GOES-R Series/ G18 Post Launch Testing Sequence of Events (PLT SOE) A Day-to-day Project Schedule

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Agenda

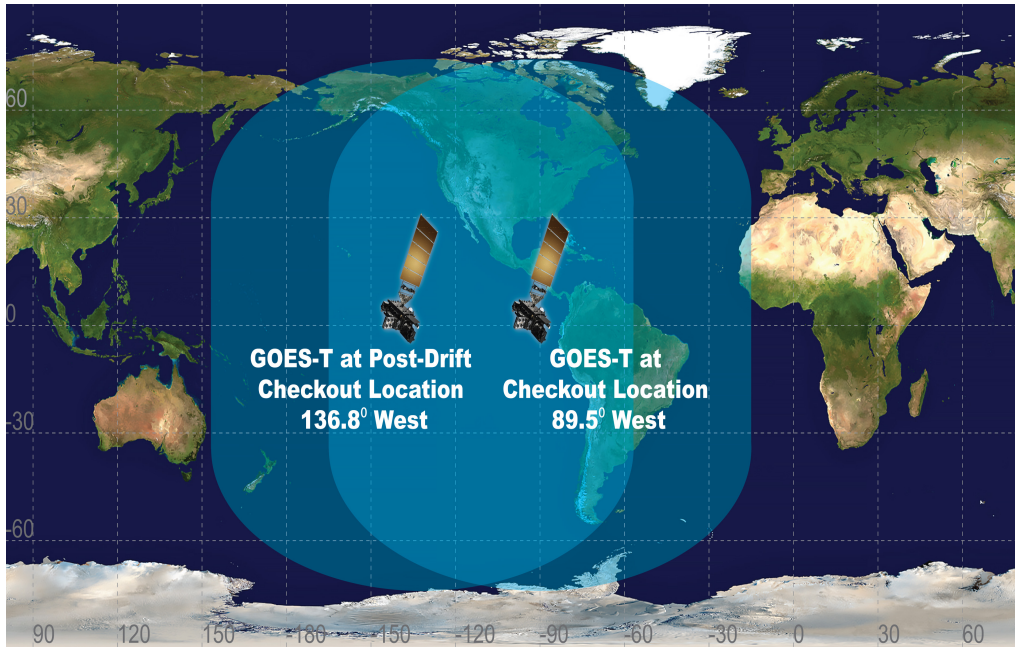
1. Post Launch Testing Objectives
2. System Engineering Process Model to deliver the PLT SOE
3. Background: Subsystems and Instruments to be tested
4. Sequence of Events planning phases
5. Day-to-Day Project Schedule

Post-launch Testing Objectives

- Geostationary Operational Environmental Satellites (GOES) - The nation's most advanced fleet of geostationary weather satellites
- Objective of the GOES-T PLT campaign - validate capability of the GOES system to perform the mission
- An integrated series of tests and demonstrations performed by the key elements of the system:

  - ★ Observatory
  - ★ Ground
  - ★ Products

- To accommodate G-17 ABI during the fall 'hot season', PLT will be conducted for the first 2 months at 89.5°, then drift to 136.8° and complete the PLT



Source: https://www.goes-r.gov/mission/mission.html

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Subsystems and Instruments to be Tested

1. ABI (Advanced Baseline Imager)
2. EXIS (Extreme Ultra-Violet X-Ray Irradiance Sensor)
3. GLM (Geostationary Lightning Mapper)
4. GMAG (Goddard Magnetometer)
5. SEISS (Space Environment in-Situ Suite)
6. SUVI (Solar Ultraviolet Imager)
7. GNC (Guidance, Navigation, and Control)
8. COMM (Communications)
9. Ground (Ground Systems)

Background

Subsystems:

1. ABI 20 tests : 500 events (tasks)
2. EXIS 13 tests: 200 events (tasks)
3. GLM 12 tests : 200 events (tasks)
4. GMAG 5 tests : 60 events (tasks)
5. SEISS 10 tests: 110 events (tasks)
6. SUVI 12 tests: 110 events (tasks)
7. GNC 10 tests: 110 events (tasks)
8. COMM 3 tests: 30 events (tasks)
9. Ground 4 tests: 30 events (tasks)
10. Satellite Events: Maneuvers, RFI, Eclipses: 300 events

