Training Form"

hh. LF 273, “Flight Research Hazard Analysis”

ii. LF 277, “NASA/Langley Research Center Flight Evaluation and Training Record"

jj. LF 432, “Research Vehicle Work Order Request and Approval Form w/continuation sheet”

kk. LF 436, “Experimental Systems Work Request”

ll. LF 444, “Simulation and Flight Work Request”

mm. ICAP Flight Ops Manual Operation Guide

nn. Academy of Model Aeronautics:

- 510-A: Safety Regulations for Model Aircraft Gas Turbines
- 510-D: Fixed Wing - Turbine Waiver Application
- 2008 Official AMA National Model Aircraft Safety Code: 105

P.5 MEASUREMENT/VERIFICATION

To determine the compliance of RSD with the requirements contained in this LPR, internal and external auditors responsible for verifying HQ and Center requirements and processes evaluate the performance against the requirements contained within this LPR, NPD 7900.4, and NPR 7900.3.

P.6 CANCELLATION

The issuance of this manual supersedes LPR 1710.16, *Aviation Operations and Safety Manual*, dated June 14, 2011.

Original signed on file

Stephen G. Jurczyk
Deputy Director

Distribution:
Approved for public release via the Langley Management System; distribution is unlimited.

1.0 ADMINISTRATIVE RESPONSIBILITIES AND REQUIREMENTS

1.0.1 To ensure that Langley Research Center (LaRC) research and support aircraft operations are conducted in a safe, efficient, and productive manner, the Research Services Directorate Director, the Chief of Research Flight Operations (CRFO), the Chief Pilot, the Aviation Safety Officer (ASO), and the Range Safety Officer (RSO) maintain direct oversight of the planning and implementation of these activities. Their responsibilities and those of other associated officials and organizations follow.

1.0.2 In addition to the continuous responsibilities delineated below, specific emergency/accident response and notification functions exist (on an as-needed basis) for various LaRC personnel as described in LMS-OP-0939, *Aviation Accident Reporting, Investigation, and Site Management Plan*.

1.1 DIRECTOR, RESEARCH SERVICES DIRECTORATE (RSD)

1.1.1 The RSD Director is the Organizational Unit Manager (OUM) responsible for oversight of RSD flight operations and aviation safety. The RSD Director formulates business policies and plans for aircraft management and ensures that appropriate procedures and policies exist to comply with government and Agency regulations. The RSD Director conforms with the definition of the "Aviation Program Manager," set forth by the Interagency Committee for Aviation Policy (ICAP) guidelines. RSD Director responsibilities include, but are not limited to:

a. Maintaining overall responsibility for LaRC aviation operations and their safe conduct.

b. Ensuring compliance with the LaRC Safety Program.

c. Ensuring that appropriate research systems development processes exist and are being used by employees.

d. Ensuring the establishment of operations and safety guidelines and procedures.

e. Providing resources and capabilities for implementation of research flight activities.

f. Preparing and implementing the aviation budget.

g. Developing and advocating staff hiring and training/certification strategies for RSD to implement LaRC research flight activities.

h. Reviewing and signing Flight Test Operations & Safety Reports (FTOSR) presented to the Airworthiness & Safety Review Board (ASRB), as well as Research Vehicle Work Order (RVWO) initiations and revisions.

i. Supervising all contract vendors, accounts, and services to ensure compliance with Federal purchasing and accounting procedures, as well as timely, uninterrupted service.

j. Ensuring compliance with Federal property acquisition and disposition regulations.

k. Establishing and maintaining communications and an effective relationship with NASA HQ personnel responsible for controlling aircraft operations.

l. Authorizing deviations/waivers of rules and maintenance procedures when necessary to provide for safe continuation of operations and with due regard to the impact on future maintenance requirements. These deviations shall not violate NASA policy or procedural requirements. Documentation of waivers and deviations shall be maintained in maintenance data logs and/or flight logs, as appropriate. These deviations are normally logged into the NAMIS database.

1.2 CHIEF OF RESEARCH FLIGHT OPERATIONS (CRFO)

1.2.1 The CRFO at NASA Langley performs the duties of the "Director of Operations," set forth by the Interagency Committee for Aviation Policy (ICAP) guidelines. He/she shall be knowledgeable concerning the contents of this document and the provisions of applicable regulations necessary for the proper performance of his/her duties and responsibilities. This person shall have the responsibility for ensuring the missions are conducted safely and in compliance with this document, Agency regulations, and applicable Federal Aviation Regulations. The CRFO shall also:

a. Hold or have held either a commercial pilot certificate, airline transport pilot certificate, or military equivalent; or

b. Have at least 3 years of experience as a pilot-in-command of an aircraft operated under 14 CFR parts 121, 125, or 135, or equivalent military service; or

c. Have at least 3 years of experience as CRFO or equivalent in the government, in the military, or with a civil certificate holder operating under 14 CFR parts 121, 125, or 135, and

d. Have at least 3 years of flight test/research operations experience.

1.2.2 As delineated in NPR 7900.3, the CRFO "is the senior line manager with authority over flight activities operated or controlled by the Center and is directly responsible to the Center Director for the safe and effective conduct of those activities." The CRFO's responsibilities include, but are not limited to:

a. Overall supervision and management of the Functional Areas of aircraft piloting, aircraft maintenance and modification, aircraft quality assurance, operations engineering, logistics and planning, and airworthiness and aircraft configuration control/management.

b. Maintaining effective communications.

c. Defining, proposing and implementing the management guidelines, processes, and procedures necessary to enable safe and effective operations of LaRC-assigned aircraft, including appropriate training/certification programs for all Functional Areas.

d. Developing and implementing flight following procedures to provide for timely notification of management and for initiating search-and-rescue operations in case of a lost or downed aircraft.

e. Developing and implementing a thorough and comprehensive training program to include initial and recurrent training appropriate for all aviation program personnel responsibilities and necessary operational skills relevant to the types of operations/missions conducted by the Center.

f. Defining and implementing an Aviation Safety and Mishap Prevention Program that meets Agency requirements and any additional Center guidelines, assisted by the Aviation Safety Officer (ASO) and the Functional Area managers.

g. Initial investigation of all incidents and accidents involving LaRC aviation personnel and/or aircraft, within the guidance and parameters set forth in NPR 8621.1.

NOTE: (Investigations may be conducted by the National Transportation Safety Board (NTSB) in which case a request shall be made to the NTSB to include a member of the Agency as a party to the investigation and to assist the NTSB as necessary.)

h. Review and concurrence with the FTOSR.

i. Establishing and maintaining effective relationships with the local Flight Standards District Office (FSDO) of the Federal Aviation Administration (FAA) when "civil" aircraft are assigned.

j. Approving waivers to provisions of this document that are under his/her area of responsibility (as defined in this section) and notifying the RSD Director when this occurs.

k. Providing management approval of Flight Requests to ensure that flights conducted in LaRC aircraft are in accordance with Flight Safety Releases (FSR), Boarding Authorizations (BA), or other management-approved activities.

l. Approving Boarding Authorizations (BA) for all personnel on LaRC aircraft.

m. Serving as the Center interface to the Inter-center Aircraft Operations Panel (IAOP).

n. Generating flight operations guidelines, directives, and procedures associated with the operation of LaRC aircraft.

o. Establishing, monitoring, and enforcing safe operating practices, currency standards, and aircraft checkout policies.

p. Ensuring that monthly and annual aviation activity reports and other required reports are prepared properly and in a timely manner.

q. Assisting with budget preparation.

r. Preparing performance evaluations of first-line supervisors assigned to the aviation activity.

s. Designating pilots and aircrew for specific positions, such as Pilot-in-Command (PIC), Instructor Pilots (IP), Functional Check Pilots (FCF), Check Airman (CA), etc.

t. Other duties, as assigned.

1.3 AVIATION SAFETY OFFICER (ASO)

1.3.1 Background - The Aviation Safety Officer is the focal point for aviation safety matters for the Center Director, RSD Director, and the CRFO. The ASO reports to the Center Director on all aviation safety matters. Qualification requirements for the ASO are set forth in NPR 7900.3. The ASO is recommended by the CRFO, approved by the RSD Director, appointed by the Chairperson of the Executive Safety Council (ESC), and acts on behalf of the Chairperson and the Center Director when discharging his/her responsibilities (LAPD 1700.2, *Safety Assignments and Responsibilities*). The ASO is a permanent member of the Executive Safety Council (ESC) and the Airworthiness and Safety Review Board (ASRB).

1.3.2 ASO responsibilities include, but are not limited to:

a. Defining and implementing the Center Aviation Safety Program in conjunction with the Ground Safety Officer (GSO) and CRFO to address all areas of flight and ground operations safety of aircraft.

b. Providing technical guidance on safety aspects of flight programs and operations.

c. Fostering an aviation safety climate, promoting mishap prevention, and developing and maintaining an aviation accident reporting and investigation plan.

d. Maintaining conformance with prescribing directives, standards, and procedures. Identifying or recommending corrective action, when required.

e. Facilitating the operation of the Aviation Safety Working Group (ASWG).

f. Reviewing and concurring with the FTOSR and hazard analyses/risk assessments presented to the ASRB.

g. Providing liaison with the LaRC Safety Manager to identify and communicate aviation-related issues needing attention from other LaRC safety groups or committees.

h. Leading initial aircraft mishap investigations.

i. Maintaining a safety library to include all appropriate safety-related publications.

j. Maintaining a safety bulletin board to ensure timely crew awareness of safety issues.

k. Holding safety meetings quarterly, or more frequently as necessary, with regard to accident prevention measures, observed or reported hazards, and other safety-related issues.

l. Ensuring timely coordination with the CRFO for review of safety preventive measures, safety-related problems, and recommendations for enhanced safety procedures.

m. Attending required NASA Safety Officer meetings, ESC meetings, and ASRB meetings.

n. Participating in FAA-sponsored and other safety meetings/seminars, as may be deemed by policy or by the CRFO, to enhance aviation safety.

o. Monitoring aviation operations and facilities to ensure timely detection and awareness of potential safety hazards and to ensure prompt preventive measures where appropriate.

p. Supporting the Inter-center Aviation Operations Panel (IAOP) reviews as an investigative panel member, when assigned.

1.3.3 The ASO shall provide independent reports on aviation safety to the RSD Director, ESC Chairperson, and/or the Head of LaRC Safety and Mission Assurance (SMAO), as requested. In times of unavoidable absence from duty or of other conflicting time demands, the Aviation Safety Officer may appoint an assistant to execute the duties of the office.

1.4 AIRWORTHINESS & CONFIGURATION CONTROL/MANAGEMENT

1.4.1 Airworthiness (Research and Basic)

1.4.1.1 Research airworthiness engineering design and review are provided by RSD Airworthiness Engineers and/or contracted engineering support and are the focal points for aircraft and research systems modification and operational airworthiness assurance. These research designs and systems are subject to airworthiness review by the ASRB upon incorporation into a research vehicle or system prior to obtaining an FSR. Airworthiness responsibilities include, but are not limited to:

a. Reviewing engineering designs, aircraft modifications, and equipment installations.

b. Ensuring that engineering designs are in compliance with applicable FAR, military design specifications, or approved NASA airworthiness guidelines, as appropriate.

c. Documenting the design and any potential limitations or restrictions to normal flight manual usage and normal risk-of-flight.

d. Obtaining appropriate approvals prior to flight operations.

1.4.1.2 Basic aircraft airworthiness is ensured through the oversight and monitoring by the Quality Assurance Office (QAO), as set forth in Section 1.10 of this document.

1.4.2 Configuration Control/Management

1.4.2.1 Configuration control is established through the initiation and completion of the Research Vehicle Work Order (RVWO) process.

1.4.2.2 Configuration Management is provided by the use of the NAMIS and is archived by the QAO. Additional documentation may be required to be provided to the ASRB prior to issuance of a FSR. This may include design review minutes, engineering drawings, and flight manual changes, for example.

1.5 GROUND SAFETY OFFICER (GSO)

1.5.1 The Research Systems Integration Branch (RSIB) shall provide a Ground Safety Officer (GSO) which is an appointed position that functions as a safety advocate and consultant to the CRFO on aviation safety matters unique to ground-based operations. The GSO monitors general aircraft operations and provides recommendations for maintaining and improving ground safety to the CRFO and the Aviation Safety Officer. The GSO conducts safety meetings and provides other safety-related activities throughout the year. The GSO is a member of the Aviation Safety Working Group (ASWG).

1.5.2 The GSO shall institute mandatory safety indoctrination briefings for all personnel required to access and work within the hangar environs. As a minimum, the briefings shall include information on aircraft-specific hazards, such as propeller arcs and jet blast, and on FOD, fire suppression systems, and chemical (Material Safety Data Sheets – MSDS) hazard considerations.

1.6 CHIEF PILOT

1.6.1 Background - The Chief Pilot shall be an experienced pilot whose training and expertise provide the leadership and technical competence necessary to support the aeronautical research mission of the Center. The Chief Pilot shall also:

a. Hold an Airline Transport Pilot certificate or have equivalent military certification, and have at least 3 years of experience as a pilot-in-command of an aircraft under 14 CFR parts 121, 125, 135, or military or civil government experience. Additional qualification requirements are set forth in NPR 7900.3.

b. Be a current NASA Research Pilot with designation as an Aerospace Technologist (AST).

c. Oversee the activities of the LaRC pilot staff to support flight experiments and piloted simulation requirements of the Center.

1.6.2 In functioning as technical and operational advisor to the CRFO, the Chief Pilot's responsibilities include, but are not limited to, functioning as a technical and operational advisor to the CRFO. He/she also:

a. Supervises the Operations and Engineering Branch, consisting of pilots and operations/instrumentation engineers.

b. Oversees flight operations activities, including processes and systems for planning, dispatch, and monitoring of flights in progress.

c. Shall be thoroughly familiar with the provisions of this document and the requirements of applicable regulations pertaining to flight operations and research.

d. Ensures that a flight schedule exists that meets flight crew currency, proficiency, experiment, and training requirements.

e. Ensures that research pilots have appropriate experience, training, and expertise to perform satisfactorily in their project pilot roles (for both flight and simulation experiments).

f. Recommends appropriate pilot staffing levels and methods to meet projected research program objectives.

g. Ensures that the pilots' and operations engineers' career development and training are defined and accomplished.

h. Assists the assigned Contracting Officer's Technical Representative (COTR) in the monitoring and oversight of any non-Civil Service pilots used in the operation of LaRC-assigned aircraft and flight projects.

i. Establishes, monitors, and enforces safe operating practices, currency standards, aircraft checkout policies, and training plans for the pilot staff.

j. Is responsible for the standardization of flight crews and aircraft operations.

k. Assists the CRFO with the preparation of the budget, administrative and pilot duties.

l. Recommends designation of qualified pilots/crewmembers as Training Officers, Instructor Pilots, Check Airmen, and Functional Check Pilots.

m. Assigns training duties to ensure the Training Program is administered as outlined in this LPR. This may include delegation of Chief Pilot duties (i.e., check rides, record keeping, etc.) as required, to Training officers and/or Instructor pilots/Check Airmen.

n. Establishes and maintains a Pilot Information File (PIF) for the dissemination of new policy and information.

o. Investigates deviations from regulations/policies and report findings to the CRFO.

1.7 RANGE SAFETY OFFICER (RSO)

1.7.1 Background - All sUAS flight operations under NASA purview are subject to the requirements of NPR 8715.5, Range Safety Program.

1.7.2 The Range Safety Officer (RSO) is responsible to provide safety oversight for UAS operations. He/she shall provide liaison support with other range safety organizations when operating at their sites. The program/project manager shall limit the assessed collective risk associated with sUAS vehicle operation and ensure that the probability of doing harm to a member of the general public is not greater than the criteria established by NPR 8715.5, Range Safety Program.

1.8 PILOT-IN-COMMAND (PIC)

1.8.1 Background - The PIC has the ultimate individual authority and responsibility for the safe and professional operation of an aircraft during the course of a specific flight and the resultant safety of the aircraft, passengers, crew, and/or payload.

1.8.2 PIC‘s shall:

a. Maintain current awareness of all pertinent Agency requirements, FAA regulations, and other regulatory data bearing on the performance of their duties.

b. Obtain and maintain all FAA-required flight reviews, medical certification, and currency as set forth in the FARs prior to operation of civil certificated aircraft.

c. Exercise responsibility for the safe conduct of all aircraft, personnel, and equipment during flight operations including, but not limited to the following:

(1) Ensuring the airworthiness of the aircraft prior to flight.
(2) Ensuring that all appropriate safety policies and procedures are carried out during the flight.
(3) Accomplishing flight planning and preparation, including preflight inspections of aircraft and equipment.
(4) Obtaining an appropriate weather briefing.
(5) Ensuring Reduced Vertical Separation Minimum/Required Navigational Performance (RVSM/RNP) compliance, when required.

(6) Ensuring a safe landing zone selection.
(7) Making go/no-go and landing judgments with regard to weather minimums or other criteria.
(8) Ensuring all air-to-air, air-to-ground, and Air Traffic Control (ATC) communications are conducted professionally.
(9) Ensuring timely reporting of new or previously unknown hazards to safe flight encountered.
(10) Conduct of post flight inspections.

d. Sign the documents required for final release of the flight once the flight is appropriately scheduled, approved by management, and released by maintenance.

e. Exercise final authority to delay or divert flights for reasons of weather, aircraft status, or other safety-related considerations.

f. Ensure that passengers and crew members are briefed on operational requirements, egress procedures, and safety and emergency procedures, as well as any other pertinent information.

g. Provide for the security of the aircraft when away from LaRC by coordination with fixed base operators/law enforcement/military security, as appropriate. Additional guidance is available in NPR 1620.3.

h. Perform additional duties, as assigned.

1.9 RESEARCH SYSTEMS INTEGRATION BRANCH (RSIB)

1.9.1 The Research Systems Integration Branch (RSIB) is the maintenance unit for the aircraft fleet assigned to LaRC. This Branch is responsible for establishing and implementing procedures for maintenance and integration of systems on all aircraft and ground support equipment in accordance with prescribing Agency regulations. Additionally, aviation maintenance and modifications shall be conducted in compliance with appropriate national, state, and Agency institutional/occupational safety and health (OSHA) regulations.

1.9.2 RSIB responsibilities include, but are not limited to:

a. Basic aircraft maintenance and aircraft research system interface configuration for aircraft implementation.

b. Maintenance of aviation ground support equipment and related hangar facilities in support of flight projects.

c. Acquisition, storage and inventory of aircraft parts and consumables.

d. Facility safety and functional management for the Building 1244 complex.

e. Management and implementation of a ground safety program in coordination with the Ground Safety Officer.

f. Proper handling and storage of hazardous materials

1.9.3 The Branch Head of RSIB serves in the role defined by ICAP guidance as the "Director of Maintenance." He/she shall be thoroughly familiar with the provisions of applicable regulations necessary for the proper performance of his/her duties and responsibilities. He/she shall have at least 3 years of maintenance experience as an FAA certificated or military mechanic on aircraft, or as an FCC-licensed avionics technician or military equivalent, in at least one of the same categories and classes of aircraft used by LaRC, or at least 3 years of experience with a certificated airframe repair station, including 1 year in the capacity of approving aircraft, parts and/or components for return to service.

1.9.4 The Branch Head designates, evaluates, and administers certification of personnel assigned to aviation maintenance duties and authorizes standard releases of aircraft for flight.

1.9.5 The Branch Head, as Director of Maintenance, shall:

a. Direct aircraft maintenance and inspection programs to ensure safety of flight in accordance with applicable military programs, manufacturers' programs, NASA prescribed programs, or civil programs, as required by the particular aircraft assigned. Coordination of these tasks shall be made with the Quality Assurance Office (QAO).

b. Ensure compliance with NASA or military safety-of-flight notices, FAA airworthiness directives, or mandatory manufacturer's bulletins applicable to the types of aircraft, engine(s), propeller(s), and appliances.

c. Maintain record-keeping procedures to record and track maintenance personnel duty time, and training.

d. Normally utilize the NAMIS to maintain and track aircraft maintenance records, to monitor crew-entered maintenance discrepancies (squawks), to track required/scheduled maintenance, and to ensure timely performance of aircraft maintenance. An alternate method may be used when NAMIS access is unavailable.

e. Maintain record-keeping procedures to record and track maintenance actions and inspections, retirement of life-limited components and parts, and flight safety critical parts (DoD/surplus military), flight hours, cycles and calendar times. This is normally accomplished through the NAMIS.

f. Monitor and schedule contract maintenance, where necessary.

g. Determine that the safe release of aircraft with inoperative equipment is in accordance with the Master Minimum Equipment List (MMEL) or Minimum Equipment List {MEL}). If an MMEL/MEL is not established for the aircraft, the CRFO shall make a determination of the releasability of the aircraft.

h. Ensure that applicable technical support, including appropriate engineering documentation and testing, for aircraft, power plant, propeller, or appliance repairs, modifications, or equipment installations is available and complete.

i. Determine that airworthiness of aircraft is maintained following the performance of maintenance.

j. Disseminate information to air crews with regard to maintenance and servicing of aircraft, as appropriate.

k. Ensure the CRFO, QAO, and Chief Pilot are kept informed with regard to maintenance-related problems requiring their attention, especially those that may negatively affect safety and/or mission performance.

l. Monitor aircraft flight time and maintenance requirements and schedule maintenance so as to minimize grounding of aircraft for maintenance.

m. Ensure timely provision of maintenance-related supplies and equipment.

n. Ensure the safe and professional upkeep of maintenance-related work areas and equipment.

o. Initiate purchase requisitions for aircraft parts, tools, supplies, and other required equipment.

p. Supervise personnel assigned.

q. Maintain a safe, neat, and efficient maintenance operation.

r. Perform other duties as designated by the CRFO.

1.10 QUALITY ASSURANCE OFFICE (QAO)

1.10.1 The QAO is responsible for verifying, with proper documentation, that each aircraft in an active status assigned to and/or controlled by LaRC has been maintained, inspected, and/or modified according to applicable standards. These standards include FARs, type certificates, service bulletins, manufacturer's bulletins, technical orders, airworthiness directives, advisory circulars, inspection aids, and any special

requirements defined from within the Research Services Directorate or by engineering designs.

1.10.2 The Quality Assurance (QA) Lead is responsible for making all job assignments to Quality Assurance Specialists based on their skill level(s).

1.10.3 The QA Lead is responsible for the enforcement of the provisions of applicable regulations necessary for the proper performance of his/her duties and responsibilities.

1.10.4 The QA Lead shall:

a. Hold an FAA mechanic certificate with both airframe and power plant ratings or have equivalent military certification and have at least 3 years of maintenance experience as a mechanic on aircraft, including, at the time of appointment, recent experience in at least two of the same categories and classes of aircraft as used by Langley Research Center, or

b. Have at least 3 years of experience with a certificated airframe repair station or equivalent military intermediate or depot level repair facility, including 1 year in the capacity of approving aircraft, parts and/or components for return to service**,** or

c. Hold an FCC radio license or equivalent military certification and have at least 3 years of avionics maintenance on aircraft, including, at the time of appointment, recent experience in at least two of the same categories and classes of aircraft as used by Langley Research Center.

1.10.5 QAO responsibilities include, but are not limited to:

a. Developing aircraft maintenance and inspection programs to ensure safety of flight in accordance with applicable military programs, manufacturers' programs, NASA-prescribed programs, or civil programs, as appropriate. These should be developed in coordination with the Director of Maintenance is encouraged.

b. Verifying that each aircraft owned, leased, or controlled by LaRC is maintained, inspected, and/or modified according to applicable policies, maintenance document guidance, and regulations, including systems, components, and experimental equipment.

c. Ensuring compliance with military safety-of-flight notices, FAA airworthiness directives, or mandatory manufacturer’s bulletins applicable to the types of aircraft, engine(s), propeller(s), and appliances.

d. Maintaining all aircraft maintenance records, monitoring maintenance discrepancies (squawks), tracking required/scheduled maintenance, and

ensuring timely performance of aircraft maintenance. This shall normally be accomplished through the use of NAMIS.

e. Developing and implementing record-keeping procedures to record and track maintenance actions and inspections, retirement-of-life components and parts, and flight-safety critical parts (DoD/surplus military), flight hours, cycles and calendar times. This shall normally be accomplished through the use of NAMIS.

f. Monitoring contract maintenance, where necessary.

g. Monitoring MEL time limits and other MEL restrictions.

h. Ensuring compliance with any applicable special standards.

i. Ensuring instrument calibrations are correct, that material, parts, and fastener certifications are verified and screened for the use of unapproved or counterfeit parts, and that aircraft permanent records are properly maintained.

j. Performing audits of aircraft baseline, maintenance, and experimental configurations.

k. Monitoring applicable technical support by ensuring that appropriate engineering documentation and testing for aircraft, power plant, propeller, or appliance repairs, modifications, or equipment installations are available and complete.

l. Monitoring determination of basic aircraft airworthiness following performance of maintenance.

m. Providing current information to crews with regard to maintenance and servicing of aircraft.

n. Ensuring the CRFO, RSIB Head, and Chief Pilot are kept informed with regard to maintenance-related problems requiring their attention, especially those that may negatively affect safety and/or mission performance**.**

o. Maintaining a current maintenance library. This includes oversight of technical publications held in other offices. These publications include:

(1) FAA Airworthiness Directives.
(2) Manufacturers Maintenance manuals.
(3) Manufacturers Service Bulletins.
(4) Avionics maintenance publications.
(5) Avionics Service Letters.

(6) Military Safety-of-Flight messages.
(7) Current aircraft operating manuals.
(8) Other pertinent maintenance publications (civil, military, manufacturers) as needed.

p. Monitoring aircraft flight time and maintenance requirements and coordinating maintenance so as to maximize aircraft availability.

q. Monitoring the safe and professional upkeep of maintenance-related work-areas and equipment.

r. Ensuring that all maintenance performed on NASA aircraft is in accordance with all manufacturer and FAA regulations governing the maintenance of aircraft.

s. Ensuring that all aircraft maintenance performed provides for the continued airworthiness of aircraft.

t. Ensuring quality control for the purchase and acquisition of replacement parts, and ensuring that parts purchased or acquired have the necessary documentation to determine airworthiness. This includes verification that parts are not unapproved or counterfeit aircraft parts.

u. Ensuring that all inspections of any maintenance performed on NASA aircraft include, but are not limited to:

(1) Demonstrated compliance with appropriate maintenance and/or repair guidance and that such work has been safely and properly completed.
(2) Removal of all tools, unattached parts or other items not required to remain on the aircraft.
(3) Completion of all required documentation.
(4) Safe return to service of aircraft within applicable certification standards.

v. Supervising personnel assigned.

w. Performing other duties as designated by the CRFO.

1.11 OPERATIONS AND ENGINEERING BRANCH (OEB)

1.11.1 The Operations and Engineering Branch (OEB) is the focal point for aircraft research and support operations planning and implementation. OEB performs the tactical planning, scheduling, implementation, and communications for aircraft research and support activities. The OEB is supervised by the Chief Pilot.

1.11.2 Branch responsibilities include, but are not limited to:

a. Providing research piloting services and corresponding research pilot project assistance.

b. Providing support piloting services, when necessary.

c. Managing operational and ground logistics coordination for research missions as assigned.

d. Managing operational and logistical planning and coordination for all deployments as assigned.

e. Coordinating with aviation weather, flight planning and dispatch-type services.

f. Coordinating with the LaRC Flight Operations Support Center (FOSC).

g. When required, preparing and/or assuring that preparation of flight requests, flight manifests, flight cards, and other associated paperwork for research missions is accomplished.

h. Providing coordination with appropriate air traffic control (ATC) facilities to ensure efficient flight in the National Airspace System (NAS) and in special use airspace for both research and non-research flight activity.

i. Providing Flight Test Director services for research operations.

j. Working with Principal Investigators (PI) or lead researchers, ASO, and Hazard Analysis personnel to conduct and document hazard analyses and risk assessments

k. Assisting Principal Investigators or lead researchers in preparation of FTOSRs for ASRB reviews and test plans for program flight missions.

l. Working with Principal Investigators (PI) or lead researchers, the Aviation Safety Officer, and Hazard Analysis personnel to develop the Project Safety Plan for inclusion in the FTOSR and review by the ASRB.

m. Generating flight test cards for research missions that meet research and operational requirements by integrating researchers' plan-of-test with operational constraints.

n. Coordinating required safety training for cabin crew with the ASO.

o. Coordinating and conducting tour and demonstrational activity involving LaRC aircraft, as assigned.

p. Assisting in preflight activities including route planning; clearances; egress briefings; ensuring aircraft, crew, and operational plan suitability for flight; and confirming release for flight.

