Langley Research Center

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Aviation Operations & Safety Manual

National Aeronautics & Space Administration

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OFFICE OF PRIMARY RESPONSIBILITY: Flight Research Services Competency

Preface

P.1 PURPOSE

This LPR 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 7900.3, *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. However, 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. Each aviation functional leader, in conjunction with the Chief of Research Operations, may issue special instructions when necessary in the interest of safety or efficient operations.

P.2 APPLICABILITY

This LPR is applicable to Langley Research Center employees.

P.3 AUTHORITY

None

P.4 REFERENCES

a. NPD 4200.1, “Equipment Management”

b. NPR 4200.1, “NASA Equipment Management Manual”

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

d. NPD 7120.4, “Program/Project Management”

e. NPD 7900.4, “NASA Aircraft Operations Management”

f. NPD 8621.1, “NASA Mishap and Close-Call Reporting, Investigating and Recordkeeping Policy”

g. NPD 8710.1, “Emergency Preparedness Program”

h. NPD 8730.3, “NASA Quality Management System Policy (ISO 9000)”

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

j. NPR 7900.3, “Aircraft Operations Management”

k. NPR 8621.1, “NASA Procedural Requirements for Mishap Reporting, Investigating and Record keeping”

l. NPR 8715.3, “NASA Safety Manual”

m. NPR 8000.4, “Risk Management Procedural Requirements”

n. CID 1150.2, “Boards, Panels, Committees, Councils and Teams”

o. LAPD 1600.3, “Langley Research Center Security Policy”

p. LAPD 1680.1, “Access to Langley Research Center”

q. LAPD 1700.1, “Safety Program”

r. LAPD 1700.2, “Safety Assignments”

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

t. LAPD 1710.1, “LaRC Aviation Safety Policy”

u. LAPD 1800.1, “Physical Examination Requirements for Aircraft Flight Support Personnel”

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

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

x. LPR 1046.1, “NASA LaRC Emergency Plan”

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

z. LPR 1710.10, “Safety Clearance Procedures (Lockout/Tagout)”

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

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

cc. LMS-OUP-0900, “Flight Research Services Competency Organizational Unit Plan”

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

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

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

gg. LMS-CP-0909, “Processing Experimental Systems Work Requests (ESWR)”

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

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

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

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

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

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

nn. LMS-TD-0940, “Langley Research Center General Aircraft Maintenance Manual for Flight Research Services Competency”

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

pp. LF 273, “Flight Research Hazard Analysis”

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

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

tt. LF 438, “Mission/Aircrew Flight Data”

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

P.5 CANCELLATION

LPR 1710.16, dated August 17, 2004.

Delma C. Freeman, Jr.
Deputy Director

1.0 RESPONSIBILITIES

To ensure that Langley Research Center (LaRC) research and support aircraft operations are conducted in a safe, efficient and productive manner, the Flight Research Services Competency Director, the Chief of Research Operations 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.

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, FLIGHT RESEARCH SERVICES COMPETENCY (FRSC)

The FRSC Director is the Organizational Unit Manager (OUM) responsible for flight operations and aviation safety. The FRSC Director formulates business policies and plans for aircraft management, and ensures that appropriate procedures and policies exist to comply with government and Agency regulations. FRSC Director responsibilities include, but are not limited to:

- Ensures compliance with the LaRC Safety Program.
- Ensures that appropriate research systems development processes exist and are being used by employees.
- Ensures the establishment of operations and safety guidelines and procedures.
- Provides resources and capabilities for implementation of research flight activities. Develops and advocates staff hiring and training/certification strategies for FRSC to implement LaRC research flight activities.
- 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 Work Request initiations and change requests
- Ensures compliance with Federal property acquisition and disposition regulations.

1.2 CHIEF OF RESEARCH OPERATIONS

In accordance with the definition contained in NPR 8715.3, *NASA Safety Manual*, and NPR 7900.3, *Aircraft Operations Management*, the Chief of Research Operations is “the senior line person assigned aircraft operations responsibilities”. Chief of Research Operations responsibilities include, but are not limited to:

- 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.

- Proposes and manages the annual budget for the aviation functional areas listed above.
- 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.
- 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.
- Reviews and approves Flight Test Operations & Safety Reports.
- Approves waivers issued by the Functional Area Managers to provisions of this document and notifies the FRSC Director when this occurs.
- Provides management approval of Flight Requests to ensure that flights conducted in LaRC aircraft are in accordance with approved programs and that passengers have appropriate boarding authority.
- Serves as the Center interface to the Intercenter Aircraft Operations Panel, with assistance from the Functional Area Managers as required.

1.3 AVIATION SAFETY OFFICER (ASO)

The Aviation Safety Officer is the focal point for aviation safety matters for the Center Director, FRSC Director and the Chief of Research Operations. The ASO is recommended by the FRSC Director, appointed by the Chairperson of the Executive Safety Board, and acts on behalf of the Chairperson and the Center Director when discharging his responsibilities (LAPD 1700.2, *Safety Assignments*). ASO responsibilities include, but are not limited to:

- Defines and implements the Center Aviation Safety Program with the Chief of Research Operations to address all areas of flight and ground operations and safety.
- Provides technical guidance on safety aspects of flight programs and operations.
- Fosters aviation safety measures, promotes mishap prevention, and develops and updates an aviation accident reporting and investigation plan.
- Maintains surveillance of aviation activities (primarily operational) for conformance with prescribing directives, standards and procedures. Identifies or recommends corrective action when required.
- Reviews and signs Flight Test Operations & Safety Reports and hazard analyses/risk assessments presented to the Airworthiness & Safety Review Board and program initiations and change requests.
- Works with the LaRC Safety Manager to identify and communicate aviation-related issues needing attention from other LaRC safety groups or committees.

The ASO will provide independent reports on aviation safety to the FRSC Director, Executive Safety Board Chairperson, and/or the Head of the LaRC Safety Manager, as requested. In times of unavoidable absence from duty or of other conflicting time demands, the Aviation Safety Officer may appoint an assistant to execute the duties of the “office”.

1.4 CHIEF PILOT

The Chief Pilot must be a current NASA research pilot meeting NASA requirements for a Chief Pilot. The Chief Pilot is the leader of the pilots' office and directs the work of the LaRC pilot staff to support the research/support flight operations and simulation requirements of the Center. The Chief Pilot functions as a technical and operational advisor to the Chief of Research Operations and responsibilities include, but are not limited to:

- Generation of flight operations guidelines, directives, and procedures associated with the operation of LaRC aircraft, for concurrence of the Chief of Research Operations.
- Oversight of flight operations activities, including processes and systems for planning, dispatch, and monitoring of flights in progress, and the coordination of activities associated with the handling of in-flight emergencies.
- Establishes, monitors and enforces safe operating practices, currency standards, aircraft checkout policies, and training plans for the pilot staff.
- Supervision of all research pilots assigned to the Pilot's Office, ensuring that pilots have appropriate training and expertise, perform satisfactorily in their project pilot role (for both flight and simulation experiments), and implement safe aircraft operating practices and procedures. Recommends appropriate pilot staffing level and approach to meet projected research program objectives.
- Professional oversight of any non-Civil-Service pilots used in the operation of LaRC-assigned aircraft.
- Interpretation of flight operations guidelines and directives as they apply to the operation of LaRC aircraft. Issuance of appropriate waivers from these guidelines and/or directives for approval by LaRC management (beginning with the Chief of Research Operations).
- Concurs on the issuance of exceptional releases of LaRC aircraft.
- Supports the Chief of Research Operations and the other Functional Area Managers in the application of flight operations guidelines and directives to management and decision-making functions.

1.5 PILOT-IN-COMMAND (PIC)

The Pilot-In-Command 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:

- Exercises final authority to delay or divert flights for reasons of weather, aircraft status, or other safety-related considerations.
- Ensures the delivery of passenger/crew briefings that address pertinent egress, safety and emergency information.
- Ensures that all appropriate safety policies and procedures are carried out during the flight and has final approval of the flight manifest.

1.6 AIRCRAFT SERVICES BRANCH (ASB), FRSC

The Aircraft Services Branch is the maintenance unit for the aircraft fleet assigned to LaRC. This Branch is responsible for establishing and implementing procedures for maintenance of all aircraft and ground support equipment in accordance with prescribing Agency regulations. The Branch Head designates, evaluates and administers certification of personnel assigned to aviation maintenance duties and authorizes standard releases of aircraft for flight. The Branch performs aviation maintenance and modifications in compliance with appropriate national, state and Agency institutional/occupational health and safety regulations. The Branch provides the Ground Safety Officer (GSO), an appointed position which 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. The Aircraft Services Branch responsibilities include, but are not limited to:

- Basic aircraft maintenance and aircraft research system interface configuration for aircraft implementation.
- Maintenance of aviation ground support equipment and related hangar facilities in support of flight projects.
- Acquisition, storage and inventory of aircraft parts and consumables.
- Facility safety and functional management for Facility 1244 complex.
- Management and implementation of a ground safety program.

1.7 QUALITY ASSURANCE OFFICE (QAO), FRSC

The Quality Assurance Office 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 Flight Research Services Competency or by engineering designs. The Lead QA Specialist is responsible for making all job assignments based on the experience and skill level(s) of the individuals. QAO responsibilities include, but are not limited to:

- Verifies 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.
- Ensures compliance with any applicable special standards.
- Performs instrument calibrations, material, parts, and fastener certifications and maintains aircraft permanent records.

- Audits aircraft baseline, maintenance, and experimental configurations.