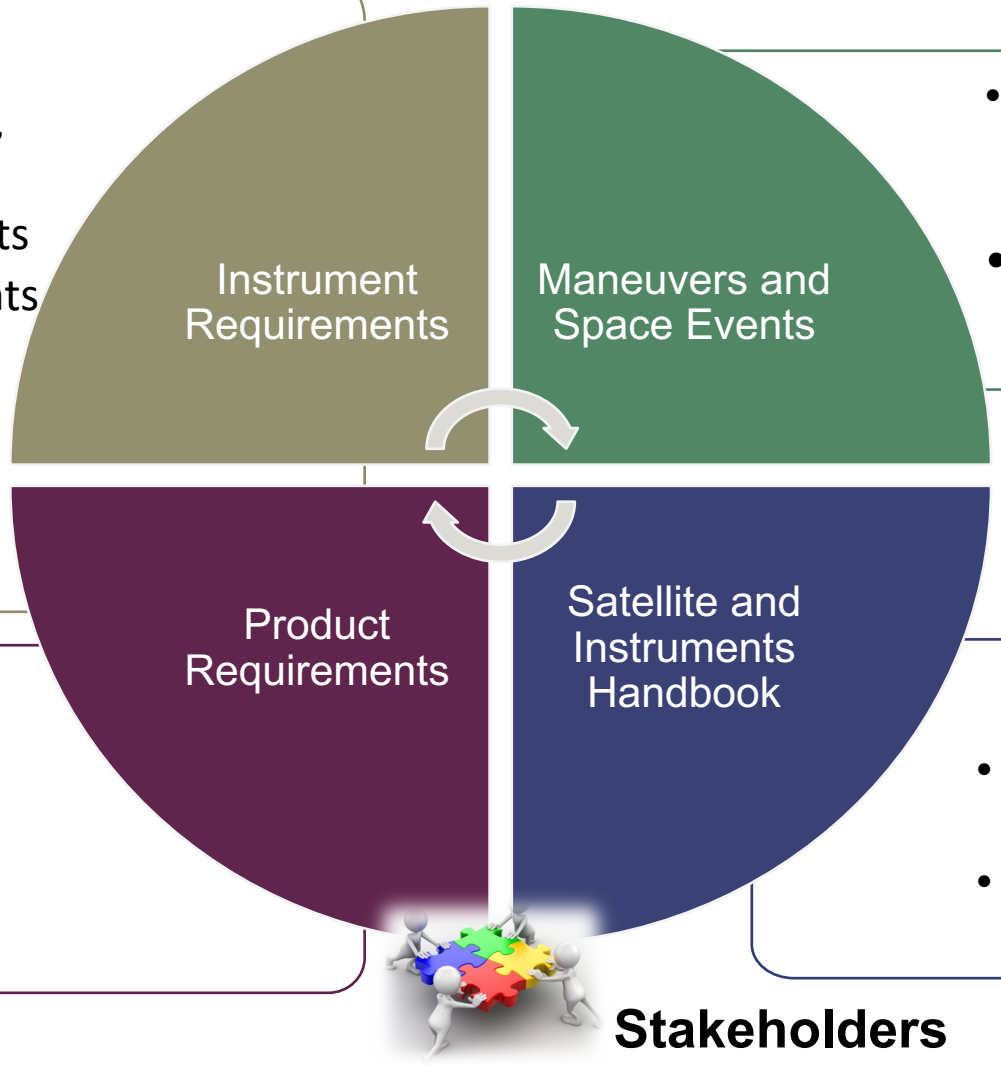
A Substantial Scheduling Effort : ~ About 2000 tasks in 6 months.

Resources:

- Subsystem/Instrument Team: 4 – 8 Engineers + Team Lead
- Workforce of about 60 highly skilled personnel
- LCR workstations/Ground Antennas
- Spacecraft

Background: Inputs for PLT SOE

- Instrument Requirements
- Execution Type: Active Commanding, Data Collection, Analysis Time
- Space Local Time Requirements
- Time Constrained Requirements
- Resources Availability