1.12 AIRWORTHINESS and SAFETY REVIEW BOARD (ASRB)

1.12.1 The Airworthiness and Safety Review Board (ASRB) is chartered by the Executive Safety Council, as defined in LAPD 1150.2, *Councils, Boards, Panels, Committees, Teams, and Groups.* It operates according to the objectives and procedure documented by LMS-CP-5580, *Airworthiness and Safety Review Board.* The Airworthiness and Safety Review Board is chartered to review all experimental modifications to aircraft and all research flight and ground scenarios developed to achieve programmatic objectives. The ASRB provides the Flight Safety Release (FSR) guidelines required for specific research flight operations. These operations may include multiple aircraft coordination with both NASA and non-NASA assets. Coordination between NASA centers and participating entities is encouraged.

1.13 AVIATION SAFETY WORKING GROUP (ASWG)

1.13.1 The Aviation Safety Working Group (ASWG) is chartered by the Executive Safety Council, as defined in LAPD 1150.2. The group operates as a grassroots organization to identify and address safety concerns at the lowest level. The ASWG is primarily focused on safety issues encountered in normal day-to-day hangar operations. It does not review research safety issues covered by ASRB review processes. Membership normally consists of representatives from each RSD flight discipline/expertise area and from other personnel directly involved in aircraft modification or flight activity.

1.14 OTHER SUPPORTING ORGANIZATIONS

1.14.1 The requirements of this LPR apply to all other organizations supporting the maintenance and modification of LaRC aircraft. Aviation operations utilizing LaRC assets (equipment, personnel, or funding) are subject to the requirements and provisions of this LPR.

1.15 DELEGATION OF AUTHORITY

1.15.1 In the absence of specific delegations issued from the RSD functional positions described in this chapter, authority and responsibility to execute these functions is delegated according to the *Research Services Directorate Organizational Unit Plan*, LMS-OUP-D1.

2.0 ADDITIONAL ADMINISTRATIVE POLICY

2.1 UNILATERAL STOP AUTHORITY - Although attempts should be made to resolve non-emergency issues through responsible management channels, Civil Servant and Contractor employees supporting aviation are vested with the right to exercise unilateral stop authority over any operation they consider unsafe, per LAPD 1710.1, *Langley Research Center Aviation Safety Policy*. This policy is implemented in accordance with LMS-CP-0902, *Unilateral Stop Authority for Flight Operations and Related Activities.* This unilateral stop authority is granted without retribution for all RSD facility, operational and aircraft-related activities. Exercise of the unilateral stop authority does not require formal initiation; either verbal or written communication is acceptable.

2.2 MEDICAL CLEARANCE

2.2.1 Aviation employees shall maintain a high state of mental and physical fitness. No employee shall accept a work assignment during a time wherein he/she suffers from a significant physical or mental deficiency. In such case, the employee shall inform his supervisor of the circumstances involved. Return-to-duty status shall only be permitted after consultation with a supervisor. In case of a serious illness or condition, an Aviation Medical Examiner/Flight Surgeon consultation shall be required for clearance to return to duty.

2.2.2 Aviation Medical Program - An aviation medical program exists at LaRC and is administered by the Center's Clinic. An Aviation Medical Examiner/Flight Surgeon is part of the resident LaRC staff, which gives all flight crewmembers, observers, and qualified non-crewmembers the capability of receiving physicals and preventive measures at levels appropriate for the circumstances involved. Flight physicals and equivalent physical examinations are conducted for the furtherance of NASA Langley Research Center missions and to help ensure the safety and suitability of required crewmembers to perform airborne flight research missions.

2.2.2.1 The CRFO shall develop an annual Center-wide list of employees required to hold FAA physicals or equivalent certification of fitness to perform current or anticipated NASA missions. This policy does not supersede any requirement for other physical examinations required at Langley for industrial health purposes (i.e., audiological exams, eye exams, etc.) or as established by other policy. In the event this local policy conflicts with another Center Procedure or Center or Agency policy, those policies shall augment or supersede the results of these criteria. The list that results from this policy shall be forwarded to the Clinic via email or hardcopy annually of each year. The list shall include the names of individuals authorized by Langley Research Center/Research Services Directorate to receive FAA medicals, the Class authorized, or flight equivalent examinations and a current contact within the Research Services Directorate to resolve individual requirements that arise between list publications. Additions to the list shall be made based on individual project requirements.

2.2.3 Required Examinations

2.2.3.1 RSD manned aircraft pilots shall pass an FAA Class I medical examination or military equivalent administered annually.

2.2.3.2 RSD manned aircraft pilots may continue to operate at Class II medical standard after the first 6 months without reexamination, except for pilots over the age of 55. Pilots over the age of 55 are required to complete the FAA Class I physical every 6 months.

2.2.3.3 The LaRC Clinic will administer Class I physicals for manned aircraft pilots at no cost, or such pilots may choose another examiner at their own expense. If a non-LaRC examiner administers the physical, the results shall be forwarded to the LaRC Clinic for review and retention.

2.2.3.4 An equivalent military flight physical is acceptable for the operation of “public” aircraft. The results of the military physical shall be forwarded to the LaRC Clinic for review and retention.

2.2.3.5 Civil certificated aircraft require pilots to have a valid Class I or Class II FAA Medical Certificate.

2.2.3.6 Pilots are responsible for ensuring that a copy of their current medical flight clearance is in their training jacket.

2.2.3.7 Manned aircraft pilots failing a FAA Class I medical may request a review of their medical fitness for flight duties by the Aerospace Medicine Board at Johnson Space Center. Any request for fitness-for-flight review shall be made through management. Certification by the Aerospace Medicine Board may permit a pilot to continue operating NASA “public” aircraft.

2.2.3.8 RSD non-pilot designated aircraft crewmembers are required to possess at least a FAA Class III equivalent medical or military flight physical. LaRC designated crewmembers generally are employees in the Research Systems Integration and Operations and Engineering Branches of the RSD. Other research personnel and observers shall be medically screened and shall be adequately fit to accomplish potential emergency egress activities.

2.2.3.9 Qualified non-crewmembers shall be authorized by the CRFO to participate in flight operations to support mission requirements. Qualified non-crewmembers are not passengers. Their presence on a flight is in direct support of, or associated with, the flight or mission that the flight is supporting. Examples of qualified non-crewmembers include, but are not limited to, media representatives observing the mission, scientists conducting in-flight experiments, and mechanics or mission managers who support the mission or flight on the ground. These other personnel are occasionally determined by the Director, RSD, LaRC line management, or the LaRC medical examiner as needing

FAA or equivalent medical certification. This certification may be required by a research partner, aircraft operator or by any official safety board as defined in LAPD 1150.2. In the event that a specific mission requirement exists for medical examination, a termination date shall be provided after which approval to renew a physical examination shall be required again. Such personnel may be from any LaRC organization. Documentation of any medical screening or certification shall be maintained by the CRFO.

2.3 TOBACCO AND SMOKING

2.3.1 Any tobacco product use in NASA aircraft is not permitted. Smoking within 50 feet of any NASA aircraft is not permitted.

2.4 ALCOHOL AND DRUGS

2.4.1 Aviation personnel shall not use illegal or non-prescription controlled substances, and shall at all times comply with the NASA drug and alcohol policy and FAR 91.17. No person may act as a crewmember for NASA:

a. Within 12 hours after the consumption of any alcoholic beverage.

b. While under the influence of alcohol.

c. While using any drug that would affect mental or physical faculties in any way.

2.4.2 Aviation personnel using prescription medications shall consult the NASA LaRC flight surgeon for concurrence with such use, and shall at all times comply with the NASA drug and alcohol policy and FAR 91.17. Such prescription drug usage may have a potential for impairment of aircrew capabilities in a flight operation. Additionally, non-prescription over-the-counter drugs may also impair faculties and their use shall be approved by the flight surgeon prior to accepting flight duties.

3.0 THE LaRC AVIATION SAFETY PROGRAM

3.0.1 Background - An effective safety program is vital to achieving the mission of the Center's aircraft/UAS flight programs. In recognition of this fact, the RSD is committed to providing a safe and healthful working environment free of recognized hazards for its employees. In pursuit of this goal, an aggressive safety strategy shall be incorporated into all directorate activities. Safety is also an individual responsibility and shall exist in our thinking, planning, and actions.

3.1 PURPOSE

3.1.1 Safety Culture

Safety culture or climate may be thought of as the collective norms, standards, perceptions and behaviors with respect to safety. Fostering of a positive safety culture by management is critical to any effective safety program. The following concepts and actions are elements of a positive safety culture:

a. Unqualified commitment to safety as a behavioral pattern and pervasive way of life by top management.

b. Unambiguous expectations by each level of management, as well as each peer group, that safe life patterns and work habits are normal and shall be practiced off the job as well as on the job.

c. Availability of quality, standardized equipment with which to accomplish the assigned tasks.

d. Clear, easily understood operating procedures, followed without deviation.

e. Inclusive system of communications for collecting, analyzing, and exchanging incident data related to safety.

f. Non-retribution for submission of incident data.

g. Retraining without penalty or stigma when safety is involved.

h. System for tracking incident and accident data, analysis of trends, and feedback of results.

i. Peer acceptance that accidents are preventable, regardless of operations.

j. Peer acceptance that safety is a matter of lifestyle – a matter of culture.

k. Effectively implemented Operational Risk Management (ORM) techniques in each task evolution. See Appendix B.

3.1.2 Aviation Safety Procedures And Guidelines - Apply to the operation, maintenance and modification of aircraft, and the equipment utilized in support of LaRC flight operations. In the context applied herein, aviation is defined to include ground and support operations, facilities and equipment, as well as, actual sUAS and manned aircraft flight. These procedures and guidelines form a closed loop to ensure that:

a. Aviation safety problems are detected and identified

b. Safe procedures for dealing with problems are devised, specified, and implemented

c. Procedures are developed and enforced by the responsible individuals

3.2 SAFETY POLICY

3.2.1 It is the documented safety policy of LaRC to take all reasonable steps to avoid loss of life, personal injury, property damage and mission failure. Aviation safety policy for the Center is established in LAPD 1710.1, *LaRC Aviation Safety Policy*.

3.2.2 Aviation safety is a line management function; however, assuring the highest practical level of safety is also the responsibility of every employee associated with flight operations. Due to the unique nature of operations, LaRC aviation safety procedures are specified in broad terms to allow the flexibility of application that is needed for the variable conditions associated with research flight operations. Appropriate, specific safety procedures are formulated for research programs. Each flight activity includes a mechanism to ensure that safety is given special consideration. This provides a chain of responsibility with a continuing check and documentation of safety elements throughout a given research activity. This system complies with the requirements of all applicable aviation and basic safety documents.

3.2.3 The civil servant and contractor staff with functional responsibilities pertaining to aviation as implemented at LaRC is vested with the right to exercise the Unilateral Stop Authority, as described in Section 2.0.

3.2.4 NASA policy supports qualification of flight operations through the adoption of an approved Safety Management System (SMS). This qualification is normally achieved through the audit process of the International Standard for Business Aircraft Operations (IS-BAO).

3.3 AIRCRAFT MISHAP PREVENTION SURVEY

3.3.1 The aviation program and flight operations at LaRC are subjected to biennial safety reviews conducted by the Headquarters Aircraft Management Office (AMO) and

the Inter-center Aircraft Operations Panel (IAOP), with independent oversight by NASA Headquarters. These reviews are based on the extensive checklist maintained by the Headquarters AMO, covering all phases of aviation at the Center, and include all functions and organizations that support these aviation activities. These reviews produce formal recommendations or action requests to which the Center shall respond to NASA Headquarters as part of a continuous improvement initiative. Any initiative that results in a change or supplement to the Aviation Safety Program is documented and incorporated into a revised program.

3.3.2 During the years between the biennial IAOP reviews, the functional aviation elements of the Center are subjected to managerial and technical independent assessments. An Annual Operating Agreement (AOA) is developed with Headquarters SMAO.

3.4 AIRCRAFT MISHAP PREVENTION, REPORTING, AND INVESTIGATION

3.4.1 Specific responsibilities and the process for aviation mishap and accident reporting are documented in LMS-OP-0939, and constitute a fundamental element of the Center Aviation Safety Program. These elements lead directly to the accident investigation process of NPR 8621.1, *NASA Mishap and Close-Call Reporting, Investigation, and Record-Keeping Policy*. Additionally, processes exist for the identification and reporting of operational incidents and near misses in order to track, analyze and apply corrective measures to situations that have caused, or may cause, unsafe situations. These include Incident/Hazard/Close Call reports that allow employees to communicate with management and the ASO about any safety issue or concern, including the identification and resolution of unsafe situations. ICAO Annex 13 addresses international incident investigations.

3.4.2 Mishap Prevention Themes - As part of the operational element of the Aviation Safety Program, the Aviation Safety Officer conducts regular, periodic briefings (both formal and informal) to pilots and other aviation personnel focused on specific safety and prevention themes. The themes addressed include:

a. historical data and analysis of LaRC aviation operations and functions, trends and noteworthy events from the military, industry and other NASA Centers,

b. specific manufacturers' safety-related information, and

c. future areas of emphasis of particular importance to LaRC operations.

3.4.3 The Ground Safety Officer conducts ground safety forums addressing themes comparable to those mentioned above on a regular basis. These supplement the periodic forums of the Aviation Safety Officer.

3.4.4 Aviation Mishap Prevention Bulletin Board - Aviation safety/mishap prevention information is posted on several bulletin boards located in public areas accessible to each functional element of the LaRC flight organization. On these boards are posted timely, aviation safety-related and mishap prevention data and announcements relevant to specific LaRC operations, as well as universal information (such as safety posters) that communicate state-of-the-art advances, significant trends, and common-sense practices of merit to all aviation organizations and efforts.

3.5 AVIATION SAFETY COUNCIL

3.5.1 The concept of the Aviation Safety Council is fulfilled at LaRC through the joint efforts of the Center Executive Safety Council (ESC), the Aviation Safety Working Group, and the Airworthiness & Safety Review Board.

3.6 AVIATION SAFETY MEETINGS

3.6.1 Safety stand-downs are called periodically at a Center level and within the RSD for communication of safety and mishap prevention information and, as needed, on a corrective basis to address specific occurrences or observations of concern. The forums and activities of the stand-down cause all other operations within the flight organization to cease while they are in progress and are open to all personnel from organizations that support LaRC aviation activities, not just those within the flight organization. Safety requirements, including meetings, are also addressed in contracts supporting the flight organization, as well as, within roles and responsibilities of management and specific functional leads. The Aviation Safety Working Group (ASWG) provides a forum for identification and methods of resolution for safety issues in daily hangar and aircraft operations.

3.7 SAFETY INCENTIVES & AWARDS

3.7.1 The Center has several means by which individuals are rewarded for safe accomplishment of functional tasks supporting aviation missions. This recognition may be in the form of both a plaque/certificate and/or cash. The RSD management receives an annual award budget for allocation to its staff or to any other individual at the Center whose performance in support of the Center aviation activity has been exemplary. Letters of recognition and non-monetary awards are provided by the Center to contractor staff, taking advantage of opportunities to recognize and award outstanding effort through the contractor. Other forms of safety acknowledgement include certificates for accident-free operation from outside organizations, such as the National Business Aviation Association (NBAA).

3.8 PERSONAL PROTECTIVE EQUIPMENT

3.8.1 Aviation Protective Equipment & Clothing - In accordance with NPR 7900.3, LaRC maintains an inventory of system-level and personal protective equipment, which

is issued to aircraft and flight crewmembers as applicable to the duties associated with given missions.

3.8.1.1 Protective equipment is defined as a device or item worn, used, or located for the safety and protection of LaRC personnel and official Center visitors. Protective clothing is also defined as an article of clothing furnished to an employee at Government expense.

3.8.1.2 Protective equipment shall be worn or carried for personal safety and protection when performing work assignments. Government issue protective equipment for loan may include: oxygen masks, aviator flashlights (with batteries), aviator watches, kneeboards, manual/electronic navigation computers, personal equipment storage bags, earplugs, nasal spray, watch caps, and any other equipment necessary to accomplish flight objectives.

3.8.1.3 Protective clothing for loan may include Nomex Flight Suits, Nomex Flight Jackets, flight boots, fitted anti-exposure suits, anti-G suits, Nomex gloves, custom-fitted helmets, undergarments, socks, and any other equipment necessary to accomplish flight objectives.

3.8.1.4 All LaRC flight research personnel shall wear the following uniform items and equipment while on research flight duty, unless otherwise approved by the CRFO:

a. Nomex flight suit (underwear shall be cotton, wool, or Nomex only)

b. Jump boots/leather shoes

c. Flight helmet (helicopter) or headset (airplane)

d. Approved nametags

3.8.1.5 When operational life support equipment is a required element of a flight mission, preflight training and orientation to the equipment is accomplished before the mission. Operational life support equipment shall be managed in accordance with NPD 4200.1, *Equipment Management*, and NPR 4200.1, *NASA Equipment Management Manual*. The Research Systems Integration Branch oversees the issuance and control of aviation protective equipment and protective clothing in accordance with the above guidelines. The issuance of all LaRC equipment shall meet the following criteria:

a. The issuance is not permanent.

b. It will benefit the Federal Government.

c. The equipment is not modified

d. Appropriate officials review and concur with purchase, inventory, and issuance.

3.8.2 Wear of Civilian Attire - Appropriate civilian attire may be worn on program support and mission management flights, as well as pilot proficiency flights on general aviation aircraft, at the discretion of the assigned pilot-in-command, if such attire is not prohibited by other regulations or Center-published guidance.

3.9 CARGO SAFETY

3.9.1 All cargo shall be inspected for hazardous material content prior to loading aboard aircraft. Refer to Section 14 for hazardous material handling procedures.

3.9.2 All other cargo shall be properly secured and documentation of weights and volumes be made available for the calculation of aircraft weight-and-balance.

3.10 DISSEMINATION OF AVIATION SAFETY INFORMATION

3.10.1 All formal LaRC aviation safety documents (numbered and configuration controlled) are maintained and “published” in the Langley Management System (LMS). These documents are also made available to all regular users and potential “outside” users of aviation services at LaRC who may not be familiar with aviation safety practices and operations, or who may work within the LaRC safety framework on a regular basis. Less formal (unnumbered) documents, such as the Aircraft Crash Rescue Handbook, are made available to potential users, inspectors and Agency safety and operations managers, as well as, to organizations from which support is needed or with which activities are conducted. The Aviation Safety Officer maintains a library of current safety magazines and trade publications which are available to interested parties.

3.11 FACILITIES SAFETY

3.11.1 The physical plants of both LaRC and Langley Air Force Base are integral elements of the Center Aviation Safety Program. The Facility 1244 Hangar complex, including taxiways and ramps, are designed to support safety and security for both the surrounding environment and personnel/equipment involved in aviation operations. Hazard barriers and controls exist for both people and equipment throughout the LaRC facilities to minimize the probability of unexpected or unmanaged exposure to risk. Only authorized (trained and/or oriented) personnel are allowed in critical areas of the facilities, and operations permitted or prohibited are documented throughout the aviation policy manuals of the Center. Specific facility safety guidance is available in LPR 1740.3.

3.11.2 This document and the Intra-Governmental Support Agreement between Langley Air Force Base and LaRC, LMS-TD-0940, the Facility 1244 Security Plan, and all applicable Center institutional/occupational health and safety policies and regulations

address facilities safety issues. Included are: routine preventive services for day-to-day operations and participation with LaRC aviation personnel in training exercises, education programs developed by the Chief of Research Flight Operations, the Aviation Safety Officer, and/or the Research Systems Integration Branch Head.

3.11.3 In addition to the Facility 1244 complex, the LaRC Fire Station (staffed by the Hampton Fire Department) and the Langley Air Force Base Fire Station provide facilities and equipment for crash/fire/rescue emergency situations. They are on call 24 hours per day, and use the *Aircraft Crash Fire Rescue Handbook*, created and maintained by the Aviation Safety Officer, as the primary source of technical and emergency data for each aircraft assigned to LaRC.

3.12 PHYSICAL SECURITY OF AIRCRAFT

3.12.1 Aircraft shall be provided physical security at all times.

3.12.1.1 When at NASA facilities, the aircraft shall normally be hangared. NASA security personnel shall monitor aircraft on a routine basis when the aircraft is not inside a hangar.

3.12.1.2 When away from LaRC, the aircraft pilot-in-command shall coordinate with the local fixed base operator/local law enforcement/military security, as appropriate, for the physical security of the aircraft to minimize opportunities for damage, sabotage, or theft of equipment. Additional guidance is available in NPR 1620.3.

3.12.1.3 International operations require extra vigilance and pre-planning to ensure adequate physical security for NASA aircraft. Consultation with HQ, embassy/consulate, Foreign Clearance Guide, State Department advisories, and /or military authorities shall be pursued prior to embarking on an international assignment.

4. FLIGHT OPERATIONS

4.0.1 General Operating Rules - All aircraft operations, including sUAS, shall be conducted in accordance with all applicable FAR, local and national laws, manufacturers' aircraft manuals, TO's and NATOPS manuals, NASA regulations and policies, and the requirements of this document. Aircraft shall be operated in an airworthy condition at all times, in accordance with NPR 7900.3 and this document. Aviation personnel are expected to utilize sound conservative judgment in their approach to their duties. Safe transportation and research is the primary objective of the flight operation.

4.0.2 The flight operations at LaRC are to be conducted in the following categories as set forth in NPR 7900.3:

a. Research and Development operations

(1) Flight research
(2) Simulator support
(3) Model dropping & recovery

b. Program Support operations

(1) Transportation of support equipment & personnel
(2) Aerial photography
(3) Safety & photo chase
(4) Currency/proficiency/training
(5) Maintenance test/ Functional Check Flights (FCF)
(6) Miscellaneous flight activities

c. Mission Management operations

d. Emergency and humanitarian operations

4.0.3 Equipage

All LaRC aircraft shall be equipped with the radio navigation and communications equipment required for the airspace and types of flights being conducted. In most cases, such equipment shall be the minimum required by the Federal Aviation Regulations for operation in the National Airspace System. Appropriate FCC aircraft radio licenses shall be obtained for the operations anticipated. International operations require compliance with ICAO regulations and the requirements of the host country. TCAS/GPWS/TAWS equipment is to be installed in all aircraft, unless compatibility with aircraft systems and/or missions makes it unfeasible. In such cases, a risk management determination shall be made as to limitations on the operation of aircraft in particular mission scenarios where such equipment is unavailable.

When commercial aircraft services (CAS) are utilized, TCAS/GPWS/TAWS shall be installed in such aircraft. Waivers to this requirement shall be referred to NASA HQ.

4.1 CLASSIFICATION OF AIRCRAFT

4.1.1 Additionally, LaRC aircraft are classified as research and development, program support, or mission management. Generally, these aircraft are operated as "public aircraft" according to 14 CFR Parts 1 and 91. When operations are conducted under the "Public Aircraft" classification, no passengers may be carried. The only persons authorized to fly aboard an aircraft, when in "Public Aircraft" status, are qualified crew members and qualified non-crewmembers. Qualified crewmembers are those required for the operation and safe conduct of the flight. Normally qualified non-crewmembers consist of research or other technical personnel flying in support of a project or program.

4.1.2 Research and Development Aircraft - Research aircraft are aircraft used primarily for research purposes directly related to the production of data. These aircraft may have modifications to the primary structure, control systems, engines, and/or basic aerodynamics subject to ASRB approval.

a. Research aircraft may be used occasionally on support missions where such missions are necessary to accomplish program objectives and can be accomplished safely.

b. The CRFO may reclassify manned research aircraft to program support aircraft, with the approval of the RSD Director.

c. These aircraft may also be used for required pilot proficiency/training.

4.1.3 Program Support Aircraft - Program support aircraft are aircraft, other than Mission Management Aircraft (MMA), that are used to carry personnel or equipment, or to provide other functions in support of approved programs.

a. Program support aircraft may have modifications, provided these modifications do not affect the aircraft's primary structure, engines, control systems, or make the aircraft unsafe for general-purpose use, including the carriage of personnel. These modifications shall be properly documented.

b. Program support aircraft may be used to support any program and may carry research personnel who are qualified non-crewmembers. When a program support aircraft is used in connection with a pilot's official travel, the incidental carriage of qualified non-crewmembers who have a need to travel on official business for a research program to the same or nearby locations is permitted.

c. Program support aircraft may be used to carry passengers with proper approval only if the aircraft is certificated as an airworthy "civil" aircraft by

the FAA. The pilot crew shall be FAA licensed and current for the type and/or category of the aircraft to be used. Additional guidance is available in NPR 7900.3.

4.1.4 Mission Management Aircraft (MMA) - MMA are aircraft officially designated by NASA Headquarters for transport of passenger personnel. Such aircraft shall be maintained in accordance with the FARs and certificated as “civil” aircraft by the FAA. The crew shall meet FAA licensing and currency requirements, as well. Additional guidance for MMA operations is available in NPR 7900.3.

4.1.5 Commercial Aircraft Services (CAS) - Use of commercially provided aircraft is authorized with required oversight by RSD. Non-NASA owned aircraft evolutions are also considered to be in a “Public Use” status during NASA operations and, therefore, are subject to NASA airworthiness guidelines. All such operations shall be coordinated with the applicable contracting officer for compliance with this requirement for NASA aviation oversight. NPR 7900.3 provides additional guidance.

4.2 GENERAL FLIGHT OPERATIONS, CLEARANCE, AND SCHEDULING

4.2.1 The applicable portions of the general operating and flight rules of Federal Aviation Regulation Part 91 shall apply to the operation of LaRC aircraft. Other federal regulations and guidelines concerning the operation of public aircraft shall also apply, as appropriate. When operating in military airspace or at military installations, applicable military regulations shall be followed. All aircraft entering or departing LaRC, whether transient or assigned, are bound by the requirements of LAFB Instruction 11-250, *Airfield Base Operations and Base Flying Procedures*. When aircraft are operated internationally, operations shall be conducted in compliance with FAA, ICAO, and host country guidance. NASA aircraft are designated by the U.S. State Department as “State Aircraft” for ICAO purposes. This is equivalent to military aircraft for operational purposes. Appropriate guidance for international operations is available in the USAF Foreign Clearance Guide (FCG). See Appendix A.

4.2.2 LaRC aircraft shall be operated in compliance with approved Airplane Flight Manuals/Pilots Operating Handbooks/Technical Orders/NATOPS manuals, as appropriate. Aircraft modified for research shall be operated within the approved flight envelope determined by the formal review process, including ASRB Flight Safety Release constraints. Performance calculations and limitations shall be taken into consideration, along with meteorological and air density performance factors, prior to flight.

4.2.3 Responsibilities - Organizations requiring the use of RSD personnel or facilities, including research and support aircraft, research pilots, and flight control rooms, shall schedule their use through appropriate RSD processes (e.g., LMS-CP-0960, *Conducting Simulation and Aircraft Services Activity Experiments*, LMS-CP-0904 *Authorizing Flight Aboard Non-LaRC Aircraft* and LMS-CP-0905, *Authorizing Flight Requests for LaRC Aircraft*).

a. Prior to implementation, the RSD Director shall approve all programmatic schedule commitments and any significant changes to commitments.

b. RSD employees are encouraged to participate fully in project planning and coordination, including the determination of windows of opportunities for flights. However, individual employees are not authorized to schedule, reschedule, postpone, or cancel flights without appropriate concurrence.

4.2.4 Scheduling - The Research Services Directorate shall publish projections of flight schedules. These schedules shall be circulated to flight project personnel, line managers, and appropriate research customers/program offices. NAMIS and other flight currency data shall be consulted prior to assignment of flight crew personnel to particular missions.

4.2.5 Communications

4.2.5.1 Aircraft shall maintain communications with ground stations as required by the FARs, ICAO, and other competent authority. When operating in the local area, communication shall be maintained with the FOSC for flight monitoring, when feasible.

4.2.5.2 “Sterile cockpit” procedures shall be in effect below 10,000 feet AGL. Only essential conversation shall be used below 10,000 feet AGL. These essential conversations are normally required only during maintenance functional check flights, research, and for approach briefings. Research missions that require cockpit conversation below 10,000 feet AGL shall be approved by the normal ASRB processes for such situations.

4.2.5.3. All flight crew members of large and turbojet aircraft, who are required to be on flight deck duty, shall communicate through boom or throat microphones when the aircraft is below the transition level/altitude.

