Goddard Procedural Requirements (GPR)

DIRECTIVE NO.	GPR 7900.1	**APPROVED BY Signature:**	*Original Signed by*
EFFECTIVE DATE:	March 22, 2016	**NAME:**	William A. Wrobel
EXPIRATION DATE:	March 22, 2021	**TITLE:**	Director of Wallops Flight Facility

COMPLIANCE IS MANDATORY

Responsible Office: 830/Aircraft Office

Title: Airworthiness and Flight Safety Review Process for Manned Aircraft and Unmanned Aerial Systems

PREFACE

P.1 PURPOSE

To establish requirements, responsibilities, and procedures for conducting airworthiness and flight safety oversight for NASA Goddard Space Flight Center (GSFC) manned aircraft and Unmanned Aerial Systems (UAS).

P.2 APPLICABILITY

This directive applies to:

a. All NASA aircraft including UAS and their subsystems.
b. Modifications of NASA aircraft/UAS or subsystems, including hardware, firmware, and software; flight envelopes; and operation. This includes, but is not limited to, stores and store suspension equipment, aviation life support systems (ALSS) utilization, and airborne and surface based components of UAS.
c. Any NASA GSFC owned or leased aircraft/UAS operated at a NASA or non-NASA-owned range.
d. Commercial Air Services (CAS) operated as a public use aircraft/UAS, under NASA contract and in direct support to NASA.
e. Non-NASA public and civil aircraft/UAS test operations conducted at a NASA GSFC facility (this does not include transient flights of manned aircraft where there is no intent to conduct test operations).

P.3 AUTHORITIES

NPR 7900.3, Aircraft Operations Management Manual
GPR 7900.0, Aviation Safety Program

P.4 APPLICABLE DOCUMENTS AND FORMS

a. Title 14, Code of Federal Regulations (CFR)
b. Title 49 United States Code (USC), including Sections 40102 and 40125
d. NPD 7900.4, NASA Aircraft Operations Management
e. NPR 7900.3, Aircraft Operations Management Manual
f. NPR 8715.5, Range Flight Safety Program
g. GPR 7900.0, Aviation Safety Program
i. 830-FOM-0001, Flight Operations Manual
j. 830-FOM-0002, UAS Flight Operations Manual
k. 830-GMM-0002, General Maintenance Manual
l. 830-TPP-0001, Test Plan and Deficiency Reporting Policy
m. 830-AERP-001, Aircraft / UAS Engineering Review Process
n. FAA, AFS-80, Public Unmanned Aircraft Systems Operational and Certification Requirements
o. RSM 2002, Range Safety Manual for NASA GSFC/WFF

P.5 CANCELLATION

800-PG-1060.2.2A Airworthiness Review Process

P.6 SAFETY

N/A

P.7 TRAINING

N/A

P.8 RECORDS

Record Title	Record Custodian	Retention
Airworthiness Flight Test Plan	Code 830 Record Custodian (RC)	*NRRS 1/14 B1 (a) Permanent Retire to FRC when 2 years old. Transfer to the National Archives when 20 years old.
Deficiency Report	Code 830 RC	NRRS 1/14 B1(a)
Letter of Determination	Code 830 RC	NRRS 1/14 B1(a)
Flight Release	Code 830 RC	NRRS 1/14 B1(a)
Airworthiness Certificate	Code 830 RC	NRRS 1/14 B1(a)

Engineering Data Requirements Agreement Plan (EDRAP)	Code 830 RC	NRRS 1/14 B1(a)
AFSRB TIM minutes	Code 830 RC	NRRS 1/14 B1(a)
AFSRB FRR Minutes	Code 830 RC	NRRS 1/14 B1(a)
AFSRB MRR Minutes	Code 830 RC	NRRS 1/14 B1(a)

**NRRS – NASA Records Retention Schedules (NRRS 1441.1)*

P.9 MEASUREMENT/VERIFICATION

Per NPR 7900.3, process compliance will be measured during the biennial Inter-center Aircraft Operations Panel (IAOP) review.

PROCEDURES

In this document, a requirement is identified by "shall," a good practice by "should," permission by "may" or "can," expectation by "will," and descriptive material by "is."

1.0 BACKGROUND

1.1 Public vs. Civil Aircraft

Aircraft in the United States (U.S.) are divided into two categories:

1.1.1. The term *Public Aircraft* is defined by 49 U.S.C. §40102 (a)(41) as:

> *An aircraft that is not used for commercial purposes and is; (A) Except with respect to an aircraft described in subparagraph (E), an aircraft used only for the United States Government, except as provided in section 40125 (b); (B) An aircraft owned by the Government and operated by any person for purposes related to crew training, equipment development, or demonstration, except as provided in section 40125 (b); (C) An aircraft owned and operated by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments, except as provided in section 40125 (b); (D) An aircraft exclusively leased for at least 90 continuous days by the government of a State, the District of Columbia, or a territory or possession of the United States or a political subdivision of one of these governments, except as provided in section 40125 (b). (E) An aircraft owned or operated by the armed forces or chartered to provide transportation or other commercial air service to the armed forces under the conditions specified by section 40125 (c). In the preceding sentence the term "other commercial air service" means an aircraft operation that (i) is within the United*

States territorial airspace; (ii) the Administrator of the Federal Aviation Administration determines is available for compensation or hire to the public, and (iii) must comply with all applicable civil aircraft rules under title 14, Code of Federation Regulations.

1.1.2 Civil Aircraft is defined as "any aircraft, other than public aircraft", per 49 U.S.C. 40102(a)(16). The Federal Aviation Administration (FAA) has airworthiness and operational oversight responsibility for all civil aircraft. In addition to providing technical and safety oversight, this responsibility includes providing licensing for pilots / mechanics, and approving designs, procedures and flight envelopes.

2.0 POLICY REQUIREMENTS

NASA aircraft/UAS are normally exempt from FAA airworthiness procedures because these aircraft are classified as "public aircraft." This document establishes the procedures for conducting NASA GSFC airworthiness and flight safety oversight.

2.1 General Airworthiness Policy

NASA GSFC / WFF Code 830 is responsible for the acquisition, integration, support, and development of NASA GSFC aircraft/UAS flown in support of NASA project objectives. Due to the myriad of unique project requirements, NASA aircraft/UAS frequently undergo configuration changes and/or expansions of the operational flight envelope. At each step, from first flight through retirement of the platform, airworthiness, flight safety and project risk shall be understood and documented by a NASA airworthiness certificate and if applicable, a flight release.

2.1.1 Airworthiness. Per NPR 7900.3, airworthiness is the capability of an aircraft to be operated within a prescribed flight envelope in a safe manner. All manned aircraft shall be airworthy. Unmanned aerial systems may have a lower level of inherent airworthiness and a higher probability of loss than manned aircraft. As such, UAS have been classified into three major categories, (see Section 3.2) so that the appropriate level of airworthiness criteria, engineering standards, and data requirements can be established.

2.1.2 Safety of Flight (SOF). SOF determines the property of an air system configuration to safely attain, sustain and terminate ("complete" in case of UAS) flight, within prescribed and accepted risk limits for injury/death to personnel, damage to equipment, property and/or environment. The intent of assessing SOF is to show that the level of risk has been appropriately identified by the Airworthiness and Flight Safety Review Board (AFSRB) and accepted by the approval authority. All NASA manned and unmanned aircraft systems shall be safe for flight within acceptable levels of risk defined by the processes in this document and GPR 7900.0, *Aviation Safety Program.*

2.2 Airworthiness Certificate Applicability

An airworthiness certificate is valid only for the specific configurations and flight envelope specified in the flight manual or flight release. Any change to the specified configuration requires the issuance of a flight release approving the new configuration.

2.3 Thresholds for Requiring an Airworthiness Certificate

For manned or unmanned fixed wing aircraft, the threshold for the requirement for an airworthiness certificate and flight release is when there is intent for flight or the potential for flight exists, as in the case of high-speed taxi. For manned and unmanned rotary wing or tilt-rotor aircraft, the threshold for the requirement of an airworthiness certificate is engagement/turning of rotors at a revolutions per minute (RPM) setting that is within 30% of that required to sustain flight.

2.4 Authority to Modify

The Chairman of the AFSRB shall be the only authority authorized to approve modification of NASA aeronautical equipment for the purposes of flight.

