Change Log

| **Revision** | **Submission Date** | **Affected Sections or Pages** | **Change Summary** |
| --- | --- | --- | --- |
| Initial | 11.15.18 | All | Initial issue of document. |
| Revision | 12.14.18 | 3 and 4 | Figure 2 changed to include activity instances as children of other activity instances. Description text for Figure two changed to say “Activity instances may be comprised of sequences, and sequences are comprised of commands.” |

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# 

# Introduction

## Identification

| **Property** | **Value** |
| --- | --- |
| Configuration ID (CI) | 621 |
| Element | MPSA |
| Program Set | SEQ |
| Version | 1.0.0 |

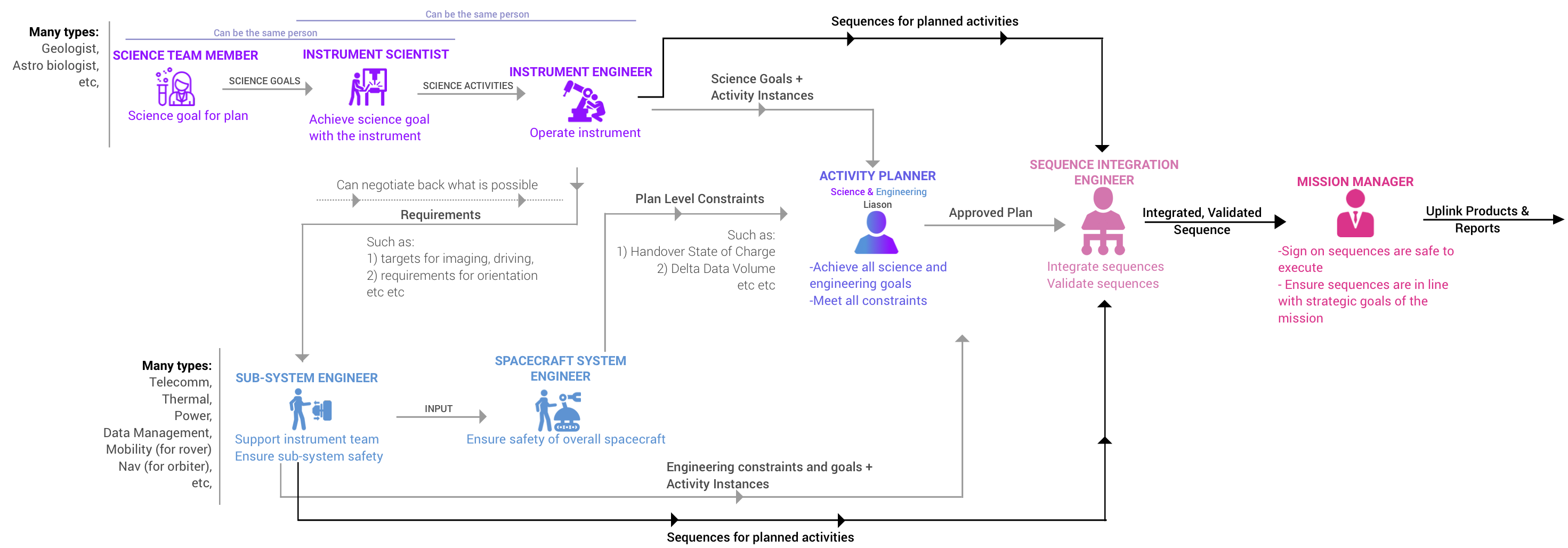
## Purpose

The purpose of this document is to identify the requirements for NEST, the graphical front-end that allows users to access the back-end services of Advanced MPSA. This application is maintained under the Mission Planning, Sequence and Analysis (MPSA) element of the Multimission Ground Systems and Services (MGSS) Program and provided as part of the SEQ Subsystem of the Advanced Multimission Operations System (AMMOS).   
  
In this requirements document:  
  
1. The word "shall" implies a required function that is verifiable.   
2. The word "should" implies an optional but desirable function.  
3. The word "may" implies an optional function.  
4. The words "will", "is", "are" are used for statement and do not represent a requirement.

## Overview

The Advanced MPSA is a software system that will provide customer space missions with mission planning, sequencing, validation and analysis capabilities. The system’s philosophy is to employ user-centered design methodology and adopt a component-based architectural approach to provide flexibility to a mix of multi-mission and mission-specific components to operate, seamlessly, as a whole.

As described in the NEST Operations Concept document, a nominal workflow for mission planning and sequencing is shown below:

Figure 1. A simplified nominal process diagram during a planning and sequencing period.

Grey lines can be omitted in some missions.

## Terminology and Notation

|  |  |
| --- | --- |
| MPSA | Mission Planning, Sequence and Analysis |
| NEST | Graphical front end for Advanced Mission Planning Sequencing and Analysis |
| MGSS | Multimission Ground Systems and Services |
| AMMOS | Advanced Multimission Operations Systems |

An complete list of relevant terminology can be found in the NEST Operations Conception Document (DOC-002181). The following terms are a subset of NEST Terms:

**Activity Type:** A description of a science or engineering activity performed by the spacecraft. An Activity Type is a unit for planning and/or simulation which generally consists of the following parts:

1) parameters that are used to command an instrument or the spacecraft itself,

2) requirements or constraints necessary for safe execution of the activity,

3) attributes that characterizes activity model and

4) formulas or expressions to compute effects on resources and spacecraft state.

**Activity Instance:** An instance of a type described above that lives in a plan. Activity Instances should have specific parameters and effects instead of descriptions.

**Constraints:** Describes set of criteria for successful and safe execution of a single activity or the overall plan.

**Command:** A directive to the Flight Software to perform a unit task.

**Plan**: A container for activity instances.  
**Sequence**: A container for commands.

## References

Table 1: Applicable JPL Rules Documents

| **Title** | **DocID** |
| --- | --- |
| Software Development | 57653 |
| Overview of Software Development Processes | 78187 |

Table 2: Applicable MGSS Documents

| **Title** | **Document Number** |
| --- | --- |
| AMMOS Technical Standards Profile | DOC-001101 Rev A |
| MGSS Implementation and Maintenance Task Requirements | DOC-001455 Rev C |
| NEST Operations Concept | DOC-002181 |

# Overall Description

## Product perspective

The NEST platform is a graphical display components of the Advanced Mission Planning and Analysis (MPSA) system that will allow users to access system capabilities needed to peform key tasks in operations, including activity planning, sequencing, generating uplink products. This includes a set of complete user interfaces designed to support canonical operations roles. Additionally, missions can easily customize their own views using the building block UI components of the NEST platform. The core need addressed by NEST is to provide a flexible, customizable front-end for the back-end services of Advanced MPSA.

## Product Functions

The NEST platform will allow users to access backend services to perform functions, but NEST does not perform the functions itself. For this reason, all requirements use the language “Shall allow the user to…”

## Assumptions

These requirements make the following assumption:

* There is a hierarchy of planning units. Activity instances may be comprised of sequences, and sequences are comprised of commands.

 Figure 2. A diagram of the hierarchical relationship between activity instances, sequences, and commands.