4.3 FLIGHT APPROVALS

4.3.1 General - All flights of LaRC aircraft shall be approved by the CRFO, Chief Pilot, or designee. Additionally, the Office of the Director shall approve Mission Management flights. Pilots shall only be assigned to flights for which they are properly designated for their assigned crew position and who meet the currency requirements for the scheduled flight operation. NAMIS and other flight currency data shall be consulted prior to assignment of flight crew personnel to particular missions.

4.3.2 Manifesting and Boarding Authority - Boarding authorization is required for every person flying on a LaRC aircraft. In addition, LaRC personnel traveling aboard non-LaRC (non-commercial) aircraft shall have boarding authorization. This may be accomplished by CRFO approval of travel orders. However, in the absence of CRFO-

approved travel orders, a normal boarding authorization (LF 313) shall be accomplished.

a. The CRFO (or designee) is responsible for ensuring that each person listed on the manifest has appropriate boarding authority. The PIC is responsible for assuring that all persons boarding LaRC aircraft are listed on the manifest portion of the flight request or other manifest.

b. It is the responsibility of each PIC to ensure that a safety briefing is provided to personnel flying on LaRC aircraft prior to takeoff on all flights. For aircraft requiring special training or qualification, such as ejection seat-equipped aircraft, the CRFO (or designee) is responsible for assuring that all medical and training requirements have been met.

c. The CRFO shall ensure records are maintained for all crewmembers with documentation of boarding authority issuance.

4.3.3 Flight Request Approval Procedures - Flight requests shall be initiated by submitting to the CRFO, Chief Pilot, (or designee) a properly signed LaRC Flight Operations Request (LF 437). It is the responsibility of the requester to ensure that the latest version of the form is used and that ALL blocks on the form are completed except those specifically designated for completion by the CRFO (or designee). The following approvals are required prior to submission to the CRFO's office:

a. The requesting individual.

b. The requester's line manager.

c. The assigned Operations Engineer when the flights are research or program support.

4.3.4 The CRFO, Chief Pilot, or designee shall review the flight request to ensure the flight is being conducted in accordance with an approved program or project (or for other valid reasons), that necessary resources are available, and that any proposed crew members or passengers have Boarding Authorizations or other approved documentation to be aboard LaRC aircraft.

a. The approving official shall verify the currency and qualification status of required crew members prior to authorizing a flight.

b. The CRFO (or designee) shall indicate approval of the flight by signing the flight request.

c. In addition to the flight approvals described above, LMS-CP-0905 requires that any person boarding a LaRC aircraft have approval from their supervisor for that specific flight. The LaRC Flight Operations Request

accommodates this requirement by providing spaces for supervisory approvals for any individuals not assigned to one of the supervisors who directly approves the flight.

NOTE: The issuance of supervisory-approved, *trip-specific* travel orders covering flight by LaRC civil servants or affiliated contractors aboard LaRC aircraft shall be recognized as meeting this supervisory approval requirement.

d. In any event that would normally meet approval criteria, where compliance with these procedures may unusually delay a response in such a way as to risk loss of life or extensive injury, the PIC shall exercise his/her judgment and proceed accordingly. In this event, every effort shall be made, as expeditiously as the situation permits, to obtain the required approvals and make the required notifications.

4.3.4.1 Changes to Flight Approvals - Non-substantive changes to requested flights, such as changes in the date and time, may be made without renewal of supervisory approvals. However, substantive changes, such as changes in the aircraft requested, the flight plan, or additions to the passenger manifest, require submission of a revised flight request or re-approval of the modified flight request. In the event of imminent flight, telephonic approval of proposed changes with affected supervisors is permitted provided the original flight request is properly annotated with the changes and the fact that supervisory approvals were obtained.

4.3.4.2 Changes during Flight - Mission requests received while in flight by senior staff individuals shall be complied with by the PIC using his/her best judgment. When crews receive requests for missions or a change to a mission requiring approval beyond the PIC's authority and original mission approval, while in flight, and mission circumstances do not render landing advisable, the appropriate approvals and notifications shall be accomplished by radio. If this is not possible, the PIC shall notify the CRFO or Chief Pilot as soon as feasible. Such deviations from planned routing shall be annotated by the PIC on the flight log upon landing. Any deviation shall conform with approved flight safety releases (FSRs).

4.3.5 Cross-Country Flights - LaRC pilots conducting multiple leg cross-country flights may obtain approval for all segments of the flight on a single flight request indicating the planned itinerary, dates and times. If approaches or touch-and-go landing operations will be conducted at another airport enroute to the destination airport, the pilot shall include the airports at which such operations will be conducted in the itinerary. During the trip, the pilot is vested with the authority to approve each flight segment in compliance with the requirements of this document. Changes to the originally submitted itinerary shall be communicated to LaRC operations, when possible. While on cross-country, the pilot shall report the termination of each day's flights to the Flight Operations Support Center (FOSC) office or the CRFO or designated alternate.

4.3.6 Deployed Flights - Research projects conducting research flights away from LaRC shall continue to prepare separate flight requests for each flight. The PIC or a designated RSD management official shall be delegated the authority to approve the flight request and passenger manifest. The requester's supervisor may also delegate approval authority to the designated RSD management official. In the event that such authority is not delegated, approval by facsimile or other electronic means shall be necessary. If approval authority is delegated, copies of flight requests and flight reports shall be sent electronically to LaRC operations each day or whenever flights occur, when possible. This documentation is normally provided as a feature of the NAMIS system and may be retrieved through the NAMIS database. It is the responsibility of the persons to whom such authority is delegated to ensure that all flights are conducted within operational and safety parameters specified in appropriate FTOSRs and FSRs.

4.4 RELEASE OF AIRCRAFT

4.4.1 General - LaRC aircraft shall be flown only after being released by authorized personnel in maintenance. Discrepancy corrective action shall be exercised only by persons designated by the RSIB Head. The discrepancy clearing official shall have had at least six months maintenance experience within the last 24 months in order to clear an aircraft discrepancy. Releasing officials shall receive recurrent training, which may include on-the-job training, at least once every 24 months on the aircraft for which they are authorized to perform maintenance. The PIC accepts responsibility for the aircraft after release by initialing the LF 115, *Aircraft Operational Report* or the NAMIS Flight Preparedness Report, as applicable.

4.4.2 Required Documents – If NAMIS internet access is unavailable for flight release, an LF 115 shall be signed and dated, releasing the aircraft for flight in accordance with LMS-TD-0940, *General Aircraft Maintenance Manual* procedures and this document. Additionally, all completed LF 781 forms or equivalent NAMIS documentation for the aircraft shall be available for pilot review prior to flight. A flight request and manifest for each flight shall be posted on the aircraft sign-out board. When NAMIS access becomes available, the data contained in the hard copy forms shall be transcribed and entered into the NAMIS database.

4.4.3 Pilot Review - Pilots shall review the discrepancies listed on the Flight Preparedness Report, or other available documents, prior to acceptance of the aircraft for flight. When possible, the crew chief or other knowledgeable supervisor shall review the form with the pilot. When the pilot is satisfied that he or she fully understands the condition and status of the aircraft, acceptance of the aircraft is accomplished by initialing the Flight Preparedness Report, or if not available, on the Form LF 115.

4.4.4 Aircrew members shall evaluate the conditions expected with regard to the execution of a flight evolution through an active Operational Risk Management/Safety Risk Management process. A go/no-go decision by the PIC shall be the outcome of this review process. See Appendix B.

4.4.5 Cross-Country Operations - During cross-country operations, the pilot is vested with the authority to release each flight segment in compliance with this document.

4.5 FLIGHT PLANNING

4.5.1 General - The Pilot in Command (PIC) of each LaRC aircraft flight is responsible for assuring that all appropriate authorities are notified concerning planned operations of LaRC aircraft. The PIC is also responsible for the operation of LaRC aircraft in accordance with clearances received from these authorities.

4.5.2 Weather - The PIC is responsible for obtaining a thorough weather briefing prior to flight. Determination of forecasted hindrances to flight along the proposed route shall be utilized to optimize the operation with avoidance of severe weather as the main priority. Such information as the location of frontal weather activity, tornadic or hurricane locations, wind forecasts, turbulence, areas of IFR visibility and ceilings, and icing associated with altitude selection and cold weather shall be obtained. Aircraft are to be operated into known icing conditions only if they are so equipped and certified for the operation. Selection of alternate airports requires adequate fuel reserves in the event of unexpected weather activity, including reduction in visibility and ceilings while enroute. Pilots are encouraged to utilize Flight Service, Flight Watch, and military Metro services. PICs shall remain focused on the impact of weather conditions throughout the flight on the safety and security of the aircraft and its occupants. Additionally, weather conditions shall be considered in order to provide for safe ground operations and adequate overnight security of the aircraft. Hangar usage is recommended if available.

4.5.3 Weather Minimums

4.5.3.1 Research Flights – Unless otherwise approved by the ASRB, and documented in a test plan, weather minimums for local research flights are 1500 feet ceiling and 5 statute miles visibility. Research flights in a local traffic pattern under tower control may be conducted down to basic VFR minimums of 1000 feet and 3 miles.

4.5.3.2 Program Support and Mission Management Flights – Program support and mission management IFR flight minimums are those published in the Instrument Approach Procedure Charts as appropriate, for the category of aircraft being operated. These may be amended by published Notices to Airmen (NOTAMs). VFR weather minimums shall be in accordance with FAR part 91 guidance.

4.5.3.3 Special Minimums – The Chief Pilot, (or the CRFO or the ASO in the case of aircraft operated by the Chief Pilot) may specify temporary higher minimums for pilots transitioning to new aircraft when deemed necessary for safe flight operations. When such special minimums apply, they shall be documented on the pilot's checkout form for that aircraft along with conditions for their removal.

4.5.3.4 Special VFR Operations – Special VFR operations shall only be conducted by qualified and current instrument-rated pilots and aircraft, where an approved instrument approach procedure is available at that airport in the event that loss of visibility occurs.

4.5.4 Local flights

4.5.4.1 VFR Operations - Pilots of LaRC aircraft operating VFR in the local area, including trips to NASA/Wallops, shall follow local VFR operations procedures. For flights in the local area within radio coverage, flight monitoring is not required, but is encouraged and is normally available from the FOSC or, by prior arrangement, with another appropriate radio-equipped office. Other flight monitoring requirements may be specified by FTOSR for research missions. The FOSC monitoring personnel or the PIC shall file a local anti-hijacking flight plan with Langley Air Force Base (LAFB) Operations, when operating from Langley AFB.

4.5.4.2 IFR Operations - An IFR flight plan shall be filed with the FAA by Flight Operations Support Center (FOSC) personnel. In the event the FOSC support is not available, the PIC shall perform these duties. The PIC shall file in a manner consistent with LAFB 11-250 when operating from Langley AFB. The PIC shall contact Langley Air Force Base Operations with the proposed IFR departure information and the information that the flight plan has already been filed. This notification shall constitute the required anti-hijacking notification. IFR clearance shall be received from Langley Clearance Delivery or Langley Ground Control prior to taxi. When operating at a location other than Langley AFB, pilots shall comply with the specific operational regulations at that particular site.

4.5.4.3 Flight Monitoring - LaRC pilots and the Flight Operations Support Center shall maintain a listening watch, when available, on the LaRC test frequency at all times when flights are within range of the FOSC, unless all radios are required for ATC or mission purposes.

a. When out of radio range of the FOSC, pilots shall maintain a listening watch on VHF or UHF guard unless all radios are required for ATC or mission purposes. If a constant listening watch is not possible, then the PIC shall coordinate with the FOSC and provide a requlr position reporting schedule to provide for lost aircraft contingencies.

b. When flying over water out of gliding distance of land in single engine aircraft, pilots shall provide frequent position reports to the Flight Operations Support Center, unless other provisions have been made for flight monitoring consistent with the mission profile and flight safety release.

4.5.5 Cross-Country Operations

4.5.5.1 General - Flights more than 50 nm from LFI (except to Wallops Island) shall be considered cross-country flights. Cross-country flights shall be conducted on either IFR or VFR FAA flight plans, except as noted below:

4.5.5.2 VFR Operations - Cross-country VFR operations may be conducted in LaRC aircraft if VFR radar flight-following services are requested along the planned route. If VFR flight following is unavailable or is terminated, pilots shall either request an IFR clearance, if the aircraft and crew are capable of instrument flight or, if radar service is not available, the flight may continue under VFR while maintaining vigilance for other traffic and airspace restrictions along the route. It is incumbent on the pilot to ensure that the VFR flight plan is opened and subsequently closed. It is imperative that the pilot ensure that the VFR flight plan is closed upon arrival at destination in order to avoid the automatic institution of search and rescue (SAR) procedures. Due to reduced Air Traffic Control (ATC) support during VFR operations, it is imperative that PICs ensure that thorough preflight planning include review of Temporary Flight Restrictions (TFR), and other special use or airspace restrictions, including Special Air Defense Identification Zones (ADIZ), affecting a proposed flight path.

4.5.5.3 IFR Operations – IFR operations are encouraged when feasible within the mission requirements. Cross-country IFR flights shall be conducted in accordance with FAA regulations governing such flights and in accordance with clearances received. When filing flight plans to Langley from cross-country locations, pilots may include a request to have a departure message sent to LAFB Operations in the last leg of the flight plan. After departure, the pilot normally will have to contact a local FAA Flight Service Station (FSS) to have the message sent.

4.5.6 Notification of Arrival - In order to assist in determining the location of LaRC aircraft and whether a LaRC aircraft might be overdue, pilots on cross-country flights, upon arrival at destination shall notify the appropriate LaRC point of contact. After normal duty hours, a message may be left on the FOSC telephone line. Pilots shall also assure that the office secretary or appropriate alternate is aware of all travel arrangements, including phone numbers for daytime work locations and hotel accommodations.

4.5.6.1 LAFB Notifications - LAFB Operations requires notification of all planned aircraft movements as a security measure. This means that local flights shall be cleared through base operations before engine start. If the aircraft has not returned within half an hour of its ETA, LAFB Operations initiates search and rescue procedures. Therefore, it is incumbent upon pilots to update their estimated arrival time with the FOSC if a local flight is going to extend beyond the originally planned flight duration.

4.5.7 International Flight Planning – Refer to Section 4.18 and Appendix A.

4.6 FLIGHT LOCATING ACTIONS

4.6.1 Flight Crew Actions - The PIC shall ensure that during critical local flight operations the FOSC is kept aware of the location of the aircraft by monitoring local metro frequency when possible and in range. If the radio is out of range, a telephone or any other available communications media may be used to ensure that the FOSC knows where the aircraft is at all times. If on an FAA flight plan, updates to base are not necessary. If on an FAA VFR flight plan, a flight log containing detailed locations and times shall be submitted either by fax or upon return to LaRC.

4.6.2 Operations Action/Late or Missing Aircraft.

4.6.2.1 These flight locating procedures are to ensure the safety of the crews. If an aircraft is late or missing, the Chief Pilot is responsible to ensure that appropriate aircraft search and rescue procedures are initiated.

4.6.2.2 A flight shall be considered overdue when a planned landing is not made at the destination airport and communications with the flight crew are lost. In the event of an overdue aircraft, the Chief Pilot or person delegated that responsibility shall notify the following:

a. CRFO

b. RSIB Head

c. ASO

d. ATC/FSS

e. Local airports where the aircraft may be expected to land.

4.6.2.3 If the aircraft or crew is not located following the above notifications, personnel shall institute the appropriate Missing Aircraft actions.

4.7 EMERGENCIES

4.7.1 Under any flight emergency condition, the PIC is responsible for the successful completion of the flight. He/she is in full and complete command and all personnel shall execute his/her orders precisely. The PIC is the final authority in any decisions concerning actions to be taken, however, consideration shall be given to recommendations given by ATC and/or other sources.

4.7.2 In an emergency involving the safety of persons or property, the PIC may deviate from prescribed procedures, methods, weather minimums, and regulations in the interest of safety.

4.7.3 If a PIC decides that an emergency condition exists during the flight, when appropriate, he/she shall contact an Air Traffic Facility and advise of the problem and request any needed assistance. Declaration of an emergency is advised when the aircraft or crew is in potential jeopardy. PICs shall ensure that assistance from emergency sources is requested and that communication is maintained with ATC facilities concerning the emergency status, if possible.

4.7.4 The PIC is the final authority regarding the sequence and manner in which crewmembers accomplish procedures. All crew members shall be thoroughly familiar with all emergency procedures and their specific duty assignments. Crew members shall accomplish from memory the specific immediate action items specified for their station and shall be familiar with other crewmembers assigned duties. Each crewmember shall be prepared to perform their assigned emergency duties including possible evacuation duties

4.7.5 Each PIC who deviates from a rule during an in-flight emergency requiring immediate action shall communicate the circumstances to the Chief Pilot and Chief CRFO. If a request is issued through official channels concerning the incident, the PIC shall, with the consent of the CRFO, send a written report of that deviation to the FAA Administrator or designated FAA offices. It is also important that an exact account of the problem be stated and relayed to the ASO for proper report generation.

4.7.6. The PIC shall have responsibility to respond to an inflight medical emergency or incapacitation in an expeditious manner. Assistance from ATC facilities for flight diversion to a location with emergency medical services shall be requested, if appropriate. A request for ambulance service to meet the aircraft on arrival is highly recommended. Declaration of an emergency in order to receive expeditious handling is also recommended.

4.7.7 No employee, regardless of involvement in an emergency situation, is authorized to make statements to the general public or to newsgathering agencies without the knowledge and consent of the Agency. Public Affairs personnel shall be consulted for further guidance.

4.7.8 Pilots are advised to take advantage of the NASA Aviation Safety Reporting System (ASRS) and Incident Reporting Identification System (IRIS), as appropriate. The Aviation Safety Officer can provide further guidance and information.

4.8 FLYING AREAS

4.8.1 Research flights and aerobatic flights shall be conducted, to the extent possible, in light traffic areas away from federal airways. When the flight plan requires high speed maneuvering or significant pilot attention inside the cockpit, the use of special use airspace or safety chase or both is encouraged. Where available, and when consistent with mission objectives, radar advisories shall be utilized. Supersonic flight

shall be accomplished only in approved restricted airspace, military operating areas, or warning areas.

4.9 FORMATION FLYING

4.9.1 Some research support missions, such as safety/photo chase and paced airspeed calibrations, require formation flying. Formation flying practice by qualified pilots in compatible aircraft is, therefore, permitted.

a. Formation flying shall be planned in advance, including a thorough preflight briefing between the pilots involved.

b. Impromptu formation flying only for flight test or safety purposes also shall be permitted when both pilots agree and coordination of the flight can be accomplished via radio prior to join up. Under no circumstances shall a LaRC pilot join up with another aircraft without the other pilot's knowledge and consent.

c. Formation takeoffs and landings are authorized for no more than two compatible aircraft. Pilots shall have documented formation experience prior to being considered for formation flight clearance. Documented experience may be from previous training or may be obtained in-house from a qualified IP.

d. Qualification for formation flying, along with any limitations, shall be determined by the Chief Pilot in conjunction with the Aviation Safety Officer, and documented in the pilot's training folder.

4.10 HIGH ALTITUDE FLYING

4.10.1 LaRC aircraft may not be operated above 50,000 feet pressure altitude unless the aircraft is FAA certified for operations above 50,000 feet, or the pilot and all crewmembers are wearing pressure suits.

a. Pressure suit use requires satisfactory training by all crewmembers prior to flight requiring such use.

b. Crewmembers and passengers shall use oxygen at cabin altitudes above 12,500 feet. In pressurized aircraft, supplemental oxygen use shall be in accordance with FAR 91.211.

4.11 AEROBATIC FLYING

4.11.1 Aerobatic flying is authorized for qualified pilots in aircraft approved for aerobatics by their type certificate or approved flight manual.

a. All limitations set forth in the flight manual, or those established by the ASRB, in the case of particular research missions, shall be strictly obeyed.

b. All aerobatic flying shall be accomplished in low-density airspace outside federal airways.

c. Flight visibility shall be at least 5 statute miles.

d. Parachutes shall be available for all occupants.

e. Qualification may be obtained from prior military service or approved training curricula. Aerobatics qualification shall be documented and retained on record.

4.12 ROTARY WING OPERATIONS

4.12.1 Qualified rotary wing pilots are required to maintain rotary wing proficiency.

a. Minimum altitude during rotary wing operations is 500 feet, except as required for takeoff, landing, training maneuvers requiring flight below 500 feet, and research missions requiring flight below 500 feet.

b. Special operations, such as sling loading and night vision goggle operations shall require specific training and designation.

c. Practice touchdown auto-rotations are not permitted in LaRC aircraft unless specifically authorized by the CRFO. Pilots desiring touchdown auto-rotation training shall be enrolled in an appropriate training course as resources permit.

4.13 OVERWATER OPERATIONS

4.13.1 All occupants of aircraft operating out of gliding distance of land shall carry personal flotation devices.

a. If feasible, life rafts shall be placed onboard aircraft operating out of gliding distance of land.

b. If a flight out of gliding distance of land is over water below a temperature of 50° F, cold-water exposure suits also shall be provided for all aircraft occupants.

4.13.2 Extended overwater operations require thorough preflight planning with regard to weather, contingencies, equal-time-point calculations, and required navigation and communication equipment for the mission. PICs shall ensure that alternates are

planned as necessary with regard to weather, fuel, runway length, customs, and other support facilities.

4.14 INSTRUMENT OPERATIONS

4.14.1 Approach and Landing Minimums under IFR

Each pilot making an IFR takeoff, approach, or landing at an airport (domestic or foreign) shall comply with the applicable instrument approach and weather minimums published for that facility. If during an instrument approach that utilizes Runway Visual Range (RVR) for landing visibility and the RVR is reported to be below the required minimums before the aircraft has passed the final approach fix (FAF), the approach shall be abandoned and a missed approach shall be executed. If the aircraft is inside of the final approach fix (FAF) when the RVR is reported to have gone below minimum conditions, the pilot may continue the approach to decision height (DH) or minimum descent altitude (MDA). At airports where weather services are not available, the approach may be initiated and a landing executed if, when reaching the MDA or DH, the weather is found to be at or greater than that specified for the approach. Continuation of an approach to landing shall be in compliance with FAR Part 91 regulations.

4.14.2 Circling Approaches

Extra care shall be exercised in the execution of circling approaches in IFR conditions. Consideration shall be given to other options, such as straight-in approaches to other runways, if available. If a circling approach is required, utilization of higher category minimums may be used if the visibility and ceiling support such use. Circling categories are based on the certificated maximum gross landing weight of the aircraft, not on the current gross weight of the aircraft at the time of the approach. Utilization of minima of categories lower than the certificated category are not authorized. However, higher categories may be used if deemed prudent by the PIC. Circling approaches in the vicinity of high terrain or other obstacles shall be avoided. Some international airports' circling minimums are ill-defined and are not recommended to be used. It is recommended that operations into such locations be thoroughly pre-briefed prior to flight and all contingencies considered.

4.14.3 Braking Action Requirements

A braking action report shall be evaluated with regard to its source, timeliness and changes to be expected with fluctuations in temperature. The reported braking action shall be better than nil. Braking action reports of "fair or poor" are acceptable if the runway is into the wind and equals or exceeds the landing field requirement or the balanced field length requirement as defined in the AFM/POH. Extreme caution shall be exercised under these conditions. The PIC's judgment shall always be the determining factor.

4.14.4 It is recommended that additional personnel qualified to assist the pilot be assigned, whenever LaRC aircraft are to be operated in instrument conditions at night, in icing conditions, on extended overwater flights requiring additional navigation or communication assistance to the PIC, into or out of high-density airports, or in conditions requiring approaches near minimums.

4.15 FUNCTIONAL CHECK FLIGHTS/INSTRUMENT CHECK FLIGHTS

4.15.1 Functional Check Flights (FCF)

When maintenance parameters require a particular aircraft to be flown on a Functional Check Flight (FCF), the pilot-in-command (PIC) shall be designated in writing as a Functional Check Flight (FCF) pilot for the type of aircraft involved. Normally, FCFs are conducted with the minimum crew complement necessary to properly conduct and document the check flight.

4.15.1.1. Conduct of FCF. FCFs shall be conducted in VFR conditions for any items requiring engine shutdown, propeller feathering, stalls, unusual flight maneuvers, high speed descent, or effects of installation of electronics equipment that could interfere with flight instruments. Also prior to the use of unchecked or unproven flight instruments or similar situations in IFR conditions, the instruments shall have been checked in VFR conditions, Once all flight checks requiring VFR conditions are completed and all flight instruments are cleared for proper operation while operating under VFR, IFR flight may be utilized, if necessary, to proceed to an area allowing for additional checks of ancillary equipment. Before leaving VFR conditions, it is recommended that the PIC contact the Flight Operations Support Center and forward the notice of intention to proceed with an IFR flight plan. Normally, functional check flights shall be conducted utilizing published approved checklists for the type aircraft. These may be provided from manufacturers, military sources, or locally developed and approved by the Chief Pilot.

4.15.2 Instrument Check Flights (ICF)

Instrument Check Flights are conducted in support of research missions upon upload and integration of research equipment to an aircraft in order to confirm proper operation of research equipment, as installed. Before an ICF may be conducted, a Flight Safety Release (FSR) shall be obtained from the ASRB. ICFs are classified as research flights and, therefore, shall be flown in compliance with the FSR and the applicable FTOSR. ICFs may be flown by a properly designated PIC, qualified in the particular type of aircraft. Qualified non-crewmembers may participate in these flights, as necessary.

4.16 RECORDS AND LOGS

4.16.1 At the completion of each flight in a LaRC aircraft, the PIC shall log all flight time for each pilot for each duty condition, including numbers and types of landings and approaches. NAMIS Form 1672A "Aircrew Flight Form" shall be used for this purpose. Form 1672A shall be completed in accordance with the following procedures:

a. A separate Form 1672A shall be completed for each day for each aircraft.

b. A separate form 1672A shall be completed for the originating date of operation. Time zones shall be based on the location of the originating flight.

c. Pilot and crewmember names shall be entered on the form.

d. The sum of all time in each pilot category (PIC, Second-in-command (SIC), Instructor Pilot (IP)) shall equal the total flight time for each leg (i.e., the sum of all PIC times for all pilots flying on a leg shall equal the total flight time for that leg). Flight time as a Check Airman shall be logged as IP time in NAMIS.

e. SIC time may be logged anytime when flying as a copilot when a SIC is required by the aircraft's type certification, or when a SIC is required by the rules under which the flight is operated.

f. Instrument approaches shall be accompanied by the logging of actual or simulated instrument time.

g. Complementary duty conditions shall add up to the total flight time for each leg (i.e., day plus night times shall add up to total leg time).

h. Duty conditions that are not complementary, such as instrument or simulated instrument times, cannot exceed the total leg time.

i. If an individual log is not kept, pilots are encouraged to record supplementary data, such as specific approaches flown, emergency procedures practiced, etc. in the "Remarks" column.

j. The flight request number is to be recorded on the form.

k. Flight time logged in FAA- approved training simulators shall be reported on a Form 1672A in order for any of the time or maneuvers to be credited against currency requirements of NAMIS.

l. Flight time in simulators not approved by the FAA, or training devices such as desktop simulators, may not be credited against any of the currency requirements of this part.

m. In the event that access to NAMIS is unavailable, flight time may be logged in a hard copy format for transcription into the NAMIS database as soon as practical.

n. Aircraft discrepancies are to be entered on Form 1672A. FCF and Ops Check sign offs are also required.

4.17 AIRCRAFT SERVICING

4.17.1 Fueling of aircraft with persons on board is normally not authorized. However, if aircraft refueling with persons aboard is authorized by local authority at a specific airport location, that aircraft may be refueled only while the aircraft is properly attended by qualified personnel ready to initiate and direct an evacuation by the most practical and expeditious means available. Two-way communication shall be maintained by the aircraft's intercommunication system or other suitable means between the ground crew supervising the refuelling and the qualified personnel on board the aircraft.

4.17.2 An aircraft shall be serviced only with approved fuels, fluids, oxygen, and other consumables as prescribed by the manufacturer or the AFM/POH. Exceptions are to be approved for research purposes through ASRB and/or RSD processes prior to use of experimental substances, such as new fuel types, in aircraft. Consideration shall be given to the long-term impact of the use of such materials on the safety and continued operational life of the aircraft and its associated components.

