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Langley Research Center

Aviation Operations & Safety Manual

National Aeronautics & Space Administration

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PREFACE

P.1 PURPOSE

a. This document sets forth general guidelines and instructions 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 requirements established by NPR 7900.3A, *Aircraft Operations Management,* which prescribes guidelines for the operation of all NASA aircraft, and NPD 7900.4, *NASA Aircraft Operations Management*, which establishes policy for the use of all non-NASA aircraft.

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), Public Law 105-137 and the rules set forth in this manual. The guidelines and procedures in this manual are not intended to conflict with any airplane/helicopter Flight Manual (AFM). This document contains the elements of the Interagency Committee for Aviation Policy (ICAP) Safety Standards Guidelines for Federal Flight Programs that must be addressed in accordance with the interagency Memorandum of Understanding.

P.2 APPLICABILITY

a. This document is applicable to Langley Research Center employees and contract personnel. It is the responsibility of all personnel to comply with applicable Federal Aviation Regulations, this operations manual, and all Agency regulations that apply. In the event of conflict between the above regulations, the more restrictive regulation should apply. This manual establishes the general policies and procedures for the operation, use, and scheduling of NASA aircraft. It is not intended to replace Federal Aviation Regulations or any Aircraft Flight Manual; rather it is intended to offer additional guidelines and policies to be followed by NASA Langley Research aviation personnel and as a means to communicate these to management. Applicable Federal Aviation Regulations and Pub. L. 105-137 are the final authority as to Agency aircraft operations.

P.3 AUTHORITY

a. ICAP Safety Standards Guidelines for Federal Flight Programs.

P.4 APPLICABLE DOCUMENTS

a. NPD 4200.1, “Equipment Management”

b. NPD 4300.1, “NASA Personal Property Disposal Policy”

c. NPD 7120.4, “Program/Project Management”

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d. NPD 7900.4, “NASA Aircraft Operations Management”

e. NPD 8710.1, “Emergency Preparedness Program”

f. NPR 1620.3, “Physical Security Requirements for NASA Facilities and Property”

g. NPR 4200.1, “NASA Equipment Management Manual”

h. NPR 7120.5, “Program and Project Management Processes and Requirements”

i. NPR 7900.3, “Aircraft Operations Management”

j. NPR 8000.4, “Agency Risk Management Procedural Requirements”

k. NPR 8621.1, “NASA Procedures and Guidelines for Mishap Reporting, Investigating and Record keeping”

l. NPR 8715.3, “NASA Safety Manual”

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

n. LAPD 1700.1, “Safety Program”

o. LAPD 1700.2, “Safety Assignments”

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

q. LAPD 1710.1, “LaRC Aviation Safety Policy”

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

s. LPR 1040.2, “NASA Langley Duty Officer’s Handbook”

t. LPR 1046.1, “NASA LaRC Emergency Plan”

u. LPR 1150.2, “Councils, Boards,

v. LPR 1710.4, “Personal Protection – Clothing and Equipment”

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

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

y. LAFB 11-251, “Quiet Hours”

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

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

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

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

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

ee. LMS-CP-0960, “Conducting Simulation and Aircraft Services Activity Experiments”

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

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

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

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

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

kk. Langley Form (LF) 238, “Software Delivery”

ll. LF 273, “Flight Research Hazard Analysis”

mm. LF 432, “Aircraft Work Order Request and Approval Form”

nn. LF 434, “Aircraft Flight Research Project Initiation Request”

oo. LF 444, “Simulation and Aircraft Service Activity (SASA) Work Request”

pp. ICAP Flight Ops Manual Operation Guide

qq. 14 CFR Part 91, “Federal Aviation Regulations”

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 7900.3, and NPR 7900.4.

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P.6 CANCELLATION

The issuance of this manual supersedes LPR 1710.16, *Aircraft Operations and Safety Manual*, dated August 17, 2004.

Original signed on file, 11/30/2009

Lesa Roe
Director

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

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1.0 RESPONSIBILITIES

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 Operations, the Chief Pilot, and the Aviation Safety Officer 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 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. RSD Director responsibilities include, but are not limited to:

a. Holds overall responsibility for LaRC aviation operations and their safe conduct.
b. Ensures compliance with the LaRC Safety Program.
c. Ensures that appropriate research systems development processes exist and are being used by employees.
d. Ensures the establishment of operations and safety guidelines and procedures.
e. Provides resources and capabilities for implementation of research flight activities.
f. Prepares and implements aviation budget.
g. Develops and advocates staff hiring and training/certification strategies for RSD to implement LaRC research flight activities.
h. Reviews and signs Flight Test Operations & Safety Reports (FTOSR) presented to the Airworthiness & Safety Review Board (ASRB), as well as Simulator and Aircraft Service Activity (SASA) Work Request initiations and change requests.
i. Supervises all contract vendors, accounts and services to assure compliance with Federal purchasing and accounting procedures, as well as timely, uninterrupted service.
j. Ensures compliance with Federal property acquisition and disposition regulations.
k. Establishes and maintains communications and an effective relationship with NASA HQ personnel responsible for controlling aircraft operations.

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1.2 CHIEF OF RESEARCH OPERATIONS (CRO)

1.2.1 As set force by Interagency Committee for Aviation Policy (ICAP) guidelines, the CRO will be knowledgeable concerning the contents of this manual and the provisions of applicable regulations necessary for the proper performance of the person's duties and responsibilities. This person will have the responsibility for ensuring the missions are conducted safely and in compliance with this manual, Agency regulations, and applicable Federal Aviation Regulations. The CRO will also:

a. Hold or have held a commercial 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 CRO or equivalent in government, military, or with a civil certificate holder operating under 14 CFR parts 121, 125, or 135.

1.2.2 The CRO is equivalent to the "Chief of Aircraft Operations" as defined in NPR 7900.3B, *Aircraft Operations Management.* As such the CRO is "the senior line person assigned aircraft operations responsibilities." CROs' responsibilities, therefore, include, but are not limited to:

a. Holds 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 management.
b. Maintain effective communications.
c. Defines/proposes and implements 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. Develop and implement 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. Develop and implement 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. Defines and implements an Aviation Safety and Mishap Prevention Program that meets Agency requirements and any additional Center guidelines, assisted by the Aviation Safety Officer and the Functional Area managers.
g. Responsible for investigation of all incidents and accidents involving LaRC aviation personnel and/or aircraft, with appropriate conclusions and recommendations for preventive action and/or disciplinary measures.

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NOTE: (Investigations may be conducted by the National Transportation Safety Board (NTSB) in which case a request will 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. Reviews and concurs with the Flight Test Operations & Safety Reports.
i. Establishes and maintains effective relationships with the local Flight Standards District Office (FSDO) of the Federal Aviation Administration (FAA).
j. Approves waivers to provisions of this document that are under his/her area of responsibility (as defined in this section) and notifies the RSD Director when this occurs.
k. Provides management approval of Flight Requests to ensure that flights conducted in LaRC aircraft are in accordance with SASA Work Requests or other management-approved activities.
l. Approves Boarding Authorizations for all personnel on LaRC aircraft.
m. Serves as the Center interface to the Inter-center Aircraft Operations Panel (IAOP).
n. Generates flight operations guidelines, directives, and procedures associated with the operation of LaRC aircraft.
o. Establishes, monitors, and enforces safe operating practices, currency standards, and aircraft checkout policies.
p. Ensures that monthly and annual aviation activity reports, and other required reports, are prepared properly and in a timely manner.
q. Assists with budget preparation.
r. Prepares performance evaluations of first-line supervisors assigned to the aviation activity.
s. Other duties as assigned.

1.3 FLIGHT SYSTEMS SAFETY

1.3.1 Flight Systems Safety is responsible for engineering and safety oversight of the LaRC aviation Operation. Flight Systems Safety contains two main components:

a. The Aviation Safety Officer (ASO)
b. Airworthiness and Configuration Management (ACM)

1.3.2 Aviation Safety Officer (ASO). The Aviation Safety Officer is the focal point for aviation safety matters for the Center Director, RSD Director, and the Chief of Research Operations. The ASO will be thoroughly familiar with the contents of this document, the provisions of applicable regulations necessary for the proper performance of assigned duties and responsibilities and has at least 3 years of experience as a safety professional, or has completed a NASA-approved aviation safety training program. This normally shall consist of a minimum of a two-week course in a recognized safety curriculum.

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1.3.3 The Aviation Safety Officer shall be an active NASA pilot. The ASO reports to the Center Director on all aviation safety matters. The ASO is recommended by the Chief of Research Operations, approved by the RSD Director, appointed by the Chairperson of the Executive Safety Council, and acts on behalf of the Chairperson and the Center Director when discharging his/her responsibilities (LAPD 1700.2, *Safety Assignments and Responsibilities*). ASO responsibilities include, but are not limited to:

a. Defines and implements the Center Aviation Safety Program in conjunction with the Ground Safety Officer and Chief of Research Operations to address all areas of flight and ground operations safety.
b. Provides technical guidance on safety aspects of flight programs and operations.
c. Fosters aviation safety measures, promotes mishap prevention, and develops and updates an aviation accident reporting and investigation plan.
d. Maintains conformance with prescribing directives, standards, and procedures. Identifies or recommends corrective action, when required.
e. Serves as a permanent member of the Airworthiness & Safety Review Board.
f. Facilitate the establishment and operation of the Aviation Safety Working Group.
g. Reviews and signs Flight Test Operations & Safety Reports and hazard analyses/risk assessments presented to the Airworthiness & Safety Review Board.
h. Reviews program initiations and change requests.
i. Works with the LaRC Safety Manager to identify and communicate aviation-related issues needing attention from other LaRC safety groups or committees.
j. Leads initial aircraft mishap investigations.
k. Maintains a safety library to include all appropriate safety-related publications.
l. Maintains a safety bulletin board and area map to ensure timely crew awareness of safety issues.
m. Holds quarterly safety meetings, or more frequently as necessary, with regard to accident prevention measures, observed or reported hazards, and other safety-related issues.
n. Ensures timely access to the Chief of Research Operations for review of safety preventive measures, safety related problems, and recommendations for enhanced safety procedures.
o. Attends required Safety Officer, Executive Safety Council, FAA-sponsored, and other safety meetings/seminars, as may be deemed by policy, or by the Chief of Research Operations, to enhance aviation safety, and disseminates information of value to flight crews and supporting personnel.
p. Monitors aviation operations and facilities to ensure timely detection and awareness of potential safety hazards, and to ensure prompt preventive measures, where appropriate.
q. Reports directly to the Chief of Research Operations to ensure his/her timely awareness of all issues that may affect aviation safety.

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

1.3.4 The ASO will provide independent reports on aviation safety to the RSD Director, Executive Safety Council Chairperson, and/or the Head of LaRC Safety and Mission Assurance, 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.

1.3.5 Airworthiness & Configuration Management. Airworthiness and Configuration Management is provided by RSD Airworthiness Engineers and is the focal point for aircraft and research systems modification and operational airworthiness assurance. Airworthiness responsibilities include, but are not limited to:

a. Reviews engineering designs, aircraft modifications, and equipment installations.
   (1) Maintains configuration management of baseline LaRC aircraft and research system integrations.
   (2) Reviews and signs program initiations and change requests, work orders and hazard analyses.

1.4 GROUND SAFETY OFFICER

1.4.1 The Research Systems Integration Branch shall provide a Ground Safety Officer (GSO), an appointed position that functions as a safety advocate and consultant to the Chief of Research Operations 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 Chief of Research Operations and the Aviation Safety Officer. The GSO conducts safety meetings and provides other safety-related activities throughout the year.

1.5 CHIEF PILOT

1.5.1 The Chief Pilot shall be an experienced pilot whose training and expertise provides the leadership and technical competence necessary to support the aeronautical research mission of the Center. The Chief pilot will also:

a. Hold a current 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 part 121, 125, 135, military, or civil government experience. Be a current NASA research pilot with designation as an Aerospace Technologist. Oversee the activities of the LaRC pilot staff to support flight experiments and piloted simulation requirements of the Center.

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1.5.2 In functioning as technical and operational advisor to the CRO, the Chief Pilot's responsibilities include, but are not limited to function as a technical and operational advisor to the CRO and his/her responsibilities include, but are not limited to:

a. Supervises the Operations and Engineering Branch, consisting of pilots and operations/instrumentation engineers.
b. Oversees of flight operations activities, including processes and systems for planning, dispatch, and monitoring of flights in progress.
c. Will 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 level 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. Oversees 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. Responsible for the standardization of flight crews and aircraft operations.
k. Assist the Chief of Research Operations with the preparation of the budget, administrative and pilot duties.
l. Recommend designation of qualified pilots/crewmembers as Training Officers/Instructor Pilots.
m. Assign training duties to ensure the Training Program is administered as outlined in this manual. This may include delegation of Chief Pilot duties (i.e., check rides, record keeping, etc.) as required, to training officers and/or instructor pilots.
n. Establish and maintain a status board (Pilot Information File {PIF}) for the dissemination of new policy and information.
o. Investigate deviations from regulations/policies and report findings to the Chief of Research Operations.

1.6 PILOT-IN-COMMAND (PIC)

1.6.1 The PIC is the ultimate individual authority responsible for the safe operation of an aircraft during the course of a specific flight and the resultant safety of passengers, crew and payload. PIC responsibilities include, but are not limited to:

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a. Maintain current awareness of all pertinent Agency requirements, FAA regulations and other regulatory data bearing on the performance of their duties.
b. Exercise responsibility for the safe conduct of all aircraft, personnel and equipment during flight operations, including but not limited to the following:

(1) Maintain a current Class II (minimum) FAA Medical Certificate.
(2) Maintain a current FAA Airline Transport Pilot Certificate with appropriate ratings if required for the aircraft, or equivalent military rating.
(3) Have the appropriate FAA certification or equivalent military rating for the aircraft.
(4) Ensure the airworthiness of the aircraft prior to flight.
(5) Ensure that all appropriate safety policies and procedures are carried out during the flight
(6) Accomplish flight planning and preparation, including preflight inspections of aircraft and equipment.
(7) Obtain an appropriate weather briefing.
(8) Conduct flight operations, including course, airspeed, altitude and duration.
(9) Ensure Reduced Vertical Separation Minimum/Required Navigational Performance (RVSM/RNP) compliance, as required.
(10) Ensure safe landing zone selection.
(11) Make go/no-go and landing judgments with regard to weather minimums or other criteria.
(12) Ensure all VHF air-to-air, air-to-ground and Air Traffic Control (ATC) communications are completed.
(13) Ensure timely reporting of new or previously unknown hazards to safe flight encountered.
(14) Conduct post flight inspection.
(15) Make appropriate entries in aircraft logbooks, noting discrepancies.
(16) Complete biennial flight review.
(17) Perform additional duties as assigned.

c. Provides pilot final release of the flight when appropriately scheduled and approved by management.
d. Exercises final authority to delay or divert flights for reasons of weather, aircraft status, or other safety-related considerations.
e. Ensures that passengers and crew are briefed on operational requirements, egress procedures, and safety and emergency procedures, as well as any other pertinent information.
f. 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.

