

 <p><b>Independent Verification &amp; Validation Program</b></p>	<p align="center"><b>IV&amp;V Project Heritage Review Template</b></p>	<p><b>T2104</b> <b>Version: Basic</b> <b>Effective Date:</b> <b>07/28/2022</b></p>
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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
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document conflicts with any document in the NASA Online Directives Information System (NODIS), this document shall be superseded by the NODIS document.**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.**

## **Heritage Review Purpose and Structure**

The core purpose of the Heritage Review (HR) process is to learn from our collective experiences to maximize the value of IV&V's contributions to NASA and other stakeholders. It also ensures that a promotion of faults do not cascade from one project to another through inherited or reuse of hardware interfaces and software. IV&V's promotion of due diligence necessitates this review in an effort to promote knowledge that understanding may be gained of previous faults, past developer assumptions and on-orbit anomaly impacts. It is with this foundational visage a more complete system understanding of the new project can be obtained, leading to higher fidelity planning and scoping, analysis and ultimately assurance provided to the mission and Agency.

The Heritage Review Template is divided into two major parts: the document body and the appendices. The document body describes the overall process to be performed during the heritage review, and the resulting conclusions that were derived from the data obtained. The appendices contain the datasets that are more dynamic in nature and could change over the course of the Project as more information becomes available or as the IV&V Project's system understanding changes as well.

The Heritage Review template may be tailored as necessary by the IV&V PM.

## **Purpose of the Heritage Review Template**

The Template is designed to provide the following:

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

## **Heritage Review 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;

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 Heritage Review is completed

National Aeronautics and Space Administration



## **Independent Verification and Validation**

IV&V Heritage Review of the ProjectX Project

1.0

month day, year

NASA Independent Verification and Validation Facility  
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## 1 Purpose

The purpose of this report is to document the heritage review performed by the <ProjectX> IV&V team. The purpose of the heritage review is to survey prior IV&V projects for applicability of their results to ProjectX and to document references to applicable project results for use in planning and scoping activities, along with early ProjectX IV&V analysis activities. This heritage review report will also serve as the base for the ProjectX's IV&V Technical Reference.

## 2 Team Members

The following team members contributed to the ProjectX IV&V Heritage Review:

- First Last– Role

*[Utilize this section to document the participating team members that supported the development of the HR in the event that roles change and the HR needs to be updated.]*

- *HR team makeup could consist of some if not all of the following personnel:IV&V project manager
 
  - *Technical Lead*
  - *TQE team member*
  - *Subject Matter Expert personnel Team member/contributor]**

## 3 Overview of the Heritage Review Process

The heritage review process involved a sequence of steps starting with heritage mission assertions identified by mission project and/or developers. The IV&V team then surveyed former IV&V projects, and added to the asserted heritage missions a list of missions with similar characteristics. This resulted in a final set of missions relevant to ProjectX where IV&V analysis was previously performed. Detailed IV&V analysis activities for each of these missions were identified to further understand their applicability to ProjectX. Finally, the IV&V team surveyed previous IV&V risk assessments, issues, risks, and lessons learned documented for each of these missions, where available, to determine their applicability to ProjectX. The following sections describe each of these steps in detail.

*[The previous projects should be within the last 5-10 years unless still operational. This is due to obsolescence, upgrades and experimentation changes of hardware, software architecture and instrumentation. However, exceptions can be made in the event that some aspect of the mission is unique or fully reusing something like an instrument]*

### 3.1 Mission Project/Developers' Asserted Software Heritage

The spacecraft developer[s], DeveloperX, conducted a study to define a baseline mission concept of operations intended to validate ProjectX mission requirements. The outcome of this study was documented in the ProjectX Concept Study Report, produced in yyyy. These results are useful to IV&V in determining the applicability of prior IV&V results. The developer's heritage assertions are documented in Section 4.

*[This section will address the Developer assertion that they will reuse software from a previous mission, an instrument, and may state to what extent they are reusing the software. Depending on the process or product developed by the mission project, the format of this section may need updating]*

### 3.2 IV&V Heritage Program Survey

The first step in performing a survey of prior IV&V results is to determine applicable programs and projects that have previously received IV&V, including similar mission concepts, spacecraft, and instruments. The results of this survey are documented in Section 5.