2.5 Other Supporting Certification Data

To minimize duplicative effort, the Airworthiness and Flight Safety Review (AFSR) process may utilize data from the Original Equipment Manufacturer (OEM) and other airworthiness certification agencies, such as the FAA, U.S. Air Force (USAF), U.S. Army (USA), U.S. Coast Guard (USCG), U.S. Navy (USN), and the Department of Homeland Security (DHS) to the maximum extent possible to establish airworthiness and equipment limitations for commercially-derived or public aircraft/UAS purchased/leased/contracted by NASA. All certification data used to establish airworthiness for NASA aircraft shall meet NASA requirements or standards.

2.5.1 Commercial Derivative Aircraft (CDA) Certification Data. Some CDA leased/owned/contracted by NASA will be operated in exactly the same operating envelope and usage spectrum that exists in the commercial environment, while others will have NASA-unique requirements. Issuance of NASA airworthiness certificates for CDA may be based on an FAA-issued Type Inspection Authorization (TIA), Type Certificate (TC), Supplemental Type Certificate (STC), supporting certification data, or a full AFSRB review of risk against NASA-unique usage. NASA-unique usage and support requirements should be clearly stated in the CDA project's documentation or can be cleared through this GPR process. This utilization may include, but is not limited to, training philosophy, maintenance plan, operational envelope, flight profiles, flight manuals and environmental factors.

2.6 Acceptance of Data

It is at the discretion of the Chairman of the AFSRB to accept or not accept airworthiness certification data from another public entity to partially or fully meet NASA airworthiness requirements.

2.7 Non-NASA Public Aircraft/UAS Airworthiness Certification Recommendations.
An airworthiness certification recommendation may be issued for non-NASA aircraft/UAS customers if a formal written agreement has been reached between the customer and NASA. The non-NASA customer shall be a public entity that is seeking NASA's assistance with Title 49 airworthiness and operational certification requirements. In this case, the airworthiness review will be handled in the same manner as for a NASA airworthiness certificate. An airworthiness certification recommendation (including a recommended flight release) will be issued in lieu of an airworthiness certificate to the requesting agency for acceptance and use at their discretion.

2.8 Exclusions
An airworthiness certificate does not:

a. Authorize operation of the aircraft/UAS system.
b. Assign aircraft/UAS or authorize aircrews/operators.
c. Authorize modification of the aircraft/UAS system.
d. Authorize installation of equipment.
e. Guarantee the modification or aircraft/UAS system will perform its intended function.
f. Preclude the need for coordination with the facility range, or airspace controlling authority to conduct operations.
g. Authorize ground or flight testing.

3.0 UAS SPECIFIC POLICY

3.1 Background
UAS vary widely in size, weight, complexity, mission, autonomy, and cost. Airworthiness and flight safety policy for UASs shall accommodate a wide range of air vehicle size and usage. This policy takes into account that UAS carry no personnel onboard, and hence may have a lower level of reliability than manned aircraft. In order to mitigate risk to personnel and property on the ground, or flight outside of pre-planned flight profiles, appropriate restrictions on UAS operations may be placed in the flight release to ensure an overall acceptable level of flight safety. In addition to airworthiness, UAS flight certification and risk acceptance is primarily a function of the area of operation of the air vehicle, with secondary considerations of mass, kinetic energy, cost, usage, and reliability. Consistent with UAS airworthiness certificate category definitions, flight releases may define areas of operation for flight (for instance, authorized to fly only over sparsely populated areas), but should not limit operations to specific ranges or specific restricted areas. Examples of unique flight certification engineering considerations for UAS are included in Appendix C, *UAS Flight Certification Policy Notes and Examples*.

3.2 UAS Airworthiness Certificate Categories
Three categories of UAS airworthiness certificates exist to accommodate the wide spectrum of UAS and the inherent level of airworthiness that each system may exhibit. The general

airworthiness and flight safety review process for all three categories remains the same as for manned aircraft; the engineering design standards, supplied data, and associated system analysis are used to define each category of airworthiness certificate. The Code 830 Chief Engineer (Engineering and Flight Test Discipline Manager), with concurrence from the AFSRB chairman, is responsible for identifying the airworthiness certificate category for the UAS based on the design, supplied data, safety analysis, system analysis and recommendations from the board members and assigned subject matter experts (SME). The airworthiness certificate category and associated language in the flight release will provide guidance to the end user's choice of operating areas. The Code 830 Chief Engineer may elect to identify a "target" system-level mishap rate for the UAS so that the SME can appropriately tailor their airworthiness criteria, engineering standards, and data requirements for a UAS. However, the SME's determination of airworthiness (in their functional area) will be based on compliance with criteria and standards chosen by the SME, rather than adherence to a system-level mishap rate target.

3.2.1 Category-A Airworthiness Certificate. Category-A airworthiness certificates are issued to UAS that intend to regularly operate in all classes of airspace, including those outside of special use airspace. Category-A airworthiness certificates will be based on airworthiness criteria, engineering standards, and data requirements similar to those of manned aircraft, while also taking into account UAS-unique design considerations. Category-A airworthiness certificates are intended primarily for UAS with a maximum take-off weight of 330 pounds (lbs.) and above, but may be issued to UAS of any weight. The engineering SMEs will choose appropriate airworthiness criteria, engineering standards, and data requirements for a Category-A airworthiness certificate such that the level of airworthiness correlates to a system-level mishap rate of no more than 1 loss of UAS per 100,000 flight hours (1E-05 per flight hour); however, determination of airworthiness should be primarily based on compliance with criteria and standards chosen by the SMEs, rather than verification of a system-level mishap rate.

3.2.2 Category-B Airworthiness Certificate. Category-B airworthiness certificates are issued to UAS that intend to regularly operate over areas of low population density or in special use airspace. They do not require the same engineering and data requirements as Category-A airworthiness certificates, but do require a tailored set of airworthiness criteria, engineering standards, and data requirements to ensure the SMEs can determine that the integrity of design and the inherent airworthiness of the system is suitable for flight in the required environment. Because engineering standards and data requirements are less stringent than Category-A airworthiness certificates, additional operating limitations and operating rules may be used to maintain acceptable levels of safety to people and property on the ground. Category-B airworthiness certificates are intended for UAS with maximum take-off weight of less than 330 lbs. but greater than 55 lbs., but may be issued for UAS of any weight. The SMEs will choose appropriate airworthiness criteria, engineering standards, and data requirements for a Category-B airworthiness certificate such that the level of airworthiness correlates to a system-level mishap rate of no more than 1 loss of UAS per 10,000 flight hours (1E-04 per flight hour); however, determination of airworthiness should be primarily based on compliance with criteria and

standards chosen by the SMEs, rather than verification of a system-level mishap rate. Examples of areas where engineering and data requirements can be tailored for UAS airworthiness certificates are listed in Appendix C, *UAS Flight Certification Policy Notes and Examples.*

3.2.3 Category-C Airworthiness Certificate. Category-C airworthiness certificates are issued for UAS that are not designed to accepted engineering standards and/or do not possess adequate engineering data to determine their compliance with accepted standards. As such, Category-C airworthiness certificates are issued with owner/sponsor acknowledgement of a higher probability of loss of the UAS. Category-C airworthiness certificates commonly include stringent operational restrictions to ensure safety to people, environment, and property on the ground. The data requirements for a Category-C airworthiness certificate directly correlate to the proposed operational restrictions, area of operation, and usage of the UAS. Category-C airworthiness certificates are intended primarily for UAS with a maximum take-off weight of 55 lbs. or less, but may be issued to UAS of any weight. Appendix C, *UAS Flight Certification Policy Notes and Examples* provides examples of how Category-C airworthiness certificate data requirements may vary based on the proposed usage of the UAS.

3.2.3.1 Category-C Airworthiness Certificate Unique Responsibilities. Because Category-C airworthiness certificates are issued for UAS that are not designed to accepted standards and/or do not possess data to verify compliance to standards, the following unique considerations exist:

a. The inherent level of airworthiness of the UAS is consistent with the proposed operational restrictions and the limits, warnings, cautions, and notes placed in the flight release by the board members.

b. Technical and/or operational risks have been identified and communicated to the AFSRB members, based on available data and operational restrictions. In some cases, the absence of data in a particular technical area may be identified as a risk.

c. The OEM-issued flight manuals have been reviewed and any discrepancies in the manuals and associated residual risks have been identified to the AFSRB members. For Category C airworthiness certificates, it is presumed that data and procedures in the OEM flight manuals will not be independently verified by the SMEs.