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1.7 RESEARCH SYSTEMS INTEGRATION BRANCH (RSIB), RSD

1.7.1 The Research Systems Integration Branch 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.

1.7.2 The Branch Head will 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 a FAA certificated or military mechanic on aircraft, 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.

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

1.7.4 The Branch Head, as Director of Maintenance, will ensure that all maintenance performed on aircraft is in accordance with applicable military programs, manufacturer's programs, Agency prescribed programs, or civil aircraft maintenance and inspection programs, and 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.
b. Ensure compliance with owning agency 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 flight, duty time, and training.
d. Maintain all aircraft maintenance records, monitoring crew-entered maintenance discrepancies (squawks), tracking required/scheduled maintenance, and ensuring timely performance of aircraft maintenance.
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.
f. Monitor and schedule contract maintenance, where necessary.
g. Determine safety of operation of aircraft with inoperable equipment (Minimum Equipment List).
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 airworthiness of aircraft following performance of maintenance and following any requests by pilots to render judgment with respect to airworthiness issues deemed in question.

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j. Disseminate information to crews with regard to maintenance and servicing of aircraft.
k. Ensure the Chief of Research Operations, Quality Assurance Lead 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. Ensure that all maintenance performed on aircraft is in accordance with all manufacturer, NASA, and FAA regulations governing the safe and legal maintenance of aircraft.
p. Initiate purchase requisitions for aircraft parts, tools, supplies and other equipment required.
q. Supervise personnel assigned.
r. Review all aircraft maintenance performed for the safe and legal airworthiness of aircraft.
s. Maintain a safe, neat and efficient maintenance operation.
t. Perform other duties as designated by the Chief of Research Operations.

1.7.5 The Research Systems Integration Branch performs aviation maintenance and modifications in compliance with appropriate national, state and Agency institutional/occupational health and safety regulations. 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.

1.8 QUALITY ASSURANCE OFFICE (QAO), RSD

1.8.1 The QAO is responsible for verifying, with proper documentation, that each aircraft assigned to or controlled by LaRC has been maintained, inspected, and/or modified according to applicable standards. These standards include 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.

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

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1.8.3 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.

1.8.4 The QA Lead shall either:

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, including 1 year in the capacity of approving aircraft, parts and/or components for return to service.

1.8.5 QAO responsibilities include, but are not limited to:

a. Develop 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.
b. Verify that each aircraft owned, leased, or controlled by LaRC is maintained, inspected, and/or modified according to applicable policies and regulations - including systems, components, and experimental equipment.
c. Ensure 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. Maintain all aircraft maintenance records, monitoring crew-entered maintenance discrepancies (squawks), tracking required/scheduled maintenance, and ensuring timely performance of aircraft maintenance.
e. Develop and implement 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.
f. Monitor contract maintenance, where necessary.
g. Monitor determination of operation of aircraft with inoperable equipment (MELs).
h. Ensure compliance with any applicable special standards.
i. Ensure instrument calibrations are correct, material, parts, and fastener certifications are verified, and maintains aircraft permanent records.
j. Audit aircraft baseline, maintenance, and experimental configurations.
k. Monitor 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.
l. Monitor determination of normal airworthiness of aircraft following performance of maintenance and following any requests by pilots to render judgment with respect to airworthiness issues deemed in question.
m. Provide current information to crews with regard to maintenance and servicing of aircraft.

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n. Ensure the Chief of Research Operations, Research Systems Integration Branch Head, and Chief Pilot are kept informed with regard to maintenance related problems requiring his/her attention, especially those that may negatively affect safety and/or mission performance.

o. Maintain a maintenance library to 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.

o. Monitor aircraft flight time and maintenance requirements, and the scheduling of maintenance so as to maximize aircraft availability for program support.

p. Monitor the timely provision of maintenance-related supplies and equipment.

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

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

s. Review all aircraft maintenance performed for the safe and legal airworthiness of aircraft.

t. Ensure quality control for the purchase and acquisition of replacement parts, and assure that parts purchased or acquired have the necessary documentation to determine airworthiness.

u. Ensure that all inspections of any maintenance performed on NASA aircraft will include, but not be limited to:

(1) Appropriate maintenance and/or repair has been safely and legally 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 and legal return to service of the aircraft in question.
(5) Ensure pilot publications are maintained
(6) Ensure chief pilot is notified of discrepancies

w. Supervise personnel assigned.

x. Perform other duties as designated by the Chief of Research Operations.

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1.9 OPERATIONS AND ENGINEERING BRANCH, RSD

1.9.1 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. Responsibilities include, but are not limited to:

a. Provides research piloting services and corresponding research pilot project assistance.
b. Manages operational and ground logistics coordination for research missions as assigned.
c. Manages operational and logistical planning and coordination for all deployments as assigned.
d. Coordinates with aviation weather, flight planning and dispatch services for LaRC.
e. Coordinates with the LaRC Flight Operations Support Center (FOSC).
f. When required, prepares and/or assures preparation of flight requests, flight manifests, flight cards, and other associated paperwork for research missions.
g. Provides coordination with appropriate air traffic control facilities to ensure efficient flight in the National Airspace System (NAS) for both research and non-research flight activity.
h. Provides Flight Test Director services for research operations.
i. Works with Principal Investigators or lead researchers, and personnel both from Research Systems Integration Branch and Flight Systems Safety to conduct and document hazard analyses and risk assessments and to develop the project safety plan for inclusion in the FTOSR and review by the ASRB.
j. Generates flight cards for research missions that meet research and operational requirements by integrating researchers plan of test with operational constraints.
k. Coordinates required safety training for cabin crew with the ASO.
l. Coordinates and conducts tour and demonstrational activity involving LaRC aircraft as assigned.
m. Assists Principal Investigators or lead researchers in preparation of FTOSRs for ASRB reviews and test plans for program flight missions.
n. Assists in preflight activities including route planning, clearances, egress briefings, ensuring aircraft, crew, and operational plan suitability for flight, and confirming release for flight.

1.10 AIRWORTHINESS & SAFETY REVIEW BOARD (ASRB)

1.10.1 The Airworthiness & Safety Review Board 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 & Safety Review Board is chartered to review all experimental modifications to aircraft and all operational flight and ground scenarios developed to achieve programmatic objectives.

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The ASRB provides the Flight Safety Release (FSR) specifying guidelines for specific flight operations.

1.11 AVIATION SAFETY WORKING GROUP (ASWG)

1.11.1 The Aviation Safety Working Group (ASWG) is chartered by the Executive Safety Council as defined in LAPD 1150.2, *Councils, Boards, Panels, Committees, Teams, and Groups.* 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.

1.12 OTHER SUPPORTING ORGANIZATIONS

1.12.1 All other organizations supporting the maintenance and modification of LaRC aircraft and LaRC aviation operations fall under the purview of the organizations and defined responsibilities above.

1.13 DELEGATION OF AUTHORITY

1.13.1 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-E6.

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2.0 UNILATERAL STOP AUTHORITY

2.0.1 Although attempts should be made to resolve nonemergency issues through responsible management channels, LAPD 1700.2, *Safety Assignments*, vests in each functional and line organizational official the authority to "stop any operation they consider unsafe." This unilateral stop authority is also granted to every civil servant and contractor employee of the Research Services Directorate, without retribution, for all facility, operational and aircraft-related activities. Exercise of the stop authority does not require formal initiation; either verbal or written communication is acceptable. This process is documented and implemented as LMS-CP-0902, *Unilateral Stop Authority for Flight Operations and Related Activities.*

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3.0 THE LaRC AVIATION SAFETY PROGRAM

3.1 PURPOSE

3.1.1 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 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 BACKGROUND

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. Aviation safety at LaRC relies on highly qualified experts rather than on extensive and detailed rules. Appropriate, specific safety procedures are formulated for research programs on an ad-hoc basis. 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.

3.3 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 Intercenter Aircraft Operations Panel (IAOP), with independent oversight by the Headquarters Safety Division. These reviews are based on the extensive checklist maintained by the Headquarters Aircraft Management Office, covering all phases of

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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 must 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 self-assessments. An Annual Operating Agreement (AOA) is developed with Headquarters Safety and Mission Assurance.

3.4 AIRCRAFT MISHAP 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 8621.1B, *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.

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.

a. The themes addressed include

(1) historical data and analysis of LaRC aviation operations and functions,
(2) trends and noteworthy events from the military, industry and other NASA Centers,
(3) specific manufacturers' safety-related information, and
(4) future areas of emphasis of particular importance to LaRC operations.

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

3.4.3 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)

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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.

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.

3.8 MEDICAL CLEARANCE

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

3.8.2 Aviation Medical Program - An aviation medical program exists at LaRC and is administered by the Center's Clinic. A flight surgeon is part of the resident LaRC staff, which gives all flight crewmembers, observers, and passengers 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

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furtherance of NASA Langley Research Center missions and to help ensure the safety and suitability of required crewmembers to perform airborne flight research missions.

3.8.2.1 The Chief of Research Operations will 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.

3.8.3 Required Examinations

3.8.3.1 LaRC pilots must pass an FAA Class I medical examination administered annually by a FAA-Designated Medical Examiner.

a. 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.
b. The LaRC Clinic will administer Class I physicals for pilots at no cost, or pilots may choose another examiner at their own expense. If a non-LaRC examiner administers the physical, the results must be forwarded to the LaRC Clinic for review and retention.
c. An equivalent military flight physical also is acceptable, but only for the operation of "public" aircraft.
d. Civil certificated aircraft require a valid Class I or Class II FAA Medical Certificate.
e. Pilots are responsible for ensuring that a copy of their current medical flight clearance is in their training jacket.
f. 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.

    (1) Any request for such a review must be made through management.
    (2) Certification by the Aerospace Medicine Board may permit a pilot to continue operating NASA "public" aircraft.
    (3) Mission Management and other civil certificated aircraft may not be operated under such medical certification.

3.8.3.2 LaRC designated aircraft crewmembers are required to possess at least an FAA Class III equivalent medical, equivalent military, commercial or NASA flight physical.

a. If a non-LaRC examiner administers the physical, the results must be forwarded to the LaRC Clinic for review and retention. When flying on LaRC aircraft research crewmembers and observers must also meet

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medical certification requirements and must be adequately fit to accomplish potential emergency egress.

b. LaRC designated crewmembers generally are employees in the Research Systems Integration and Operations and Engineering Branches of the RSD.

3.8.3.3 Other personnel are occasionally determined by 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.

a. The list that results from this policy will be forwarded to the Clinic via email or hardcopy annually in January of each year.
b. In the event that a specific mission requirement exists for medical examination, a termination date will be provided after which approval to renew a physical examination will be required again.
c. Such personnel may be from any LaRC organization.
d. The list will include the names of individuals authorized by Langley Research Center/Research Services Directorate to receive FAA medicals, the Class authorized, or flight equivalent examinations (which will be conducted to Class III standards) and a current contact within the Research Services Directorate to resolve individual requirements that arise between list publications.

3.8.3 Tobacco/Smoking

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

3.8.4 Alcohol and Drugs

3.8.4.1 Aviation personnel will not use illegal or nonprescription 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.

3.9 PERSONAL PROTECTIVE EQUIPMENT

3.9.1 Aviation Protective Equipment & Clothing - In accordance with NPR 7900.3B, 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.

a. 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.

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Protective clothing is also defined as an article of clothing furnished to an employee at Government expense,

b. Protective equipment shall be worn 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.

c. Protective clothing for loan may include:

(1) 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.

3.9.1.2 All LaRC flight research personnel shall wear the following:

a. Uniform items and equipment while on research flight duty unless otherwise approved by the CRO:
b. Nomex flight suit (underwear will be cotton, wool, or Nomex only)
c. Jump boots/leather shoes
d. Flight helmet (helicopter) or headset (airplane)
e. Only approved nametags will be worn

3.9.1.3 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.

a. Operational life support equipment will be managed in accordance with NPD 4200.1, *Equipment Management*, and NPR 4200.1, *NASA Equipment Management Manual*. Thus, the issuance of all LaRC equipment must meet the following criteria:

(1) The issuance is not permanent.
(2) It will benefit the Federal Government .
(3) The equipment is not modified .
(4) Appropriate officials review and concur with purchase, inventory and issuance. See NPD 4200.1, *Equipment Management*.

b. The Research Systems Integration Branch oversees the issuance and control of aviation protective equipment and protective clothing in accordance with the above guidelines.

3.9.2 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.

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3.10 CARGO SAFETY

3.10.1 Hazardous/toxic material used on the ground for aviation activities is handled, stored and disposed 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.

a. This material is under inventory control and may be handled only by personnel appropriately trained and certified.
b. Disposal of such material is also documented to complete inventory accountability records.
c. Hazardous/toxic material is seldom carried aboard LaRC aircraft as cargo or research material. In cases where transport of such material is unavoidable; however, the OSHA and EPA regulations, and appropriate Federal Air Regulations, are followed.

3.11 DISSEMINATION OF AVIATION SAFETY MATERIAL

3.11.1 All formal LaRC aviation safety documents (numbered and configuration controlled) are maintained and “published” in the Langley Management System (LMS).

a. 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.
b. 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.

3.12 FACILITIES SAFETY

3.12.1 The physical plants of both LaRC and Langley Air Force Base are integral elements of the Center Aviation Safety Program.

a. 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.
b. 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.
c. 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.

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3.12.2 This document and the Intra-Governmental Support Agreement between Langley Air Force Base and LaRC, the *General Aircraft Maintenance Manual for Research Services Directorate*, LMS-TD-0940, the Facility 1244 Security Plan, and all applicable Center institutional /occupational health and safety policies and regulations.

a. 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.

(1) Included are: routine, preventive services for day-to-day operations and participate with LaRC aviation personnel in training exercises and education programs developed by the Chief of Research Operations, the Aviation Safety Officer, and/or the Research Systems Integration Branch Head.
(2) 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.

3.13 PHYSICAL SECURITY

3.13.1 Aircraft shall be provided physical security at all times.

a. When at NASA facilities the aircraft shall normally be hangared. NASA security personnel will monitor aircraft on a routine basis when the aircraft is not inside a hangar.
b. When away from LaRC, the aircraft pilot-in-command will 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.
c. Additional guidance is available in NPR 1620.3.

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4.0 FLIGHT OPERATIONS

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

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
(6) Miscellaneous flight activities

c. Mission Management operations
d. Emergency and humanitarian operations

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.

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 Chief of Research Operations 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, 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

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systems, or make the aircraft unsafe for general-purpose use including the carriage of personnel. These modifications must be properly documented.

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

4.1.4 Mission Management Aircraft (MMA) - Mission Management Aircraft are aircraft officially designated by NASA Headquarters for transport of passenger personnel. Such aircraft must be maintained and certificated as “civil” aircraft. LaRC does not operate Mission Management Aircraft at the present time.

4.2 GENERAL FLIGHT CLEARANCE AND SCHEDULING

4.2.1 The applicable portions of the general operating and flight rules of Federal Aviation Regulation Part 91 will apply to the operation of LaRC aircraft. Other federal regulations and guidelines concerning the operation of public aircraft will also apply as appropriate. When operating in military airspace or at military installations, applicable military regulations will 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*.

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

a. Prior to implementation, the RSD Director must 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.

