Independent Verification & Validation Program	IV&V Project Execution Plan (IPEP) Template	T2103 Version: H Effective Date: June 7, 2023

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AUTHORITY		DATE
Jeffrey Northey (original signature on file)	IMS Manager	09/05/2018
Joelle Spagnuolo-Loretta (original signature on file)	Process Owner	09/05/2018

REFERENCES	
Document ID/Link	Document Title
IVV QM	NASA IV&V Quality Manual
IVV 09-1	Independent Verification and Validation Technical Framework
IVV 09-4	Project Management
NASA-STD-8719.13C	NASA Software Safety Standard
NASA-STD-8739.8B	Software Assurance and Software Safety Standard
NPR 7150.2D	NASA Software Engineering Requirements
NPR 8715.3D	NASA General Safety Program Requirements
S3105	Guidelines for Writing IV&V TIMs
S3106	PBRA and RBA Process

If any process in this document conflicts with any document in the NASA Online Directives Information System (NODIS), this document shall be superseded by the NODIS document. Any external reference shall be monitored by the Process Owner for current versioning.

VERSION HISTORY				
Version	Description of Change	Rationale for Change	Author	Effective Date
Basic	Initial Release		Leigh Gatto	12/18/2008
A	Updated to reflect new organization and updates to IVV 09-4		Jerry Sims	08/12/2010
B	Update to refine content based on IPEP reviews		Jarrod Petersavage	02/18/2011
C	Modified Table 4-1 to remove dates. Modified Section 4.1.1 to reference new Appendix G.6, *IV&V Deliverables*. Removed Appendix G.6, *Planned Travel*. Removed Appendix G.7, *IV&V Resources*.	CAR: 2012-C-357. Deliverable dates moved from Section 4.11 to new Appendix G.6 since the Appendix may be updated without a signature cycle. Travel and other resources information is captured elsewhere.	Frank Huy Steve Raqué	09/21/2012

VERSION HISTORY				
Version	Description of Change	Rationale for Change	Author	Effective Date
D	Major updates throughout the entire document; some of the changes are: Replaced App B to use Focus vs. coverage and add 3 questions. Section 2 (major update) - combined Verification and Validation. Removed observations. Updated Table 4-2 Issue severity for currency. Added simulation. Removed outdated roles; added new roles. Also addressed several other comments – link here.	CAR: 2013-C-378 (aka Work ID: 4425383). Add compliance with IVV 09-1, Technical Framework; The reasons for ceasing the use of Observations are several, but most importantly they are: a. Very low usage rate; b. Inconsistent understanding of their purpose among IV&Ver's and mission projects; c. Potential value was a relatively narrow niche; and d. Changing paradigms for how we communicate potential issues to the projects. Simulation is a valuable addition to IV&V work.	Noble N. Nkwocha	05/15/2013

E	1. Revised section 1 to improve organization and reduce redundancy 2. Revised Fig. 3-1 to show PM as part of IV&V Project Team, added Security personnel, and added informal communication paths 3. Changed version explanation on the concurrence sheet to allow editorial changes without needing new signatures 4. Removed constraint on research use of export-controlled data 5. Clarified researcher NDA restriction 6. Changed “Analysis Reports” in Table 4-3 caption to “Presentations” 7. Added a Version History log 8. Revised table 2-1 to add Security artifacts 9. Revised Appendices A and B	1. Clarification 2. Clarification and adding Security 3. Allow simple clarifications and corrections to body without requiring new signatures 4. Restriction on use of export-controlled data is not covered by NDA 5. Clarification 6. To match context 7. To effectively communicate changes made 8. Expand/clarify IV&V security work 9. Clarify intent and update content	Eric Sylvania, Michael Facemire	07/07/2015

VERSION HISTORY				
Version	Description of Change	Rationale for Change	Author	Effective Date
F	Added Baseline Performance Review (BPR) to Table 4-4 and Acronyms list (Appendix F).	Beginning in Jan 2016, IV&V started providing project level inputs to the OSMA BPR	Wes Deadrick	02/12/2016
G	Including Assurance Conclusions as products in section 4.1 (IV&V Products) Changes to Appendix A and B including to include Assurance Goal Networks and high-level Mission Capability Assurance Goals	Incorporate the shift to Capability-based Assurance	Michael Lemon	09/05/2018

VERSION HISTORY				
Version	Description of Change	Rationale for Change	Author	Effective Date
H	Revised template to reflect best practices observed from the IVVO review of FY20-23 IPEPs. Revised several sections within the body of the template as well as revised content in each of the appendices to reflect best practices. Incorporated changes to align IPEP with the latest 7150.2D and 8739.8B requirements. Added SMA Technical Authority to the signature page. Cleaned up Figure 3-1 (Interfaces) and added the IV&V Director.	Provide increased clarity to end users of the IPEP on IV&V approaches such as CBA, FTR, and Assurance Objectives/Conclusions.	Joelle Spagnuolo-Loretta, Ricky Forquer	06/07/2023

IV&V Project Execution Plan (IPEP) Structure

The purpose of the IPEP is two-fold. First, it is to communicate IV&V interactions, interfaces, roles and responsibilities, technical products, and reporting methods with the Project. Second, the IPEP serves as the overarching project plan for the execution of the IV&V efforts. The IPEP is prepared and maintained by the IV&V Project Manager (PM). The IV&V PM coordinates the creation and maintenance of this document with affected individuals and organizations (within the NASA IV&V Program as well as with the Project).

The IPEP is divided into two major parts: the document body and the appendices. The document body describes the overall IV&V project and defines the basic agreements for the partnership between the IV&V Team and the Project. The second part of the document, the appendices, focuses on the fiscal year activities for the IV&V efforts. The appendices contain data that are more dynamic in nature and are expected to evolve over the course of the Project. The appendices include the results of, or a reference to, the IV&V Heritage Review, IV&V software risk assessments, and detailed information for each planned execution year, including items such as IV&V assurance goals and objectives, anticipated milestone review support, and risks.

The IPEP may be tailored as necessary by the IV&V PM with IV&V Office (IVVO) Management approval.

Purpose of the IPEP Template

The IPEP Template is designed to provide the following:

1. A standard outline and format for IPEPs such that reviewers, approvers, and users of the document know where to find information
2. Standard text that is used in all or most IPEPs
3. Differentiation of standardized text and formatting from tailored text and formatting
4. Guidance and best practices that provide those who generate or update IPEPs with tailoring guidance and section content guidance

IPEP Template Conventions

Different styles of text are used in this template:

1. <Text included in angled brackets>

This text represents Project-specific information to be provided and/or adjusted for; examples are <IV&V Point of Contact> for a particular role on the Project. This text should be updated/replaced before the IPEP is submitted for review/approval.

2. {*Red italic text in braces*}

   This text is guiding or explanatory in nature. It is intended to be a heads-up and provide guidance regarding section content, content format, tailoring, possible sources and locations of information, and suggestions for filling in each section. This text should be removed before the IPEP is submitted for review/approval.

3. Normal Text

   Text that appears normal (i.e., not highlighted or italicized) is intended to be common among all Projects. This is standard text that should be copied verbatim into the IPEP, unless Project-specific information should be inserted. If you think that the text is not accurate for your Project, you may propose a change and provide rationale to those who review and approve the document.

The author shall incorporate version numbering to all versions of the IPEP for their Project. All draft versions of the IPEP shall be marked as “DRAFT” in the footer. The initial version of the IPEP shall have a version number of 1.0; the version number shall be updated by one (e.g., Version 2.0) based upon subsequent updates to the IPEP on a FY basis. Any revisions made to this IPEP during the year (e.g., during mid-year rebaseline efforts) shall result in an update to the number to the right of the decimal (e.g., Version 1.1).

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Template begins on the following page.}

National Aeronautics and Space Administration

Independent Verification and Validation (IV&V)
<PROJECT NAME>

IV&V Project Execution Plan (IPEP)

FY <Fiscal Year> v<Version X.X>

Updated Date: <Date>

Katherine Johnson Independent Verification and Validation Facility

100 University Drive, Fairmont WV 26554

DOCUMENT COORDINATION and APPROVALS

{From an external perspective, this section captures the various signatures of all individuals who are committed to provide support/service/artifacts across the interface between IV&V and the Project. Tailor/update the listing of external signatures as applicable. For instance, if SMA or SQA personnel are expected to provide something, please include them on the signature list. The same would go for other entities that might be sought for contribution}

This is Version 1.0 of the <PROJECT NAME> IPEP. This IPEP will be revisited and updated as necessary on a semi-annual basis. At a minimum, a new version of this IPEP will be published for review, approval, and concurrence by all entities listed below each fiscal year and the base version number will be increased by one (e.g., Version 2.0). Editorial revisions to the body of the IPEP and any revisions to the appendices for the current fiscal year will result in an update to the decimal part of the version number (e.g., Version 1.1) and require concurrence by the Project IV&V Point of Contact at a minimum. Draft versions of the IPEP will be marked as "DRAFT."

PREPARED BY:

_____DATE:___/___/___
<IV&V PM Name>, NASA IV&V Project Manager

APPROVED BY:

_____DATE:___/___/___
<IV&V Office Lead Name>, NASA IV&V Office Lead

CONCURRED BY:

_____DATE:___/___/___
<PROJECT NAME> Project IV&V Point of Contact (POC)

_____DATE:___/___/___
<PROJECT NAME> Chief Safety Officer (CSO) {or equivalent Project SMA Technical Authority (e.g., Mission Assurance Manager (MAM) for JPL Projects)}

_____DATE:___/___/___
<PROJECT NAME> Project Manager

VERSION HISTORY			
Version	Description of Change	Rationale for Change	Modified By

Table of Contents

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1 Introduction

1.1 Document Purpose

This IPEP has two primary purposes. First, it describes the overall <PROJECT NAME> IV&V project and defines the basic agreements for the partnership between the <PROJECT NAME> IV&V Team (hereinafter referred to as the IV&V Team) and the <PROJECT NAME> Project (hereinafter referred to as the Project). These agreements include roles and responsibilities, communications paths, IV&V products, IV&V reporting methods, and artifacts anticipated to be shared between the IV&V Team and the Project. Second, the IPEP serves as the overarching project plan for the execution of the IV&V efforts.

1.2 Intended Audience

{This section should be tailored to each individual Project. The "audience" in this section will reflect who is on the signatory page and on Figure 3-1, the IV&V – Project Interfaces diagram}.

The intended audience of this document includes:

- NASA IV&V Program personnel, particularly the IV&V Director; IV&V Office (IVVO) management; and the <PROJECT NAME> IV&V project team (including the IV&V Mission Protection Services (MPS) team)
- Project personnel, particularly the <PROJECT NAME> Project Manager (PM), IV&V Point of Contact (POC), Chief Safety Officer (CSO); Safety and Mission Assurance (SMA), and Cyber Security personnel. *{Tailor out any aforementioned text if not applicable.}*

1.3 Document Organization

The IPEP is divided into two major parts: the document body and the appendices. The document body describes the overall IV&V project and defines the basic agreements for the partnership between the IV&V Team and the Project.

The second part of the document, the appendices, contain data that are more dynamic in nature and are expected to change over the course of the IV&V project. The appendices include the results of, or a reference to, the IV&V Heritage Review, IV&V software risk assessments, and detailed information for each planned execution year, including items such as IV&V goals and objectives, schedule, and risks.

2 IV&V Overview

2.1 IV&V Goals and Objectives

{This section describes at a high level what the IV&V efforts are trying to accomplish overall for the mission. Specific goals and objectives for each of the fiscal years are identified in the appendices}.

The IV&V Team strives to develop and provide objective evidence and recommendations to increase the assurance that the <PROJECT NAME> safety and mission critical software will operate reliably, safely, and securely in support of critical capabilities, in the expected operating environment, under both nominal and off-nominal conditions. The IV&V Team will document the assurance provided and any identified issues and risks to this assurance, and will work with the Project to advance these issues and risks to resolution.

IV&V analyses are intended to add evidence-based assurance that minimizes the overall risk of <PROJECT NAME> software preventing the mission from occurring safely and successfully.

Specific IV&V project assurance objectives for each Fiscal Year (FY) are identified in the appendices.

2.2 IV&V Approach

The IV&V approach will consist of validation- and verification-related analyses. Validation and verification are described further below, including the artifact types generally required for specific analysis objectives.

Validation-related analyses strive to assure the system software satisfies the user's capability needs under operational conditions. These analyses evaluate the attributes, features, and qualities exhibited by the Project's development artifacts for each selected critical capability, in the context of the following *three perspectives* defined in NASA IV&V System Level Procedure (SLP) IVV 09-1, *Independent Verification and Validation Technical Framework*:

- Assuring the software will perform as intended
- Assuring that the software will not perform in unintended ways
- Assuring that the software will respond appropriately to/under adverse conditions

Verification-related analyses determine whether the products of each development activity fulfill the requirements or conditions imposed by a previous development activity while being clear, consistent, verifiable, correct, and complete.

Critical software capabilities have been identified for <PROJECT NAME> by the IV&V Team; these capabilities are used to develop a set of assurance objectives, which capture the items of risk or concern the IV&V Team has regarding that specific capability. These assurance objectives have been prioritized and will be used to drive the analysis that the IV&V Team will perform to provide added assurance for the <PROJECT NAME> mission software.

Specific analyses that the IV&V Team may perform include verification and validation using the following types of Project artifacts: Concept Documentation, Requirements Documentation, Design Documentation, Test Documentation, Test Simulators/Environments, Implementation (e.g., Source Code, Executables, Patches), Security Documentation, Models, and Operations and Maintenance Documentation. The IV&V Team may also perform independent testing using test systems provided by the IV&V Program or the Project to help provide further evidence.

Examples of artifact types the IV&V Team needs to support verification and validation-related analyses are listed in Table 2-1, below. It is the evidence from the provided artifacts that is used to drive positive assurance conclusions and increase stakeholder confidence. The inability to acquire evidence will lead to gaps in IV&V provided assurance and potential risks to the development effort and overall mission success. In the event any of these artifact types cannot be provided to the IV&V Team, and/or the IV&V analyses are required to be performed on-site at the development organization, the IV&V PM and the IV&V POC will closely coordinate any impacts to the performance of the IV&V efforts. The IV&V Team does not drive or mandate the creation of specific software artifacts. The IV&V Team will work with available information and content in most formats, as long as the artifacts provided include the data necessary to verify and validate the developer's software and draw credible assurance conclusions on the software's mission suitability.

Results of the verification and validation will serve as a basis for assessing the goodness of the system software considering the Project's mission success criteria and the software's ability to perform or support expected system and software behaviors for critical capabilities.

Typical outputs of the verification- and validation-related analyses will include assurance conclusions, analysis reports, issues, and risks. Refer to Section 4 of this document for additional information on these products.

For additional information regarding verification- and validation-related analyses, see NASA IV&V SLP IVV 09-1.

The IV&V Mission Protection Services (MPS) group assesses for security vulnerabilities across the end-to-end mission system, providing an independent assessment of mission security risk, informed by available threat intelligence, focused on system and operational security risk factors. The goals of MPS are to provide Project insight into vulnerabilities, threats and security risks to provide the Project an opportunity to:

- Take action to reduce mission security risk to acceptable levels;
- Consciously accept risk where appropriate;
- Build-in security, removing vulnerabilities or reducing their impact, for mission systems in development and operations; and
- Enhance operations planning with insight into security monitoring capabilities and response readiness that will enhance mission success.

MPS analyzes relevant mission content from mission engineering artifacts, safety & reliability artifacts, mission security artifacts, ground system and IT artifacts, and operations capabilities and

procedures. MPS incorporates available threat information, and works to identify system vulnerabilities and mission security risks. MPS works in coordination with the <PROJECT NAME> Project to gain access to needed artifacts, provide status of ongoing investigations, and communicate current views of mission security risk. Table 2-1, below, also includes the types of artifacts that MPS needs to support security assessments.

{Modify the data in this table to reflect the targeted artifacts for your Project.}

Table 2-1: Project Targeted Verification & Validation Artifacts

Artifact Name
Operations Concept Document/Data
Early concept/design review documentation/data
Requirements Artifacts (including all levels, i.e., System, Software, Interface)
Traceability Related Data (e.g., requirement-to-requirement, requirement-to-design, requirement-to-code, and requirement-to-test traces)
Hazard Analyses (Preliminary Hazard Analyses (PHAs), Fault Tree Analyses (FTAs), etc.)
System Level Test Plans / Cases / Procedures / Scripts / Results
Software Level Test Plans / Cases / Procedures / Scripts / Results
Integration Level Test Plans / Cases/ Procedures / Scripts / Results
Software Design Documentation
Software Design Models
Source Code and binaries as required to support independent testing
Software Build delivery/release packages/Version Description documentation/data
Discrepancy reports from test activities
Compile and build procedures
Build environments (utilized to support independent testing, static code analysis, and increasing the fidelity of IV&V source code analysis)
Test environment resources (e.g., simulators, emulators, and supporting configuration items/data and tools)
System Security Plan
Security CONOPS
Software Security Requirements (if separate)
Security Design and Architecture
System's FIPS-199 Classification
System's FIPS-200 Classification
System Security Test Plan (if separate)
System Security Test Cases (if separate)
Threat Assessments
Project Protection Plan

2.3 IV&V Scope and Focus

As part of Software Assurance, IV&V plays an important role in the Agency's overall software risk mitigation strategy applied throughout the entire software lifecycle to improve the safety, reliability, and quality of software systems. It is critical that the IV&V Team identify and prioritize those parts of the system that are most critical, and should receive appropriate assurance services. Scope is the parts of the system that should be considered for IV&V assurance services. Focus is the set of in-scope items that will receive IV&V assurance services. In most cases, Focus is smaller than Scope. There are a variety of reasons why this is the case. Where this occurs, the rationale will be documented accordingly.

The IV&V Program seeks to define Focus through an understanding of the software risk profile, using an independent software risk assessment.

The <PROJECT NAME> IV&V Team uses an IV&V defined, capability-level software risk assessment process to scope and assess the required system capabilities for which software contributes, in terms of impact of a defect and likelihood of a defect. Impact and likelihood are evaluated considering IV&V-defined impact and likelihood scoring criteria. This top-down prioritization ensures application of IV&V resources to the most critical software capabilities and is referred to as Capability Based Assurance (CBA).

The <PROECT NAME> IV&V Team uses an IV&V defined, entity-level software risk assessment process to assess supporting software entities (e.g., CSCIs) to further focus and plan the IV&V project. The bottoms-up entity-to-capability mapping produced by this process provides a useful tool for discussing and deciding where to apply IV&V effort.

The IV&V Team's goal is to expand assurance to as many areas as possible that pose risk to mission success. The IV&V Team can adjust the amount of rigor at both the capability level as well as the entity level to provide an acceptable level of confidence regarding the most critical capabilities in support of the mission. This understanding of software risk will then be used to plan and execute analyses at appropriately targeted levels of rigor. The <PROJECT NAME> IV&V Team follows a consistent process, described in detail in Appendix D, to determine what analysis needs to be provided for specific areas of concern in order to add assurance. The IV&V Team's distribution of effort, focus, assurance strategy and approach are adapted as appropriate through the IV&V execution period based on evolving risk insight to maximize overall assurance for the mission, and is referred to as "Follow The Risk" (FTR).

3 Roles, Responsibilities, and Interfaces

To facilitate successful execution of the IV&V efforts as described in this plan, various roles, responsibilities, and interfaces are maintained. These roles and responsibilities can be described in terms of personnel within the NASA IV&V Program and personnel within the Project. The subsections below describe these roles and responsibilities. Figure 3-1 depicts the interfaces associated with these roles.

{The generalized diagram in Figure 3-1 should be tailored to reflect the interfaces for your Project and reflect the characteristics of your Project. Also, update Section 3.3 Project-related text below if additional Project personnel are on the signature page of the IPEP and/or have any roles pertaining to the IV&V efforts.}

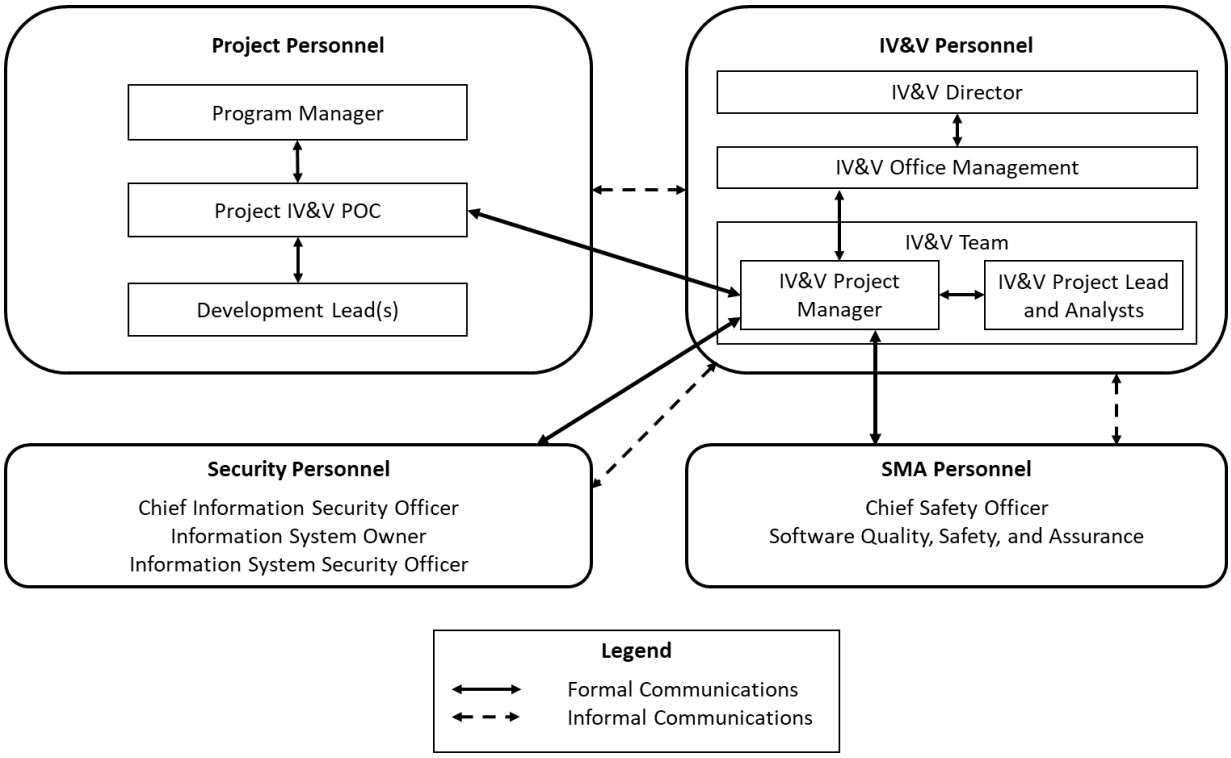

Figure 3-1 – IV&V Team and Project Interfaces

3.1 IV&V Team

The IV&V Team primarily consists of an IV&V PM, a contractor IV&V Project Lead (PL), and IV&V analysts (including MPS analysts as needed). The IV&V PM serves as the primary interface with the Project in support of the IV&V efforts. The IV&V PM is responsible for the overall leadership and direction of the IV&V efforts. This IPEP is prepared and maintained by the IV&V PM. The IV&V PM coordinates the creation and maintenance of this document with affected individuals and organizations (within the IV&V Program as well as with the <PROJECT NAME> Project). The IV&V PM is responsible for establishing the goals and objectives of the IV&V efforts through the use of assurance objectives; performing project management, tracking and oversight;

and conducting risk management in support of the IV&V efforts. The IV&V PM is responsible for ensuring that the commitments with the Project, as defined in this plan, are met.

The IV&V PL and analysts perform the verification- and validation-related analyses, which may include MPS analysis and Independent Testing. At times and at the request of the IV&V PM, the IV&V PL/analysts may interface with the IV&V POC directly. Formal and informal interfaces between IV&V personnel and Project personnel are indicated in Figure 3-1. Development of informal interfaces is encouraged to enhance communications and resolve concerns and questions with more efficiency at the various levels.

Table 3-1 – IV&V Personnel Contact Information

NASA IV&V Program		
Position	**Name**	**Contact Information**
NASA IV&V Director	<Director Name>	<Director contact phone number> <Director contact email address>
IV&V Office Lead	<IV&V Office Lead Name>	<IV&V Office Lead contact phone number> <IV&V Office Lead contact email address>
<PROJECT NAME> IV&V Project Manager	<IV&V PM Name>	<PM contact phone number> <PM contact email address>
<PROJECT NAME> IV&V Deputy Project Manager *{if assigned}*	<IV&V Deputy PM Name>	<Deputy PM contact phone number> <Deputy PM contact email address>
<PROJECT NAME> IV&V Project Lead	<IV&V PL Name>	<PL contact phone number> <PL contact email address>

3.2 Project Personnel

The Project will provide an IV&V POC for formal interactions between the IV&V Team and the Project. The IV&V POC will facilitate the IV&V tasks to be performed through coordination between Project personnel and the IV&V PM. The IV&V POC will be informed of all direct communications with other members of the Project which may include members of the Safety Office.

The Project will provide the IV&V Team the necessary interfaces, Project development data/documentation, and any other negotiated resources to perform the IV&V tasks. The Project will provide such data/documentation to the IV&V Team at the same time as the information is made available to the Project's teams. The Project will provide draft and final versions of IV&V-

requested development artifacts. It is expected that many of the development artifacts necessary to perform the IV&V analysis will be formal deliverables. However, in some cases non-deliverable or informal documentation (e.g., Software Development Folders, incremental pre-release builds) may be needed to support the IV&V analysis. In such cases, the IV&V POC will make these items available on a case-by-case basis after taking into consideration various factors, including but not limited to, overall impact on the Project. The incremental pre-release builds, in particular, are often necessary for the IV&V Team to achieve in-phase identification of issues. While not required, electronic access to Project repositories/tools is preferred (e.g., requirement tracing tools and databases, issue tracking systems, document repositories).

The Project, through the IV&V POC, is responsible for working with the IV&V Team to resolve issues/risks identified by the IV&V Team.

Table 3-2 – Project Personnel Contact Information

<PROJECT NAME> Project		
Position/Role	**Name**	**Contact Information**
<PROJECT NAME> Project Manager	<PM Name>	<PM contact phone number> <PM contact email address>
IV&V Point of Contact	<IV&V POC Name>	<POC contact phone number> <POC contact email address>
Chief Safety Officer or Mission Assurance Manager	<CSO/MAM Name>	<CSO/MAM contact phone number> <CSO/MAM contact email address>
Software Chief Safety Officer (SCSO)) Representative *{or equivalent, if applicable}*	<SCSO Rep. Name>	<SCSO contact phone number> <SCSO contact email address>
Software Development Lead *{if applicable}*	<SDL Name>	<SDL contact phone number> <SDL contact email address>
Chief Information Security Officer *{if applicable}*	<CISO Name>	<CISO contact phone number> <CISO contact email address>
Information System Owner *{if applicable}*	<ISO Name>	<ISO contact phone number> <ISO contact email address>
Information System Security Officer *{if applicable}*	<ISSO Name>	<ISSO contact phone number> <ISSO contact email address>

3.3 IV&V Capability Development Support

The IV&V Program conducts research in various areas that directly contribute to the efficiency and effectiveness of IV&V. All Project data will be closely protected and not released outside the IV&V project and its research contractors. No proprietary Project data will be used to support IV&V research unless there is a non-disclosure agreement in place between the IV&V researchers and the owner of the proprietary data. The Project agrees that non-proprietary, non-export-controlled, non-Controlled Unclassified Information (CUI) Project data may be used to support software IV&V-related research without requiring Project approval. The IV&V project agrees that any related research will not interfere with Project priorities. The IV&V project agrees not to publish or allow publication of any research document that can be referenced back to the Project without specific, prior written approval from the Project.

4 IV&V Products, and Communication and Reporting Methods

The IV&V Team generates various products and utilizes various communication and reporting methods throughout the lifecycle. The following subsections describe the IV&V products and associated communication and reporting methods further.

4.1 IV&V Products

4.1.1 Assurance Conclusions

Once the analysis has reached a point when the analyst has determined that there is no more analysis that can or should be performed in order to support an assurance objective, an assurance conclusion will be documented based on the evidence collected. This assurance conclusion documents the assessment, including any issues, risks, assumptions, forward work, and other caveats and limitations that have been found or understood during the analysis. In many cases these analyses will be suspended until further maturation of the artifacts occurs at which time the IV&V Team could choose to revisit that assurance objective. Assurance conclusions along with any issues or risks will be provided to the appropriate Project personnel and the IV&V POC as generated.

4.1.2 Analysis Reports

Over the course of the lifecycle, the IV&V Team may generate analysis reports that document the results of the analyses performed. These reports will typically describe what the IV&V Team analyzed (Project artifacts), a high-level description of the process, approach, and tools used (if applicable), and associated results. The IV&V Team will provide the analysis reports to the Project as defined in the Appendix for each fiscal year.

4.1.3 Technical Issue Memorandums

A Technical Issue Memorandum (TIM) is the formal mechanism the IV&V Team uses to document one or more instances of defects (i.e., issues) identified within a development artifact, and subsequently formally communicate defects to the Project. Each TIM has a documented impact and is assigned a severity rating between 1 (highest severity) and 5 (lowest severity) as defined in Table 4-2. TIMs of severity rating 1-3 require a formal disposition by the Project and

must be verified to have been addressed prior to closure. TIMs of severity rating 4 or 5 do not require formal disposition by the Project and may transition directly to the "Not To Be Verified" state in IV&V Program issue tracking system in the absence of a Project response. Resolving severity rating 4 and 5 TIMs, nonetheless, will certainly improve the quality of the Project's software and reduce or eliminate risks associated with maintenance of the software product.

Table 4-2: TIM Severity Rating and Description[1]

Severity	Capability Affected	Success Criteria	Safety	Test	Cost & Schedule	Other
1 **Catas-trophic**	Loss of an essential capability OR Complete loss of mission critical asset	Inability to achieve minimum mission success criteria	Causes loss of life or injury	N/A	N/A	N/A
2 **Critical**	Degradation of an essential capability OR Damage/ destruction to mission asset which affects performance	Impact to the accomplish-ment of a mission objective	N/A	Essential capability not tested	Significant cost increases or schedule slip	Significant reduction to requirements margins or design margins
3 **Moderate**	Degradation of system dependability OR Loss of a non-essential capability	Impact to the accomplish-ment of extended/ optional mission objectives	N/A	Essential capability inadequately tested	Cost or schedule impact resulting from redesign, reimplemen-tation, and/or retest	Degradation of an essential capability or inability to accomplish mission objective, but with a known workaround
4 **Minor**	Degradation of a non-essential capability	N/A	N/A	Non-essential capability inadequately tested	Defect impacting maintainability on current mission or reuse on future missions	Creates inconvenience for operators, crew or other projects' personnel

[1] Source: S3105, Guidelines for Writing IV&V TIMs

5 **Communi-cations Or Editorial**	Defect impacting documentation and communication clarity

TIM Resolution Path: The Project will review the TIM as provided by the IV&V Team and respond in a timely manner. Timing may require coordination on a case-by-case basis. In general, it is best if TIM can be reviewed and responded to within a couple of weeks. Timely Project review and response is important to avoid propagation of defects into subsequent Project products, to prevent incorrect IV&V reporting (e.g., to Office of Safety and Mission Assurance (OSMA) and other NASA IV&V Program stakeholders), and to minimize IV&V rework.

If the Project concurs that a TIM is legitimate, the Project will propose a solution or formally accept the risk of not resolving the issue. IV&V does not advocate for the acceptance of risk associated with Severity 1 or 2 TIMs. When the Project identifies a plan to fix the defect, the TIM will be put in the "To Be Verified" state. After the defect is resolved, the Project will notify the IV&V Team that the corrective action has been made and will provide the appropriate evidence (e.g., updated development artifacts, etc.) to the IV&V Team for verification and subsequent closure of the TIM. If verification of the corrective action cannot be completed, the IV&V Team will request additional information from the Project. If the Project accepts the risk of not resolving the TIM, the TIM will be put in the "Project Accepts Risk" state.

If there is a dispute at any time in the issue resolution process, the TIM may be placed in an "In Dispute" state, at which time the Project and IV&V Team can continue dialog on the TIM. Subsequent to these discussions, the TIM may be withdrawn, placed in the "Project Accepts Risk" state, or reverted to the "To Be Verified" state.

If the Project does not concur a TIM is legitimate, the Project will provide appropriate data and/or explanation to support this conclusion. The IV&V Team will review and consider this data and if the IV&V Team agrees, the TIM will be withdrawn. If the IV&V Team does not agree, additional dialog and discussion between the Project and IV&V Team may be required and an appropriate course of action will be determined.

When one or more TIMs remain in an open ("Submitted" or "To be Verified") state for an extended period of time, it may reduce the Project's ability to address the issue in phase with development, leading to schedule impacts and issues propagating through later development lifecycle artifacts. This is referred to as "Stale TIMs". When impacts appear likely, stale TIMs may lead to an escalation in IV&V reporting of Issue Resolution Status to the Agency (see Section 4.1.6).

4.1.4 Risks

By conducting IV&V analysis, the IV&V Team may become aware of circumstances or information that represents a potential undesirable event for the Project. The IV&V Team will document such items as risks and will formally communicate these risks to the Project. The IV&V Team will assess all risks based on the likelihood and consequence of the undesired event using

the Project's likelihood and consequence ranking criteria (as defined in the Project's risk management plan). The IV&V Team may also provide recommendations to eliminate, reduce, or mitigate the risks. The IV&V Team will coordinate all risks with the Project prior to formal submission. To facilitate the submission of risks, the IV&V Team may request access to the Project's Risk Management System (RMS) and the IV&V Team and IV&V POC will work together to determine the appropriate level of access to the RMS. The IV&V Team will continue to monitor and report on all open IV&V-identified project risks regardless of whether they are captured in the Project's RMS.

Typically, Projects retain residual risks throughout the lifecycle. As such, the IV&V Team may need to assess the Project's residual risks. At minimum, and as required by the Chief SMA Officer, the IV&V Team will evaluate residual risk data as provided by the Project in preparation for the SMSR. The IV&V Team will communicate their stance with regards to such residual risk data to the Project prior to the SMSR.

Risk Resolution Path: The Project will review risks as provided by the IV&V PM. If the Project agrees with the nature of the risk, the Project will document the risk and associated mitigation plan(s) in the Project's RMS. It is expected that the Project actively manages, tracks, and mitigates such risk. The IV&V Team will monitor the progress of these activities until the risk is closed. This monitoring may be performed independently or via the Project providing status data to the IV&V Team. If the IV&V Team determines that the risk is not being actively managed, the IV&V Team will discuss this with the IV&V POC and determine an appropriate course of action.

If the Project decides not to accept, mitigate, and manage a risk, the Project will provide appropriate information to support this conclusion. The IV&V Team will review this information. If the IV&V Team is in agreement, the risk will be withdrawn. If the IV&V Team is not in agreement, additional dialog between the Project and IV&V Team may be required and an appropriate course of action will be determined.

4.2 IV&V Communication and Reporting Methods

Communications and reporting methods between the IV&V Team and the Project occur via both formal and informal channels. Formal communication and reporting methods include delivery of IV&V analysis reports and associated technical data, IV&V briefings at milestone reviews, and dialog between the IV&V Team and Project regarding scope, priorities, access to resources, etc. consistent with this plan. Informal communications and reporting methods include recurring teleconferences and tag-ups between the IV&V Team and IV&V POC, requests for and delivery of development artifacts, and technical discussions on IV&V analysis results to facilitate resolution of IV&V issues and risks.

4.2.1 Item Tracking, Monitoring, and Escalation

All data such as issues and risks are recorded and provided to the Project as they are identified and/or as per an agreed-to schedule. The IV&V Team will evaluate Project responses to this data and update the status of this data in terms of tracking towards resolution in the appropriate NASA IV&V Program repository. In addition, this "goodness of product" data will be documented in

other IV&V products including but not limited to lifecycle review presentations, analysis reports and recurring or ad hoc status reports as applicable.
{Modify this section to reflect the escalation chain that is appropriate for your Project}.
Given the reporting data mentioned above, any areas of disagreement regarding this data that cannot be resolved between the IV&V Team and the Project within an appropriate period, the IV&V PM will elevate the issue to IV&V Office Management. The IV&V PM will ensure that the Project is aware that the issue is being elevated. The final level of resolution will be the Program Management Council (PMC) responsible for the Project.

4.2.2 Lifecycle Review Presentations

Throughout the lifecycle, the IV&V Team supports formal Project milestone reviews (e.g., Preliminary Design Review (PDR)) by providing information that portrays the IV&V assurance status, including overall goodness of product data, at the time of the review. At a minimum, and as required by the NASA Agency's Chief SMA Officer, the IV&V Team will present status of the IV&V efforts and associated recommendations at the Safety and Mission Success Review (SMSR). The IV&V PM will provide IV&V status data and associated results of the IV&V efforts at various Project milestone reviews as defined in Table 4-3. The IV&V PM will communicate and coordinate the overall content of the presentation with the Project prior to the actual review.
{Tailor the data in this table to reflect what the requirements are for your Project based on customer discussion.}

Table 4-3: Milestone Review IV&V Presentations

Milestone Review	Project Recipient	Input Due
Subsystem level reviews	IV&V POC	As required by the Project
Mission Reviews (i.e., PDR, CDR, MRR, LRR, SMSR)	IV&V POC	As required by the Project

4.2.3 Agency/Mission Directorate/IV&V Program Management Briefings

Throughout the course of the lifecycle, the IV&V Team is required and/or requested to present IV&V status to various stakeholders including but not limited to Center Management and the Mission Directorates, etc. At a minimum, all IV&V Projects will generate a Monthly Status Report (MSR) dashboard, which will be shared via SharePoint with applicable stakeholders. The IV&V Team will communicate and coordinate the overall content of these presentations with the Project prior to the actual review as defined in Table 4-4.
{Tailor the data in this table to reflect what the requirements are for your Project based on customer discussion. Use working days unless there is a true requirement for calendar days to be used, e.g., a contractual or legal requirement. Regardless, be specific as to the type of days intended.}

Table 4-4: Additional Reporting Events

Milestone Review	Project Recipient	Input Due
Monthly Status Report (MSR) Dashboard	IV&V POC	5 working days prior to review
OSMA Baseline Performance Review (BPR)	IV&V POC	5 working days prior to review
IV&V Advisory Board (IAB) Semi-Annual Briefings	IV&V POC	5 working days prior to review

4.2.4 Routine Tag-ups

The IV&V Team will work with Project personnel to establish routine tag-ups to discuss overall IV&V status, development artifacts requests, results of IV&V analyses (issues and risks), status of Project schedule and artifacts, resolution plans and expected timeframe of IV&V issues and risks, and delivery of formal IV&V reports, etc. Such tag-ups may occur on a weekly, bi-weekly, or monthly basis as agreed to by both parties. These routine tag-ups represent the preferred method for communicating and resolving any issues and/or risks that the IV&V Team has identified.

4.2.5 Development Reviews and Working Groups Support

The IV&V Team will support mutually agreed upon Project working groups or development reviews, and provide appropriate analysis results through these forums. This will provide IV&V analysis results in-phase with the Project's activities to the extent practical, with IV&V findings submitted in the Project's own formats when possible. Significant IV&V findings submitted through such forums will also be captured as TIMs and analysis reports.

4.2.6 NASA Audit, Assessment, and Review Support

The IV&V Team will support any NASA led review or audit functions, as needed, to provide any requested status and assessments. The IV&V team will ensure the Project is aware of participation in such reviews and the content being shared.

Appendix A: IV&V Capability-Level Software Risk Assessment Results

Table A-1 shows the results from the capability-level risk assessment performed for this mission. The results help prioritize and focus IV&V activities pertaining to the mission capabilities. The risk assessment was developed using the S3106 process guideline, and results will continue to be refined as more information becomes available.

{The data below is from an example IV&V Project. This data shall be tailored for each individual project. The format and content can be tailored as necessary to fulfill the intent of this section. It is recommended that at the time of development of the IPEP that the generator of this content consult with the IV&V Office Lead as well as other IV&V PMs to identify other candidate examples as well as best practices. Content has been intentionally deleted and altered to conceal the source project.}

Table A-1 Capability-Level Risk Assessment Results

I = Impact Score C = Confidence Score CCS = Composite Capability Score

ID	Capability	I	C	CCS
1	**Launch Flight System to Earth Orbit**			
1.1	Separate from launch vehicle	1	4	2
1.2	Establish communications with ground	1	4	2
1.3	Deploy solar array for power	2	3	2
2	**Checkout Spacecraft and Instruments**			
2.1	Boot instruments for commissioning	2	3	2
2.2	Characterize performance for mission	2	2	2
3	**Travel to XYZ for Operations**			
3.1	Perform trajectory for mission	2	2	2
3.2	Perform gravity assist	2	2	2
4	**Perform Approach to XYZ**			
4.1	Collect information for approach	1	4	2
4.2	Transition to science orbit	3	3	3
5	**Collect Science Data**			
5.1	Collecting information on magnetic field	2	2	2
5.2	Gather preliminary gravity measurements	3	2	3
5.3	Acquire systematic topography	3	2	3
5.4	Perform gravity science	3	2	3
5.5	Perform orbit to orbit transfer	1	5	3

ID	Capability	I	C	CCS
6	**Support Observatory from Ground**			
6.1	Determine ephemeris for orbit	1	1	1
6.2	Uplink data to SC	2	2	2
7	**Cross-cutting Capabilities**			
7.1	Detect faults onboard observatory	1	5	3
7.2	Handle faults as detected	1	5	3
7.3	Maintain temperature for mission	1	5	3
7.4	Validate commands from ground	1	4	2
7.5	Route commands to systems	1	4	2
7.6	Execute commands as scheduled	1	4	2
7.7	Point observatory toward objective	1	4	2
7.8	Stabilize observatory for mission	1	4	2
7.9	Provide data to ground	1	3	1
7.10	Receive data from ground	2	3	2
7.11	Provide power for operations	2	3	2
7.12	Generate power for operations	1	4	2
7.13	Distribute power for operations	3	3	3
7.14	Load image for operations	3	4	3
7.15	Update files for software	3	3	3
7.16	Store data for downlinking	3	4	3
7.17	Record data from instruments	1	4	2
7.18	Playback data for ground	2	1	2
7.19	Manage files for storage	2	3	2

The supporting rationale for this data is maintained by the IV&V PM and is available upon request.

Appendix B: IV&V Entity-Level Software Risk Assessment Results

{The data below is from an example IV&V Project. This data shall be tailored for each individual project. The format and content can be tailored as necessary to fulfill the intent of this section. It is recommended that at the time of development of the IPEP that the generator of this content consult with the IV&V Office Lead as well as other IV&V PMs to identify other candidate examples as well as best practices. Content has been intentionally deleted and altered to conceal the source project.}

The process for prioritization of IV&V resources starts with the capability-level risk assessment, which is applied to mission capabilities (results shown in Appendix A). The next step is the software entity-level risk assessment, which extends the risk assessment to the software components (i.e., entities) that implement the system behaviors necessary to accomplish mission capabilities. Table B-1 shows the entity-level software risk assessment scores and priorities.

Table B-1 – Entity-Level Software Risk Assessment Scores

I = Impact Score L = Likelihood Score R = Risk Score

Entity	I	L	R
Spacecraft FSW			
AVS (Avionics)	4	2	14
BOOT (Boot & Init)	4	2	14
BC (Bus Controller)	4	2	14
CB (Comm Behavior)	3	3	15
CMD (Command)	5	2	17
DP (Data Products)	2	1	3
DHR (Device Health & Redundancy)	4	3	19
DWN (Downlink)	4	2	14
EP (Electric Propulsion)	4	3	19
FP (Fault Protection)	5	4	24
FILE (File System)	4	3	19
FSW (Flight Software)	3	1	5
GNC (Guidance, Navigation & Control)	4	4	22
HWC (Hardware Commands)	5	2	17
PRM (Parameters)	2	2	8
PM (Power Management)	3	4	18
PS (Power Switching)	5	3	21

Entity	I	L	R
PYRO (Pyro)	3	3	15
SEQ (Sequencing)	3	3	15
SM (System Mode Management)	4	4	22
TELE (Telecom)	5	3	21
TLM (Telemetry)	4	2	14
THRM (Thermal)	4	4	22
TIM (Timekeeping)	3	3	15
UPL (Uplink)	4	2	14
IMG (Imager)	4	2	8
SUROM	4	2	14
PPROM	3	1	5
Instrument Software			
Instrument 1	2	2	8
Instrument 2	4	2	14
Instrument 3	4	2	14
Instrument 4	3	2	11
Ground Software			
GDS (Ground Data System)	2	2	8

	Low Priority/Limited IV&V Coverage
	Medium Priority
	High Priority

Appendix C: IV&V Heritage Review & Applicable Lessons Learned

{Either include the Heritage Review document or identify the relevant document(s) and include a pointer to the location.

Include all applicable lessons learned from past mission(s), past IV&V experience, or from other Lessons Learned databases.}

Appendix D: Assurance Design

{Formerly the Technical Scope & Rigor (TS&R). This appendix will include the assurance design, including Assurance Objectives, an outline of focus areas, and the approaches considered for performing technical tasks. This appendix can reference a separate document for your particular Project and/or embed content directly into this appendix. Identify the relevant document(s) and include a link to the location.}

Upon prioritizing the critical flight software capabilities identified for <PROJECT NAME>, the IV&V team developed a set of assurance objectives which captured the items of risk or concern the IV&V team had regarding that specific capability. Figure D-1 identifies the High and Moderate priority IV&V Assurance Objectives (AOs) derived as part of the risk assessment. These AOs drive the IV&V focus.

{The data below is from an example IV&V Project. This data shall be tailored for each individual project. The format and content can be tailored as necessary to fulfill the intent of this section. It is recommended that at the time of development of the IPEP that the generator of this content consult with the IV&V Office Lead as well as other IV&V PMs to identify other candidate examples as well as best practices. Content has been intentionally deleted and altered to conceal the source project.}

Table D-1 IV&V Assurance Objectives

AO ID	Priority	Assurance Objective - *Provide assurance the spacecraft system and software can…*
AO-001	Moderate	...detect the deployment status of the solar array, reducing the risk of insufficient information for diagnosing power generation issues
AO-002	High	...trigger the appropriate safe mode using configurable fault logic, reducing the risk of degradation of software and hardware reliability, up to and including potential loss of mission.
AO-005	Moderate	...generate enough power to last without sunlight, reducing the risk of running out of power during an eclipse.
AO-009	Moderate	...switch power boards without power loss to systems or instruments, reducing the risk of losing power to systems or instruments and becoming inoperable.
AO-011	Moderate	...fail safe and power off non-essential systems when battery SOC falls to critical levels, reducing the risk of running out of power.
AO-012	Moderate	...effectively determine the SOC, reducing the risk of under/over charging battery cells.
AO-022	Moderate	...fail safe if reaction wheels fail, reducing the risk of the spacecraft not being able to stabilize.
AO-024	Moderate	...report autonomous redundancy switching in telemetry, reducing the risk of bad, autonomous switching and reconfigurations.
AO-025	High	...detect failed, redundant components, reducing the risk of operating with failed components.
AO-029	High	...fail safe when an unplanned off-nominal situation occurs, reducing the risk of unplanned off-nominal situations depredating mission success.
AO-032	High	...transmit telemetry while in a safe mode that completely describes the failure, reducing the risk of operations not being able to isolate root cause of the failure.
AO-034	High	...control heaters to maintain components within desired operational temperature ranges, reducing the risk of losing/impairing thermal sensitive components essential for mission success.
AO-035	High	...detect a thermostat fault/failure, and mitigate the impact of the fault/failure, reducing the risk of incorrectly heating instruments, causing degradation to instruments.

AO ID	Priority	Assurance Objective - *Provide assurance the spacecraft system and software can…*
AO-036	High	...regulate temperatures in safe mode, reducing the risk of losing thermal sensitive components in safe mode.
AO-038	Moderate	...execute commands according to their priority, reducing the risk of urgent commands being delayed.
AO-040	Moderate	...inform ground that telecommand failed verification, reducing the risk of commands being ignored quietly.
AO-048	Moderate	...detect command loss and respond appropriately, reducing the risk of losing ability to receive commands.
AO-051	Moderate	...protect instruments from sun through rotation, reducing the risk of sun exposure damaging instruments.
AO-052	Moderate	...validate GN&C data, reducing the risk of incorrect autonomous orbit corrections.
AO-053	Moderate	...validate routing parameters, reducing the risk of telecommand routing to incorrect systems.
AO-055	High	...prevent DSOC from interfering with spacecraft, reducing the risk of DSOC interference.
AO-056	Moderate	...detect and handle pointing inaccuracies, reducing the risk of the spacecraft not being able to point to its desired target.
AO-070	Moderate	...operate the NS as expected, reducing the risk of inaccurate/reliable data.
AO-078	Moderate	...detect jitter and stabilize the spacecraft, reducing the risk of jitter interfering with science data collection.
AO-079	Moderate	...detect bad sensor data, and switch to redundant sensors, reducing the risk of using invalid sensor data.
AO-081	High	...successfully side swap C&DH, reducing the risk of side swapping C&DH compromising the system.
AO-082	Moderate	...switch to redundant SDST/TWTA, reducing the risk of SDST/TWTA preventing communication.
AO-085	High	...achieve required thrust profile, reducing the risk of using more propellant than anticipated due to thruster failure, degrading mission success.
AO-089	Moderate	...autonomously unload momentum, reducing the risk of not being able to provide sufficient attitude control.
AO-091	High	...alert ground of bus comm loss, or assure a redundant bus exists, reducing the risk of bus comm loss impacting mission.
AO-092	High	...have enough resources necessary to maintain desired orbit, reducing the risk of loss of science data capture periods.
AO-093	High	...efficiently use cold gas when needed, and not using cold gas for AC unless deemed absolutely necessary by ground, reducing the risk of cold gas being completely gone before the end of the mission.
AO-096	Moderate	...that the system could detect a bad load, and the system could correctly put itself into a safe state if the software update has issues, reducing the risk of putting the spacecraft into an inoperable state.

{The following provides an example description of IV&V's typical analysis activities. Tailor as needed}

The following provides a summary of each IV&V activity:

- Requirements Analysis – Verify and Validate Requirements
  - Analyze the software requirements to assure that the right behaviors have been defined and that the specifications are of high quality. Assure that requirements specify appropriate corrective and preventative actions to off-nominal conditions (i.e., responses to credible faults and failures).
  - Assess parent-child traceability. Assure requirements are flowed down completely and sufficiently decomposed, and confirm child requirements have an appropriate parent.
- Design Analysis - Verify and Validate Software Design
  - Assess the software design to assure it adequately satisfies the validated requirements, including dependability and required fault tolerance requirements.
- Implementation Analysis – Verify and Validate Software Implementation
  - Assure the source code is high quality and free of common defects by applying static code analysis.
  - Assure that the implementation complies with software design and requirements, including dependability and required fault tolerance requirements, and the implementation does not include undocumented behaviors by code inspection.
- Test Analysis – Verify and Validate Test Design
  - Ascertain scope and completeness of test approach; assure the test program is robust and tests functional and non-functional requirements.
  - Assure tests verify both the positive and negative perspectives of the requirements, as well as verify both sides of upper and lower limits where applicable.

Appendix E: Reference Documentation

{Include documents that were identified in this IPEP and any other relevant Project documentation. The purpose of this section is to identify locations and/or versions of documentation that is specified in the body of the IPEP.}

Table F-1: Relevant Documentation

Document	Title	Link or Date
IVV 09-1	Independent Verification and Validation Technical Framework	IVV 09-1
S3105	Guidelines for Writing IV&V TIMs	S3105
S3106	PBRA and RBA Process	S3106
NASA-STD-8719.13C	NASA Software Safety Standard	NASA-STD-8719.13C
NASA-STD-8739.8B	NASA Software Assurance and Software Safety Standard	NASA-STD-8739.8B
NPR 7150.2D	NASA Software Engineering Requirements	NPR 7150.2D
NPR 8715.3D	NASA General Safety Program Requirements	NPR 8715.3D

For more information regarding the <PROJECT NAME> mission, see the Project's website at: <URL for Project's website>.

Appendix F: Acronyms

{Add any mission specific or additional acronyms not already defined.}

BPR	Baseline Performance Review
CAR	Corrective Action Report
CDR	Critical Design Review
CISO	Chief Information Security Officer
CONOPS	Concept of Operations
CSCI	Computer Software Configuration Item
CSO	Chief Safety Officer
CUI	Controlled Unclassified Information
FIPS	Federal Information Processing Standard
FTA	Fault Tree Analysis
FTR	Follow The Risk
FY	Fiscal Year
IPEP	IV&V Project Execution Plan
ISO	Information System Owner
ISSO	Information System Security Officer
ITC	Independent Test Capability
IBA	IV&V Board of Advisors
IV&V	Independent Verification and Validation
IVVO	Independent Verification and Validation Office
JWST	James Webb Space Telescope
LRR	Launch Readiness Review
MAM	Mission Assurance Manager
MRR	Mission Readiness Review
MSR	Monthly Status Review
NASA	National Aeronautics and Space Administration
NDA	Non-Disclosure Agreement
NODIS	NASA Online Directives Information System
NPR	NASA Procedural Requirements
OSMA	Office of Safety and Mission Assurance
PBRA	Project Based Risk Assessment
PDR	Preliminary Design Review
PHA	Preliminary Hazard Analysis
PM	Project Manager
PMC	Program Management Council
POC	Point of Contact
RBA	Risk Based Assessment
RMS	Risk Management System
SDL	Software Development Lead
SLP	System Level Procedure
SMA	Safety and Mission Assurance
SMSR	Safety and Mission Success Review

SQA	Software Quality Assurance
SRR	System Readiness Review
STD	Standard
SWAT	Software Assurance and Tools
TIM	Technical Issue Memorandum
TS&R	Technical Scope & Rigor

Appendix G: Fiscal Year <XX> IV&V Summary

{This appendix should focus on identifying the goals and objectives of the IV&V efforts for the applicable FY, and any known risks associated with the IV&V Team's ability to achieve the identified goals/objectives. ***This data should be repeated in subsequent appendices for each of the remaining Fiscal Years; the data should be of higher fidelity for the current FY and decreasing in fidelity for the out-years.}***

G.1 FY <XX> Assurance Goals and Objectives

{The intent of this section is to identify at a high level the assurance goals and objectives of the IV&V efforts for the applicable FY.}

See Appendix D for the full set of IV&V Assurance Goals and Objectives.

G.2 FY <XX> Targeted External Milestones

{List the key development project milestones in text or tabular format. Depending on the development project, this may include milestones such as SRR, PDR, CDR, MRR, ORR, Launch Date, etc.}.

Table G-1: Project FY <XX> Milestones

Key Milestone	Current Planned Date
SRR	mm/20yy
PDR	mm/20yy
Launch	mm/20yy

G.3 FY<XX> Internal Milestones

{List key internal milestones for the IV&V efforts in text or tabular format. These will vary depending on the project, but may include mid-year risk assessment update, IV&V kickoff meeting, next year planning meeting with development Project, etc.}

Table G-2: IV&V FY <XX> Internal Milestones

Milestone	Current Planned Date
Risk Assessment Update	mm/20yy
Checkpoint Review	mm/20yy
FY XX Planning	mm/20yy

G.4 FY <XX> Schedule

{Provide a snapshot or summary of the IV&V Schedule for the applicable FY efforts. Ensure that it is viewable (note that you may have to change the orientation of this page accordingly); OR include a link in the IV&V ECM that identifies the location of the schedule and the name of the file.}

G.5 FY <XX> Risks

{Provide a listing of risks that you perceive exist with the execution of your plan for the applicable year. This data only needs to be at the summary level as these risks will be managed via the IV&V Risk Review Board}.

Table G-3: IV&V Identified Risks

Risk Title	Risk Statement/Description

G.6 FY <XX> IV&V Technical Reports

{List specific technical reports planned for the fiscal year. For relative dates, use working days unless there is a true requirement for calendar days to be used, e.g., a contractual or legal requirement. Regardless, be specific as to the type of days intended.}

Table G-4: FY <XX> IV&V Technical Reports

Report Title or Scope	Delivery Date or timeframe
Requirements Analysis Report	mm/20yy
Build x.x Analysis Report	mm/20yy
Test Analysis Report	15 working days after activity completed

{Update Table of Contents once this document is completed}