4.18 INTERNATIONAL OPERATIONS

4.18.1 Advanced planning is the key to successful foreign operations, and lead times of at least three to six months may be required of some flights. It is the joint responsibility of RSD management and the Pilot in Command to ensure the success of the trip. The Operations and Engineering Branch shall provide coordination for planning and conduct of all international operations.

4.18.2 Items to be taken into account before an international flight include, but are not limited to:

a. Route planning and flight information documents, including charts.

b. Personal documentation, including passports, visas, medical certificates, immunization records, and pilot certificates.

c. Foreign travel briefings.

d. Air crew training and certification for the airspace types (i.e., MNPS, RVSM, RNP, etc.) and for the anticipated countries of operation.

e. Communications equipment availability for theater of operation.

f. USAF Foreign Clearance Guide (FCG) compliance.

g. Aircraft documentation, including certificates of airworthiness, registration, aircraft radio license, and noise certificates. Also included are MNPS, RVSM, RNP, CPDLC, ADS-B, etc. required certifications for the aircraft in the areas of operation.

h. Landing and overflight permits coordinated through NASA HQ.

i. Customs arrangements, including eAPIS reports.

j. Aircraft handling agents, if desired.

k. Foreign user charges/fees.

l. Fuel and other consumables availability and quality.

m. Payment methods available

n. Aircraft incident/mishap preparation per LMS-OP-0939, ICAO Annex 13, and the FCG.

o. Special survival equipment requirements for the area of operation.

p. Coordination with the Export Control Office

4.18.3 NASA aircraft are operated as ICAO “State Aircraft” per NPR 7900.3 during international operations. This is the same status under which military aircraft operate. Therefore, all international operations of LaRC aircraft shall comply with the *Air Force Clearance Guide* and appropriate DoD Flight Information Publication (FLIP) guidance. This status has been granted by the U.S. State Department, but is not universally recognized by foreign entities. Therefore, NASA aircraft and crews may be categorized as “civil” or “private” aircraft in some foreign locations. This may subject the crews to ramp checks for compliance with local or ICAO regulations, leading potentially to fines and mission delays. Crews shall make appropriate contingency plans for such possible mission impacts. Additional details regarding international flight operations can be found in Appendix A.

4.18.3.1 Diplomatic clearances shall be obtained prior to operations into foreign-controlled airspace. NASA HQ shall arrange for all diplomatic clearances.

4.18.3.2 Current Reduced Vertical Separation Minimums (RVSM), Minimum Navigation Performance Standards (MNPS), and Required Navigation Performance (RNP) procedures and standards shall be reviewed prior to flight. If these standards cannot be maintained during a proposed flight operation, then prior coordination and permission shall be obtained for operation in RVSM airspace with non-compliant equipment before initiating flight into that area.

4.18.4 Customs and Border Protection (CBP) designates non-military aircraft entering the United States as either "Commercial" or "Private" aircraft for customs purposes. NASA aircraft are considered to be "Private" aircraft for these purposes, since they are not operated or owned by a licensed air carrier. Therefore, CBP entry requirements for customs, eAPIS, immigration, and agriculture apply to all NASA aircraft and air crew. Information concerning compliance is summarized in Appendix B. It is essential that these procedures are rigorously followed. Additional information and clarification of these rules are available at www.cbp.gov.

4.19 FAA ENFORCEMENT ACTIONS AND REGULATORY VIOLATIONS

4.19.1 Any employee who is informed of an FAA violation, potential violation, or investigation being opened on an action in which they have been involved shall report the circumstances to the Chief Pilot as soon as possible. This notification shall include a detailed written record of the circumstances. The Chief Pilot and CRFO shall investigate the incident to determine the facts associated with the event. Legal assistance may be provided to an employee who has acted in good faith and in the best interest of the Agency.

4.19.2 The Chief Pilot shall coordinate with the FAA, military, and NASA HQ, as necessary, to resolve such issues. The Aviation Safety Officer shall be informed as to the resolution of the issue.

4.19.3 Pilots are advised to take advantage of the NASA Aviation Safety Reporting System (ASRS) and IRIS, as appropriate. The Aviation Safety Officer can provide further guidance and information.

4.20 NOISE ABATEMENT POLICY AND PROCEDURES

4.20.1 Policy. The objective of NASA is to minimize community-perceived noise caused by aircraft by emphasizing crew awareness and exercising noise-abatement operating techniques. Benefits of an effective noise abatement policy include:

a. Improved community relations.

b. Eased operational approvals.

c. Self-regulation.

d. Compliance with noise abatement ordinances and regulations.

4.20.2 Noise Abatement Implementation. The policy is to minimize noise disturbance as a result of LaRC flight operations. Noise Abatement Implementation includes:

a. Altitude - Fly the highest practical altitude, increase at night.

b. When possible, fly over the least populated areas.

c. Avoid sharp maneuvers.

d. Use high takeoff and approach profiles.

e. Vary your route - avoid repetition.

f. Avoid known noise sensitive areas where possible.

g. Follow published noise abatement procedures, if available, consistent with safety, including airport curfews.

h. Comply with host country noise abatement regulations when in international airspace.

4.20.3 Citizen Complaints. Each pilot shall be familiar with the noise abatement policy. This will assist in dealing with citizen inquiries and complaints. A significant number can be prevented if given sensitivity, foresight and commitment.

a. Upon receiving a noise complaint from a citizen, the employee shall refer the complainant to the CRFO.

4.20.4 Noise certificates.

Large and turbojet-powered aircraft are issued noise certificates as part of their type certification. Availability of a copy of a noise certificate issued by the FAA is a requirement for operation in some jurisdictions, especially in Europe.

5.0 UNMANNED AIRCRAFT SYSTEMS

5.1 GENERAL

5.1.1 Emerging Concepts. There has been a growing interest at NASA LaRC regarding the operation of small Unmanned Aircraft Systems (sUAS) for a variety of research projects that have identified a need to fly unmanned aircraft systems ranging from very small micro air vehicles, weighing several ounces, to larger sUAS turbine powered vehicles with complex onboard control systems and processors, weighing nearly 330 pounds.

5.1.1.1 Levels of Complexity. Typically sUAS vehicles are designed as single-string, hence no system or mechanical redundancy. This is primarily done as a trade-off compromise between performance requirements against weight and available volume. As the Center's operational infrastructure, procedures, and equipment are developed and expanded to support these program-funded flight activities, the need for trained pilots, observers, and system operators with unique sUAS-related skill sets is recognized. The skills required to support such research programs are beyond the typical hobby level for recreational Radio Control (RC) enthusiasts. Precision maneuvering of sUAS configurations with complex multi-layered control systems utilizing sophisticated ground stations and displays are becoming the norm, along with sUAS vehicles characterized by high wing loading dynamically scaled to the full-scale size of a flight vehicle configuration.

5.1.1.2. Technological Advances. Technological advances continue to provide unprecedented leaps in sUAS capability. LaRC is currently focused on sUAS applications supporting research objectives that can be met by vehicles weighing less than 330 lbs. Research applications include: aeronautics, space science, and earth science. Technology that permits the rapid dissemination of remote sensing data acquisition products will play an important role in this effort. Most importantly, the sUASs shall be responsive to the needs of scientists and researchers by providing data-gathering capabilities through the use of user-configurable test bed design and modular payloads. Currently, the sUASs are able to launch from the ground and provide consistent support to the researcher, and are able to return to land at a predetermined site.

5.1.1.3. Reliability and Maintainability. A balanced utility for the sUAS capability includes reliability with low mean time between failures and low/predictable maintenance man-hours per flight hour. The potential loss of the vehicle(s) are evaluated at the project level to weigh the value of the data and knowledge being gathered against cost and schedule consequences while maintaining safety as the number one priority.

5.1.2 UAS Definition. An Unmanned Aircraft System (UAS) is any airborne vehicle without a pilot onboard that is controlled autonomously by an onboard control and guidance system or is controlled from a monitoring station outside of or remote from the UAS vehicle. UAS can also be operated via a remotely located, manually operated flight control system. UAS are categorized (CAT III) by weight and airspeed where the vehicle gross weight is greater than 330 lbs and has the potential of airspeeds greater than 200 knots.

5.1.2.1 Small Unmanned Aircraft System (sUAS) is a model or sub-scale aircraft designed and built to operate with an onboard flight management system. sUAS may carry a variety of payloads and operate using either licensed or unlicensed electronic spectrum for command and control. sUAS can be operated via a manual control, manually via an onboard flight management system (FMS) or autonomously. sUAS are categorized (CAT II) by weight and airspeed where the vehicle gross weight is greater than 55 lbs but less than 330 lbs and has the potential of airspeeds less than or equal to 200 knots.

5.1.2.2 Radio Controlled Model, also referred to as sUAS, is a sub-scale aircraft built from balsa wood, plywood, foam or other lightweight materials that is typically flown by means of a commercial off-the-shelf RC flight controller. Model aircraft are designed to be operated within visual line of sight (VLOS) of the controlling pilot (referred to as either an external pilot or safety pilot). Model aircraft in this category typically operate at takeoff gross weights less than or equal to 55 lbs and operate at airspeeds less than or equal to 70 knots.

5.1.2.3 All sUAS shall be operated within the requirements of this LPR. The CRFO has the authority to determine the appropriate level of oversight as described in this document.

5.1.2.4 If and when a requirement exists to operate a UAS at NASA LaRC (weighing more than 330 lbs), Center guidance with recommendation from the CRFO shall define the appropriate level of control.

5.1.3 sUAS Flightcrew Definition and Responsibilities. The sUAS flightcrew may consist of sUAS pilot(s), engineer(s), Principal Investigator and technician(s) who are required to operate a sUAS and are authorized by position descriptions, letters of appointment, memoranda of understanding, memoranda of agreement (MOA), or contracts to perform sUAS flight. Any sUAS operated on behalf of NASA that operates within the National Airspace System (NAS) shall be piloted by an individual who, as a minimum, is a holder of an FAA Private Pilot's license. The sUAS PIC is responsible for the safe control and operation of the sUAS. The flight crew is involved in all mission planning, complete pre-launch, mission and recovery checklists, and assist in evaluating and disseminating in-flight data. The RSD UAS Chief Pilot shall provide independent oversight over all aspects of sUAS project operations, flightcrew qualifications and training, and risk assessment in accordance with this LPR and NPR 8715.5, Range Safety Program.

5.1.4 Policy. The LaRC Airworthiness and Safety Review Board (ASRB) ensures that all sUAS flight projects are properly reviewed, documented and approved (ref. LMS CP-5580). The ASRB review includes approval of the Concept of Operations (CONOPS). The LaRC CRFO shall ensure that sUAS flight crews and operations comply with the guidance within this document.

5.1.5 sUAS Command and Control Systems. sUAS flightcrews shall have the capabilities to command, control, coordinate, and manage the sUAS. These systems include air control and airspace control as discussed below:

5.1.5.1 Air Control. Air Control is the authority to direct the physical maneuvers of a sUAS in flight in accordance with the defined and approved Concept of Operations (CONOPS). CONOPS may include Visual Line of Sight (VLOS), Beyond Visual Line of Sight (BVLOS) and / or Beyond control link Line of Sight (BLOS). Risk assessments and procedures for CONOPS shall include strategies to keep the sUAS within the boundaries of the predetermined airspace area of operations (AO) during normal and emergency operating conditions.

5.1.5.2 Airspace Control. Airspace control provides for the coordination, integration, and regulation of the use of a defined airspace and identification of all airspace users. Any airborne object that may interfere with the flight path or trajectory of any other object within the NAS or non-NAS (i.e. restricted airspace) is of concern and requires airspace coordination and integration. Airspace control is the authority to direct the maneuvers of a sUAS (along with other aircraft and airspace users) for the best use of the airspace. Airspace control is accomplished through established procedures for coordination of airspace by the FAA or range control authorities. Principles and procedures of airspace control used in manned flight operations apply to NAS sUAS operations.

5.1.5.2.1. Vehicle Operator Responsibility. The vehicle operator is responsible for compliance with the airspace control authority. Positive separation between aircraft and sUAS is required and is the responsibility of the sUAS PIC. This may be accomplished by the following:

a. Operation of sUAS shall be limited to one sUAS in the airspace at a time unless previously approved and authorized by the ASRB.

b. sUAS altitude separation and de-conflicting with other airspace users shall be accomplished with the use of ground observers (spotters) who have been trained in the use of airspace management. The role of the observer is to visually track the activity of the unmanned aircraft and surrounding airspace. The observer shall have access to radio communication with the local air traffic to announce the use of airspace for sUAS operations and to communicate any potential hazard between other aircraft and the sUAS. All manned aircraft shall have right of way over the sUAS. The PIC shall

operate the sUAS accordingly to avoid all air traffic entering the operating airspace.

c. Activating airspace in the NAS shall be coordinated through the respective FAA Certificate of Authorization (COA) and associated facility management procedures. This includes the communication with the facility and the local air traffic control (ATC) through the issuance of notice to airmen (NOTAM) for all flight missions. For non-NAS, coordination shall be accomplished procedurally via the respective facility policy and procedures.

5.2 PLANNING

5.2.1 The level of planning required prior to a sUAS flight mission varies depending on the level of complexity and support resources needed. It also depends on the flight facility and the airspace being utilized; either National Air Space (NAS) or non-NAS (i.e., Restricted Air Space). For example; a typical one-day pilot training mission usually requires two or three days' preparation to ready the equipment and schedule the flight facility, air space, and qualified support staff. On the other hand, for a two-week flight research mission deployment, considerable planning shall take place well in advance, from several months up to a year prior to the sUAS operation. Project coordination with the appropriate agencies shall occur as soon as possible to avoid schedule delays due to airspace and facility usage conflicts.

5.2.1.1 FAA Certificate of Authorization. The FAA is responsible for airspace management within the United States. Upon COA appropriate request the regional FAA administrator will draft a Certificate of Authorization, which sets forth the requirements for sUAS personnel qualifications, communications procedures, and a definition of the requested airspace. An sUAS shall not fly beyond the boundaries of special use airspace without specific authorization of the FAA and the local air traffic control authority. The LaRC sUAS flight area of operations (AO) boundary is defined in the COA, such that the vehicle shall stay within the Visual Line of Sight (VLOS) of the PIC. In the event a requirement exists for the sUAS operations to expand Beyond Visual Line of Sight (BVLOS) or Beyond control link Line of Sight (BLOS), the appropriate reviews and approvals through the FAA (new COA) and the LaRC Airworthiness and Safety Review Board (ASRB) shall be conducted.

5.2.1.2 Memorandum of Understanding (MOU). A memorandum of understanding with the local airspace manager is required (e.g., Ft. A. P. Hill, NAS Patuxent River, Wallops Flight Facility) to ensure that the facility and the sUAS flight crews have a complete understanding and agree to the air traffic control procedures that shall be used to ensure safe sUAS operations in the operating area. If additional air traffic control services are required, the sUAS operator may be asked to augment the local air traffic control facility with additional air traffic control personnel. Fuel and hazardous material storage, hangar facilities, runway use, or any other logistical and support requirements shall be agreed upon in this MOU.

5.2.1.3 Letter of Agreement (LOA). A letter of agreement with local airfield facilities (e.g., Smithfield Foods, Inc., Military Aviation Museum) shall be completed to ensure that proper

coordination of support requirements are understood and agreed upon. Fuel and hazardous material storage, hangar facilities, runway use, or any other logistical and support requirements shall be agreed upon in this document.

5.3 PRE-FLIGHT OPERATIONS

5.3.1 Operations Site. Particular consideration shall be given to the location of the sUAS operations site. A proper landing surface shall be available to safely recover the sUAS upon completing its mission. Consideration shall be given to the size of the area of operations (AO). The location of an adequate launch and recovery area within the AO boundary and the location of the control station are very important considerations when employing a sUAS. Availability of adequate roads or other transportation methods for sUAS support requirements are critical to sustained UAS operations. If the sUAS is expected to move from one site to another, transportation logistics and support become increasingly important. Provisions for the operation site shall be included with the facility agreement, management plan documentation, and risk assessment.

5.3.2 Weather. sUAS project managers shall consider the expected weather conditions in the AO at the time of operations. Many sUAS cannot operate in inclement weather (e.g., high winds or when the cloud layer visibility and separations standards cannot be maintained). Due consideration shall be given to probable weather conditions from the outset. Prior to mission deployment, the project lead for flight operations shall review weather conditions and make the appropriate determination as to commencing flight operations for that day.

5.3.3 Communication. Depending on the system design, the sUAS may have control links including a ground control station (GCS), a tracking and control unit, a mobile operation station (MOS), and remote receiving stations. The sUAS may require manual control by an external safety pilot, or the sUAS may optionally be controlled from an internal pilot control station or be programmed to fly autonomously under control of its autopilot system. Regardless of the control method, the PIC shall have the capability to override any of the above mentioned systems to maintain safe operation and return of the vehicle. If this is not possible, an independent Flight Termination System (FTS) shall be an integral part of the safety design such that in the event of a loss of communication control and command link by the PIC, the Range Safety Officer or his designee shall have the ability to terminate the flight.

5.3.4 Operational Phase. NASA LaRC sUAS operations are conducted similarly to manned aviation operations. Once the mission is approved to proceed, many tasks are executed simultaneously. The operations phase begins the planning process. The project managers and the sUAS flightcrew study the assigned mission and plan for its operation. The maintenance crew begins preparation of the sUAS and the sUAS ground control system, while communications personnel ensure that the proper communication connectivity is provided to fulfill the mission.

5.3.5 Route Planning. LaRC sUAS missions shall be planned by the respective sUAS projects in close coordination with the LaRC projects, the ASRB, and Research

Services Directorate. This planning is done to ensure there is no conflict with other flight operations and to allow timely inclusion of sUAS missions in the Center's planning process. This planning becomes especially critical when multiple project operations will be conducted at the same flight facility over the same period of time. Even though multiple project activities may take place, only one sUAS shall occupy the airspace at any one period of time unless otherwise reviewed and approved by the ASRB and CRFO.

5.3.6 In-flight Emergencies. During planning, sufficient attention shall be given to the possibility that an in-flight emergency may occur. Particular attention shall be given to the location of potential impact sites if the sUAS exits controlled flight and impacts the ground. All hazards shall be considered within the safety analysis to minimize risk to the public, personal property, flightcrew, and equipment.

5.3.6.1 Loss of Link Procedures. When an sUAS senses a significant delay or loss of the command uplink, the predetermined loss of link procedures shall be invoked to contain the vehicle within the AO, or in the case of an auto navigation system, initiate the return home profile. The sUAS return home profile is a preapproved route at a specific altitude to its return home site (waypoint). During this emergency, the sUAS PIC shall attempt to reestablish communication with the sUAS. In the event the external pilot does not reestablish communications, emergency procedures shall be in place to retrieve the vehicle once it makes contact with the ground.

5.3.6.2 Agency Notification. Upon notification of an in-flight emergency, emergency procedures shall be performed by the sUAS PIC in accordance with the sUAS emergency operations procedures. In the event of a mishap where the sUAS impacts the ground, other than a hard landing, the Aviation Safety Officer (ASO) shall provide notification with the pertinent information to relay and coordinate with the appropriate agencies (e.g., ASRB, NASA HQ, FAA, and NTSB). The Research Services Directorate shall ensure that appropriate agencies have been notified of the sUAS mishap and the course of action.

5.4 sUAS FLIGHT OPERATIONS

5.4.1 The ASRB reviews and approves all proposed plans for sUAS utilization, including operations and flight testing presented by the program / project (LMS-CP-5580). Results of the review shall be documented and reflected in the approved FTOSR and then by the subsequent approved FSR. sUAS flight missions shall not commence prior to approval of these documents. sUAS pilot training and proficiency flight activities shall be the responsibility of the CRFO.

5.4.2 Mission Flight Brief. A flight brief, that includes the flightcrew shall be conducted prior to all flights for that day. Flight briefs provide specific information in accordance with sUAS standard operating procedures. The format for the brief shall depend on the complexity of the day's flight agenda. Briefs shall include but not be limited to the following:

a. Verification that flight facility and airspace approvals are in place

b. Verification of communications with facility and airspace control centers

c. Weather update

d. Program agenda for the flight mission

e. sUAS and mission support system status

f. Emergency procedures and terminology, and an “emergency of the day” review / discussion

g. Mission profile (CONOPS) for VLOS, BVLOS, or BLOS

h. sUAS pilot training and proficiency flight activities shall be the responsibility of the CRFO.

i. Safety Briefing

5.4.3 Takeoff Method. The maintenance crew readies the sUAS for launch as the flightcrew performs systems checks to ensure systems perform in accordance with operating checklist procedures. The system operating checklist shall include, but not be limited to, an independent means to verify: integrity of the radios system control link(s), flight termination configuration, and auto navigation waypoints entered into a navigational system prior to takeoff.

5.4.4 Areas of Operation. Suitable takeoff and landing areas shall be available for UAS operations that are clear of obstructions and non-participating personnel.

5.4.5 Preparing for Recovery. Upon return to the sUAS operations landing site, flight and maintenance crews shall prepare for sUAS recovery. The sUAS recovery checklist shall be adhered to in accordance with the standard operating procedures. Once the recovery operation is completed, a post flight de-brief shall take place to summarize and review the flight. Depending on the complexity of the operation, this de-brief may be formal or informal.

5.5 sUAS PILOT REQUIREMENTS

5.5.1 Qualifications. sUAS flightcrew members shall be in compliance with the minimum qualifications for all LaRC sUAS missions as defined in section 5.5.2. The LaRC CRFO shall ensure that each sUAS flightcrew possesses an adequate level of training and experience to perform the duties of the designated positions. Qualifications for the designations are made based on flight experience, experience in similar types of sUAS aircraft, experience in the actual sUAS aircraft type, other associated training, and demonstrated performance. Designated sUAS pilots are those who perform sUAS

piloting duties as a part of their official position descriptions, to fulfill NASA contract requirements, or in accordance with an interagency agreement. A designated sUAS pilot is required to be present as instructor and PIC while overseeing a student pilot who has not been fully qualified.

5.5.1.1 Additional requirements may be defined by the respective project based on vehicle complexity, wing loading, value to the project, and/or overall project risk management. Flightcrew members may be cross-trained to perform multi-function roles and responsibilities.

5.5.1.2 Initial UAS training shall be documented with the approval of the Center's Chief of Research Flight Operations. The training program shall be tailored to consider previous experience in UAS aircraft, currency in similar types of UAS aircraft, previous training background, and availability of other resources to ensure an adequate level of training.

5.5.1.2.1. The LaRC UAS Flight Crew Continuous Training Program shall be completed for initial training / certification and thereafter annually for maintaining minimum UAS training / certification requirements for the Center.

5.5.1.3. External Pilot (EP): The RC Pilot (also called Safety Pilot or External Pilot) is an individual who operates an unmanned aircraft by means of a remotely located, manually operated radio-controlled flight management system (direct control by means of stick-to-surface interface). The flight controller is typically commercial off-the-shelf RC hobby equipment. Radio frequencies associated with the command and control function of the system are typically in the unlicensed spectrum suite (72 MHz, 900 MHz, or 2.4 GHz). The RC Pilot is the designated PIC of the unmanned aircraft. An RC Pilot also may perform crewmember duties of a safety (or external) pilot who acts as a failsafe to an unmanned aircraft system that is normally controlled by a pilot-operator. The safety (or external) pilot flight control system is typically commercial off-the-shelf RC hobby equipment that may be either stand alone or be modified to function as a buddy box. In the buddy box configuration, the safety (or external) pilot controls the unmanned aircraft through the GCS communication link protocol. When the safety (or external) pilot is controlling the unmanned aircraft, that person is considered the PIC. All flight operations are within visual line of sight of the controlling pilot.

5.5.1.3.1. A candidate for the NASA LaRC EP assignment shall have as a minimum, 10 years of RC modeling and flight experience, including design, building, operating and flying a range of performance RC vehicles weighing 8 lbs. up to at least 25 lbs. The EP shall have the flying skill set capability to perform the proficiency events listed in section 5.5.3. successfully (without damage) and be acceptable for approval by the UAS Chief Pilot or designee.

5.5.1.4. Student External Pilot (EP): In cases where a pilot of lesser experience will be flying a UAS for NASA LaRC, either in the NAS or restricted airspace, there shall be an instructor UAS designated pilot present for taking full PIC responsibilities over

the student. This is typically the case where a project uses a summer student or in the event the UAS is being flown by a Contractor and NASA is responsible for range safety oversight.

5.5.1.5. Remote Pilot: Remote Pilot (also called Remotely Operated Aircraft (ROA) or Remotely Piloted Vehicle (RPV) Pilot) is an individual who operates an unmanned aircraft system by means of manual control in a remotely located ground control station. The Remote Pilot typically manages the unmanned aircraft flight path through a command and control communication link using manual stick-and-rudder inputs, a forward looking video camera feed, and a moving map display system located in the GCS. The Remote Pilot is the designated PIC of the unmanned aircraft (e.g., a Predator pilot, CAT III UAS > 330 lbs, > 200 knots).

a. A Remote Pilot at LaRC is a NASA Civil Servant or NASA contractor. Remote Pilots shall meet the minimum qualifications for a NASA pilot based on NPR 7900.3 and Center-established processes and procedures in this LPR, Chapter 7.

5.5.1.6. Pilot-Operator. A pilot-operator (a. Ground Control Operator (GCO) or b. Internal Pilot) is an individual who manages the operation of an unmanned aircraft by means of a remote flight control station (also called a ground control station (GCS) or a mobile operations station (MOS)). The pilot-operator typically controls the unmanned aircraft autonomously by means of computer interface with an onboard flight management system (fly-by-mouse) through a command and control communications link.

a. A Ground Control Operator (GCO) Pilot-Operator PIC is a NASA Civil Servant or NASA contractor. Pilot-Operator requires a certificate of qualification identifying completion of a Center-developed/HQ-approved company or military flight training course. The pilot-operator is the designated pilot in command of the unmanned aircraft when there is no external pilot. Since there are many variations of GCS configurations for this type of operation, training requirements for this position shall be the responsibility of the respective project or lab and approved by the UAS Chief Pilot.

b. LaRC sUAS Internal Pilot. LaRC sUAS Internal Pilot is an individual who operates a small unmanned aircraft system by means of an autonomous system or manual control in a remotely located ground control station (e.g., LaRC MOS). The Internal Pilot typically manages the small unmanned aircraft flight path through a command and control communication link using an autonomous system or manual stick-and-rudder inputs, a forward looking video camera feed, and / or a moving map display system located in the GCS (e.g., MOS). The Internal Pilot is the designated PIC of the CAT I, CAT II small unmanned aircraft < 330lbs, < 200kt (e.g., AirSTAR BAT-4).

5.5.2 Any UAS operated on behalf of NASA that operates within the NAS, shall be piloted

by an individual who is either a NASA pilot, holds an FAA Pilot's License or is designated as a UAS pilot by the CRFO. The CRFO shall provide a letter designating each LaRC UAS pilot PIC providing that person can meet the minimum NASA LaRC sUAS Pilot Standards. Minimum qualifications, training, currency, re-currency, and proficiency shall include the following:

a. Qualifications

(1) Shall have proof of holding a FAA pilot certificate or assigned as NASA UAS pilot based on completion of LaRC UAS Flight Crew Continuous Training Plan.

(2) Shall have completed Crew Resource Management (CRM) training.

(3) Hold a current medical as defined by the FAA to fly in the NAS.

(4) Shall hold a FAA or NASA equivalent Class III medical to fly other than in the NAS.

(5) Propeller-powered vehicles: Shall be able to perform all proficiency events as PIC (ref 5.5.3) successfully (without damage) and be acceptable for approval by the UAS Chief Pilot or designee.

(6) Turbine-powered sUAS: Shall hold turbine waiver issued by the Academy of Model Aeronautics (AMA) as PIC: Ref. Safety Regulations for Model Aircraft Powered by Gas Turbines (http://www.modelaircraft.org/files/510-a.pdf), and Fixed Wing - Turbine Waiver Application (http://www.modelaircraft.org/files/510-d.pdf).

(7) Internal Pilot; NASA LaRC Defined 5.5.1.6.b:

a.) Shall hold an FAA pilot license or equivalent and instrument rating for flight in the NAS (i.e. outside of Restricted Airspace).

b.) Shall complete a simulation proficiency check approved by the sUAS Chief Pilot.

c.) Shall hold an FAA 2nd class medical, or as appropriate for airspace use.

b. Training

(1) PC based simulator training: May be utilized at the discretion of the pilot / project.

(2) Refresher training: Shall have completed CRM every two years and LaRC UAS Flight Crew Continuous Training Plan. The LaRC sUAS Chief Pilot shall be responsible for implementing the appropriate training.