4.2.3 Scheduling - The Research Services Directorate will publish projections of flight and simulator schedules. These schedules will be circulated to flight project personnel, line managers, and appropriate research customers/program offices.

4.3 FLIGHT APPROVALS

4.3.1 General - All flights of LaRC aircraft must be approved by the Chief of Research Operations, Chief Pilot, or designee. Flight Requests must have approval of supervisory personnel from the requesting organization and by designated RSD managers per LMS procedures. Additionally, the Office of the Director must approve Mission Management flights.

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4.3.2 Approval Procedures - Flight requests should be initiated by submitting to the Chief of Research Operations, Chief Pilot, (or designee) a properly signed LaRC Flight Operations Request (LaRC Form 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 CRO (or designee). The following approvals are required prior to submission to the CRO'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.

4.3.3 The CRO, Chief Pilot, or designee will 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 Chief of Research Operations (or designee) will 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 approve the flight.

NOTE: The issuance of supervisory-approved, *trip-specific* travel orders covering flight by LaRC civil servants or affiliated contractors aboard LaRC aircraft will 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.

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4.3.3.1 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 the passenger manifest, require submission of a revised 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.

4.3.3.2 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 will be accomplished by radio. If this is not possible, the PIC shall notify the Chief of Research Operations 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).

4.3.4 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 must 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 should be communicated to LaRC operations when possible. While on cross-country, the pilot should report the termination of each day's flights to the Flight Operations Support Center (FOSC) office.

4.3.5 Deployed Flights - Research projects conducting research flights away from LaRC must continue to prepare separate flight requests for each flight. The PIC or a designated RSD management official will 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 will be necessary. If approval authority is delegated, copies of flight requests and flight reports should be sent electronically to LaRC operations each day or whenever flights occur. 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 will be flown only after being released by authorized personnel in maintenance. The PIC accepts responsibility for the aircraft after release by initialing the LF 115, *Aircraft Operational Report*.

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4.4.2 Required Documents - A LF 115 must 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 for the aircraft will be available for pilot review prior to flight. A flight request and manifest for each flight will be posted on the aircraft sign-out board.

4.4.3 Pilot Review - Pilots should review the LF 115, LF 781A, and LF 781K forms. Since LF 781A forms are removed from the 781 binder each week, pilots should also review the Form LF 115 from the last several flights to determine any recent problem areas. When possible, the crew chief or other knowledgeable supervisor should review the forms 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 on the Form LF 115.

4.4.4 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 CLEARANCES

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 IFR Operations - An IFR flight plan will be filed with the FAA either by the pilot or through the Flight Operations Support Center (FOSC) dispatcher. If the pilot files the flight plan, a copy must be made available to the FOSC dispatcher. The dispatcher will file a local anti-hijacking flight plan with Langley Air Force Base (LAFB) Operations. In the event the dispatcher (or suitable substitute) is not available, the PIC must perform these duties. The PIC may follow the same procedures used by the dispatcher or may file in any manner consistent with LAFB 11-250. IFR clearance must be received from Langley Clearance Delivery or Langley Ground Control prior to taxi.

4.5.2.1 VFR Operations - Pilots of LaRC aircraft operating VFR in the local area, including trips to NASA/Wallops, will follow local VFR operations procedures. For flights in the local area within radio coverage flight following will also be provided by the FOSC (or another appropriate radio-equipped office by prior arrangement).

4.5.3 Cross-Country Operations

4.5.3.1 General - Flights more than 50 nm from LFI will be considered cross-country flights. Cross-country flights will be conducted on either IFR or VFR FAA flight plans, except as noted below.

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4.5.3.2 IFR Operations - Cross-country IFR flights will 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 to have the message sent.

4.5.3.3 VFR Operations - Cross-country VFR operations may be conducted in LaRC aircraft if VFR radar flight-following services are available and utilized along the planned route. If a FAA VFR flight plan is filed for a departure from Langley, the flight plan will automatically be opened by LAFB Operations on departure. It is therefore incumbent upon the pilot to close the flight plan upon arrival at destination in order to avoid the automatic institution of search and rescue 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.

4.5.4 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 must notify the appropriate LaRC point of contact. After normal duty hours, a message may be left on the FOSC telephone line. Pilots should 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.

4.5.4.1 LAFB Notifications - LAFB Operations requires notification of all planned aircraft movements as a security measure. This means that local flights must be cleared through base operations before engine start. If the aircraft has not returned within 1/2 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 Flight Operations Support Center if a local flight is going to extend beyond the originally planned flight duration.

4.6 FLIGHT LOCATING ACTIONS/FLIGHT FOLLOWING

4.6.1 Flight Crew Actions - The PIC shall ensure that during local flight operations the Flight Operations Support Center 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 operations 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 will be submitted.

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4.6.2 Operations Action.

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 will 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. Chief of Research Operations
b. Research Systems Integration Branch Head
c. Aviation Safety Officer
d. Air Traffic Centers/Flight Service Stations
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 will institute the appropriate Missing Aircraft actions.

4.7 EMERGENCIES

4.7.1 All flight personnel must be thoroughly familiar with all emergency procedures and their specific duty assignments.

4.7.2 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.

4.7.3 In an emergency involving the safety of persons or property, the PIC may deviate from the published rules to the extent required to meet that emergency.

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

4.7.5 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.

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4.8 IN-FLIGHT EMERGENCY

4.8.1 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.

4.8.2 He/She may deviate from prescribed procedures, methods, weather minimums, and regulations in the interest of safety.

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

4.8.4 After landing, he/she will inform the Chief of Flight Operations/Chief Pilot of the emergency/problem.

4.9 EMERGENCY PROCEDURE COMPLETION

4.9.1 The PIC is the final authority regarding the sequence and manner in which crewmembers will accomplish procedures. Flight crewmembers must accomplish from memory the specific immediate action items specified for their station and should be familiar with other crewmembers assigned duties. Report position and nature of the emergency to Air Traffic Control (ATC). If additional assistance is required, request ATC to relay to an appropriate communications center. The PIC is the final authority in any decisions concerning actions to be taken, however, consideration should be given to recommendations given by ATC and/or other sources. Each crewmember must be prepared to perform their assigned emergency duties including possible evacuation duties.

4.10 WEATHER MINIMUMS

4.10.1 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 unless otherwise approved by the ASRB and documented. Research flights in a local traffic pattern under tower control may be conducted down to basic VFR minimums of 1000 feet and 3 miles.

4.10.2 Program Support and Mission Management Flights – Program support and mission management 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).

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4.10.3 Special Minimums – The Chief Pilot, (or the Chief of Research Operations or the Aviation Safety Officer 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 will be documented on the pilot's checkout form for that aircraft along with conditions for their removal.

4.10.4 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.

4.11 BOARDING AUTHORITY

4.11.1 Boarding authorization is required for every person flying on a LaRC aircraft. In addition, LaRC personnel traveling aboard non-LaRC aircraft must have boarding authorization. This is normally accomplished by approval of travel orders. However, in the absence of travel orders a normal boarding authorization (LF 313) must be accomplished.

a. The Chief of Research Operations (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 Chief of Research Operations (or designee) is responsible for assuring that all medical and training requirements have been met.
c. Operations and Engineering Branch is responsible for ensuring these reviews for research flights.
d. The Chief of Research Operations shall ensure training records are maintained for all crewmembers.

4.12 FLYING AREAS

4.12.1 Research flights will be conducted, to the extent possible, in light traffic areas off of 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 should be utilized. Supersonic flight will be accomplished only in approved restricted airspace, military operating areas, or warning areas.

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4.13 FLIGHT FOLLOWING

4.13.1 LaRC pilots and the Flight Operations Support Center will maintain a listening watch 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. The FOSC will also use flight following methods to monitor LaRC flight operations.

a. When out of radio range of the FOSC, pilots will maintain a listening watch on VHF or UHF guard unless all radios are required for ATC or mission purposes.
b. When flying over water out of gliding distance of land in single engine aircraft, pilots will provide frequent position reports to the Flight Operations Support Center.

4.14 FORMATION FLYING

4.14.1 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 will 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 will be permitted when both pilots agree and coordination of the flight can be accomplished via radio prior to join up. Under no circumstances will 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 must 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, will be determined by the Chief Pilot in conjunction with the Aviation Safety Officer, and documented in the pilot's training folder.

4.15 HIGH ALTITUDE FLYING

4.15.1 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.

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a. Pressure suit use requires satisfactory training by all crewmembers prior to flight requiring such use.
b. Crewmembers and passengers must use oxygen at cabin altitudes above 12,500 feet. In pressurized aircraft, supplemental oxygen use will be in accordance with FAR 91.211.

4.16 AEROBATIC FLYING

4.16.1 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 shall be strictly obeyed.
b. All aerobatic flying shall be accomplished in low-density airspace outside federal airways.
c. Flight visibility must be at least 5 statute miles.
d. Parachutes must 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.

4.17 ROTARY WING OPERATIONS

4.17.1 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 CRO. Pilots desiring touchdown auto-rotation training will be enrolled in an appropriate training course as resources permit.

4.18 OVERWATER OPERATIONS

4.18.1 All occupants of single-engine aircraft or helicopters operating out of gliding distance of land must 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 must be provided for all aircraft occupants.

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4.19 INSTRUMENT OPERATIONS

4.19.1 To the extent permitted by available staff resources, a second aircraft crewmember will be assigned whenever LaRC aircraft are to be operated in instrument conditions at night, in icing conditions, into or out of high-density airports, or in conditions requiring approaches near minimums. This additional crewmember will normally be another pilot or operations engineer.

4.20 RECORDS AND LOGS

4.20.1 At the completion of each flight in a LaRC aircraft, the PIC will log all flight time for each pilot for each duty condition, including numbers and types of landings and approaches. LaRC Form 438, "Mission/Aircrew Flight Data" must be used for this purpose. LF 438 will be completed in accordance with the following procedures:

a. A separate Form 438 will be completed for each day for each aircraft.
b. For flights originating and terminating on different dates, the form will be dated on the date of origination.
c. Name and pilot number will be entered on the form.
d. The sum of all time in each pilot category (PIC, SIC, IP) must equal the total flight time for each leg. (i.e., the sum of all PIC times for all pilots flying on a leg must equal the total flight time for that leg)
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 must be accompanied by the logging of actual or simulated instrument time.
g. Complementary duty conditions must add up to the total flight time for each leg. (i.e., day plus night times must 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 must be reported on a Form 438 in order for any of the time or maneuvers to be credited against currency requirements of this document.
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.

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4.21 INTERNATIONAL OPERATIONS

4.21.1 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 will provide coordination for planning and conduct of all international operations.

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

a. Route planning and flight information documents.
b. Personal documentation and foreign travel briefings.
c. Communications equipment availability for theater of operation.
d. USAF Foreign Clearance Guide compliance.
e. Aircraft documentation.
f. Landing and overflight permits.
g. Aircraft handling agents.
h. Foreign user charges/fees.
i. Fuel and other consumables availability.
j. Payment methods available.

4.21.3 NASA aircraft are operated as state aircraft per NPR 7900.3B 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.

a. Diplomatic clearances shall be obtained prior to operations into foreign-controlled airspace. NASA HQ shall arrange for all diplomatic clearances.
b. Current Reduced Vertical Separation Minimums (RVSM) 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 must be obtained for operation in RVSM airspace with non-compliant equipment before initiating flight into that area.
c. Additional details regarding international flight operations can be found in Appendix A.

4.22 FAA ENFORCEMENT ACTIONS AND REGULATORY VIOLATIONS

4.22.1 Any employee who is informed of a violation, potential violation or investigation being opened on an action in which they have been involved will report the circumstances to the Chief Pilot as soon as possible.

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a. This notification will include a detailed written record of the circumstances.
b. The Chief Pilot and Chief of Research Operations will investigate the violation to determine the facts associated with the event.
c. Legal assistance may be provided to an employee who has acted in good faith and in the best interest of the Agency.

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

4.22.3 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.

4.23 NOISE ABATEMENT POLICY AND PROCEDURES

4.23.1 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.

4.23.2 Noise Abatement Techniques. The policy is to minimize noise disturbance as a result of LaRC flight operations. Noise Abatement Techniques include:

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.

4.23.3 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 Chief of Research Operations.

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5.0. UNMANNED AERIAL SYSTEMS OPERATIONS

5.1 GENERAL

5.1.1 UAS Definition, an Unmanned Aircraft Systems (UAS) is a powered aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, and can fly autonomously or be piloted remotely. There is a growing interest at NASA to operate UASs for a variety of research needs.

a. UASs range from micro vehicles measuring inches in size and ounces in weight to large aircraft weighing more than 30,000 pounds.
b. The Chief of Flight Operations shall determine the appropriate level of oversight of UAS operations dependent on the complexity of the particular system, the size and speed of the UAS aircraft, and planned operations.

5.1.2 UAS Flight Crew Definition and Responsibilities

a. The UAS flight crews consist of UAS pilots, engineers, Principal Investigator(s) and technicians, both civil service and contractor, who are required to operate a UAS and are authorized by position descriptions, letters of appointment, memorandums of understanding (MOU), memorandums of agreement (MOA), or contracts to perform UAS flight by the Center Director.

b. Any UAS operated on behalf of NASA that operates within the National Airspace (NAS) shall be piloted by an individual who is either a designated NASA pilot or holds an FAA Pilot Certificate.

c. Additionally each pilot operating a UAS must be officially designated for piloting of that specific system.

d. The UAS flight crew is responsible for the safe control and operation of the UAS and must be involved in all mission planning, complete pre-launch, mission and recovery checklists, and assist in evaluating and disseminating in-flight data.

5.1.3 Policy

a. All LaRC UAS flights shall be properly approved and documented.

b. The Center Chief of Flight Operations shall ensure that UAS flight crews and operations receive direct oversight by the LaRC Flight Operations Office or through coordination with another NASA Center with a Flight Operations Department to provide the required oversight. Normally this oversight will be provided by the Center's Aviation Safety Officer or the RSD Chief Pilot.

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c. Because UASs are considered to be aircraft subject to FAA or other agency regulations, control and oversight specific to aviation apply to their employment. The most common are air control, airspace control, and air direction, which are exercised by aviation personnel and agencies.

5.1.4 UAS Command and Control Systems

5.1.4.1 UAS flight crews must have the ability to provide command and control, to coordinate, and to manage the operation of the UAS. These command and control systems include air control and airspace control.

a. Air Control.

(1) Air control encompasses the direction of the actual physical maneuvers of a UAS in flight or to direct a UAS to gather data or operate in a specific area.

b. Airspace Control

(1) Airspace control provides for the coordination, integration, and regulation of the use of a defined airspace, and identification of all airspace users.

(2) Any airborne object that may interfere with the flight path or trajectory of any other object within the NAS airspace is of concern and requires airspace coordination and integration.

(3) Airspace control includes directing the maneuvers of a UAS (along with other aircraft and airspace users) for the best use of the airspace.

(4) Airspace control is accomplished through established procedures for coordination of airspace by ATC or range authorities. Principles and procedures of airspace control similar to those used in manned flight operations apply to UAS operations.

(5) UASs capable of long-distance flight are normally routed through existing air control points by airspace control agencies.