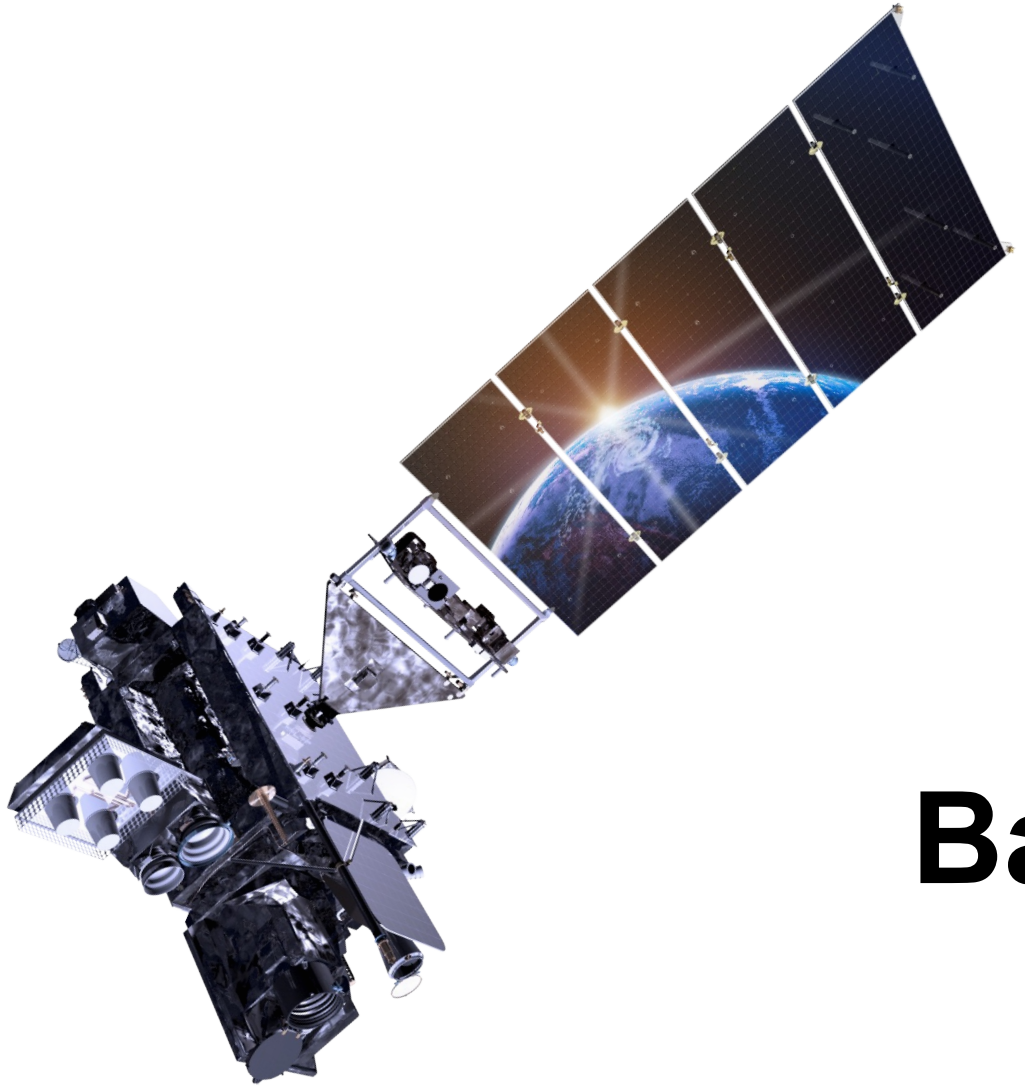
- Maneuver Plan (NSSK, EWSK, Momentum Adjustments)
- Eclipses, Solar and Lunar Intrusions, and RFI events