*[Utilization of past artifacts and IV&V products to help inform current efforts, ensure that the best Methods are used and that that focus remains on the most critical capabilities and components to maximize the assurance provided]*

### 3.3 Per-Project Heritage Survey

Once the set of applicable heritage projects was identified, the specific IV&V analysis activities performed for each heritage project was determined, further refining their potential applicability to ProjectX. Section 0 captures the results of this analysis.

*[In this section, determine if the past IV&V analyses are potential targets for the mission. Determine if the Methods are still applicable and if any of the results of past analysis still has bearing for the current mission]*

### 3.4 Risk Assessments, Issues, Risks, and Lessons Learned from Heritage Missions

The IV&V team reviewed high severity issues, risks, and lessons learned that had been documented for each selected heritage mission. When possible, the ProjectX IV&V team consulted with heritage IV&V PM and team members to gain insight into their efforts, opinions of what worked well, what didn't, etc. The purpose was to identify high severity issues and risks that may be pertinent to the planning and scoping efforts for ProjectX and to utilize lessons learned to ensure IV&V is adding assurance in an efficient manner. Section 7 captures the results of this analysis.

*[For this section is necessary to look at AOs, high severity issues, internal/external risks and issues that the project accepted as risk. These help identify areas of focus for future work. Key internal resources include PBRA/RBAs, Resolve, and its predecessors Orbit and PITS; project final reports; and the IV&V Lessons Learned Database. External resources include agency anomaly data, NASA Lessons Learned Database, Mission Project Websites, and Mission Project personnel]*

## 4 Mission Project/Developer's Asserted Software Heritage

The Mission Project/developer, DeveloperX, has performed an assessment of the level of reuse expected for each spacecraft software capability and component. The following content was reviewed from the assessment...

*[This section should define as clearly as possible the reuse plan for the mission. Keys in this area are identifying any changes in the environment in which the reused software might be used, and understanding the differences in constraints that might exist between the various heritage missions. For SMD missions document instrument reuse and for other missions this may be broken down by a spacecraft subsystem architecture.]*

## 5 IV&V Heritage Program Survey

The <spacecraft bus, integrated components, and flight software> used for ProjectX have significant heritage from, or similar characteristics as, prior programs, all having already flown.





## 7 Issues, Risks, AOs, Risks Considerations and Lessons Learned from Heritage Missions

This section further expands upon the findings from previous IV&V efforts and captures the relevant issues, risks, capabilities, entities, assurance objectives and lessons learned.

*[The appendices of the heritage review report can be utilized to capture all the items related to the heritage mission, but this section abstracts the important or relevant items that will support planning and scoping, assurance design or general analysis activities]*

### 7.1 Issues from Heritage Missions

As part of the Heritage Review, the ProjectX IV&V Team evaluated the TIMs generated during the selected heritage IV&V Projects.

Table provides a high-level summary of the TIMs reviewed by project, by severity, and by State. Appendices A, B, and C *[note additional appendices can be added depending on the number of projects]* provide a detailed breakdown of each of the Severity 1, Severity 2, and “Project Accepts Risk” (PAR) TIMs included in the counts below. These particular TIMs will be further reviewed during the relevant planning and scoping activities.

**Table 3 – TIM Survey**

Project	Sev 1	Sev 2	Sev 3	Total		Project Accepts Risk	Submitted	To be Verified
Mission1								
Mission2								
Mission3								

In particular, the IV&V Project will investigate these TIMs further in Table 4 as they relate to IV&V project planning for ProjectX.

**Table 4 – TIM Targets for Investigation**

Id	IVV Severity	State	Subject	Application/Effect on Current IV&V Project

Additionally, the following trends were noted from the analysis of the TIMs...

*[Note, this section should be utilized to assess the TIMs for any trends in issue types, phase found, etc to identify any systemic trends that could affect planning and scoping, analysis activities or external risks as the mission progresses]*

## 7.2 Risks from Heritage Missions

The IV&V team evaluated IV&V risks that were generated on the selected heritage projects shown in Section 0. The purpose was to identify risks that may be applicable to ProjectX, as captured in Appendix E. Based on analysis of those risks, the following applicable risks will be inputs to the planning and scoping activities:

**Table 5 – Risks to be incorporated/evaluated for ProjectX**

Project/ Risk #	Risk Title	Risk Statement	Applicability to ProjectX

*[These risks will be further reviewed by the IV&V team during the performance of ProjectX planning and scoping activities.]*

## 7.3 Lessons Learned from Heritage Missions

Lessons learned from applicable heritage missions were surveyed to determine potential problems that might be encountered during the ProjectX lifecycle, along with project-specific recommendations for mitigation. It is important that the ProjectX IV&V team considers these recommendations throughout the mission lifecycle to maintain efficiencies throughout the course of planning as well as requirements, design, code, and test analysis.

Appendix E contains all the applicable lessons learned from prior heritage missions and discussions with prior IV&V Team Members. From the lessons learned and discussions, the team observed the following items to be cognizant of during the execution of ProjectX IV&V:

1. <Enter item applied from lesson learned>
2. <Enter item applied from lesson learned>
3. <Enter item applied from lesson learned>
4. <Enter item applied from lesson learned>
5. As Necessary

*[If possible document any discussions with the prior IV&V team members of heritage projects. the Appendix should also identify where the lessons learned were obtained. These might come from within the IV&V program or external sources such as agency on-orbit anomaly database, NASA Lessons Learned Database, Mission Project websites, and Mission Project personnel, etc. ]*

## 7.4 PBRA/RBAs from Heritage Missions

As part of the conduct of the Heritage Review, the ProjectX IV&V Team evaluated the PBRA/RBAs generated during the selected heritage IV&V Projects. The effort that went into defining and scoring the assurance design for previous missions can be utilized to build out the new assurance design for the new IV&V Project. Items such as capability descriptions, scoring, assumptions and assurance objectives can be utilized to help plan and scope the new mission.

Appendix F includes the applicable capabilities and entities from Mission1, Mission2, MissionN and their relevant scoring and assumptions. The following table summarizes applicable items to be carried forward into the planning and scoping activities of ProjectX.

**Table 6 – Relevant PBRA/RBA Targets**

Project /ID	Cap / Entity	Scoring	Assumptions	Assurance Objectives

### 7.5 Additional Data/Information from Heritage Missions

As part of the conduct of the Heritage Review, the ProjectX IV&V Team evaluated...

*[This section can be utilized to capture additional relevant information from the projects. Examples include Developer CR Repositories, Developer risk repositories, SA Coordination, Project Metrics, Hazard Controls, Safety Critical Requirement Sets – anything that may be useful to investigate during the heritage review process. If necessary, additional sections can be compiled to keep the content delineated]*

## 8 Heritage Review Conclusions

With the Heritage Review concluded, the IV&V ProjectX Team recommends the following based on the items reviewed during the Heritage Review Process...

*[The conclusion contains suggestions for incorporating the heritage review results into planning and scoping/planned IV&V analysis of the current project areas. Highlight the areas of previous concern, on-orbit and operational anomalies for future investigation or inclusion into IV&V processes. Possibly include a forecast of the anticipated re-use of software and reasons for your conclusions. Include items that could impact your tools and staffing of the project. Format for this section can vary based on the results, but will be direct input into the next phases of the IV&V Project]*

**Appendix A: Mission1 Very High Severity or PAR IV&V TIMS**

Id	IVV Severity	State	Subject	Description

### Appendix B: Mission2 Very High Severity or PAR IV&V TIMS

Id	IVV Severity	State	Subject	Description



## Appendix E: Lessons Learned from Heritage Projects

*[For support, reach out to TQ&E/SCO to support this data mining effort to include success stories, values statements and other sources of lessons learned]*

Project/ID/ Name	Title	Description	Recommendations



## Appendix F: PBRA/RBA Capabilities and Entities Scoring, Assumptions, Assurance Objectives from Heritage Missions

*[Other fields can be added based on the content within the risk assessments, as decided per the IV&V Project]*

Project/ ID	Capability / Entity	Scoring	Assumptions	Assurance Objectives