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| IT Asset Maintenance Plan |
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| RAVEN and RAVEN Plug-ins Asset Maintenance Plan |

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| RAVEN and RAVEN Plug-ins Asset Maintenance Plan | | |
| **PLN-5698** | | | |
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| **Prepared by:** |  | | |
| [Required. For EDMS controlled documents, reference the eCR.] |  |  | |
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# INTRODUCTION

## Purpose, Scope, and Objectives

The continued support (both for development and M&O) of the RAVEN software and RAVEN supported Plug-ins is crucial to meet customer and stakeholder expectations. The M&O activities shall be performed following the same development process used for adding new capabilities (i.e. Agile development process). In order to guarantee continuity and homogeneity of the software, the M&O activities will be performed by the RAVEN core team.

### Business Requirements

The business requirements associated with the RAVEN software and RAVEN supported Plug-ins coincide with the software requirements specified in “RAVEN Software Requirements Specification”. The software requirements are stored and maintained in the RAVEN GitHub, for open-source software, and GitLab, for protected Plug-ins (see PLN-5552 for information on how to retrieve them).

## Assumptions and Constraints

Assumptions and constraints during the M&O activity include:

1. For external release, the M&O team will adhere to LWP-1401, “Preparing and Releasing Scientific & Technical Information Products.”
2. Section 508 of the Workforce Investment Act of 1998 considerations will be made for the ability of disabled individuals to access the information or service provided by the software.
3. This plan applies to software that is within the scope of the software quality assurance (SQA) program and is governed by LWP‑13620, “Managing Information Technology Assets.”
4. 29 USC 794d, Section 508 of the Workforce Investment Act of 1998 considerations will be made for the ability of disabled individuals to access the information or service provided by the software.
5. Adequate funding, required hardware, and system software is available to complete planned RAVEN maintenance and operations (M&O) activities.
6. Roles and responsibilities cited in this plan can be reassigned as needed by the M&O manager or personnel designated by the RAVEN asset owner.
7. RAVEN was assessed as a Quality Level 2 software.
8. Maintenance activity scope:

* External or regulatory changes that result in new software requirements
* Internal changes that result in new software requirements
* Upgrades for performance, adaptability, etc.
* New technologies that need to be incorporated
* Software refactoring.

## Schedule and Budget Summary

The budget for the RAVEN software and RAVEN supported Plug-ins (for M&O and development) is fluid and changing based on year to year customer needs and funding granted by research and development activities. The current year budget can be obtained by contacting the responsible project manager.

## Evolution of the Plan

The M&O manager is responsible for maintaining this plan and ensuring that the M&O activities necessary are appropriately executed throughout the life cycle of the RAVEN and RAVEN supported Plug-ins.

This plan is controlled per LWP‑1201, “Document Management,” and subordinate plans, including PLN-5553, “RAVEN Software and RAVEN Plug-ins Configuration Management Plan (CMP),” PLN-5552, “RAVEN Software and RAVEN Plug-ins Quality Assurance Plan (SQAP),” and PLN-5554, “RAVEN Software and RAVEN Plug-ins Test and V&V Plan” Revisions to this plan will occur on an as-needed basis as a result of reviews, audits, and requested changes. Modifications to this plan must be independently reviewed and approved by the RAVEN Asset Owner.

# REFERENCES

ASME NQA‑1‑2008 with the NQA-1a-2009 addenda, “Quality Assurance Requirements for Nuclear Facility Applications”

ISO/IEC/IEEE 24765:2010(E), “Systems and software engineering — Vocabulary”

LWP‑1201, “Document Management”

LWP‑1202, “Records Management”

LWP-1305, “Acquisition of Computer Hardware/Software Resources”

LWP-1401, “Preparing and Releasing Scientific & Technical Information Products”

LWP‑4001, “Material Acquisitions”

LWP‑4002, “Service Acquisitions”

LWP-4003, “Using Purchase Cards to Acquire Materials and Services”

LWP-4503, “Supplier Evaluation and Qualification”

LWP-10000, “Engineering Inputs”

LWP‑10109, “Commercial Grade Dedication”

LWP‑13014, “Determining Quality Levels”

LWP‑13620, “Managing Information Technology Assets”

# DEFINITIONS AND ACRONYMS

This section defines all terms and acronyms required to properly understand this plan.

## Definitions

*Baseline*. A specification or product (e.g., project plan, maintenance and operations [M&O] plan, requirements, or design) that has been formally reviewed and agreed upon, that thereafter serves as the basis for use and further development, and that can be changed only by using an approved change control process. [ASME NQA-1-2008 with the NQA-1a-2009 addenda edited]

*Change control board*. The group by which a change is proposed, evaluated, approved or rejected, scheduled, and tracked. This board is also responsible for evaluating and approving or disapproving proposed changes to configuration items and implementation of approved changes when required.

*Change requests*. Change requests can be initiated by anyone, including offsite users, and can be used for maintenance (fine‑tuning and problem resolving), new development, and enhancements, or can be used to report program errors and problems.

*Configuration Item*. An item or aggregation of hardware or software (including documentation) or both that is designed to be managed as a single entity. [ISO/IEC/IEEE 24765:2010(E) edited]

*Configuration Management*. A discipline applying technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a *configuration item* (see def.), control changes to those characteristics, record and report change processing and implementation status, and verify compliance with specified requirements. [ISO/IEC/IEEE 24765:2010(E)]

*Electronic Document Management System (EDMS)*. System approved for long‑term storage, management, and maintenance of electronic and hardcopy records.

*Enterprise Architecture (EA) Repositor*y. An database that houses information about software applications and servers and is the source for the INL data dictionary. The applications are related to the management system business functions it supports or implements. EA is the repository for the technology (e.g., software/hardware) used to construct and implement software applications. EA contains links to the software documentation stored in *EDMS* (see def.).

*Issue.* Issues can be initiated by anyone, including offsite users, and are used for maintenance (fine‑tuning and problem resolving), new development, enhancements, or can be used to report program errors and problems.

*Pull requests.* Pull requests can be initiated by anyone, including offsite users, and are used for maintenance (fine‑tuning and problem resolving), new development, enhancements, or can be used to report program errors and problems.

*Safety function*. The performance of an item or service necessary to achieve safe, reliable, and effective utilization of nuclear energy and nuclear material processing. For INL, safety functions are identified and defined in a formal safety basis or commitment document as credited for achieving nuclear safety (e.g., safety structures, systems, and components; safety significant; safety class; safety related; or important to safety) (ASME NQA‑1‑2008 with the NQA‑1a‑2009 addenda edited).

*Safety software.* Software, including the following:

1. **Safety system software.** Software for a nuclear facility that performs a *safety function* (see def.) as part of a structure, system, or component and is cited in either (a) a DOE‑approved documented safety analysis, or (b) an approved hazard analysis per DOE P 450.4, “Safety Management System Policy,” dated October 15, 1996 (or latest version), and 48 CFR 970‑5223.1, “Integration of Environment, Safety, and Health into Work Planning and Execution.”
2. **Safety analysis and design software.** Software that is used to classify, design, or analyze nuclear facilities. This software is not part of a structure, system, or component, but helps to ensure that proper accident or hazards analysis of nuclear facilities or a structure, system, or component that performs a safety function.
3. **Safety management and administrative controls software.** Software that performs a hazard control function in support of nuclear facility or radiological safety management programs or technical safety requirements or other software that performs a control function necessary to provide adequate protection from nuclear facility or radiological hazards. This software supports eliminating, limiting, or mitigating nuclear hazards to the worker, the public, or the environment as addressed in 10 CFR 830 “Nuclear Safety Management,” the Department of Energy Acquisition Regulations (DEAR) ISMS (Integrated Safety Management System) clause, and 48 CFR 970‑5223.1.

*Software*. Computer programs and associated documentation and data pertaining to the operation of a computer system and includes application softwareand support software.

*Test driven development.* A method of software development in which unit testing is repeatedly conducted on source code. After each test, refactoring is done and the same or a similar test is performed again. The process is iterated until the unit functions in accordance with the specifications

*Validation.* Confirmation, through the provision of objective evidence (e.g., acceptance test), that the requirements for a specific intended use or application have been fulfilled*.* [ISO/IEC/IEEE 24765:2010(E) edited]

*Verification.* (1) The process of: evaluating a system or component to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase. (2) Formal proof of program correctness (e.g., requirements, design, implementation reviews, system tests). [ISO/IEC/IEEE 24765:2010(E) edited]

## Acronyms

ASME American Society of Mechanical Engineers

CCB change control board

CI Configuration Item

CM Configuration Management

DOE Department of Energy

EA Enterprise Architecture

EDMS Electronic Data Management System

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

INL Idaho National Laboratory

ISO International Organization for Standardization

IT Information Technology

M&O Maintenance and Operations

NQA Nuclear Quality Assurance

QA Quality Assurance

QL Quality level

QLD Quality level determination

SQA Software quality assurance

V&V Verification and Validation

# MAINTENANCE & OPERATIONS CONTEXT

## Process Model

The process that the RAVEN core team uses, parallels the process model identified in LWP‑13620, utilizing the Agile software development process. This procedure, and all subordinate plans (i.e., PLN‑5552, PLN‑5553, and PLN‑5698), are aligned with the process defined in LWP‑13620.

### System Hardware and Operating Systems

There is no restriction as to the type of computing hardware and operating systems that may be used, provided it is capable of running the development tools for the application software. For internal INL personnel, anomalies identified with hardware will be reported to the Ops Center (6‑1000), and the INL Field Services organization will be utilized to ensure the identified hardware anomalies are resolved.

### Backup and Recovery

RAVEN software and RAVEN supported Plug-ins are stored on servers within and outside of the INL network. The servers containing RAVEN software code and its supported Plug-ins are identified in the EA. The main repository for RAVEN source code is hosted by GitHub and can be found at <https://github.com/idaholab>. The GitHub service also functions as a system for generating tracking *issues* (see def.) that are used as the main form of a *change request* (see def.). The tracking issues and associated data contained within the external GitHub services are backed up to local services at least once a year. The GitHub service is hosted in a cloud environment and features its own backup and recovery protocols offered by the managing services.

Local copies of the RAVEN software code are kept on the computer of each RAVEN core team member. In addition, business continuity is managed in accordance with PLN‑117, “Information Management Contingency Plan for the Idaho National Laboratory.”

## Methods, Tools, and Techniques

The RAVEN software and its supported plug-ins are in continuous evolution, via an Agile development process (see def.), since new expansions and capabilities are needed by the different projects/programs. In order to guarantee the SQA standards identified by this plan, an articulated set of tools, techniques and methodologies are required:

Methods:

* Test and user-need driven development
* Pull requests
* Continuous integration.

Techniques:

* Code coverage analysis
* Regression testing
* Expected error testing
* Unit testing (when applicable)
* Cascading builds
* Agile development
* Peer reviews
* Performance testing
* Shared repository (GitHub)
* Decentralization.

Tools:

* GitHub (Git) software code repository used outside the INL software network.
* Python software development language
* C++/C language
* Bash scripting
* Wiki – RAVEN documentation
* Doxygen – Software framework documentation generator
* Enterprise Architecture (EA)
* EDMS Safety Software Determination system
* Quality Level Determination (QLD) system
* PLN‑5553 will be used to ensure that changes to configuration items are properly managed.
* PLN‑5552 will be used ensure that the RAVEN software is managed in accordance with quality processes.
* SPC-2366 will be used to ensure that RAVEN software applications meet specifications and fulfill the intended purpose.
* Form 562.29, “Software Product Review Report and Checklist”
* Form 562.33, “INL SQA Assessment Checklist”

## Product Acceptance Plan

Product acceptance is attained through adherence to the M&O process that the RAVEN core team follows.

It is incumbent upon any organization relying on the RAVEN software to conduct final acceptance testing prior to implementing any version of RAVEN in their software products.

## Organization

The RAVEN core team is responsible for the daily M&O activities of the software application.

### External Interfaces

No interfaces with entities external to the M&O work activities are required.

### Internal Structures

All M&O activities for the RAVEN software are supported by the RAVEN core team. The RAVEN core team interfaces with both Quality Assurance and SQA organizations for the purpose of auditing and SQA reviews.

EDMS will be used for managing and archiving controlled documents and records associated with the RAVEN software and RAVEN supported Plug-ins. The RAVEN core team will interface with EDMS personnel, as necessary, to ensure documents and records are properly placed in EDMS

### Roles and Responsibilities

Table 1 specifies the roles and responsibilities for the M&O activities.

Table 1. Roles and responsibilities.

| **Role** | **Responsibility** |
| --- | --- |
| Management | **General**   * Provide funding and staffing for RAVEN M&O software activities.   **Software Quality Assurance**   * Assign personnel and ensure they are properly qualified and trained to perform SQA tasks. * Ensure corrective actions are implemented as needed. * Ensure assessments are performed as documented in PLN-5552. |
| Asset Owner | **General**   * Acquire and dedicate materials and services in accordance with INL acquisition policy and this plan. * Responsible for administration and execution of this plan.   **Software Quality Assurance** (see def.)   * Complete the safety software determination as part of a criticality/risk analysis. * Ensure the completion of the QLD as part of a criticality/risk analysis.   ***Configuration Management*** (see def.)   * Participate as necessary on the *change control board* (see def.) as needed and act as final authority when necessary. * Act as the final authority for approval/disapproval of change requests.   ***Verification* and *Validation*** (see def.)  Review acceptance test and approve RAVEN asset for deployment. |
| M&O Manager | **General**   * Primary interface for all internal and external RAVEN contacts. * Train team members for effective implementation of software project plans. * Responsible for process improvements/lessons learned. * Identify variances to this plan. * Provide status reports to management as needed. * Responsible for ensuring that the EA Repository entry for their assigned assets (software applications) is kept up‑to‑date. * Responsible to ensure that records associated with assets are managed in accordance with PLN‑4653, “INL Records Management Plan” * Ensure the appropriate level of rigor, for the SQA activities, is performed as required. * Assist in maintaining this plan and other management plans. Notify relevant stakeholders when there are changes to this plan or other management plans.   **Software Quality Assurance**   * Manage and resolve problems per the software quality assurance plan.   **Configuration Management**   * Act as the chair of the change control board (CCB). |
| Technical Lead | **General**   * Maintain requirements baseline. * Final approval on design reviews. * Oversight of design implementation and integration testing activities when applicable. * Assign system administrator duties as needed.   **Software Quality Assurance**   * Document test procedures and instructions for use. * Conduct requirements, design, and implementation reviews.   **Configuration Management**   * Identify and manage configuration items. * Ensure implementation and verification of change and document as required by this plan. * Participate on the CCB. * Place assets under version control. * Establish *baseline* (see def.) of asset prior to acceptance test. * Approve/disapprove and status all change requests.   **Verification and Validation**   * Evaluate issues and anomalies. * Initiate component and integration tests prior to system test. * Ensure implementation and verification activities are completed and documented as required. |
| Independent Reviewer | **General**   * Review this plan.   **Software Quality Assurance**   * Review PLN‑5552.   **Configuration Management**   * Review PLN‑5553.   **Verification and Validation**   * Review PLN‑5554. * Review technical products including requirements, design, and implementation of the design when applicable. |
| CCB | **Configuration Management**   * Review and approve change requests. * Evaluate test results as part of the approved changes. |
| Software Developer | * Perform design, coding, and unit testing of software code. * Participant on the CCB as needed. * Adhere to this plan and supporting management plans. |
| System Administrator | **General**   * Perform system management and administration activities as assigned by the technical lead. |
| Quality Level Analyst | **Software Quality Assurance**   * Identify and document the QLD. * Revises QLD as needed. |

# MAINTENANCE AND OPERATIONS PLANNING

## M&O Initiation

RAVEN software and RAVEN supported Plug-ins, covered by this plan, is presently in the M&O phase. This section specifies the details for initiating the transition to M&O including estimation of the required staffing, training, and other resources to support the M&O activity.

The M&O manager is responsible for ensuring adherence to this plan and subordinate plans (see PLN‑5553, PLN‑5552, and PLN‑5554).

### Estimation Plan

The budget for conducting M&O is fluid and changing based on year to year customer needs and funding granted by research and development activities. 0.2/0.3 FTEs are generally appropriate for M&O activities.

### Staffing Plan

The number of RAVEN core team members is fluid and changing based on year to year needs and customer expectations. The staffing is performed by the RAVEN project manager in accordance with the Technical Leader.

### Training Plan

Project manager is responsible for ensuring implementation of the required SQA and training for both deployment and M&O activities.

The RAVEN core team personnel have been selected based on the expertise required for RAVEN software development.

Personnel assigned to any of the roles supporting the RAVEN software shall be assigned Training Records and Information Network (TRAIN) job code XXXXXX, Asset Management, on their employee training plan.

Training includes the following activities, all of which will be documented on the employee’s individual training plan within the TRAIN system:

* Complete laboratory IT Asset Management training course 0INL1631, “Introduction to IT Asset Management,” as required by LWP-13620, “Managing Information Assets.”
* Orientation for this plan will be given to every staff member by the RAVEN core team’s project manager or designee.
* Team members will also be trained in the use of Git, GitHub, GitLab, coding, and commentary standards through study of the RAVEN Developer Guide webpage (https://github.com/idaholab/raven/wiki/Developer\_Information).

Required training shall be implemented as described in PDD-13610, “Software Quality Assurance Program.”

## M&O Work Plans

### Work Activities

The following M&O work activities are performed by the RAVEN core team:

* System administration
* Change management
* Requirements analysis
* Design
* Development
* Verification and validation
* Configuration management
* Software quality assurance.

Configuration management and change control activities must be performed in accordance to PLN‑5553. Verification and validation and requirements analysis activities are governed by PLN‑5554. Software quality assurance is guided by PLN‑5552.

### Resource Allocation

Under the guidance of the RAVEN Asset manager, resource allocation is made by the M&O manager and/or RAVEN Technical lead. Most of the assigned resources for RAVEN M&O work activities are for development. Each assigned developer participates in each of the other identified work activities due to the process contained within PLN‑5552, “RAVEN and RAVEN Plug-ins Configuration Management Plan,” due to the nature of the *Agile development* process, decentralization and continuous integration method taken to maintain the RAVEN software.

The resource allocation is performed at needs-basis.

### Budget Allocation

INL budget process produces the budget allocations that are necessary to maintain the RAVEN software.

For aspects of the RAVEN software that require budget allocations, refer to the EA repository.

### Acquisition Plan

The asset owner will acquire materials and services that are necessary to support M&O activities for RAVEN and its supported Plug-ins. These acquisitions include otherwise acquired software (i.e., software that has not been previously approved under a program consistent with the INL Quality Assurance program including freeware, shareware, and firmware).

Acquisitions must be handled in accordance with the following procedures:

* LWP‑4001, “Material Acquisitions”
* LWP‑4002, “Service Acquisitions”
* LWP‑1305, “Acquisition of Computer Hardware/Software Resources.”

In addition, Quality Level‑1 or Quality Level‑2, acquisitions must be handled in accordance with the following procedures:

* LWP‑4501, “Preparation and Control of Procurement Documents”
* LWP‑4503, “Supplier Evaluation and Qualification.”

Acquisitions for software applications that perform a safety function (includes open source, shareware, and firmware) from a supplier that is not on the INL qualified supplier list must be dedicated in accordance with LWP‑10109, “Commercial Grade Dedication.” The commercial grade dedication process must be performed on the initial acquisition and then again, each time the software is upgraded.

When acquiring application software (including upgrades), the following documentation is required:

1. Business requirements describing the capabilities and limitations.
2. Test plans and test cases that will be used to validate the capability of the system for its specific application.
3. Instructions for use.

# M&O ASSESSMENT AND CONTROL

This section specifies how the M&O team will assess and control the product requirements/design as well as the quality and timeliness of acquired products from subcontractors.

## Requirements and Design Control Plan

Requirement and design changes are managed per the change management process as defined in LWP-13620. Changes in scope are documented with associated impacts to the requirements and design, schedule, and budget. Requirement and design documentation shall be re‑baselined and approved on a biannual basis. Requirements and design documentation are controlled per Section 7.3.1, “Documentation.”

## Subcontractor Management Plan

At this time, there are no plans to utilize subcontractors for RAVEN software and its supported Plug-ins M&O activities. If a need to assign subcontractor resources arises in the future, see the Subcontractor/Vendor Control Section in PLN‑5553 for details on the management of work performed by subcontractors.

# SUPPORTING PROCESS PLANS

This section contains plans for the supporting processes that span the duration of the M&O activity.

## Risk Management

Risk management guidelines for RAVEN are outlined in PLN‑5552.

## Configuration Management

PLN‑5553 describes the process used for configuration management of the RAVEN software.

## Information Management

### Documentation

M&O work plans, IT acquisition requirement and design specifications, management plans, test plans, and user documents are managed according to the requirements in LWP‑1201. Electronic documents are controlled within EDMS. For non‑safety software, documents may be controlled in the organization’s version control system.

Records are dispositioned using the procedures outlined in LWP‑1202, “Records Management.” For hard‑copy‑managed records, the records coordinator dispositions and stores all records according with PLN‑4653, “INL Records Management Plan.”

### Communication and Publicity

Due to the open source nature of the RAVEN software framework, communication is part of the process that takes place during M&O work activities. The documentation generation activities, Wiki, and GitHub/GitLab available to RAVEN software framework users are sufficient methods to communicate successfully integrated RAVEN software changes.

### Communication and Publicity

All the stakeholders listed in PLN-5552 shall receive information about M&O activities, in case of raised concerns or changes of this plan and subordinate plans. The information, status and deviations will be shared via the RAVEN user and development email lists.

## Quality Assurance

Quality assurance methods used to support this plan are outlined in PLN-5552.

## Reviews and Audits

Reviews and audits of the RAVEN software will follow Sections 4 and 7 of PLN‑5552, which conform to the guidelines outlined in PDD‑13610.

## Verification and Validation

The verification and validation of the RAVEN software and its supported Plug-ins will be conducted in accordance with the processes and activities documented in PLN‑5554, “RAVEN Software and RAVEN Plug-ins Test and V&V Plan,” which also includes V&V.

## Retirement

When the RAVEN core team determines that the RAVEN software (or one or more supported Plug-ins), addressed by this plan has reached end‑of‑life, the retirement plan must be documented and approved by the asset owner. In addition, the following activities must be completed, as applicable:

* Electronic data, if any, will be transferred to a replacement system or archived per the records disposition as specified on the records analysis stored in the Enterprise Architecture Repository.
* This plan and any associated controlled documents in EDMS will be updated to reflect the change in asset disposition. If all assets within the scope of this plan are retired, this plan and all associated controlled documents in EDMS will be cancelled and records destroyed.
* Access to the identified asset will be terminated.
* The identified asset will be removed from both INL and external network infrastructure.

The status for the EA repository record for identified asset will be changed to “retired.”

# ADDITIONAL PLANS

PLN‑5553, “RAVEN Software and RAVEN Plug-ins Configuration Management Plan”

PLN‑5552, “RAVEN Software and RAVEN Plug-ins Quality Assurance Plan”

PLN-5554, “RAVEN Software and RAVEN Plug-ins Test and V&V Plan”

SPC-2366, “RAVEN Software Requirements Specification”

SDD-513, “RAVEN Software Design Description”