- Requirements for Declaring Product Maturity

- Instrument Operations Handbook
- Satellite Operations Handbook

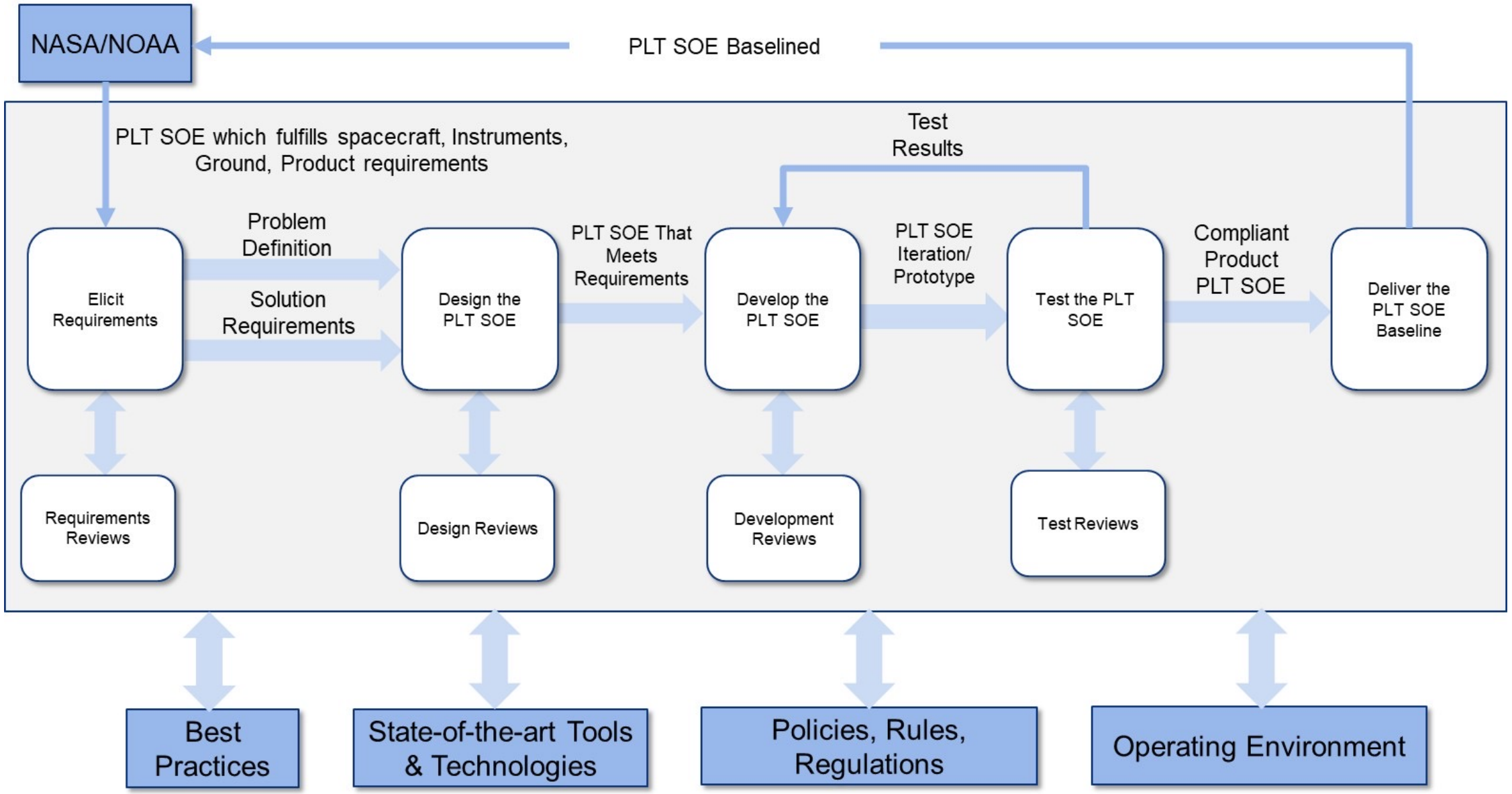
Stakeholders

Missions Operations Manager, Systems Operations Manager, Instrument Systems Manager, MOST Subsystem Manager/Instrument Leader/Instrument Team, Flight Project Subject Matter Experts, Product Readiness and Operations Team (PRO), Ground System Leader, Contingency Manager, Configuration Manager, NWS, NASA, NOAA



Baseline Planning

System Engineering Process Model



PLT SOE Baseline

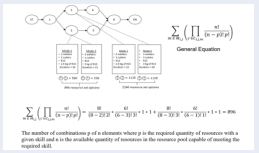
Generate starting point of PLT SOE draft

TPM Algorithm

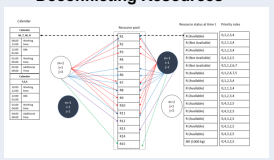
- Discrete Event Simulation, Define Starting Date
- Resource Management: Spacecraft: Active Commanding
- What if Rules/resource: Subsystems Priorities (Dynamic rules - Change daily/weekly - Defined as parameters)
- Space local requirement : Time Range
- Data Collection vs Spacecraft Slew

Inputs → TPM Database → Outputs csv,txt mpp files

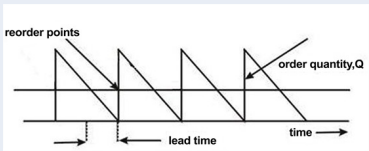
Multi-Mode, Managing Skills - Combination



Deconflicting Resources



Renewable, Non-Renewable Resources - Orders



Generate PLT SOE drafts and PLT SOE Baseline

Merge Output - One Time Only

Inputs → Planning → Output: PLT SOE

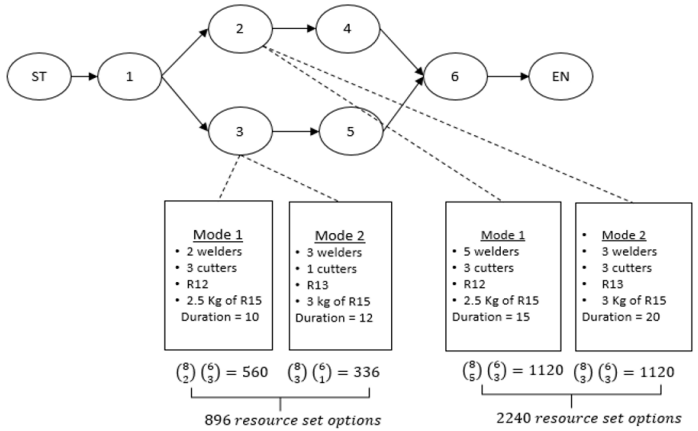
Google Apps Script

Visual Basic for Applications

PLT SOE Database Table Design

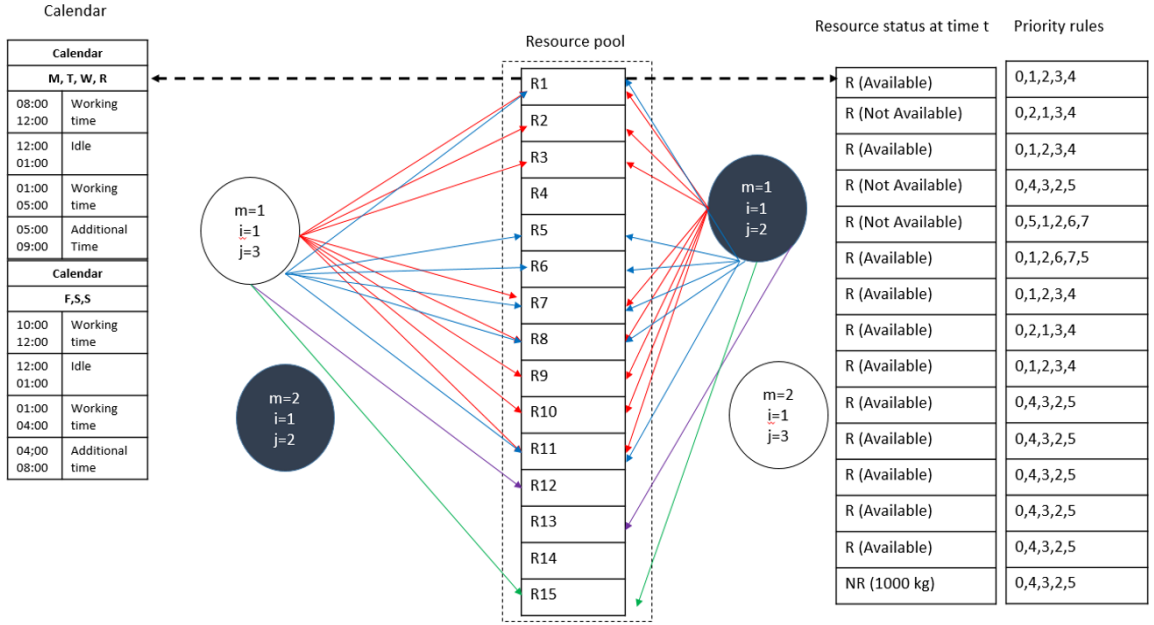
Field Name	Data Type	Description (Optional)
UniqueID	Number	Unique event Id
PLT Day	Short Text	PLT Day #. It starts with 1 and finishes about 180. 6 months later
Subsystem	Short Text	Unique Id for Subsystems
TaskName	Short Text	Description of the event
Start	Date/Time	Start time (UTC)
Finish	Date/Time	Finish time (UTC)
Duration	Short Text	Event duration
Test Technique	Short Text	Test Technique: Active Commanding, Quiescent test, Data Collection, Data Analysis, CM, Deployment
Misson Scripts	Short Text	Active Commanding Scripts
Scheduling Comments	Short Text	Any comment needed
% Complete	Number	Percentage of completion

General Methods



$$\sum_{m \in M_{i,j}} \left(\prod_{c \in C_{i,j,m}} \frac{n!}{(n-p)!\,p!} \right)$$

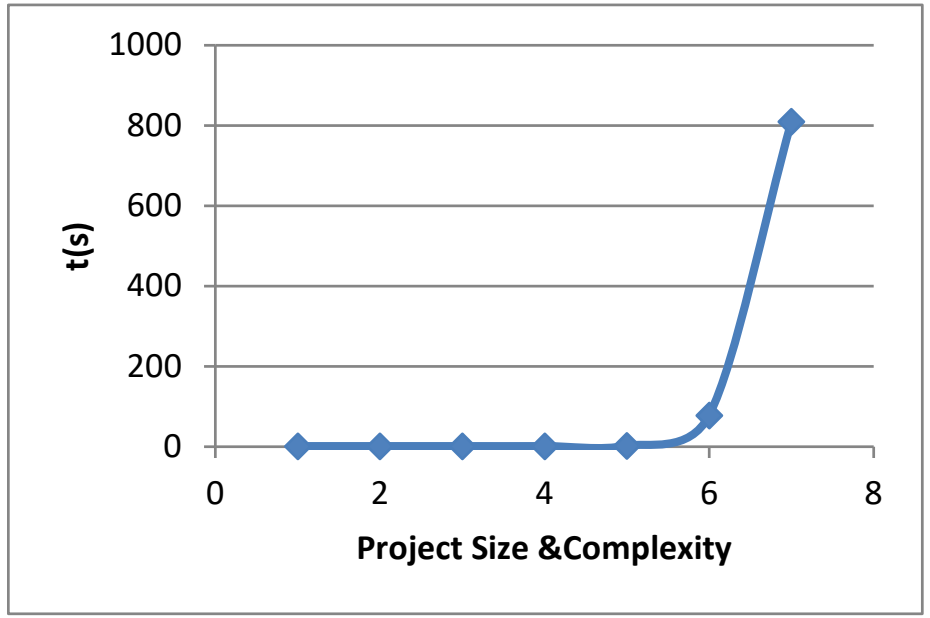
General Equation

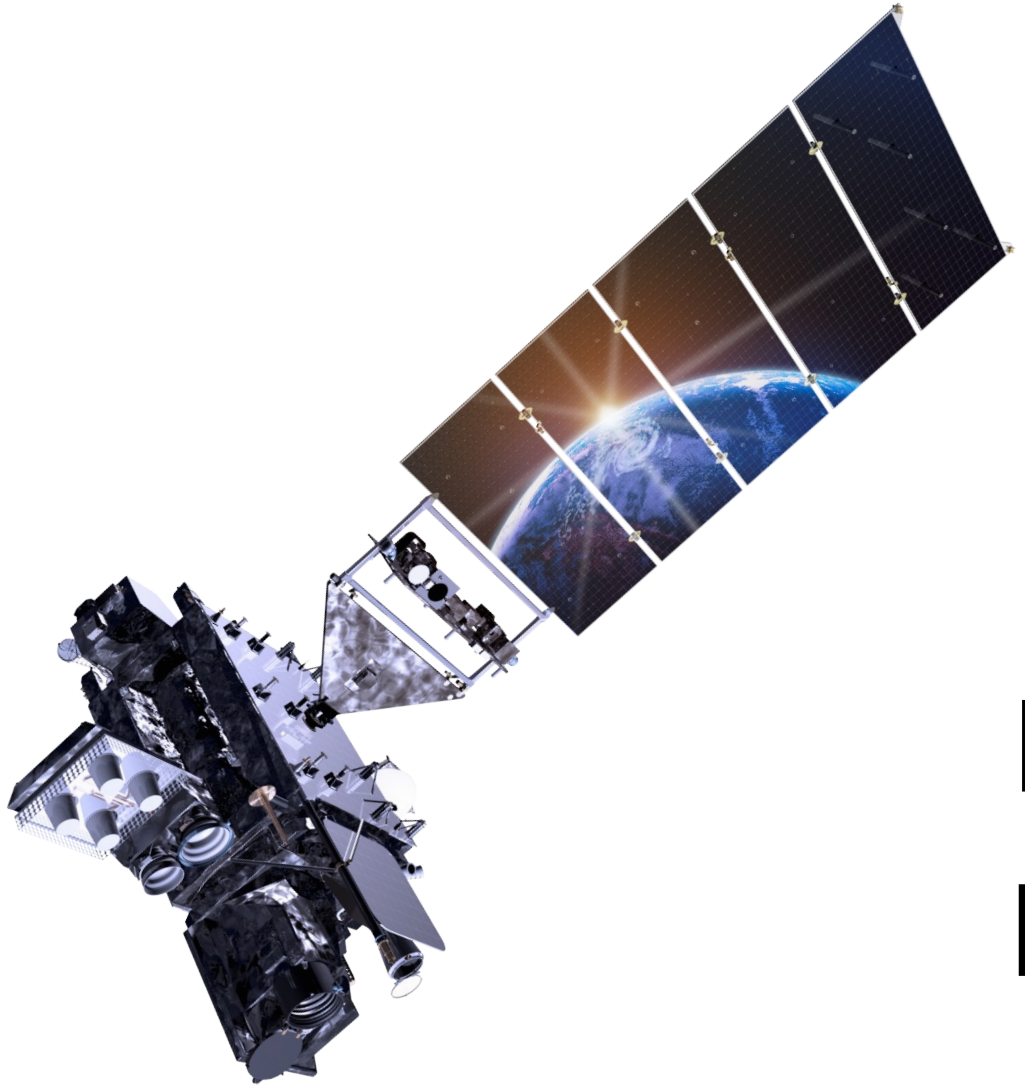


$$\sum_{m \in M_{i,j}} \left(\prod_{c \in C_{i,j,m}} \frac{n!}{(n-p)!\,p!} \right) = \frac{8!}{(8-2)!\,2!} * \frac{6!}{(6-3)!\,3!} * 1 * 1 + \frac{8!}{(8-3)!\,3!} * \frac{6!}{(6-1)!\,1!} * 1 * 1 = 896$$

The number of combinations p of n elements where p is the required quantity of resources with a given skill and n is the available quantity of resources in the resource pool capable of meeting the required skill.

	Number of Tasks	Number of resources	Multiple skills	Multi-mode	Multiple calendars with interr.	Multiple priority rules	Multiple Projects	Number of Projects	Time (s)
1	33	31	X	x	x	x		1	1
2	100	65				x		1	1
3	111	475	x	x	x	x		1	1
4	222	475	x	x	x	x	x	2	1
5	333	475	x	x	x	x	x	3	2
6	3330	475	x	x	x	x	x	30	78
7	11100	475	x	x	x	x	x	100	810





Monitor and Re-planning

Day-to-Day Project Schedule

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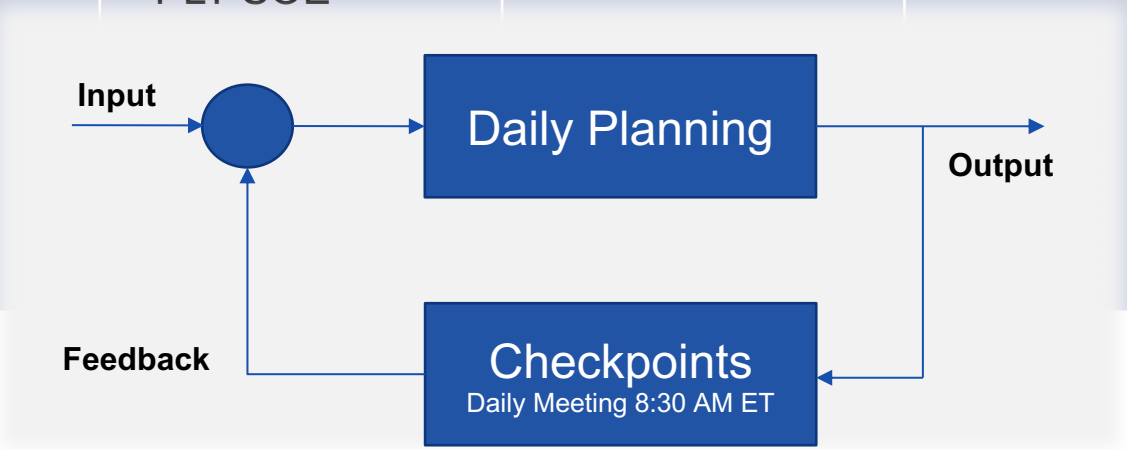
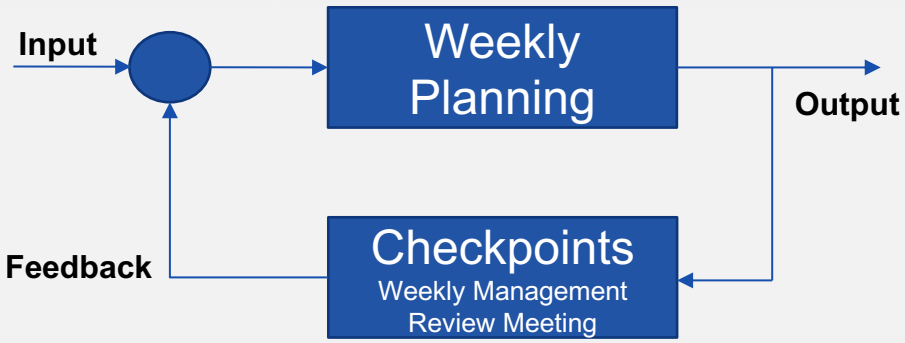
Sources of Inputs / Upstream Processes	Inputs	Daily Planning	Outputs	Receivers of Outputs/ Downstream Processes	Checkpoints
• LCR/Systems Applications • Vendors • MOST • Scientists • NASA • NOAA • NSW • PRO	• Accomplishments From Previous Day • Items of Note From Previous Day • Work Requests with Potential Impact on PLT • Space Events (Eclipses, Solar and Lunar Intrusions) • Maneuver Plan • Additional Requirements	• Re-planning and Resource Management	• 10-day Look Ahead to Upcoming Tests • Today's Schedule • Next Day Schedule • Impacts on the PLT SOE	• Vendors • MOST • Scientists • NASA • NOAA • NSW • PRO	• Daily Management Review Meeting



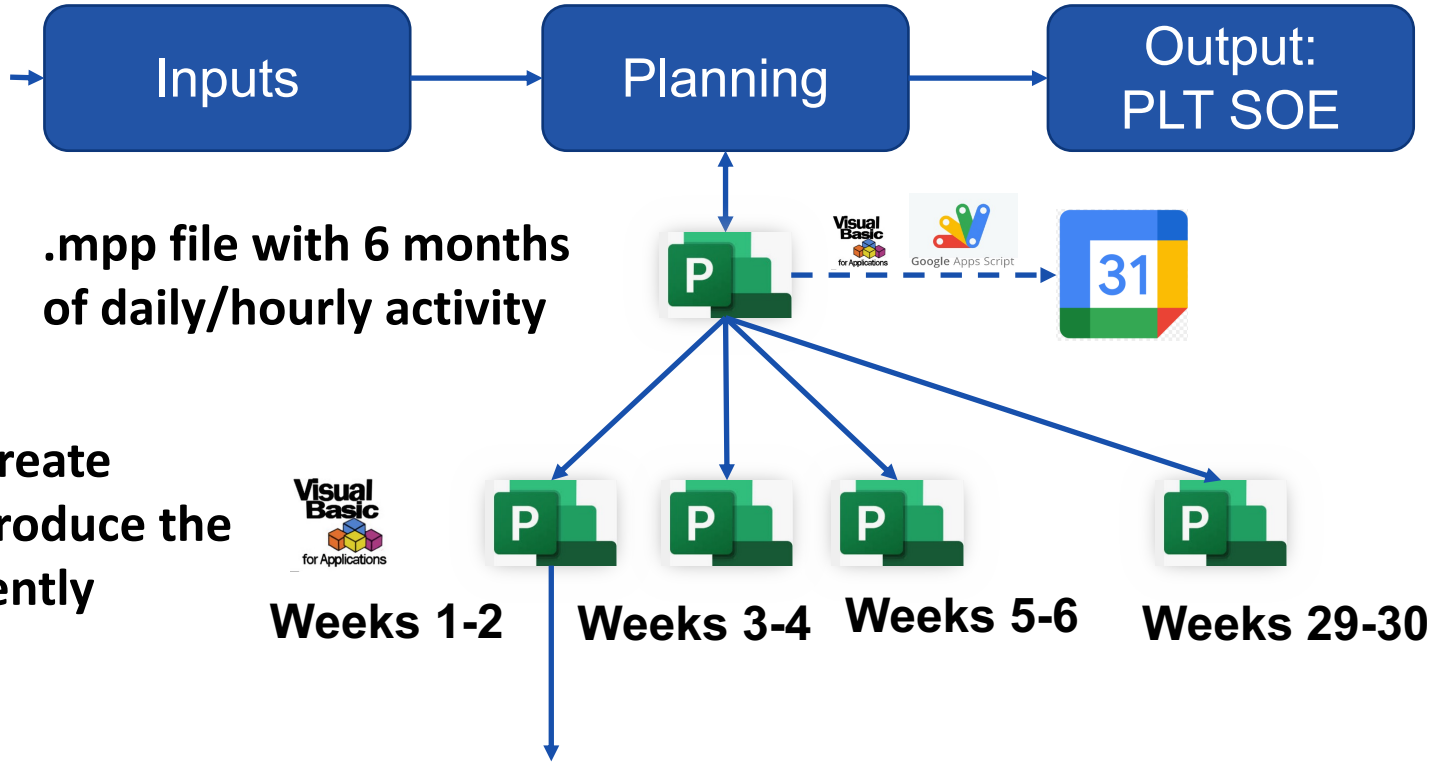
Replanning Analysis (Weekly)

TPM

Sources of Inputs / Upstream Processes	Inputs	Weekly Planning	Outputs	Receivers of Outputs/ Downstream Processes	Checkpoints
• LCR/Systems Applications • Vendors • MOST • Scientists • NASA • NOAA • NSW • PRO	• Weekly Accomplishments • Items of Note • Additional Requirements • Work Requests with Potential Impact to PLT	• Review Test Progress Against Baseline SOE • Re-planning and Resource Management	• Updated PLT SOE	• Vendors • MOST • Scientists • NASA • NOAA • NSW • PRO	• Weekly Management Review Meeting • Schedule Coordination Meeting

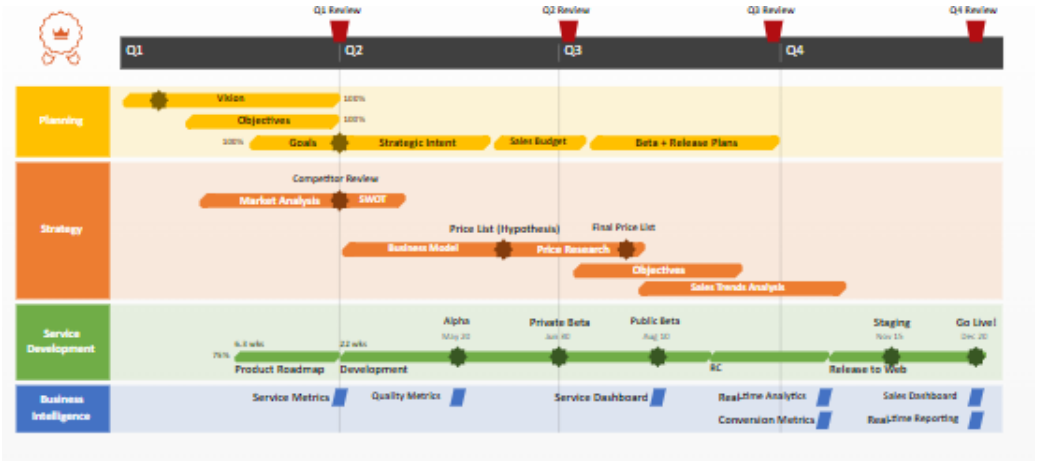


Day-to-Day Creation of Deliverables

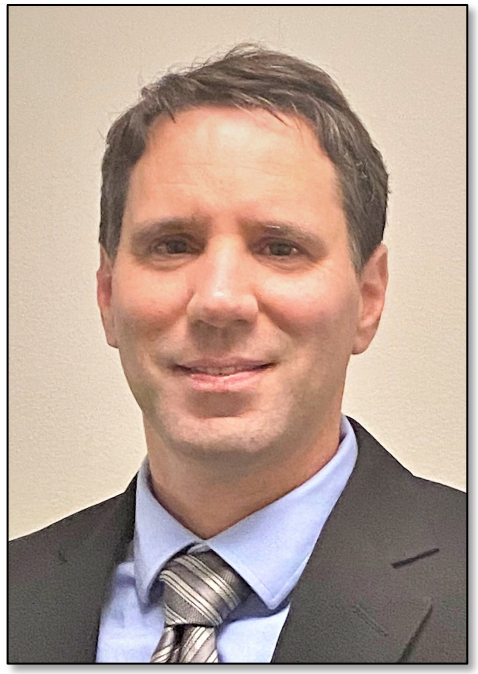


Automated routine to create multiple .mpp files to produce the daily charts more efficiently

Today's Schedule, Next Day Schedule and 10-day Look Ahead Schedule Presented During the Daily Briefing



Contacts



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Thank you!
Questions?