(6) Airspace control authority is inherent in the operator whose unit is responsible for particular blocks of airspace.

(7) Positive separation between aircraft and the UAS is required and is the responsibility of the PIC and airspace control agency. This may be accomplished by the following:

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i. Activating temporary airspace coordination areas (ACAs); Class D airspace or restricted operations zones (ROZs) for UAS takeoffs and landings; and mission areas or flight routes. ROZs are also known as restricted operations areas (ROA's).
ii. Routing separation via existing air control points. Specific UAS routes may be created by connecting selected air control points.
iii. Altitude separation, which can be effected by having block altitudes or by deconflicting whatever altitude at which the UAS is flying with other airspace users.
iv. Time separation, which can be effected by having block times for UAS operations.
v. Any combination of the above, as required.

5.2 PLANNING

5.2.1 Initial Planning/Areas of Operation

a. Before any deployment, considerable planning takes place well in advance of UAS operation. Coordination with appropriate agencies or countries should occur as soon as the decision is made to employ a UAS.

5.2.1.1 Certificate of Authorization (COA).

a. The FAA is responsible for airspace management within the United States. If a UAS will be flown outside the boundaries of special use airspace, such as restricted areas or warning areas, a Certificate of Authorization must be obtained from the FAA. This Certificate is also required in all non-military airspace including Class C and D tower-controlled facilities.

b. The regional FAA administrator will draft the COA, which sets forth the requirements for UAS personnel qualifications, communications procedures, mishap reporting procedures, and a definition of the requested airspace.

c. A UAS cannot fly beyond the boundaries of special use airspace without specific authorization of the FAA and the local air traffic control authority.

d. Assistance in obtaining the COA may be requested from the Aviation Safety Officer.

5.2.1.2 Memorandum of Understanding

a. If UAS operations are to be conducted within airspace controlled by a local air traffic control facility, a memorandum of understanding (MOU) with the local air traffic control facility is required to ensure that the facility and the UAS flight crews have a complete understanding and agree to the air

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traffic control procedures that will be used to ensure safe UAS operations in the operating area.

b. Additionally a formal letter of agreement with local support facilities shall be completed to ensure that proper coordination of support requirements is understood and agreed to.

c. Fuel and hazardous material storage, hangar facilities, runway use, mishap contingencies, or any other logistical and support requirements must be agreed to in this document.

5.2.2 Deployment Overseas

a. Foreign governments are sensitive to the types of information that could be collected through the use of UASs, as well as to the inherent risks associated with unmanned flight operations.

(1) UAS planners must ensure UAS operations are coordinated with host nation organizations, as appropriate, during the initial planning of proposed flights within host nation (HN) airspace.
(2) Planners must communicate clearly to the HN organizations how the UAS is to be employed so that any concerns the HN may have are fully satisfied.
(3) The UAS planner shall coordinate with the U.S. Embassy or consulate in the HN of contemplated UAS operations within the HN. Waivers, agreements, and rules by the International Civil Aviation Organization (ICAO), the HN's government and the U.S. Embassy must be thoroughly understood and signed before conducting UAS operations overseas.
(4) It is of critical importance that <u>all</u> HN organizations involved with HN approvals be involved. It is normally critical that the HN's military and air traffic control organizations be thoroughly briefed on potentially sensitive operations.
(5) Additionally, operations over international waters are subject to control and oversight by the applicable FIR/UIR controlling agency. Often these controlling agencies are located in nations other than the nation with the airspace adjacent to the anticipated operational locale.

5.2.3 Flight Authorization

a. A Flight Test, Operations, and Safety Report (FTOSR) shall be submitted for approval and a Flight Safety Release (FSR) must be obtained from the Aviation Safety Review Board (ASRB) prior to any commencement of research flight operations. Issuance of the ASRB FSR implies concurrence with the airworthiness condition of the UAS vehicle.

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5.3 PRE-FLIGHT OPERATIONS

5.3.1 Operations Site

a. Particular consideration must be given to the location of the UAS operations site. Depending on the UAS, an adequate runway may be required for safe UAS operations. At a minimum, a proper landing surface must be available to safely recover the UAS upon completing its mission.

b. Consideration also must be given to the distance from the UAS operations site to the area of operations (AO). Many UASs are not particularly fast and require considerable time to fly to their mission area. The location of an adequate launch and recovery area and its distance to the AO and control station are very important considerations when employing a UAS.

c. Availability of adequate roads or other transportation methods for resupply of fuel and other UAS support requirements are critical to sustained UAS operations. If the UAS is expected to move from one site to another, transportation support becomes increasingly important.

d. Additionally, proximity to inhabited areas and industrial facilities may limit the selection of particular sites and their approval for use.

5.3.2 Weather

a. UAS managers must consider the expected weather conditions in the AO at the time of operations. Many UASs cannot operate in inclement weather (e.g., high winds and precipitation, freezing conditions, or when the cloud layer is below the UASs intended operating altitude). Due consideration must be given to probable weather conditions and potential weather-related mission abort considerations.

5.3.3 Communication

a. A properly designed command and control architecture must be designed for operation of the UAS. Depending on the size, speed, and operating parameters of a particular UAS, systems may require a ground control station (GCS), a tracking and control unit, a portable control station (PCS), remote receiving stations, or manual radio control units.

b. The UAS may be manually controlled by a pilot from a control station or may be programmed to fly independently under the autonomous control of its autopilot. More than one control station may be used to increase the UASs effective range or to control more than one UAS.

c. Specific flight termination system design and operational procedures are required for LaRC UASs. These systems will be reviewed for adequacy by the Chief of Flight Operations and the Aviation Safety Review Board.

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5.3.4 Operational Phase

a. UAS operations are conducted similarly to manned aviation operations. Once the UAS has authority to conduct the mission, program managers, operations engineers, and the UAS flight crew study the assigned mission and plan for its operation.

b. The maintenance crew begins preparation of the UAS and the UAS ground control system, while communications personnel ensure that the proper communication connectivity is provided to fulfill the mission.

c. The designated UAS pilots' qualifications and associated records shall be reviewed by the RSD Chief Pilot and the Center Aviation Safety Officer for both adequacy and accuracy.

d. UAS pilot designated positions assigned by a particular project operation shall include a pilot-in-command, backup safety pilot, and/or a research pilot as appropriate.

e. A project-designated "safety pilot" does not substitute for the direct oversight responsibility of the Center's Aviation Safety Officer.

5.3.5 Route Planning

a. UAS missions will be planned by the UAS planners in close coordination with the Flight Operations Office.

(1) This is done to ensure that there is no conflict with other flight operations and to allow timely inclusion of UAS missions in the Center planning process.
(2) This also allows for proper coordination with FAA or other controlling agencies. Routes shall be established, as necessary, in the event that diversion of a flight to an alternate landing site is required.

5.3.6 In-flight Emergencies

a. During planning, sufficient attention must be given to the possibility that an in-flight emergency may occur. Particular attention should be given to the location of emergency landing sites if the UAS exits controlled flight and impacts the ground. Flight paths, minimum-risk routes, and other air management tools must be included.

b. The Center's Pre-Mishap Plan shall address UAS mishap procedures in general, including notification and crash site safety. Specific project hazard analyses shall address mission-specific mishap issues that are in addition to the generic pre-mishap procedures.

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5.3.6.1 Loss of Link Procedures

a. When a UAS senses a significant delay or loss of the command uplink, the predetermined loss of link procedures will be invoked to place the UAS on a return home profile or flight termination routine, as appropriate.

(1) The UAS return home profile is a preapproved route at a preapproved altitude to its preapproved return home site.

b. During this emergency, the UAS pilot will attempt to reestablish communication with the UAS.

(1) If this does not occur, flight termination contingencies must be employed to alleviate potential for hazards to persons or property.

5.3.6.2 Agency Notification

a. Upon notification of an in-flight emergency, emergency procedures shall be performed by the UAS pilot in accordance with the approved project UAS operations procedures. The Flight Operations Office will then relay and coordinate with the appropriate agencies (e.g., FAA ATC).

b. The Flight Operations Office will ensure that affected air traffic control agencies have been notified of the UAS emergency and its expected course.

c. Controlling agencies will ensure that other air assets are separated from the UAS's expected route of flight and notify the Flight Operations Office of any further actions taken.

d. Any such deviations from intended flight paths shall be reported to proper authorities within NASA, with the FAA, and other agencies, as appropriate.

5.4 UAS FLIGHT OPERATIONS

5.4.1 Flight Brief

a. A flight brief that includes the flight crew, a program representative, and a maintenance representative shall be conducted prior to all flights. Briefs provide specific information in accordance with UAS SOPs.

b. Briefs will include the following:

(1) Weather update.
(2) Program brief.
(3) System update.
(4) Emergency divert airfields, as appropriate
(5) Emergency procedures and terminology, including flight termination

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(6) Mission profile
(7) Pilot assignments for the mission.

5.4.2 Preflight

a. The maintenance crew readies the UAS for launch as the flight crew performs systems checks to ensure all systems perform in accordance with operating procedures.

b. Systems checks shall include an independent means to verify waypoints entered into a navigational system prior to takeoff, if utilized.

5.4.3 Launch

a. An appropriate launch method shall be used, appropriate to the approved operation.

b. Adequate separation of personnel from the launch area must be provided in the event of loss of control during launch.

c. An adequate surface area must be available for a safe emergency landing for the UAS and clearance of nearby personnel.

5.4.4 Preparing for Recovery

a. Recovery procedures are specific to the UAS operation being conducted.

b. Flight and maintenance crews shall be briefed on recovery procedures and site safety during the recovery operation.

c. The appropriate checklists shall be utilized as approved by the Flight Safety Release.

5.5 PILOT REQUIREMENTS

5.5.1 Qualifications

a. UAS flight crew members shall be qualified for UAS operations through completion of a formal syllabus of training tailored to the type of UAS operation.

b. UAS pilots must be designated as a NASA UAS pilot and must conform to the pilot experience, currency, and medical standards stipulated in the COA. For operation in special use airspace where a COA is not required, the Chief of Flight Operations shall verify the medical, currency, and pilot qualification status of all UAS pilots involved in the specific flight operation.

c. The Chief of Flight Operations, with the concurrence of the Center Director, shall designate a UAS pilot for a specific UAS aircraft type. The

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Chief of Flight Operations shall ensure that each UAS flight crew possesses an adequate level of training and experience to perform the duties of the designated positions.

d. Overall qualifications for the designations are made based on flight crew overall flight experience, experience with similar types of UAS aircraft, experience with the actual UAS aircraft type, other training, and demonstrated performance.

e. Designated UAS pilots are those who perform UAS piloting duties as a part of their official position descriptions, to fulfill NASA contract requirements, or in accordance with an interagency agreement.

5.5.2 Training

a. UAS pilots shall receive qualification training under direction of a military, civilian, or NASA UAS instructor pilot.

b. Appropriate training records shall be maintained by the Chief of Flight Operations or his/her designee.

5.5.2.1 Qualification training will vary with the UAS aircraft involved and the complexity of the system to be operated, but will normally include:

a. Ground training (including UAS ground control station checkout), handbook study, attendance at formal UAS aircraft training programs, emergency procedure training, and the performance of a UAS aircraft written examination (open book).

b. Simulator training, if available, including normal and emergency procedure training.

c. UAS aircraft checkout flights, including a prescribed number of UAS flights and landings (if applicable) under the supervision of a UAS instructor pilot.

d. A mission profile flight monitored by a UAS instructor pilot to obtain full UAS mission qualification.

5.5.2.2 An initial UAS checkout training program shall be developed and approved for each specific UAS type. Documentation of the training shall be maintained in the UAS flight crew flight record file. The checkout training program will 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.

5.5.2.3 In the case of prototype, experimental, or research UAS aircraft for which no formal schools are available, the services of the designers and the manufacturer's best qualified personnel shall be utilized to brief and familiarize the UAS pilots with the

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aircraft, UAS aircraft systems, and ground control stations. In addition, existing UAS simulators and/or UAS aircraft of a similar nature may be used to train pilots prior to flying the UAS research vehicle.

5.5.2.4 Training for all members of the UAS flight crew shall include crew resource management (CRM) training.

5.5.3 Currency

a. The Chief of Flight Operations shall establish and approve UAS flight currency requirements for all flight crews operating assigned UAS aircraft.

b. Records of qualification and flight evaluations shall be maintained.

c. A review of UAS pilot and crew qualifications shall be made prior to flight assignment to ensure that prerequisites for the intended mission are met.

5.6 AIRWORTHINESS AND FLIGHT SAFETY REVIEWS

5.6.1 General

a. The airworthiness requirements of NPR 7900.3B, chapter 2 must be used for UAS airworthiness approvals.

b. Additionally, all UAS flight operations under NASA purview are subject to the requirements of NPR 8715.5, Range Safety Program.

5.6.2 Aviation Safety Review Board

a. The Aviation Safety Review Board (ASRB) shall conduct reviews to establish the airworthiness and evaluate the safety of flight operations.
b. Included in these reviews are:

(1) the mission manager and/or Principal Investigator,
(2) the UAS operator,
(3) Range Safety personnel,
(4) and the cognizant UAS Contracting Officer Technical Representative (COTR) and appropriate Center safety representatives.

5.6.2.1 The following topics shall be addressed by a NASA ASRB to assess the risks associated with a UAS flight program:

a. Overview of the specific UAS program.
b. Communication links and frequency management plan.
c. Flight control system and configuration control procedures.
d. Backup systems and procedures.
e. Flight terminations systems including ground abort.

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f. Definition and designation of piloting skills to be required for the specific UAS program.
g. Weather requirements.
h. Defined location of operations, including range safety requirements.
i. Foreign host nation/international procedures, if applicable.

5.6.3 Public Safety

a. The safety of the proposed UAS operation to the general public shall be assessed through a formal hazard and risk analysis process.

b. This process shall be equivalent to the methodology used in manned aircraft flight operations. The ability to achieve this level of protection can be demonstrated through a combination of analysis, test, simulation, use of redundancy in design, and flight operational procedures.

(1) This process shall be conducted independently from the FAA COA process, but shall coordinate with that process to ensure uniformity of operational procedures.

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6.0 TRAINING

6.1 GENERAL TRAINING

6.1.1 All Aviation personnel will receive the following training annually:

a. Fire fighting.
b. Emergency egress training.

6.2 EGRESS & 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 in each aircraft in which they fly as a crewmember.
b. Crew chiefs, maintenance technicians, pilots, and operations engineers must be familiar enough with egress procedures in their aircraft to be capable of briefing observers and passengers during a preflight briefing.
c. Egress training is required for initial qualification in each make and model aircraft.

    (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, will, as a minimum, be given aircraft and mission-specific egress and emergency briefings and orientations by an aircraft crew member prior to flight.

6.3 PHYSIOLOGICAL AND HYPOBARIC CHAMBER TRAINING

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

a. All crewmembers will 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. However, 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.

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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. Personnel working in ejection seat aircraft will 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.

a. 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 will be made available as needed to those pilots desiring the training. This training is encouraged but not required.

6.7 PRESSURE SUIT TRAINING

6.7.1 Pilots operating aircraft above 50,000 feet pressure altitude will be required to undergo initial and recurrent pressure suit training, unless the aircraft involved is FAA-certified for flight above 50,000 feet and the aircraft is not operated above its certificated maximum altitude.

a. When pressure suit operations are required, refresher training will be required biennially.