1.8 FLIGHT OPERATIONS BRANCH, FRSC

The Flight Operations Branch is the focal point for aircraft research and support operations planning and implementation. Flight Operations Branch performs the tactical planning, scheduling, implementation, and communications for aircraft research and support activities. Flight Operations Branch responsibilities include, but are not limited to:

- Pilot services for research flight activities, functional check flights, program support missions, etc.
- Manages operational and ground logistics coordination for research missions as assigned.
- Manages operational and logistical planning and coordination for all deployments as assigned.
- Manages aviation weather, flight planning and dispatch services for LaRC.
- Manages LaRC Flight Operations Support Center (FOSC).
- Prepares and/or assures preparation of flight requests, flight manifests, flight cards, and other associated paperwork for research missions.
- 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.
- Provides Flight Test Director services for research operations.
- Presents flight operations concepts at Test Operations Review with project pilot.
- Generates flight cards for research missions that meet research and operational requirements by integrating researchers plan of test with operational constraints.
- Coordinates required safety training for cabin crew.
- Coordinates and conducts tour and demo activity involving LaRC aircraft as assigned.
- Assists Principal Investigators or lead researchers in preparation of FTOSR's for ASRB reviews and test plans for program flight missions.
- Assists pilot staff in preflight activities including route planning, clearances, egress briefings, ensuring aircraft, crew, and operational plan suitability for flight, and confirming release for flight.

1.9 AIRWORTHINESS ENGINEER(S), FRSC

The Airworthiness Engineer(s) is the focal point for aircraft and research systems modification and operational airworthiness assurance. Airworthiness Engineer(s)responsibilities include, but are not limited to:

- Reviews engineering designs, aircraft modifications, and equipment installations.
- Maintains configuration management of baseline LaRC aircraft and research system integrations.
- Works with Principal Investigators or lead researchers, personnel from FSSB and AEB and Flight Operations Branch, the ASO, and OSMA 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.
- Reviews and signs program initiations and change requests, work orders and hazard analyses.

1.10 AIRWORTHINESS & SAFETY REVIEW BOARD (ASRB)

The Airworthiness & Safety Review Board is chartered by the Executive Safety Board as defined in CID 1150.2, *Boards, Panels, Committees, Councils and Teams.* 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.

1.11 OTHER SUPPORTING ORGANIZATIONS

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.

1.12 DELEGATION OF AUTHORITY

In the absence of specific delegations issued from the FRSC functional positions described in this chapter, authority and responsibility to execute these functions is delegated according to the *Flight Research Services Competency Organizational Unit Plan*, LMS-OUP-0900.

2.0 UNILATERAL STOP AUTHORITY

While attempts should be made to resolve non-emergency 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 granted also to every civil servant and contractor employee of the Flight Research Services Competency, 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.*

3.0 THE LaRC AVIATION SAFETY PROGRAM

3.1 PURPOSE

Aviation safety procedural requirements 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 procedural requirements form a closed loop to ensure that:

- Aviation safety problems are detected and identified
- Safe procedures for dealing with problems are devised, specified, and implemented
- Procedures are developed and enforced by the responsible individuals

3.2 BACKGROUND

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*.

Aviation safety is a line management function. However, assuring the highest practical level of safety also is the responsibility of every employee associated with flight operations. Because of 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.

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 4.0.

3.3 AIRCRAFT MISHAP PREVENTION SURVEY

The aviation program and flight operations at LaRC are subjected to biennial safety reviews conducted by the Headquarters Aircraft Management Office (Code OJP) and the Intercenter Aircraft Operations Panel (IAOP), with independent oversight by the Headquarters Safety Division (Code QS). These reviews are based on NPR 7900.3, Chapter 7, “Intercenter Aircraft Operations Panel Review Program,” covering all phases of aviation at the Center, and include all functions and organizations that

support these aviation activities. These reviews produce formal recommendations or action requests to which the Center must respond to Code R, Code J and Code Q 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.

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 Code Q for safety and mission assurance as well.

3.4 AIRCRAFT MISHAP REPORTING AND INVESTIGATION

Specific responsibilities and the process for aviation 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 NPD 8621.1, *NASA Mishap and Close-Call Reporting, Investigation, and Record-Keeping Policy*. Additionally, processes exist for the identification and reporting of operational incidents and near misses in order to track, analyze and apply corrective measures to situations that have caused, or may cause, unsafe situations. These include Incident/Hazard/Close Call reports that allow employees to communicate with management and the ASO about any safety issue or concern, including the identification and resolution of unsafe situations.

3.4.1 Mishap Prevention Themes - As part of the operational element of the Aviation Safety Program, the Aviation Safety Officer conducts regular, periodic briefings (both formal and informal) to pilots and other aviation personnel focused on specific safety and prevention themes. The themes addressed include historical data and analysis of LaRC aviation operations and functions, trends and noteworthy events from the military, industry and other NASA Centers, specific manufacturers' safety-related information, and future areas of emphasis of particular importance to LaRC operations. 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.

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

3.5 AVIATION SAFETY COUNCIL

The concept of the Aviation Safety Council is fulfilled at LaRC through the joint efforts of the Center Executive Safety Board and the Airworthiness & Safety Review Board. Both of these entities are described in Sections 3.10 and 10.7.

3.6 AVIATION SAFETY MEETINGS

Safety stand-downs are called periodically at a Center level and within the Flight Research Services Competency 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.

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3.7 SAFETY INCENTIVES & AWARDS

The Center has several means by which individuals are rewarded for safe accomplishment of functional tasks supporting aviation missions. The Safety and Facility Assurance Office (SFAO) recognizes both facility coordinators/safety heads and quality assurance personnel for furtherance of the goals and objectives of the Center Safety program through their work in achieving aviation safety. This recognition is in the form of both a plaque/certificate and cash. The Flight Research Services Competency 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. This award is both a certificate and a cash stipend with attention to and achievement of safety goals as a major discriminator in the both the award and amount of allocation. 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 OCCUPATIONAL HEALTH, MEDICAL CLEARANCE, EMERGENCY EGRESS, AND SURVIVAL

3.8.1 Egress & Survival Training - The Flight Research Services Competency has a comprehensive and formal egress and survival-training program for all personnel who have official flight duties. This training is both aircraft and individual-based, and is available to personnel at various levels of rigor based on need and application. Syllabuses covering the full scope of training available and/or required are available from the Flight Research Services Competency. 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.

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

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 this criteria.

Required Examinations:

1. NASA Langley Pilots and Contracted Pilots receive FAA Class I medicals. See section 4.10.

2. NASA Langley flight crew personnel receive FAA Class III medicals or equivalent. Generally, this group consists of the employees in Flight Research Services Competency who are trained and eligible to serve as B-757 "door captains." See section 5.2.1.

3. Other personnel who are determined by LaRC line management as needing FAA or equivalent medical certification. This may be required by a research partner, aircraft operator or by any official safety board as defined in CID 1150.2. Such personnel may be from any LaRC organization. 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.

The list that results from this policy will be forwarded to the Clinic via email or hardcopy annually in January of each year. The list will include the names of individuals authorized by Langley Research Center/Flight Research Services Competency 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 Flight Research Services Competency to resolve individual requirements that arise between list publications.

3.8.3 Aviation Protective Equipment & Clothing – In accordance with NPR 7900.3, LaRC maintains an inventory of system-level and personal protective equipment, which is issued to aircraft and flight crewmembers in correlation to the degree of risks associated with given mission(s). All aviation protective equipment is maintained on prescribed, documented programs that entail elements of both shelf life and interval refurbishment. Certified technicians perform all equipment maintenance and test activities. 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. Such 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:

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

The Aircraft Services Branch oversees the issuance and control of aviation protective equipment and protective clothing in accordance with the above guidelines.

3.8.4 Definitions - Protective equipment is defined as a device or item worn, used, or located for the safety and protection of LaRC personnel and official Center visitors. Protective clothing is defined as an article of clothing furnished to an employee at Government expense, and shall be worn for personal safety and protection when performing work assignments.

3.8.5 Equipment Included – Government issue protective equipment for long-term loan may include: oxygen masks, aviator flashlights (with batteries), aviator watches, kneeboards, manual/electronic navigation computers, personal equipment storage bags, earplugs, nasal spray, watch caps, and any other equipment necessary to accomplish flight objectives.

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

3.9 FACILITIES

The physical plants of both LaRC and Langley Air Force Base are integral elements of the Center Aviation Safety Program. The Facility 1244 Hangar complex, including taxiways and ramps, are designed to support safety and security for both the surrounding environment and personnel/equipment involved in aviation operations. Hazard barriers and controls exist for both people and equipment throughout the LaRC facilities to minimize the probability of unexpected or unmanaged exposure to risk. Only authorized (trained and/or oriented) personnel are allowed in critical areas of the facilities, and operations permitted or prohibited are documented throughout the aviation policy manuals of the Center. These include this document and the Intra-Governmental Support Agreement between Langley Air Force Base and LaRC, the *General Aircraft Maintenance Manual for Flight Research Services Competency*, LMS-TD-0940, the Facility 1244 Security Plan, and all applicable Center institutional /occupational health and safety policies and regulations.

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. These stations provide 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 Aircraft Services Branch Head. These stations are on call 24 hours per day, and use the *Aircraft Crash Fire Rescue Handbook*, created and maintained by the Aviation Safety Officer, as the primary source of technical and emergency data for each aircraft assigned to LaRC.

The mission of LaRC can require flight operations to be conducted in the following categories that are permitted by NPR.7900.3:

- Research operations
  - Flight research
  - Simulator support
  - Model dropping & recovery
- Program Support operations
  - Transportation of support equipment & personnel
  - Aerial photography
  - Safety & photo chase
  - Currency/proficiency/training
  - Maintenance test
  - Miscellaneous flight activities

- Mission Management operations
- Emergency and humanitarian operations

3.9.1 Classification of Aircraft - LaRC aircraft will be classified as experimental, research, program support, or mission management. Generally, these aircraft are operated as “public” according to 14 CFR Parts 1 and 91.

