Gemini Program Platform

Project Plan

Version 1.2- Last updated: 2019 December 4

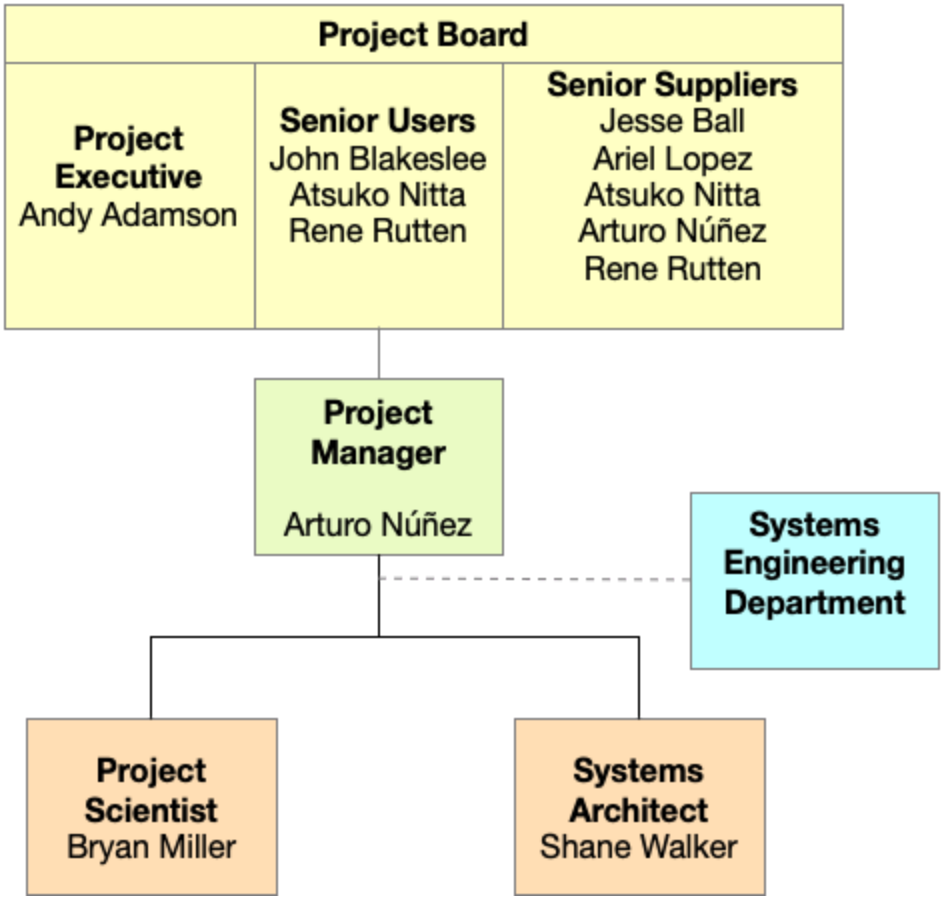
1 Introduction

This document provides a plan to build the Gemini Program Platform (GPP) as described in the GPP Software Conceptual Design. This document introduces the team organization, identifies the core products that will form the system, describes the project stages, schedule, key milestones and identifies required resources for completion.

This version of the document is updated in preparation for completing the Conceptual Design stage. As such, we also document here the stage plan for the next project stage, the Inception Stage.

2 Team Organization

The internal project governance is illustrated below:



Internal organization of key project staff

Project Board: The Project Board is accountable to Gemini for the success of the project, and has the authority to direct the project within the remit set by corporate as described in the project mandate. The Project Board is also responsible for the communications between the project management team and stakeholders external to the team. The Project Board is formed of a Project Executive, Senior Users and Senior Suppliers.

Project Executive: The Project Executive is responsible for supporting the Project Manager and ensuring that the Project Manager performs the assigned tasks. The Project Executive manages the escalation process outside of the purview of the Project Manager. The Project Executive works with the Project Board (Senior Users and Senior Suppliers) to make decisions outside of the Project Manager's tolerances. The Executive is ultimately accountable for the project's success and is the key decision maker.

Senior Users: The Senior Users are responsible for specifying the needs of those who will use the project products, for user liaison with the project management team, and for monitoring that the solution will meet those needs.

Senior Suppliers: The Senior Suppliers represents the interests of those designing, developing, facilitating, procuring and implement the project's products. This role is accountable for the quality of the products delivered by the suppliers and is responsible for the technical integrity of the project.

Project Manager: Reports to the Project Executive in the Project Board. The Project Manager is accountable to the Project Executive for the management of the project. Within the tolerances agreed upon with the Project Executive, the Project Manager has the authority to make decisions on all aspects of the project. Decisions outside the tolerances must be approved by the Project Executive.

Project Scientist: Reports to the Project Manager. Responsible for the scientific direction pertaining to the project.

Systems Architect: Reports to the Project Manager. Responsible for the project technical direction pertaining to the project.

Systems Engineering Department: Supports the Project Manager with Systems Engineering activities pertaining to the project.

3 Project Products

The GPP is organized as a collection of services and end user applications that will form the core products that this project will deliver. Specifically, the Product Breakdown Structure (PBS) for GPP is listed below with an indication of our basis for estimating the effort required to build them:

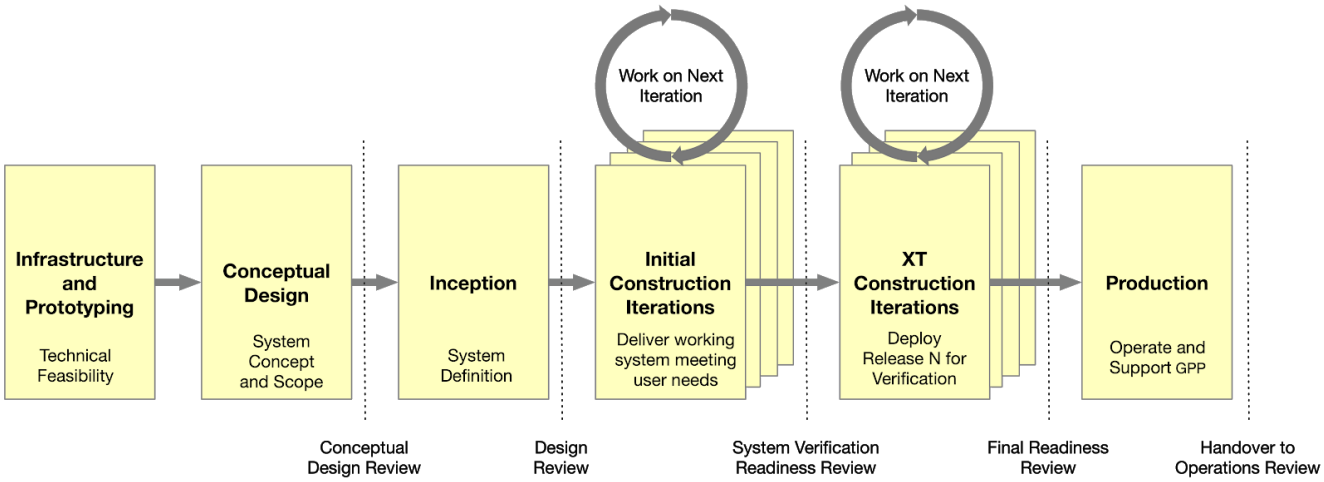
Core End User Applications *The following are the key end user tools that GPP will provide.*	
Program Tool	The Program Tool is a new web-based application that will be used to propose for time and prepare science programs. This is the largest application within GPP. It will be built using similar technologies used by the new web-based sequence executor.
Execution Tool	The Execution Tool is targeted to night time operators and is envisioned as an extension to the web-based Sequence Executor with additional interfaces to incorporate user interactions with the Scheduler.

Observing Log	This is a new web-based system to provide a view of events happening at night and allow operators to provide input. It will aim to replace the existing Night Log/Obslog systems.
Small End User Applications *These applications either already exist in the current system and they will be adapted to obtain data from the new database, or they are relatively simple so the anticipated effort for them is smaller than for the Core End User Applications.*	
Reports	GPP will offer reporting capabilities using standard SQL statements against a read-only replica of the observing database. The effort here will focus on setting up this replica database, and defining the required endpoints for reports to be built. The intent is that actual reports can be written not only by software staff but also end users according to their needs.
Laser Clearing House	LCH software will continue as is, with small adjustments to interact with the new observing database.
Queue Visualization	Queue Visualization will continue as is, with small adjustments to interact with the new observing database.
Manual Planning Tool	The Manual Planning tool will be the existing QPT updated to read information from the new observing database.
Services *The applications listed above require the following infrastructure services to meet their primary functions. GPP will provide all of these.*	
Observing Database	The Observing Database service includes all work on the science program model and its mapping to relational database tables. This service will be under constant development for the duration of the GPP project.
Scheduler	The scheduler will take advantage of an existing constraint solver like Gurobi. The majority of the work here will be writing the weighting function that will be optimized, providing visibility into its decisions, and user access to its configuration.
Single Sign On Service	Single Sign On provides authentication services required to use the GPP APIs.

Target Database	Much of the target database has been prototyped successfully. The remaining work is to make it a standalone service with a GraphQL API.
Automated Guide Star Service	The Automated Guide Star Service will be a rewrite of the existing AGS, incorporating lessons learned and providing probe range and science area models that can be shared directly with the Program Tool.
Integration Time Calculator	The Integration Time Calculator service work involves creating a small wrapper around the existing ITC such that it is accessible to other applications and services via GraphQL.
Facility Service	The Facility Service replaces the existing ICTD, adding visibility into past and present availability of masks and instrument features along with the telescope schedule.
Calibration Service	The Calibration Service is entirely new and will determine which calibrations are required (and which are already present) for a given dataset.
Environmental Monitor	The Environmental Monitor tracks existing automated sources and manually provided conditions information in a database such that it is available for the Scheduler.
Instrument Service	The Instrument Service will be an update to the existing new Seqexec backend such that it works with the remainder of the GPP.
Control Systems Bridge Service	The control systems bridge simply exposes low-level telescope and instrument status to the remainder of the GPP.

4 Project Stages

GPP will be built using Agile software methodologies that Gemini has used successfully in previous software projects. The Project stages are illustrated below and discussed in the next sections.



GPP Project Stages and Stage Reviews

4.1 Infrastructure and Prototyping

This stage was completed by the end of 2018. The core software infrastructure that supports the Program Platform was prototyped during this stage, based on lessons learned from the first generation of the system. These components are required irrespective of what tools or operational model we choose to implement. In particular, this infrastructure provided:

- A sequence model - a representation of science sequences. Includes a new sequence model (with F2 as a working example), its corresponding program model, a new observing database, authentication, backups, automatic deployment infrastructure and mechanisms to import content from the existing database into the new one.
- Instrument model - a way of representing Gemini instruments and their properties in a relational database.
- Target Model - a representation of targets, and their characteristics. This provides a unified way of handling targets in the GPP, and it is the foundation block for services that use targets like the Automated Guide Star service.

4.2 Conceptual Design Stage

The goals of this stage are:

- Agree upon and baseline the GPP high-level scope
- Review and agree upon an Operational Concept Document for GPP.
- Review and agree upon a proposed software concept for GPP.

- Review and agree upon a proposed verification process concept to ensure the system can be built with required verification prior to its final release.

To achieve these goals, this stage produces an Operational Concept Document (OCD) for the GPP describing the overarching goals of the system focusing on addressing key shortcoming in the existing software. The OCD introduces a software concept to address them, including a proposal for system verification during construction.

An initial GPP architecture is described, identifying the core software products that will be built. A plan is presented to assess the project feasibility and required funding.

4.3 Inception Stage

Once the concept of operations is baselined and GPP scope is approved, we will begin the inception stage. The goals of this stage are:

- Obtain initial product feature set and high level requirements for the system
- Continue to refine the system and product architecture
- Detail the system verification process and get project executive approval
- Update project plan for construction
- Prepare project teams for construction

Science staff has made progress identifying user needs, documented as “user stories” that describe desired features and usage patterns. These stories will be source material for requirement-gathering during this stage. We will focus on the core end-user products (Program Tool, Execution Tool, and Obslog) and their underlying support services, and will identify core features with sufficient detail to plan the initial milestones and allocate staff resources for the next phase.

The plan for construction will be updated, identifying top level milestones that will be used to guide the software development work. This stage ends with a design review to ensure the goals are met and the software is sufficiently defined to begin the construction stage.

4.4 Initial Construction Stage

This stage covers the initial implementation of the software products that form the new system, to the point that a usable initial release may be delivered to external PIs for verification. This is an iterative process of implementation and refinement with the end goal of producing an end-to-end system for at least a single observing mode for a single instrument (for instance GMOS Longslit). It will be capable of creating a proposal, refining its phase 2 details, and executing the resulting observations.