6.8 NIGHT VISION GOGGLE INITIAL, TRANSITION, AND UPGRADE TRAINING

6.8.1 No agency may use any person, nor may any person serve as pilot-in-command of an aircraft operating with the aid of night vision devices unless that person has received appropriate ground and flight training in the use of such devices. Recency of experience or military training may be used as a basis for establishing an individual's competency to act as pilot/crewmember.

a. Prior to performing as a crewmember using night vision devices the following criteria must be met.
b. To act as a pilot conducting night vision device operations the individual must:

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(1) Hold a commercial pilot certificate.
(2) Hold an instrument rating with appropriate category and class.
(3) Show evidence of previous military or government training in the use of night vision goggles or the completion of a formal training course.

6.8.2 The following shall be used as a guide when establishing recency of experience for the purpose of integrating additional crewmembers into the night vision goggle training program:

6.8.2.1 If no night vision goggle experience or more than 1 year has elapsed since qualification: A pilot must (for Night Vision Goggle Qualification):

a. Undergo at least 10 hours flight instruction with an NVG qualified CFI or FAA designee training or military equivalent to the maneuvers listed in the commercial rotorcraft or airplane instrument practical test standards
b. Complete an evaluation flight with oral or written examination conducted by an NVG qualified CFI, military NVG instructor, or qualified FAA designee.

6.8.2.2 Academics should consist of those items pertinent to night flying techniques and instrument aircraft and NVG emergency procedures, and aircrew coordination / cockpit management. Complete a check flight with an NVG qualified Check Airman in the aircraft, operational area, and mission type to be flown.

6.8.2.3 If more than 6 months but less than 1 year since last NVG flight (for Night Vision Goggle Refresher):

a. Undergo at least 5 hours flight instruction with an NVG qualified CFI or FAA designee.
b. Academics and maneuvers consistent with initial qualification standards above.
c. Complete a check flight with an NVG qualified Check Airman in the aircraft, operational area, and mission type to be flown.

6.8.2.4 In order to maintain currency as an NVG crewmember the individual must log at least 1 hour of NVG flight every 30 days. If the individual exceeds this period, they will be required to complete a 1 hour flight with a current NVG pilot-in-command prior to resuming NVG duties.

6.8.2.5 In all cases where non-rated individuals will be acting as crewmembers during Night Vision Device operations, they shall be integrated into the qualification, refresher, and currency training cycle and operator training programs to maintain proficiency in the use of these devices. For the purposes of this part, the term “non-rated crewmember” is understood to include medics, observers, flight nurse, mission commanders or any other person functioning as a member of the crew for the duration of the flight.

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6.9 RECURRENT PILOT TRAINING

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

a. Formal recurrent training will be scheduled at least annually for all LaRC pilots.
b. Mission Management operations require semi-annual recurrent crew training.
c. However, if research schedule or other time constraints exist, the Chief of Research Operations may delay recurrent training. Proficiency goals may include more frequent training as resources permit.

6.10 NOISE ABATEMENT

6.10.1 The Chief Pilot will emphasize awareness and recognition of noise sensitive areas by keeping flight crews aware of noise complaints and noise sensitive locations.

6.11 TRAINING RECORDS

6.11.1 The Chief Pilot and Research Systems Integration Branch Head will maintain complete training records for all their assigned personnel.

6.11.2 The Chief of Research Operations will ensure that training records are maintained for all other personnel.

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

6.11.4 Training record will include the following:

a. Name.
b. Crew position.
c. Physical date.
d. Certificate type.
e. Number 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, crew resource management (CRM)).

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7.0 LaRC PILOT QUALIFICATIONS & RESPONSIBILITIES

7.1 GENERAL

7.1.1 LaRC pilot staff must be capable of skillfully and safely operating the range of aircraft types for which the Center is responsible. Therefore, pilots are required to maintain proficiency over a number of different aircraft, as required to support assigned projects.

7.1.2 In this section, use of the term “management” shall mean the Chief of Research Operations and the RSD Director, unless otherwise noted.

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

7.2 PILOT DESIGNATION

7.2.1. Pilot designations and qualifications will be documented and signed by the CRO. Pilots will fly subject to the authority of the CRO. 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 Chief of Research Operations, may approve waivers to these requirements where appropriate and justified.

7.2.2 Pilot Classifications

7.2.2.1 Research Pilots - Research pilots will be designated as an "Aerospace Engineer and Pilot - AST Research Pilot" and must 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.

7.2.2.2 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 an as-needed basis, with the concurrence of the Chief Pilot, the Principal Investigator or lead researcher, and the RSD Director provided they have familiarized themselves with the provisions of this document related to research operations, have

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familiarized themselves with the provisions of any applicable approved test plans, and are otherwise current and qualified to fly the mission. Such assignments will be specific to make, model, project, and duration and may be accompanied by limitations specific to the pilot.

7.2.2.3 UAS Pilots - Unmanned Aerial Systems (UAS) pilot designation and operational status is detailed in chapter 5.

7.3 MANNED AIRCRAFT PILOT QUALIFICATIONS, CURRENCY AND READINESS

7.3.1 Academic Qualifications - Research pilots must possess at least a Bachelor's degree in engineering from an accredited college/university or an equivalent scientific degree. A degree in Aeronautical or Aerospace Engineering is desirable. There are no specific academic requirements for support pilots.

7.3.2 Flight Experience - LaRC pilots are expected to have achieved the following basic minimum experience requirements prior to being employed as a NASA pilot, as outlined in the following table. In individual cases, management may waive or amend these requirements. Any lowering of these requirements requires approval of the RSD Director, Chief of Research Operations, and the Chief Pilot.

	Research	**Support**
First Pilot/Pilot-in-Command	2000 hrs.	1100 hrs.
High Performance 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.	**
* Aircraft with HP > 1000 or Thrust > 3000 lb.		
** Dependent upon the performance class of the aircraft to be flown.		

7.3.3 Multiple Aircraft Qualifications- 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 qualification. However, in order to maintain a professional level of performance, it is recommended that a pilot maintain currency and proficiency in no more than three types of aircraft at any one time. If it becomes necessary to regain currency/qualification in a particular aircraft due to research or support needs, the CRO will provide the means to obtain recurrent training and proficiency flying in that aircraft. When this occurs, the CRO will make a determination as to which other aircraft will no longer be operated by that pilot. Pilots may request to qualify in support aircraft based on need, individual desire, and available resources. Pilots will qualify in research aircraft on the basis of programmatic or safety needs. The Chief Pilot will evaluate each pilot aircraft assignment, in consultation with the ASO, for safety and training demands prior to assigning the pilot to a particular

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aircraft. The Chief of Research Operations will concur on any proposed pilot and aircraft reassignments to ensure adequate programmatic support.

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

a. Instructor Pilot (IP)
   (1) In order to be designated as an instructor pilot in NASA LaRC aircraft, a pilot will be recommended by the Chief Pilot, and shall have demonstrated superior systems knowledge and piloting skills in the type of aircraft in which designation is sought. Designation shall be by type.
   (2) In general, the assigned aircraft custodian will be considered the subject matter expert on the particular type of aircraft and will normally complete the instructor designation syllabus for the aircraft. This syllabus shall be developed with regard to manufacturer's or military guidance, as appropriate.
   (3) NASA instructor pilots are expected to have a previous or current designation as an FAA Certified Flight Instructor or military instructor pilot before obtaining designation as a NASA Instructor Pilot.

b. 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 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 will obtain a face-to-face briefing with appropriate maintenance/QA personnel prior to flight. This is usually obtained during a formal Flight Readiness Review (FRR). If an FCF is required at a remote location, the PIC will obtain permission from the Chief of Research Operations to conduct checks prior to any flight being released. If possible, the Aircraft Custodian shall be consulted for guidance on proper FCF procedures. No other mission will be combined with an FCF. At the completion of the FCF, the pilot will debrief QA and appropriate maintenance personnel on all aspects of the flight and discrepancies that were noted.

7.3.5 Pilot in Command Requirements - A Pilot in Command is designated as such based on demonstrated airmanship and maturity. A PIC is responsible for the safe conduct of the flight and for the safety of all embarked personnel. Therefore, a PIC shall only be designated on the recommendation of the Chief Pilot and the Instructor Pilot for the type aircraft involved. Normally a NASA LaRC Pilot will hold an Airline Transport Pilot certificate, with a minimum requirement that a Commercial Pilot certificate with appropriate ratings (including Instrument-Airplane) or military equivalent

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be held. If a NASA-owned aircraft is operated as a civil aircraft under an FAA Airworthiness Certificate, then all FAA-mandated pilot certification must be complied with, including current medical certification and applicable ratings.

7.3.6 Second in Command Requirements - If a second-in-command (SIC) is required by the aircraft's original certification or by the rules under which it is operated, the SIC must be type-rated. Alternatively, for domestic operations in the United States, an SIC without a type rating may operate an aircraft as Second in Command 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 flight training requirements established by the Chief Pilot and be evaluated by an IP.

7.3.7 Visiting and Guest Pilots - Non-LaRC pilots required or invited to fly LaRC aircraft to meet LaRC mission requirements will meet qualification and currency requirements as specified by the FTOSR or CRO. In special cases, the Chief Pilot, with the concurrence of the Chief of Research Operations, may substitute or waive certain requirements.

a. The Chief Pilot shall maintain pilot training and qualification folders on non-LaRC 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. Research missions utilizing guest pilots shall require ASRB review and approval.
c. A Flight Safety Release (FSR) based on a research FTOSR will establish mission limitations for the aircrew involved in the research.

7.3.8 Pilot Release from Flight Status - All LaRC Research Pilots will meet the minimum qualifications for an Aerospace Technologist (AST) position as a condition of employment. Pilots may be released from flight status under the following conditions:

a. Failure to meet the minimum pilot requirements of this document (including medical), or
b. Failure to operate LaRC aircraft in a safe and professional manner, or the gross or consistent use of poor judgment, or
c. If their piloting services are no longer required to meet organizational commitments.

7.3.8.1 Civil Service Research Pilots will normally be hired as Aerospace Technologists (AST). Therefore, Civil Service Research Pilots released from flight status may automatically qualify for reassignment as an AST in a research or other capacity consistent with their skills and abilities.

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7.4 INITIAL QUALIFICATION OF MANNED AIRCRAFT PILOTS

7.4.1 General - Due to the nature of research aircraft operations, it may not always be possible for pilots and other crewmembers to obtain formal training prior to operating some LaRC aircraft.

a. All reasonable efforts will be made to obtain appropriate training prior to the operation of LaRC aircraft.
b. Normally if a formal training syllabus is unavailable, an in-house training syllabus will be adopted to provide for safe initial operations, utilizing qualified instructors.

7.4.2 In Category

a. LaRC research pilots must have, or obtain, the following minimum experience levels in order to qualify 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 - For initial certification and operation of LaRC aircraft operated as civil aircraft, pilots will be required to have appropriate FAA certificates and ratings.

a. Pilots normally will receive initial NASA checkouts in individual aircraft types from the appropriate instructor for that aircraft. Normally the Aircraft Custodian for that type aircraft shall be a designated instructor. Other qualified instructor pilots may provide training leading to initial qualifications in type.
b. All check flights will be conducted by a NASA instructor or FAA Designated Examiner and will be documented on a Flight Evaluation and Training Record form.
c. Initial checkouts in aircraft will include a completed handbook exam on aircraft systems and emergency procedures, unless the initial qualification was at an FAA approved training school. Research aircraft may or may not have handbook exams that are available.
d. When available and appropriate, the Aircraft Custodian for each aircraft will attend an established civil or military school for classroom, simulation, and flight training. (Other pilots may attend if resources permit.) The Aircraft Custodian for each aircraft may then provide training for pilots who cannot attend an established school.

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e. 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 will establish checkout requirements, with the concurrence of the Chief of Research Operations. These requirements will be based on recommendations from the Aviation Safety Officer, and the assigned Aircraft Custodian.

7.4.4 Type Ratings - For LaRC aircraft operated as public aircraft in domestic airspace, FAA type ratings are not required.

a. However, pilots who do not already have the requisite type rating for a particular aircraft will obtain type ratings through NASA-funded training for aircraft requiring type ratings in civil operations, if the type rating process will enhance the pilot's ability to operate the aircraft safely. If the type rating process will not be productive, or could be counterproductive, due to important differences between the LaRC aircraft and the training aircraft or devices, an in-house checkout may be substituted.
b. If a pilot will not be assigned to passenger-carrying or Mission Management missions, formal training is desirable, but not required.
c. For LaRC aircraft that carry an FAA civil airworthiness certificate, type rating training is required if the aircraft is being operated in accordance with the FAA civil airworthiness certificate.

7.4.5 Special Requirements - Aircraft with Supplementary Research Cockpits or Supplementary Research Controls

7.4.5.1 Applicability - These special requirements apply to aircraft equipped with experimental flight control systems located either in the primary cockpit or in a separate research cockpit. In order for these special requirements to apply, the aircraft must have at least one safety pilot station with unmodified controls and an unobstructed view outside the cockpit.

7.4.5.2 Safety Pilot Requirements - The primary safety pilot (PIC) must be type-rated if applicable, - see Section 7.4.4, meet the minimum experience requirements for initial qualification, and be current in the aircraft. Additionally, anyone serving as a PIC or SIC must have completed cockpit, systems, and procedures training unique to the LaRC aircraft.

7.4.5.3 Research Cockpit Pilot Requirements - All test subjects operating experimental control systems or flying a LaRC aircraft from a research cockpit must meet requirements established by appropriate FTOSRs and flight safety releases. The safety pilot(s) must concur with any proposed operations. The test subjects will be thoroughly briefed on crew procedures and responsibilities, aircraft limitations, and emergency procedures.

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7.5 PILOT RESPONSIBILITIES

7.5.1 Upon acceptance of the aircraft for flight, the Pilot in Command (PIC) is responsible for the safe operation of the aircraft and the safety of the passengers and crew.

a. The PIC shall ensure that passenger briefings are conducted for normal and emergency egress and other safety related matters.
b. Although scheduling personnel will 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 7900.3B prior to undertaking flight operations in a LaRC aircraft.
c. The Chief Pilot, with concurrence of the Chief of Research Operations, may provide waivers from the provisions of this chapter.

7.6 AIRCRAFT CUSTODIAN RESPONSIBILITIES

7.6.1 LaRC operates under an aircraft custodian concept in which each aircraft is assigned to an individual pilot for administrative purposes. The Chief Pilot will make Aircraft Custodian assignments.

7.6.2 The Aircraft Custodian is responsible for:

a. Maintaining the documents and other written materials for assigned aircraft,
b. Administering initial and recurrent checkouts (along with other pilots designated for this purpose)
c. Preparing handbook exams/quizzes for initial checkout and annual review (if required)
d. Providing advice and technical consultation concerning the aircraft's capabilities and limitations
e. Managing cockpit modifications for that aircraft
f. Serving as the Research Services Directorate specialist for the particular assigned aircraft.