3.9.2 Classification Definition and Utilization

3.9.2.1 *Experimental Aircraft* - Experimental aircraft are research aircraft that have not completed an envelope expansion following modifications requiring an envelope expansion, or aircraft which have not gained sufficient operational experience to permit reclassification to the research category. Experimental aircraft always will be operated with minimum crew. Reclassification of aircraft from the experimental to research categories requires approval of the Chief of Research Operations and the Chairman of the ASRB, as well as notification of the FRSC Director. Experimental aircraft can be used only for research flights.

3.9.2.2 *Research Aircraft* - Research aircraft are aircraft used primarily for research purposes. These aircraft may have modifications to the primary structure, control systems, engines, and/or basic aerodynamics subject to ASRB approval. To be classified as a research aircraft, a modified aircraft must have completed an envelope expansion (if required), and have gained enough operational experience to provide confidence in the safety of any modifications. Research aircraft may be used occasionally on support missions where such missions are necessary to accomplish program objectives and can be accomplished safely. The Chief of Research Operations may reclassify research aircraft to program support aircraft, with the approval of the FRSC Director.

3.9.2.3 *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. Program support aircraft may be used to support any program and may carry passengers if the aircraft has an FAA certificate to carry passengers. LaRC pilots, in connection with official travel, may use program support aircraft in order to reduce the need for separate cross-country proficiency flying. When a program support aircraft is used in connection with a pilot's official travel, the incidental carriage of passengers who have a need to travel on official business to the same or nearby locations is permitted. Program support aircraft may have modifications, provided these modifications do not affect the aircraft's primary structure, engines, control systems, or make the

aircraft unsafe for general-purpose use including the carriage of passengers. If an envelope expansion is required following any type of modification, such expansion must be completed prior to the carriage of passengers.

3.9.2.4 *Mission Management Aircraft (MMA)* - Mission Management Aircraft are aircraft officially designated by NASA Headquarters. Mission Management Aircraft are operated exclusively in accordance with NPD 7900.4.

3.10 CARGO SAFETY

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. This material is under inventory control and may be handled only by personnel appropriately trained and certified. Disposal of such material is also documented to complete inventory accountability records. Hazardous/toxic material is seldom carried aboard LaRC aircraft as cargo or research material. In cases where transport of such material is unavoidable however, the same OSHA and EPA regulations referenced in the previous paragraph and appropriate FAR's are followed.

3.11 DISSEMINATION OF AVIATION SAFETY MATERIAL

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

4.0 LaRC PILOT QUALIFICATIONS & RESPONSIBILITIES

4.1 GENERAL

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.

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

4.2 PILOT DESIGNATION

Formal designation as a LaRC pilot will be accomplished by management, typically through the indication of piloting duties in the employee's position description. All employees operating LaRC aircraft as a PIC will be assigned to the Flight Research Services Competency. 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.

4.2.1 Pilot Classifications

4.2.1.1 *Research Pilots* - Research pilots will be designated as an "Aerospace Engineer and Pilot - AST Research Piloting" and must meet the hiring and academic qualification requirements for an 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. 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 experimental, research, program support and mission management aircraft, provided they are properly qualified and current in the aircraft identified for the mission.

4.2.1.2 *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 limited to the operation of support and mission management aircraft in which they are qualified and current. However, support pilots may operate support aircraft on research missions on an as-needed basis, with the concurrence of the Principal Investigator or

lead researcher, provided they have familiarized themselves with the provisions of this document related to research operations, have familiarized themselves with the provisions of any applicable approved test plans, and are otherwise current and qualified to fly the mission. Support pilots may fly as PIC in a research aircraft only as approved by the Chief Pilot, with the concurrence of the Chief of Research Operations (and notification of the FRSC Director). Such assignments will be specific to make, model, project, and duration and may be accompanied by limitations specific to the pilot. Support pilots may not operate aircraft in the experimental category as PIC.

4.3 PILOT QUALIFICATIONS, CURRENCY AND READINESS

4.3.1 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.

4.3.2 Flight Experience - LaRC pilots are expected to meet basic experience requirements as outlined in the following table. In individual cases, management may waive or amend these requirements. Any lowering of these requirements requires approval of management and the Chief Pilot.

	Research	**Support**
First Pilot	2000 hrs.	1100 hrs.
High Performance Aircraft *	500 hrs.	**
Instrument (Actual or Simulated)	75 hrs.	75 hrs
Night	100 hrs.	20 hrs.
Cross-Country	500 hrs.	100 hrs.
* Aircraft with HP > 1000 or Thrust > 3000 lb. and aerobatic ** Dependent upon the performance class of the aircraft.		

4.3.3 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 currency. Pilots may 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.

4.3.4 Instructor Pilots and Functional Check Flight (FCF) Pilots - Minimum experience requirements are not set for designation as an Instructor Pilot (IP) or FCF pilot in LaRC aircraft. In general, Aircraft Managers (see Section 4.6) will be considered IP's and FCF pilots in their assigned aircraft. The Chief Pilot may assign other IP's and FCF pilots as required to meet flight and mission requirements.

4.3.5 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 or meet the following requirements:

- Complete an appropriate ground school in accordance with FAR Part 61 SIC requirements.
- Be landing current.
- Meet flight training requirements established by the Chief Pilot and be evaluated by an IP.

4.3.6 Visiting and Guest Pilots - Non-LaRC pilots required or invited to fly LaRC aircraft to meet LaRC mission requirements must meet the same qualification and currency requirements as LaRC pilots. In special cases, the Chief Pilot, with the concurrence of the Chief of Research Operations, may substitute or waive certain requirements if justified. Non-LaRC pilots operating LaRC aircraft will maintain pilot training and qualification folders documenting their compliance with the requirements of this document. This section is not applicable to research subjects in cockpits of aircraft operating with a LaRC safety pilot.

4.3.7 Pilot Release from Flight Status - All LaRC 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:

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

Pilots released from flight status will automatically qualify for reassignment in a research or in another capacity consistent with their skills and abilities.

4.4 INITIAL QUALIFICATION

4.4.1 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. All reasonable efforts will be made to obtain appropriate training prior to the operation of LaRC aircraft. Initial operations will be conducted in a conservative manner regardless of formal training.

4.4.2 In Category - 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	10 hrs.
Jet Aircraft	10 hrs.
Rotary Wing/VTOL Aircraft	10 hrs.
Multi-Engine, Wt. > 12,500 lbs.	20 hrs.

4.4.3 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. Research pilots normally will receive initial checkouts in individual aircraft types from the Aircraft Manager (see Section 4.6) for that aircraft. If qualified in that aircraft, another qualified pilot may give training leading to initial qualifications in type. All check flights will be documented on a Flight Evaluation and Training Record form. Initial checkouts in support aircraft will include a completed questionnaire on aircraft systems and emergency procedures unless the initial qualification was at an FAA approved training school. Research aircraft may or may not have questionnaires. When available and appropriate, the Aircraft Manager 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 Manager for each aircraft may check out pilots who cannot attend an established school. 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 concurrence of the Chief of Research Operations. These requirements will be based on recommendations from the Aviation Safety Officer, and the assigned Aircraft Manager. When an aircraft is similar in size, performance, and systems operation to another aircraft in which a pilot is checked out, and when authorized by the Chief Pilot, a pilot may be permitted to qualify in an additional, similar aircraft without an initial checkout from another pilot. Under these circumstances, the pilot must read all available material for the aircraft, and complete the maneuvers required by the initial qualification form.

4.4.4 Type Ratings - For LaRC aircraft operated as public aircraft, FAA type ratings are not required. However, type ratings will be obtained 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. For LaRC aircraft that carry a FAA airworthiness certificate, type rating training is required if applicable. If a pilot will not be assigned to mission management missions, formal training is desirable but not required.

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

4.4.5.1 *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.

- *Safety Pilot Requirements* - The primary safety pilot (PIC) must be type-rated if applicable, - see Section 4.9.3.7, “Aircraft Requiring Type Ratings,” 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.

4.4.5.2 *Research Cockpit Requirements* - All test subjects operating experimental control systems or flying a LaRC aircraft from a research cockpit must meet requirements established by appropriate FTOSR’s 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.

4.5 PILOT RESPONSIBILITIES

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

It is the responsibility of each pilot to ensure that he or she is qualified and current in accordance with the provisions of this document prior to undertaking flight operations in a LaRC aircraft.

The Chief Pilot, with concurrence of the Chief of Research Operations, may provide waivers from the provisions of this Chapter when necessary and justified.

4.6 AIRCRAFT MANAGER RESPONSIBILITIES

LaRC operates under an aircraft manager concept in which each aircraft is assigned to an individual pilot for administrative purposes. The Chief Pilot will make Aircraft Manager assignments. The Aircraft Manager is responsible for:

- Maintaining the documents and other written materials for assigned aircraft,
- Administering initial and recurrent checkouts (along with other pilots designated for this purpose),

- Preparing handbook questionnaires for initial checkout and annual review (if required),
- Providing advice and technical consultation concerning the aircraft's capabilities and limitations,
- Managing cockpit modifications for that aircraft, and
- Serving as the Flight Research Services Competency specialist for assigned aircraft.

4.7 FLIGHT TEST REPORTS

Upon completion of each research mission in an aircraft, simulator, or other flight vehicle, research pilots are required to complete a Pilot Report in a format appropriate to the activity, unless the Principal Investigator or lead researcher waives this requirement.