(3) Internal Pilot; NASA LaRC Defined 5.5.1.6.b:

a.) Shall complete a simulation proficiency check approved by the sUAS Chief Pilot.

c. Currency

(1) Shall have complete 3 proficiency events (defined in section 5.5.3) within 90 days utilizing the category of vehicle(s), day or night operations, established in NPR 7900.3 policy.{the type of vehicle(s) flown shall be based on wing loading and level of difficulty to fly (propeller vs. turbine)}.

(2) For turbine currency, shall have logged 20 turbine flights within 24 months

(3) Internal Pilot; NASA LaRC Defined 5.5.1.6.b:

a.) Shall have completed 3 simulation operations within the past 90 days.

d. Re-currency

(1) Shall initiate with Category I (per NPR 7900.3) vehicle training event that includes 3 full stop landings.

(2) Shall include completion of 3 proficiency events with the highest category sUAS the pilot is required to fly for day or night operations.

(3) Internal Pilot; NASA LaRC Defined 5.5.1.6.b:

a.) Shall complete 3 simulation operations.

e. Evaluation

(1) Shall perform 3 scheduled proficiency events annually in the presence of LaRC RSD sUAS Chief Pilot utilizing “rated” vehicle(s).

a) CRFO may authorize other independent evaluations of sUAS pilots. Evaluation “flight check” shall to be documented in the LaRC UAS Flight Crew Continuous Training Plan.

(2) Internal Pilot; NASA LaRC Defined 5.5.1.6.b:

a.) Shall have completed simulation proficiency check within 60 days prior to research mission.

b.) Procedure for simulation proficiency is project-dependent and shall be approved by the sUAS Chief Pilot.

5.5.3 Proficiency Events: All turns shall be smooth and coordinated to avoid stall departure. The pilot shall demonstrate reasonable accuracy in maintaining airspeed, glide slope, and runway centerline on the final approach, with smooth transition to flare and touchdown without damaging the vehicle. Pilots are required to demonstrate their skills, knowledge, and understanding of how to safely operate and fly all rated powered sUAS. Each proficiency event shall include the following skill elements, provided they are in the approved flight envelope for the aircraft: Elements from multiple flights can be grouped to qualify as a proficiency event:

a. Takeoff, to be held within 10 ft. either direction of centerline, with smooth, controlled corrections as necessary.

b. Horizontal figure-8 or sUAS procedure turns. *This element demonstrates skills at both left and right hand patterns and the ability to control the model's flight path.*

c. Perform two aerobatic maneuvers with combined looping and rolling elements. Examples include Cuban-8, loop and Immelman, split S, or similar maneuvers. *This element demonstrates the general pilot flying skills.*

d. High-speed circuit of the field performed at a safe high rate of speed. *This element demonstrates the ability to control a model aircraft at speed.*

e. Traffic pattern including a missed approach/go-around. *This element demonstrates the ability to control a model aircraft in the landing approach configuration.*

f. Three full-stop landings. Smooth, controlled corrections to maintain the aircraft's airspeed and flight path through touchdown, within 10 ft. either direction of centerline, are required. *The landing shall be completed on the runway with no damage to the vehicle through touchdown and rollout.*

g. One additional flight maneuver, which may include: looping maneuvers, rolling maneuvers, inverted flight, spins, stalls, trim shots, axis doublets, and touch-and-go landings.

h. One simulated emergency, which may include: engine out (dead-stick), extinguishing an on-board fire, disorientation maneuver and recovery, missed approach, and traffic collision avoidance maneuver.

5.5.3.1 In the case of prototype, experimental, or research sUAS aircraft for which no formal schools are available, the services of the researchers, designers, and the manufacturer's best qualified personnel shall be utilized to brief and familiarize the sUAS pilots with the aircraft, sUAS aircraft systems, and ground control stations. In addition, existing sUAS simulators and sUAS aircraft of a similar nature shall be used to train pilots prior to flying a sUAS research vehicle.

5.5.4 Observer (Spotter) qualifications and training. A trained observer is a person who assists the sUAS pilot in the duties associated with collision avoidance. The observers are trained by the pilots during field operations to know what to look for in terms of observing other air traffic in the area and how to communicate to the pilot and crew in the event of air traffic conflict or an emergency. The minimum requirements shall be as follows:

a. Qualifications

(1) Shall have a medical certificate as defined by the FAA for NAS Ops. or NASA Class III equivalent for other than NAS Ops.

(2) Shall have completed CRM training.

(3) Shall have completed LaRC-approved Observer/Spotter training contained in the LaRC UAS Flight Crew Continuous Training Plan. Annual requirement.

b. Training

(1) PC based simulator training: May be utilized at the discretion of the project.

(2) Refresher training: Shall have CRM training and /or sUAS-related refresher every two years.

5.5.5 Additional training requirements may be defined by the respective project, RSD, or the ASRB, based on overall project risk management and CONOPS.

5.5.6 Records: All flightcrew qualification, training, currency, re-currency, evaluations, and proficiency records shall be kept on file and maintained by the UAS Chief Pilot. The LaRC CRFO may request audit of such records at any time. A training folder or equivalent database in electronic format shall be maintained. Training records required content is outlined in para. 6.11 of this document.

5.6 AIRWORTHINESS AND FLIGHT SAFETY REVIEWS

5.6.1 General. The airworthiness requirements detailed in NPR 7900.3 shall be used for sUAS airworthiness approvals. Additionally, all sUAS flight operations under NASA purview are subject to the requirements of NPR 8715.5, Range Safety Program.

5.6.2 Airworthiness and Flight Safety Review Board (ASRB). The NASA LaRC ASRB shall review and approve all proposed sUAS airworthiness processes presented by the projects (LMS-CP-5580) to establish the airworthiness and evaluate the safety of flight operations. The topics addressed by a NASA ASRB to assess the risks associated with a sUAS flight program can be found in LMS-CP-5580. Airworthiness and Safety Review Board (ASRB) and Langley Form LF273, Flight Research Hazard Analysis.

5.6.2.1 The ASRB issues an sUAS Statement of Airworthiness for UAS weighing

up to 330 lbs or “Airworthiness Certification” for UAS weighing greater than 330 lbs.

5.6.2.1 The ASRB issues an sUAS Statement of Airworthiness or “Airworthiness Certification.”

5.6.2.2 The respective sUAS project is responsible for the process of maintaining airworthiness utilizing best practices in model fabrication, assembly and maintenance, modifications and repair for the structure, flight control system, instrumentation, data system, etc.

5.6.2.3 Airworthiness documentation for the project may include:

a. Configuration Control and Change Control Boards (CCB).

b. Logbooks to document vehicle history of assembly, modifications and repairs.

c. Lab notebooks to document vehicle history of assembly, modifications and repairs.

d. An airworthiness statement.

e. Documentation of an unmodified COTS sUAS.

5.6.3 Public Safety. The program / project manager shall limit the assessed collective risk associated with sUAS vehicle operation and ensure that the probability of doing harm to a member of the general public is not greater than the criteria established by NPR 8715.5, Range Safety Program, section 5.8, subject to approval of the CRFO. The level of protection can be demonstrated through a combination of analysis, test, simulation, use of redundancy in design, and flight operation experience / data.

5.7 sUAS FLIGHT MISSION REQUEST PROCESS

5.7.1 General. The sUAS Flight Mission Request Process satisfies the safety oversight requirement and includes the submittal, review, and approval. An additional benefit from this process is to manage and track metrics-at-a-glance associated with vehicle airworthiness, pilot / crew qualifications, and mission definition. Prior to every flight mission, the CRFO shall ensure that the flightcrew assigned to the sUAS/mission meets the minimum defined requirements for qualification, currency, and proficiency.

5.7.1.1 Flight Mission Request. The flight mission request provides pertinent information associated with the airworthiness of the sUAS pilot/crew qualifications and the defined mission.

5.7.1.2 Records and documents shall be maintained at the project level and subject to the review of the CRFO and the sUAS Chief Pilot. A data base shall track data/metrics-

at-a-glance that includes but is not limited to: sUAS Flight Mission Request approval, Important Dates, Vehicle Status (number of flights, number of landings, etc.), Pilot Qualifications, Currency, and Proficiency (minimums and project specific).

5.7.1.3 The project shall submit an sUAS Flight Mission Request via NAMIS (or metrics-at-a-glance spreadsheet) / email containing the following data:

a. ASRB-approved FTOSR date *(current version).*

b. ASRB FSR issuance and expiration date *(renewed as required for each vehicle and / or deployment).*

c. Radio Frequency Authorization (RFA) date *(reviewed every five years).*

d. Facility agreement date *(renewed periodically).*

e. Facility approval date for airspace usage for non-NAS usage (facility dependent). *Includes issuance and expiration date of Range Safety Officer (RSO) analysis, review and approval documentation.*

f. FAA NAS approval date (COAs shall be renewed annually or extension request approved).

g. Agenda (summary of test plan) and Schedule (including FRR, if applicable), approval date. P*roject-dependent based on test plan, risk and vehicle replacement value.*

h. Flightcrew staffing (depends on project mission requirements).

i. Qualifications (date of current medicals) and currency (last 90 days of flight activity).

j. Training: *spotters, ground station operators, external pilot, internal pilot*

k. Currency and / or proficiency: *dependent on vehicle, number of flights, landings, maneuvers, etc.*

5.7.1.4 Mission Concurrence and Approval. The sUAS Chief Pilot shall review the data, then concur and recommend approval to the CRFO, and then the sUAS Chief Pilot shall provide a response to the requesting project via email.

5.7.1.5 Waiver requests shall be reviewed by the CRFO. All waivers shall require documentation.

5.8 UAS Range Safety

In accordance with NPR 8715.5A, the Range Flight Safety Program provides for protection of the public, workforce, and property during range operations associated with the flight operations of UAS in the national airspace (NAS) and in restricted airspace (as controlled by NASA or other government entities). This section describes the NASA LaRC range flight safety policy, roles and responsibilities, requirements, and procedures tailored to unmanned aerial vehicles (UAS) as defined and described in NPR 7900.3, Aircraft Operations Management, Chapter 5, and the applicable range safety requirements and methodologies of this LPR.

5.8.1 NASA LaRC Range Safety Officer (RSO): A person responsible for safety and oversight during a range operation involving UAS. The LaRC RSO has the authority to hold or abort the operation, or take a risk mitigation action, which includes terminating the flight. RSO is synonymous with the term “Mission Flight Control Officer” used at some DoD ranges. The LaRC RSO is a Center-appointed position under the LaRC safety management organization, Office of Safety and Mission Assurance (OSMA), works for and takes direction from the LaRC manned flight organization’s CRFO, and has a permanent position as voting member on the Airworthiness and Safety Review Board (ASRB). Qualifications for this position include demonstrated knowledge, experience, and decision making involved with safety at the Center, which may have included operation of various labs, projects, manned flight, simulators, and wind tunnels. In addition to the previous experience and knowledge, the RSO is required to complete the series of NASA Range Safety training courses listed on SATERN as follows:

a. Flight Safety Systems
b. Range Safety Orientation
c. Joint Advanced Range Safety System (JARSS)
d. Range Flight Safety
e. Range Safety Operations
f. Range Flight Safety Analysis

5.8.2 Designated LaRC Range Safety Officer (DRSO): A person authorized by the RSO to oversee the range safety of a specific UAS operation. Qualifications for this position include demonstrated knowledge, experience, and decision making involved with safety at the Center, which may include the operation of various labs, projects, manned flight, simulators, and wind tunnels. In addition to the previous experience and knowledge, the DRSO shall complete the annual DRSO Continuous Training Plan, signed off by the Range Safety Officer verifying qualification and status. Requalification requires completion of DRSO Continuous Training Plan and Crew Continuous Training, signed off by the Range Safety Officer verifying qualification and status. There are times when the function of DSRO and Observer may be combined depending on workload and complexity of a particular range operation. This decision shall be made by the RSO on a case-by-case basis.

5.8.3 Roles

a. Serves as NASA LaRC Range Safety Officer for the Agency's Office of Safety and Mission Assurance Range Safety Program (NPR 8715.5) associated with the safe operation of Unmanned Aerial Systems (UAS).

b.Provides interface with the FAA / NASA liaison with regard to national airspace (NAS) usage for the development of UAS procedures, policy, and recommendations.

c.Provides interface with other government ranges to ensure flight operation in restricted airspace is consistent with NASA Range Safety Program risk mitigation requirements.

5.8.4 Responsibilities

a. Implements policy and procedures in accordance with NPR 8715.5, Range Safety Program, tailored for this LPR.
b. Has the authority to hold or abort the operation, or take a risk mitigation action, which includes terminating the vehicle.
c. May delegate authority to a DSRO as required to meet mission needs.
d. Verifies that commit criteria have been met prior to a range and flight mission operation.

5.8.4 National Airspace System (NAS)**.** This applies to each NASA program that uses the National Airspace System during conduct of a range operation.

a. The NASA RSO shall coordinate with the FAA on each range operation that uses the National Airspace System (NAS). Program managers needing access to the NAS shall coordinate with the RSO regarding requirements for using the NAS, and the RSO shall provide the information needed to obtain permission to use UAS in the NAS, as directed by the FAA.

b. A NASA program shall obtain a Certificate of Authorization or Waiver (COA) from the FAA for each UAS operation within the National Airspace System outside of authorized Special Use Airspace.

c. A NASA program shall coordinate the required information with RSO prior to submitting the request to the FAA center(s) with authority over the planned areas of operation.

5.8.5 UAS Range Flight Safety. Range flight safety considerations include three basic elements: range safety analysis, range safety systems, and operational requirements. The following section provides a description of these elements and related concepts tailored specifically to LaRC UAS safety of flight.

5.8.5.1 Range Safety Analysis. A range safety risk analysis shall incorporate the elements of risk management; i.e., risk assessment, risk mitigation, containment (a), and risk acceptance. UAS Programs shall present the Flight Research Hazard Analysis (LF 273)

before the ASRB for review and final approval to address containment, fight termination, severity and probability of identified hazards along with control measures for mitigating risk down to acceptable levels for final approval and signature by the Aviation Safety Officer (ASO) and the ASRB chairperson.

a. Containment: A range safety technique that precludes hazards from reaching the public, the workforce, or property that requires protection during normal and malfunctioning vehicle flight.

b. Risk Criteria: Each range operation shall satisfy the following criteria for assessed risk unless higher risk levels are specifically authorized for the operation. For range operations managed by other government agencies, the RSO shall verify that the equivalent level of risk is aligned with NASA policy and then shall accept those conclusions or document in a separate Hazard Analysis Report generated for that particular location and operation. This would be typical for a range operation in the NAS under the authorization of an FAA COA.

c. Individual Risk:

(1) Probability of casualty (Pc) < 1 x 10-6 for individual people who are **not** mission essential or critical operations personnel.

(2) Pc < 1 x 10-6 for mission essential or critical operations personnel.

d. Property Impact Probability: Probability of vehicle impact < 1 x 10-3 for any property within the containment (operations / hazard) area.

e. Collective Risk.

(1) Collective Risk Criterion for the combination of Mission Essential Personnel and Critical Operations Personnel: Expectation of Casualty (Ec) < 300 x 10-6.

(2) Collective Public Risk Criteria: Ec < 100 x 10-6.

5.8.5.2 Range Safety Systems: Each flight operation shall have a contingency plan in the event the vehicle experiences momentary or permanent loss of command communication of the control link with the ground station where the pilot in command is operating. This plan may have one or all of the following features as part of the strategy.

a. Flight Termination System (FTS): The FTS is an independent system specifically designed to terminate the flight of the vehicle in the event of a system failure in which the vehicle no longer responds nominally to control commands from the ground station / PIC. In such a case, the RSO or designee shall initiate the termination-of-flight command to bring the vehicle down to the ground in a safe location.

b. Failsafe System: The failsafe system is an integral part of the flight control system and program logic that will be initiated automatically or by the PIC. In this case, the on-board control system will initiate a pre-programmed series of maneuvers to either bring the vehicle down in a controlled manner or, in the case of autonomous flight operations, direct the vehicle to a predetermined specific

GPS waypoint or “home” location. If communication is not reestablished, then the vehicle can linger, circling the waypoint until all fuel is consumed, or an auto-land may be initiated. In either case, the vehicle will be brought down to the ground in a way that will minimize property damage and optimize containment measures.

c. Safety Critical Software: Vehicle programs and range safety organizations shall identify safety-critical software in range safety systems owned by NASA or used to support NASA missions and ensure it satisfies project and mission requirements.

5.8.5.3 Operational Launch Commit Requirements: The launch/flight commit criteria for a range operation shall identify the conditions required to initiate each flight (ref. 5.7.1.3) or phase of flight, specific to each vehicle in the form of a checklist. These criteria ensure public, launch site, and launch complex safety. They include vehicle, range, and environmental factors. The sUAS Flight Mission Request and Approval spreadsheet verifies that the following range operation questions have been answered:

a. What are the hazards of this system?

b. How this range is vulnerable to these identified system hazards?

c. If safeguards are needed to reduce risk, will they work?

Commit criteria elements for the day’s flights are listed in paragraph 5.4.2, in addition to specific checklist requirements for the UAS.

6.0 TRAINING

6.1 MANNED AIRCRAFT GENERAL TRAINING

6.1.1 Pilots shall receive the following training annually:

a. Firefighting.

b. Emergency egress training.

c. Crew resource management (CRM) training.

d. Pilot recurrent aircraft training, as appropriate.

e. Additional emergency procedures training, as required by the Safety Management System requirements of NPR 7900.3.

f. Single-pilot crew operations training (by type), if available.

g. RVSM/RNP training, as appropriate.

6.1.2. Individual Training Plan - Prior to the start of each calendar year, each pilot shall develop an individual training plan for Chief Pilot and CRFO approval.

a. A training plan for the Chief Pilot shall be approved by the CRFO.

b. These plans shall contain quantitative goals for obtaining or maintaining proficiency in specific aircraft types, in specific flight conditions, including cross-country flight, and in specific maneuvers necessary to support assigned flight projects and aircraft.

c. Training that will add to career professional development as pilots, engineers, and researchers is encouraged to be included in the plan.

d. Recurrent formal training shall be included and will normally include simulator training in an FAA-approved facility. This may include single-pilot operations training, if available, dependent upon the aircraft type certification allowing single-pilot operation.

e. International procedures training shall be included if international operations are anticipated. Normally recurrent international training is conducted biennially and includes RVSM/RNP recurrent training.

6.1.2.1 Once approved, this individual training plan shall guide the scheduling and assignment of pilots, with the goal of continuously meeting currency requirements and proficiency Metrics.

6.2 EGRESS AND SURVIVAL TRAINING

6.2.1 The Research Services Directorate has a comprehensive and formal egress and survival training program for all personnel who have official flight duties.

a. Egress training is required for all crewmembers and qualified non-crewmembers in each aircraft in which they fly and shall be documented on LF123.

(1) This training is both aircraft and individual-based and is available to personnel at various levels of rigor based on need and application.

(2) Personnel who may not be available for group and hands-on training sessions when offered, and for whom the training is not required for presence on a flight, shall, as a minimum, be given aircraft and mission-specific egress and emergency briefings and orientations by an aircraft crew member prior to flight.

b. Crew chiefs, maintenance technicians, pilots, and operations engineers shall be familiar enough with egress procedures in their aircraft to be capable of briefing observers and passengers during a preflight briefing.

c. Medical emergency situations and inflight aircrew incapacitation shall be addressed. MEDEVAC emergencies shall require, as a minimum, a checklist for emergency response with planned diversion to appropriate locations for immediate care. It is recommended that EMT or other medically trained personnel accompany MEDEVAC flights when at all possible.

6.3 PHYSIOLOGICAL AND HYPOBARIC CHAMBER TRAINING

6.3.1 LaRC pilots and crewmembers operating aircraft above 12,500 ft pressure altitude are required to attend initial and refresher physiological training.

a. All crewmembers shall be required to attend physiological refresher training at least every five years.

b. If a crewmember has completed three documented career hypobaric chamber rides, refresher training does not need to include further chamber rides.

c. If a medical event occurs that might change the pilot's fitness for, or response to hypobaric conditions, the LaRC medical examiner may require an additional chamber ride.

6.4 EJECTION SEAT TRAINING

6.4.1 Ejection seat training is required for all aircraft crewmembers approved for flight in aircraft equipped with ejection seats.

a. This training may be obtained from military sources or may be given locally by pilots familiar with the ejection system.

b. A review of ejection seat operation is required annually. Maintenance personnel working on ejection seat aircraft shall be afforded the opportunity for ejection seat training.

6.5 WATER SURVIVAL TRAINING

6.5.1 Water survival refresher training is normally required biennially for all pilots and for those crewmembers routinely involved in over-water flights. However, once a pilot has three documented career refresher training classes, the interval between refresher classes can be extended to 5 years.

6.6 COLD WATER SURVIVAL TRAINING

6.6.1 Cold-water survival training shall be made available as needed to those pilots desiring the training. This training is encouraged but not required. However, the RSD or a particular FSR may require such training due to operations into arctic or similar environments.

6.7 RECURRENT PILOT TRAINING

6.7.1 If the civil equivalent of a particular LaRC aircraft is required to have a type rating under civil certification procedures, recurrent training is required for that aircraft, provided a suitable training course is available.

a. Formal recurrent training, in at least one aircraft, shall be scheduled at least annually for all LaRC pilots. This training is normally obtained from approved simulator training facilities.

b. Mission Management operations require semi-annual recurrent crew training. Specific additional requirements for MMA operations are found in NPR 7900.3

c. If research schedule or other time constraints exist, the CRFO may delay recurrent training. Proficiency goals may include more frequent training as resources permit.

6.7.2 Emergency procedures training shall normally be conducted during annual recurrent training at an approved simulator facility. If emergency procedure training is conducted on an actual aircraft, no non-essential personnel or passengers shall be on board.

6.8 TRAINING RECORDS

6.9.1 The Chief Pilot, UAS Chief Pilot, and RSIB Head shall maintain complete training records for crew members, qualified non-crewmembers, and maintenance personnel. UAS projects shall document and maintain training records pertinent to the requirements of the project FTOSR and the requirements of Chapter 5 of this document.

6.8.2 The CRFO shall ensure that training records are maintained for all other personnel routinely involved in manned aircraft operations.

6.8.3 Manned aircraft training records shall include the following:

a. Name

b. Crew position, if applicable

c. Flight physical date

d. Certificate type

e. Number of certificate

f. Date of indoctrination training completion

g. Date of initial equipment training completion

h. Dates of completion for the following recurrent training:

(1) Ground school

(2) Annual check ride/recurrent training

(3) Special training (any agency-specific training deemed necessary i.e., windshear, seat dependent task training, project-specific training requirements, crew resource management (CRM), single-pilot checkout, etc.)

(4) Handbook exams, if required by type of aircraft.

6.8.4 Training records may be maintained in conjunction with SATERN, NAMIS, and hard copy documentation, as appropriate. Reference in the hard copy file shall make reference to the applicable links to SATERN, NAMIS, or other electronic filing systems.

6.8.5 Records of the completion of all required and optional training shall be kept in these files for a minimum of 5 years.

7.0 MANNED AIRCRAFT PILOT QUALIFICATIONS & RESPONSIBILITIES

7.1 GENERAL

7.1.1 Manned aircraft pilot staff shall be capable of skillfully and safely operating the range of aircraft types, as assigned, for which the Center is responsible. Therefore, pilots are required to maintain qualifications over a number of different aircraft, as required to support assigned projects. sUAS pilot qualifications are addressed in chapter 5.

7.1.2 LaRC pilots may be qualified LaRC civil service employees, qualified contractor employees hired in accordance with a contract providing piloting services, or qualified military or civilian detailees from other government organizations. The Chief Pilot, with concurrence of the CRFO, may approve waivers to these requirements where appropriate and justified. There are two occupational categories of manned aircraft pilots: Research and Support. Research pilots shall possess at least a bachelor's degree in engineering or an equivalent scientific degree from an accredited college/university. A degree in Aeronautical or Aerospace Engineering is desirable. There are no specific academic requirements for support pilots.

7.1.3 Pilots shall be designated in writing by the CRFO as Pilot-in-Command (PIC) or as Second-in-Command (SIC) for a particular type aircraft. Additional designations that may be granted include Instructor Pilot (IP), Check Airman (CA), and Functional Check Flight (FCF) Pilot.

7.1.4 In this section, use of the term “management” shall mean the CRFO and the RSD Director, unless otherwise noted.

7.1.5 All pilots are considered to be in safety critical positions and are subject to the provisions of the LaRC Random Drug Testing Program.

7.2 PILOT OCCUPATIONAL CATEGORIES

7.2.1 Manned Aircraft Research Pilots – Manned aircraft research pilots shall be designated as an "Aerospace Engineer and Pilot - AST Research Pilot" and shall meet the hiring and academic qualification requirements for an Aerospace Technologist (AST) position, in addition to the pilot requirements listed in this document. In general, research pilots are expected to have engineering or similar scientific backgrounds, documented flight test experience, and a broad background of flying experience. Military pilots detailed to NASA who have similar qualifications may also be designated as “Research Pilots.” Research pilots are expected to participate in the scientific aspects of the programs to which they are assigned and to publish the results of their efforts, as appropriate. Research pilots may fly research, program support, and mission management aircraft, provided they are properly qualified and current in the aircraft identified for the mission.

7.2.2 Manned Aircraft Support Pilots - Support pilots are not required to have engineering or scientific backgrounds, and thus are not required to contribute to the scientific aspects of the programs they support. Support pilots are normally limited to the operation of program support and mission management aircraft in which they are qualified and current. However, support pilots may operate research or program support aircraft on research missions on a case-by-case basis, with the concurrence of the Chief Pilot, the Principal Investigator or lead researcher, the CRFO, and the RSD Director. To conduct this research, support pilots shall familiarize themselves with the provisions of this document related to research operations, be cognizant of the requirements and restrictions of the applicable approved FTOSR, and shall be current and qualified in the aircraft used to fly the mission. Such assignments shall be specific to make, model, project, and duration and may be accompanied by limitations specific to the pilot.

7.3 MANNED AIRCRAFT PILOT DESIGNATION

7.3.1 Flight Experience - LaRC manned aircraft pilots are expected to have achieved minimum experience requirements prior to being employed as a pilot, as outlined in the following table. In individual cases, management may waive or amend these requirements.

a.

	Research	**Support**
First Pilot/Pilot-in-Command	2000 hrs.	1100 hrs
Turbine Aircraft	500 hrs.	*
Instrument (Actual or Simulated)	250 hrs.	250 hrs
Night	100 hrs.	100 hrs
Cross-Country	500 hrs.	250 hrs
Aerobatic	15 hrs.	*
Formation	15 hrs.	*
*To be determined by the CRFO on a case-by-case basis		

b. LaRC Research Pilots shall meet the following minimum experience levels to be designated as PIC in each category of aircraft:

Propeller Aircraft	20 hrs
Jet Aircraft	50 hrs
Rotary Wing/VTOL Aircraft	50 hrs
Multi-Engine, Wt. > 12,500 lbs.	50 hrs

c. There is no established minimum flight experience for Second-in-Command (SIC) designation.

7.3.2 Pilot-in-Command - A PIC designation requires demonstrated airmanship, maturity, and aircraft systems knowledge for a particular type of aircraft. The individual shall be recommended by the Chief Pilot, approved by the CRFO and designated in writing. A PIC is responsible for the safe conduct of the flight and for the safety of all embarked personnel. The PIC shall use Crew Resource Management (CRM) techniques in the conduct of assigned flight operations. The PIC shall comply with all mandated FAA pilot certifications, including current medical certification and applicable ratings, if a NASA-owned aircraft is operated as a civil aircraft under an FAA Airworthiness Certificate. Specific LaRC PIC responsibilities are listed in section 1.8. PIC requirements for Mission Management operations are addressed in NPR 7900.3.

7.3.3 Second-in-Command – An SIC designation requires demonstrated airmanship, maturity, and aircraft systems knowledge for a particular type aircraft at a level of expertise that provides for professional cockpit assistance to the PIC. This shall include the implementation of Crew Resource Management (CRM) techniques. Designation shall be in writing and shall be approved by the CRFO upon the recommendation of the Chief Pilot. Some aircraft may require an SIC to be assigned based on aircraft type certification or on specific research requirements. SIC requirements for Mission Management operations are addressed in NPR 7900.3. Most international operations require the SIC to hold a valid type rating, if a type rating is available for a particular aircraft. Alternatively, for domestic operations in the United States, an SIC without a type rating may operate an aircraft as SIC if they meet the following requirements:

a. Complete an appropriate ground school/systems training in accordance with FAR Part 61 SIC requirements.

b. Be landing current in type as set forth in FAR Part 61.

c. Meet additional flight training requirements established by the Chief Pilot and be evaluated by an IP.