7.7 FLIGHT TEST REPORTS

7.7.1 Upon completion of each research mission in an aircraft, simulator, or other flight vehicle, designated research aircrew are required to complete a Flight Test Report in a format appropriate to the activity. If required by the Principal Investigator or lead researcher, a report shall always be accomplished.

7.7.2 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 should be attached.

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a. When multiple aircrew are involved in a mission, only the one report is required to be accomplished. However, all other aircrew having opinions, evaluations, or information that could be important to the project or to future operations, should submit separate or combined reports.
b. The Chief Pilot and Principal Investigator or lead researcher will review completed reports prior to LaRC-internal distribution.
c. Such reports are not considered publications and may not be disseminated to non-LaRC entities without management approval.

7.8 ASSIGNMENT OF PROJECT AIRCREW

7.8.1 The Chief Pilot will make project aircrew assignments, based upon pilot workload, related experience, short and long-term availability, costs of training and checkouts, demonstrated professionalism, and other factors.

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 should not be assigned as a Project Aircrew. The ASO may participate in research project flying as a PIC or SIC, however.

7.9 PILOT FLIGHT CURRENCY REQUIREMENTS

7.9.1 General - LaRC pilots must 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 7900.3B.
b. In addition to these requirements, the Chief Pilot or the Chief of Research Operations may establish special requirements if warranted by safety concerns.
c. Conversely, the CRO may waive compliance with these requirements in special cases where justified.

7.9.1.1 The currency requirements of this guideline are minimum requirements and meeting them should 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. For LaRC aircraft operated as civil aircraft, pilots will be required to meet the currency requirements of FAR Part 61.

7.9.2 Individual Training Plan - Prior to the start of each calendar year, each pilot will develop an individual training plan for Chief Pilot and Chief of Research Operations approval.

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a. A training plan for the Chief Pilot will be approved by the CRO.
b. These plans will 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.

7.9.2.1 Once approved, this plan will 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.

a. If a pilot fails to meet minimum currency requirements, except any requirements that may be deliberately allowed to lapse through management decision, the Chief Pilot will take action to ensure currency is met. The Chief of Research Operations also will be responsible for this action if any pilot fails to meet minimum currency requirements.
b. If a pilot falls behind on meeting proficiency goals, additional flights will be scheduled during normal working hours to increase closure toward these goals.

7.9.2.2 In the event that a pilot's proficiency goals are not being met as a result of normal project and project support flying, supplemented with additional proficiency flights during normal working hours, the pilot may request after-hours flying on a voluntary basis.

a. After hours flying must be approved by the Chief Pilot and the Chief of Research Operations.
b. Flights in NASA aircraft will be planned to minimize perceptions of misuse of government aircraft.
c. Travel orders shall be issued for all overnight travel.

7.9.3 Minimum 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 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.	

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a. Failure to meet any currency requirement in this category will result in restriction to operations not carrying personnel until the appropriate requirement is met or a waiver is obtained.
b. Mission Management requirements of NPR 7900.3A shall not be waived.

7.9.4 Other Currency Requirements

7.9.4.1 Instrument Proficiency Check

a. LaRC pilots attend B200 recurrency training yearly to cover the requirement for an Instrument Proficiency Check.
   (1) Failure to meet this currency requirement will result in restriction to Visual Flight Rules (VFR) conditions carrying personnel.
   (2) A type rating or annual recurrent training conducted by an FAA approved training organization may be substituted.
   (3) If recurrency training is not accomplished, the CRO will document pilot limitations.

7.9.4.2 Annual Instrument Refresher - Each LaRC pilot will attend a classroom instrument refresher course annually. Taking an open book instrument exam prepared by the Chief Pilot may be substituted if an instrument course is not available.

7.9.4.3 Annual Handbook Review - Each pilot is required to review the pilot's operating handbook annually for each support aircraft in which he/she is qualified number of pilots qualified in each, handbook exams are not required. Retaking or reviewing the aircraft handbook exam, as applicable, may document this review.

a. If a formal systems refresher course is accomplished during the year, a handbook exam is not required.
b. Due to the highly modified nature of most research aircraft, and the limited for research aircraft.
c. Each pilot jacket should contain documentation indicating the date each handbook review was conducted.
d. Failure to meet this requirement will result in restriction from operating the aircraft until the review is completed.

7.9.4.4 High Performance Jet Aircraft Proficiency - Each pilot current in a high performance jet aircraft (fighter or T-38) must have proficiency evaluated annually.

a. The Chief Pilot may conduct this evaluation if qualified and current, or the Chief Pilot may task another person designated as an IP in a high performance jet aircraft.
b. Failure to meet this requirement will result in restriction from operating a high performance jet aircraft.

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7.9.4.5 Rotary Wing Proficiency - Each pilot operating LaRC rotary wing aircraft must have proficiency evaluated annually.

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

7.9.4.6 Cross-Country Proficiency - There are no specific minimum currency requirements for cross-country flying. However, familiarity with both the low and high altitude airspace structures, and the flight and fuel planning requirements unique to each aircraft, requires that pilots maintain cross-country proficiency in each category of aircraft in which they are qualified.

a. Cross-country proficiency goals will be specified in an individual training plan developed for each pilot.
b. Every attempt will be made to meet these goals by judicious assignments of pilots to normally scheduled flights.

7.9.4.7 Recurrent Aircraft Training - If the civil equivalent of a particular LaRC aircraft is required to have a type rating under civil certification procedures, recurrent training, at a minimum, is required for that aircraft, provided a suitable training course is available.

a. LaRC pilots normally receive their recurrent training annually in a formal B200 King Air simulator course.
b. If formal recurrent training is unavailable for a particular type of aircraft, then the Aircraft Custodian of that aircraft will develop a local recurrent training syllabus.
c. Mission Management operations require semi-annual recurrent crew training.
d. For other aircraft, recurrent training will be not less than once every two years.
e. Proficiency goals may include more frequent training as resources permit.

7.9.4.8 Re-examination Procedures - A check airman/instructor may retrain and recheck or identify the deficiency and recommend remedial training to the Chief Pilot.

a. Upon completion of remedial training, the check pilot/instructor will request through the Chief Pilot, in writing, a reexamination check.
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. Until the reexamination has been satisfactorily completed, the individual shall not be used as a mission flight crewmember.

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7.9.4.9 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 will be accomplished with another pilot current in the aircraft.

a. If all pilots are noncurrent, the least noncurrent pilot will act as the instructor to requalify the most noncurrent pilot. The newly current pilot will then re-qualify the other pilot.
b. Currency then may be obtained by solo or minimum crew operations at the discretion of the Chief of Research Operations, as appropriate.
c. Other aircrew or research personnel will not be carried until currency requirements have been achieved for the crew position and type of operation required.

7.9.4.10 Removal Procedures - Any flight crewmember who does not meet the recent flight experience requirements stated in this Operations Manual must have his position reviewed by the RSD Director.

a. After thorough review of training and qualification difficulties, a decision will be made concerning continuation in flight status or whether a waiver action is appropriate.
b. Additional guidance is available in NPR 7900.3A.

7.9.4.11 Records and Logs - An automated pilot flight time logging system will be provided for documenting pilot currency status with regard to flight time, instrument approach, and landing currency requirements.

a. The Chief Pilot, in conjunction with the Chief of Research Operations, is responsible for maintaining and documenting pilot currency status with regard to all other currency requirements.
b. Pilots will 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 will 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.

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8.0 REQUIREMENTS FOR NONPILOT 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 will be determined by the aircraft's civil type certification or handbook limitations.

a. Where an aircraft has no equivalent civil or military counterpart, the Chief Pilot will 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. Due to the large diversity of types in the LaRC aircraft inventory, 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

a. Due to the large diversity in the type of flight operations conducted by the LaRC aircraft inventory, the pilot staff may rely heavily on the operations engineers to assist in various aspects of the flight planning, coordination, arrangements, and orchestration. Therefore, the participation of the operations engineer in flight activities associated with their aircraft and/or projects will add to the safety of flight operations and is encouraged. In specific cases, such as where multiple research crewmembers are needed, or operational tasking is unusually high, the operations engineer's participation in the flight may be required to fulfill test director duties.

b. Due to the requirement for operations engineers to be able to support other aircraft and/or projects when the regular operations engineer is absent, occasional participation in flights by operations personnel other than the regular assigned crew is encouraged to facilitate cross training. Achieving and maintaining a level of professionalism in the aircraft adds to the safety

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of flight operations and is highly encouraged. This requires attention to individual proficiency in the flight environment. Depending on individual backgrounds and experience levels, aircraft complexity, and mission requirements, maintaining this proficiency may require exposure beyond that minimally necessary to complete assigned missions.

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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 must 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	14
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	6
Max. hours/4 weeks without OUM/LaRC Safety Mgr. approval	240

9.2 CREW REST

9.2.1 Crew rest is required for all primary 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 will 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.

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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 is assigned normally terminate within the published limitations, but due to circumstances beyond the control of the flight crewmember (such as adverse weather conditions), are not at the time of departure expected to reach their destination within the planned flight time.

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 must 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 must have a rest period as determined by the CRO before being assigned or accepting an

9.3 WAIVERS

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

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10.0 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 Chief Of Research Operations).

> **NOTE:** Some of these procedures may not apply to LaRC research experiments not being conducted at LaRC, those not being flown on LaRC aircraft, or those not requiring LaRC resources, personnel and/or contractors to fly.

10.2 AIRCRAFT RESEARCH EXPERIMENT INITIATION

10.2.1 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* (LF 434, 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 CHANGES TO AIRCRAFT RESEARCH EXPERIMENT DEFINITION

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

10.4 SAFETY REVIEWS

10.4.1 Safety review and approval processes are used to ensure that aircraft experiments are evaluated for appropriate safety considerations. Those considerations determined and evaluated during safety reviews include but are not limited to:

a. Procedures
b. Chase
c. Photography
d. Airworthiness
e. Communications

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f. Minimum crew
g. Documentation of tested flight envelope
h. Emergency equipment (parachutes, flotation devices, helmets, etc.)

10.5 AIRCRAFT MODIFICATION AND DOCUMENTATION

10.5.1 When a new experiment has been approved, 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.

10.6 ASRB SAFETY REVIEWS

10.6.1 The Airworthiness and Safety Review Board (ASRB) is a committee of the Executive Safety Council (ESC) as established by LAPD 1150.2, Councils, Boards, Panels, Committees, Teams, and Groups, 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 that 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 that are needed to determine the safety requirements for aircraft modifications, equipment design, and flight operations, and are assigned by the Chairperson of the Executive Safety Council.
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 will issue a Flight Safety Release.
    (2) This release is required prior to the initiation of research flights.

d. LaRC may accept the results of the flight safety reviews of certain companies, institutions, or other NASA installations and participate in their projects. LaRC also may negotiate review authority with non-LaRC entities with which the Center intends to conduct research missions. At all times however, authority prescribed for safety reviews to the Center by NASA Headquarters guidance is exercised. For LaRC aircraft, the ASRB is the prescribed reviewing authority, regardless of the affiliation of personnel and heritage of the equipment aboard.

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10.7 SYSTEM SAFETY

10.7.1 General - Aviation safety at LaRC relies on highly qualified experts rather than on detailed rules. 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 S&MA, and any other experts deemed appropriate, assist the Principal Investigator or lead researcher in this effort.
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, the Chief of Research Operations and/or Center management depending upon the level of risk encountered. (For more information on system safety, see NPR 8715.3, *NASA Safety Manual*.)

10.7.2 System Safety Implementation - The goal of system safety, as practiced at LaRC, is to assure 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.

a. This information is presented to the ASRB and included in the FTOSR. Some of the salient points to be documented include:

    (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 at LaRC is that hazards will be reduced to the lowest, practical risk level.
    (1) The first goal is to affect a design that eliminates hazards.
    (2) If this is not possible, safety devices should be incorporated to prevent or ameliorate consequences of hazardous situations.
    (3) If safety devices cannot adequately accomplish the objective, warning devices should be incorporated.

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c. This risk reduction process is applied as a fundamental risk management tenet of every LaRC aircraft research experiment.

10.8 HAZARD ANALYSIS & DOCUMENTATION

10.8.1 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 category or class.

10.8.2 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. In support of these analyses, flight operations personnel will provide technical expertise and the S&MA 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," LF 273, is the recommended minimum format for documenting the analysis.

10.8.3 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.

10.9 AIRCRAFT MODIFICATIONS

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

a. 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

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and procedures recommended by the Head of the Research Systems Integration Branch.

b. The maintenance procedures are:

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

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

d. 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.

e. 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 Chief of Research Operations.

10.9.2 Aircraft Classification- All NASA aircraft are publicly owned and/or operated as defined by Public Law 103-411. However, the use of publicly owned aircraft determines the rules and regulations under which these aircraft must operate.

a. Those 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) They must be operated and maintained under applicable Federal Aviation Regulations (Parts 91, 23 or 25, etc.).
(3) LaRC aircraft operated under a civil certificate are subject to both the LaRC work order processes and to 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 can operate as “public” and as “civil” based strictly on its 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.

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10.10 RESEARCH VEHICLE WORK ORDER REQUEST AND APPROVAL (ref LMS-CP-0910, Process Aircraft Work Orders)

10.10.1 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, prior to and including the QAO, disapproves of the requested work, or required alteration, a new RVWO may be written to replace the original.
b. Once the RVWO passes the QAO, however, an "Aircraft Work Order Change Request" is used to change or cancel any work already approved by the original RVWO.

10.10.2 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 must be notified of the change(s) and approve them prior to implementation.

10.10.3 After installation is completed, the AWO is routed in reverse order until it reaches the QAO. As part of the QAO closeout process, the QAO and Airworthiness Engineer will 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.
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 modification made since original approval are correct and documented.
d. Communication of completion may be sent to the Principal Investigator or lead researcher upon request.

10.11 AIRCRAFT WORK ORDER CHANGE REQUEST

10.11.1 Changes to an open AWO are accomplished with an "Aircraft Work Order Change Request".

a. The request follows the same approval process as described above and represents a complete re-issuance of the original AWO.
b. A marker in the margins indicates any change to the work requested.
c. Once the change is approved, the original AWO is signed off as "revised per Change ‘X’" 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 AWO.
f. A continuation is to be used if additional space is required.

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10.12 EXPERIMENTAL SYSTEMS WORK REQUEST (ref LMS-CP-0909, Processing Experimental Systems Work Requests (ESWR))

10.12.1 Changes to the aircraft research systems are accomplished with an Experimental Systems Work Request (ESWR), LF 436.

a. This process is applicable to both hardware and 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 an Aircraft Work Order (LF 432, LMS-CP-0910) if the requested changes require aircraft modifications.
c. ESWR tracking numbers are assigned by the originating organizations and are filed with airworthiness engineers. Additionally, ESWRs are logged and tracked by airworthiness engineers to help prevent duplication of identification numbers and to help ensure closure.

10.13 STRESS ANALYSIS

10.13.1 Any structural experimental modification to LaRC aircraft will 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 airworthiness engineers prior to, or concurrent with, the submittal of the associated Aircraft Work Order (LF 432, ref LMS-CP-0910).
b. When scheduling modification activities, up to two weeks should be allowed for the review and approval of submitted analysis, and the subsequent approval of the associated Aircraft Work Order(s).
c. Any analysis shall be complete and sufficiently comprehensive as to require no further explanation.
d. Analyses may be handwritten, but must be legible and easily reproducible by photocopier and mass storage technology.
e. The first several pages of a stress analysis should 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.