We anticipate beginning with the core program model along with services like integration time calculation and automatic guide star search in order to enable progress on the Program Tool. Early milestones will likely focus on providing a very general model of sequence construction that can support all operating modes for a single instrument, providing a basis for specialized, automated modes in future milestones; as well as API access to allow programmatic assembly of sequences by instrument scientists and others contributing to the automation effort.

The stage ends with a system verification readiness review that will confirm the system is sufficiently defined to allow PIs to use it for verification.

In the following sections, we list the products that will be incrementally built during this stage. A collection of supporting applications will be left to the next stage since they are not critical to achieving our goal of providing an initial release to external PIs.

4.4.1 Core End User Applications

The first versions of these applications are built to support the goals defined in this stage:

- Program Tool
- Execution Tool
- Obslog

Details of these products are discussed in section 3. They will be implemented by a team of high-level software engineers with web development and user interface design experience in collaboration with science experts including astronomers and telescope operators.

4.4.2 Gemini Program Platform Services

The Gemini Program Platform Services are the services that enable the applications in GPP. During this stage, the following services are implemented with sufficient functionality to support the stage goals:

- Observing Database
- Authentication Service (Single Sign-On SSO)
- Target Database
- Scheduler
- Automated Guide Star Service
- Integration Time Calculators
- Facility Service
- Environmental Monitor Service

- Instrument Service
- Control System Bridge

These services will be built in parallel with the required applications that will consume them.

4.5 XT Stage

The readiness review from the Initial Construction stage will confirm that we have produced a minimally functional version of the Program Tool and the Execution Tool, with adequate documentation and training materials for at least a single observing mode and instrument. In other words, the XT Stage begins when we have sufficient support to offer our applications to external PIs for verification in practice, obtaining real science data at night.

The XT stage will then proceed in an iterative process much like the initial construction stage. Here we incorporate improvements that have been identified through usage of the system along with adding new observing modes and instruments. It is also in this stage that we begin to add auxiliary applications like Laser Clearing House and the Manual Planning Tool. At this stage, we expect to start using the system via the “XT” mode described in the GPP Operational Concept Document.

Testers consisting of Gemini staff, NGO staff, and community users will be recruited during the inception and initial construction phases and will be involved as soon as there are new features and interfaces to evaluate. Initially the testers may help generate test observations or translate observations from programs in the legacy system. XT time will likely need to be oversubscribed in order to provide a sufficient body of observations to test all modes and evaluate scheduler performance; and the amount of on-sky time required for XT will likely increase through this stage.

The stage ends with a final readiness review, to approve the use of the system for regular operations.

4.5.1 Auxiliary Applications

In addition to perfecting the major applications and services begun in the Initial Construction Stage, during the XT Stage we will produce the following auxiliary applications:

- Reports
- Laser Clearing House
- Queue Visualization
- Manual Planning Tool

We believe these products can be scheduled for later in the process, as they are either less complex or built based on existing products and not required for an initial public offering.

4.6 Production Stage

This stage is when the GPP will become fully operational. At this stage, we expect to retire the “XT” mode and turn off the old system from operations. The process to do this will be detailed later in the project, and will complete with a Handover to Operations review. That will mark the end of the project.

5 Project Schedule

The following table summarizes the overall project schedule:

Project Stage	Begin	End
Infrastructure and Prototyping	January 2018	December 2018
Conceptual Design	January 2019	October 17, 2019
Inception Stage	Oct 18, 2019	Feb 27, 2020
Initial Construction Stage	Feb 28, 2020	April, 2021
XT Stage	April, 2021	Feb, 2023
Production Stage	February 2023	July 2023

6 Project Resources

We estimate about 22.3 FTE over 5 years (2018-2023) to complete this project, distributed as follows:

14 FTE High Level Software Engineers
2.6 FTE Project Scientist
0.9 FTE SOS
3.4 FTE Scientist/Astronomers
1.4 FTE Project Management

Non-labor budget is for travel to support project reviews, technical team meetings and training. We estimate these to be in the order of $90K, distributed as follows:

2020: 30K - Design Review plus technical visits during construction and technical training
2021: 20K - Technical visits during construction plus technical training.
2022: 20K - Technical visits during construction plus technical training.

2023: 20K - Training and final release travel support.

7 Inception Stage Plan

7.1 Plan Description

The Gemini Program Platform identifies a number of end user products, and corresponding supporting services. Out of these, the Program Tool, the Execution Tool and the Obslog form the core key new systems that GPP will produce. The Inception stage is focused on defining a backlog of initial features and determining the initial scope for these applications.

7.2 Plan Organization

The plan is organized in four WBS items:

- Program Tool Scope and Backlog Definition
- Execution Tool Scope and Backlog Definition
- Obslog Scope and Backlog Definition.
- Review Preparation.

The Scope and Backlog Definition work packages are focused on extracting initial specifications for the Program Tool, Execution Tool and Obslog, the corresponding APIs that will be needed for their operation, and their supporting services. For each one, an initial technical proposal will be produced that will be refined with input from key stakeholders. The goal will be to identify the initial set of core features to implement with sufficient detail to plan the construction stage and allocate staff resources.

The Review Preparation WBS item contains the required work to prepare documentation and associated material for a stage review.

7.3 Plan Prerequisites

This plan assumes a successful completion of the Conceptual Design Stage, which includes a baselined Operational Concept Document and Software Conceptual Design.

7.4 Planning Assumptions

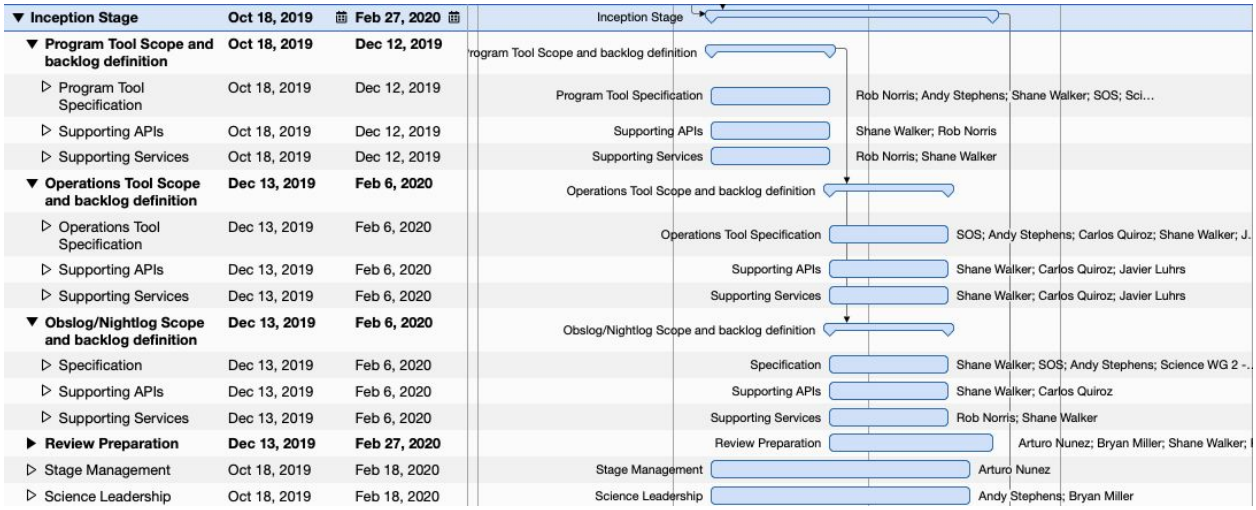
For this plan, we assume the availability of the software and science personnel required for the completion of this stage, as detailed in section 7.8.

7.5 Monitoring and Control

The project will continue being monitored via monthly highlight reports to the project executive.

7.6 Schedule

The Inception schedule is shown in the following WBS:



7.7 Milestones

The following are the stage milestones we will be tracking:

Milestone	Expected Completion
Stage kick off	October 18, 2019
Review Committee defined and stage review dates firmed	December 19, 2019
Program Tool scope definition and initial backlog completed	December 12, 2019
Execution Tool scope definition and initial backlog completed	February 6, 2020
Obslog scope definition and initial backlog completed	February 6, 2020
Stage review material distributed for internal review	Feb 14, 2020

Stage review material submitted to review committee	Feb 27, 2020
Stage Review	March 12, 2020

7.8 Resources

The expected cost for the inception stage is 1472 hours or 1.17 FTE from September 2019 to February 2020, distributed as follows:

- Software Engineering effort: 752h
- Project Scientist effort: 340h
- Astronomer effort: 160h
- SOS effort: 350h
- Project Management Effort: 260h

In addition, we estimate about $20K for travel required for a stage review.

8 Risk Management

Program risks are managed using the Gemini PMO risk management processes, and reported on a monthly basis to the project executive. The program risk registry can be found here.