# Functional Requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID | Title | Requirement | Rationale | Verification  Method |
| MP-001 | Activity Dictionary Import | NEST shall allow a user to import an activity dictionary  through interface defined in *Advanced MPSA Activity Dictionary SIS* DOC-002228. | Missions will create their own activity dictionaries. The tool needs to be able to ingest it and use the data for planning. | Test |
| MP-002 | Activity Type View | NEST shall allow a user to view activity types. | Users need to view activity types prior to deciding which one to choose to instantiate. | Test |
| MP-003 | Activity Type Request Form | NEST shall allow a user to request the creation of an activity type. | A request form will allow users a more simplified method of creating an activity type. | Test |
| MP-004 | Plan Create | NEST shall allow a user to create a plan. | Users need a container to place and arrange their activities in. That container is a plan. | Test |
| MP-005 | Plan Maturity | NEST shall allow a user to differentiate between plan maturity levels. | Users need to know which plan is operational, as opposed to draft and/or sandbox. | Test |
| MP-006 | Plan Constraints | NEST shall allow a user to define plan constraints. | Plans must have their own constraints that the sum of all activity instance resource effects cannot exceed, like duration, handover state of charge, etc. | Test |
| MP-007 | Plan View | NEST shall allow a user to view a plan. | Users need to view plans. | Test |
| MP-008 | Plan Edit | NEST shall allow a user to edit a plan. | Users need to edit plans. | Test |
| MP-009 | Plan Delete | NEST shall allow a user to delete a plan. | Users need to delete plans. | Test |
| MP-010 | Activity Instance Create | NEST shall allow a user to instantiate activities in a plan. | Users need to populate plans with activity instances. | Test |
| MP-011 | Activity Instance View | NEST shall allow a user to view an activity instance. | Users need to view activity instances. | Test |
| MP-012 | Activity Instance Edit | NEST shall allow a user to edit an activity instance. | Users need to edit activity instances. | Test |
| MP-013 | Activity Instance Delete | NEST shall allow a user to delete an activity instance. | Users need to delete activity instances. | Test |
| MP-014 | Activity Instance Prioritization | NEST shall allow a user to prioritize activity instances for scheduling. | Users need to indicate a priority for instances as an input to the scheduling service. | Test |
| MP-015 | Activity Instance Scheduling | NEST shall allow a user to schedule activity instances based on activity instance constraints and priorities. | Users desire a feature that would allow them to give inputs to a scheduling service that schedules activities for them based on their priorities. | Test |
| MP-016 | Plan Simulation | NEST shall allow a user to simulate the effects of activity instances and commands on the flight system. | Users need to simulate the resource effects that their plans will have to know if they exceed available resources. | Test |
| MP-017 | Plan Simulation Results | NEST shall allow a user to view the results of flight system simulations. | Users need to view and understand the simulation results. | Test |
| MP-018 | Collaborative Plan Edit | NEST shall allow multiple users to concurrently edit a plan. | Users need to be able to view and edit a plan at the same time, but not necessarily edit the same activity. The goal is to make changes to one’s activities while others are making changes to their activities. | Test |
| MP-019 | Plan Import/Export | NEST shall allow a user to export a plan through interface defined in *Advanced MPSA Activity Plan SIS* DOC-002229. | Users want to be able to export a plan to use in their own tools. | Test |
| MP-020 | Command Dictionary Import | NEST shall allow a user to import a command dictionary through interface defined in *Advanced MPSA Command Dictionary SIS* DOC-002230. | Mission (Flight System) will create their own activity dictionaries. The tool needs to be able to ingest it and use the data for sequencing. | Test |
| MP-021 | Command Select | NEST shall allow the user to select a command definition from the active command dictionary. | Users need to be able to select a command from the command dictionary to insert into a sequence. | Test |
| MP-022 | Sequence Create | NEST shall allow a user to create a sequence. | Users need a container to place and arrange their commands in. That container is a sequence. | Test |
| MP-023 | Command Add | NEST shall allow a user to add a command to a sequence. | Users need to populate sequences with commands. | Test |
| MP-024 | Command Edit | NEST shall allow a user to edit a command in a sequence. | Users need to edit commands within a sequence. | Test |
| MP-025 | Command Delete | NEST shall allow a user to delete a command from a sequence. | Users need to delete commands from a sequence. | Test |
| MP-026 | Sequence Delete | NEST shall allow a user to delete a sequence. | Users need to delete sequences. | Test |
| MP-027 | Command Dictionary Switch | NEST shall allow a user to switch active command dictionaries. | Users need to be able to switch which command dictionary is active. | Test |
| MP-028 | Sequence to Activity Instance Association | NEST shall allow a user to represent the parent-child relationship between an activity instance and a sequence by linking them in a hierarchical fashion. | Users need a way to associate activity instances, sequences and commands in a hierarchical fashion (Refer to Figure 2). | Test |
| MP-029 | Activity Expansion | NEST shall allow a user to view the complete hierarchy of activity instances, sequences, and commands associated with a selected activity instance. | Users need to view the hierarchy of activity instances to their child sequences to their child command expansions (Refer to Figure 2). | Test |
| MP-030 | Flight Rule Checks | NEST shall allow a user to check constraints. | Users need to be able to check constraints like flight rules. | Test |
| MP- 031 | Flight Rule Check Results | NEST shall allow a user to view the results of constraint checks. | Users need to view the results of constraint checks like flight rules. | Test |
| MP-032 | Command Translation | NEST shall allow a user to create a set of products for uplink using the Command Link transmission Units (CLTUs) contained in the Command Link Transmission Unit File (CLTUF) as defined in Space data and information transfer systems - TC synchronization and channel coding ISO 22671:2011. | NEST will create a set of products for uplink using the Command Link transmission Units. | Test |
| MP-033 | Mission- Specific Services | NEST shall allow a user to add access to mission-specific services. | Users need a way to add mission specific tools to and services. | Test |

# Security Requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID | Title | Requirement | Rationale | Verification  Method |
| MP-034 | Security Capabilities | NEST shall provide authorization and authentication capabilities. | NEST must provide a way to control access and require users to log in. | Test |
| MP-035 | Authenticate | NEST shall allow a user access only to authorization and authentication capabilities until they have been successfully authenticated. | A user will not be able to access any features of NEST without first logging in. | Test |
| MP-036 | Permission to View | NEST shall prohibit a user to view data unless they have been granted permission. | NEST will have permissions that control which data a user can view. | Test |
| MP-037 | Permission to Edit | NEST shall prohibit a user to edit data unless they have been granted permission. | NEST will have permissions that control which data a user can edit. | Test |
| MP-038 | Permission to Delete | NEST shall prohibit a user to delete data unless they have been granted permission. | NEST will have permissions that control which data a user can delete. | Test |
| MP-039 | Permission to Access | NEST shall allow a user to access capabilities for which they have been granted permission. | NEST will have permissions that control which capabilities a user can use. | Test |

# Design Principles

By their nature, design principles are not verifiable, and as such, they are fundamentally different from requirements. Rather, they are highly desirable goals that we will strive to meet when possible.

The design principles of NEST are:

1. NEST should be simple to use.
2. NEST should be accessible from all modern web browsers.
3. NEST should leverage programming libraries.