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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.

10.14 SOFTWARE

10.14.1 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 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.
b. Before lockdown, software may be delivered to the aircraft without tracking or approval.
c. After lockdown, software is delivered with the LF 238, *Software Delivery*.
d. Lockdown ends upon the completion of the aircraft research experiment, (see LMS-CP-0960, Appendix B2). RSD development of any software required for flight or control of flight processes, or for research systems is discussed in detail in the Appendix.

10.15 AIRWORTHINESS GUIDELINES

10.15.1 This section provides a set of general guidelines and procedures to be used in the design, fabrication and installation of aircraft modifications, 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.

a. Specific, 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.
b. The Airworthiness Engineers, the Aviation Safety Officer, and the QAO will establish these guidelines in response to requirements formulation per LMS-0960.
c. Applicable manufacturer, military, or FAA standards or guidelines should be utilized by QAO and airworthiness engineers to ensure adequacy of installations and designs.
d. Not all standards listed are applicable to every platform or design.

    (1) In normal situations, manufacturer's guidelines will be followed with additional reference to appropriate FAA regulations for airworthiness.
    (2) Military requirements will normally be followed when the aircraft or equipment was or is being developed for military, non-civil use.

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e. Questions concerning the standards to be utilized for a particular design should be referred to the Airworthiness Engineers.

10.16 MODIFICATION, OPERATION, AND SYSTEM CLASSIFICATIONS

10.16.1 Modifications shall be classified as to function and purpose in order to establish safety guidelines. This determination will 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.

10.16.2 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 will require the most stringent guidelines for equipment certification, installation, and operation. All airborne research hardware and software will 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 should 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, will use more standardized guidelines for equipment certification, installation and operation, and will focus predominantly on product and mission assurance.
(3) **System Critical:** Any aircraft modification, system installation, or operation which, if incurring a failure during use, would prevent the

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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 will be short-term, and will use the least stringent guidelines for equipment certification, installation, and operation.

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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 will 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.

11.3 REQUIREMENTS

11.3.1 Crew - All Mission Management flights will be crewed by two pilots qualified in accordance with NPR 7900.3.

11.3.2 Approvals - Requests for Mission Management flights must obtain the same approvals as any other flight. Additionally, each Mission Management flight must have the approval of the Center Director or designee.

11.3.3 Manifest - The manifest will be completed as specified in NPR 7900.3.The senior passenger on Mission Management flights will be responsible for determining whether the passenger manifest is complete prior to flight.

11.3.4 Cost Comparison - Each Mission Management flight request must be accompanied by a cost comparison with commercial transportation per NPR 7900.3.

11.3.5 Records - The CRO is responsible for retaining records of all Mission Management flights for a period of two years. The records must 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 CRO (or designee) shall be responsible for preparing a summary of all Mission Management flights for the Headquarters Aircraft Management Office every six (6) months, or as required.

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12.0 ACQUISITION, DISPOSITION OF AIRCRAFT

12.1 AIRCRAFT ACQUISITION

12.1.1 Acquisition of aircraft at LaRC will be in accordance with NASA HQ and Federal agency acquisition regulations and guidelines.

a. Each aircraft for which an operational use is planned will be acquired through the acquisition process described in NPR 7900.3B.
b. Each aircraft so acquired will 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 will be accomplished appropriately.

12.1.2 Aircraft intended to be used solely as a source of spare parts also will be subject to the acquisition process of NPR 7900.3B.

a. Aircraft so acquired will be required to be entered into NEMS, but will 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 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 will be entered into NEMS, but need not be reported to NASA Headquarters or GSA as active aircraft.

12.2 AIRCRAFT DISPOSITION

12.2.1 LaRC aircraft will 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 will be coordinated through LaRC management and Headquarters functional and administrative codes.
b. Aircraft that do not have such intrinsic value may be entered into the federally mandated disposition process. The method of acquisition will often determine the disposition option.

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(1) Loaned aircraft will utilize the termination of loan process to return assets.
(2) Owned aircraft will first be surveyed through the Agency for requirement, then, with HQ Aircraft Management Office concurrence, enter the GSA disposition authority. They will 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 will be coordinated with Headquarters Aircraft Management Office prior to final disposition.

12.2.2 All aircraft dispositions will be in accordance with applicable Federal agency rules and regulations.

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13.0 ACCIDENT/INCIDENT PROCEDURES

a. 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 Chief of Research Operations and the Aviation Safety Officer and securing the scene as necessary.

13.2 AVIATION SAFETY OFFICER

13.2.1 The Aviation Safety Officer shall be responsible for ensuring that a report of an accident or incident is made according to NPR 8621.1.

13.3 ACCIDENT OR INCIDENT SCENE SECURITY

13.3.1 The PIC or PIC representative shall:

13.3.2 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.

13.3.3 Ensure that aircraft 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.

13.3.4 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.

13.3.5 Obtain additional information and guidance from the ASO. If unavailable, contact the nearest military facility for assistance.

13.4 OTHER OCCURRENCES

13.4.1 Other occurrences are those occurrences which may not be reportable in accordance with NPR 8621.1 or NASA HQ, but require notification to the Chief Pilot and/or Chief of Research Operations. These include but are not limited to:

a. Ground Operations Occurrences

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(1) Loss of life or serious injury which occur 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.

c. Other Additional Occurrences
(1) Fires not incident to flight.
(2) Ni-Cad battery overtemperature failures.
(3) Hazardous materials incidents.
(4) Damage to property.
(5) Occurrences which may generate unfavorable publicity.
(6) Threats (bomb or otherwise).
(7) Sabotage.
(8) Hijacking.

d. Flight crew occurrences while in a TDY status
(1) Sickness (other than aircrew sickness).
(2) Injury.
(3) Incarceration.
(4) Any occurrence which in the judgment of the PIC or a representative should be brought to the attention of the Chief Pilot, Chief of Research Operations, or Aviation Safety Officer.

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14.0 HAZARDOUS MATERIALS

14.1 DEFINITION OF HAZARDOUS MATERIAL

14.1.1 Means a substance or material which 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 Parts 200-277.

14.2 AUTHORITY TO TRANSPORT

14.2.1 Any person or crewmember who is aware there are hazardous materials on board the aircraft will notify the PIC immediately.

14.2.2 The Center will not accept for shipment aboard any aircraft hazardous materials except those exempted by CFR 49, Part 275.20 including:

a. The Agency will 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 pounds or less, and also marked "Carbon Dioxide, Solid" or "Dry Ice."
b. The Agency will permit packages containing dry ice in quantities not exceeding 4 pounds per passenger when used to pack perishables in carry-on baggage.
c. Packages containing dry ice must be designed to prevent a build-up of pressure that could rupture the packaging.
d. Current copies of CFR 49 are available for reference.

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 CFR 49.

a. The individual, who loads specifically exempted materials listed in CFR 49, Part 275.20, will 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 must accompany the shipment it covers during transportation aboard the aircraft.

14.2.4 Management Responsibility - The Chief of Research Operations 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:

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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 which are 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 shipper's presentation of the proper papers and certification must be part of the request for transportation and accompany the HM during transportation.

Note: The general transportation requirements of CFR 49, states that persons presenting HM for transportation must 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 which are classified as HM. Personnel accepting baggage, cargo and packages for transportation must be vigilant in scanning all items. They should 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 which 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:

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(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 Chief of Research Operations, 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 Chief of Research Operations, upon receiving notification of a discrepancy, shall notify the FAA Civil Aviation Security Field Office nearest the scene of the discrepancy.

14.3 INCIDENTS

14.3.1 An 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, which:

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 should be reported even though it does not meet the criteria listed above.

14.3.2 Any person who has knowledge of an incident as listed above shall, as soon as practicable, notify the Chief of Research Operations providing the following information:

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a. Name and telephone number of the person reporting the incident.
b. Date, time and location of the incident.
c. The extent of injuries, if any.
d. The classification, name and quantity of hazardous material involved in the incident, if such information is available.
e. Type of incident and nature of HM involvement.
f. Whether or not a continuing danger to life exists at the scene, if such can be reasonably ascertained.

14.3.3 The Chief of Research Operations upon receiving notification of an incident, 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 Chief of Research Operations shall ensure DOT Form F 5800.2, Department of Transportation Hazardous Materials Incident Report is:

a. Completed by personnel who where 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.

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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 Pilot in Command to assure the success of the trip. Typical considerations include:

a. Route Planning and Flight Information Documents - Flight planning services should 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. These fees need to be anticipated in the early mission planning.
b. Personal Documentation - Requirements for most countries likely to be visited are contained in the International Flight Information Manual (IFIM) and USAF Foreign Clearance Guide. Passengers should be notified of these requirements sufficiently far in advance of the trip. Foreign Travel Briefings are required prior to commencement of foreign travel.
c. Aircraft Documentation - Aircraft and engine log books, noise certificate, MNPS/RVSM approval letter, and insurance certification, if required, must be carried in addition to all the normal documentation.
d. Landing and Overflight Permits - Aircraft entry requirements are shown in the IFIM and *Air Force Foreign Clearance Guide*. These permits often require several weeks to obtain and may require extensive NASA Headquarters coordination with embassies.
e. Aircraft Handling Agents - The use of a handling agent for all but the most routine international destinations is highly recommended.
f. Foreign User Charges/Fees - These charges may require cash or letters of credit; the handling agent should be consulted.

A.2 RESPONSIBILITIES FOR INTERNATIONAL DEPLOYMENT

A.2.1 Operations and Engineering Branch - Obtain or confirm:

a. Applicable flight information publications (FLIPS)/Jeppesen Charts
b. Diplomatic clearances for entry and overflight through HQ
c. U.S. military base use permission/PPR numbers
d. International Flight Information Manual, USAF Foreign Clearance Guide, and ICAO rules and procedures
e. Certificate of aircraft ownership/NASA registration/airworthiness certificates/noise certificates
f. Insurance certificates (If required)
g. Customs, immigration and agricultural forms
h. Credit cards, carnets, letters of credit, SF-44's, travelers checks and cash
i. Trip itinerary and passenger manifest
j. MNPS/RVSM Certification (aircraft and crew)
k. Ground handling services
l. NASA and U.S. State Department security briefings, as appropriate

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m. Immunizations and records
n. Passport and documentation

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 will be prepared to include the following:

a. Aircraft and engine logbook information
b. Inspection and life limited items status
c. Spare parts appropriate for the route/destinations anticipated
d. Maintenance reference manuals
e. Survival equipment - FAR 91 and NASA items

A.2.3 Crewmembers - Ensure they have the following:

a. FAA Airman and medical certificates (required outside of the U.S.)
b. FCC Radiotelephone Permit (required outside of the U.S.)
c. Passport and visas for countries to be visited
d. Credit cards, cash or travelers checks
e. Travel orders
f. Operations Manual (including RVSM section) on-board
g. Aircraft Flight Manual on-board
h. Immunization records (“yellow card”)

(1) Crewmembers should increase their security awareness 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 should be consulted prior to departure for questionable countries.
(2) The PIC must 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 should be contacted prior to any international flight to check for unusual or hazardous situations that may impact the security of a planned flight.
(3) The flight crew will be responsible for ensuring aircraft security by adhering to the following procedures:

i. When away from home base, close and lock the entrance door when leaving the vicinity of the aircraft.
ii. No visitors will be allowed on board the aircraft without a crewmember present.
iii. If possible, overnight parking away from home base should be in a well-lighted area, or, preferably, in a hangar. All plugs and covers must be installed when parked outside. Gust locks should be installed, as appropriate. Wheels shall be chocked.

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iv. Crews shall be particularly alert when the aircraft is being serviced. One crewmember will 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.
v. In the event a situation arises that raises the crew's suspicions, report the facts to the nearest police or government authority.
vi. All aviation personnel should challenge anyone in the hangar bay or on the ramp that can't be identified, is not wearing an appropriate ID badge, or behaves suspiciously.
vii. Do not fly any aircraft where its safety is in question.

A.2 REQUIREMENTS FOR OPERATION IN MNPS/RVSM/RNP AIRSPACE (North Atlantic/Europe/Pacific)

A.2.1 Requirements will 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.2.2 For Unrestricted Operation in the North Atlantic Route System

A.2.2.1 Required - Minimum Navigation Performance Standard (MNPS) certification of aircraft and crew for operation between FL285 and FL420 in MNPS airspace:

a. Aircraft MNPS certification requires navigation performance to meet RNP-12.6 standard (2-IRS's or 2-GPS's)
b. Crew must receive training in MNPS procedures
c. Letter of Authorization (normally combined with RVSM certification letter)
d. Notification of MNPS qualification to authorities

A.2.2.2 Required - Reduced Vertical Separation Minimum (RVSM) certification of aircraft and crew for operation between FL290 and FL410.

a. Aircraft RVSM certification
b. Crew must receive training in RVSM procedures
c. Letter of Authorization (renewed every two years)
d. Notification of RVSM qualification to authorities for insertion into ICAO database

A.2.2.3 Required - One HF radio and one VHF radio (two HFs if on random route)

A.2.2.4 Required - Adequate maritime survival equipment per FARs

A.2.2.5 Recommended - Two HF radios with SELCAL

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A.2.2.6 Recommended - Upgrades for ETOPS operation (extended range, not required for FAR Part 91 operations)

A.2.3 For Limited Operation in the North Atlantic Area

A.2.3.1 Required - Must have MNPS certification if operating between FL285 and FL420. (Can operate below FL285 without MNPS certification on random routes)

A.2.3.2 Required - Notification of MNPS qualification to authorities

A.2.3.3 Other Considerations

(a) May utilize "Blue Spruce" routes or, possibly, random routes well clear of NAT tracks.
(b) Some routes do not require HF radios if transiting above certain altitudes and in certain areas (VERY RESTRICTIVE).
(c) May be restricted below FL350 in Reykjavik FIR.
(d) Adequate maritime/polar survival equipment per FARs

A.2.4 For Unrestricted Operation in Europe

A.2.4.1 Required - Must meet RNP-5 when above FL95 (Normally accomplished with 2 IRS's with Navaid updates, or 2 GPS's)

A.2.4.2 Required - 8.33 KHz spacing VHF radios (FM interference shielded)

A.2.4.3 Required - Noise Certificate (Stage III)

A.2.4.4 Required - Airworthiness Certificate

A.2.4.5 Required - Registration

A.2.4.6 Required - RVSM in effect for FL290 to FL 410

A.2.4.7 Required - Letter of Authorization for RVSM

A.2.4.8 Required - Notification of RVSM qualification to authorities

A.2.4.9. Required – Traffic Collision Avoidance System (TCAS) II with Version 7 equipment required

A.2.5 For Unrestricted Operation in the Pacific

A.2.5.1 Required - RNP-10 Navigation performance

A.2.5.2 Required - RVSM certification

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A.2.5.3 Required - HF radios

A.2.5.4 Required - Adequate maritime survival equipment per FAR's

A.2.5.5 Required - Letter of Authorization if in RVSM airspace

A.2.5.6 Required - Notification of RVSM qualification to authorities

A.2.5.7 Recommended - Two HF radios with SELCAL

A.2.5.8 Recommended - ER upgrades for extended ETOPS range (Not required for FAR Part 91 Operations)

A.2.6 For Unrestricted Operation in the Western Atlantic Track Route System (WATRS) and Domestic Airspace (DRVSM):

A.2.6.1 Required - Letter of Authorization for RVSM

A.2.6.2 Required - Notification of RVSM qualification to authorities

A.2.6.3 Required - RVSM in effect for FL290 to FL 410

A.2.6.4 Required – Traffic Collision Avoidance System (TCAS) II with Version 7 equipment required

A.2.6.5 Required – RNP-10 Navigation performance

A.2.7 For Restricted Operation in the Western Atlantic Track Route System (WATRS) and Unrestricted Operation in Domestic Airspace (DRVSM):

A.2.7.1 Required - Letter of Authorization for RVSM

A.2.7.2 Required - Notification of RVSM qualification to authorities

A.2.7.3 Required - RVSM in effect for FL290 to FL 410

A.2.7.4 Required – Traffic Collision Avoidance System (TCAS) II with Version 7 equipment required

A.2.7.5 Prior Coordination – Operation in RVSM/RNP airspace with non- equipped aircraft requires prior ATC coordination and approval

A.3 REFERENCES and REVISION CHANGES

A.3.1 FAA guidance on the use of RVSM airspace is available at: http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/rvsm/documentation/

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A.3.2 Dispatch Checklist

A.3.2.1 Determine flight level (FL) floor, FL ceiling and horizontal boundaries of RVSM airspace.

A.3.2.2 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.3.2.3 Verify that the airframe is RVSM approved.

A.3.2.4 Determine if any operating restrictions apply to the aircraft for RVSM operations (e.g., speed or altitude limitations).

A.3.2.5 Check the MEL for system requirements related to RVSM

A.3.2.6 Check block 10 (Equipment) of the ICAO flight plan to ensure that it correctly reflects RVSM approval status. Letter “W” indicates to ATC that the operator and aircraft are RVSM approved. Letter “Q” indicates that RVSM and FMS Navigation is available.

A.3.2.7 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.3.2.8 Determine if TCAS is operational.

A.3.2.9 Review enrout RVSM theater-specific contingency procedures

A.3.3 Flight Of Non-Rvsm Compliant Aircraft

A.3.3.1 The PIC must comply with ATC requirements for flight of non-RVSM compliant aircraft for research, maintenance, aircraft delivery or humanitarian flights.

A.3.3.2 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. “STS/NONRNP10” (no space between letters and numbers).
b. Additional information on this region is available at:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/watrs_plus/

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A.3.4 Flight Planning

A.3.4.1 RVSM Airspace - RVSM airspace is defined as any airspace between FL 290-410 where 1,000-foot vertical separation is applied.

A.4.4.2 Minimum Equipment List - When planning and filing into RVSM airspace, aircraft must meet certain Minimum Equipment Lists (MEL) provisions for RVSM operation.

A.3.4.3 Weather - The PIC must 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.3.4.4 TCAS – It is recommended that, for those aircraft that are TCAS equipped, TCAS should be operational for dispatch into RVSM airspace. TCAS is not required aircraft equipage for RVSM in all theaters of operation, however, TCAS enhances operational safety by enhancing pilot situational awareness and by providing a system for collision avoidance.

> **Note**: RVSM aircraft are required to be equipped with TCAS II V.7 to operate in certain areas (such as the U.S. and Europe); however, there are provisions for MEL relief. The dispatcher must dispatch the aircraft in accordance with MEL provisions for flight in the specific area of operations.

A.3.4.5 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. The dispatcher must be informed of and comply with the policy for such operations published in NOTAMS, Aeronautical Information Publications and other appropriate documents.

A.3.4.6 Delivery and Humanitarian Flights - ATC have made provision for limited flights by aircraft not approved for RVSM for delivery and humanitarian flights. The dispatcher must comply with the policies for this operation published in State AIPs, NOTAMS and other appropriate documents.

A.3.5 Oceanic Enroute Contingencies

A.3.5.1 Prior to entry into RVSM Airspace - The following equipment is required to be operational at entry into RVSM airspace:

a. Two independent primary altimetry systems
b. One automatic altitude control system
c. One altitude alerting device

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A.3.5.2 If any required equipment fails prior to entering RVSM airspace, the PIC will notify ATC and obtain a new oceanic clearance above or below the RVSM stratum.

A.3.5.3 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 will then either confirm the new clearance with ATC or request a new clearance to another airport. The final decision rests with the PIC.

A.3.5.4 After Entry into RVSM Airspace - ICAO 91-RVSM, Appendix 5 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. Continue with original ATC clearance if ATC can apply an alternate form of separation (i.e., lateral, longitudinal or 2,000 ft vertical separation).
b. Request ATC clearance to climb above or descend below RVSM airspace if ATC cannot provide adequate separation from other aircraft.
c. Execute ICAO contingency procedures to offset from track and FL, if ATC cannot provide adequate separation from other aircraft. The PIC will maintain the offsets until a revised ATC clearance can be obtained.
d. These contingency procedures are subject to change by the FIR/UIR controlling agency. Current procedures must be available to the aircrew prior to entry into a particular RVSM/RNP region.

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APPENDIX B: SOFTWARE DELIVERY, RECEIPT AND CHECKOUT

B.1 RESEARCH DELIVERY PROCESS INTRODUCTION

B.1.1 This appendix details the process for delivering research software to the research aircraft at LaRC. The software includes those developed by NASA organizations, those provided by researchers and associated industrial partners who are principal investigators of experiments to be conducted on the airplanes, and those developed for the Data Acquisition Systems (DAS) installed on the airplanes.

B.2 LIMITATION

B.2.1 This document does not address the delivery process of software generated only and entirely for simulator use. In addition, this document does not address any process during software development. This document describes the formal process of software delivery and checkout after the software lockdown date.

B.3 DOCUMENTATION DELIVERY

B.3.1 Documentation is required to be delivered with the software at the initial delivery. The documentation should include descriptions of the following:

a. Software objective
b. Software file listing
c. Software Test Plan
d. Software Pre-flight Procedure
e. Software Start-up and Reset Procedures
f. Software Configuration Management Procedure

B.4 CODE DELIVERY

B.4.1 Software code designated for flight is to be delivered on CD-ROMs, disks, or tapes. Two identical copies of each unique media generated are to be delivered. One copy shall be labeled for aircraft use; the second copy shall be labeled for storage in the Quality Assurance Office (QAO) . In the event of any accident or mishap, officials will retrieve the QA records for investigation purposes. The procedure to deliver the software code is detailed as follows:

a. Use LaRC Form (LF) 238 for software to be delivered to the research airplanes.
b. Check a box to indicate that the software is either RSD/SDAB developed, researcher-provided, or Data Acquisition System related.
c. Use a separate LF 238, *Software Delivery*, for each set of software that resides on a separate platform or is provided by a specific vendor/research partner.
d. For software to be hosted on the research computers aboard aircraft:
   (1) Select choice of delivery media, i.e. CD, disk, or tape.

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(2) Provide the LF 238 with:

i. Software title
ii. Software provider (name of company/university)
iii. Contract/grant/agreement type and number
iv. Version number
v. Delivery date
vi. Number of CDs, disks, or tapes needed for the software to be delivered

(3) Provide two copies of software in the media of choice.
(4) Label each media copy with software title and version number.
(5) Label each media copy with "QA" or "Aircraft".

e. For software that resides on an avionics box such as an UAT, a Mode-S Transponder, or a TCAS computer, provide the LF 238 with

(1) Software title
(2) Software provider (name of company/university)
(3) Contract/grant/agreement type and number
(4) Manufacturer part/identification number and/or version number

f. At initial delivery of software, provide documentation according to Paragraph B.2. After initial delivery, provide documentation of software changes such as functionality descriptions, user instructions, file listing, and/or release notes.
g. Sign and date as a "NASA LaRC Point of Contact" on the first signature line. This "NASA LaRC Point of Contact" is a person who receives software from the vendors/research partners, and is able to verify the software version received.
h. Deliver the LF 238 and two copies of software media to the Software Manager.
i. For any software change after initial delivery, follow the above procedure.

B.5 SOFTWARE MEDIA CONTENT

B.5.1 For each software delivery, the media should contain the following information:

a. A label containing software delivery title, version number, generation date, and aircraft or QAO designation tag.
b. Run time executables
c. Source code
d. Text files containing installation and operating procedures
e. Text files of user guides – some of these may be hardcopy deliveries

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B.6 FUNCTIONAL RESPONSIBLITIES IN THE DELIVERY PROCESS

B.6.1 NASA LaRC Point of Contact - A civil service employee, either a researcher or developer, who is responsible for providing the software pertaining to a flight experiment to be conducted.

B.6.2 Software Manager - A civil service employee in RSD or other NASA organization who has responsibility to coordinate and accept delivery of software from RSD/SDAB, researchers, and DAS for various experiments. The Software Manager also ensures that any software accepted for flight is also delivered to the QAO, notify Airworthiness software engineer, if applicable, of software delivery through the LF 238, “Software Delivery”, as well as log and file the LF 436, “Experimental Systems Work Request” (ESWR) in the Software ESWR Log Book.

B.6.3 Integration Lab Manager - A civil service employee who has overall responsibility of research system checkout in the integration lab located in Building 1268 or Building 1244.

B.6.4 Operations and Engineering Branch/RSD - This office accepts the delivery of the software from the Software Manager, maintains records for all software changes, and secures all software media and documentation necessary for each flight.

B.6.5 QAO/RSD – This office has the responsibility to maintain a ground copy of any software delivered to the aircrafts for accident investigation and recovery purposes.

B.6.6 Software Operator - An employee who is responsible to pre-flight the software before each flight and/or operate the software during flights.

B.6.7 Integration System Engineer – A civil service employee in RSD/SDAB who is responsible to monitor and ensure that overall research system pre-flight and checkout is appropriately completed before each flight.

B.7 SOFTWARE ACCEPTANCE AND APPROVAL FOR FLIGHT

B.7.1 For all software media copies delivered to the airplane and QAO, the software shall be scanned for anti-virus purpose. The scanned date shall be labeled on each media copy after the scanning process.

B.7.2 For each software delivery, the Software Manager shall brief the software at the preflight briefing to obtain approval of software for flight. The preflight briefing is attended by representatives from the Pilot Office, QAO, Operations and Engineering Branch, ACM, and researchers.

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a. After software is delivered to the aircraft for the first Instrument Check Flight, any change to the delivered software will require the process of filling out an ESWR form LF 436 for managing a software change on the aircraft.
b. Each software developer shall keep a documented log of software symptoms or bugs occurring during the flight. A software change may be requested due to either a requirement change or a deficiency.
c. Submission of the ESWR may occur either before or after the implementation of the change depending on the ability of a software developer in knowing the scope of the software change in advance. After the ESWR has been completed and signed off, the modified software may be submitted as a new version with the software delivery form LF 238.
d. The EWSR number(s) should be referenced on the software delivery form in the “title” field.
e. Once software is delivered, it may then be installed on the subsystem.

B.7.3 The following is the order in filling out the ESWR form.

a. ESWR Submission by the software provider with the following fields completed:

    (1) System or Aircraft Designation – Name of experiment
    (2) Subsystem – Title found on software delivery form
    (3) Requested By – PI of experiment
    (4) Description of work to be done should include the following:
        i. Identification of requirement change or software deficiency
        ii. Proposed or actual software modification
        iii. Affected software and associated hardware systems (provide affected files)

b. Software Manager assigns an ESWR number.
c. Acceptance and approval of ESWR by having Software Manager obtaining signatures from the following:

    (1) Systems Engineer (RSD/SDAB Integration System Engineer)
    (2) ACM (sign after the change is approved at the preflight briefing)
    (3) QAO (i.e., Operations Engineer Lead)

d. Software Manager oversees or witnesses the installation and test.
e. During the preflight briefing, discuss and obtain approval of change implementation. Post implementation acceptance includes the completion of the following:

    (1) Affected source files, object files, and executables
        i. Source line differences with comments
        ii. Statement of planned validation test
    (2) “Work Completed” box ("Work Completed" is understood to mean "initial installation completed" or "ready to proceed to functional test.")

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i. Signatures from Software Manager and QAO (i.e. Operations Engineer Lead)

(3) "Functional Test" box (One could argue that work is not really complete until the installed item is demonstrated to work, i.e. functionally checked.)

i. Signatures from Software Manager and QAO (i.e. Operations Engineer Lead)

(4) "ESWR Completed" box

i. Signatures from integration system engineer, airworthiness engineer and ACM

(5) Put new version number for the software module specified at the "Subsystem" field on the "Remarks" field.

f. After the preflight briefing, the Software Manager ensures that any software accepted for flight is delivered to the QAO, a copy of the ESWR LF 436 and Software Delivery LF 238 are delivered to the airworthiness software engineer, as well as logging and filing the LF 436, "Experimental Systems Work Request" (ESWR) in the Software ESWR Log Book.

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APPENDIX C: ACRONYMS

ACM	Aircraft Configuration Manager
AD	Airworthiness Directive
AE	Airworthiness Engineer
AMO	Aircraft Management Office
AO	Area of Operations
AOA	Annual Operation Agreement
AWO	Aviation Safety Officer
ASRB	Airworthiness & Safety Review Board
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
AWO	Aircraft Work Order
COA	Certificate of Authorization
DoD	Department of Defense
DOT	Department of Transportation
ESC	Executive Safety Council
ESWR	Experimental Systems Work Request
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCF	Functional Check Flight
FLIP	Flight Information Publication
FOSC	Flight Operations Support Center
FRR	Flight Readiness Review
FSR	Flight Safety Release
FTOSR	Flight Test Operations and Safety Report
GCS	Ground Control Station
GSO	Ground Safety Officer
HN	Host Nation
IAOP	Inter-center Aviation Operations Panel
ICAO	International Civil Aviation Organization
ICAP	Interagency Committee for Aviation Policy
ICF	Instrument Check Flight
IMC	Instrument Meteorological Conditions
IFR	Instrument Flight Rules
IP	Instructor Pilot
IRIS	Incident Reporting Identification System
LAFB/LFI	Langley Air Force Base/Langley Field International
LAPD	Langley Research Center Policy Document
LPR	Langley Research Center Procedures & Guidelines
LaRC	Langley Research Center
LMS	Langley Management System
MEL	Minimum Equipment List
MNPS	Minimum Navigation Performance Standard
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NEMS	NASA Equipment Management System

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NOTAM	Notices to Airmen
PCS	Portable Control Station
RNP	Required Navigational Performance
RSD	Research Services Directorate
RSIB	Research Systems Integration Branch
RVWO	Research Vehicle Work Order
RVSM	Reduced Vertical Separation Minimum
SASA	Simulator and Aircraft Service Activity
SDAB	Simulator Development and Analysis Branch
SED	Systems Engineering Directorate
SIC	(Pilot) Second in Command
UAS	Unmanned aircraft Systems
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

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