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. When multiple pilots are involved in a research mission, only the primary pilot need to submit a report. However, if other pilots have opinions, evaluations, or information that could be important to the project or to future operations, they should submit separate or combined reports. The Chief Pilot and Principal Investigator or lead research will review completed reports prior to LaRC-internal distribution. Such reports are not considered publications and may not be disseminated to non-LaRC entities without management approval.

4.8 ASSIGNMENT OF PROJECT PILOTS

The Chief of Research Operations will make project pilot assignments, based upon pilot workload, related experience, short and long-term availability, costs of training and checkouts, demonstrated professionalism, and other factors. Assignment as project pilot does not preclude later changes to this designation or the use of other pilots on the project, if required by situational factors.

4.9 PILOT CURRENCY REQUIREMENTS

4.9.1 General - LaRC pilots must meet minimum currency requirements listed in Section 4.9.2 in order to carry passengers in LaRC aircraft. However, pilots are not expected to meet all minimum currency requirements at all times. If maintaining currency in a particular category or type is not required to meet mission requirements, currency may be allowed to lapse provided it is not one of the minimum currency requirements of NPR 7900.3. In addition to these requirements, the Chief Pilot or the Chief of Research Operations may establish special requirements if warranted by safety concerns. Conversely, the Chief Pilot, with concurrence from the Chief of Research Operations, may waive compliance with these requirements in special cases where justified.

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.

Prior to each fiscal year each pilot will develop an individual training plan for Chief Pilot and Chief of Research Operations approval. A training plan for the Chief Pilot will be approved by the Chief of Research Operations. 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.

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. If a pilot fails to meet minimum currency requirements, except any requirements that may be deliberately allowed to lapse, 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. If a pilot falls behind on meeting proficiency goals, additional flights will be scheduled during normal working hours to increase closure toward these goals.

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. After hours flying must be approved by the Chief of Research Operations. Flights in NASA aircraft will be planned to minimize perceptions of misuse of government aircraft.

4.9.2 Minimum Currency Requirements

	PIC/IP
Total Flight Time [1]	200hrs./year, 75hrs. in last 180 days
Instrument Time [2]	50 hrs./year, 20 hrs. in last 180 days
Instrument Approaches	36/year, 18 in last 180 days. Of the 36 -18 precision/year, 18 non-precision/year
Night	3 landings every 90 days in category
Type (Make/Model)[3]	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.

3. Personal minimum landing requirements will be determined by individual pilots, but will be at least three.

Failure to meet any currency requirement in this category will result in restriction to operations not carrying passengers until the appropriate requirement is met or a waiver is obtained.

4.9.3 Other Currency Requirements

4.9.3.1 *Instrument Proficiency Check* - the Chief Pilot, or his designee, will give each LaRC pilot an annual instrument proficiency check. The Aircraft Manager, or his designee, will give the Chief Pilot this proficiency check. This check will be accomplished in a support aircraft suitable for conducting precision and non-precision approaches, when possible. Failure to meet this currency requirement will result in restriction to Visual Flight Rules (VFR) conditions carrying passengers. A type rating or annual recurrent training conducted by a FAA approved training organization may be substituted.

4.9.3.2 *Annual Instrument Refresher* - Each LaRC pilot will attend a classroom instrument refresher course annually. Taking a 50-question open book instrument exam prepared by the Chief Pilot may be substituted if an instrument course is not available. Failure to meet this requirement will result in restriction to VFR conditions carrying passengers.

4.9.3.3 *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. If a formal systems refresher course is accomplished during the year, a handbook exam is not required. Due to the highly modified nature of most research aircraft, and the limited number of pilots qualified in each, handbook exams are not required for research aircraft. Retaking or reviewing the aircraft handbook exam, as applicable, may document this review. Each pilot jacket should contain documentation indicating the date each handbook review was conducted. Failure to meet this requirement will result in restriction from operating the aircraft until the review is completed.

4.9.3.4 *High Performance Proficiency* - Each pilot current in a high performance aircraft must have proficiency evaluated annually. 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 aircraft. Failure to meet this requirement will result in restriction from operating a high performance aircraft with passengers.

4.9.3.5 *Rotary Wing Emergency Procedures* - Each pilot operating LaRC rotary wing aircraft must complete a flight review of rotary wing emergency procedures biennially. It is desirable to conduct this review in a training environment that permits touchdown auto-rotations. However, if such training is not available, an in-house review with a designated rotary wing IP is acceptable. In-house reviews will terminate all auto-rotations with power recoveries. Failure to meet this requirement will result in restriction from operating rotary wing aircraft with other personnel until the review is complete.

4.9.3.6 C*ross-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 require that pilots maintain cross-country proficiency in each category of aircraft in which they are qualified. Cross-country proficiency goals will be specified in an individual training plan developed for each pilot. Every attempt will be made to meet these goals by judicious assignments of pilots to normally scheduled flights. However, if the goals are not being met, additional dedicated flights will be scheduled to meet the goals. If the goals are still not being met, voluntary after-hours flying may be permitted with approval of the Chief Pilot and Chief of Research Operations.

4.9.3.7 *Aircraft Requiring Type Ratings* - 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. Formal recurrent training will be scheduled semi-annually for any aircraft that carries passengers or research crew. For other aircraft, recurrent training will be not less than once every two years. Proficiency goals may include more frequent training as resources permit.

4.9.4 Re-qualification - If any currency requirement is not met, re-qualification may be accomplished by operating an appropriate aircraft solo, or with minimum crew, until the requirement of the applicable category is met. Demonstrating proficiency in flight to the Chief Pilot or his designee also will satisfy this requirement.

4.9.5 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. The Chief Pilot, in conjunction with the Chief of Research Operations's administrative staff, is responsible for maintaining and documenting pilot currency status regarding all other currency requirements. Pilots will not be required to maintain

individual logbooks provided an automated logging system is in operation to document compliance with currency requirements.

4.10 MEDICAL CERTIFICATION

LaRC pilots must pass a FAA Class I medical examination administered annually by a FAA-Designated Medical Examiner. Pilots over the age of 55 are required to complete the FAA Class I physical every 6 months as long as this provision exists in NPR 7900.3. 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. An equivalent military flight physical also is acceptable. Pilots are responsible for ensuring that a copy of their current medical flight clearance is in their training jacket. Pilots failing a FAA Class I medical may request a review of their medical fitness for flight duties by the Aerospace Medicine Board at Johnson Space Center. Any request for such a review must be made through management. Certification by the Aerospace Medicine Board may permit a pilot to continue operating NASA aircraft, except Mission Management Aircraft, or other aircraft performing mission management missions.

4.11 TRAINING

4.11.1 Physiological and Hypobaric Chamber Training - LaRC pilots operating aircraft above 12,500 feet pressure altitude are required to attend initial and refresher physiological training. Pilots will be required to attend physiological refresher training at least every five years. If a pilot has completed three documented career hypobaric chamber rides, refresher training does not need to include further chamber rides. However, if a medical event occurs that might change the pilot's fitness for, or response to hypobaric conditions, the Chief Pilot or the LaRC medical examiner may require an additional chamber ride.

4.11.2 Ejection Seat and Egress Training - LaRC pilots are required to obtain ejection seat training during initial qualification in aircraft equipped with ejection seats. Egress training is required for initial qualification in each make and model aircraft. Egress and ejection seat training may be formal or in-house. Following initial qualification, a review of ejection seat and egress procedures, as applicable, is required annually for each type aircraft.

4.11.3 Water Survival Training - Water survival refresher training is required biennially for all pilots. However, once a pilot has three documented career refresher training classes, the interval between refresher classes can be extended to 5 years.

4.11.4 Cold Water Survival Training - Cold-water survival training will be made available as needed to those pilots desiring the training. This training is encouraged but not required.

4.11.5 Pressure Suit Training - 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. When pressure suit operations are required, refresher training will be required biennially.

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

5.0 REQUIREMENTS FOR NON-PILOT FLIGHT CREW

5.1 CREW COMPLEMENT

5.1.1 Minimum Crew - The minimum non-pilot aircraft crew on LaRC aircraft will be determined by the aircraft's civil type certification or handbook limitations. 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. In large and/or complex aircraft, the crew chief will be considered a part of the minimum crew, even if this is not a requirement in the equivalent civil or military version of the aircraft. Minimum research crew is quantified as the minimum number required to accomplish the objectives of a specific mission.

5.1.2 Maintenance Technicians - 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.

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.

5.1.3 Operations Engineers - Similarly, 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.

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 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. Flight Operations Branch, with oversight from the Chief of Research Operations, will develop a proficiency plan for each individual. This plan will contain quantitative goals

for obtaining and maintaining proficiency goals with specific aircraft types, maneuvers, and flight conditions.

5.2 CREW TRAINING REQUIREMENTS

5.2.1 Medical Certification - All LaRC aircraft crewmembers are required to possess at least a FAA Class III medical or an equivalent military or NASA flight physical. Research crewmembers and observers have no medical certification requirements, but must be adequately fit to accomplish potential emergency egress. If a non-LaRC examiner administers the physical, the results must be forwarded to the LaRC Clinic for review and retention. An equivalent military flight physical also is acceptable. Aircraft crewmembers are responsible for ensuring that a copy of their current medical flight clearance is in their training jacket.

5.2.2 Ejection Seat and Egress Training - Ejection seat training is required for all aircraft crewmembers approved for flight in aircraft equipped with ejection seats. This training may be obtained from military sources, or may be given locally by pilots familiar with the ejection system. A review of ejection seat operation is required annually. Egress training is required for all crewmembers in each aircraft in which they fly as a crewmember. Crew chiefs, maintenance technicians, 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.

5.2.3 Physiological and Hypobaric Chamber Training - Physiological and hypobaric chamber training are required for all persons flying in ejection seat equipped aircraft. Physiological refresher training is required at least every five years. If a crewmember has completed three documented career hypobaric chamber rides refresher training does not need to include further chamber rides. However, if a medical event occurs that might change the crewmember's fitness for, or response to hypobaric conditions, the Chief Pilot or the LaRC medical examiner may require an additional chamber ride.

Persons requiring infrequent flights in an ejection seat equipped aircraft may substitute a thorough briefing by a qualified pilot for this requirement if the flight is restricted to 18,000 feet pressure altitude. Although not required, maintenance, inspection, operations and cabin safety attendant personnel serving as aircraft crewmembers in pressurized aircraft are encouraged to attend initial physiological and hypobaric chamber training.

5.2.4 Water Survival Training - Water survival training is required for all crewmembers flying regularly out of gliding distance of land in LaRC aircraft. Water survival refresher training is required biennially for non-pilot crewmembers. However, once a crewmember has three documented career refresher training classes, the interval between refresher classes can be extended to 5 years.

5.2.5 Cold Water Survival Training - Cold-water survival training is encouraged for crewmembers, but not required.

5.2.6 Pressure Suit Training - This requirement is the same as the pilot requirement, Section 4.11.5.

5.2.7 Records - The Flight Research Services Competency will keep a record of all training accomplished by persons designated as aircraft crew. It is the responsibility of each aircraft crewmember to advise in writing when required training has been completed, and provide copies of appropriate documentation.

5.2.8 Waivers - In some circumstances, it may be beneficial to the government and/or to an employee to waive certain training requirements. In these circumstances, such as a requirement for a single flight in a particular aircraft, or where training may represent a greater hazard to a particular employee than the situation for which training is being conducted, the Chief Pilot or Chief of Research Operations may grant such waivers. Where possible, equivalent alternate training will be provided. All waivers granted will be documented.

5.2.9 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.

6.0 FLIGHT CLEARANCE AND OPERATIONS

6.1 GENERAL

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, is bound by the requirements of LAFB Instruction 11-250, *Airfield Base Operations and Base Flying Procedures*.

6.2 SCHEDULING

6.2.1 Responsibilities - Organizations requiring the use of Flight Research Services Competency personnel or facilities, including research and support aircraft, research pilots, and flight control rooms, must schedule their use through appropriate Flight Research Services Competency processes (e.g., LMS-CP-0960, *Conducting Simulation and Aircraft Services Activity Experiments*, LMS-CP-0905, *Authorizing Flight Requests for LaRC Aircraft*). Prior to implementation, the Flight Research Services Competency Director must approve all programmatic schedule commitments and any significant changes to commitments. FRSC 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.

6.2.2 Long-Range Scheduling - The Flight Research Services Competency will publish long and short-range projections of flight and simulator schedules on at least a monthly basis. These schedules will be circulated to flight project personnel, line managers, and appropriate research customers/program offices.

6.3 FLIGHT APPROVALS

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

6.3.2 Procedures – Flight requests should be initiated by submitting to the Chief of Research Operations (or designee) a properly signed (or initialed) 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 Chief of Research Operations (or designee). The following

approvals are required prior to submission to the Chief of Research Operations (or designee):

- The requesting individual
- The requester's line manager
- Flight Operations Branch when the flights are research or program support

The Chief of Research Operations (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 (except where such clearances were reviewed by Flight Operations Branch). The Chief of Research Operations (or designee) will indicate approval of the flight by signing the flight request.

6.3.3 Approvals - 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.

6.3.4 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.

6.3.5 Cross-Country Flights - LaRC pilots conducting multiple leg cross-country flights may obtain approval for all segments of the flight on a single flight request indicating the planned itinerary, dates and times. If approaches or touch-and-go landing operations will be conducted at another airport enroute to the destination airport, the pilot 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 Chief Pilot or his designee.

6.3.6 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 FRSC 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 FRSC 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 prior to deployment.

6.4 RELEASE OF AIRCRAFT

6.4.1 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*.

6.4.2 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 DOD 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.

6.4.3 Pilot Review - Pilots should review the LF115, DOD 781A, “Aircraft Maintenance Discrepancy/Work Record, and DOD 781K, “Aircraft Delayed Discrepancy Record,” forms. Since DOD 781A forms are removed from the 781 binder each week, pilots should also review the 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, he or she must accept the aircraft by initialing on the LF 115.

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

6.5 FLIGHT CLEARANCES

6.5.1 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.

6.5.2 Local Operations - All local flights in LaRC aircraft will be conducted on either IFR or VFR flight plans, except as noted below.

6.5.2.1 *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 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. When filing a flight plan for a flight that terminates after normal duty hours the pilot should include the LaRC Duty Officer's phone number in the flight plan (Block 17).

6.5.2.2 *VFR Operations* - Pilots of LaRC aircraft operating VFR in the local area, including trips to NASA/Wallops, are required to file FAA VFR flight plans:

- For flights in the local area within radio coverage flight following will also be provided by the Flight Operations Support Center (or another appropriate radio-equipped office by prior arrangement).

6.5.3 Cross-Country Operations

6.5.3.1 *General* - Flights more than 100 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.

6.5.3.2 *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.

6.5.3.3 *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.

6.5.4 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 Flight Operations Support Center during normal duty hours, or the Chief Pilot or his designee after normal working hours. 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.

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.

6.6 WEATHER MINIMUMS

6.6.1 Research Flights - Unless otherwise approved by the ASRB, and documented in a test plan, weather minimums for local research flights are 1500 feet ceiling and 5 statute miles visibility. Research flights in the local traffic pattern may be conducted down to basic VFR minimums of 1000 feet and 3 miles. The Chief Pilot may waive or modify these requirements when necessary to meet mission requirements and when such operations can be accomplished safely.

6.6.2 Program Support and Mission Management Flights – Program support and mission management flight minimums are those published in the National Oceanic and Atmospheric Administration (NOAA) Instrument Approach Procedure Charts or military FLIP charts (or commercial equivalent), as appropriate, for the category of aircraft being operated. These may be amended by published Notices to Airmen (NOTAM's).

6.6.3 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.

6.7 BOARDING AUTHORITY

Boarding authorization is required for every person flying on a LaRC aircraft. 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 passenger manifest portion of the flight request or other manifest. Also, it is the responsibility of each PIC to ensure that a safety briefing is provided to passengers prior to takeoff on all passenger-carrying 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. Flight Operations Branch is responsible for ensuring these reviews for research flights. The Chief of Research Operations (or designee) will keep training records for all crewmembers.

6.8 FLYING AREAS

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 restricted 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 or warning areas.

6.9 FLIGHT FOLLOWING

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. 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. 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.

6.10 FORMATION FLYING

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

6.11 HIGH ALTITUDE FLYING

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. 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.

6.12 AEROBATIC FLYING

Aerobatic flying is authorized for qualified pilots in aircraft approved for aerobatics by their type certificate or approved flight manual. All aerobatic flying should be accomplished in low-density airspace outside federal airways. Flight visibility must be at least 5 statute miles. Parachutes must be available for all occupants. Aerobatics qualification shall be documented and retained on record.

6.13 ROTARY WING OPERATIONS

Qualified rotary wing pilots are required to maintain rotary wing proficiency. 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. Practice touchdown auto-rotations are not permitted in LaRC aircraft unless specifically authorized by the Chief Pilot. Pilots desiring touchdown auto-rotation training will be enrolled in an appropriate training course as resources permit.

6.14 OVERWATER OPERATIONS

All occupants of single-engine aircraft operating out of gliding distance of land must carry personal flotation devices. In all other aircraft, occupants must be offered the use of a personal flotation device if that aircraft is to be operated out of single-engine gliding distance of land. Whenever possible, pilots should request that life rafts be placed onboard aircraft operating out of gliding distance of land. 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. Pilots are encouraged to operate their aircraft in such a manner as to minimize exposure to the possibility of a water ditching.

6.15 INSTRUMENT OPERATIONS

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

6.16 RECORDS AND LOGS

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 separate LF 438 will be completed for each day for each aircraft.
- For flights originating and terminating on different dates, the form will be dated on the date of origination.
- Name and pilot number will be entered on the form.
- 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)
- 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.
- Instrument approaches must be accompanied by the logging of actual or simulated instrument time.
- 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)
- Duty conditions that are not complementary, such as instrument or simulated instrument times, cannot exceed the total leg time.
- 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.
- The flight request number is to be recorded in the “Remarks” column.
- Flight time logged in FAA approved training simulators must be reported on a LF 438 in order for any of the time or maneuvers to be credited against currency requirements of this document.
- 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.

6.17 INTERNATIONAL OPERATIONS

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 FRSC management and the Pilot in Command to ensure the success of the trip. Flight Operations Branch will provide coordination for planning and conduct of all international operations.

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

- Route planning and flight information documents
- Personal documentation and foreign travel briefings
- Aircraft documentation
- Landing and overflight permits
- Aircraft handling agents
- Foreign user charges/fees

NASA aircraft are operated as state aircraft per NPR 7900.3 during international operations. This is the same status under which military aircraft operate. Therefore, all international operations of LaRC aircraft shall comply with the *Air Force Clearance Guide* and appropriate DoD Flight Information Publication (FLIP) guidance. NASA HQ Code I shall arrange for all diplomatic clearances. Current Reduced Vertical Separation Minimums (RVSM) and Required Navigation Performance (RNP) procedures and standards shall be reviewed prior to flight.

Additional details regarding international flight operations can be found in Appendix A.

7.0 CREW DUTY LIMITATIONS

7.1 GENERAL

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. 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.

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

7.2 CREW REST

Crew rest is required for all primary aircraft crewmembers. 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. 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.