3.3 FAA Certificates of Authorization

In order to fly in the U.S. National Airspace System (NAS) outside of Restricted or Warning Areas, the FAA requires NASA UAS to obtain a Certificate of Authorization (COA). One of the FAA requirements to obtain a COA is an airworthiness statement from the sponsoring agency. For UAS subject to this GPR, a flight release shall serve as the statement of airworthiness to the FAA. UAS possessing a Category-A airworthiness certificate are generally considered airworthy for all COA applications. For UAS with Category-B and Category-C airworthiness certificates, the flight release provided to the FAA shall be consistent with the intended operation proposed in

the COA application (e.g., an airworthiness certificate containing a restriction for flight over sparsely populated areas only may not accompany a COA application to fly over a densely populated area). Appendix C, *UAS Flight Certification Policy Notes and Examples* provides example statements of airworthiness that are inserted in flight releases supporting COA applications.

4.0 FLIGHT CERTIFICATION PROCESS FOR NASA AIRCRAFT/UAS

4.1 General Process

Airworthiness and flight safety oversight at NASA GSFC consists of six core disciplines that are governed by the AFSRB Chairman. Each discipline is managed by a designated board member who is responsible for ensuring that all processes and procedures within their respective discipline are complied with. Additionally, the Chief, Aircraft Office (Chief of Flight Operations) shall nominate and the Director, WFF/Suborbital and Special Orbital Projects Directorate (SSOPD) shall approve a Technical Ex Officio (TExO) for AFSRB membership. The TExO shall be selected from outside Code 830/Aircraft Office in order to provide an independent technical assessment of the proposed operation. Any disagreements (dissenting opinions) between the TExO and AFSRB Chairman shall be adjudicated by the Director, WFF/SSOPD. Appendix E, *Airworthiness and Flight Safety Oversight Structure for NASA Aircraft*, illustrates the AFRSB structure for NASA aircraft, applicable instructions and deliverables that are an output from the AFSRB process. The fundamental review phases are:

a. Technical Interchange
b. Planning and Analysis
c. Flight Readiness Review
d. Interim Flight Release
e. Mission Readiness Review
f. Approval to Proceed
g. Flight Test Execution
h. Finalize Flight Release

4.1.1 Technical Interchange. The local Project Manager will schedule a Technical Interchange Meeting (TIM) with the AFRSB members and the Project Sponsor and/or aircraft/UAS owner. The Project Manager shall develop an agenda and distribute to all project stakeholders. The Project Manager and Project Pilot will brief all agenda items to the board in order to allow the respective discipline managers to gain an understanding of the proposed aircraft / modification and develop a certification strategy. At the completion of the TIM, the AFSRB members shall assign SMEs, if required. Meeting minutes shall be recorded by an individual assigned by the AFSRB Chairman and distributed to all stakeholders.

4.1.1.1 After the TIM is complete, each discipline manager will issue a recommendation to the AFSRB Chairman that states whether their discipline is require during AFSRB oversight of the proposed operation. The purpose of this feature is to streamline the AFSRB process for low-cost and low-risk flight operations. If the AFSRB Chairman concurs, the discipline will be omitted from the AFSRB process with the understanding that doing so will not violate NASA policies or procedures.

4.1.1.2 If necessary, the technical interchange many be conducted over a series of meeting throughout the AFSR Process. The goal is to ensure all project stakeholders have an understanding of the original concept and any anomalies / actions that develop during the project lifecycle. The goal is to promote an atmosphere of informed decision making during each aircraft modification project.

4.1.2 Planning and Analysis

4.1.2.1 Intra-Discipline Planning and Analysis. Sound planning and communication are critical to the successful execution of the AFSR process. Planning activities should be initiated as soon as possible after the technical interchange has been completed and may recur as the project matures. Each discipline manager is responsible for initiating planning and analysis activities within their respective discipline and ensuring compliance with the respective NASA policies, instructions or procedures listed in Appendix E, *Airworthiness and Flight Safety Oversight Structure for NASA Aircraft*. During this phase, managers should identify what project metrics, analyses, documentation, ground testing, and/or flight testing may be required as part of the certification process.

4.1.2.2 Inter-Discipline Planning and Analysis. The Project Manager and Project Pilot shall enable cross-discipline communication in the airworthiness and risk assessment of the aircraft under test. Additionally, the Project Manager, Operations Engineer and Project Pilot shall maintain lines of communication to the Project Sponsor and other stakeholders during the execution of the AFSR process. Disagreements between AFSRB members shall be addressed and adjudicated by the AFSRB Chairman.

4.1.2.3 Data Requirements. Data required to support flight certification shall be determined by the Code 830 Chief Engineer and incorporated into an Engineering Data Requirements Agreement Plan (EDRAP). The EDRAP represents the negotiated written agreement between the Engineering and Flight Test Discipline and the AFSRB chairman. The plan shall contain a detailed description of the engineering data required to establish the system airworthiness with confidence. It should be understood that not all characteristics of a system or planned test can be known well ahead of the system development or test plan development. Therefore some deviation from the original EDRAP agreement should be expected as detailed knowledge of the system or test becomes available. Appendix H, *Information Required for the Determination of Flight Operating Limitations,* contains a list of engineering data that may be required as part of the flight certification process.

4.1.2.4 Deliverables. All discipline deliverables identified in Appendix E, *Airworthiness and Flight Safety Oversight Structure for NASA Aircraft*, shall be completed and submitted to the Project Manager, Operations Engineer, and Project Pilot prior to the Flight Readiness Review (FRR).

4.1.3 Flight Readiness Review. The Project Manager and Project Pilot will review the engineering considerations and data gathered under the EDRAP, as well as, the deliverables from each Discipline Manager. Based upon this information, the Project Manager and Project Pilot will create a draft Interim Flight Release (IFR) with each deliverable included as a reference. The IFR shall be formally presented to the Project Sponsor and AFSRB at the project FRR. During the presentation, each Discipline Manager will brief the project risks, technical concerns and safety issues unique to their discipline. The project manager is responsible for ensuring all NPR 7900.3 FRR requirements are briefed. Final AFSRB approval of the Interim Flight Release is at the discretion of the AFSRB Chairman.

4.1.4 Mission Readiness Review (MRR). If the project includes multi-aircraft operations (similar or dissimilar), a MRR is required by the AFSRB following the FRR. The intent of the MRR is to coordinate activities and discuss risk mitigation strategies that apply to multi-aircraft operations. The Project Manager is responsible for ensuring all NPR 7900.3, MRR requirements are briefed.

4.1.5 Approval to Proceed (ATP). All project risks, technical concerns and safety issues will be presented to the Director, WFF/SSOPD. Final flight approval is at the discretion of the Director, WFF/SSOPD.

4.1.6 Flight Test Execution. The Airworthiness Flight Test Plan shall be executed by qualified personnel in accordance with (IAW) the Flight Operations Manual, (830-FOM-0001, or 830-FOM-0002 for UAS). Aircraft/UAS or subsystem flight test deficiencies shall be documented in accordance with the NASA Test Plan and Deficiency Reporting Policy (830-TPP-001). Any Part I** deficiencies (see Definitions) identified during flight test require the AFSRB to identify the root cause of the deficiency, perform a corrective action and brief the results to the Director, WFF/SSOPD prior to further testing. The Root Cause and Corrective Action (RCCA) investigation is also required for Part I* deficiencies (see Definitions) with the exception that deficiencies shall be corrected prior to operational deployment and the Chairman of the AFSRB is the approval authority.

4.1.7 Finalize Flight Release. Once all Part I* and Part I** deficiencies have been resolved, the Project Manager and Project Pilot will incorporate the remaining deficiencies into the final flight release. The resulting Flight Release shall be signed by the AFSRB chairman.

5.0 NON-NASA PUBLIC AIRCRAFT/UAS OVERSIGHT REQUIREMENTS

5.1 NASA GSFC infrastructure and ranges are frequently utilized by non-NASA public and civil aircraft/UAS to conduct test operations. In the case of civil aircraft, the FAA is legally responsible for conducting airworthiness, operational and safety oversight per Title 14 of the Code of Federal Regulations. For all public aircraft/UAS operations, there is a complete transfer of legal responsibility from the FAA to the certifying entity per Title 49 U.S.C. §§ 40102(a) (41) and 40125. It is important to note that a public entity may choose to operate an aircraft in accordance with Title 14 rather than exercise their Title 49 right. In this case, each aircraft shall have a civil type or airworthiness certificate, maintenance shall be performed by FAA certified mechanics and pilots shall possess FAA issued certificates. In this scenario, the FAA bears airworthiness and operational oversight responsibility for the civil aircraft operation.

5.2 Certain public aircraft/UAS operators such as the U.S. Department of Defense (DoD) have existing internal organizations competent and experienced in the design, airworthiness certification, operation, and maintenance of complex aircraft systems, including UAS. They also have established processes to train and certify pilots and crewmembers. These public aircraft/UAS operators may utilize their existing processes and procedures to independently oversee flight operations conducted at a NASA GSFC facility, with NASA acting in a support role.

5.3 Other public aircraft/UAS operators such as non-DoD federal agencies, state and local government entities, and state colleges and universities may not have existing internal processes or procedures to conduct airworthiness and operational certification. Historically, these entities have operated manned aircraft in accordance with Title 14. If a public entity does not have established internal airworthiness and operational oversight processes and the desired operation is not conducted under Title 14, NASA GSFC shall assume oversight responsibility and execute the Flight Certification Process defined in Section 4, Flight Certification Process for NASA Aircraft/UAS.

5.4 Each non-NASA public entity that wishes to independently oversee public aircraft/UAS operations conducted at a NASA GSFC facility shall have an established airworthiness and operational oversight process. The certifying entity shall submit the following documents to NASA GSFC Code 802/Advanced Projects Office along with their request to operate at a NASA GSFC facility:

a. Organizational processes, procedures or regulations that define airworthiness and operational oversight
b. Statement of airworthiness for the aircraft/article under test
c. COA (for UAS only)
d. Test Plan or Operations Plan

5.4.1 The AFSRB shall review the documents listed above and make a formal determination as to whether the certifying public entity will be allowed to proceed with the planned operation. When making this determination, the AFSRB shall utilize the draft guidance presented in FAA, AFS-80, *Public Unmanned Aircraft Systems Operational and Certification Requirements*. This document was developed by the FAA in collaboration with the U.S. Department of Defense, NASA, and other government UAS operators as part of the FAA Modernization and Reform Act of 2012. Although the document still exists in a draft form, NASA GSFC shall utilize it as a baseline set of requirements that each certifying entity should have in order to conduct independent airworthiness and operational oversight of public aircraft/UAS operations at GSFC (the principals in this document are applicable to organizations overseeing both manned and unmanned operations and NASA shall use it for both applications). It is important to note that the AFSRB is evaluating the certifying entity's airworthiness and operational certification process and not the aircraft/article under test. A diagram of the AFSRB oversight process for non-NASA aircraft is presented in Appendix G, *Airworthiness and Flight Safety Oversight Structure for Non-NASA Aircraft*, and discipline manager responsibilities are defined in Appendix F, *Flight Certification General Process for Non-NASA Aircraft*.

5.4.2 If the AFSRB concurs that the airworthiness and operational certification process defined in the submitted documents meets the intent of the Operational and Certification Requirements guidance, the AFSRB Chairman shall submit a Letter of Determination (LOD) to the Director, WFF/SSOPD stating the board's opinion. Determinations rendered shall be objectionable or non-objectionable. It is important to note that a non-objectionable LOD issued by NASA is not permission nor an endorsement of the proposed operation. For non-objectionable determinations, the project will still undergo a TIM, FRR and ATP, but NASA GSFC will only act in a supportive role to schedule and coordinate the requested range and airfield assets. Technical, safety and operational oversight will reside with the certifying non-NASA entity.

6.0 RESPONSIBILITIES

6.1 Chief, Aircraft Office (also known as Chief of Flight Operations)

The Chief of Flight Operations approves and oversees the processes used to issue airworthiness certificates and empowers all AFSRB personnel. The Chief of Flight Operations is also the RCCA approval authority for Part I* deficiencies.

6.2 AFSRB

The AFSRB is the cross-discipline group of individuals dedicated to the processing, tracking, and issuance of NASA GSFC airworthiness certificates and flight releases. Responsibilities of the AFSRB include:

a. Ensuring that all applicable processes have been followed prior to issuing an airworthiness certificate and flight release.
b. Educating all participants on the AFSRB process.
c. Informing leadership of airworthiness and safety of flight issues.

6.2.1 Specific empowerment levels and/or responsibilities for AFSRB personnel are as follows: AFSRB Chairman.

6.2.1.1 The AFSRB Chairman is appointment by the Director, WFF/SSOPD to oversee airworthiness and flight safety for NASA GSFC aircraft. The board chairman resolves disputes between AFSRB members and presides over the FRR.

The AFSRB Chair shall have the following credentials:
Basic Education: A bachelor's degree or higher from an accredited college or university with major study in one of the following areas: mechanical engineering, aerospace engineering, electrical engineering, computer engineering, civil engineering, systems engineering, physics, mathematics or any of the sub disciplines of each of the listed degrees above (structural engineering, aeronautics, applied physics, etc.)

In addition to the Basic Education Requirement, the AFSRB Chair shall have the following specialized experience: three years of experience in flight and ground test preparation and execution, aircraft in flight evaluation, and a general knowledge of flight control theory, stability and control and systems testing.

6.2.1.2 Aviation Safety. The Aviation Safety Officer (ASO) is responsible for submitting a Mission Operational Risk Assessment Memorandum to the Project Manager prior to the FRR. Additionally, the ASO shall oversee all aspects of aviation safety that pertain to aircraft and UAS operations. The ASO shall work with the Code 830 Chief Engineer and ensure that all flight and ground safety hazards are incorporated into the Airworthiness Test Plan.

6.2.1.3 Safety Office. The Safety Office is responsible for complying with the NPR 8715.5, *Range Flight Safety Program*. Any applicable safety plans shall be submitted to the Project Manager prior to FRR.

6.2.1.4 Business. The Business Manager is responsible for ensuring compliance with the Federal Acquisition Regulations, providing a cost / risk evaluation following the initial TIM and providing a Work Breakdown Schedule (WBS)/Task assessment prior to FRR.

6.2.1.5 Engineering and Flight Test. The Code 830 Chief Engineer manages the Engineering and Flight Test Discipline and is designated as the engineering authority for all NASA GSFC aircraft. The Code 830 Chief Engineer is also responsible for providing a signed project test plan and configuration clearance prior to FRR. The Discipline Manager is also responsible for developing the EDRAP and submitting it to the AFSRB chairman.

6.2.1.6 Airfield. Airfield Discipline is required for all UAS operations and projects that will utilize specialized airfield assets. For the purposed of this directive, "specialized" means equipment or property that is not normally included for routine flight operations. Examples include high speed cameras, water-ingestion pits, radars, telemetry, etc. Airfield representatives shall attend the TIM and FRR, review the project test plan, and ensure compliance with local

airfield policies. An Airfield Readiness Review Memorandum shall be presented at the FRR and included as an enclosure with the Flight Release. The ARR memo indicates readiness to support the proposed mission and that external RF emission within the Wallops Range Complex have been controlled such that they will not interfere with the UAS under test.

6.2.1.7 Maintenance. The Maintenance Manager is responsible for ensuring that the proposed operation is in compliance with the GSFC General Maintenance Manual (830-GMM-002). A GMM Compliance Memo shall be presented at the FRR and included as an enclosure with the Flight Release.

6.3 The Project Manager shall have the following responsibilities:

a. Schedule the TIM, FRR and ATP.
b. Draft the TIM agenda.
c. Take ownership of flight certification actions and priorities.
d. Establish and maintain lines of communication to the customers and stakeholders during the execution of the AFSRB process. NOTE: The Project Sponsor, AFSRB, contractors, SMEs, testers, and the engineering team are all contributors to the success of this process.
e. Draft the Interim Flight Release.
f. Incorporate outstanding flight test deficiencies into final Flight Release.
g. Incorporate all AFSRB deliverables as enclosures to the Flight Release.

6.4 Project Pilot. The Project Pilot assists the Project Manager in executing their assigned duties. Duties requiring project pilot opinion include (but are not limited to); defining project support requirements; assessing technical performance; documenting project risk; drafting security plans, mishap and contingency plans; drafting the flight release.

6.5 TExO

The TExO provides independent technical oversight for all AFSRB activities. Any conflicts between the TExO and AFSRB Chairman shall be adjudicated by the Director, WFF/SSOPD.

6.5.1 The TExO shall have the following credentials:

Basic Education: A bachelor's degree or higher from an accredited college or university with major study in one of the following areas: mechanical engineering, aerospace engineering, electrical engineering, computer engineering, civil engineering, systems engineering, physics, mathematics or any of the sub disciplines of each of the listed degrees above (structural engineering, aeronautics, applied physics, etc.)

In addition to the Basic Education Requirement, the TExO must be selected from management level personnel outside of Code 830 and shall have the following specialized experience on modified aircraft: three years of flight and ground test preparation, air vehicle in flight evaluation, and a general knowledge of flight control theory, stability and control and systems testing.

6.6 Director, WFF/SSOPD.

The Director, SSOPD has the following responsibilities:

a. Provides final flight approval during ATP.
b. Serves are the RCCA approval authority for resuming flight after a Part I** Deficiency.
c. Designates the TExO and AFSRB Chairman including alternates.
d. Resolves disagreements between the AFSRB Chairman and TExO.
E. Accepts risks requiring a waiver.

Appendix A – Definitions

For additional related definitions refer to NPR 7900.3

A.1 Aerial Vehicle - Any vehicle that uses aerodynamic forces generated by the surrounding atmosphere to provide vehicle lift.

A.2 Aircraft - A manned or unmanned aerial vehicle that uses aerodynamic forces generated by the surrounding atmosphere to provide vehicle lift.

A.3 Aircraft System - A manned or unmanned fixed wing, rotary wing, tilt rotor craft, or vertical/short takeoff and landing air vehicle, including onboard hardware, firmware, and software, equipped with or without stores. Store configuration is considered to be part of the aircraft system. The ground control station, launch and recovery, and data link systems for unmanned aircraft are also part of the aircraft system.

A.4 Aircraft/UAS Configuration - A comprehensive listing of individual modifications, installations, and personnel, along with their locations and their characteristics that may affect safety of flight. It is represented in the review process by the aircraft/UAS floor plan layout, instrument/installation matrix, and the aircraft/UAS weight and balance.

A.5 Aircrew - Personnel located within the aircraft with duties, as assigned by the Chief of Flight Operations, to operate or assist in the aircraft system operation.

A.6 Airworthiness and Flight Safety Review Board - The AFSRB is the cross-discipline group of individuals dedicated to the processing, tracking, and issuance of NASA GSFC airworthiness certificates and flight releases.

A.7 Airworthiness Certificate - The airworthiness certificate is evidence that an engineering assessment of airworthiness has been performed, and the assessment indicates the aircraft system can be operated with an acceptable level of technical risk.

A.8 Airworthiness Test Flight (ATF) - A flight test conducted to verify the airworthiness of an aircraft/UAS layout/modification IAW the Airworthiness Test Plan. Airborne Science equipment and sensors will be installed but remain unpowered, unless specifically required for test execution.

A.9 Aviation Life Support System (ALSS) - Equipment required for aircrew to operate aircraft and for aircrew flight safety including aircraft escape system, special environmental protective system, personal parachute system, aviator's personal protective and survival equipment, aircrew mounted mission systems (e.g., night vision goggles), search and rescue gear, and aircraft fixed seat system.

A.10 Configuration Control - Conformity to type design is considered attained when the aircraft configuration and the components installed are consistent with drawings, specifications,

and other data that are part of the type certificate and would include any supplemental type certificates and field-approved alterations incorporated into the aircraft.

A.11 Engineering Data Requirements Agreement Plan - The EDRAP represents the negotiated written agreement between the Engineering and Flight Test Discipline Manager and AFSRB Chairman.

A.12 Firmware - Firmware is the programmable content of a hardware device, which can consist of machine language instructions for a processor, or configuration settings for a fixed-function device, gate array or programmable logic device. A common feature of firmware is that it can be updated post manufacturing by electronic means.

A.13 Flight Envelope - Aircraft performance limits or limitations approved by the aircraft manufacturer, Department of Defense (DoD), Federal Aviation Administration (FAA), or established by a formal NASA airworthiness review.

A.14 Flight Release - A document produced as part of the AFSRB process that contains operating limitations, warnings, cautions, notes, flight test deficiencies and safety considerations unique to a non-standard aircraft/UAS configuration.

A.15 High Speed Taxi - Any taxi event where there is intent to achieve an indicated airspeed that is within 30% of the predicted stall speed in the test configuration.

A.16 Letter of Determination (LOD) - A letter produced by the AFSRB and signed by the AFSRB Chairman that documents AFSRB findings regarding another public entities airworthiness and operational certification process. Determinations rendered are either objectionable or non-objectionable. A non-objectionable letter of determination issued by NASA is not permission for the proposed flight operation or an airworthiness endorsement.

A.17 NASA Aircraft - Aircraft that are bought, borrowed, chartered, rented, or otherwise procured or acquired--including aircraft produced with the aid of NASA funding--regardless of cost, from any source for the purpose of conducting NASA science, research, or other missions, and which are operated by NASA or whose operation is managed by NASA. Unmanned aircraft are defined as "aircraft" by the FAA and are included in the definition of NASA aircraft, unless specified otherwise.

A.18 Nonstandard Configuration - Any aircraft/UAS system configuration, including stores, onboard avionics, and software not approved via an existing NASA GSFC airworthiness certificate or flight release. Nonstandard configurations include but are not limited to changes in external configuration, changes to hardware, firmware, and/or software, modification/change in personal flight equipment, modification to an external store, or modification to payload, and changes to Ground Control Station hardware or software for an unmanned aircraft system.

A.19 Nonstandard Operating Envelope - Any operating envelope or limit not authorized by an existing NASA GSFC airworthiness certificate or flight release.

A.20 Part I Deficiency - Aircraft or subsystem deficiency documented during flight test that must be corrected as soon as possible. This class of deficiency, recommended by the assigned Research Test Pilot, endorsed by the ASO and approved by the Chief of Flight Operations. Test Pilot opinion or specification compliance can be used as the basis for classification.

A.21 Part I* Deficiency – Aircraft or subsystem deficiency documented during flight test that must be corrected prior to operational deployment. This class of deficiency is recommended by the assigned Research Test Pilot, endorsed by the ASO and approved by the Chief of Flight Operations. Test Pilot opinion or specification compliance can be used as the basis for classification.

A.22 Part I Deficiency** – Aircraft or subsystem deficiency documented during flight test that must be corrected prior to further testing. This class of deficiency is recommended by the assigned Research Test Pilot, endorsed by the ASO and approved by the Chief of Flight Operations. Test Pilot opinion or specification compliance can be used as the basis for classification.

A.23 Part II Deficiency – Aircraft or subsystem deficiency documented during flight test that must be corrected as soon as practicable. This class of deficiency, recommended by the assigned Research Test Pilot, endorsed by the ASO and approved by the Chief of Flight Operations. Test Pilot opinion or specification compliance can be used as the basis for classification.

A.24 Part III Deficiency – Aircraft or subsystem deficiency documented during flight test that shall be avoided in future designs. This class of deficiency, recommended by the assigned Research Test Pilot, endorsed by the ASO and approved by the Chief of Flight Operations. Test Pilot opinion or specification compliance can be used as the basis for classification.

A.25 Project Test Flight (PTF) - Following completion of installation efforts, the PTF is the first flight performed under the direction of the customer for the purpose of verifying the functionality of his/her science equipment. This flight occurs after the ATF unless an ATF is not required. Aircrew may continue to evaluate airworthiness for test points that can only be carried with science equipment or sensors operating such as electromagnetic compatibility checks (EMC) and electrical loads testing.

A.26 Readiness Review (RR) - Consisting of either a Mission Readiness Review or a Flight Readiness Review, these reviews are initiated by the assigned Project Manager. Readiness reviews are outlined in NPR 7900.3, *Aircraft Operations Management Manual*

A.27 Safety of Flight (SOF) - The property of a particular air system configuration to safely attain, sustain and terminate flight within prescribed and accepted limits for injury/death to personnel and damage to equipment, property and/or environment. The intent of assessing SOF is to show that appropriate risk management has been completed and the level of risk (hazard to the system, personnel, property, equipment and environment) has been appropriately identified and accepted by the approval authority

A.28 Standard Operation Configuration (SOC) - A predefined operating configuration of an aerial vehicle as defined in its flight and/or maintenance manuals. A SOC type operation may include, but not limited to: cargo operations, parachute jumps, medical evacuation, visual surveillance, use of standard unmodified military equipment, etc. SOC operations are exempt from AFSRB review unless the aircraft has been modified from its predefined flight manual configurations in order to conduct the operation.

A.29 Store - Any device carried internally or externally and mounted on suspension and release equipment (or air vehicle structure), whether or not the device is capable of being separated in flight from the aircraft/UAS system.

A.30 Unmanned Aircraft System (UAS) – Any airborne vehicle system without a pilot onboard that is controlled autonomously by an onboard control and guidance system or is controlled from a monitoring station outside of or remote from the UAS vehicle. A UAS is defined as an aircraft by the FAA. UASs also can be operated via a remotely located, manually operated flight control system or ground control system.

Appendix B – Acronyms

AFSR	Airworthiness and Flight Safety Review
AFSRB	Airworthiness and Flight Safety Review Board
ALSS	Aviation Life Support System
ASO	Aviation Safety Officer
ATF	Airworthiness Test Flight
ATP	Approval to Proceed
CAS	Commercial Air Services
CDA	Commercial Derivative Aircraft
COA	Certificate of Authorization
DHS	Department of Homeland Security
DoD	Department of Defense
EDRAP	Engineering Data Requirements Agreement Plan
EMC	Electromagnetic Compatibility Checks
FAA	Federal Aviation Administration
FRR	Flight Readiness Review
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
IAOP	Intercenter Aircraft Operations Panel
IAW	In Accordance With
IFR	Interim Flight Release
LOD	Letter of Determination
MRR	Mission Readiness Review
NAS	National Air Space
NASA	National Aeronautics and Space Administration
OEM	Original Equipment Manufacturer
PTF	Project Test Flight
RC	Records Custodian
RCCA	Root Cause and Corrective Action
RF	Radio Frequency
RPM	Revolutions Per Minute
RR	Readiness Review
SME	Subject Matter Expert
SOC	Standard Operating Configuration
SOF	Safety of Flight
SSOPD	Suborbital and Special Orbital Projects Directorate
STC	Supplemental Type Certificate
TC	Type Certificate
TExO	Technical Ex Officio
TIA	Type Inspection Authorization
TIM	Technical Interchange Meeting
U.S.	United States
U.S.C.	United States Code
UAS	Unmanned Aerial System
USA	United States Army
USAF	United States Force
USCG	United States Coast Guard
USN	United States Navy
WBS	Work Breakdown Schedule
WFF	Wallops Flight Facility

Appendix C - UAS Flight Certification Policy Notes and Examples

1. Unique UAS Airworthiness and Flight Safety Considerations. There are airworthiness considerations unique to UAS that shall be considered in all three categories of flight clearance. Areas of consideration include, but are not limited to:
   a. Unique launch and recovery methods and equipment such as pneumatic launch, parachute, and net recovery.

   b. Data link and/or GPS availability and reliability.

   c. Loss of positional awareness.

   d. UAS operator workload and situational awareness of UAS status and position relative to other aircraft within the airspace.

   e. Control of multiple UAS from a single remote control station, including handoff of UAS control between remote control stations.

   f. Environmental considerations such as robustness to icing and/or lightning.

   g. Lost link contingencies including autonomous "return home" and flight termination.

2. Engineering and Data Requirement Tailoring Considerations for UAS. The level and amount of engineering and data requirements necessary for determining UAS airworthiness and/or safety of flight, as determined by the SMEs, may be affected by, but not limited to:
   a. Intended use, including the area of operation and airspace requirements (e.g., densely populated areas in civil airspace vice sparsely populated areas in a controlled test range).

   b. Airframe life for which the UAS is designed (e.g., whether proof testing can be used in lieu of dedicated static testing).

   c. Unconventional command and control.

   e. Risks associated with operating the UAS in close proximity to the remote control station, personnel, property or other equipment.

   f. Requirement of the UAS to recover from stall, spins or departures.

   g. Store carriage and/or release.

   h. Whether direct overflight of densely populated areas is required versus conducting operations at a slant range.

i. Guidance, navigation, and control accuracy requirements (e.g., requirement for the UAS to stay contained in a specified area).

j. Landing precision requirement.

k. Requirement to operate in certain weather conditions (e.g., lightning, gusts, icing, etc.).

l. Requirement to operate complex Radio Frequency (RF) environment.

3. Data Requirements for Category-C UAS Flight Clearance

a. The data requirements for a Category-C flight clearance will vary significantly, based on the proposed location for UAS flight. For example, the data requirements to fly a UAS in active restricted airspace (or in a Warning Area) over an unpopulated or sparsely populated area may be limited to; a completed UAS questionnaire and assessment of the likelihood that the vehicle can be contained within dedicated range space. Because a higher probability of loss of the UAS is acknowledged and because the UAS will be flown in a controlled environment, a reduced number of engineering disciplines may be required to review the data and concur with the flight clearance. For example, a review of this nature could consist of safety officials certifying that risks to people, property and the environment are acceptable; and the Spectrum Manager certifying that external RF does not create an unsafe situation; the UAS will not fly outside of the approved area; and loss of link procedures are adequate.

b. In comparison, for a proposed Category-C flight clearance where UAS flight occurs over populated areas, the data requirements will be closer to that of a Category 2 airworthiness certificate, and a larger complement of engineering disciplines will be required to review the data and concur with the flight clearance.

4. Statements of Airworthiness in Support of a Certificate of Authorization (COA)

a. Within the U.S., a COA is usually required for flight outside of restricted and/or warning areas. The following statements shall be used to fulfill the FAA's requirement for an airworthiness statement for a COA:

(1) For Category-A UAS, the following statement should appear in the flight release: "PER NASA GSFC GPR 7900.1, THIS FLIGHT RELEASE PROVIDES NASA CATEGORY “A” AIRWORTHINESS CERTIFICATION SUBSEQUENT TO AN ENGINEERING REVIEW."

(2) For Category-B UAS, the following statement should appear in the flight release: "PER NASA GSFC GPR 7900.1, THIS FLIGHT RELEASE PROVIDES NASA CATEGORY “B” AIRWORTHINESS CERTIFICATION SUBSEQUENT TO AN ENGINEERING REVIEW."

(3) For Category-C UAS, the following statement should appear in the flight release: "PER NASA GSFC PG, THIS FLIGHT RELEASE PROVIDES NASA CATEGORY "C" AIRWORTHINESS CERTIFICATION SUBSEQUENT TO AN ENGINEERING REVIEW."

b. Any operational and/or airspace restrictions in the Category-B or C UAS airworthiness certificates must be consistent with the operations proposed in the COA application.

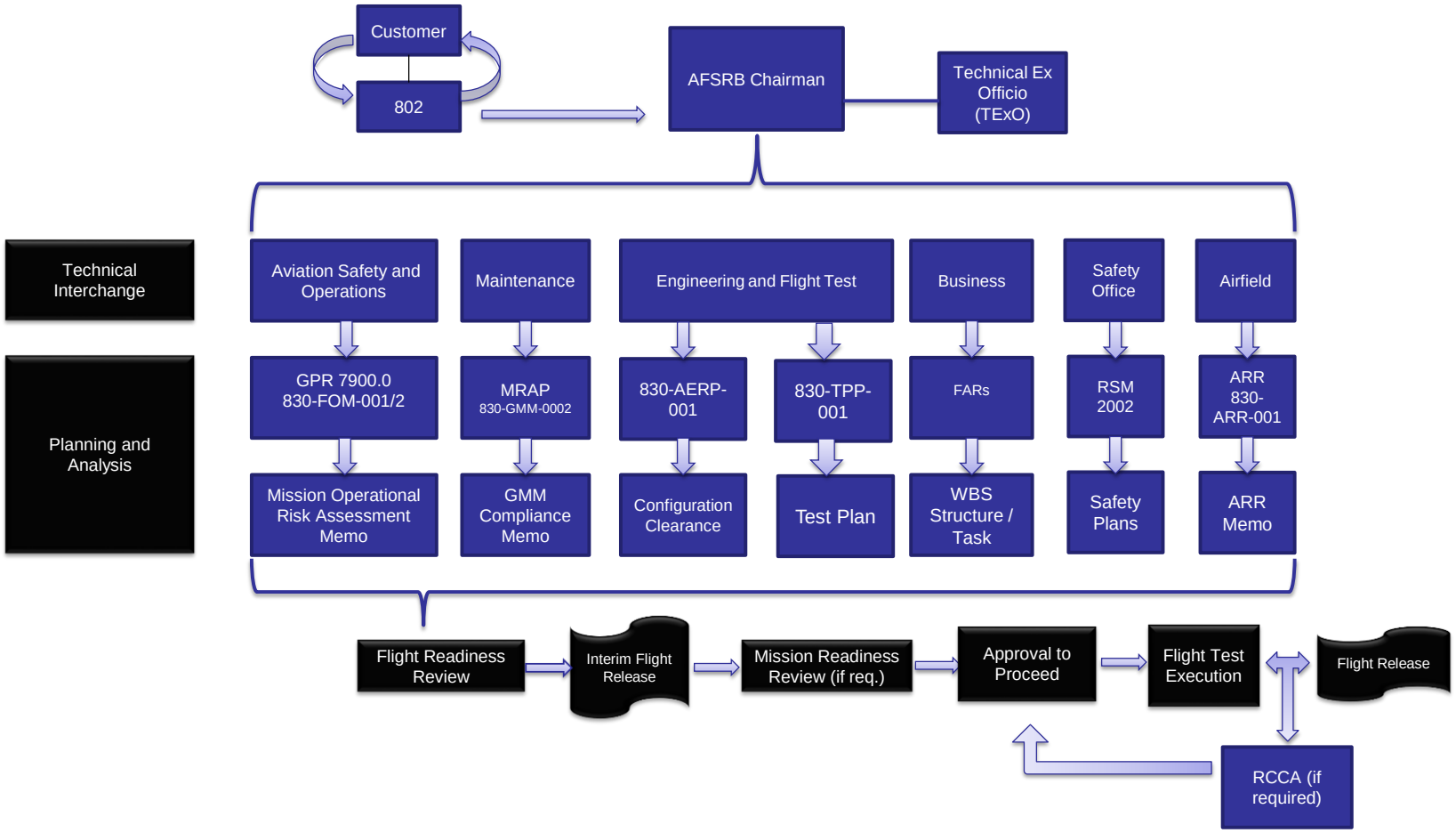
Appendix D - Flight Certification General Process for NASA Aircraft

Process Phase	Responsible Party	Process Duties
Technical Interchange	Project Manager / Project Pilot/ Code 830 Chief Engineer	Develop Technical Interchange Meeting (TIM) agenda and distributes to all stakeholders
	Project Manager	Schedules TIM. Brief all TIM agenda items to the AFSRB in order to allow the respective discipline managers to gain an understanding of the proposed aircraft / modification and develop a certification strategy.
	Project Sponsor	Attend TIM and present information / data, as required by Project Manager (PM)
	Discipline Managers	Attend TIM and review proposal; determine and assign required Subject Matter Experts (SMEs).
	Business Manager	At TIM completion, provide cost / risk assessment and supply WBS code for billing
Planning and Analysis	Discipline Managers	Initiate planning and analysis activities within respective discipline; ensure compliance with respective NASA policies, instructions or procedures listed in Appendix E, *Airworthiness and Flight Safety Oversight Structure for NASA Aircraft*; Identify project metrics, analyses, documentation, ground testing, and/or flight testing required for certification process; Inform Project Manager of risks and project issues identified within respective discipline.
	Code 830 Chief Engineer	Advise on existing data; come to consensus with SMEs on data requirements; Draft Engineering Data Requirements Agreement Plan (EDRAP) and submit to AFSRB Chairman.
	Project Manager / Operations Engineer/ Project Pilot	Establish and maintain lines of communication to the customers and stakeholders; establish cross-discipline consensus in the airworthiness and risk assessment; communicate risks and project issues to the AFRSB Chairman and Project Sponsor.
	SME	Assess proposed flight certification; provide necessary testing/data requirements; provide analysis.
	AFSRB Chairman	Adjudicate disagreements between Discipline Managers and assigned personnel.

Flight Readiness Review	Project Manager / Operations Engineer / Project Pilot	Review the engineering considerations and data gathered under the EDRAP as well as deliverables from each Discipline Manager; Draft Interim Flight Release (IFR) with each deliverable included as a reference; Present interim flight release to AFSRB at Flight Readiness Review (FRR).
	Discipline Managers	Brief all project risks, technical concerns and safety issues within respective discipline. Review draft flight release; provide discipline endorsement/rejection.
	AFSRB Chairman	Reconcile review conflicts. Provide FRR approval/rejection of IFR.
MRR	Project Manager / Project Pilot Discipline Managers AFSRB Chairman	Coordinate activities and discuss risk mitigation strategies that apply to multi-aircraft operations.
ATP	Project Manager / Project Pilot	Brief all project risks, technical concerns and safety issues to the Director, WFF/SSOPD.
	Director, SSOPD	Approve / reject interim flight release.
Flight Test Execution	Project Test Pilot	Execute Flight Test Plan, document any deficiencies IAW NASA GSFC Test Plan Policy, brief deficiencies to project leadership, initiate Root Cause and Corrective Action (RCCA) (if required)
Finalize Flight Release	Project Manager / Project Pilot	Incorporate Part I, II and III deficiencies into flight release along with any other flight test findings
	AFSRB Chairman	Approve final flight release

Appendix E – Airworthiness and Flight Safety Oversight Structure for NASA Aircraft

(Black colors describe AFSRB process, blue colors describe AFSRB structure)

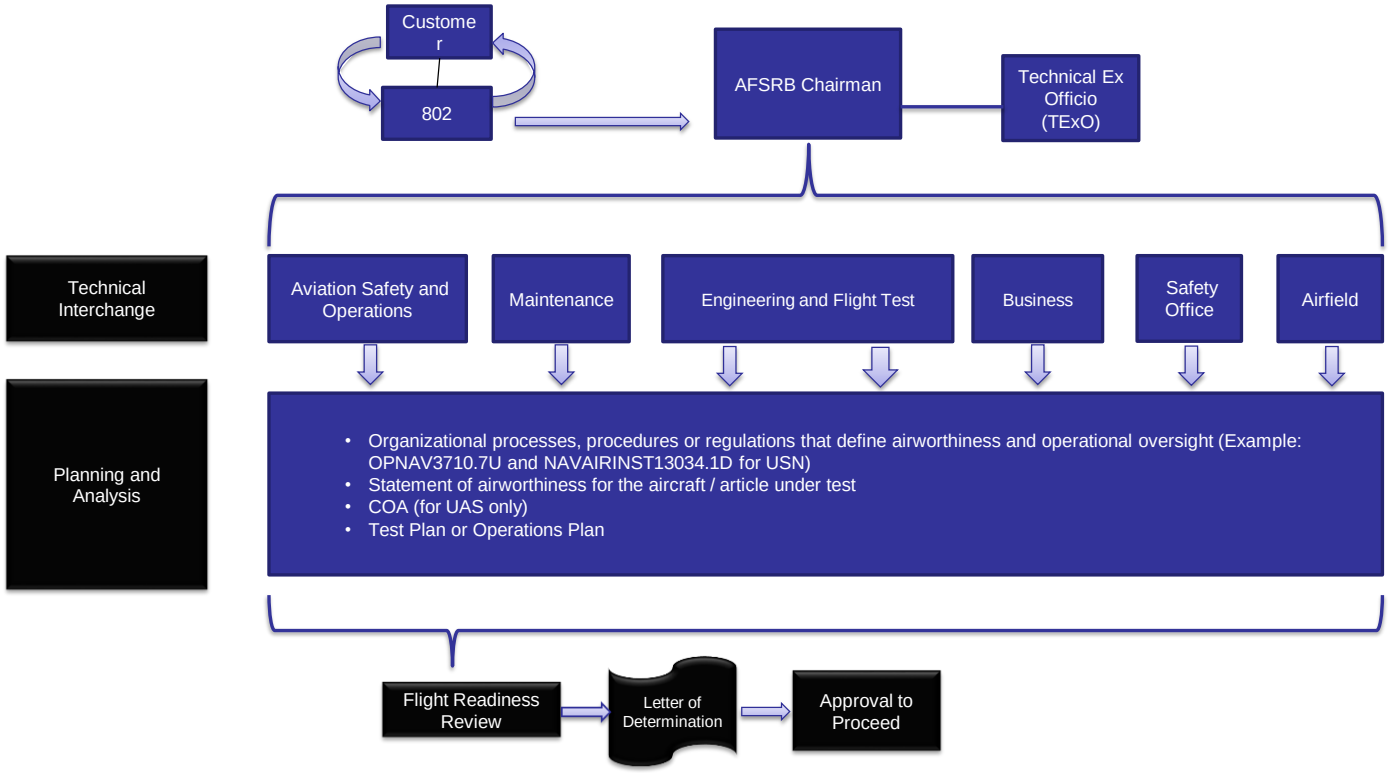


Appendix F - Flight Certification General Process for Non-NASA Aircraft

Process Phase	Responsible Party	Process Duties
Technical Interchange	Project Manager / Project Pilot / Code 830 Chief Engineer	Develop Technical Interchange Meeting (TIM) agenda and distributes to all stakeholders
	Project Manager	Schedule TIM.
	Certifying Entity	Brief all TIM agenda items to the AFSRB in order to allow the respective discipline managers to gain an understanding of the aircraft / UAS under test, proposed test points and the certifying entities airworthiness and operational certification processes.
	Discipline Managers	Attend TIM and review proposal.
	Business Manager	At TIM completion, provide cost / risk assessment and supply Work Breakdown Schedule (WBS) code for billing.
Planning and Analysis	Maintenance Manager	Assess whether certifying entity's maintenance practices are IAW the applicable criteria listed in the FAA Public Unmanned Aircraft Systems Operational and Certification Requirements
	Engineering and Flight Test Manager	Assess whether certifying entity's airworthiness practices are IAW the applicable criteria listed in the FAA Public Unmanned Aircraft Systems Operational and Certification Requirements
	Aviation Safety Manager	Assess whether certifying entity's operational certification practices are IAW the applicable criteria listed in the FAA Public Unmanned Aircraft Systems Operational and Certification Requirements. Assess whether certifying entity's safety program is IAW the applicable criteria listed in the FAA Public Unmanned Aircraft Systems Operational and Certification Requirements
	Safety Office	Assess whether certifying entity's safety program is IAW the applicable criteria listed in the FAA Public Unmanned Aircraft Systems Operational and Certification Requirements
	Airfield Manager	Manage requested specialized airfield assets. Ensure aircraft / UAS operations will be conducted IAW Airfield Operations Manual.

	Project Manager	Coordinate requested specialized airfield assets; establish and maintain lines of communication to the certifying entity; establish cross-discipline consensus in the airworthiness and operational certification assessment; communicate project issues to the AFRSB Chairman and certifying entity; schedule Flight Readiness Review (FRR) when ready.
	AFSRB Chairman	Adjudicate disagreements between Discipline Managers and assigned personnel.
Flight Readiness Review	Project Manager	Brief proposed operation.
	Discipline Managers	Brief project compliance with the FAA Public Unmanned Aircraft Systems Operational and Certification Requirements as applicable to respective discipline.
	Airfield Manager	Brief status of requested specialized airfield assets.
	AFSRB Chairman	Make formal assessment of certifying entity's airworthiness and operational certification process. Issue determination on the proposed operation.
	Project Manager	Draft letter of determination.
ATP	Project Manager / Project Pilot	Brief all project risks, technical concerns and safety issues to the Director, SSOPD.
	Director, WFF/SSOPD	Approve / reject proposed operation.

Appendix G – Airworthiness and Flight Safety Oversight Structure for Non-NASA Aircraft



Appendix H – Considerations for the Determination of Flight Operating Limitations

Introduction. The following is a compilation of the data that should be considered for each aircraft / UAS modification and incorporated into the Engineering Data Requirements Agreement Plan (EDRAP). This list does not include all possible data requirements for all projects, nor are all data listed required for each application. The Airworthiness and Flight Safety Review Board (AFSRB), in cooperation with cognizant engineers, will determine the applicability and tailor the data requirements for each specific application.

1. Descriptive:
   a. A complete description of proposed modification or operation, including aircraft/UAS configuration, store loadings, flight envelope, and store carriage/employment/jettison envelope.
   b. Three-view drawings, including all dimensions, materials, and physical/geometric/kinematics clearances.
   c. Air vehicle and stores weight and balance data, and appropriate mass moments of inertia.
   d. Air vehicle electrical wiring diagrams.
   e. Description of store arming/tail banding wiring configuration.
   f. Software architecture and version description documents and a listing of associated computer software configuration items.
   g. Assembly drawings of ALSS equipment.
   h. Drawings detailing installation of test instrumentation.
   i. Store release/launch event timelines, delays, and activation.
   j. The largest center of gravity shift during a store release.
   k. Drop/launch, fuel jettison/burn, or airborne refueling.
   l. The location of onboard instruments, e.g., angle-of- attack, Mach, airspeed, etc.

2. Analysis (reports that detail the following):
   a. Design criteria.
   b. Air vehicle loads, store loads, and strength.
   c. Vibrations, flutter, and divergence.
   d. Vibration, thermal, and acoustic fatigue.
   e. Electrical loads.
   f. Effects on aircraft/UAS performance.
   g. Effects on air vehicle stability and control, including flight control system failure or degraded mode effects.
   h. Stores separation characteristics, including miss distances.
   i. Store autopilot or aircraft/UAS stability augmentation system function changes.
   j. Aircraft/UAS or store control system mechanism dynamic; effects.

k. Effects on air vehicle spin and stall recoveries.
l. Effects on air vehicle ALSS.
m. Software change hazard analysis.
n. Effects of normal operation and failures of test instrumentation on air vehicle systems, stores and stores employment, and ALSS operation, including:
   (1) Electromagnetic interference.
   (2) Integrity of structures modified for instrumentation installation.
   (3) Physical interference/clearance.
o. System safety hazard analysis.
p. Power plant effects.
q. Data links.
r. Flight termination system vulnerability.

3. Testing (reports that detail the following):
   a. Laboratory and ground testing.
   b. Air vehicle/stores compatibility (fit check, electrical interface, arming wire/clip/tail band, etc.).
   c. Store separation and jettison (wind tunnel).
   d. Ground vibration frequency (including ground resonance for rotary wing and rotorcraft) and modal survey.
   e. Electromagnetic effects.
   f. Stability and control, flying qualities, and performance (wind tunnel).
   g. Thermal, vibration, and acoustic fatigue.
   h. Environmental.
   i. Structures static and fatigue.
   j. Anthropomorphic Accommodation.
   k. Man-mounted ALSS equipment compatibility/tolerance tests.
   l. Escape system compatibility.
   m. Cockpit lighting/instrument lighting and readability.
   n. Aircrew or operator displays, including software change effects.
   o. Software formal qualification and regression testing.
   p. Flight control integration testing (lab and ground).
   q. Test instrumentation compatibility.
   r. Power plant effects.
   s. Cockpit transparencies and transmissivity.

4. In-Flight Testing (reports that detail the following):
   a. Stores captive carriage.
   b. Store carriage loads.
   c. Stores separation and jettison.
   d. Flutter and divergence.
   e. Acoustic and vibration environment.
   f. Loads and stress survey.
   g. Electromagnetic compatibility/electromagnetic.
   h. Interference.
   i. Flying qualities, and stability and control.
   j. Aircraft/UAS performance.
   k. Engine, transmission, auxiliary power unit, and cross shaft performance.
   l. Escape/egress system compatibility.
   m. Aircrew or operator displays.
   n. Flight controls, including software change effects.
   o. Effects of forward firing ordnance on engine operation, including surge and restart envelope.
   p. Software, including effects on aircrew or operator displays.
   q. Air vehicle subsystems performance.

CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	March 22, 2016	Initial Release. This GPR cancels 800-PG-1060.2.2, Airworthiness Review Process