7.3.4 Instructor Pilots, Check Airmen, and Functional Check Flight Pilots - Special designations of pilots are required for the following positions:

a. Instructor Pilot (IP)

(1) To be designated as an instructor pilot in manned NASA LaRC aircraft, a pilot shall have demonstrated superior systems knowledge and piloting skills in the type of aircraft in which designation is sought. The pilot shall be recommended by the Chief Pilot and designated in writing by type aircraft.

(2) In general, the IP shall be considered a subject matter expert on the particular type of aircraft. The Chief Pilot shall determine the training

syllabus to be used to provide for IP designation. The syllabus may utilize the aircraft manufacturer's or military guidance, as appropriate.

(3) NASA manned aircraft instructor pilots shall have a previous or current designation as an FAA Certified Flight Instructor (CFI) or military instructor pilot before obtaining designation as a NASA Instructor Pilot.

(4) Minimum IP qualifications are:
For GA aircraft (C206, SR22, COL3): 100 hours GA & 25 hours in type
For B200/UC-12B: 200 hours in type
For OV-10: 100 hours in type; 200 hours of aerobatic time
For UH-1H: 100 hours in type
For large multi-engine: 1000 hours multi-engine (non-center line thrust); 200 hours in type

d. Check Airman (CA)

Check Airmen are senior IPs who have been designated to not only provide training, but also to provide check rides for the aircraft in which this designation has been granted. This designation is granted through the evaluation by the CRFO and the Chief Pilot of the experience and knowledge of the instructor pilot to perform check ride signoffs in the appropriate aircraft. These pilots shall be designated in writing and shall familiarize themselves with appropriate flight training syllabi and check flight procedures for the type aircraft that they are authorized to check. Check Airman minimum qualifications are designation as an IP and PIC in the aircraft. The CA shall be qualified, designated, and current in the model aircraft that the check is being performed in.

c. Functional Check Flight (FCF) Pilot

(1) Functional check flight pilots are to be chosen and recommended by the Chief Pilot, based on their superior systems knowledge. These pilots shall be designated in writing and shall familiarize themselves with appropriate maintenance functional check flight procedures for the type aircraft that they are authorized to check.

(2) Maintenance functional check flights (FCFs) normally require such checks as engine shutdown and restart, propeller feathering, pressurization checks, and electrical system checks in flight. Therefore, all FCF pilots shall obtain a briefing from appropriate maintenance/QA personnel prior to flight, concerning the maintenance checks that need to be performed. This briefing is normally obtained during a formal maintenance Flight Readiness Review (FRR). If an FRR is required when the aircraft and crew are at a remote location, the PIC shall coordinate and conduct the FRR by telephone, if possible, prior to any flight being released. No other mission shall be combined with an FCF. At the completion of the FCF, the

pilot shall debrief QA and appropriate maintenance personnel on all aspects of the flight and discrepancies that were noted.

(3) Minimum FCF qualifications are:
For GA aircraft (C206, SR22, COL3, etc.): 100 hours GA & 25 hours in type
For B200/UC-12B: 100 hours in type
For OV-10: 100 hours in type
For UH-1H: 100 hours in type
For large multi-engine: 1000 hours multi-engine; 200 hours in type

7.3.5 Multiple Aircraft Designations - Given the need for pilots with a broad base of experience and the highly structured flight environment at LaRC, there is no prescribed limit to the number of aircraft types in which a pilot can maintain designation. Maintenance of currency and proficiency, and provision for retraining and/or requalification in a particular type aircraft, shall be coordinated with the Chief Pilot for appropriate scheduling.

7.3.6 Visiting, Guest, and Subject Pilots - Pilots required or invited to fly LaRC aircraft to meet LaRC mission requirements shall meet LaRC qualification and currency requirements or as specified by the FTOSR or CRFO. Pilot designations shall be documented and signed by the CRFO. Pilots shall fly subject to the authority of the CRFO.

a. The Chief Pilot shall maintain pilot training and qualification records on pilots operating LaRC aircraft as PIC. As a minimum, documentation shall include a copy of their pilot and medical certificates, and pertinent training records or logbook documentation.

b. For research missions, a Flight Safety Release (FSR) based on a research FTOSR shall establish qualification requirements for the aircrew involved in the research.

7.4 REQUIREMENTS FOR MANNED AIRCRAFT PILOT CERTIFICATION

7.4.1 General - Due to the nature of research aircraft operations, special arrangements may be necessary for pilots and other crewmembers to obtain training prior to operating some LaRC aircraft. Normally if a formal outside training syllabus is unavailable, an in-house training syllabus shall be adopted to provide for safe initial operations, utilizing qualified IPs and CAs. Approved FAA and/or military training facilities may be utilized as an alternative method of obtaining type-specific training and checkout. .

7.4.2 In Category

a. LaRC research pilots shall meet the following minimum experience levels in order to obtain designation as PIC in each category of aircraft:

Propeller Aircraft	20 hrs.
Jet Aircraft	50 hrs.
Rotary Wing/VTOL Aircraft	50 hrs.
Multi-Engine, Wt. > 12,500 lbs.	50 hrs.

7.4.3 In Type

a. For initial certification and operation of LaRC aircraft operated as civil aircraft with a FAA certificate of airworthiness, manned aircraft pilots shall be required to have appropriate FAA certificates and ratings.

b. Pilots shall receive initial training in individual aircraft types from the appropriate flight instructor for that aircraft or from a formal FAA training provider. Use of formal ground school and simulator facilities are encouraged, if available.

c. All RSD syllabus flights shall be documented on an LF 277, *NASA/Langley Research Center Flight Evaluation and Training Record.*

d. All check flights shall be conducted by a NASA CA or FAA Designated Examiner, as appropriate, and shall be documented on a LF 277, or equivalent FAA training record form, such as a logbook entry or completion certificate.

e. Initial checkouts in aircraft shall include a completed locally-developed handbook exam on aircraft systems and emergency procedures, unless the initial qualification was through the use of an FAA-approved training course. Handbook exams for research aircraft shall be tailored to the aircraft configuration and mission equipment installation, with emphasis on unique inflight emergency procedures required.

f. When an established school is not available, as in the case of a one-of-a-kind research aircraft or other type of flying device, the Chief Pilot shall establish checkout requirements with the concurrence of the ASO and the CRFO. Approvals for operation of these aircraft shall be guided by engineering and design reviews and appropriate test plan approvals.

7.4.3.1 Type Ratings - For LaRC aircraft operated as public aircraft in domestic airspace, FAA type ratings are not required, but are recommended, if available.

a. Pilots who do not already have the requisite type rating for a particular aircraft shall obtain type ratings through NASA-funded training for aircraft requiring type ratings in civil operations. For LaRC aircraft that carry an FAA civil airworthiness certificate requiring a type rating, type rating training

and certification is required if the aircraft is being operated in accordance with the FAA civil airworthiness certificate.

b. If a pilot will not be assigned to passenger-carrying or Mission Management missions, attainment of a type rating is desirable, but not required.

7.5 MANNED AIRCRAFT PILOT RESPONSIBILITIES

7.5.1 Upon acceptance of the aircraft for flight, the PIC is responsible for the safe operation of the aircraft and the safety of the passengers and crew. A list of PIC responsibilities is included in Section 1.8.

a. The PIC shall ensure that passenger briefings are conducted for normal and emergency egress and other safety-related matters.

b. Although scheduling personnel shall monitor currency and qualification of pilots prior to flight assignment, it is ultimately the responsibility of each pilot to ensure that he or she is qualified and current in accordance with the provisions of this document and NPR 7900.3 prior to undertaking flight operations in a LaRC aircraft.

7.5.2 SICs, when assigned, shall provide assistance and CRM support to the PIC while in flight and during ground operations. Especially important is the support from the SIC while providing copiloting duties during IFR conditions, congested airport operations, and research non-standard operations.

7.5.3 No emergency or non-normal procedures shall be practiced in aircraft while in flight with passengers or non-qualified crew members on board. Documented FCF procedures are considered normal for the purposes of this section.

7.6 FLIGHT TEST REPORTS

7.6.1 If required by the Principal Investigator (PI) or lead researcher, or other entity, designated research aircrew shall complete a Flight Test Report in a format appropriate to the activity.

7.6.2 If multiple flights are required to complete an experiment card, the flights may be combined on a single report. If other documents are referenced, such as experiment plans, copies shall be attached.

a. When multiple air crew are involved in a mission, only one report is required. However, all other air crewmembers having opinions, evaluations, or information that could be important to the project or to future operations, shall submit separate inputs or combined reports.

b. Any reports that require internal distribution shall be reviewed by the

Chief Pilot and Principal Investigator or lead researcher prior to distribution.

c. Such reports are not considered publications and may not be disseminated to non-LaRC entities without management approval.

7.7 ASSIGNMENT OF PROJECT AIRCREW

7.7.1 The Chief Pilot shall make project pilot and/or operations engineer assignments, based upon pilot/operations engineer workload, related experience, short and long-term availability, costs of training and checkouts, demonstrated professionalism, and other factors. Assignment may be on the LF444 or in another format, but:

a. Assignment as project aircrew does not preclude later changes to this designation or the use of other aircrew on the project.

b. The Aviation Safety Officer shall not be assigned as a Project Pilot. However, the ASO may participate in research project flying as a PIC or SIC, but may not be assigned directly to the project.

7.8 PILOT FLIGHT CURRENCY REQUIREMENTS

7.8.1 General - LaRC pilots shall meet minimum currency requirements listed in this section in order to carry personnel in LaRC aircraft. However, pilots are not expected to meet all minimum currency requirements at all times.

a. If maintaining currency in a particular category or type is not required to meet mission requirements, currency may be allowed to lapse provided it is not one of the minimum currency requirements of NPR 7900.3.

b. In addition to these requirements, the Chief Pilot or the CRFO may establish special requirements if warranted by safety considerations.

c. Conversely, the CRFO may waive compliance with these requirements in special cases, where justified.

7.8.1.1 The currency requirements of this guideline are minimum requirements, and meeting them shall not be construed as constituting proficiency. Depending on individual pilot backgrounds and experience levels, aircraft complexity, and mission requirements, proficiency flying beyond that necessary to meet the minimum currency levels of this guideline may be approved and/or required. LaRC pilots shall use the standards for currency found in FAR Part 61 as the minimum basis for assessing pilot flight currency. For LaRC aircraft operated as civil aircraft, the currency requirements of FAR Part 61 are mandatory.

7.8.2 Individual Training Plan - Prior to the start of each calendar year, each pilot shall develop and submit an individual training plan for Chief Pilot and CRFO approval. This

plan shall guide the scheduling and assignment of pilots to regularly scheduled flights in support of approved projects, with the goal being to continuously meet currency requirements, as a minimum, and meet proficiency plans as a goal.

7.8.3 Currency Requirements for Research and Support Pilots

	PIC/IP
Total Flight Time [1]	120 hrs./year, 60 hrs in last 180 days
Instrument Time [2]	12 hrs./year, 6 hrs in last 180 days
Instrument Approaches	12/year, 6 in last 180 days. Of the 12 - 6 precision/year, 6 non-precision/year
Night	3 night takeoffs and 3 full-stop landings every 90 days in category
Category	3 landings every 90 days
1. Annual requirements defined from Jan. 1 – Dec. 31	
2. Actual or simulated. Research simulator time cannot be applied against this requirement.	

a. Failure to meet any night or instrument currency requirement in this category shall result in restriction to operations not carrying personnel in night or instrument conditions until the appropriate requirement is met or a waiver is obtained. Re-attainment of currency, when again required, shall be the responsibility of the Chief Pilot to coordinate.

b. Mission Management requirements of NPR 7900.3 shall not be waived.

c. If a pilot fails to meet currency requirements, the Chief Pilot shall take action to ensure currency is met, unless it has been waived as set forth in para. 7.8.3 a., above.

7.8.4 Other Currency Requirements

7.8.4.1 Instrument Proficiency Check (IPC)

a. LaRC pilots normally attend B200/UC-12 or other type-specific formal recurrency training yearly to cover the requirement for an Instrument Proficiency Check (IPC).

(1) Failure to meet this IPC currency requirement shall result in restriction to Visual Flight Rules (VFR) conditions.
(2) A type rating or initial instrument or annual recurrent instrument training conducted by an FAA approved training organization may be substituted.

(3) If recurrency training is not accomplished, the CRFO shall document pilot limitations.

7.8.4.2 Annual Instrument Refresher - Each LaRC pilot shall attend a classroom instrument refresher course annually. This course may be completed at an approved military or civilian training facility. Taking an open book instrument exam prepared by the Chief Pilot may be substituted if an instrument course is not available.

7.8.4.3 Annual Handbook Review - Each pilot is required to review the pilots operating handbook annually for each aircraft in which he/she is qualified. Retaking or reviewing the aircraft handbook exam, as applicable, may document this review.

a. If a formal systems refresher course for a particular type of aircraft is accomplished during the year, a handbook exam is not required.

b. Each pilot jacket shall contain documentation indicating the date each handbook review was conducted.

c. Failure to meet this requirement shall result in restriction from operating the aircraft until the review is completed.

7.8.4.4 Rotary Wing Proficiency - Each pilot operating LaRC rotary wing aircraft shall have proficiency evaluated annually normally through a check ride.

a. Failure to meet this requirement shall result in restriction from operating rotary wing aircraft with other personnel aboard until the evaluation is complete.

7.9 REMEDIAL RE-EXAMINATION PROCEDURES

7.9.1 Upon identification of deficiency during a training event or check flight, a check airman/instructor may retrain and recheck or identify the deficiency and recommend remedial training to the Chief Pilot.

a. If additional flight or simulator retraining is required, the check airman/instructor shall request a reexamination check, in writing, to the Chief Pilot.

b. The request shall include a verification statement that remedial training has been completed and the crewmember has reached a performance level that warrants re-examination.

c. Re-examination flight checks shall be accomplished as directed by the Chief Pilot.

d. The Chief Pilot shall document any limitations placed on the crewmember until the reexamination has been satisfactorily completed.

e. Documentation of the recheck shall be made using LF 277, *NASA/Langley Research Center Flight Evaluation and Training Record.*

7.9.2 Requalification - If any currency requirement is not met, requalification may be accomplished by demonstrating proficiency in flight to an IP. If an IP is not available, re-currency shall be accomplished with another pilot current in the aircraft.

a. If all pilots are noncurrent, the least noncurrent pilot shall act as the safety pilot to re-qualify the other pilots.

b. If two pilots are not available, currency then may be obtained by solo or minimum crew operations at the discretion of the CRFO, as appropriate.

c. Other aircrew or research personnel shall not be carried until currency requirements have been achieved for the crew position and type of operation required.

7.10 REMOVAL PROCEDURES

7.10.1 Any flight crewmember who does not meet the recent flight experience requirements stated in this Operations Manual shall have his position reviewed by the RSD Director.

a. After thorough review of training and qualification difficulties, a decision shall be made concerning continuation in flight status or whether a waiver action is appropriate.

b. Additional guidance is available in NPR 7900.3.

7.11 PILOT RELEASE FROM FLIGHT STATUS

7.11.1 Pilots may be released from flight status under the following conditions:

a. Failure to meet the minimum pilot requirements of this document (including medical).

b. Failure to operate LaRC aircraft in a safe and professional manner, or the gross or consistent use of poor judgment (Additional guidance is available in NPR 7900.3).

c. If their piloting services are no longer required to meet organizational commitments.

7.12 RECORDS AND LOGS

7.12.1 An automated pilot flight time logging system shall be provided for documenting pilot currency status with regard to flight time, instrument approach, and landing currency requirements. This is normally provided through the use of the NAMIS system.

a. The Chief Pilot, in conjunction with the CRFO, is responsible for maintaining and documenting pilot currency status with regard to all other currency requirements.

b. Pilots shall not be required to maintain individual logbooks, provided an automated logging system is in operation to document compliance with currency requirements.

c. The automated logging system shall be maintained on a daily basis so that a ready reference is available to assist in properly assigning crews based on currency and training accomplished.

8.0 REQUIREMENTS FOR MANNED AIRCRAFT NON-PILOT FLIGHT CREW

8.1 CREW COMPLEMENT

8.1.1 Drug Testing - All maintenance technicians, quality assurance inspectors, avionics technicians, operations engineers and airworthiness engineers are considered to be in safety critical positions. Thus, all employees in these positions, and any other positions designated in the LaRC Random Drug Testing Program, are subject to the provisions of this program.

8.1.2 Minimum Crew - The minimum non-pilot aircraft crew on LaRC aircraft shall be determined by the aircrafts civil type certification or handbook limitations.

a. Where an aircraft has no equivalent civil or military counterpart, the Chief Pilot shall establish the minimum crew in accordance with research and operational requirements, and safety considerations.

b. Minimum research crew is quantified as the minimum number required to accomplish the objectives of a specific mission.

8.1.3 Maintenance Technicians

a. The participation of the crew chief of each aircraft, or other supporting maintenance technicians, in flight activities associated with their aircraft, will add to the safety of flight operations and is encouraged.

b. Due to the requirement for maintenance technicians to be able to crew other aircraft when the regular crew chief is absent, occasional participation in flights by maintenance personnel other than the normal crew also is encouraged.

8.1.4 Operations Engineers. The participation of the operations engineer in flight activities adds to the safety of flight operations and is encouraged. When multiple research crewmembers are needed or operational tasking is unusually high, the operations engineer’s participation in the flight may be required to fulfill mission requirements. Depending on individual backgrounds and experience levels, aircraft complexity, and mission requirements, maintaining proficiency may require exposure beyond that minimally necessary to complete assigned missions.

9.0 CREW DUTY LIMITATIONS

9.1 GENERAL

9.1.1 Definitions for *critical job* and *critical person* from LAPD 1700.5, *NASA Langley Research Center Maximum Work Time Policy*, apply to all who fly, operate or prepare aircraft or research systems, and generally to those who conduct research aboard aircraft. LaRC aviation operations are conducted in accordance with the policies/limits established by LAPD 1700.5, with additional restrictions as noted in the table below.

9.1.2 The normal crew duty time limit is 12 hours. Each crew duty period of 12 hours or greater shall be followed by a minimum rest period of 10 hours. Crew duty time begins when a crewmember arrives at his duty station, whether for the purpose of flight or non-flight activities. Crew duty time ends when a crewmember has completed official duties for the day. Crew duty hour maximums are:

Element	Hours
Max. work day without OUM approval	12
Max. work day with OUM approval	16
Min. rest between 12+ hour work days	10
Max. hours/week without OUM approval (7 day week)	60
Max. consecutive work days without OUM approval	7
Max. hours/4 weeks without OUM/LaRC Safety Mgr. approval	240

9.2 CREW REST

9.2.1 Crew rest is required for all aircraft crewmembers.

a. Crew rest is the time period prior to the time the crew reports for flight, during which the crewmembers are assigned no official duties. During this time the crew is expected to obtain sufficient rest prior to the flight.

b. Minimum crew rest time shall be 10 hours beginning at the time the crewmember completes official duties for the day and ending when the crewmember reports for duty.

c. A crewmember may accept an assignment for flight time only when the applicable requirements are met.

d. No crewmember may be made to accept a mission during any required rest period.

e. Time spent in transportation, not local in character, that is required of flight crewmembers is not considered part of a rest period.

f. A flight crewmember is not considered to be assigned flight time in excess of flight time limitations if the flights to which he/she is assigned are expected to terminate within the published time limitations. In the case where circumstances beyond the control of the flight crewmember (such as adverse weather conditions) cause an unexpected delay in landing, the PIC shall exercise good judgment concerning the continuation of the flight. If it is deemed to be safer to continue to the intended destination within a short period of time, rather than to divert to another location based on weather, landing conditions at the alternate, or other factors, then the PIC may continue, but shall provide a debrief on the situation to the CRFO and Chief Pilot upon landing.

9.2.2 Flight Time Limitations and Rest Requirements.

9.2.2.1 A pilot may not be assigned or accept an assignment for flight time as a member of a crew if that crewmember's total flight time in all government flying will exceed:

a. 500 hours in any calendar quarter

b. 800 hours in any two consecutive calendar quarters

c. 1,400 hours in any calendar year.

9.2.2.2 The total flight time during any 24 consecutive hours of the assigned flight, when added to any other flying by that pilot, may not exceed:

a. 8 hours for a flight crew consisting of one pilot

b. 10 hours for a flight crew consisting of two pilots qualified for the operation being conducted.

9.2.2.3 Each assignment shall provide for at least 10 consecutive hours of rest during the 24-hour period that precedes the planned completion time of the assignment.

9.2.2.4 When a flight crewmember has exceeded the daily flight time limitations in this section, because of an emergency response or circumstances beyond the control of the agency or flight crewmember (such as adverse weather conditions), that flight

crewmember shall have a rest period as determined by the CRFO, but not less than 12 hours before being assigned or accepting an additional flight assignment.

9.3 WAIVERS

9.3.1 Center policy permits the RSD Director to extend crew duty time to 16 hours in exceptional circumstances. RSD also requires concurrence of the CRFO. Additional criteria to extend crew duty time to 16 hours are outlined in NPR 7900.3.

10.0 MANNED AIRCRAFT RESEARCH EXPERIMENTS

10.1 GENERAL

10.1.1 The functional implementation of LaRC aircraft research experiments is guided by policies and procedures described in this chapter. The specific, chronological activities of the personnel and organizations involved in planning and carrying out aircraft research experiments are detailed herein. Although specified in a chronological order, the order may be changed or some of the activities may be conducted in a parallel manner to expedite the aircraft research process (as authorized by the ASRB or CRFO).

> **NOTE:** The ASRB shall determine the process for review and oversight of research projects planned and conducted away from LaRC. These activities may use alternative oversight methods, such as the use of other NASA centers.

10.2 AIRCRAFT RESEARCH EXPERIMENT INITIATION

10.2.1 The implementation and/or safety assessment of aircraft research experiments are initiated in accordance with LMS-CP-0960, with the submittal of an *Aircraft Flight Research Project Initiation Request* (LF434, for experiments involving non-LaRC aircraft) or a *Simulation and Aircraft Service Activity Work Request* (LF444, for experiments involving LaRC aircraft), as appropriate.

a. The request defines the scope of the research and has a specific routing for approvals.

b. The submission of these requests also serves to inform the ASRB of the new requirement and initiates the process of determining and planning the requisite ASRB reviews (ref. LMS-CP-5580)

10.3 SYSTEM SAFETY

10.3.1 General - Safety procedures are formulated for each program as appropriate to the application. Each program includes measures to ensure that safety is given special consideration and that a chain of responsibility is established and maintained throughout. From a system safety standpoint, this document provides information on hazard identification, hazard analysis, and risk management requirements for LaRC flight research projects.

a. An Airworthiness Engineer, an Operations Engineer, designated system safety professionals from OSMA, Research Pilot, and any other experts deemed appropriate, assist the Principal Investigator or lead researcher in developing safety procedures.

b. The ASO and an Airworthiness Engineer serve as consultants and final reviewers of the hazard analyses prior to presentation to the ASRB.

c. The flight release for research activities is made by the ASRB or Center management depending upon the level of risk encountered. (For more information on system safety, see NPR 8715.3, *NASA Safety Manual*.)

10.3.2 System Safety Implementation - The goal of system safety is to ensure that the safety requirements of each aircraft research experiment are understood by each participant and that the tasks, products, and methods of implementation are clearly defined. This risk reduction process is applied as a fundamental risk management tenet.

a. The following information is presented to the ASRB and included in the FTOSR:

(1) Hazard reporting and resolution
(2) Assignment of safety responsibilities
(3) System safety milestones and schedules
(4) System safety interface with other engineering disciplines
(5) System safety tasks to be performed, such as:
    a) Testing
    b) Hazard analysis and risk assessment
    c) Configuration management

b. The fundamental premise of system safety and the Aviation Safety Program is that hazards shall be reduced to the lowest practical risk level.

(1) The first goal is to effect a design that eliminates hazards.
(2) If this is not possible, safety devices shall be incorporated to prevent or ameliorate consequences of hazardous situations.
(3) If safety devices cannot adequately accomplish the objective, warning devices shall be incorporated

10.4 RSD SAFETY REVIEWS

10.4.1 RSD safety review and approval processes are used to ensure that aircraft experiments are evaluated for appropriate safety considerations. These can be conducted as a formal review meeting or as a continuous review process. Those considerations determined and evaluated during the safety review processes include, but are not limited to:

a. Procedures

b. Chase

c. Photography

d. Airworthiness

e. Communications

f. Minimum crew

g. Documentation of tested flight envelope

h. Emergency equipment (parachutes, flotation devices, helmets, etc.)

These reviews normally utilize the expertise of the RSD Chief Engineer, Airworthiness Engineer, Hazards Engineer, Chief Pilot, ASO, and other necessary technical personnel.

10.5 CHANGES TO AIRCRAFT RESEARCH EXPERIMENT DEFINITION

10.5.1 Changes to approved aircraft research experiments are accomplished according to LMS-CP-0960. This encompasses planning, implementation and functional/safety review(s).

10.6 HAZARD ANALYSIS AND DOCUMENTATION

10.6.1 Identification - A hazard, or hazardous condition, exists when any research-related component, subsystem, or system has the potential to cause injury, illness, death, or equipment damage through its normal performance, performance degradation, functional failure, or inadvertent functioning. Formal hazard identification methods (such as the development of fault trees, failure modes and effects analysis, etc.) are utilized to identify potential hazards that result from aircraft modifications, research systems, operational requirements, human factors, environmental conditions or any other source of hazard due to the experiment requirements that are above the normal risk of flight for that aircraft.

10.6.2 Hazard Analysis Process - It is a Principal Investigator's or lead researcher's responsibility to ensure that hazard analyses are conducted and documented and included as part of the FTOSR.

a. Flight operations personnel shall provide technical expertise, and SMAO may provide system safety experts to identify and apply specific analysis techniques (fault tree, failure modes /effects, etc.). These analyses are best accomplished by a group effort, including the Principal Investigator or lead researcher, RSD personnel, and all other sources of technical expertise, as required.

b. These analyses examine hazards or hazardous conditions systematically to

(1) Evaluate the risks associated with those hazards, and
(2) Eliminate or abate those hazards to acceptable levels.

c. The “Flight Research Hazard Analysis," LF273, is the recommended minimum format for documenting the analysis.

10.6.3 Risk Assessments - An assessment of each undesired event is conducted as to the type of risk involved and the effectiveness of any countermeasures that exist.

a. The risks associated with death or injury to personnel or damage to equipment are managed so that the desired level of safety is maintained.

b. Project managers are required to provide a project-specific risk assessment plan when Center risk assessment plans do not adequately address specific project risks. These project-specific risks are normally addressed in the FTOSR. Additional guidance is available in NPR 7120.8.

10.7 MANNED AIRCRAFT MODIFICATION AND DOCUMENTATION

10.7.1 General - This section describes responsibilities and procedure for implementing aircraft research experiments and modifying LaRC aircraft for research purposes.

10.7.2 When a new experiment has been approved by RSD, any modification to LaRC aircraft, aircraft systems, aircraft research systems, or software requires the submittal of the appropriate request for implementation, review, approval, and documentation.

a. LaRC aircraft research experiments that involve aircraft, aircraft modifications, and airborne equipment provided under contract or grant, or which may require LaRC personnel to fly, are reviewed in accordance with LMS-CP-0960 and LMS-CP-5580 as appropriate.

b. Aircraft owned, leased, or controlled by LaRC receive basic maintenance according to DoD, FAA, manufacturer, or NASA-approved standards that apply to the particular aircraft type, and according to any special standards and procedures recommended by the Head of the Research Systems Integration Branch.

c. The maintenance procedures are:

(1) Recommended, established, and implemented by the Head, RSIB.
(2) Approved by the CRFO.
(3) Documented by the Quality Assurance Office, RSD.

d. QAO personnel are notified prior to the completion of maintenance requiring the opening of research equipment for adjustment or parts replacement.

e. Research equipment modifications are documented by drawings and approved by the Langley Management System (LMS) process. The Research Vehicle Work Order (RVWO) Request and Approval (LF 432) is used to document and authorize modifications that affect aircraft configuration or interfaces with the basic aircraft systems.

f. Procedures for assuring the safety of the aircraft and flight operations with nonstandard modifications to the aircraft or with nonstandard research equipment are established by the CRFO.

10.7.3 Aircraft Classification - All NASA aircraft are defined as “public” aircraft and are operated as defined in 49 USC 40102. The type of use of public aircraft determines the rules and regulations under which these aircraft shall operate.

a. Those aircraft used for passenger transport are required to be operated as “civil” aircraft, with a valid FAA Certificate of Airworthiness when doing so.

(1) When operating as “civil” aircraft, the provisions for relaxed operating requirements as set forth for aircraft used as “public” aircraft are not available to government agencies.

(2) The civil aircraft shall be operated and maintained under applicable Federal Aviation Regulations (Parts 91, 23 or 25, etc.). Use of certificated personnel is required for maintenance signoff and flight operations.

(3) LaRC aircraft operated under a civil certificate are subject to both the LaRC work order processes and the FAA processes for configuration changes, equipment certification, etc.

(4) FAA regulations shall govern if there is a conflict between NASA and FAA processes for aircraft operating under a civil certificate.

b. The same aircraft and crew can operate as “public” and as “civil” based strictly on the intended use for a particular flight.

(1) If the aircraft is operated as a “civil” aircraft, the pilot(s) shall meet all Federal Air Regulations requirements pertaining to qualification, certification, and currency applicable to the operation.

(2) The aircraft shall meet all the requirements of its FAA type certificate including having a valid FAA Certificate of Airworthiness when returned to service as a “civil” aircraft. This requirement includes compliance

with all inspections, ADs, and maintenance logbook entries required by regulation.

(3) Any civil certificated aircraft modified for purposes that deviate from the civil type certification shall report such changes to the local FAA Flight Standards District Office (FSDO). Once such modifications are removed, coordination shall be made with the FSDO for return to proper civil airworthiness certification status, including compliance with appropriate inspections.

10.8 RESEARCH VEHICLE WORK ORDER REQUEST AND APPROVAL

10.8.1 Modifications to aircraft and aircraft systems under the control of RSD are initiated by the submission of a Research Vehicle Work Order Request and Approval (LF 432).

a. If any office in the routing and approval sequence disapproves of the requested work or required alteration, a new Research Vehicle Work Order (RVWO) may be written to replace the original.

b. Once the RVWO is approved by the QAO, a “Research Vehicle Work Order Change Request” is used to change or cancel any work already approved by the original RVWO.

10.8.2 The RVWO remains with the Crew Chief throughout the installation and implementation process. In the event that red-line changes to engineering drawings are needed during the installation and implementation process, airworthiness engineers and QAO shall be notified of the change(s) and approve them prior to implementation.

10.8.3 After installation is completed, the RVWO is routed in reverse order until it reaches the QAO. As part of the QAO closeout process, the QAO and Airworthiness Engineer shall review and approve the completed work and work order.

a. The signature and approval of the Airworthiness Engineer signifies that the redlined drawings represent the as-built configuration. Those drawings may now be officially modified to reflect that configuration. The configuration and analysis shall be updated within 30 days of the closing of the RVWO per LMS-CP-0910.

b. The QAO files the original of the completed work order in the aircraft files.

c. The Airworthiness Engineer logs the work order as complete and verifies that any modifications made since original approval are correct and documented.

10.9 RESEARCH VEHICLE WORK ORDER REVISION

10.9.1 Changes to an open RVWO are accomplished with an LF432, utilizing revision number assignment.

a. The request follows the same approval process as described above and represents a revision to the original RVWO.

b. Bold print indicates any change to the work requested.

c. Once the change is approved, the revised RVWO is signed off and sent back through the system.

d. The change request remains with the aircraft crew chief until the work is finished.

e. The request also is used for the cancellation of an RVWO.

f. A continuation is to be used if additional space is required.

10.10 EXPERIMENTAL SYSTEMS WORK REQUEST

10.10.1 Changes to the aircraft research systems software are accomplished with an Experimental Systems Work Request (ESWR), LF436.

a. This process is applicable to software applications and incorporates the concept of verification and validation by encompassing checkout facilities, such as the Flight System Integration Lab (FSIL).

b. This process may require the use of Research Vehicle Work Order Request and Approval Form (LF432) if the requested changes require aircraft modifications.

c. ESWR tracking numbers are assigned by the originating organizations and are filed with QAO. Additionally, ESWRs are logged and tracked by QAO to prevent duplication of identification numbers and to ensure closure.

10.11 SOFTWARE

10.11.1 Software delivery specifics are contained in LMS-CP-0960. Installation and modification of flight software is accomplished according to the processes and procedures of the preceding sections. Software is delivered to aircraft in one of two phases, pre-lockdown and lockdown. The purpose of lockdown is to maintain a configuration record of software while in aircraft research experiment activities.

a. Lockdown is established when developmental activity is coming to an end and the research experiment is about to commence. Research flights may include developmental activity and do not necessarily indicate the software phase.

b. Before lockdown, software may be delivered to the aircraft without tracking or approval.

c. After lockdown, software is delivered with the Software Delivery form, LF 238.

d. Lockdown ends upon the completion of the aircraft research experiment, RSD development of any software required for flight or control of flight processes, or for research systems.

10.12 STRESS ANALYSIS

10.12.1 Any structural research modification to LaRC aircraft or installed research system shall require some form of stress analysis to establish that applicable design criteria have been met or maintained.

a. The required stress analysis and any drawings referenced by the analysis shall be submitted to the QAO and the airworthiness engineers prior to, or concurrent with, the submittal of the associated Research Vehicle Work Order Request and Approval Form (LF432).

b. When scheduling modification activities, up to two weeks shall be allowed for the review and approval of submitted analysis and the subsequent approval of the associated RVWO.

c. Any analysis shall be complete and sufficiently comprehensive as to require no further explanation.

d. Analyses may be handwritten, but shall be legible and easily reproducible by photocopier and mass storage technology.

e. The first several pages of a stress analysis shall follow the recommended general format outlined below:

(1) Cover Sheet
(2) NASA Signature Sheet
(3) Revision Sheet (if applicable)
(4) Contractor Signature Sheet (if applicable)
(5) Table of Contents
(6) Introduction
(7) Summary of Critical Factors of Safety

(8) Drawing List
(9) General Diagram(s)
(10) General Loading Description

f. Each analysis shall contain free body diagrams, statements of assumptions, and section and material properties.

g. General equations and their sources are to be given before substitution of numerical values.

h. It is preferred that all material specifications and vendor items be grouped together in one section, either in the body of the analysis or as an appendix.

10.13 PUBLIC AIRCRAFT AIRWORTHINESS GUIDELINES

10.13.1 This section provides a set of general guidelines and procedures to be used in the design, fabrication, and installation of aircraft modifications to public-use aircraft, i.e. airborne research equipment and/or modification of an aircraft for research purposes. It is intended to scope the requirements for airworthiness definition and certification for flight and operation of hardware and systems aboard LaRC aircraft. Airworthiness of civil certificated aircraft is subject to the FARS and appropriate FAA oversight and compliance.

a. The RSD Chief Engineer, the Airworthiness Engineers, the ASO, and the QAO shall establish airworthiness guidelines in response to requirements formulation per LMS-CP-0960 and LMS-CP-0910.

b. Applicable manufacturer, military or FAA standards or guidelines shall be utilized to ensure adequacy of installations and designs.

c. Not all standards are applicable to every platform or design.

(1) In normal situations, manufacturer’s guidelines shall be followed with additional reference to appropriate FAA regulations for airworthiness.

(2) Military requirements shall normally be followed when the aircraft or equipment was or is being developed for military, non-civil use.

d. Non-standard detailed guidelines are determined only after definitions are made of experiment requirements and system/component functions and operational characteristics in conjunction with existing aircraft and research systems configurations and operational limitations, through a formal NASA design review process.

e. Questions concerning the standards to be utilized for a particular design shall be referred to the Airworthiness Engineers.

10.14 MODIFICATION, OPERATION, AND SYSTEM CLASSIFICATIONS

10.14.1 Modifications shall be classified as to function and purpose in order to establish safety guidelines. This determination shall take into account:

a. Both the equipment and operation immediately being addressed.

b. The integration of the equipment into the existing configuration and the operation of systems within an envelope of limitations that may exist for the configuration.

10.14.2 Classifications result from the assessment of specific aircraft modification, operation, or system integration requests in conjunction with other concurrent configuration and operational limitations (the “envelope”).

a. Consultations with technical experts within all elements of RSD, other LaRC organizational units, other NASA centers, DoD, and private industry may be made for these determinations.

b. Early consultation with the airworthiness engineers or the Aviation Safety Officer to determine the appropriate airworthiness guidelines is imperative for each activity undertaken.

c. These guidelines are classified in three broad categories:

(1) **Flight Critical:** Any aircraft modification, system installation, or operation which, if incurring a failure during use, would place the aircraft, primary aircraft systems, or personnel at significantly greater risk than the normal “assumed risk” of flying. This category shall require the most stringent guidelines for equipment certification, installation, and operation. All airborne research hardware and software shall be subject to formal design reviews, testing or verification, full shop quality assurance and additional flight quality assurance, as required, to ensure airworthiness and safety compliance. Equipment that has not been flight qualified for flight critical applications shall be considered for use in such applications only after consultation with and inspection by airworthiness engineers, the Operations and Engineering Branch, and QAO.

(2) **Mission Critical:** Any aircraft modification (hardware or software), system installation, or operation which, if incurring a failure during use, would prevent the accomplishment of the research mission or operational objectives, but not affect any flight critical systems. Elements defined within this category may be long-term, shall use more standardized guidelines for equipment certification, installation

and operation, and shall focus predominantly on product and mission assurance. Mission Critical assessments are conducted with the cooperation of SMAO, the ASRB, and RSD.

(3) **System Critical:** Any aircraft modification, system installation, or operation which, if incurring a failure during use, would prevent the accomplishment of only a portion of a research mission or operational objectives, and not affect any other component, system or operation. Elements defined within this category shall be short-term, and shall use the least stringent guidelines for equipment certification, installation, and operation. System Critical assessments are conducted with the cooperation of SMAO, the ASRB, and RSD.

10.15 ASRB SAFETY REVIEWS

10.15.1 The Airworthiness and Safety Review Board (ASRB) is a committee of the Executive Safety Council (ESC) as established by LAPD 1150.2, which also establishes its charter and membership.

a. Safety is achieved through the cumulative knowledge and diverse skills of the individual engineers, scientists, and technicians selected for ASRB duty because of their unique experience relevant to particular systems and functions associated with flight research and aviation safety.

b. Board members are experts or have access to other experts in the various technology disciplines needed to determine the safety requirements for aircraft modifications, equipment design, and flight operations, and assigned by the Chairperson of the Executive Safety Council (ESC)

c. The Chairperson of the ASRB schedules ASRB reviews as required commensurate with the degree of risk involved, (see LMS-CP-5580).

(1) After all required reviews have been completed successfully, the Chairperson has the responsibility to issue an FSR.

(2) This release is required prior to the initiation of research flights.

11.0 MISSION MANAGEMENT OPERATIONS

11.1 GENERAL

11.1.1 Aircraft are normally assigned to the mission management (passenger and logistics) mission on a permanent basis. However, NPR 7900.3 provides for the occasional use of program support aircraft for mission management purposes. LaRC aircraft approved for this type of mission shall comply with the requirements of NPR 7900.3.

11.2 AIRCRAFT

11.2.1 Only aircraft specifically approved by the Headquarters Aircraft Management Office (AMO) and certificated by the FAA to carry passengers may be used for Mission Management Flights. This includes the use of program support aircraft in Mission Management operations. These aircraft shall comply with the FAA type certification and have all required maintenance actions logged per FAA regulations by FAA certificated maintenance personnel. To provide passenger services, the aircraft shall also have an FAA Normal or Transport Category Certificate of Airworthiness and a current valid FAA registration.

11.3 REQUIREMENTS

11.3.1 Crew - All Mission Management flights shall be crewed by two pilots qualified in accordance with NPR 7900.3. Pilot crew members shall be FAA licensed and current for the aircraft to be used, per FAR Part 61.

11.3.2 Approvals - Requests for Mission Management flights shall obtain the same approvals as any other flight. Additionally, each Mission Management flight shall have the approval of the Center Director or designee.

11.3.3 Manifest - The manifest shall be completed as specified in NPR 7900.3.The senior passenger on Mission Management flights shall be responsible for determining whether the passenger manifest is complete prior to flight.

11.3.4 Cost Comparison - Each Mission Management flight request shall be accompanied by a cost comparison with commercial transportation per NPR 7900.3.

11.3.5 Records - The CRFO is responsible for retaining records of all Mission Management flights for a period of two years. The records shall include:

a. Aircraft used

b. Flight dates

c. Justification for the request

d. Itinerary

e. Names of flight crew

f. Names of all passengers and legs flown

g. Cost comparison

11.3.5.1 The CRFO (or designee) shall be responsible for preparing a summary of all Mission Management flights for the Headquarters Aircraft Management Office (AMO) every six (6) months, or as required.

12.0 ACQUISITION, DISPOSITION OF AIRCRAFT

12.1 AIRCRAFT ACQUISITION

12.1.1 Acquisition of aircraft at LaRC shall be in accordance with NASA HQ and Federal agency acquisition regulations and guidelines.

a. Each aircraft for which an operational use is planned shall be acquired through the acquisition process described in NPR 7900.3.

b. Each aircraft so acquired shall be entered into the formal NASA Equipment Management System (NEMS) files and placed into NASA Headquarters and GSA active aircraft files.

c. FAA registration also shall be accomplished appropriately.

12.1.2 Aircraft intended to be used solely as a source of spare parts also shall be subject to the acquisition process of NPR 7900.3.

a. Aircraft so acquired shall be required to be entered into NEMS, but shall not be entered into Headquarters or GSA active aircraft files unless activated at a later date.

12.1.3 Aircraft for which there exists no plan for flight operations do not require Headquarters approval and may be acquired directly through Center channels with information provided to appropriate Headquarters offices.

a. This requirement includes aircraft intended for uses such as wind tunnel models, test fixtures, ground mockups, iron birds, or which are in temporary storage for museums or other purposes.

b. Aircraft so acquired shall be entered into NEMS, but need not be reported to NASA Headquarters or GSA as active aircraft.

12.2 AIRCRAFT DISPOSITION

12.2.1 All aircraft dispositions shall be in accordance with applicable Federal agency rules and regulations. LaRC aircraft shall be disposed of in accordance with NASA HQ and GSA aircraft disposition processes when no longer required for current or projected research or support needs.

a. It is recognized, however, that modified, instrumented, or one-of-a-kind aircraft may sometimes have intrinsic value to the research community beyond their pure “book” value. Disposition of aircraft having such intrinsic

value shall be coordinated through LaRC management and Headquarters functional and administrative codes.

b. Aircraft that have no such intrinsic value may be entered into the federally mandated disposition process. The method of acquisition shall often determine the disposition option.

(1) Loaned aircraft shall utilize the termination of loan process to return assets.

(2) Owned aircraft shall first be surveyed through the Agency for requirement, then, with HQ Aircraft Management Office concurrence, enter the GSA disposition authority. They shall survey the aircraft through Federal and State agencies, finally placing the asset based upon requirement and owner criteria.

c. Should aircraft or associated equipment be deemed unsuited to the disposition process due to hazardous or classified materials, the aircraft may be cannibalized and/or “de-militarized.”

d. All planned aircraft dispositions shall be coordinated with Headquarters Aircraft Management Office prior to final disposition.

13.0 ACCIDENT/INCIDENT PROCEDURES

These procedures are applicable to all flight crew personnel and NASA owned, operated, leased and rented aircraft. (Refer to LMS-OP-0939).

13.1 RESPONSIBILITIES

13.1.1 The PIC or a representative shall be responsible for reporting an occurrence to the CRFO and the ASO and securing the scene as necessary, including the safeguarding of Cockpit Voice Recorder (CVR), Flight Data Recorder (FDR) data, and data acquisition system information, if applicable.

13.2 AVIATION SAFETY OFFICER

13.2.1 The Aviation Safety Officer shall be responsible for ensuring that reports of an accident or incident are made according to NPR 8621.1. He/she shall initiate entry into the Incident Reporting Information System (IRIS) of all applicable close calls, incidents, and/or accidents.

13.2.2 The ASO shall activate the Pre-Mishap Plan found in LMS-OP-0939. He/she shall ensure that the QAO/RSO impounds aircraft records related to the aircraft in question. Additionally, training records shall be impounded and secured. Director, RSD, shall be contacted for adjudication of toxicology screening requirements of NPR 8621.1.

13.3 ACCIDENT OR INCIDENT SCENE SECURITY

13.3.1 The senior NASA LaRC representative on-site shall:

13.3.1.1 Request the assistance of local law enforcement agencies and other government agencies for security of the accident/incident scene until released to the NTSB investigator in charge, if applicable.

13.3.1.2 Ensure that aircraft (non-sUAS) wreckage, cargo etc., is not moved or disturbed except to the extent necessary:

a. to remove trapped or injured persons.

b. to protect equipment/material from further damage.

c. to protect the public from injury.

13.3.2 For sUAS or when it is necessary to move aircraft wreckage, cargo, etc., sketches, descriptive notes and photographs shall, to the extent possible, be used to document original positions and conditions of the wreckage and any significant impact marks.

13.3.3 Obtain additional information and guidance from the ASO. If unavailable, contact the nearest Federal facility for assistance.

13.3.4 If an incident or accident occurs in an international location, contact the nearest U.S. Embassy or Consulate for assistance. Often the Defense Attache at those locations can provide assistance with arrangements for security and safeguarding of Government-owned material. ICAO Annex 13 applies. See Appendix A for additional information.

13.4 OTHER OCCURRENCES

13.4.1 Other occurrences, which may or may not be required to be reported in accordance with NTSB rules, FAA regulations, NPR 8621.1 or NASA HQ guidance, but require notification to the Chief Pilot and/or CRFO. These include but are not limited to:

a. Ground Operations Occurrences

(1) Loss of life or serious injury which occurs as a result of personnel present in or on an aircraft or in direct contact with the aircraft or with anything attached during ground operations while the engines are functioning without the intention of flight.
(2) Substantial damage to the aircraft or property sustained during ground operations without the intention of flight.
(3) Servicing aircraft with improper fuel and/or other aviation fluids.

b. In-Flight Occurrences
(1) Failures requiring emergency action.
(2) Accumulations of smoke or toxic fumes in occupied spaces.
(3) Unplanned or asymmetrical thrust reversal.
(4) Unscheduled in-flight engine shutdown.
(5) Damage from hail, bird strikes, or turbulence.
(6) Near midair collisions.
(7) Gear-up landings or collisions with the ground or objects other than aircraft.
(8) Diversion of a flight for a medical incident or emergency.

c. Other Additional Occurrences
(1) Fires not incident to flight.
(2) Ni-Cad battery over-temperature failures.
(3) Lithium battery thermal runaway or explosion.
(4) Hazardous materials incidents.
(5) Damage to property.
(6) Occurrences that may generate unfavorable publicity.
(7) Threats (bomb or otherwise).
(8) Sabotage.

(9) Hijacking.

d. Flight crew occurrences while in a TDY status
(1) Sickness.
(2) Injury.
(3) Incarceration.
(4) Any occurrence which, in the judgment of the PIC or a representative shall be brought to the attention of the Chief Pilot, CRFO, or ASO.

14.0 HAZARDOUS MATERIALS

14.0.1 Hazardous materials are not normally carried as cargo aboard NASA Langley aircraft. In the event that it is necessary to carry or use such material, the following information is provided. This section does not apply to the carriage of hazardous material on research missions. Research use of these materials shall be reviewed and approved by the ASRB processes and documented in the FTOSR.

14.1 DEFINITION OF HAZARDOUS MATERIAL

14.1.1 Hazardous material is a substance or material that has been determined by the U.S. Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated in CFR Title 49 Chap. I, Subchapter C. LPR 1710.12 shall be consulted for proper handling of these materials. International transport is addressed in ICAO Annex 18.

14.1.2 Hazardous/toxic material used on the ground for aviation activities is handled, stored, and disposed of according to appropriate OSHA and EPA regulations. In aviation facilities, all such material is stored in appropriately marked containers and in appropriately marked and equipped lockers/rooms. This material is under inventory control and may be handled only by appropriately trained and certified personnel. Disposal of such material is also documented to complete inventory accountability records. Hazardous/toxic material is seldom carried aboard LaRC aircraft as cargo or research material. In cases where transport of such material is unavoidable, however, OSHA and EPA regulations and appropriate FARs are followed.

14.2 AUTHORITY TO TRANSPORT

14.2.1 Any person or crewmember who is aware there are hazardous materials on board the aircraft shall notify the PIC immediately.

14.2.2 The Center shall not accept for shipment aboard any aircraft hazardous materials, including lithium metal batteries, except those exempted by 49 CFR Chap. I, Subchapter C.,

a. The Agency may accept shipments (cargo) containing carbon dioxide, solid (dry ice) provided the package is clearly marked with the name of the contents being cooled, the net weight of the dry ice or an indication that the net weight is 5 lbs. or less, and also marked “Carbon Dioxide, Solid” or “Dry Ice.”

b. The Agency may permit packages containing dry ice in quantities not exceeding 4 lbs. per passenger when used to pack perishables in carry-on baggage.

c. Packages containing dry ice shall be designed to prevent a build-up of pressure that could rupture the packaging.

14.2.3 Assigned personnel are responsible for screening of all shipments, cargo, freight, etc., to prevent the carriage of hazardous materials as specified in 49 CFR Chap. I, Subchapter C.

a. The individual who loads specifically exempted materials listed in 49 CFR Chap. I, Subchapter C shall be responsible for notifying the PIC in writing that the exempted material is carried on board the aircraft.

b. A copy of the written notification required in the preceding paragraph shall accompany the shipment it covers during transportation aboard the aircraft.

14.2.4 Management Responsibility - The CRFO shall ensure that each crewmember is adequately trained to recognize those items classified as hazardous materials.

14.2.5 Hazardous Materials Classifications - For the purposes of this chapter, hazardous materials shall include any item classified as:

a. Hazardous materials (HM)

b. Hazardous substances

c. Dangerous materials

d. Dangerous goods

e. Regulated materials

f. Restricted articles

14.2.6 Hazardous Material Common Items - Common items in the HM category include, but are not limited to:

a. Strike anywhere matches

b. Gasoline

c. Paints

d. Lighter fluid

e. Lighters with flammable liquid reservoirs

f. Fireworks

g. Tear gas/Mace

h. Radio-pharmaceuticals

i. Fish meal

j. Celluloid film

k. Batteries

l. Compressed gas

m. Ammunition

14.2.7 Handling of Baggage, Cargo and Packages Containing Hazardous Materials. The shippers presentation of the proper papers and certification shall be part of the request for transportation and accompany the HM during transportation.

Note: The general transportation requirements of 49 CFR Chap. I, Subchapter C state that persons presenting HM for transportation shall properly declare any such material at the time it is delivered for transportation. It is an acceptable practice to assume that items containing HM may be recognized by their conspicuous markings and labels, which are required to be displayed upon the outside of the package. Many persons presenting items for transportation may not be aware of the Federal requirements for transporting HM and may not know that they are shipping items classified as HM. Personnel accepting baggage, cargo and packages for transportation shall be vigilant in scanning all items. They shall question persons presenting items as to the contents, to prevent inadvertent transportation of HM.

14.2.8. Required Reports - A discrepancy is an occurrence involving hazardous materials that are improperly described, certified, labeled, marked, or packaged including:

a. Baggage, cargo, or packages found to contain HM after being accepted as a non-hazardous shipment.

b. Shipments that contain HM:

(1) Other than described or certified.
(2) In quantities exceeding authorization.
(3) In unauthorized containers or with improper closures.
(4) In inside containers which are not oriented in accordance with outer markings.
(5) With insufficient or improper absorption materials, when required.

14.2.8.1 Any person who discovers a discrepancy as listed above shall, as soon as practicable, notify the CRFO, providing the following information:

a. Name and telephone number of the person reporting the discrepancy.

b. Specific location of the shipment concerned.

c. Name of shipper.

d. Nature of the discrepancy.

14.2.8.2 The CRFO, upon receiving notification of a discrepancy, shall notify the FAA Civil Aviation Security Field Office nearest the scene of the discrepancy, if the incident occurred on a “civil” aircraft. Public aircraft discrepancies shall be reported to the Director, RSD and the ASO. The Aviation Safety Officer shall comply with the requirements of LPR 1710.12.

14.3 HAZARDOUS MATERIAL INCIDENTS

14.3.1 A hazardous material incident is an event, including accident, discharge, or spillage, which occurs as a direct result of transporting (including loading, unloading, or temporarily storing) hazardous materials, that:

a. Results in a death.

b. Causes injuries requiring hospitalization.

c. Causes $50,000 estimated property damage.

d. Causes an evacuation of the general public lasting one or more hours.

e. Causes one or more major transportation arteries or facilities to close or shut down for one hour or more.

f. Requires an aircraft to alter its operational flight pattern or routine.

g. Results in fire, breakage, or spillage.

h. Generates suspected contamination from a shipment of radioactive material or etiologic agents.

i. In the judgment of a person at the scene, a situation of such a nature exists that it shall be reported, even though it does not meet the criteria listed above.

14.3.2 Any person who has knowledge of a hazardous material incident, as listed above, shall, as soon as practicable, notify the CRFO, providing the following information:

a. Date, time, and location of the incident.

b. The extent of injuries, if any.

c. The classification, name, and quantity of hazardous material involved in the incident, if such information is available.

d. Type of incident and nature of HM involvement.

e. Whether or not a continuing danger to life exists at the scene, if such can be reasonably ascertained.

14.3.3 The CRFO upon receiving notification of such an incident aboard a civil aircraft, shall notify:

a. The FAA Civil Aviation Security Field Office nearest the scene of the incident.

b. The Department of Transportation at 800-424-8802. If etiologic material is involved, see (d) below.

c. The shipper, if radioactive material is involved.

d. The Center for Disease Control/Atlanta 404-633-5323 or 202-267-2675 if etiologic material is involved.

14.3.4 The CRFO shall ensure DOT Form F 5800.2, Department of Transportation Hazardous Materials Incident Report is:

a. Completed by personnel who were at the scene of the incident as soon as practicable but no later than 30 days from the date of the incident.

b. Forwarded, in duplicate, to the Materials Transportation Bureau, Information Systems Manager, Department of Transportation, Washington, DC 20590-0002, with an additional copy furnished to the FAA Civil Aviation Security Field Office which received initial notification of the incident.

c. Public aircraft discrepancies shall be reported to the Director, Research Services Directorate, and the Aviation Safety Officer. The Aviation Safety Officer shall comply with the requirements of LPR 1710.12.

APPENDIX A: INTERNATIONAL FLIGHT OPERATIONS

A.1 ADVANCED PLANNING

A.1.1 Advanced planning is the key to uneventful foreign operations. It is the joint responsibility of RSD management and the PIC to ensure the success of the trip. International and oceanic flight preparations are thoroughly addressed in FAA AC 91-70A.

Typical considerations include:

A.1.1.1 Route Planning and Flight Information Documents – It is recommended that flight planning services be used, whenever possible, for every international flight for route, weather, and NOTAM services. Most countries will bill operators for Air Traffic Control services within their boundaries. If such bills are received, they are to be forwarded to headquarters for State Department adjudication.

A.1.1.2 Personal Documentation - Requirements for most countries likely to be visited are contained in the International Flight Information Manual (IFIM) and USAF Foreign Clearance Guide (FCG). Passengers and crew members shall be notified of these requirements sufficiently far in advance of the trip. Foreign Travel Briefings are required prior to commencement of foreign travel.

A.1.1.3 Aircraft Documentation - Aircraft and engine log books, noise certificate, MNPS/RVSM approval letters and operations manuals, and insurance certification, if required, shall be carried in addition to all the normal documentation, such as airworthiness certificates, registration certificates, and aircraft radio station licenses. Airplane Flight Manuals or equivalent are required.

> **NOTE:** RVSM certification and approval allows operation in any RVSM airspace worldwide. However, there may be specific theater-based requirements for each area of operation which shall be considered.

A.1.1.4 Landing and Overflight Permits - Aircraft entry requirements are shown in the IFIM and FCG. These permits often require several weeks to obtain and may require extensive NASA Headquarters coordination with embassies.

A.1.1.5 Aircraft Handling Agents - The use of a handling agent for all but the most routine international destinations is highly recommended.

A.1.1.6 Foreign User Charges/Fees - These charges may require cash or letters of credit; the handling agent or foreign location Point-of-Contact (POC) shall be consulted for details concerning payment.

A.2 RESPONSIBILITIES FOR INTERNATIONAL DEPLOYMENT

A.2.1 OPERATIONS AND ENGINEERING BRANCH - Obtain or confirm:

A.2.1.1 Applicable flight information publications (FLIPS)/Jeppesen Charts

A.2.1.2 Diplomatic clearances for entry and overflight through HQ

A.2.1.3 U.S. military base use permission/PPR numbers

A.2.1.4 IFIM, FCG, and ICAO rules and procedures

A.2.1.5 Certificate of aircraft ownership/FAA registration/FAA or NASA airworthiness certificates (as appropriate)/noise certificates

A.2.1.6 Insurance certificates (If required). Normally a letter on NASA letterhead stating that the U.S. government is a self-insurer shall suffice to meet this requirement.

A.2.1.7 Customs, immigration and agricultural forms

A.2.1.8 eAPIS message submissions

A.2.1.9 Credit cards, carnets, letters of credit, SF-44s, travelers checks and cash, as appropriate

A.2.1.10 Trip itinerary and passenger manifest

A.2.1.11 MNPS/RVSM Certification (aircraft and crew)

A.2.1.12 Ground handling services

A.2.1.13 NASA and U.S. State Department security briefings, as appropriate

A.2.1.14 Immunizations and records

A.2.1.15 Passports, visas, and personnel documentation

A.2.1.16 Coordination with the Export Control Office

A.2.2 RESEARCH SYSTEMS INTEGRATION BRANCH - Ensure the aircraft has enough time/cycles remaining to complete the deployment prior to any required inspections that may come due, or have plans to accomplish the inspection with certified personnel. An aircraft pack-up kit shall be prepared to include the following:

A.2.2.1 Aircraft and engine logbook information

A.2.2.2 Inspection and life limited items status

A.2.2.3 Spare parts appropriate for the route/destinations anticipated

A.2.2.4 Maintenance reference manuals

A.2.2.5 Survival equipment - FAR/ICAO and NASA required items

A.2.2.6 Aircraft Radio Station License

A.2.3 CREWMEMBERS - Ensure they have the following:

A.2.3.1 FAA Airman certificates with appropriate type ratings and current medical certificates (required outside of the U.S.) (*Temporary pilot certificates are not valid outside of the U.S.*)

A.2.3.2 FCC Radiotelephone Permit (required outside of the U.S.)

A.2.3.3 Passport and visas for countries to be visited

A.2.3.4 Credit cards, cash or travelers checks

A.2.3.5 Travel orders

A.2.3.6 Operations Manual (including RVSM section) on-board (LPR 1710.16)

A.2.3.7 Aircraft Flight Manual (AFM) on-board

A.2.3.8 Immunization records (“yellow card”)

A.2.4 INTERNATIONAL SAFETY AND SECURITY

A.2.4.1 Increased security awareness is important on international flights. When traveling into countries where stability might be questionable, timely review of newspaper articles and magazine reports are of value. The FAA Security Office and the U.S. Department of State country desk are aware of potential problems and can be consulted prior to departure for questionable countries. The PIC shall ensure that destination airports and surroundings for a planned flight do not present a threat to safety or security. This is particularly true of international flights to destinations that have a poor reputation for safety and security. NASA security shall be contacted prior to any international flight to check for unusual or hazardous situations that may impact the security of a planned flight.

A.2.4.2 The flight crew shall be responsible for ensuring aircraft security by adhering to the following procedures:

A.2.4.2.1 When away from home base, close and lock the entrance door when leaving the vicinity of the aircraft.

A.2.4.2.2 No visitors shall be allowed on board the aircraft without a crewmember present.

A.2.4.2.3 If possible, overnight parking away from home base shall be in a well-lighted area, or, preferably, in a hangar. All plugs and covers shall be installed when parked outside. Gust locks shall be installed, as appropriate. Wheels shall be chocked.

A.2.4.2.4 Crews shall be particularly alert when the aircraft is being serviced. One crewmember shall supervise all fueling and require that a fuel sample be taken if there is any doubt as to the quality of the fuel. The aircraft shall be properly grounded during all fueling operations.

A.2.4.2.5 In the event a situation arises that raises the crew's suspicions, report the facts to the nearest police or government authority.

A.2.4.2.6 All aviation personnel shall challenge anyone in the hangar bay or on the ramp who cannot be identified, is not wearing an appropriate ID badge, or behaves suspiciously.

A.2.4.2.7 **Do not fly any aircraft where its safety is in question.**

A.2.4.2.8. In the event of illness by persons aboard the flight, the PIC shall determine the location where such a person shall be transported for medical care. Due regard shall be given for the types of facilities that are available. If necessary, the local US embassy or consulate shall be consulted for recommendations for appropriate care.

A.3 REQUIREMENTS FOR OPERATION IN MNPS/RVSM/RNP AIRSPACE (North Atlantic/Europe/Pacific)

A.3.1 Requirements shall be kept up to date in accordance with current federal regulations in effect at the time of any planned international flight. Current regulations for civil aircraft operation include:

A.3.2 UNRESTRICTED OPERATION IN THE NORTH ATLANTIC ROUTE SYSTEM

A.3.2.1 Minimum Navigation Performance Standard (MNPS) certification of aircraft and crew for operation between FL285 and FL420 in MNPS airspace:

A.3.2.1.1 Aircraft MNPS certification requires navigation performance to meet RNP-12.6 standard (2-IRSs or 2-GPSs)

A.3.2.1.2 Crew shall receive training in MNPS procedures

A.3.2.1.3 Letter of Authorization (normally combined with RVSM certification letter)

A.3.2.1.4 Notification of MNPS qualification to authorities

A.3.2.2 Reduced Vertical Separation Minimum (RVSM) certification of aircraft and crew for operation between FL290 and FL410.

A.3.2.2.1 Aircraft RVSM certification (RVSM monitoring per *ICAO Doc. 9574*)

A.3.2.2.2 RVSM/MNPS manual approved by FAA for civil aircraft operations

A.3.2.2.3 Crew shall receive training in RVSM procedures

A.3.2.2.4 FAA Letter of Authorization (renewed every two years), if aircraft is operated as a “civil” aircraft. An equivalent NASA letter of authorization for State aircraft operation is recommended.

A.3.2.2.5 Notification of RVSM qualification to authorities for insertion into FAA/ICAO database

A.3.2.3 One HF radio and one VHF radio (two HFs if on random route)

A.3.2.4 Adequate maritime survival equipment per FARs

A.3.2.5 Traffic Collision Avoidance System (TCAS) II with Version 7 equipment required

A.3.2.6 Recommended - Two HF radios with SELCAL

A.3.2.7 Recommended - Upgrades for ETOPS operation (extended range, not required for FAR Part 91 operations)

A.3.3 LIMITED OPERATION IN THE NORTH ATLANTIC AREA

A.3.3.1 MNPS certification if operating between FL285 and FL420. (Can operate below FL285 without MNPS certification on random routes)

A.3.3.2 Notification of MNPS qualification to authorities

A.3.3.3 RVSM certification for operations FL290-FL410

A.3.3.4 Other Considerations

A.3.3.4.1 May utilize random routes well clear of NAT tracks.

A.3.3.4.2 Some routes do not require HF radios if transiting above certain altitudes and in certain areas. (VERY RESTRICTIVE)

A.3.3.4.3 May be restricted below FL350 in Reykjavik FIR.

A.3.3.4.4 Adequate maritime/polar survival equipment per FARs

A.3.4 UNRESTRICTED OPERATION IN EUROPE

A.3.4.1 Shall meet BRNAV (RNP-5) (Normally accomplished with 2 IRSs with Navaid updates, DME/DME,or 2 GPSs) {Effective altitudes vary by country. Consult Eurocontrol for details.}

A.3.4.2 8.33 KHz spacing VHF radios (FM immunity interference shielded with documentation of compliance)

A.3.4.3 Noise Certificate (Stage III or approved waiver for airport used)

A.3.4.4 Airworthiness Certificate

A.3.4.5 Current FAA Registration Certificate

A.3.4.6 RVSM in effect from FL290 to FL410

A.3.4.7 FAA Letter of Authorization (renewed every two years,if using RVSM airspace), if aircraft is operated as a “civil” aircraft An equivalent NASA letter of authorization for State aircraft operation is recommended.

A.3.4.8 Notification of RVSM qualification to authorities (FAA/ICAO)

A.3.4.9. Traffic Collision Avoidance System (TCAS) II with Version 7 equipment required (Also known in Europe as ACAS II)

A.3.5 UNRESTRICTED OPERATION IN THE PACIFIC

A.3.5.1 RNP-10 Navigation performance

A.3.5.2 RVSM certification from FL290-FL410 (FL410 is available to non-RVSM)

A.3.5.3 HF radio

A.3.5.4 Adequate maritime survival equipment per FARs

A.3.5.5 FAA Letter of Authorization (if in RVSM airspace), if aircraft is operated as a “civil” aircraft

A.3.5.6 Notification of RVSM qualification to authorities (FAA/ICAO)

A.3.5.7 Recommended - Two HF radios with SELCAL

A.3.5.8 Recommended - ER upgrades for extended ETOPS range (Not required for FAR Part 91 Operations)

A.3.6 UNRESTRICTED OPERATION IN THE WESTERN ATLANTIC TRACK ROUTE SYSTEM (WATRS) AND DOMESTIC AIRSPACE (DRVSM):

A.3.6.1 FAA Letter of Authorization (if in RVSM airspace), if aircraft is operated as a "civil" aircraft. An equivalent NASA letter of authorization for State aircraft operation outside of domestic airspace is recommended.

A.3.6.2 Notification of RVSM qualification to authorities (FAA/ICAO)

A.3.6.3 RVSM in effect for FL290 to FL 410

A.3.6.4 RNP-10 Navigation performance

A.3.6.5 If TCAS is installed, it shall comply with TCAS II, Version 7, when operating in RVSM airspace

A.3.7 RESTRICTED OPERATION IN THE WESTERN ATLANTIC TRACK ROUTE SYSTEM (WATRS) AND UNRESTRICTED OPERATION IN DOMESTIC AIRSPACE (DRVSM):

A.3.7.1 Letter of Authorization for RVSM

A.3.7.2 Notification of RVSM qualification to authorities (FAA/ICAO)

A.3.7.3 RVSM in effect from FL290 to FL 410

A.3.7.4 If TCAS is installed it shall comply with TCAS II, Version 7, when operating in RVSM airspace

A.3.7.5 Prior Coordination – Operation in RVSM/RNP airspace with non-equipped aircraft requires prior ATC coordination and approval

A.3.7.6 RNP-10 Navigation performance or approved deviation/waiver or operation outside of RVSM or RNP tracks

A.4 RECOMMENDED PROCEDURES AND FLIGHT PREPARATION

A.4.1 FAA GUIDANCE - FAA guidance on international and oceanic flight operations is found in AC 91-70A. FAA guidance on the use of RVSM/RNP airspace is found in AC 91-85.

A.4.2 RVSM DISPATCH CHECKLIST

A.4.2.1 Determine flight level (FL) floor, FL ceiling and horizontal boundaries of RVSM airspace.

A.4.2.2 Determine if RVSM approval is specifically required to file for flight into a specified airspace. With limited exceptions, RVSM approval is required to file for flight at FL290-FL410 throughout most of the world.

A.4.2.3 Verify that the airframe is RVSM approved.

A.4.2.4 Determine if any operating restrictions apply to the aircraft for RVSM operations (e.g., speed or altitude limitations).

A.4.2.5 Check the MEL for system requirements related to RVSM.

A.4.2.6 Check block 10 a. & b. of the ICAO flight plan to ensure that it correctly reflects RVSM/Equipment status.

A.4.2.7 Review reported and forecast weather conditions enroute, with specific emphasis on conditions such as turbulence greater than moderate, which may affect aircraft ability to maintain level flight.

A.4.2.8 Determine if TCAS is operational.

A.4.2.9 Review enroute RVSM theater-specific contingency procedures.

A.4.2.10. RVSM operations manual/instructions aboard.

A.4.3 RVSM FLIGHT PLANNING

A.4.3.1 RVSM Airspace - RVSM airspace is defined as any airspace between FL 290-410 where 1,000-foot vertical separation is applied.

A.4.3.2 Minimum Equipment List - When planning and filing into RVSM airspace, aircraft shall meet certain Minimum Equipment Lists (MEL) provisions for RVSM operation.

A.4.3.3 Weather - The PIC shall review reported and forecast weather conditions with specific emphasis on conditions such as greater than moderate turbulence that may affect the aircraft’s capability to maintain level flight.

A.4.3.4 TCAS – For TCAS equipped aircraft , use of TCAS is highly encouraged. TCAS enhances operational safety by enhancing pilot situational awareness and by providing a system for collision avoidance.

> **Note: Aircraft are required to be equipped with TCAS II, V.7, if TCAS-equipped, in order to operate in most RVSM airspace, however, there are provisions for MEL relief. The aircraft shall be dispatched in accordance with MEL provisions for flight into the specific area of operations and prior coordination with ATC.**

A.4.3.5 Maintenance Flights - ATC providers have established policy to enable aircraft that are temporarily non-RVSM compliant to fly in RVSM airspace for the purpose of re-positioning the aircraft to a maintenance facility. This policy requires prior coordination with appropriate ATC centers so that 2000-foot separation can be applied between the non-compliant aircraft and other aircraft. Compliance requirements and policy for such operations are published in NOTAMS, Aeronautical Information Publications (AIP), and other appropriate documents.

A.4.3.6 Delivery and Humanitarian Flights - Provision for limited flights by aircraft not approved for RVSM for delivery and humanitarian flights is available. Compliance requirements and policy for such operations are published in NOTAMS, AIPs, and other appropriate documents.

A.4.4 OCEANIC ENROUTE CONTINGENCIES

A.4.4.1 Prior to entry into RVSM Airspace - The following equipment is required to be operational at entry into RVSM airspace:

A.4.4.1.1 Two independent primary altimetry systems

A.4.4.1.2 One automatic altitude control system

A.4.4.1.3 One altitude alerting device

A.4.4.2 If any required equipment fails prior to entering RVSM airspace, the PIC shall notify ATC and obtain a new oceanic clearance above or below the RVSM stratum.

A.4.4.3 The PIC shall evaluate the new clearance with due consideration for the effect on fuel consumption, time enroute, any MEL/CDL issues or any other operational factors. The PIC shall evaluate the ability to continue to destination, or whether to proceed to an intermediate airport, or to return to the departure airport. The pilot shall then either confirm the new clearance with ATC or request a new clearance to another airport. The final decision rests with the PIC.

A.4.4.4 After Entry into RVSM Airspace – AC 91-85 provides guidance for pilot and controller actions if RVSM required aircraft equipment fails after entry into RVSM airspace or the aircraft encounters turbulence that affects the aircraft's ability to maintain level. If any required RVSM equipment fails or turbulence greater than moderate is encountered, the PIC is expected to notify ATC of the intended course of action. The PIC has the following options:

A.4.4.4.1 Continue with original ATC clearance if ATC can apply an alternate form of separation (i.e., lateral, longitudinal or 2,000 ft vertical separation).

A.4.4.4.2 Request ATC clearance to climb above or descend below RVSM airspace if ATC cannot provide adequate separation from other aircraft.

A.4.4.4.3 Execute ICAO contingency procedures to offset from track and FL, if ATC cannot provide adequate separation from other aircraft. The PIC shall maintain the offsets until a revised ATC clearance can be obtained.

A.4.4.4.4 These contingency procedures are subject to change by the FIR/UIR controlling agency. Current procedures shall be obtained and thoroughly understood by the aircrew prior to entry into a particular RVSM/RNP region.

A.4.5 NON-RVSM COMPLIANT AIRCRAFT

A.4.5.1 The PIC shall comply with ATC requirements for flight of non-RVSM compliant aircraft for research, maintenance, aircraft delivery or humanitarian flights.

A.4.5.2 Flight in certain portions of the WATRS region can be approved for non-RNP aircraft. Operators of Non-RNP10 aircraft shall annotate ICAO flight plan Item 18 as follows:

A.4.5.2.1 "STS/NONRNP10" (no space between letters and numbers).

A.5 CUSTOMS AND BORDER PROTECTION (CBP) REQUIREMENTS

A.5.0 Due to changing requirements refer to the latest CBP guidance for proper compliance with CBP rules and implementation.

A.5.I eAPIS MANIFEST REQUIREMENTS

A.5.1.1 NASA aircraft are considered "private aircraft" for the purposes of customs, immigration, and agriculture. Pilots of all private aircraft arriving in the U.S. from a foreign port or place, or departing the U.S. for a foreign port or place, are required to submit manifest information electronically to CBP for each individual traveling onboard the aircraft. APIS manifest submissions can be transmitted through the CBP Electronic Advance Passenger Information System (eAPIS) web portal or another CBP-approved electronic data interchange system. eAPIS has a web portal (https://eapis.cbp.dhs.gov)

that enables users to create, manage, and submit APIS manifests. A notice of arrival or notice of departure is required in the same transmission as the corresponding arrival or departure traveler manifest information. This complete transmission will hereafter be referred to as an "APIS manifest."

> **NOTE:**
> **Notices of arrival or departure submitted outside the eAPIS web portal or other CBP approved electronic data interchange system do not satisfy electronic manifest submission requirements. Telephone calls, ADCUS messages, faxes, e-mails, etc., do not meet electronic manifest submission (APIS) requirements (unless expressly authorized by CBP in a particular case). However, these types of informational communication are always encouraged and may be required by the CBP port of entry *in addition* to the electronic APIS manifest requirements discussed in this document.**

A.5.1.2 APIS regulations do not apply to flights between the United States and the U.S. Virgin Islands, Puerto Rico, Guam, or the Commonwealth of the Northern Mariana Islands, as these locations are considered part of the United States for APIS purposes. **However, notice of arrival requirements for flights from the U.S. Virgin Islands still apply**. Additionally, private aircraft APIS regulations do not apply to overflights of foreign airspace, provided the private aircraft departs and arrives in the U.S. and does not land at a foreign port (or overflights of U.S. airspace that do not include a U.S. arrival or departure). The private aircraft pilot is responsible for ensuring that the APIS manifest is transmitted to CBP. Crews are advised to consult the www.cbp.gov web site for complete information.

A.5.1.3 Airports of Entry - Pilots may arrive only at approved CBP airports of entry (from the table provided in eAPIS) unless permission has been otherwise granted by CBP to arrive at another port or place (Fixed Base Operator (FBO), landing strip, etc.). CBP, based on security or other risk assessments, may limit the locations where aircraft entering the United States from a foreign port or place may land. Pilots seeking to arrive at an unlisted location shall contact the CBP port of entry closest to the proposed landing site. If an arrival has been approved at an unlisted location: Normally aircraft shall land and clear customs at the first customs airport in U.S. territory along their route of flight when arriving from Mexico, Central or South America, or the Caribbean. Overflight to other locations requires a formal request procedure with written approval from CBP prior to flight.

A.5.1.4 Agricultural Inspection – Crews shall ensure that prior coordination has been made for required agricultural inspections, including trash/garbage handling, at the port of entry. Substantial fines can be assessed if garbage is improperly disposed of. Additionally, disinsectation procedures are required at many locations, requiring proof of insecticide application.

A.5.2 FOREIGN DEPARTURE

A.5.2.1 Departures from a foreign port or place can originate from almost anywhere. However, eAPIS reports shall be initiated electronically unless CBP grants a waiver. Internet service is required to initiate the eAPIS report. **Telephone calls to CBP do not alleviate the eAPIS requirement.**

A.5.3 CHANGES TO MANIFESTS

A.5.3.1 The private aircraft pilot is obligated to make necessary changes to the APIS manifest after it has been transmitted to CBP. If changes to an already submitted manifest are necessary, an updated and amended manifest shall be resubmitted to CBP. If additional travelers are added to an already-submitted manifest, an updated manifest submission with the new traveler information is required. When a traveler on an already submitted manifest does not travel on the flight, current CBP policy does not require submission of an updated manifest. Certain changes to an already-submitted manifest do not require electronic resubmission. Flight cancellations, changes in expected time of arrival (ETA)/departure (ETD), or changes in arrival/departure location may be submitted telephonically, by radio, or through existing processes and procedures. On a limited case-by-case basis, CBP may permit a pilot to submit or update notice of arrival or departure and arrival/departure manifest information telephonically when unforeseen circumstances preclude submission of the information via eAPIS. Under such circumstances, CBP will manually process the notice of arrival/departure and traveler manifest information provided by the pilot; the pilot is required to wait for CBP screening and approval to depart. In these cases, the pilot shall contact the CBP airport of arrival/departure for assistance.

Changes in ETA and arrival location shall be coordinated with the CBP arrival location to ensure that resources are available to inspect the arriving aircraft. If an updated manifest is submitted, any approval to depart previously granted by CBP is invalid. *The private aircraft pilot is required to receive approval from CBP for the amended manifest before the aircraft may depart.*

A.5.3.2 Failure to follow DHS instructions:
Prior to departure to or from the United States, the pilot of a private aircraft shall receive a message from DHS approving departure and follow any instructions contained therein prior to departure. The pilot is ultimately responsible for the validity, accuracy, completeness, and timeliness of the APIS manifest even if submitted through a third party. In the event of an APIS deficiency, CBP will consider the circumstances surrounding the alleged infraction before any APIS penalty case initiation occurs. Pilots are encouraged to describe any and all mitigating factors when APIS deficiencies are identified. As explained in the comments section of the "*Advance Information on Private Aircraft Arriving and Departing the United States*" final rule, APIS penalty cases are assessed against the aircraft pilot in the amount of $5,000 for the first violation and $10,000 for each subsequent violation.

For additional information regarding the assessment and mitigation of these penalties, please refer to *"Customs Administrative Enforcement Process: Fines, Penalties, Forfeitures and Liquidated Damages"* available at www.cbp.gov.

A.6 Search and Rescue

A.6.1 Search and rescue (SAR) operations in domestic airspace are coordinated with the Coast Guard with notification normally provided by the FAA in the case of lost or missing aircraft. In international airspace, SAR is coordinated in accordance with the International Maritime Organization (IMO) and other United Nations (UN) mandates and treaties. The governing guidance for SAR responsibilities internationally can be found in IMO document, SAR.8/Circ.1 and ICAO Annex 12.

APPENDIX B: ORM DECISION MAKING

B.1 Operational Risk Management.

B1.1 The operational risk management process is a simple five-step process. The concept of applying a standard, systematic approach to minimizing risk was originally developed to improve safety in the development of weapons, aircraft, space vehicles and nuclear power. It has been embraced by many civilian corporations and the Army, and is now being implemented in the Navy, Air Force and Coast Guard. Although a risk management process like this has been part of the NAVOSH program for years, it has traditionally been applied primarily to workplace hazards. However, this process is also effective when applied to planning, operations, training and procedures.

B.1.1 The five steps of ORM are:

B.1.1.1 Identify potential causes of injury, damage, or mission degradation.

B.1.1.2 For each hazard identified, determine the associated risk in terms of severity and probability.

B.1.1.3 Develop risk control options, then decide if benefit outweighs risk. Seek further controls or guidance from CoC, if necessary.

B.1.1.4 Once risk decision is made, implement selected controls.

B.1.1.5 Followup to ensure controls are working and watch for changes.

B.2 Decision Making (DM)

B.2.1 What is Decision Making?
Effective decision making refers to the ability to use logical and sound judgment to make decisions based on available information.

B.2.2 This includes:

a. Assessing the problem.

b. Verifying information.

c. Identifying solutions.

d. Anticipating consequences of decisions.

e. Informing others of decision and rationale.

f. Evaluating decisions.

B.2.3 Factors That Promote Good Decision Making:

a. Teamwork.

b. Extra time to make a decision.

c. Alert crew members.

d. Decision strategies and experience.

B.2.4 A Decision Making Strategy for Troubleshooting:

a. Identify all the symptoms.

b. Make a hypothesis as to the possible cause.

c. Test your hypothesis.

d. Apply appropriate remedies.

B.2.5 Barriers to Good Decision Making:

Barrier	**How to Overcome**
Time	Use SOPs and select the best decision using available information.
Inaccurate or ambiguous information	Cross-check information.
Pressure to perform	Evaluate the rationale for making a decision.
Rank Difference	Use assertive behaviors.

B.3 Decision Strategy for Risk Assessment:

B.3.1 AESOP Model:
Once a hazard has been detected, evaluate it to determine its potential effect on the planned flight by considering its impact on the:

a. Aircraft

b. Environment

c. Situation

d. Operations

e. People

B.3.2 The analysis shall consider the crew's relative ability to cope with changes in each of the five basic elements listed in the AESOP model.

Remember:
Good decisions optimize risk management and minimize errors, while poor decisions can increase them. Poor judgment or decision making is a leading cause of failure to complete missions and of mishaps. Each decision affects your future options.

APPENDIX C: ACRONYMS

ACAS	Airborne Collision Avoidance System
ACCM	Aircraft Configuration Control/Management
AD	Airworthiness Directive
AE	Airworthiness Engineer
AFM	Aircraft Flight Manual
AMA	Academy of Model Aeronautics
AMO	Aircraft Management Office
AO	Area of Operations
AOA	Annual Operating Agreement
APIS	Advance Passenger Information System
ASO	Aviation Safety Officer
ASRB	Airworthiness & Safety Review Board
ASRS	Aviation Safety Reporting System
ASWG	Aviation Safety Working Group
ATC	Air Traffic Control
BA	Boarding Authorization
BRNAV	Basic Area Navigation
CA	Check Airman
CBP	Customs and Border Protection
CDL	Considered Discrepancy List
CRFO	Chief of Research Flight Operations
CFR	Code of Federal Regulations
COA	Certificate of Authorization
CoC	Chain of Command
DA	Decision Altitude
DH	Decision Height
DHS	Department of Health and Human Services
DOD	Department of Defense
DOT	Department of Transportation
DRVSM	Domestic Reduced Vertical Separation Minimum
eAPIS	Electronic Advance Passenger Information System
ER	Extended Range
ESC	Executive Safety Council
ESWR	Experimental Systems Work Request
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCF	Functional Check Flight
FCG	USAF Foreign Clearance Guide
FL	Flight Level
FLIP	Flight Information Publication
FOSC	Flight Operations Support Center
FRR	Flight Readiness Review

FSDO	Flight Standards District Office
FSIB	Flight Systems Integration Branch
FSR	Flight Safety Release
FTOSR	Flight Test Operations and Safety Report
GCS	Ground Control Station
GPS	Global Positioning Satellite
GSO	Ground Safety Officer
HM	Hazardous Materials
HN	Host Nation
IAOP	Inter-center Aviation Operations Panel
ICAO	International Civil Aviation Organization
ICAP	Interagency Committee for Aviation Policy
ICF	Instrument Check Flight
IFIM	International Flight Information Manual
IMC	Instrument Meteorological Conditions
IMO	International Maritime Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IP	Instructor Pilot
IRIS	Incident Reporting Information System
IS-BAO	International Standard for Business Aircraft Operations
LAFB	Langley Air Force Base
LAPD	Langley Research Center Policy Document
LPR	Langley Research Center Procedures and Requirements
LaRC	Langley Research Center
LMS	Langley Management System
MDA	Minimum Decision Altitude
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
MNPS	Minimum Navigation Performance Standard
NAMIS	NASA Aircraft Management Information System
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NAVOSH	Navy Occupational Safety and Health
NEMS	NASA Equipment Management System
NOTAM	Notices to Airmen
OEB	Operations and Engineering Branch
ORM	Operational Risk Management
OUM	Organizational Unit Manager
PCS	Portable Control Station
PIC	Pilot-in-Command
POH	Pilot’s Operating Handbook
PL	Public Law
QA	Quality Assurance
QAO	Quality Assurance Office/Officer
RFA	Radio Frequency Authorization

RNAV	Area Navigation
RNP	Required Navigational Performance
RSD	Research Services Directorate
RSIB	Research Systems Integration Branch
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
RVWO	Research Vehicle Work Order
SAR	Search and Rescue
SDAB	Simulator Development and Analysis Branch
SED	Systems Engineering Directorate
SIC	Second-in-Command
SMAO	Safety and Mission Assurance Office
SMS	Safety Management System
SOP	Standard Operating Procedure
sUAS	Small Unmanned Aircraft Systems
UAS	Unmanned Aircraft Systems
UAV	Unmanned Aerial Vehicle
UN	United Nations
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions