



Exploration Ground Systems Program

GSDO-PLN-1229 Exploration Ground Systems Program Sustaining Engineering Plan– Errata

3/29/2022

A Product Background	
Title: Exploration Ground Systems Program Sustaining Engineering Plan	
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C Forward Work (Items to be included in the next revision)	
Page/Sect	Comment
2.1	DELETE <TBD 2-1>
2.1	REPLACE <TBD 6-1> with Document # - GSDO-CHTR-1303 - EGS Ground Configuration Control Board Charter
6.0	REPLACE <TBD 6-1> with GSDO-CHTR-1303
5.2	Replace paragraph 3 and 4 with following: The ETA defined criteria for determination if a GSE modification invalidates certification and requires a Delta DCR/SAR is if the modification changes Form, Fit, or Function of the system. Form Fit and Function are a collection of physical attributes that fully define the interface of GSE with outside entities. Form, fit, and function are defined together because of their effect on GS certification. - Form is the outer shape where it can interface with facilities, other GS, flight hardware, or human operators. - Fit is related to form but includes dimensional tolerance and compatibility. The form and fit of GS includes outer shape, dimensional tolerance, connections (structural, mechanical, data format, and electrical connections), internal and external architecture, and every other externally measurable feature. - Function is the action or actions that a part or end-item is designed to perform in the subsystem. <u>Any of the following is a change to form, fit, and/or function:</u> - Changes to form, fit, and function are evaluated at the end-item assembly level (identified in the Program plan) rather than the individual component level. - Changes to critical items (SAA/CIL) or increases to risk or hazards (RSAR/SAA) are changes to form and fit. - Changes to force, speed, timing, voltage, current, control, monitoring, flow, pressure, safety factor, overcurrent protection, grounding, color, software, etc. are changes to function. - Changes to operations, training, environmental susceptibility, electromagnetic compatibility, reliability, and criticality are changes to form and fit. Changes to form, fit, or function define when GS certification is invalidated or requires an updated certification for use.

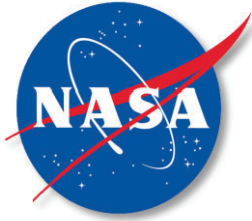


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D	Known Issues/Gaps with Product (Items to be addressed prior to the next revision)
Page/Sect	Comment

USE: Errata to EGS released products may be published to correct text or information that appears anywhere within an earlier published product in order to alert users and refer them to the source of the erratum information. Errata refers to errors in printing or writing, such as misspellings, omissions, and other typographical errors. Errata may also be used to identify forward work required to be incorporated in the next revision of a released document. Information contained in errata is not authoritative unless otherwise indicated.

Notes: Section C – Items should be entered as redlines in the native file when submitted to DQA prior to release of CR. **These items will be validated by DQA.**
Section D – Items to be addressed as needed or inserted as TBD/TBRs in the next revision. These items may or may not be included in the next revision. These items will not be validated by DQA.



National Aeronautics and
Space Administration

GSDO-PLN-1229

REVISION B

RELEASE DATE: 05/08/2020

EXPLORATION GROUND SYSTEMS PROGRAM

SUSTAINING ENGINEERING PLAN

NOT EXPORT CONTROLLED

This document has been reviewed by the KSC Export Control Office and it has been determined that it does not meet the criteria for control under the International Traffic in Arms Regulations (ITAR) or Export Administration Regulations (EAR).

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REVISION AND HISTORY PAGE

Status	Revision No.	Change No.	Description	Release Date
Baseline	-		Baseline (Approved at PRB, per D0738, dated 04/10/18) Prepared By: Paul A. Mogan Program Integration Engineer EGS Program Office	04/12/2018
Revision	A		Revision A (approved at PRB per D1070, dated 11/13/2018) Prepared By: Kevin A. Ingoldsby Program Integration Engineer EGS Program Office Change Summary: Defines criteria for scoping modification projects, updates definitions, adds content to show relationships between EGS ops/sustainment documentation plans/tools, incorporates software sustainment content, resolves TBDs and TBRs.	11/16/2018
Revision	B		Revision B (approved at PRB per GSDO-D1434, dated 04/21/2020) Prepared By: Kevin A. Ingoldsby Program Integration Engineer LX-S2 Change Summary: Clarifies roles and responsibilities for C3 systems/software sustainment	05/08/2020

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1.0 INTRODUCTION

Note: Exploration Systems Development Management Directive ESD-MD-12029, November 16, 2017, establishes the Exploration Ground Systems (EGS) Program name and retires the name Ground Systems Development and Operations (GSDO). There is no change in scope or architecture for EGS. Documentation may still contain references to GSDO until revisions are completed through normal updates. GSDO will remain as part of the document number.

This document is the Sustaining Engineering Plan for the EGS Program at John F. Kennedy Space Center (KSC). This plan describes the program-level process and organizational roles and responsibilities involved in performing Sustaining Engineering for EGS Ground Systems.

The goal of EGS Sustaining Engineering is to ensure that the Ground Support Equipment (GSE), Ground Support Systems (Subsystem), facilities and systems (both hardware and software) are operationally available, and efficiently and successfully performing their intended functions during operations.

1.1 PURPOSE

This document defines Sustaining Engineering for the EGS Program and describes the top-level Sustaining Engineering activities at the EGS Program-level, ensuring the Sustaining Engineering activities support Operations. This plan defines Sustaining Engineering functions, identifies roles and responsibilities, and defines interactions between the various organizations involved in Sustaining Engineering. This plan also defines the processes used to identify candidate Sustaining Engineering projects; describes the process used to verify the need for the proposed project; describes how project scope, schedule and budget estimates are defined; and defines how the EGS Program determines the required level of project reviews.

1.2 SCOPE

This document is intended to apply to all activities related to EGS Program Sustaining Engineering, including sustaining projects for facilities, Subsystem and GSE approved by the EGS Program Boards. This plan applies to the entire EGS Program, including all work to be performed by KSC organizations, contractors, other National Aeronautics and Space Administration (NASA) Centers performing work on behalf of EGS, and any other organizations involved in Sustaining Engineering of EGS components and products.

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Exceptions:

- a. GSE and support hardware received from the Space Launch System (SLS) and Orion to be used in ground processing Operations will use the GSDO-PLN-1075, Cross-Program Ground Support Equipment Sustaining Engineering Plan, which provides guidance to the Sustaining Engineering of GSE hardware and software received from SLS and Orion.

This plan is written so as to avoid duplication of information available in other EGS documents. Information in this plan provides basic contextual information and references the other document(s) when possible. This plan provides supplemental information or elaboration of information in other documents when required.

1.3 KEY TERMS

The terms defined in this section are provided for informational purposes to ensure a common understanding of terms used in this document. These basic definitions will be supplemented and elaborated upon in later sections of this document when necessary.

Maintenance: Maintenance is defined as the systematic day-to-day and periodic work required to preserve software or equipment in a condition such that it can be effectively used for its designated purpose and also to prevent malfunction or failure. Maintenance encompasses (but is not limited to) scheduled inspection, cleaning, testing, adjustment, calibration, lubrication and replacement of parts. Maintenance also includes those activities required to restore functionality of hardware or software to its original specification (return to print) and includes analyses such as performance and failure history monitoring; regularly scheduled adjustments and inspections, emergency repairs and service calls, preventive maintenance tasks. Refer to GSDO-PLN-1142 EGS Program Operations and Maintenance Controlled Requirements Management Plan for information related to maintenance requirements.

Life Cycle Sustainment: Life cycle sustainment comprises the range of analyses, planning, and execution of activities required to ensure the continued operation of the system throughout its life cycle. Life cycle sustainment of the EGS Ground System includes the maintenance, repair and upgrade activities necessary for the Ground Systems to continue to meet requirements for each mission. Life Cycle Sustainment includes maintenance and Sustaining Engineering.

Note: Maintenance is not considered part of Sustaining Engineering. This Sustaining Engineering Plan does not address pre-planned or condition-based maintenance.

Sustaining Engineering: Technical tasks (engineering and logistics investigations and analyses) to ensure continued operation and maintenance of a system with managed (i.e., known) risk. This involves the identification, review, assessment, and resolution of deficiencies throughout a system's life cycle. It also involves implementation of selected

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corrective actions, to include configuration or maintenance processes, and the monitoring of key sustainment health metrics such as the following:

- a. Collection and triage of all service use and maintenance data;
- b. Analysis of safety hazards, failure causes and effects, reliability and maintainability trends, and operational usage profiles changes;
- c. Root cause analysis of in-service problems (including operational hazards, deficiency reports, parts obsolescence, corrosion effects, and reliability degradation);
- d. The development of required design changes to resolve operational issues;
- e. Other activities necessary to ensure cost-effective support to achieve readiness and performance requirements over a system's life cycle.

Software Sustainment: The comprehensive set of activities required to support, maintain, upgrade and ensure the operational status of software capabilities. This includes the processes, procedures, material, and information required to support, maintain, manage the configuration of and operate the software aspects of a system (or subsystem). Software sustainment addresses other issues that are not always an integral part of maintenance such as documentation, system deployment, security, configuration management (CM), training (users and sustainment personnel) and training systems, help desk, COTS product management, and technology refresh. Successful software sustainment consists of more than modifying and updating source code.

Hardware Sustainment: Collection and triage of all service use and maintenance data, analysis of safety hazards, failure causes and effects, reliability and maintainability trends, and operational usage profiles changes, root cause analysis of in-service problems (including operational hazards, deficiency reports, parts obsolescence, corrosion effects, and reliability degradation), and development of required design changes to resolve operational issues, other activities necessary to ensure cost-effective support to achieve readiness and performance requirements over a system's life cycle. This includes documentation, deployment, security, CM, training (for users and sustainment personnel) and training systems, COTS product management, and technology refresh.

1.4 CHANGE AUTHORITY/RESPONSIBILITY

Proposed changes to this document shall be submitted by an EGS Program Change Request (CR) to the EGS Program Review Board (PRB) for consideration and disposition.

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All such requests will adhere to the CM Change Process as defined in GSDO-PLN-1001, Exploration Ground Systems Program Information and Configuration Management Plan.

The appropriate NASA Office of Primary Responsibility identified for this document is EGS Systems Engineering and Integration (SE&I) Division.

2.0 DOCUMENTS

There are several cross-program and EGS documents pertaining to EGS Sustaining Engineering. Figure 1 (below) shows these documents and their relationship with the EGS Sustaining Engineering Plan, as well as the various tools used by EGS to directly support program-level Sustaining Engineering activities. These documents and tools will be discussed in more detail in subsequent sections of this document. The plans are grouped as follows:

1. GSDO-PLN-1195, Cross-Program Processes and Agreements for Launch Site Ground Operations (PALSGO).
2. GSDO-PLN-1183, EGS Program Ground Operations Management Plan, (GOMP) describe EGS operations and processes, performance reviews and analyses which may result in the identification of potential Sustaining Engineering needs. For example, a Material Review Board (MRB) or post-launch assessment may identify system modifications.
3. GSDO-PLN-1075, Cross-Program Ground Support Equipment Sustaining Engineering Plan, defines Sustaining Engineering for GSE and support systems provided to EGS by SLS and Orion
4. GSDO-PLN-1002, Exploration Ground Systems Program Systems Engineering Management Plan (SEMP), defines processes used for EGS design and development. A number of roles in Sustaining Engineering will be similar to or identical with roles described in GSDO-PLN-1002.
5. GSDO-PLN-1043, Exploration Ground Systems Program Master Subsystems List, defines the organization owning Sustainment Governance and Sustainment Execution responsibilities for each subsystem.
6. GSDO-PLN-1046, Exploration Ground Systems Program Software Management Plan, defines processes used for EGS software design and development. Sustaining Engineering project roles will be similar to or identical to the development roles described in GSDO-PLN-1046.

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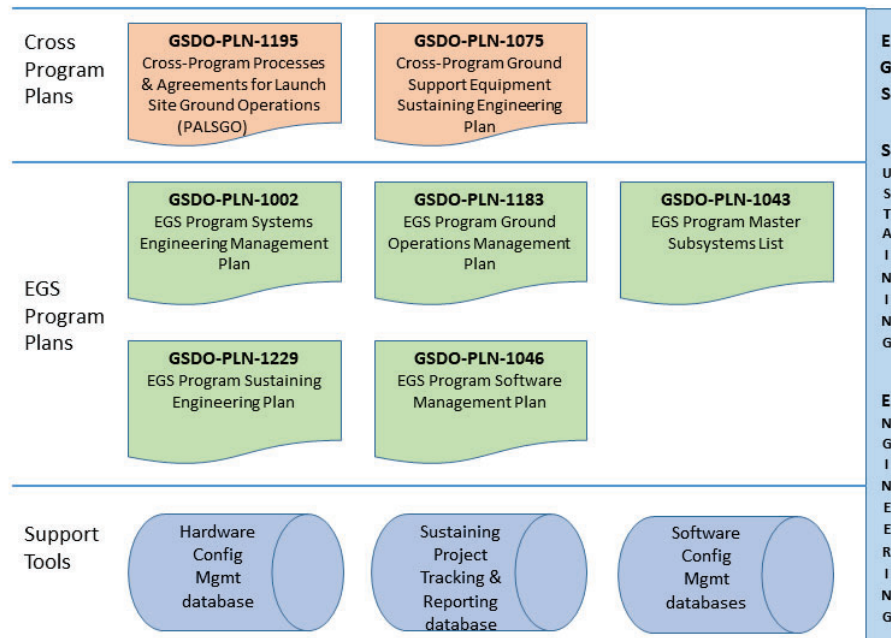


FIGURE 1 SUSTAINING ENGINEERING DOCUMENTS AND TOOLS

2.1 APPLICABLE DOCUMENTS

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications. The documents listed in this paragraph are applicable to the extent specified herein.

<u>KDP-P-2713</u>	Technical Review Process
GSDO-CHTR-1017	Exploration Ground Systems Program Review Board Charter
GSDO-CHTR-1019	Exploration Ground Systems Program Command, Control, and Communications Forum Charter
GSDO-CHTR-1175	Exploration Ground Systems Program Operations Processing Project Review Forum
GSDO-CHTR-1296 <TBD 2-1>	Software Configuration Control Board Charter
<TBD 6-1>	Ground Configuration Control Board Charter
GSDO-PLN-1001	Exploration Ground Systems Program Information and Configuration Management Plan

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GSDO-PLN-1013	Exploration Ground Systems Risk Management Plan
GSDO-PLN-1043	Exploration Ground Systems Program Master Subsystems List
GSDO-PLN-1046	Exploration Ground Systems Program Software Management Plan
GSDO-PLN-1142	Exploration Ground Systems Program Operations and Maintenance Controlled Requirements Management Plan
GSDO-PLN-1183	Ground Systems Development and Operations Program Ground Operations Management Plan
GSDO-PLN-1195	Cross-Program Processes and Agreements for Launch Site Ground Operations
K0000137694-PLN	E2ECC Software and LCS Hardware Configuration Management Plan
K0000232096-PLN	Software Maintenance Plan, Kennedy Ground Control System
SOP-NE-P-008	GSDO GSE Subsystem ADP Guidance Standard Operating Procedure (SOP)

2.2 REFERENCE DOCUMENTS

The following documents contain supplemental information to guide the user in the application of this document.

NPR 7120.5	NASA Space Flight Program and Project Management Processes and Requirements
NPR 7120.7	NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements
NPR 7123.1	NASA Systems Engineering Processes and Requirements
NPR 7150.2	NASA Software Engineering Requirements
NPR 8820.2	Facility Project Requirements
KDP-KSC-P-2393	KSC Lessons Learned System
KSC-DE-512-SM	Facility Systems, Ground Support Systems, and Ground Support Equipment General Design Requirements

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KSC-IT-14500-V2	Information Technology (IT) and Communications Services Directorate Configuration and Technical Data Management Plan, Volume 2: IT Communications Systems
KSC-IT-13550	Communications Development Project (CDP) System Engineering Management Plan (SEMP)
B-0001	KSC Councils, Boards, and Committees Charter - Facility Management Board (FMB)
B-0011	KSC Councils, Boards, and Committees Charter - Information Technology and Communications Services Directorate (IT) Engineering Review Board (ERB)
B-0026	KSC Councils, Boards, and Committees Charter - Integrated Engineering Review Board (IERB)
B-0032	KSC Councils, Boards, and Committees Charter – Ground Systems Development and Operations (GSDO) Program Design Certification Review (DCR) Board
GSDO-P-1061	EGS Program Assessment Procedure
GSDO-PLN-1079	Exploration Ground Systems Program Requirements Management Plan
GSDO-PLN-1008	Exploration Ground Systems Program TechDoc Governance Plan
GSDO-PLN-1024	Exploration Ground Systems Program Integrated Logistics Support Plan
GSDO-PLN-1036	Exploration Ground Systems Program Safety and Mission Assurance Plan
GSDO-PLN-1069	Cross-Program Heritage Ground Support Equipment Assessment and Certification Plan
GSDO-PLN-1070	Cross-Program Logistics Integration Plan
GSDO-PLN-1075	Cross-Program Ground Support Equipment Sustaining Engineering Plan

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GSDO-PLN-1076	Cross-Program Operations and Maintenance Requirements and Specifications Plan
GSDO-PLN-1088	Exploration Ground Systems Program Certification of Flight Readiness Implementation Plan
GSDO-TEMPL-031	Exploration Ground Systems Program Test Readiness Review Template
GSDO-WBS-1009	Ground Systems Development and Operations Program Work Breakdown Structure and Work Breakdown Structure Dictionary
E2ECC-P-5028	CR/CCBD Management
K0000137273-PLN	Configuration & Data Management Plan for GSDO Subsystems

2.3 PARENT DOCUMENT

The following document is the higher level specification, standard, guideline, handbook, special publication, or requirement document containing the requirement driving the creation of this document.

GSDO-PLN-1002	Ground Systems Development and Operations Program Systems Engineering Management Plan
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3.0 EGS SUSTAINING ENGINEERING OVERVIEW

EGS Sustaining Engineering includes ground system operational and performance assessments; identifying, assessing, prioritizing and approving proposed Sustaining Engineering projects; design and development activities; monitoring Sustaining Engineering project performance and all other activities required to ensure that the EGS Sustaining Engineering projects support the launch manifest.

Sustaining Engineering can be described as changes to hardware or software requiring a change to engineering drawings/models or software version. This may include everything from replacement of a part with another part not listed as equivalent in the engineering documentation to full system replacement. Sustaining Engineering also includes software modifications that go beyond routine maintenance and security patching activities.

Tasks supporting Sustaining Engineering include the activities required to investigate and resolve issues or events, fully analyze a problem, recommend a solution for a system deficiency, and develop a system upgrade or concur with a change package. Sustaining Engineering also includes providing engineering support on an on-call basis, flight- and non-flight-specific reconfiguration efforts, and the development of CR packages as needed.

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The scope of EGS Sustaining Engineering projects shall include any required updates to the Spaceport Command and Control System (SCCS) including the Launch Control System (LCS) and Kennedy Ground Control System (KGCS), the Kennedy Complex Control System, Ground and Flight Application Software, subsystem software, and other associated command, control, and communication systems. The scope of EGS Sustaining Engineering projects shall include production of configuration documentation (refer to the CM section of this document).

The EGS Sustaining Engineering process provides an approach to ensure successful continued operation for ground systems after system turnover through the operational life cycle phase.

The primary objective of the Sustaining Engineering efforts is to ensure capability, availability, and reliability of all ground systems to support processing requirements. Specific activities of Sustaining Engineering include but are not limited to:

- a. Sustaining system performance through design modifications focused on functionality, reliability, maintainability, and availability
- b. Updating and maintaining engineering and operational documentation (e.g. Work Authorizing Documents, Operations and Maintenance Requirement Specifications [OMRS], Operations and Maintenance Controlled Requirements)
- c. Evaluation and recommendation of design changes to address obsolescence issues or increase capability/capacity.
- d. Diagnosing, analyzing, and resolving hardware failures and software anomalies
- e. Periodic review and modification (if required) of maintenance procedures for new and legacy systems
- f. Monitoring maintenance data for adverse trends and recommending/incorporating appropriate process changes to reverse undesirable trends in performance or reliability
- g. Recommendations for decommissioning of unneeded systems

4.0 SUSTAINING ENGINEERING PROCESS

This section describes how the EGS Program identifies Sustaining Engineering responsibilities for Ground Systems hardware and software as well as the process (at the Program-level) for approving and executing Sustaining Engineering projects.

4.1 SUSTAINMENT GOVERNANCE AND SUSTAINMENT EXECUTION

The EGS Program identifies two types of general responsibilities in Sustaining Engineering. These two types of responsibilities are Sustainment Governance and Sustainment Execution. GSDO-PLN-1043, EGS Program Master Subsystems List (MSL) defines the terms Sustainment Governance and Sustainment Execution and the

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organization having Sustainment Governance and Sustainment Execution responsibilities for each of the subsystems. The Operations, Maintenance, Engineering and User (OMEU) tool, described below, defines the Sustainment Execution responsibility for individual Configuration Items. Note that the organization defined as having Sustainment Execution responsibility in GSDO-PLN-1043 should be the same organization having “E” responsibility in OMEU as defined below.

The OMEU tool

The OMEU tool is part of the KSC CM Data System. The OMEU tool identifies four types of responsibilities for hardware and software Configuration Items (items that have been assigned a Program Model Number). These four types of responsibility are Operations (O), Maintenance (M), Engineering (E) and User (U). After Configuration Items are turned over (at the end of design and development activities) the organization having “E” responsibility is the organization responsible for Sustainment Execution for that Configuration Item. For additional information about EGS Program CM, refer to GSDO-PLN-1001, EGS Program Information and Configuration Management Plan.

4.1.1 Sustainment Governance

The organization responsible for sustainment governance is the organizational unit responsible for the engineering oversight and acceptance of modifications of the grouped subsystems corresponding to the entries in the MSL. Organizations having sustainment governance responsibility (defined at the subsystem level in the MSL) may be the KSC Engineering (NE) organization, Information Technology and Communications Services (IT) organization, Spaceport Integration and Services (SI) Organization or EGS (LX). Sustaining engineering of IT subsystems (IT sustainment governance per the MSL) will be per IT institutional process as described in KSC-IT-13550, Communications Development Project (CDP) System Engineering Management Plan. Refer to the note below about the role of the Engineering Technical Authority (ETA) in sustainment governance.

Organizations having sustainment governance will:

1. Develop and maintain processes/procedures for design projects or document the use of another organization’s existing design processes such as Kennedy Documented Procedure, (KDP) KDP-P-2713, Technical Review Process.
2. Provide recommendations for when Sustaining Engineering projects will require involvement of a NASA Subject Matter Expert (SME) in design reviews and engineering analyses.
3. Provide recommendations to the ETA when they believe that sustaining engineering projects invalidate system certifications (e.g. Design Certification Review [DCR])

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4. Recommend to the ETA the use of a tailored process for re-certifying these systems. The application of this process to specific projects may be customized by project. The recertification process will be tailored based on project complexity and system performance risk tolerance to be efficient and effective. This recertification includes determining which board will be used to recertify.
5. Develop any additional governance the organization requires that is unique to sustaining engineering projects.
6. Provide engineering input and design review comments during Sustaining Engineering project execution through any SMEs they provide to the project
7. Maintain cognizance of Sustaining Engineering projects (on systems for which they have sustainment governance responsibility) and the scope of the projects so as to ensure
 - a. Timely and adequate involvement of their SMEs;
 - b. Timely technical input (support for trades, design review comments, technical analyses etc.)
 - c. Early identification of any required recertification of systems.
8. Participate in technical trade studies or assessments to support selection of sustainment implementation options
9. Provide advice and technical assistance during the evaluation process for Engineering Support Requests (ESRs), Engineering Change Requests (ECRs), Nonconformances (NCs) or other equivalent requests in support of the Element Operations Managers (EOMs) and NASA Operations Managers (NOMs)
10. Provide advice to NOMs related to the prioritization of proposed Sustaining Engineering projects.
11. Support acceptance or recertification of modified systems.

Note: The ETA has a role in sustainment governance for all Sustaining Engineering projects beyond the general organizational role described here and in the sections below. Refer to the ETA section of this document.

4.1.2 Sustainment Execution

The organization responsible for Sustainment Execution is the organizational unit responsible for maintaining engineering design products, development of needed design modifications, and preservation of operational capability of the grouped subsystems or Configuration Items. Organizations responsible for Sustainment Execution may be KSC organizations (SI, IT, NE or LX) or associated operations contractors. Sustainment Execution includes functions such as project management; requirements management; production of design drawings/models; hardware/software modification and testing; technical assessments and producing products for and conducting design reviews and conducting any required acceptance and/or

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recertification reviews. Note: Subsystem acceptance or recertification reviews may need to be presented to a board outside the Sustainment Execution organization. The applicable board will be identified by the ETA.

Each KSC organization uses its own processes to manage and execute projects, and perform Sustaining Engineering. The following sections of this document describe the program-level process for managing all Sustaining Engineering projects. These document sections also define the roles and responsibilities played by stakeholders in this process.

The EGS Program relies on KSC institutional organizations to supply some of the infrastructure and capabilities to support processing operations. These institutional organizations include IT, the SI organization and the KSC Engineering organization (NE).

Each of these organizations and their support contractors were involved in design and development of Ground Systems for EGS. EGS and its operations contractor were also involved directly in design and development. GSDO-PLN-1002, GSDO Program Systems Engineering Management Plan, describes these design and development processes and the roles of the Technical Authority and other organizations in design and development. . Execution of Sustaining Engineering projects will utilize these same design and development processes, any exceptions will be specified in this plan.

4.2 EGS SUSTAINING PROCESS

Figure 2 (below) defines the process the EGS Program uses to execute Sustaining Engineering. The left column provides examples of activities, analyses or other sources for identifying potential Sustaining Engineering projects. The center section (green) of the figure depicts the process for verifying the need for and defining scope, schedule and budget associated with each potential project; prioritizing and selecting projects and ensuring proper execution of Sustaining Engineering projects. The third column depicts activities by the responsible Sustainment Execution organization as well as EGS Program-level activities required to integrate and manage sustaining projects. Note that execution of the project by the Sustainment Execution organization will be in accordance with their internal project execution processes with ETA involvement as described in the ETA section of this plan.

The following sections will describe in more detail the activities shown in each block or group of blocks in Figure 2.

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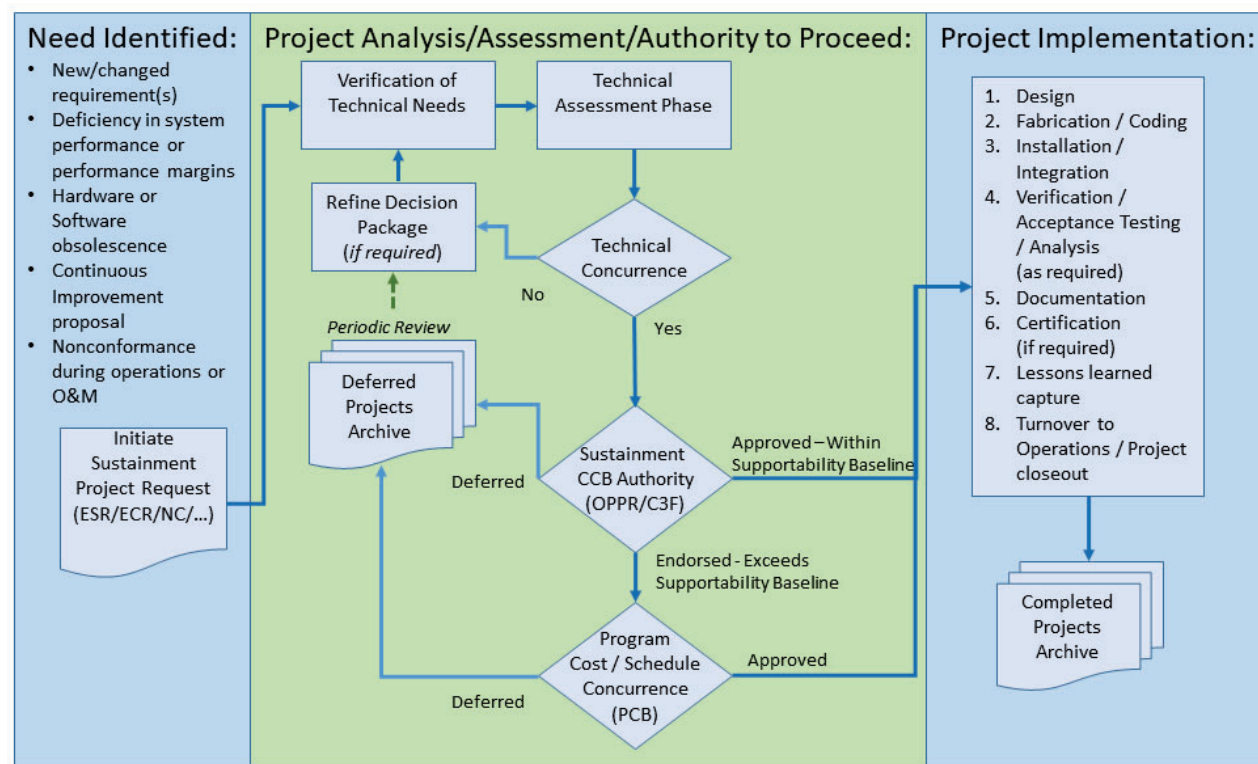


FIGURE 2 SUSTAINING PROJECT PROCESS

4.3 CONDITIONS TRIGGERING SUSTAINING ENGINEERING ACTIVITIES

The need to perform Sustaining Engineering activities may be brought about by a number of different conditions. These include (but are not limited to):

- Obsolescence of hardware or software triggers a need to change the system beyond the scope of what is considered maintenance
- Post-launch system assessments, including review of imagery
- Problems encountered during system operation or system maintenance
- New or Changing requirements (due to a range of factors including insufficient performance margins, flight hardware changes, the need for improved reliability or availability)
- System changes required for operational efficiency, usability, Human Factors, human interfaces or other needs
- Modifications made to systems as required to support the tempo of operations (e.g. correction of a problem with engineering to follow)

The identified Sustaining Engineering needs enter the EGS process when they are identified by the EGS EOM of the Element or Elements affected or by the appropriate

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Command, Control, and Communications (C3) Integrated Product Team (IPT). Proposed Sustaining Engineering projects may be identified to the EOM or C3 IPT¹ by SMEs from the ETA or organization having Sustainment Execution responsibility or by members of the Element or C3 IPT teams. EOMs, SMEs and IPT leads will assess and champion any recommendations to improve/enhance/sustain the affected Ground System.

Sustaining Engineering needs may also be identified by organizations within the EGS Program, such as Safety and Mission Assurance (S&MA), Systems Engineering, Logistics, operators, and technical experts. Sustaining inputs may include corrective actions, SME or user feedback, lessons learned, comments submitted by the Operations Support Contractor, Human Factors experts or other affected stakeholders.

The initiating/requesting organization or team should champion the change process and engage partnering organizations for support. This is intended to prevent a piecemeal approach to the proposed change where critical stakeholders could be overlooked and to prevent identical CRs. In the cases where a noncertified system requests change of a certified system, the onus for championing and processing the change falls to the requesting body with the support of the certified team.

Note that there may be CRs, Problem Reporting and Corrective Action (PRACA) items, MRB items, results of failure investigations, nonconformances (NCs) and other items associated with Sustaining Engineering projects. These items are described and defined in other EGS and cross-program plans (reference SEMP, GOMP, CP PALSGO, etc.) and will not be discussed further in this document.

4.4 VERIFICATION OF TECHNICAL NEED

The EOM is responsible for ensuring the Element's operational capability supports EGS's operational needs. The appropriate C3 IPT is responsible for ensuring the C3 systems support EGS's operational needs. This involves ensuring that all potential Sustaining Engineering needs are identified and assessed for their Element. They may do this through participating in operations coordination forums, monitoring problem reports or trouble tickets, or other methods depending on the internal processes used by the organizations responsible for the systems. EOMs may also conduct Element capability assessments or use other methods to elicit proposed sustaining projects.

The EOMs and Facility Managers will work with subsystem SMEs, stakeholders in the operation and maintenance of the systems in their Element. The prioritized list of proposed Sustaining Engineering activities will be provided to the NOM for integrated or offline operations. The NOM will integrate and prioritize the needs across the elements and systems for which they are responsible. These assessments and prioritizations may be informed as needed by informal or formal trade studies. The offline and integrated

¹ The C3 End to End Element is organized into IPTs (Ground and Flight Applications Software Team [GFAST], KGCS, LCS and Models & Sims) for development and sustainment.

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NOMs will coordinate and integrate their inputs and will decide the initial level of technical concurrence (refer to flow diagram block labeled “Technical Concurrence”).

The verification of technical need for a sustaining project will be supported by operations support SMEs as needed. SMEs may come from the EGS Program, the ETA, NE, IT, SI or KSC contractors. Verification of technical need will also be supported by EGS Logistics, Information and Configuration Management (ICM), Schedulers, Risk Management, SE&I, C3, and other organizations.

After the technical need is verified, the proposed sustaining project enters the “Develop Technical Options” process as described below. The EOM will work with the support team to develop a prioritized list of proposed Sustaining Engineering activities.

4.5 DEVELOP TECHNICAL OPTION ASSESSMENTS

The NOMS, EOMs, and C3 IPTs will work with a team of subsystem SMEs and specialty disciplines including SE&I, C3, ICM, Logistics, S&MA and others to develop options for implementation of sustaining projects. Developing these options may include informal or formal trade studies (reference GSDO-P-1061 GSDO Program Assessment Procedure).

At a minimum, these Technical Assessments will establish the project scope, determine the need date / operational constraints, provide a high-level schedule for completion, estimate the effort (hrs) and / or estimated cost (ODC), provide details of affected maintenance plans or other systems impacted, list new or impacted requirements, list new or modified KDP-P-2713 products, include applicable risk assessments, and identify other characteristics of the potential Sustaining Engineering project as necessary. Formal trade studies will be vetted through the appropriate technical board for completeness and selection of preferred solutions. The ETA will offer advice and inputs into this process (GSDO-P-1061 GSDO Program Assessment Procedure). In addition, the ETA will provide direction on project classification (Class I or Class II) and determine if a Certification type (SAR/DCR) will be required, and if required, what board will govern the Certification activity.

Each proposed Sustaining Engineering activity will include scope; estimated costs; Technical, Schedule, Budget, and Risk Assessments; and proposed duration of the project. The required level of detail for the Technical Assessment is dependent on the size and complexity of the proposed work.

The developed options should reflect the complexity of the desired change and account for all engineering products to be developed or altered during the proposed system modification project. Surgical project tailoring should occur per the governing engineering processes (KDP-P-2713) to right size the proposed work products to the size and complexity of the proposed change. Options should include the technical team’s recommendation and an assessment of implementation difficulty.

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4.6 TECHNICAL CONCURRENCE

This section describes the activities involved in maintaining prioritized lists of proposed Sustaining Engineering projects with the required ETA concurrence.

The EOMs/C3 IPTs will develop and maintain a prioritized list of proposed Sustaining Engineering projects. The EOM/C3 IPT will ensure that each project on their list has received ETA concurrence with the proposed design review process, level of oversight, project approval board to be used and the type of recertification or acceptance review required. For hardware projects that also impact C3 controlled systems, review/approval will be conducted in a joint C3/Operations Processing Project Review (OPPR) Configuration Control Board (CCB).

The NOMs develop an integrated prioritized list of proposed Sustaining Engineering projects. The steps to prepare this list include:

- a. NOMs integrate the inputs received from the EOMs into a prioritized list for the areas of operations under their responsibility (offline and integrated operations)
- b. NOMs will coordinate all lists with one another and with the C3 IPT leads to ensure all potential impacts are identified and accounted for.
- c. NOMs will verify that each project on the list has the required ETA concurrence.

The NOMs will submit the list of proposed Sustaining Engineering projects to the OPPR/C3 CCB for approval.

4.6.1 Determining Sustaining Project Classification

The EGS Program will categorize proposed sustaining projects into two classes in order to ensure proper oversight and governance of the projects. Classification of the projects is required prior to approval by the governing CCB. Project classification is the responsibility of the relevant EOM/C3 IPT lead. In the case where a sustaining project spans elements/C3 IPTs, the EOMs/IPT leads of each Element/IPT will share this responsibility. The project classification determination will be informed by EGS SE&I Ground Integration Engineer (GIE), EGS Operations (NOM), SMEs, and the ETA. The project category determination is approved by the required relevant GIE, NOM and the Chief Engineer representative for the organization owning sustainment governance for the system(s) being modified (LX, SI, IT or NE). The category of projects spanning multiple elements requires approval of the GIE of each Element (in addition to NOM and Chief Engineer representative). Evidence of this concurrence will be provided through electronic or other signature on an ESR, Configuration Control Board (CCB) Directive or other equivalent. An NC that requires engineering changes to disposition the problem, using Engineering Order (EO) to Follow, is a form of sustaining project request.

Minor modifications that do not impact fit, form, or functional/physical interchangeability should be reviewed for Class II Status.

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The following criteria will be used to classify projects into the appropriate category:

Class I Projects are projects that meet any of the following criteria:

- a. The project creates new system/subsystems that physically or functionally interface with Flight Elements
- b. The project is a modification to previously certified or accepted subsystem (shown as having a DCR or System Acceptance Review in the EGS MSL and the modification results in any of the following:
 1. Changes implementation of EGS Program or Interface Control Document (ICD) Requirements (EGS CRADLE database), including safety, reliability or supportability requirements
 2. Change impacts multiple subsystems or requires modifications to support equipment
 3. Hardware modifications that drive software changes or software modifications that drive hardware change.
 4. Modification results in significant re-training of Operations and Maintenance personnel
 5. Implements new Program or ICD Requirement(s)
 6. Alters prior system acceptance/certification evidence
Affects form, fit, function or functional/physical interchangeability, requires test, modification of KDP-P-2713 products, changes to the Design Verification Matrix, Requirements Traceability Verification Matrix, or Software Requirements Design Specification)
 7. Affects a Hazard Control or mitigation

Class II projects are those that do not meet the criteria for Category I.

- a. Intended to address drawing/documentation corrections or minor fixes
- b. Do not require modification to baseline to implement.
- c. Do not require Verification & Validation (V&V)

4.6.2 Project Governance

Class I Projects

- a. Comply with KDP-P-2713 process

“Not Export Controlled”

Reference EDR Log #: 7100 NASA KSC Export Control Office, 321-867-9209

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- b. Tailoring of Product Tailoring Matrix (PTM) (KDP-F-2713) to appropriate items for Project (approved by Integrated Engineering Review Board [IERB])
- c. IERB or Design Certification Review Board as decision authority (based on MSL requirement for System Acceptance Review or DCR). The type and contents of the review should be tailored to address the scope of the change and requirements or hazards affected by the project.
- d. Class I projects shall conduct a System Requirements Review at the IERB. The System Requirements Review will also verify the project category, tailoring of project reviews, the PTM and any required certification or acceptance reviews for the project.
- e. Class I projects affecting configured systems shall produce updated configuration models/drawings for the configured systems incorporating all changes that reflect the actual configuration of the system. This includes incorporation of Engineering Orders or similar change drivers. Refer to the section on CM for further guidance.

Class II Projects

Follow the internal sustainment/project management processes of the organization with sustainment governance responsibility or applicable contracted project processes.

[e.g. *OP-0075 (Ground Hardware Requirements Management (ESR)); OP-0031 (Design); OP-0032 (Transition); OP-0033 (S/W Engineering); OP-0005 (Nonconformance); OP-0071 (verification and validation [V&V] Certification)*]

4.7 SUSTAINMENT CONFIGURATION CONTROL BOARD AUTHORITY

During the Analysis Assessment shown in Figure 2, there are a series of decision blocks to approve or defer candidate sustaining projects. The EGS board making the decision depends on whether the project is within or outside the budgetary approval authority held at that level of the program. The nominal approval boards are the OPPr CCB for GSE hardware changes, C3F CCB for software and C3-owned hardware changes, or joint OPPr/C3F CCB for projects affecting both hardware and software sustainment.

The OPPr/C3F CCB makes a decision to approve or defer the proposed projects. If the OPPr/C3F CCB determines that the project is needed and the funding exceeds the resources controlled by the OPPr/C3F, CCB the proposed project is elevated through program boards as described in the next section.

If the proposed project is deferred by the OPPr/C3F CCB, any associated risk is documented and the stakeholders who proposed the project are notified, and the proposed project may re-enter the prioritization process in subsequent years. The associated risk may be included in the EGS Risk Management System. The level of risk will be determined by the NOM/C3 IPT and handled in accordance with the Risk Management Plan, GSDO-PLN-1013.

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4.8 PROGRAM-LEVEL BOARDS

The SEMP, GSDO-PLN-1002, describes the process for elevating proposed Sustaining Engineering projects through the EGS boards due to budgetary or other considerations. This is the same process used by the OPPR/C3F CCB for all other decisions affecting budget.

If the project is deferred, stakeholders will be notified, associated risk will be documented, and the proposed project may re-enter the prioritization process in subsequent years.

4.9 IMPLEMENTATION

Program-level activities

The Implementation Phase of approved Sustaining Engineering projects, shown in Figure 2, is more than the Sustainment Execution organization working on the approved project. The EGS Program performs the following roles during project execution:

- a. Ensure the sustaining projects are completed, V&V is performed and that re-certifications/acceptance reviews are performed.
- b. Ensure that the scheduled project completion supports ground processing need dates (e.g. falls within a facility block-mod window).
- c. Coordinate between various maintenance and sustaining projects that may be occurring in the same area (systems in the same facility may be the responsibility of various organizations)

The EGS-level coordination and integration function is provided through the EOM or appropriate C3 IPT and the team supporting them.

The EGS scheduling organization will identify modification windows for when a particular facility or asset may be modified. An overall schedule will be developed and maintained for these projects, and the schedule will be used to monitor for and mitigate potential conflicts between projects to ensure that the launch manifest is supported.

The EGS SE&I organization will assist in the integration of Sustaining Engineering projects. Their role will be to ensure that requirements are closed, V&V testing is completed and that any required Systems Acceptance Review or DCR is completed. SE&I will have the same role they do in design and development life cycle phase.

In the event that outside contracts are used to accomplish Sustaining Engineering projects, SE&I will assist in developing the Request for Proposal (RFP), Statement of Work (SOW) and contract reporting and data deliverable requirements. The purpose of SE&I involvement is to ensure proper flow down of requirements, and that the products, inspections, and analyses are produced that will be required to accept or certify the systems being replaced or modified.

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Acceptance Data Packages (ADPs) are required deliverables supporting GSE subsystem DCR and GSE Component completion and should follow SOP-NE-P-008, GSDO GSE Subsystem ADP Guidance Standard Operating Procedure (SOP).

At the discretion of the EGS Technical Integration Manager an EGS Project Manager may be assigned for complex projects, for projects spanning multiple facilities, for projects larger than a certain dollar threshold, or for projects that have a certain level of risk. The Project Manager will oversee the development of the RFP, SOW and will manage the contract and EGS SE&I will review and concur with these products. These projects will follow the processes and guidance in the EGS SEMP.

Specialty disciplines, such as ICM, Logistics, Human Factors, and S&MA will be involved in Sustaining Engineering projects in the same way they support EGS projects during the design and development life cycle as described in the SEMP.

Sustainment Execution Organization Activities

The organization responsible for Sustainment Execution will execute projects in accordance with their organization's design processes as discussed in the SEMP, tailored as agreed to by the ETA. The Sustainment Execution organization will conduct the design reviews and acceptance/recertification reviews using the boards agreed to by the ETA.

The EGS Program expectation is that the systems are fully returned to operational status by the conclusion of a Sustaining Engineering project. This includes tracking and resolution of open issues, completion of all required testing, re-activation of maintenance tasks, and any required acceptance or re-certifications. The system is expected to be under appropriate configuration control with all engineering, procedures and other documentation up-to-date.

5.0 ROLES AND RESPONSIBILITIES

The EGS Sustaining Engineering process (refer to Figure 2) includes a number of stakeholders such as Engineering, Operations, C3, Logistics, Safety, CM, and the program. It requires timely coordination with stakeholders and integration of required products. Successful sustainment is dependent on NE, IT, SI, and LX effectively executing their respective Sustaining Engineering processes, as well as, coordinating and integrating among each other, as applicable. The following sections outline the roles and responsibilities of key personnel involved in the Sustaining Engineering process. They provide a high-level functional description of each individual's role as it relates to Sustaining Engineering, followed by a small list of specific Sustaining Engineering tasks that are examples of the responsibilities for that individual. The list is not all-inclusive, but is intended to provide context and samples to help the reader understand the role of the individual.

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As stated in Section 1.2 of this document, it is EGS Program policy not to repeat information already covered in other program documentation. Many of the roles and responsibilities in Sustaining Engineering are the same as those already documented in GSDO-PLN-1002. Roles and responsibilities described in the EGS Sustaining Engineering Plan will focus on new or changed roles and responsibilities not described in the SEMP.

5.1 EGS PROGRAM SUSTAINING ENGINEERING

The EGS Program roles in Sustaining Engineering projects include identification of potential Sustaining Engineering projects; verification of the need for these projects; formulation of scope, budget and schedule; approval of projects; overseeing implementation of sustaining projects; and managing the integrated Sustaining Engineering effort (for all sustaining projects).

The EGS Operations organization identifies, prioritizes, and obtains approval of Sustaining Engineering projects at the appropriate EGS boards as described in Section 4 of this document. They are also involved in scheduling integrated operations and managing the integration of the operational manifest and overall schedule of Sustaining Engineering activities.

The EGS SE&I organization supports the Operations organization through

- a. Leading trade studies
- b. Performing their role in design, development, V&V and system certification/acceptance as described in the EGS SEMP
- c. Assisting in identification, tracking and resolution of technical problems as needed
- d. Performing requirements development, management and closure as described in the EGS SEMP

The EGS C3 organization performs functions described in the EGS SEMP for design and development projects that impact subsystem software or C3 systems. Additional roles include:

- a. Assisting with trade studies
- b. Performing their role in design, development, V&V and system certification/acceptance as described in the EGS SEMP
- c. Assisting in identification, tracking and resolution of technical problems as needed
- d. Performing requirements development, management and closure as described in the EGS SEMP

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The EGS Program Planning and Control organization performs functions described in the EGS SEMP for design and development projects, as well as:

- a. Risk Management
- b. Information and Configuration Management
- c. Support to cost and schedule assessments
- d. Scheduling – including identification of dependencies, modification windows and other tasks required to support Sustaining Engineering

The Logistics organization's role in Sustaining Engineering is very similar to the roles for design and development as described in the SEMP. The paragraph below defines some of the differences in focus of Logistics during the operational phase where Sustaining Engineering occurs:

During the Operations Phase, Logistics monitors and identifies obsolescence issues in operational systems and designs. They provide input on parts availability and logistics concerns related to the operations community. Issues such as parts obsolescence or identifying systems requiring excessive maintenance may drive identification of Sustaining Engineering projects.

5.2 ENGINEERING TECHNICAL AUTHORITY

The ETA will continue to perform the functions already described in other EGS Program charters and documentation. The ETA will continue to participate in ongoing Sustaining Engineering projects in the same way as during design and development activities.

The ETA will develop and maintain a set of criteria for Sustaining Engineering projects, which will be used as guidance to identify the need for increased scrutiny and SME involvement in projects. These criteria will also be used to support risk-based tailoring of the design review and certification/acceptance processes.

The ETA will also develop criteria to determine when a GSE modification invalidates certification and requires a Delta DCR. The ETA will approve the tailored recertification process required for GSE modifications.

The ETA Sustaining Project tailoring and recertification criteria will be documented by the ETA in **<TBD 5-1>**, *EGS Sustaining Project ETA Evaluation Criteria*.

The ETA will advise the EGS EOMs, C3 IPTs, NOMs and the OPPIR/C3 CCB during the process of identifying, verifying the need for, prioritizing and approving Sustaining Engineering Projects. The ETA will provide SMEs when requested to review RFPs or Statements of Work.

Prior to the OPPIR/C3 CCB approving any Sustaining Engineering project the ETA will concur with the following (as proposed by the subsystem SME)

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- a. The proposed level of NASA SME involvement in the project
- b. The proposed level of acceptance or recertification review
- c. Any tailoring of the design review process
- d. The approval board used for recertification or acceptance reviews

5.3 CONFIGURATION MANAGEMENT

EGS ICM ensures that proper configuration identification, change management, status accounting, verification and auditing continues throughout life cycle sustainment. These ICM activities are further described in GSDO-PLN-1001, EGS Program Information and Configuration Management (ICM) Plan.

All changes implemented by a sustaining activity must be verified to ensure consistency between the product, its documentation, and its support elements. This may involve a detailed audit of the product against its documentation; a validation of operation, maintenance, installation, and/or modification instructions; or a simple inspection per GSDO-PLN-1153 Cross-Program Integrated Physical Configuration Audit Plan or GSDO-PLN-1170 GSDO Program Functional Configuration Audit Plan.

CM of C3 software sustainment activities will be documented and controlled in accordance with K0000137694-PLN C3 E2ECC Software and LCS Hardware Configuration Management Plan and K0000232096-PLN Software Maintenance Plan, KGCS. Software development plans processes and procedures called out in GSDO-PLN-1046 EGS Software management Plan utilized for development will continue to be followed for sustainment of these delivered systems.

The EGS Program recognizes that KSC institutional organizations with Sustainment Execution responsibility may use ESRs, Engineering Work Requests or other methods to identify and track potential Sustaining Engineering projects, according to their organization's internal processes. Institutional organizations that use Kennedy Design Data Management System (KDDMS) will maintain all associated Sustaining Engineering models, drawings, analysis and documentation in KDDMS for the subsystems that they are responsible for per the MSL. Sustaining Execution organizations will ensure that, regardless of the change process, changes are approved by a CCB. Prior to closeout of Sustaining Engineering projects the CM function of the organization with Sustaining Engineering execution responsibility shall ensure that updated models/drawings and documentation are released to the official repository utilized by that organization (e.g., KDDMS, TechDoc, etc.) and shall verify that the associated metadata in Configuration Management Data Systems (CMDS) is correct.

5.4 OPERATION AND MAINTENANCE CONTRACTORS

The operations support contractors are responsible to perform design, development, and Sustaining Engineering of both new and heritage ground systems as assigned by

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the OMEU. The NE Technical Review Process, KDP-P-2713, or similar processes (as described in the EGS SEMP), are followed. The design process may be tailored with approval of the ETA for a particular project. Sustaining projects will comply with NASA and KSC design standards and requirements. The scope of the hardware/software responsibilities includes Sustaining Engineering and CM of the components and software which have been allocated to each contract through the OMEU database.

Design efforts are authorized by a variety of change drivers, such as ESR or other type of CR (depending on the initiating organization), or nonconformance documentation. Activities that maintain fit, form and function (such as updating obsolescent parts) require Configuration Managed updates and may not require the full rigor of the design review process. Modifications or new designs that affect fit, form, and function; change the intended usage of heritage equipment; or add new capabilities to the ground systems require design reviews and updates to documentation required by KDP-P-2713 or project-specific documentation. Any tailoring of the organization's design review process will be approved by the IERB. This tailoring includes a PTM.

This process follows the classic Systems Engineering model:

- a. Requirements Development
- b. Technical Assessment (ability of the concept design to meet the requirements, and inherent operational risk of performing/not performing the change)
- c. Resource Assessment (cost, schedule, project risk)
- d. Approval by appropriate level CCBs
- e. Implementation
- f. V&V
- g. Design Certification or Delta Certification (if so deemed by IERB)
- h. Turnover to Operations
- i. Closeout of project and implementation of open items
- j. Activation of Maintenance Procedures

Changes within contractor scope, both per the contract and OMEU, are authorized by the responsible LX and NE points of contact and authorized by technical/operational boards, panels or forums. Changes outside the contractor scope require a contract CR. Once contract direction is received, the same design/sustaining processes are used. The contractor is responsible for scheduling design reviews and ensuring proper participation, including invitations to both internal and external stakeholders. Review products are distributed through the Change Management Support Tool application, and review comments received through the tool or at the review meetings.

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5.5 SUBJECT MATTER EXPERT

The subsystem SME (who may also be referred to as the Cognizant Engineer) will support identification of proposed sustainment projects to EGS. The SME will assist EOMs and C3 IPTs in developing scope, schedule and other estimates for scoping proposed sustaining projects. SMEs will assist EGS in the process of prioritizing sustainment projects.

Based on the criteria established by the Sustaining Governance organization and the ETA, the SME is responsible for proposing and obtaining ETA concurrence with:

- a. The level of NASA involvement in the sustaining activity/project
- b. The design review process and any required acceptance or certification reviews

5.6 ELEMENT OPERATIONS MANAGER

In addition to the responsibilities described in Section 4, the EOM fulfills the NASA project manager role for Sustaining Engineering projects, except in any cases where EGS appoints a different project manager. The EOM project management functions include:

- a. Ensuring the project's technical content, budget and schedule are defined and any EGS tracking and reporting requirements are fulfilled
- b. Ensuring any required trade studies include the right participants and receive any required approvals
- c. Ensuring project schedules align with available modification windows and support operations schedules
- d. Ensuring that required project approvals from the IERB or other boards have been successfully completed
- e. Ensuring that any required acceptance or certification reviews and any turnovers are completed and support operational need dates.

6.0 CONFIGURATION MANAGEMENT OF GROUND SYSTEMS

Configuration Control Boards

The Ground Configuration Control Board (GCCB) and the Software Configuration Control Board (SCCB) are the controlling authorities for any changes to the configuration baseline of assigned Facilities, Systems, Equipment and Utilities/C3 systems and the associated documentation suites as reflected in CMDS. The GCCB provides oversight and approval for all proposed changes that affect/impact the Form/Fit/Function of all configured ground subsystems. The SCCB provides oversight

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and approval for all proposed changes that affect/impact C3 systems and/or associated software code. The CCBs function as described in their respective charters—<TBD 6-1> and GSDO-CHTR-1296². At a minimum, attendance shall include representatives from CM, system engineering, logistics, safety, and activation and turnover.

Configuration Control Board Governance Model for Sustaining Engineering

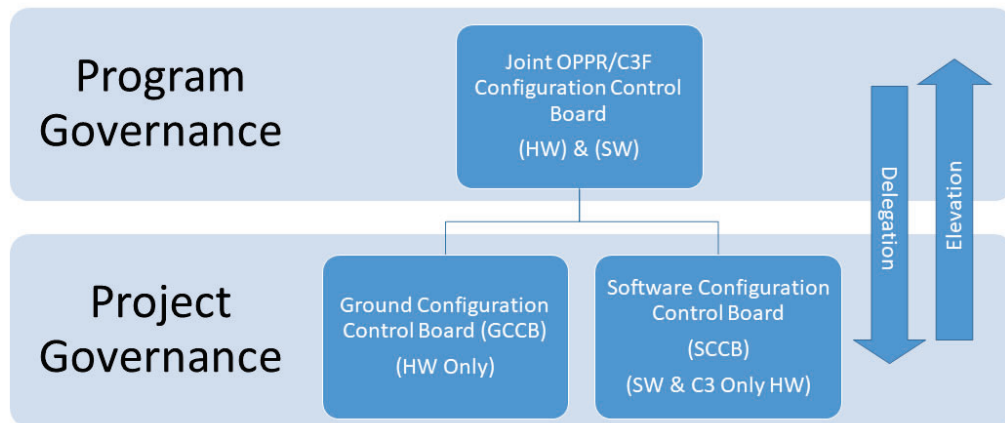


FIGURE 3 - CONFIGURATION CONTROL BOARD MODEL

When Sustaining Engineering projects modify systems that will ultimately be under the control of different contractors (e.g. a project that modifies some TOSC systems and systems that are under the control of another contractor such as facility power or gas systems) the project scope shall include producing separate configuration drawings in KDDMS for systems to be turned over to each contractor and the appropriate CM documentation required for that organization's processes. A configuration audit shall be performed for each system to be turned over and all configuration discrepancies tracked and addressed.

7.0 TRACKING AND REPORTING

Given the potential number of sustaining projects, it is necessary for EGS management to maintain awareness of the status of these projects. Therefore, the program will require regular communication in the most efficient manner practical. Tracking methodology will be consistent with the Ground Project Management Review.

7.1 DEFERRED SUSTAINING PROJECT TRACKING

Sustaining Engineering projects that have been identified and verified may be deferred due to budgetary, technical, schedule or other considerations. Deferred sustaining

² CCB process follows direction in C3-IDM-007, *Creation of Interim Process for C3 Related Post-DCR Configuration Changes* until CCB charters are baselined

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projects will be tracked by the NOMs or C3 IPTs so that the projects can be incorporated into future Planning, Programming, Budgeting, and Execution activities.

7.2 SUSTAINING PROJECT PROGRESS

Progress toward completion of sustaining projects and any associated acceptance or recertification reviews will be tracked against program schedules. This tracking will ensure that the modified systems are ready to support processing operations to meet EGS schedules. EOMs, NOMs and C3 IPTs will maintain awareness of potential impacts to operations and will work with the organization responsible for Sustaining Engineering projects to ensure timely completion.

7.3 PROGRAM-LEVEL REPORTING

Status of major sustaining projects and any sustaining project with potential impacts to Program-level milestones will be briefed to the OPPIR and EGS Performance Management Team. This is to ensure stakeholder awareness of potential issues or impacts to program-controlled milestones.

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APPENDIX A ACRONYMS AND ABBREVIATIONS

A1.0 ACRONYMS AND ABBREVIATIONS

ADP	Acceptance Data Package
C3	Command, Control, and Communications
CCB	Configuration Control Board
CCBD	Configuration Control Board Directive
CM	Configuration Management
CMD5	Configuration Management Data Systems
CR	Change Request
DCR	Design Certification Review
ECR	Engineering Change Request
EGS	Exploration Ground Systems
EO	Engineering Order
EOM	Element Operations Manager
ESR	Engineering Support Request
ETA	Engineering Technical Authority
GCCB	Ground Configuration Control Board
GFAST	Ground and Flight Applications Software Team
GIE	Ground Integration Engineer
GOMP	Ground Operations Management Plan
GSDO	Ground Systems Development and Operations
GSE	Ground Support Equipment
ICD	Interface Control Document
ICM	Information and Configuration Management
IERB	Integrated Engineering Review Board
IT	Information Technology
ITAR	International Traffic in Arms Regulations
KDDMS	Kennedy Design Data Management System
KDP	Kennedy Documented Procedure
KGCS	Kennedy Ground Control System
KSC	Kennedy Space Center

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LCS	Launch Control System
MRB	Material Review Board
MSL	Master Subsystems List
NASA	National Aeronautics and Space Administration
NOMs	NASA Operations Managers
O&M	Operations and Maintenance
OMEU	Operations, Maintenance, Engineering, and User
OPPR	Operations Processing Project Review
PALSGO	Processes and Agreements for Launch Site Ground Operations
PRACA	Problem Reporting and Corrective Action
PRB	Program Review Board
PTM	Product Tailoring Matrix
RFP	Request for Proposal
S&MA	Safety and Mission Assurance
SCCB	Software Configuration Control Board
SCCS	Spaceport Command and Control System
SE&I	Systems Engineering and Integration
SEMP	Systems Engineering Management Plan
SI	Spaceport Integration
SLS	Space Launch System
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SOW	Statement of Work
TBD	To Be Determined
TBR	To Be Resolved
TOSC	Test and Operations Support Contract
V&V	Verification and Validation

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APPENDIX B OPEN WORK

B1.0 TO BE DETERMINED

Table B-1 lists the specific To Be Determined (TBD) items in the document that are not yet known. The TBD is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBD item is numbered based on the section where the first occurrence of the item is located as the first digit and a consecutive number as the second digit (i.e., **<TBD 4-1>** is the first undetermined item assigned in Section 4 of the document). As each TBD is solved, the updated text is inserted in each place that the TBD appears in the document and the item is removed from this table. As new TBD items are assigned, they will be added to this list in accordance with the above described numbering scheme. Original TBDs will not be renumbered.

TABLE B-1 TO BE DETERMINED ITEMS

TBD	Section	Description
<TBD 2-1>	2.1	SCCB Charter not baselined
<TBD 5-1>	5.2	ETA/NE document containing EGS Sustaining Project ETA Evaluation Criteria needs to be identified/created
<TBD 6-1>	6.0	GCCB Charter needs to be created

B2.0 TO BE RESOLVED

Table B-2 lists the specific To Be Resolved (TBR) issues in the document that are not yet known. The TBR is inserted as a placeholder wherever the required data is needed and is formatted in bold type within brackets. The TBR issue is numbered based on the section where the first occurrence of the issue is located as the first digit and a consecutive number as the second digit (i.e., **<TBR 4-1>** is the first unresolved issue assigned in Section 4 of the document). As each TBR is resolved, the updated text is inserted in each place that the TBR appears in the document and the issue is removed from this table. As new TBR issues are assigned, they will be added to this list in accordance with the above described numbering scheme. Original TBRs will not be renumbered.

TABLE B-2 TO BE RESOLVED ISSUES

TBR	Section	Description
None		

B3.0 FORWARD WORK

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Table B-3 lists the specific forward work items identified during this document's CR review and evaluation. Each item is given a sequential number (i.e., **<FWD 001>**). For each item, in the CR/CE field enter the specific number of the CR followed by the comment number from the Change Evaluation (CE) i.e., GSDO-C0345/CE-10, GSDO-C0345/CE-27. Do not include a placeholder for forward work items in the body of the document; list them only in Table B-3.

TABLE B-3 FORWARD WORK

FWD	CR/CE	Description
None		