7.3 WAIVERS

Center policy permits the FRSC Director to extend crew duty time to 16 hours in exceptional circumstances.

8.0 AIRCRAFT RESEARCH EXPERIMENTS

8.1 GENERAL

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.

8.2 AIRCRAFT RESEARCH EXPERIMENT INITIATION

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

8.3 CHANGES TO AIRCRAFT RESEARCH EXPERIMENT DEFINITION

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

8.4 SAFETY REVIEWS

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:

- Procedures
- Chase
- Photography
- Airworthiness
- Communications
- Minimum test crew
- Documentation of tested flight envelope
- Emergency equipment (parachutes, flotation devices, helmets, etc.)

8.5 AIRCRAFT MODIFICATION AND DOCUMENTATION

When a new experiment has been approved, any modifications to LaRC aircraft, aircraft systems, aircraft research systems, or software requires the submittal of the appropriate request for implementation, review, approval, and documentation. LaRC aircraft research experiments which 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 (using LaRC aircraft) and LMS-CP-5580 (using non-LaRC aircraft), as appropriate.

8.6 ASRB SAFETY REVIEWS

The Airworthiness and Safety Review Board (ASRB) is a committee of the Executive Safety Board (ESB) as established by CID 1150.2*, Boards, Panels, Committees, Councils and Teams*, which also establishes its charter and membership. 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. 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 Board.

The Chairperson of the ASRB schedules ASRB reviews as required commensurate with the degree of risk involved. See LMS-CP-5580. After all required reviews have been completed successfully, the Chairperson will issue a Flight Safety Release. This release is required prior to the initiation of research flights.

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 Codes OJP and Q is exercised. For LaRC aircraft, the ASRB is the prescribed reviewing authority, regardless of the affiliation of personnel and heritage of the equipment aboard.

8.7 SYSTEM SAFETY

8.7.1 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. An Airworthiness Engineer (from the Flight Systems Safety Office), an Operations Engineer (from the Flight Operations Branch), designated system

safety professionals from OSMA, and any other experts deemed appropriate, assist the Principal Investigator or lead researcher in this effort. The ASO and an Airworthiness Engineer serve as consultants and final reviewers of the hazard analyses prior to its presentation to the ASRB. 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*.)

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

- Hazard reporting and resolution
- Assignment of safety responsibilities
- System safety milestones and schedules
- System safety interface with other engineering disciplines
- System safety tasks to be performed, such as:
  - Testing
  - Hazard analysis and risk assessment
  - Configuration management

The fundamental premise of system safety and the Aviation Safety Program at LaRC is that hazards will be reduced to the lowest, practical level. The first goal is to effect a design that eliminates hazards. If this is not possible, safety devices should be incorporated to prevent or ameliorate consequences of hazardous situations. If safety devices cannot adequately accomplish the objective, warning devices should be incorporated. This risk reduction process is applied as a fundamental risk management tenet of every LaRC aircraft research experiment.

8.8 HAZARD ANALYSIS & DOCUMENTATION

8.8.1 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.

- Hazard Analysis Process – It is a Principal Investigator or lead researcher responsibility to ensure that hazard analyses are conducted and documented, and included as part of the FTOSR. In support of these analyses, flight operations personnel will provide technical expertise and the OSMA 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, FRSC personnel and all other sources of technical expertise as required. 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. The “Flight Research Hazard Analysis," LF 273, is the recommended minimum format for documenting the analysis.

8.8.3 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. The risks associated with death or injury to personnel, or damage to equipment, are managed so that the desired level of safety is maintained. The analyst concentrates on three critical factors when assessing the undesired events - hazard severity and probability of occurrence over a given exposure interval.

8.9 AIRCRAFT MODIFICATIONS

8.9.1 General - This section describes responsibilities and procedure for implementing aircraft research experiments and modifying LaRC aircraft for research purposes. Aircraft owned, leased, or controlled by LaRC receive basic maintenance according to DoD, FAA, manufacturer, or NASA-approved standards which apply to the particular aircraft type, and according to any special standards and procedures recommended by the Head of the Aircraft Services Branch. The maintenance procedures are:

- Recommended, established, and implemented by the Head, ASB
- Approved by the Chief of Research Operations, and
- Documented by the Quality Assurance Office, FRSC.

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

Research equipment modifications are documented by drawings and approved by an operations engineer, an airworthiness engineer, pilots, maintenance, and QA specialists. The *Aircraft Work Order Request and Approval* (LF 432) is used to document and authorize modifications that affect aircraft configuration or interfaces with the basic aircraft systems. 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.

8.9.2 Aircraft Classification – All NASA aircraft are “public aircraft” as defined by 49 U.S.C. 40102 (a)(37). However, all public aircraft that are used for passenger transport are considered as civil aircraft when doing so and must be operated and maintained under specific classification (i.e., Federal Aviation Regulations, Parts 91, 23 or 25, etc.). Therefore, LaRC aircraft are subject to the LaRC work order process, and the FAA processes for configuration changes, equipment certification, etc. (For specific details regarding the FAA Form 337 process, contact the ASB or the Airworthiness Engineer(s). Generally, the process can be carried out internal to FRSC.)

8.10 AIRCRAFT WORK ORDER REQUEST AND APPROVAL (ref LMS-CP-0910, *Process Aircraft Work Orders*)

Modifications to aircraft and aircraft systems under the control of FRSC are initiated by the submission of an *Aircraft Work Order Request and Approval* (LF 432). 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 AWO may be written to replace the original. Once the AWO passes the QAO, however, an "Aircraft Work Order Change Request" is used to change or cancel any work already approved by the original AWO.

The AWO 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 Engineer(s) and QAO must be notified of the change(s) and approve them prior to implementation.

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. The signature and approval of the Airworthiness Engineer signifies that the redlined drawings represent the as-built configuration. Those drawings may now be officially modified to reflect that configuration. The QAO files the original of the completed work order in the aircraft files. The Airworthiness Engineer logs the work order as complete and verifies that any modification made since original approval are correct and documented. Communication of completion may be sent to the Principal Investigator or lead researcher upon request.

8.11 AIRCRAFT WORK ORDER CHANGE REQUEST

Changes to an open AWO are accomplished with an "Aircraft Work Order Change Request". The request follows the same approval process as described above and represents a complete re-issuance of the original AWO. A marker in the margins indicates any change to the work requested. Once the change is approved, the original AWO is signed off as "revised per Change ‘X’" and sent back through the system. The change request remains with the aircraft crew chief until the work is

finished. The Request also is used for the cancellation of an AWO. A continuation is to be used if additional space is required.

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

Changes to the aircraft research systems are accomplished with an Experimental Systems Work Request (ESWR), LF 436. 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). This process may require the use of an Aircraft Work Order (LF 432, LMS-CP-0910) if the requested changes require aircraft modifications. ESWR tracking numbers are assigned by the originating organizations and are filed with AEB. Additionally, ESWR's are logged and tracked by Airworthiness Engineer(s) to help prevent duplication of identification numbers and to help ensure closure.

8.13 STRESS ANALYSIS

Generally, any experimental modification to LaRC aircraft will require some form of stress analysis to establish that applicable design criteria have been met or maintained. The required stress analysis and any drawings referenced by the analysis should be submitted to the cognizant Airworthiness Engineer(s) prior to, or concurrent with, the submittal of the associated Aircraft Work Order (LF 432, ref LMS-CP-0910). 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).

Any analysis shall be written in English and is to be complete and sufficiently comprehensive as to require no further explanation. Analyses may be handwritten, but must be legible and easily reproducible by photocopier and mass storage technology. The first several pages of a stress analysis should follow the recommended general format outlined below:

- Cover Sheet
- NASA Signature Sheet
- Revision Sheet (if applicable)
- Contractor Signature Sheet (if applicable)
- Table of Contents
- Introduction
- Summary of Critical Factors of Safety
- Drawing List
- General Diagram(s)
- General Loading Description

Each analysis shall contain free body diagrams, statements of assumptions, and section and material properties. General equations and their sources are to be

given before substitution of numerical values. 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.

8.14 SOFTWARE

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. Lockdown is established when developmental activity is coming to an end and the research experiment is about to commence. Before lockdown, software may be delivered to the aircraft without tracking or approval. After lockdown, software is delivered with the LF 238, *Software Delivery*, and the ESWR, LF 436. Lockdown ends upon the completion of the aircraft research experiment. See LMS-CP-0960, Appendix B2.

AirSC development of any software required for flight or control of flight processes, or for research systems is discussed in detail in the Appendix.

8.15 AIRWORTHINESS GUIDELINES

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. 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. The Airworthiness Engineer(s) and the QAO will establish these guidelines in response to requirements formulation per LMS-0960.

Table 8.3
Airworthiness Guidelines and Standards

Flight Critical	Mission Critical	System Critical
▪ MIL-STD 810 *or* RTCA DO-160A-80 ▪ FAR 21 ▪ FAR 23 *or* 25 *or* 27 *or* 29 ▪ FAA AC 43.13-1B/2A *or* T.O. 1-1A-1 through -14 *or* OEM (Manufacturer Airframe Maintenance Manual) ▪ SEPG 100.4	▪ FAR 21 ▪ FAA AC 43.13-1B/2A *or* T.O. 1-1A-1 through -14 *or* OEM ▪ MIL-STD 810 *or* RTCA DO-160A-80 ▪ SEPG 100.3 or 100.2	▪ FAA AC 43.13-1B/2A *or* T.O. 1-1A-1 through -14 *or* OEM ▪ UL Std. ▪ ANSI ▪ SAE ▪ SEPG 100.2 or 100.1

NOTE: The latest version of each reference shall be governing.

