Ames Procedural Requirements

Effective Date: __11/2/2023_____

Expiration Date: __11/2/2028_____

COMPLIANCE IS MANDATORY

Subject: Reviews for Flight Projects

Responsible Office: Code D / Office of the Chief Engineer

CHANGE LOG

Status [Baseline /Revision /Cancelled]	Document Revision	Date of Change	Description
Baseline	0	12/13/2010	New Document: Defines review requirements for flight systems and ground support programs and projects led by ARC. Establishes review phasing, purpose, responsibilities, entrance and exit criteria
Revision	1	5/2/2018	Significant update to remove duplication of NPR 7120.5E and NPR 7123.1B
Revision	2		Significate update that eliminated all external reviews and to focus on how the Center conducts project readiness reviews for NPR 7120.5 and NPR 7120.8 projects

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PREFACE

P.1 PURPOSE

a. This Ames Procedural Requirement (APR) defines how Ames Research Center (ARC) conducts Project Readiness Reviews (PRRs) to ensure that its flight projects have met all stakeholder requirements, identified and mitigated risks within the approved risk posture, and are ready to be delivered and/or operated.

b. This policy contains two elements:

(1) The first element identifies PRRs that are likely required by a project's external Decision Authority (DA) yet may be supplementary.

(2) The second element defines an independent Assessment of Residual Risk (ARR), results of which are to be reported at the prescribed Readiness Reviews.

P.2 APPLICABILITY

a. This directive applies to all flight programs/projects that are led by Ames Research Center.

b. Flight projects include spacecraft, aircraft, instruments and experiment payloads, designated technology developments to be incorporated by flight projects, critical technical facilities specifically developed or significantly modified for flight systems, and ground systems that are in direct support of flight operations.

c. This directive applies to contractors, grant recipients, or parties to agreements only to the extent specified or referenced in the appropriate contracts, grants, or agreements.

d. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The terms "may" or "can" denote discretionary privilege or permission, "should" denotes a good practice and is recommended, but not required, "will" denotes an expected outcome, and "are/is" denotes descriptive material.

e. In this directive, all document citations are assumed to be the latest version unless otherwise noted.

P.3 AUTHORITY

a. NPR 7120.5, NASA Space Flight Program and Project Management Requirements

b. NPR 7120.8, NASA Research and Technology Program and Project Management Requirements

P.4 APPLICABLE DOCUMENTS AND FORMS

a. NPR 7123.1, NASA Systems Engineering Processes and Requirements

b. APD 7120.8, Project Core Requirements

c. APR 7120.5, Project Management for Space Flight Systems

P.5 MEASUREMENT/VERIFICATION

a. Verification of conformance to requirements in this directive is measured through Center and Responsible Organizational management reviews, self-assessments, and subsequent analysis and reports of conformance to requirements, as well as periodic internal audits.

P.6 CANCELLATION

a. APR 7120.51, Program/Project Reviews for Space Flight, dated May 2, 2018.

Eugene Tu
Director

DISTRIBUTION STATEMENT:

Internal and external distribution.

CHAPTER 1 RESPONSIBILITIES

1.1 **The Center Director** shall approve the Post-PRR Record certifying that NPR 7120.5 and NASA Science Mission Directorate (SMD) 7120.8 missions are ready to be delivered and/or operated and transmit it as required to any external stakeholders.

1.2 The Ames Chief Engineer (ACE) shall:

a. Approve the PRR plan in conjunction with the Managing Organization Director.

b. Select the ARR Team Chairperson.

c. Arbitrate Request for Action (RFA) resolution between the PM and ARR Team.

d. Report major issues resulting from the ARR to Center Management.

e. Develop and manage the ARR process and its implementation.

1.3 The Managing Organization Director (MOD) shall:

a. Approve the PRR plan in conjunction with the Ames Chief Engineer.

b. Coordinate with the program office to:

(1) Consolidate center and program reviews as possible.

(2) Combine review criteria to satisfy both center and program requirements.

(3) Consolidate review board membership as possible.

c. Select the PRR Board chairperson(s).

d. Ensure their Projects are prepared for PRRs.

e. Report PRR results to the Ames Center Management Council (ACMC).

f. Approve and transmit to the Center Director the Post-PRR Record certifying that missions are ready to be delivered and/or operated.

1.4 The Program/Project Manager (PM) shall:

a. Develop and submit the PRR plan to the MOD and ACE for approval.

b. Coordinate and facilitate the delivery of all requested materials to the PRR Board and ARR Team.

c. Manage resolution, closure, and reporting status of the PRR RFAs to the PRR Board Chairperson.

1.5 The Ames Center Management Council shall ensure their line organizations support the implementation of this APR by providing ARR review and/or PRR board members as requested.

1.6 The ARR Team Chairperson shall:

d. Develop criteria for the ARR review (in consultation with the ACE and PM).

e. Facilitate the assignment of ARR Team members with the appropriate line organizations.

f. Collect, review, and assign due dates for all ARR activities.

g. Provide a residual risk assessment at the PRR.

h. Document the ARR activity using the Certificate of Flight Readiness (CoFR) tool.

1.7 The PRR Board (PRRB) Chairperson shall:

a. Facilitate the assignment of PRRB members with the appropriate line organization.

b. Collect, review, and assign due dates for all PRR activities.

c. Schedule, manage, and chair the PRR.

d. Brief Center management as requested.

e. Prepare and deliver any Post PRR records to the Presiding Official for signature (see Table 2).

CHAPTER 2 PROCEDURE

2.1 Project Readiness Reviews (PRRs)

2.1.1 Flight projects shall have either separate or some combination of a Pre-Ship Review (PSR), Operational Readiness Review (ORR), and Mission Readiness Review (MRR).

2.1.1.1 The PSR shall occur prior to flight systems being released for launch integration. Review elements include those specified by the Systems Acceptance Review specified in NPR 7123.1 and packing and transportation logistics.

2.1.1.2 The ORR and MRR criteria are also specified in NPR 7123.1.

2.1.2 For projects governed by NPR 7120.5 or NPR 7120.8 within SMD, the PSR will likely be a Center-led review as a supplement to the program review structure. For non-SMD projects governed by NPR 7120.8, the PSR, ORR, and MRR events can tailored and consolidated. Ideally, the sponsoring program and MOD will agree to a review plan that meets center requirements without additional review events.

2.1.3 Within the Project Plan, the PM shall include a section that addresses all pre-delivery and/or pre-launch/operations reviews (i.e., PRRs as defined in this APR) and ensure approval from the ACE and MOD prior to delivering the Project Plan to the DA for approval (usually after the Mission Definition Review/Systems Definition Review (MDR/SDR)). The specific PRR for a project may be tailored based on project scope, complexity, and risk (reference Table 2).

2.1.4 The contents of the Project Plan with respect to readiness reviews shall include:

a. The sequence and anticipated timeframe for each PRR.

b. A concise statement of the purpose and objectives of each PRR.

c. The process for managing and executing each type of PRR.

d. The process and protocols for adjudicating comments and RFAs for each PRR.

Table 2 - NASA Ames Mandatory Project Readiness Reviews

<table>
<tr><td rowspan="2">Project Readiness Review (PRR)Activity</td><td colspan="2">Project Governance</td></tr>
<tr><td>7120.8 Tech Demo</td><td>7120.5 & SMD 7120.8</td></tr>
<tr><td>Pre-Ship Review (PSR)</td><td rowspan="3">As agreed to by the PM, ACE, & MOD</td><td>X</td></tr>
<tr><td>Operational Readiness Review (ORR)</td><td>X</td></tr>
<tr><td>Mission Readiness Review (MRR)</td><td>X</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Presiding Officials at ARC
(When Review not Required/Presided over by a Program Office)</td></tr>
<tr><td>MOD & ACE</td><td>Center Director</td></tr>
</table>

Note 1: The Presiding Officials at ARC are the authorities for waiving or tailoring these requirements (i.e., eliminating and/or combining readiness assessments or reviews) and signing the Post Readiness Review Record

Note 2: The Readiness Reviews (i.e., PSR, ORR, and/or MRR) fulfill the Center Director's responsibility to "certify that programs and/or projects have been accomplished properly..." per NPR 7120.5F.

2.2 Conduct of Project Readiness Reviews

2.2.1 Prior to the PRR, the Project Manager and the PRR chairperson shall review the approved PRP and define the applicable entrance and exit criteria for the upcoming PRR as well as project status and issues in order to finalize the agenda and schedule for the review, determine adequacy of review team membership, and define applicable project documents/materials needed to support the upcoming review (see Appendix C and NPR 7123.1 for guidance).

2.2.2 PRR Board membership should include subject matter experts capable of covering the elements, engineering, and SMA.

2.2.3 Based on the agenda, the Project Manager shall finalize all presentation material and deliver it, along with the identified project documents, to the PRR stakeholders (e.g., PRR Board, ACE, SMA, Performing Directorate line management, etc.) one week prior to the PRR.

2.2.4 The chairperson moderates the interaction between the PRRB and the project team and collects RFA's from PRR stakeholders.

2.2.5 At the conclusion of each PRR, the chairperson shall summarize the PRRB's initial impressions and discuss the draft actions and determine reasonable due dates for responses.

2.3 Reporting the Project Readiness Review Results

2.3.1 The PRRB shall prepare a report to document its assessment of the review with copies to the Project Manager, the applicable Program Manager, the ACE, the MOD, and the Center Presiding Official. The timeframe for this report is agreed between the PRRB Chair and the Project Manager. In cases where there is involvement of another NASA Center in implementing the project, a copy should also be sent to appropriate management of that Center.

2.3.2 The report should include, but is not limited to, the following:

a. A conclusion as to whether or not the project has met all stakeholder requirements, identified and mitigated risks within the approved risk posture, and is ready to be delivered and/or operated.

b. Any outstanding steps considered necessary to conclude that the project has met all stakeholder requirements, identified and mitigated risks within the approved risk posture, and is ready to be delivered and/or operated (e.g., a delta-review, closure of specific RFAs, etc.).

c. Findings and attendant rationale regarding attainment of each technical and programmatic review objective, along with identification of any areas where project progress fell notably below the expectations identified in the success criteria.

d. The ARR Team's evaluation of the project's residual risk.

e. All RFAs, identifying the date by which the project response is due.

f. A copy of the review specific agenda, objectives, and success criteria as well as a list of all review participants and attendees that includes their organization and contact information.

2.3.3 The PRRB chairperson shall provide briefings as requested by the ACMC or Center Director.

2.4 Post Project Readiness Review Record

2.4.1 Since the PRR provides the basis for the Center to ensure that projects have met all stakeholder requirements, identified and mitigated risks within the approved risk posture, and are ready to be delivered and/or operated, it should be concluded (assuming all outstanding actions have been closed) with a record stating the Center's testament of the project's readiness. This record should be signed by the Center's Presiding Official and filed/archived with the project documentation and transmitted per any agreements and protocols consistent with any internal and external stakeholders receiving the transmittal (e.g., Center Director, Program Manager, Associate Administrator).

2.4.2 While the formality and content of the Post PRR Record should be tailored depending on the project governance and the record's end customer (e.g., Center Director, Program Manager, Associate Administrator), content to consider addressing in the record include:

a. When the review was held and the scope of the review.

b. Conclusions reached by the PRRB relative to project/mission readiness to be delivered and/or operated.

c. Any unique issues associated with the mission that might impact mission safety and/or success.

d. Identification of residual risk per the ARR, unresolved liens, constraints, important verification actions to be completed prior to delivery/launch/operations.

e. Delivery/operations/launch time, date, and windows for which the Center's testament of readiness is valid.

f. In the case of Principal Investigator (PI)-managed missions, the PI recommendation that the mission is ready to be delivered and/or operated and that the Center concurs.

2.5 Conduct of Assessment of Residual Risk

2.5.1 An Assessment of Residual Risk is an independent Center evaluation of the as-built hardware, software, and operational procedures. The Assessment team is led by a chairperson and comprised of subject matter experts who evaluate project documentation to assess the risk inherent to the as-built system.

2.5.2 The ARR team is active from about the time of system integration through to the readiness reviews at which they report their findings. The team evaluates the elements specified in Appendix C, such as deviations from engineering policies and accepted best practices, non-conformances, anomaly resolutions, and system-wide vulnerabilities.

2.5.3 In the event the Center is requested to provide a Certification of Flight Readiness, the ARR is the basis of the certification.

2.5.4 The Center Chief Engineer administers the ARR and monitors its progress.

2.5.5 The ARR shall use the web-based Ames CoFR tool to process and document the assessment.

APPENDIX A. DEFINITIONS

Assessment of Residual Risk (ARR)	An activity taking place over the project's technical life cycle up to and including planed operations for the purpose of assessing the residual risk associated with the major functions and elements of the systems engineering work break down structure (reference Appendix C)
Decision Authority (DA)	The individual authorized by the Agency to make important decisions on programs and projects under their authority (per NPR 7120.5 Appendix A).
Center Presiding Officials	The authorities for waiving or tailoring the requirements (i.e., eliminating and/or combining readiness assessments or reviews) within this APR. These officials are also responsible for signing the Post Readiness Review Record.
Mission Readiness Review (MRR)	The review that examines a project's tests, demonstrations, analyses, and audits to determine the system's readiness for a safe and successful flight or launch and for subsequent flight operations. The MRR also ensures that all flight and ground hardware, software, personnel, and procedures are operationally ready.
Operational Readiness Review (ORR)	The review that is equivalent to the MRR for projects that are delivering ground support systems/facilities.
Project Readiness Review (PRR)	A review to ensure that projects have met all stakeholder requirements, identified and mitigated risks within the approved risk posture, and are ready to be delivered and/or operated. The PRR may be fulfilled by a PSR, MRR, and ORR, or some combination of the three.
Post Project Readiness Review Record	The Center's testament of the project's readiness to be delivered, operated, and/or launched.
Pre-Ship Review (PSR)	A review to ensure that a project has met all stakeholder requirements, identified and mitigated risks within the approved risk posture, and is ready to ship/deliver its products.
Request for Action (RFA)	The comment forms that reviewers submit during milestone reviews that capture their comments, concerns, and/or issues about the product or documentation.

APPENDIX B. ACRONYMS

ACE	Ames Chief Engineer
ACMC	Ames Center Management Council
APR	Ames Procedural Requirements
ARC	Ames Research Center
ARR	Assessment of Residual Risk
CoFR	Certificate of Flight Readiness
DA	Decision Authority
MOD	Managing Organization Director
MRR	Mission Readiness Review
NPR	NASA Procedural Requirements
ORR	Operational Readiness Review
PI	Private Investigator
PM	Program/Project Manager
PRP	Project Review Plan
PRR	Project Readiness Review
PRRB	Project Readiness Review Board
PSR	Pre-Ship Review
RFA	Request for Action

APPENDIX C. ASSESSMENT OF RESIDUAL RISK ELEMENTS

ID	Title	Element Description
A	Design Documentation - Requirements, Technical Standards, Institutional, etc.	Functional and performance requirements for complete and minimum mission success (including planetary protection) are documented. Institutional requirements compliance matrices audited/approved by ACE/SMA.
B	Design Documentation - External Interfaces	All external interface (e.g., DSN, L/V, foreign partners) design and operational agreements have been defined.
C	[reserved]	
D	Design Documentation - Detailed H/W Design & S/W Design	Hardware Drawings (ICD's, parts, assemblies, schematics, circuit data sheets, etc.) are released or under CM control. Software design description, source code, and utilization guides are released and under CM control.
E	System and Subsystem Design & Reliability Analysis	System and subsystem design analyses (fault trees, FMECA, reliability, timing margin, functional models, mass properties, error budgets, etc.) are complete, updated with test results, and reviewed. Single Point Failures understood and accepted. Critical margins understood and documented.
F	Waivers	Waivers (with audit of mod/high risk and dissent).
G	Problem/Anomaly Reports, NCRs, Out-of-family results	Problem reports (with audit) are closed and approved. Unverified failures reviewed. NCR dispositions, especially use-as is, examined. Open or deferred software action items (including but not limited to bugs and issues) are examined and approved.
H	TAYF	Test as you fly exception list complete, reviewed and approved.
I	V&V	V&V requirements compliance matrix, including calibration, as run procedures, and test/analysis reports complete. System environmental design and test reports complete. Inspection reports, logbooks, open analysis items, and component test records are complete and all open items closed out.
J	Testbed Certification	Testbed certification of equivalence to flight system complete and all differences documented and accounted for.
K	ITL Completion	Incompressible Test List tests complete, reviewed & any deviations approved.
L	Launch Campaign	All work-to-go to launch activities have been planned, reviewed, and approved.
M	Operational Readiness	Commissioning activities, critical events preparation, flight rules, launch versions of command and telemetry dictionaries, launch/hold criteria, idiosyncrasies, and contingency plans are complete, reviewed and delivered to the flight team. All post launch development work has been planned, reviewed & approved.
N	Residual Risk	Accepted/Residual risk list complete, reviewed and approved by senior management.
O	Safety	All safety compliance documents have been approved.