Additional clarification of these specifications and guidelines for detailed considerations such as fasteners, material certification, wiring, etc. may be obtained from the Airworthiness Engineer(s) and/or the Quality Assurance Office.

8.16 MODIFICATION, OPERATION, AND SYSTEM CLASSIFICATIONS

All aircraft modifications, systems, and operations will be classified by the Airworthiness Engineer(s) as to function and purpose in order to establish safety guidelines. This determination will take into account both the equipment and operation immediately being addressed. It also considers 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. Thus, 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"). Consultations with technical experts within all elements of FRSC, other LaRC organizational units, other NASA centers, DoD and private industry may be made for these determinations. Early consultation with Airworthiness Engineer(s) for the determination of the appropriate airworthiness guidelines is imperative for each activity undertaken. These guidelines are classified in three broad categories:

- **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 risk significantly greater 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 Engineer(s), the Flight Operations Branch, and QAO.

- **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.

- **System Critical:** Any aircraft modification, system installation, or operation which, if incurring a failure during use, would prevent the accomplishment of only a portion of a research mission or operational objectives, and not affect any other component, system or operation. Elements defined within this category will be short-term, and will use the least stringent guidelines for equipment certification, installation, and operation.

9.0 MISSION MANAGEMENT OPERATIONS

9.1 GENERAL

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.

9.2 AIRCRAFT

Only aircraft specifically approved by the Headquarters Aircraft Management Office (Code OJP) and certificated by the FAA to carry passengers may be used for Mission Management Flights.

9.3 REQUIREMENTS

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

9.3.2 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.

9.3.3 Senior Passenger - The senior passenger on Mission Management flights will be responsible for determining whether the passenger manifest is complete prior to flight.

9.3.4 Cost Comparison - Each Mission Management flight request must be accompanied by a cost comparison with commercial transportation. Mission Management flights are conducted only in FAA Certificated aircraft. Since Mission Management flights represent only a small portion of the overall use of these LaRC aircraft, only the fuel costs for each aircraft will be used in cost comparisons. If other costs specifically can be identified with a Mission Management flight, such as use of an additional contractor crew, these costs will be included in the comparison.

9.3.5 Records - The FRSC Office is responsible for retaining records of all Mission Management flights for a period of two years. The records must include:

- Aircraft used
- Flight dates
- Justification for the request
- Itinerary
- Names of flight crew
- Names of all passengers and legs flown
- Cost comparison

The Chief of Research Operations (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.

10.0 ACQUISITION, DISPOSITION OF AIRCRAFT

10.1 AIRCRAFT ACQUISITION

Acquisition of aircraft at LaRC will be in accordance with NASA HQ and Federal agency acquisition regulations and guidelines. Each aircraft for which for operational use is planned will be acquired through the acquisition process described in NPR 7900.3. 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. FAA registration also will be accomplished appropriately.

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

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 operating codes and Code J. 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. Aircraft so acquired will be entered into NEMS, but need not be reported to NASA Headquarters or GSA as active aircraft.

10.2 AIRCRAFT DISPOSITION

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. 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. 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. Loaned aircraft will utilize the termination of loan process to return assets. Owned aircraft will first be surveyed through the Agency for requirement, then, with Code OJP 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. 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 demilled. All planned aircraft dispositions will be coordinated with Headquarters Code J prior to final disposition.

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

A. APPENDIX A: INTERNATIONAL FLIGHT OPERATIONS

Advanced planning is the key to uneventful foreign operations. It is the joint responsibility of FRSC management and the Pilot in Command to assure the success of the trip. Typical considerations include:

- Route Planning and Flight Information Documents - Flight planning services should be used whenever possible for every international flight for route, weather and NOTAM services.

- Personal Documentation - Requirements for most countries likely to be visited are contained in the International Flight Information Manual 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.

- Aircraft Documentation - Aircraft and engine log books, noise certificate, MNPS/RVSM approval letter, and insurance certification must be carried in addition to all the normal documentation.

- 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 NASA Headquarters (Code I) coordination with embassies.

- Aircraft Handling Agents - The use of a handling agent for all but the most routine international destinations is highly recommended.

- Foreign User Charges/Fees - These charges may require cash or letters of credit; the handling agent should be consulted.

A.1 RESPONSIBILITIES FOR INTERNATIONAL DEPLOYMENT

A.1.1 <u>Flight Operations Branch</u> - Obtain or confirm:

- Applicable flight information publications (FLIPS)/Jeppesen Charts
- Diplomatic clearances for entry and overflight (Code I)
- U.S. military base use permission/PPR numbers
- International Flight Information Manual, USAF Foreign Clearance Guide, and ICAO rules and procedures
- Certificate of aircraft ownership/NASA registration/airworthiness certificates/noise certificates
- Insurance certificates (If required)
- Customs, immigration and agricultural forms
- Credit cards, carnets, letters of credit, travelers checks and cash
- Trip itinerary and passenger manifest
- MNPS/RVSM Certification (aircraft and crew)

- Ground handling services
- NASA and U.S. State Department security briefings, as appropriate
- Immunizations and records
- Passport and documentation

A.1.2 Aircraft Services Branch - Ensure the aircraft has enough time/cycles remaining to complete the flight prior to any required inspections that may come due. An aircraft pack-up kit will be prepared to include the following:

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

A.1.3 Crewmembers - Ensure they have the following:

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

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.

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.

The flight crew will be responsible for ensuring aircraft security by adhering to the following procedures:

- When away from home base, close and lock the entrance door when leaving the vicinity of the aircraft. Set Secura-Plane system, if equipped.

- No visitors will be allowed on board the aircraft without a crewmember present.
- 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.
- 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.
- In the event a situation arises that raises the crew's suspicions, report the facts to the nearest police or government authority.
- 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.
- 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)

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 include:

A.2.1 <u>For Unrestricted Operation in the North Atlantic Route System</u>

A.2.1.1 *Required* - Minimum Navigation Performance Standard (MNPS) certification of aircraft and crew for operation between FL285 and FL420 in MNPS airspace:

- Aircraft MNPS certification requires navigation performance to meet RNP-12.6 standard (2-IRS's or 2-GPS's)
- Crew must receive training in MNPS procedures (included in Flight Safety "International Procedures- Initial" course
- Letter of Authorization (normally combined with RVSM certification letter)
- Notification of MNPS qualification to authorities

A.2.1.2 *Required* - Reduced Vertical Separation Minimum (RVSM) certification of aircraft and crew for operation between FL290 and FL410.

- Aircraft RVSM certification - Boeing Service Bulletin
- Crew must receive training in RVSM procedures (included in Flight Safety "International Procedures- Initial" course)
- Letter of Authorization (renewed every two years)
- Notification of RVSM qualification to authorities for insertion into ICAO database

A.2.1.3 *Required* - One HF radio and one VHF radio (two HF's if on random route)

A.2.1.4 *Required* - Adequate maritime survival equipment per FAR's

A.2.1.5 *Recommended* - Two HF radios with SELCAL

A.2.1.6 *Recommended* - Upgrades for ETOPS operation (extended range, not required for FAR Part 91 operations)

A.2.2 For Limited Operation in the North Atlantic Area

A.2.2.1 *Required* - Must have MNPS certification if operating between FL285 and FL420. (Can operate below FL285 without MNPS certification on random routes)

A.2.2.2 *Required* - Notification of MNPS qualification to authorities

A.2.2.3 *Other Considerations* -

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

A.2.3 For Unrestricted Operation in Europe

A.2.3.1 *Required* - Must meet RNP-5 when above FL95 (Normally accomplished with 2 IRS's with Navaid updates, or 2 GPS's)

A.2.3.2 *Required* - 8.33 KHz spacing VHF radios (FM interference shielded)

A.2.3.3 *Required* - Noise Certificate (Stage III)

A.2.3.4 *Required* - Airworthiness Certificate

A.2.3.5 *Required* - Registration

A.2.3.6 *Required* - RVSM in effect for FL290 to FL 410

A.2.3.7 *Required* - Letter of Authorization for RVSM

A.2.3.8 *Required* - Notification of RVSM qualification to authorities

A.2.3.9. *Required* – Traffic Collision Avoidance System (TCAS) II equipment required

A.2.4 For Unrestricted Operation in the Pacific

A.2.4.1 *Required* - RNP-10 Navigation performance (B-757 is restricted to 6.2 hours of NAV mode operation without Navaid updating

A.2.4.2 *Required* - RVSM certification

A.2.4.3 *Required* - HF radios

A.2.4.4 *Required* - Adequate maritime survival equipment per FAR's

A.2.4.5 *Required* - Letter of Authorization if in RVSM airspace

A.2.4.6 *Required* - Notification of RVSM qualification to authorities

A.2.4.7 *Recommended* - Two HF radios with SELCAL

A.2.4.8 *Recommended* - ER upgrades for extended ETOPS range (Not required for FAR Part 91 Operations)

A.2.5 For Unrestricted Operation in the Western Atlantic Track Route System (WATRS):

A.2.5.1 *Required* - Letter of Authorization for RVSM

A.2.5.2 *Required* - Notification of RVSM qualification to authorities

A.3 REFERENCES and REVISION CHANGES

A.3.1 FAA Interim Guidance (IG) 91-RVSM (Change 1, 6/30/99) - This document was developed in ICAO sponsored international working groups to provide guidance on airworthiness and operations programs for RVSM. ICAO has recommended that State Civil Aviation Authorities use IG 91-RVSM or an equivalent State document for approval of aircraft and operators to conduct RVSM operations.

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 in European, Pacific, and North Atlantic FIR's.

A.3.3.3 Verify that the airframe is RVSM approved.

A.3.3.4 Determine if any operating restrictions apply to the aircraft for RVSM operations (e.g., speed or altitude limitations).

A.3.3.5 Check the MEL for system requirements related to RVSM

A.3.3.6 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.

A.3.3.7 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.3.3.8 Determine if TCAS is operational. (TCAS is recommended, but not required for RVSM operations).

A.3.3.9 FLIGHT OF NON-RVSM COMPLIANT AIRCRAFT - The PIC must comply with ATC requirements for flight of non-RVSM compliant aircraft for maintenance, aircraft delivery or humanitarian flights.

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.3.4.2 *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 captain 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 and is not required for dispatch into RVSM airspace; however, TCAS enhances operational safety by enhancing pilot situational awareness and by providing a system for collision avoidance.

Note: aircraft are required to be equipped with TCAS to operate in certain areas (such as the U.S.); 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 positioning the aircraft at 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 AIP's, NOTAMS and other appropriate documents.

A.3.5 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:

- Two independent primary altimetry systems
- One automatic altitude control system
- One altitude alerting device

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 captain 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 IG 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:

- Continue with original ATC clearance if ATC can apply an alternate form of separation (i.e., lateral, longitudinal or 2,000 ft vertical separation).

- Request ATC clearance to climb above or descend below RVSM airspace if ATC cannot provide adequate separation from other aircraft.

- 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.

B. APPENDIX B: SOFTWARE DELIVERY, RECEIPT AND CHECKOUT

This appendix details the process for delivering research software to the research aircraft at LaRC. The software includes those developed by the Flight Research Services Competency/Flight Simulation and Software Branch (FRSC/FSSB), 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. Personnel in FRSC/FSSB, FRSC/AEB and FRSC Flight Operations Branch operate the research systems on the airplanes.

B.1 LIMITATION

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.2 Documentation Delivery

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

- Software objective
- Software file listing
- Software Test Plan
- Software Pre-flight Procedure
- Software Start-up and Reset Procedures
- Software Configuration Management Procedure

B.3 Code Delivery

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 (QA) Office. 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:

- Use LaRC Form (LF) 238 for software to be delivered to the research airplanes.
- Check a box to indicate that the software is either FRSC/FSSB developed, researcher-provided, or Data Acquisition System related.
- 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.
- For software to be hosted on the research computers aboard aircraft:

  - Select choice of delivery media, i.e. CD, disk, or tape.
  - Provide the LF 238 with:
    - Software title
    - Software provider (name of company/university)
    - Contract/grant/agreement type and number
    - Version number
    - Delivery date
    - Number of CDs, disks, or tapes needed for the software to be delivered
  - Provide two copies of software in the media of choice.
  - Label each media copy with software title and version number.
  - Label each media copy with "QA" or "Aircraft".

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

- 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.
- 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.
- Deliver the LF 238 and two copies of software media to the Software Manager.
- For any software change after initial delivery, follow the above procedure.

B.4 SOFTWARE MEDIA CONTENT

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

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

B.5 FUNCTIONAL RESPONSIBLITIES IN THE DELIVERY PROCESS

B.5.1 <u>NASA LaRC Point of Contact</u> - 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.5.2 Software Manager - A civil service employee in FRSC/FSSB who has responsibility to coordinate and accept delivery of software from FRSC/FSSB, researchers, and DAS for various experiments. The Software Manager also ensures that any software accepted for flight is also delivered to the Quality Assurance Office, notify the cognizant Airworthiness Engineer 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.5.3 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.5.4 Flight Operations Branch/FRSC - An Operations Engineer within 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.5.5 QAO/FRSC – This office has the responsibility to maintain a ground copy of any software delivered to the aircrafts for accident investigation and recovery purposes.

B.5.6 Software Operator - An employee who is responsible to pre-flight the software before each flight and/or operate the software during flights.

B.5.7 Integration System Engineer – A civil service employee in FRSC/FSSB or AEB who is responsible to monitor and ensure that overall research system pre-flight and checkout is appropriately completed before each flight.

B.6 SOFTWARE ACCEPTANCE AND APPROVAL FOR FLIGHT

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

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 QAO, Pilots, and Operations Engineers from the Flight Operations Branch, Airworthiness Engineer(s), and researchers. 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. 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. 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. The EWSR number(s) should be referenced on the software delivery form in the “title” field. Once software is delivered, it may then be installed on the subsystem.

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

- ESWR Submission by the software provider with the following fields completed:
  - System or Aircraft Designation – Name of experiment
  - Subsystem – Title found on software delivery form
  - Requested By – PI of experiment
  - Description of work to be done should include the following:
    - Identification of requirement change or software deficiency
    - Proposed or actual software modification
    - Affected software and associated hardware systems (provide affected files)

- Software Manager assigns an ESWR number.
- Acceptance and approval of ESWR by having Software Manager obtaining signatures from the following:
  - Systems Engineer (FRSC/FSSB or AEB Integration System Engineer)
  - Configuration Manager (sign after the change is approved at the preflight briefing)
  - QA or a Software QA designee

- Software Manager oversees or witnesses the installation and test.
- During the preflight briefing, discuss and obtain approval of change implementation. Post implementation acceptance includes the completion of the following:
  - Affected source files, object files, and executables
    - Source line differences with comments
    - Statement of planned validation test
  - “Work Completed” box ("Work Completed" is understood to mean "initial installation completed" or "ready to proceed to functional test.")
    - Signatures from Software Manager and QAO or a Software QA designee
  - “Functional Test” box (One could argue that work is not really complete until the installed item is demonstrated to work, i.e. functionally checked.)
    - Signatures from Software Manager and QAO or a Software QA designee
  - “ESWR Completed” box
    - Signatures from integration system engineer (hardware) and Airworthiness Engineer.
  - Put new version number for the software module specified at the “Subsystem” field on the “Remarks” field.

- After the preflight briefing, the Software Manager ensures that any software accepted for flight is delivered to the QA Office, a copy of the ESWR LF 436 and

Software Delivery LF 238 are delivered to the Airworthiness Engineer(s), as well as logging and filing the LF 436, “Experimental Systems Work Request” (ESWR) in the Software ESWR Log Book.

C. APPENDIX C: DEFINITIONS OF TERMS

Aircraft Crew (member): Aircraft crewmembers are necessary for the operation of the aircraft and its systems. This includes flight deck personnel, aircraft or ground systems maintenance personnel, test director and cabin safety attendants.

Aircraft Modification for Research: Any alteration, addition or removal of aircraft structure, components equipment or instrumentation.

Airworthiness: The ability of an aircraft in a known and approved configuration to operate safely within a defined flight envelope.

Experimental Aircraft: Research aircraft that have not completed an envelope expansion

LaRC Aircraft: Aircraft that are, or will be, owned by, assigned to, leased by, or operated by or for LaRC.

Maintenance Test Flight: Any flight of an aircraft for which the sole purpose is routine maintenance or checkout.

MIL-STD: Military Standard

Mission Management Flights/Aircraft: Flights/aircraft used primarily to transport management and staff personnel to provide direction, coordination and oversight in support of NASA's mission.

Mission: Any flight of an aircraft for purposes other than routine maintenance or pilot proficiency.

Proficiency Flight: A flight of an aircraft for which a purpose is pilot proficiency or currency.

Program Support Flight/Aircraft: A flight/aircraft primarily in direct support of NASA programs and projects including, but not limited to, science applications, special-purpose cargo aircraft, range surveillance, microgravity research, launch security, search and rescue, chase, support of tracking and remotely located sites, and pilot proficiency (including cross-country).

Research Aircraft: Aircraft used primarily for research and development of aircraft systems and operations, applications, the study of the atmosphere and space-oriented programs.

Research Crew (member): Research crewmembers are required for research systems operation or monitoring, or for any other activity directly related to the acquisition of data for the accomplishment of the research objective(s).

Training Flight: Any flight of an aircraft for routine or specialized crew training.

D. APPENDIX D: DEFINITIONS OF ACRONYMS

AD	Airworthiness Directive
AE	Airworthiness Engineer
AEB	Aircraft Engineering Branch
FRSD	Flight Research Services Directorate
AMS	Aerospace Mechanical Systems
ARIES	Airborne Research Integrated Experiment System (B-757)
ASB	Aircraft Services Branch
ASO	Aviation Safety Officer
ASRB	Airworthiness & Safety Review Board
ASWG	Aviation Safety Working Group
ATC	Air Traffic Control
AWO	Aircraft Work Order
BFR	Biennial Flight Review
DoD	Department of Defense
ESWR	Experimental Systems Work Request
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCF	Functional Check Flight
FLIP	Flight Information Publication
FOB	Flight Operations Branch
FRPO	Flight Research Projects Office
FSSB	Flight Simulation and Software Branch
FSSO	Flight Systems Safety Office
FOSC	Flight Operations Support Center
FTOSR	Flight Test Operations and Safety Report
GSO	Ground Safety Officer
ICAO	International Civil Aviation Organization
ICF	Instrument Check Flight
IMC	Instrument Meteorological Conditions
IFR	Instrument Flight Rules
IP	Instructor Pilot
LAFB/LFI	Langley Air Force Base/Langley Field International
LAPD	Langley Research Center Policy Directive
LPR	Langley Research Center Procedural Requirements
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
NOTAM	Notice to Airmen
MAB	Mission Assurance Branch
SMAO	Safety & Mission Assurance Office
OUM	Organizational Unit Manager

PE/PI	Project Engineer/Principle Investigator
PIC	Pilot in Command
QAB	Quality Assurance Branch
RAC	Risk Assessment Code
RNP	Required Navigational Performance
RTCA	Radio Technical Commission for Aeronautics
RVSM	Reduced Vertical Separation Minimum
SED	Systems Engineering Directorate
SIC	(Pilot) Second in Command
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions