How Focusing on Schedule Maintenance and Control Improves Projects

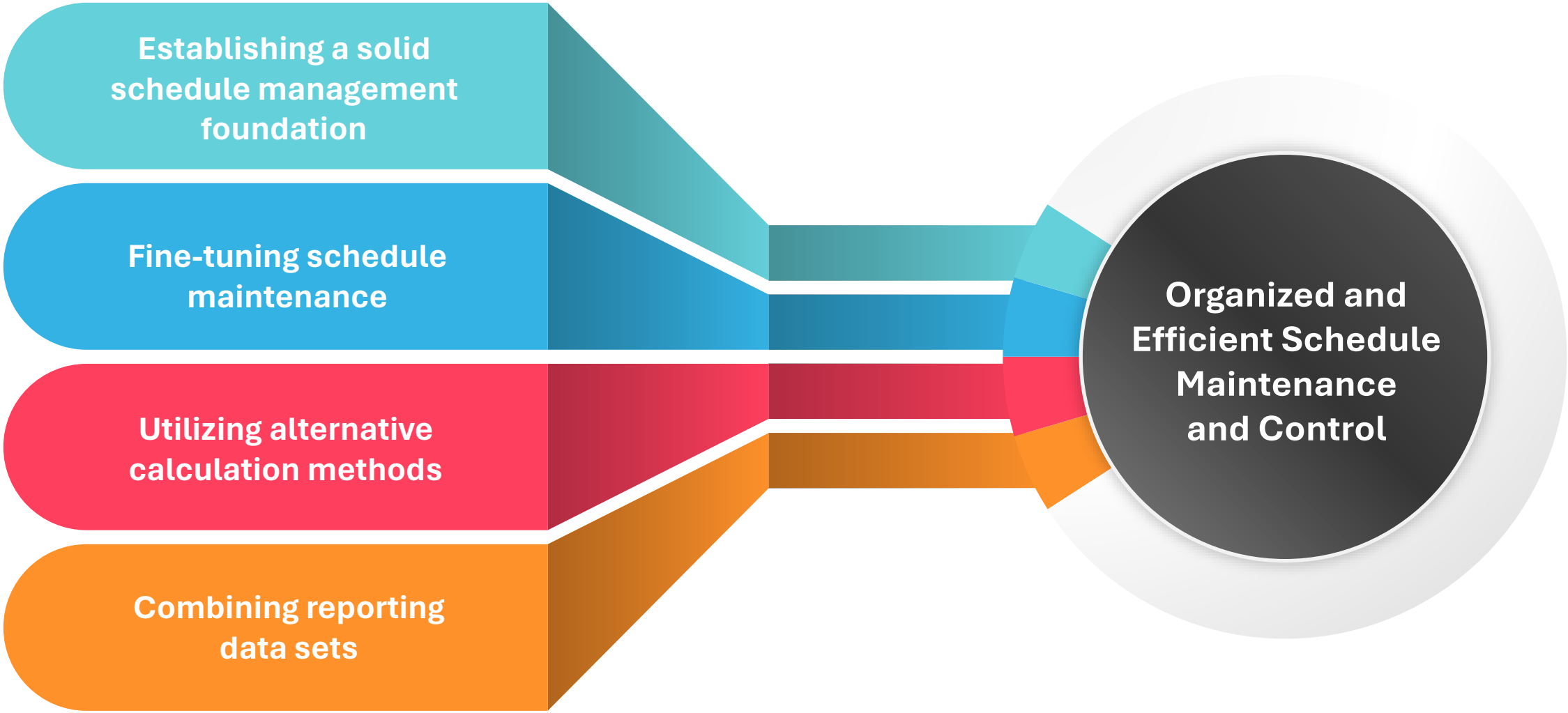
2024 NASA COST & SCHEDULE SYMPOSIUM

Zachary Dolch

NASA GSFC Program Analysis & Control (PAAC) V Contract

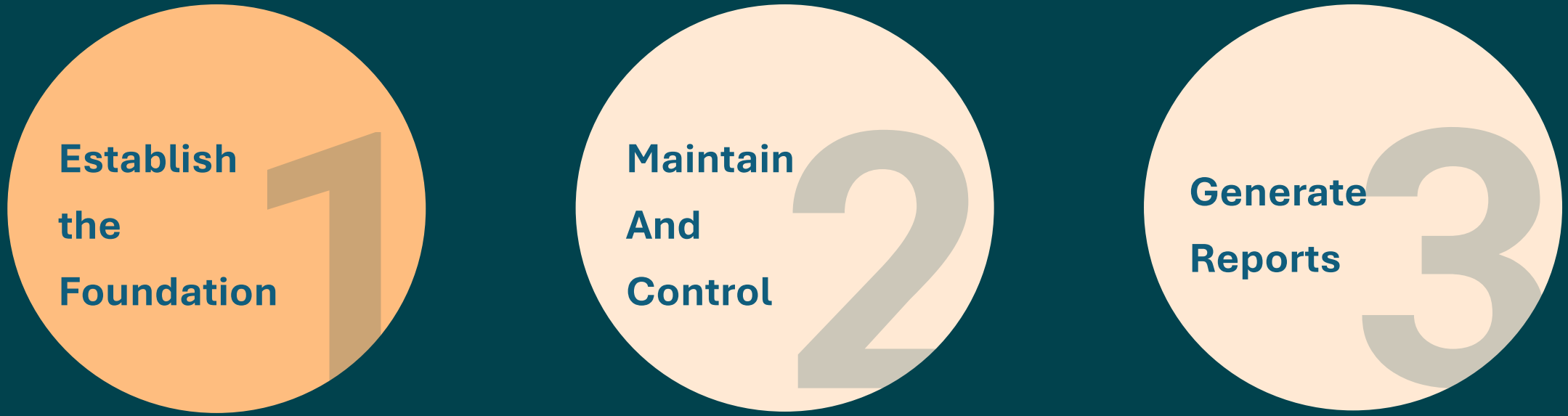
Overview

A discussion of the best practices for gaining insight to month-to-month schedule performance through organizational and efficiency processes



Schedule Management Foundation

The first step for success is to establish a solid foundation for schedule management



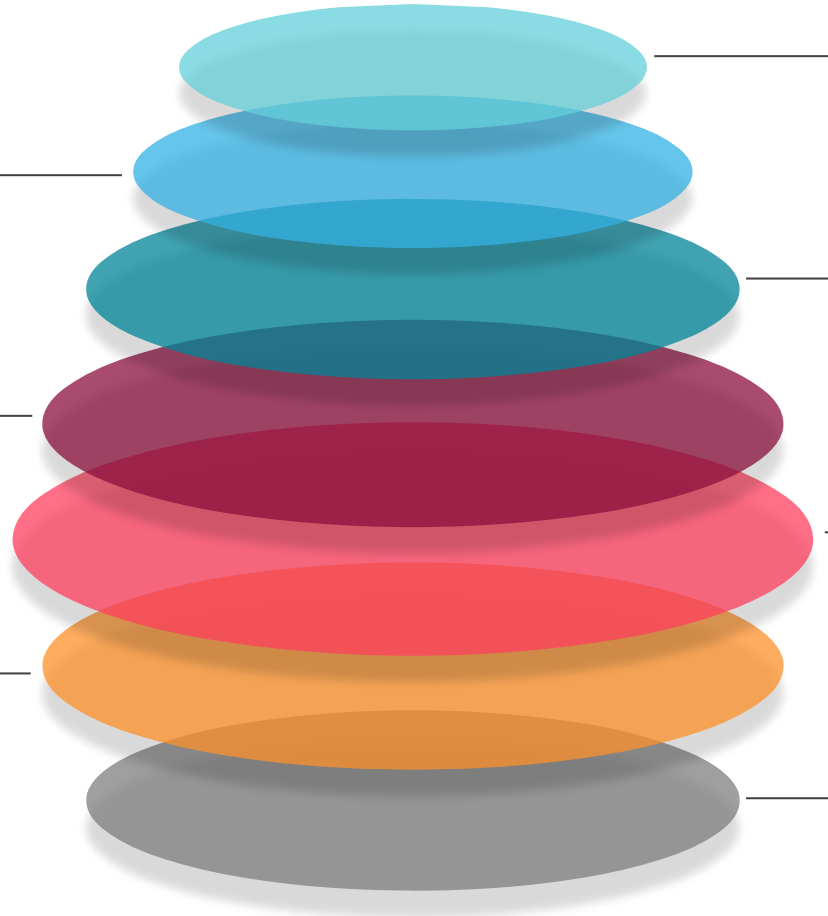
Schedule Management Foundation

Establishing a solid foundation for schedule management is crucial to the success of any project:

Schedule Management Foundation

Schedule Management Foundation

Customize and organize the data structure of the schedule with the future in mind



Use custom fields strategically

Combine similarly-purposed custom fields

Use multi-purposed fields intended for interfacing with other business systems

Use delimiters to combine multiple hierarchal fields

Use lookup tables to reduce input error

Use consistent nomenclature (Improves trending of coding schema)

Populate each field completely

Customized and organized coding facilitates consistent vertical schedule traceability and helps to filter, aggregate, and summarize your schedule data.

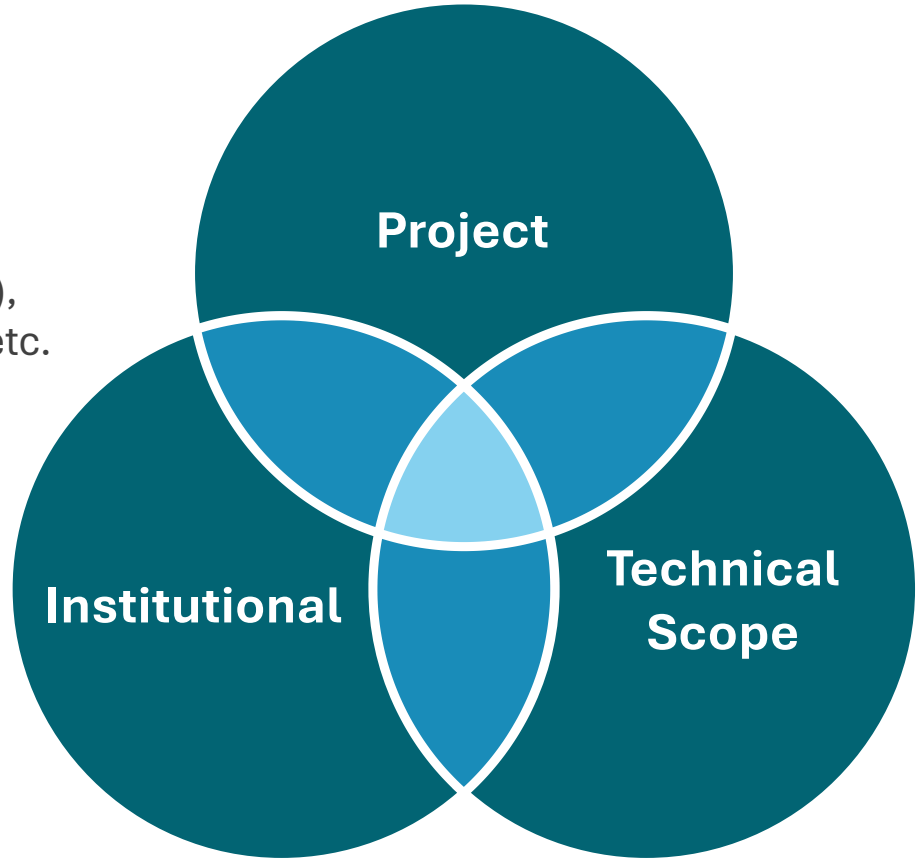
Schedule Management Foundation

Utilize simple coding structures to identify a schedule breakdown structure, critical paths, delay cause codes, variance explanations, and tracking event categories

Reasons for coding can vary and overlap functionality.

Examples:

- Responsibility, Resources, Point of Contact (POC), Control Account Manager (CAM), etc.
- Work Breakdown Structure (WBS), Organizational Breakdown Structure (OBS), Product Breakdown Structure (PBS), *Schedule Breakdown Structure (SBS), etc.
- Phase
- Company, Department, Organization, etc.
- Location, Facility, etc.
- Configuration, Deliverable Unit, etc.
- Business System Interfaces: Cost, Earned Value Management (EVM), Risk, Configuration Management (CM) (Documents/Drawings/Work Orders)



SBS - blends the functionality of WBS and PBS, but provides flexibility for when the customization of the schedule may differ

Schedule Management Foundation

Organized coding promotes vertical schedule traceability and increases reporting effectiveness

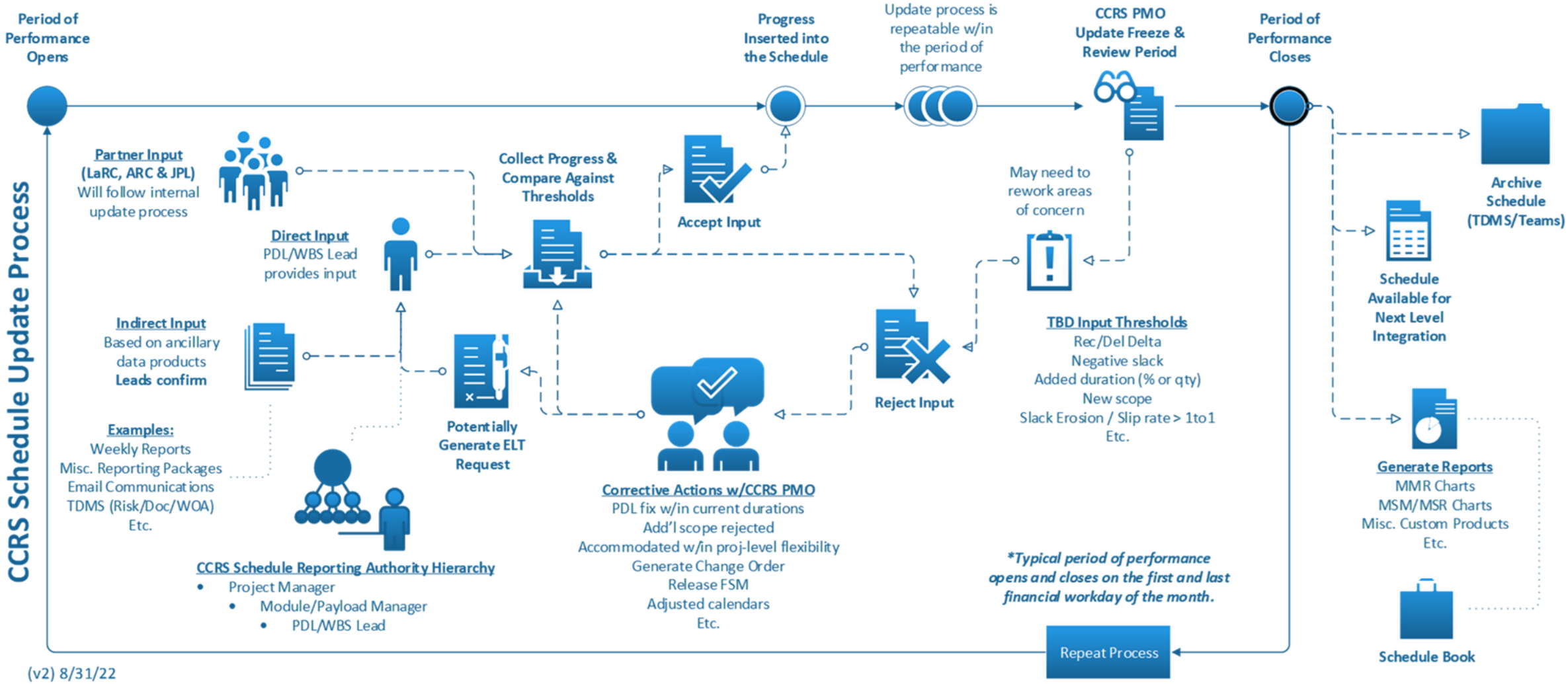
					CM Interface	SBS Hierarchy			Control Event ID	
WBS	POC	Org	Phase	Facility	Doc Info	SBS L1 (Subsystem)	SBS L2 (Component)	SBS L3 (Config)	SCHD Event	Task Name
5.5	Nelson	545	B/C			S&D	S&D	S&D		**Structures & Deployables**
5.5	Nelson	545	B			S&D	Structure	ETU		**Structure Engineering Test Unit (ETU)**
5.5	Nelson	545	B			S&D	Structure	ETU		STR ETU – Design
5.5	Nelson	545	B			S&D	Structure	ETU	PDR	STR ETU – PDR EPR
5.5	Nelson	545	B	B5/N150	DWG-5347	S&D	Structure	ETU		STR ETU – Fab
5.5	Nelson	545	B	B5/N250	PROC-12	S&D	Structure	ETU		STR ETU – Assemble
5.5	Nelson	545	B	B7/W107	WOA-237	S&D	Structure	ETU	RR	STR ETU – Test
5.5	Nelson	545	B			S&D	Structure	ETU	DIP	STR ETU – Deliver in Place
5.5	Nelson	545	C			S&D	Structure	FM		**Structure Flight Model (FM)**
5.5	Nelson	545	C			S&D	Structure	FM		STR FM – Design
5.5	Nelson	545	C			S&D	Structure	FM	CDR	STR FM – PDR EPR
5.5	Nelson	545	C	B5/N150	DWG-5347.1	S&D	Structure	FM		STR FM – Fab
5.5	Nelson	545	C	B5/N250	PROC-25	S&D	Structure	FM		STR FM – Assemble
5.5	Nelson	545	C	B7/W107	WOA-531	S&D	Structure	FM		STR FM – Test
5.5	Nelson	545	C			S&D	Structure	FM	FM DEL	STR FM – Deliver in Place

Schedule Maintenance and Control

Once the schedule management foundation is secure, focus is placed on the routine maintenance and its supporting documentation

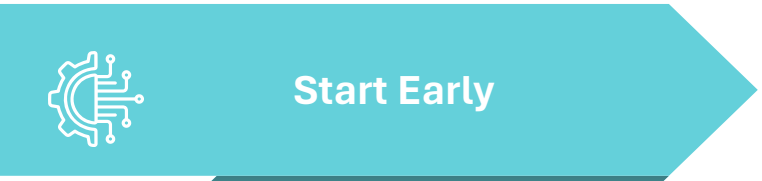
Schedule Maintenance and Control

An example of a Project's typical Period of Performance (POP) activity

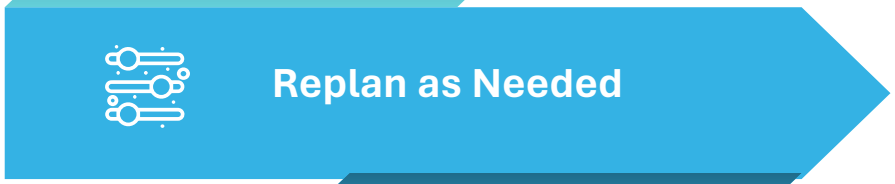


Schedule Maintenance and Control

Unofficially baseline the schedule as early as possible

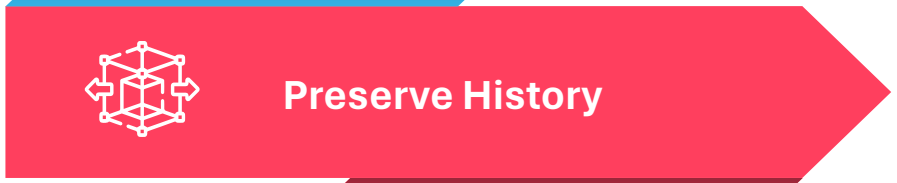


Start with the first lifecycle review (SRR/SDR/MDR)



Replan the baseline when necessary:

- Project-level: At lifecycle reviews, fiscal years, architecture replans, etc.
- Subsystem-level: Scope changes, design changes, etc.



Maintain this single baseline field for the entire project life cycle:

- Never override historical performance
- Only baseline future tasks

Resume typical baseline management best practices once the Performance Measurement Baseline (PMB) is set.

Schedule Maintenance and Control

Improve the Period of Performance (POP) status process

Look Beyond

Broaden the status window to include the next POP:

- Status current POP and confirm plan for next POP
- Accurately sets the Current Execution Index (CEI) plan for the next month

Take Notes

Utilize the notes field to document task changes:

- Date stamp every new entry and place each entry on a separate line
- Use this to jump-start your task-level variance explanations

Track Delays

Codify reasons for the change in the schedule:

- Use Delay Cause Codes (DCCs) to capture why tasks changed
- DCCs can be used during statusing or any time updates are made

Schedule Maintenance and Control

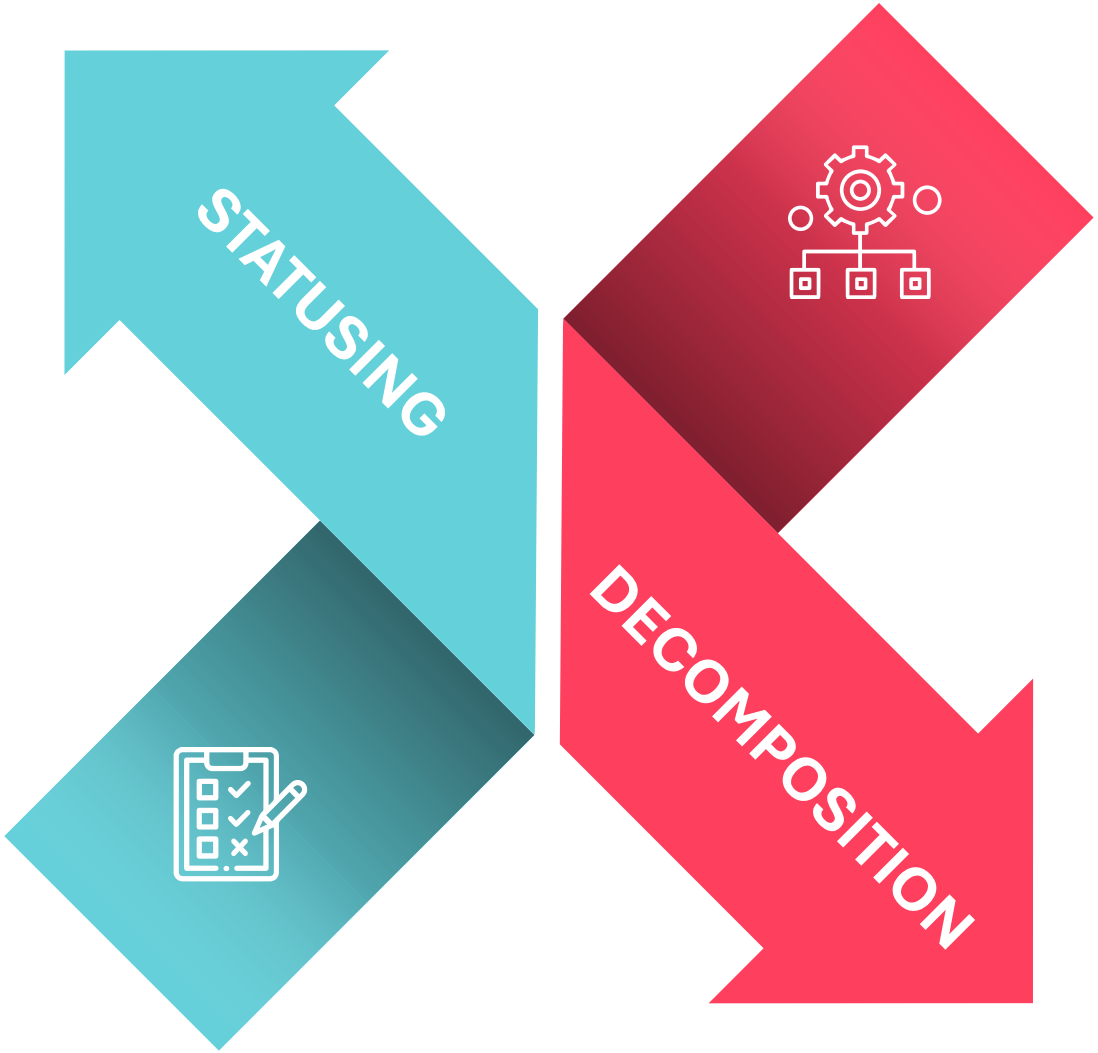
Use other Project business systems/tools to inform schedule progress

Schedule status can be gleaned from regular project communications:

- Weekly Reports
- Electronic Work Order Authorizations (WOAs)
- Production Planning Reports

BONUS: Configuration Management (CM) systems have products to help with decomposition:

- Engineering Drawings (DWG)
- Master Equipment Lists (MELs)
- Cost Basis of Estimates (BOE)
- Hardware Plan/Procedures
- Contract Statements of Work (SOWs)



Schedule Maintenance and Control

Establish a scope management and control process:

New tasks should be reviewed and approved:

- Approval comes from the management level
- Updates may require formal Encumbrance, Lien, Threat (ELT) request and/or Baseline Change Request (BCR)
- Add to the baseline once approved

New Tasks

Deleted Tasks

Don't immediately remove deleted tasks from the schedule:

Establish a process to review and approve the removal. Examples:

1. Mark as inactive
2. Label as descoped (in the task name and activity attribute fields)
3. Ensure the task(s) are not control events for reporting
4. Remain in the schedule until management provides acceptance for removal

Schedule Maintenance and Control

Improve the status closeout process

Preset Schedule Views

Use preset views to configure your activity attributes:

- WBS/SBS coding
- Critical path coding
- LOE identification
- Date trending
- etc. .

Process Checklist

Use a checklist to ensure efficiency:

- Useful for multiple-schedule team member environments
- Outline steps logically to avoid repeating any steps due to finding corrections

Data Scrub

Clean up schedule data so that reports refresh without errors and data stays consistent.

Pencils Down

Implement a freeze period to allow time to close out the schedule.

Schedule Maintenance and Control

An Example of a Monthly Checklist

Life File Statusing

- Prepare IMS file for statusing
  - Request vendor schedule files
  - Review latest reference schedules
- Status the schedule
- Update LOE field
  - PM, SE, SMA, and Spares
- Capture missing delay cause codes
- Run health checks & cleanup
- Configure external files for reports

Schedule Cleanup

- Identify critical paths
  - Subsystem-level
  - Project-level
- Populate activity attributes
- Capture date trending
- Perform New Task Assessment
  - Baseline approved tasks
  - ELT/BCR unapproved tasks
- Generate baseline change log
- Save Month-End (ME) file and print PDF
- Upload, notify, and archive IMS
  - Project, Program, and GSFC sites

Populate Monthly Reports

- Run performance metrics tool
- Export Excel and CSV files
- Send CAM-specific requested reports
- Populate Schedule Book
- PM review of variance explanations prior to first monthly review
- Send Supply Chain Impact Delay Cause codes impacts to DPMR
- Update GSFC Portfolio Management Milestone schedule

Schedule Maintenance and Control

An Example of Schedule Cleanup with Preset Views

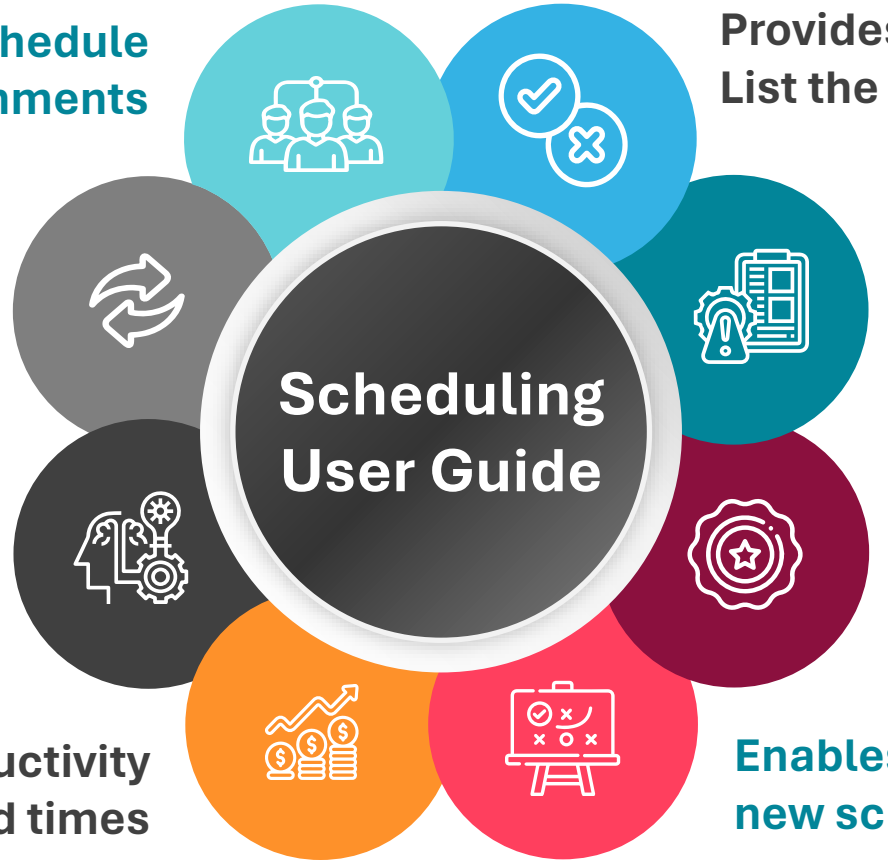
	Project	Summary	Status	Task Calendar	Task Mode	Effor Drive	Type	Estimated	Name
1	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	No	ESA Earth Return Orbiter (ERO) Mission Management
30	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	No	Sample Retrieval Lander (SRL) Phases
37	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	No	Mars Sample-Return (MSR) Program Management
81	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	No	Capture, Containment & Return System (CCRS) Project Mana
316	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	Yes	CCRS Systems Engineering (SE)
619	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	No	CCRS Safety & Mission Assurance (SMA)
648	CCRS IMS	Yes	On Schedule	Federal Holidays and Nonworkdays		No	Fixed Duration	Yes	Contain Module (CCM)

Preset views focus on specific content

This example allows user to assess whether fields are configured correctly to ensure accurate dates and durations are shown.

Schedule Maintenance and Control

Create a schedule user guide and prepare process one sheet for vendors



Supports multiple-schedule team member environments

Provides concise outline of instructions: List the Scheduling Dos and Don’ts

Provides an opportunity for open feedback loops

Reduces errors and misuse of the schedules, reporting tools, and scheduling products

Supports various learning styles

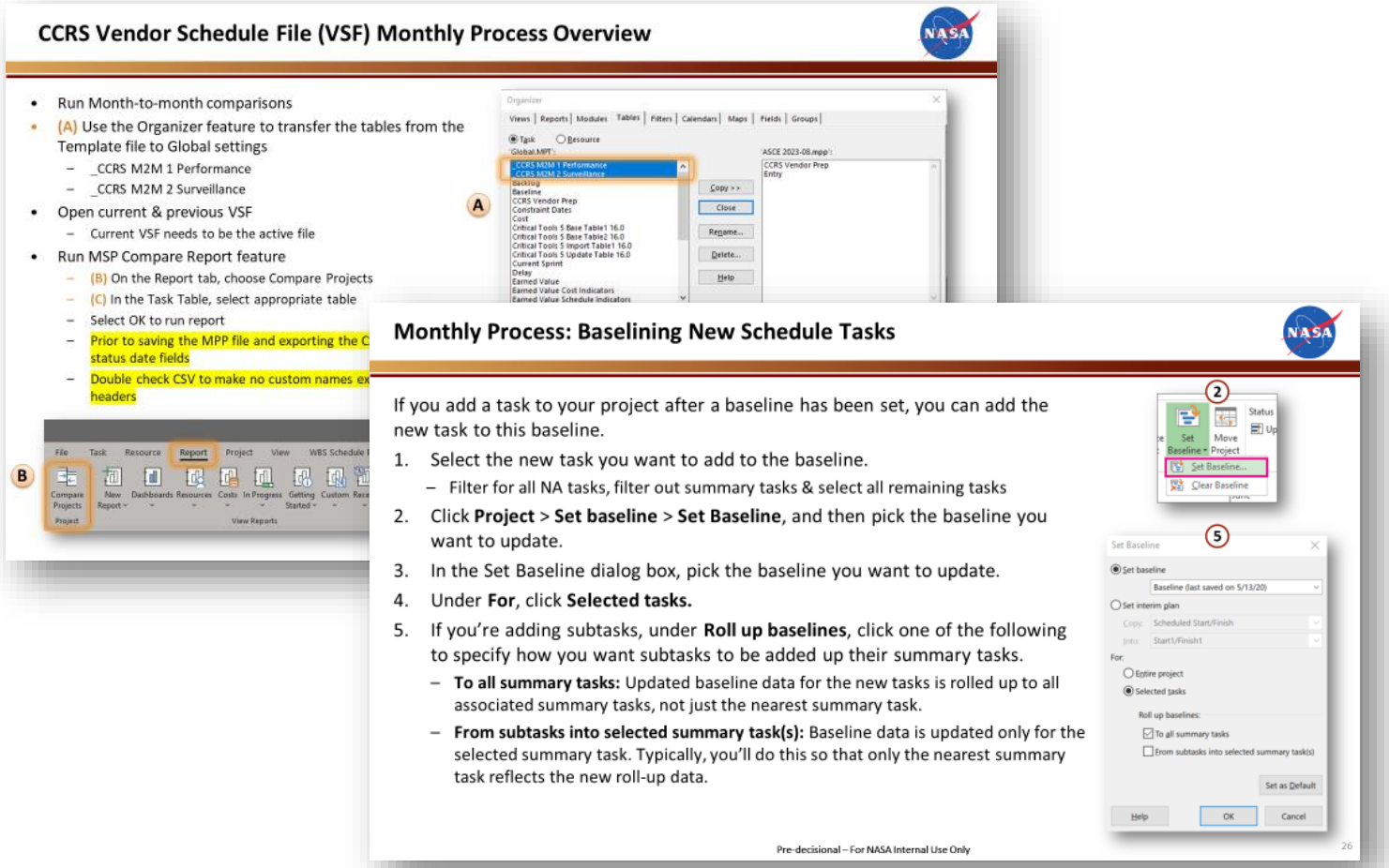
Enhances user experience and capabilities

Increases team productivity and reporting turnaround times

Enables faster onboarding for new schedulers

Schedule Maintenance and Control

Dedicating time to create and frequently review the Schedule User Guide (and Vendor Instruction Sheets) yield efficiencies later in the project and increase quality control



CCRS Vendor Schedule File (VSF) Monthly Process Overview

- Run Month-to-month comparisons
- (A) Use the Organizer feature to transfer the tables from the Template file to Global settings
  - _CCRS M2M 1 Performance
  - _CCRS M2M 2 Surveillance
- Open current & previous VSF
  - Current VSF needs to be the active file
- Run MSP Compare Report feature
  - (B) On the Report tab, choose Compare Projects
  - (C) In the Task Table, select appropriate table
  - Select OK to run report
  - Prior to saving the MPP file and exporting the C status date fields
  - Double check CSV to make no custom names ex headers

Monthly Process: Baselining New Schedule Tasks

If you add a task to your project after a baseline has been set, you can add the new task to this baseline.

1. Select the new task you want to add to the baseline.
   - Filter for all NA tasks, filter out summary tasks & select all remaining tasks
2. Click **Project** > **Set baseline** > **Set Baseline**, and then pick the baseline you want to update.
3. In the Set Baseline dialog box, pick the baseline you want to update.
4. Under **For**, click **Selected tasks.**
5. If you're adding subtasks, under **Roll up baselines**, click one of the following to specify how you want subtasks to be added up their summary tasks.
   - **To all summary tasks:** Updated baseline data for the new tasks is rolled up to all associated summary tasks, not just the nearest summary task.
   - **From subtasks into selected summary task(s):** Baseline data is updated only for the selected summary task. Typically, you'll do this so that only the nearest summary task reflects the new roll-up data.

Pre-decisional – For NASA Internal Use Only

26

Statusing the Schedule in Microsoft Project

Purpose & Benefits:

The purpose of regularly statusing and updating the project schedule with actual progress for activities and milestones accomplished as well as the forecast-to-complete for activities underway is to provide the project team with important schedule information for management control and decision making including schedule performance against the schedule baseline, an accurate critical path, condition of remaining schedule slack and margin, and shifting of key milestones including project completion such as launch or delivery. The primary benefit of statusing and updating the project schedule is to provide an accurate tool for managing the project.

Step 1: Set the Status Date

- Choose **Project** > **Status Date**.
- Select the new status date for the current Period of Performance (PoP).

Step 2: Status Tasks in Current PoP

- The **Task Status** field will indicate all "Late" tasks which need to be statused for the current PoP.
- Following schedule best practices, appropriately adjust task durations or network logic.
- In their most basic terms, the questions to be answered in this step include:
  - On what date did work on the activity start? (**Actual Start**)
  - On what date did work on the activity finish? (**Actual Finish**)
  - How many working days are needed to finish the task after the status date for those activities that have already started? (**Remaining Duration**)
  - For activities that have already started, but have not been completed, on what date is it expected to finish? (**Expected Finish**)

Step 3: Update tasks to scheduled percent complete for a specific date

- In the **Schedule** group, choose **Mark on Track**.
  - Hold CTRL and select each of the tasks in the list that you want to update.
- The Task Status field should now show "Complete" or "On Schedule".

(Bonus) Step 4: Confirm 1mo Lookahead Plan

- Confirming the 1-month (or 1 PoP) lookahead plan will help to ensure a solid forecast plan for the following months' performance measurement metrics.
- Primary focus should be on all finish dates in the next PoP.
- Use Microsoft Project filtering and/or task highlighting or coding in custom fields to aid and expedite the process.

Schedule Maintenance and Control

Create monthly reporting cadence tables

Identify the routine chain of reports

Illustrate how monthly reports travel through the reporting cycle:

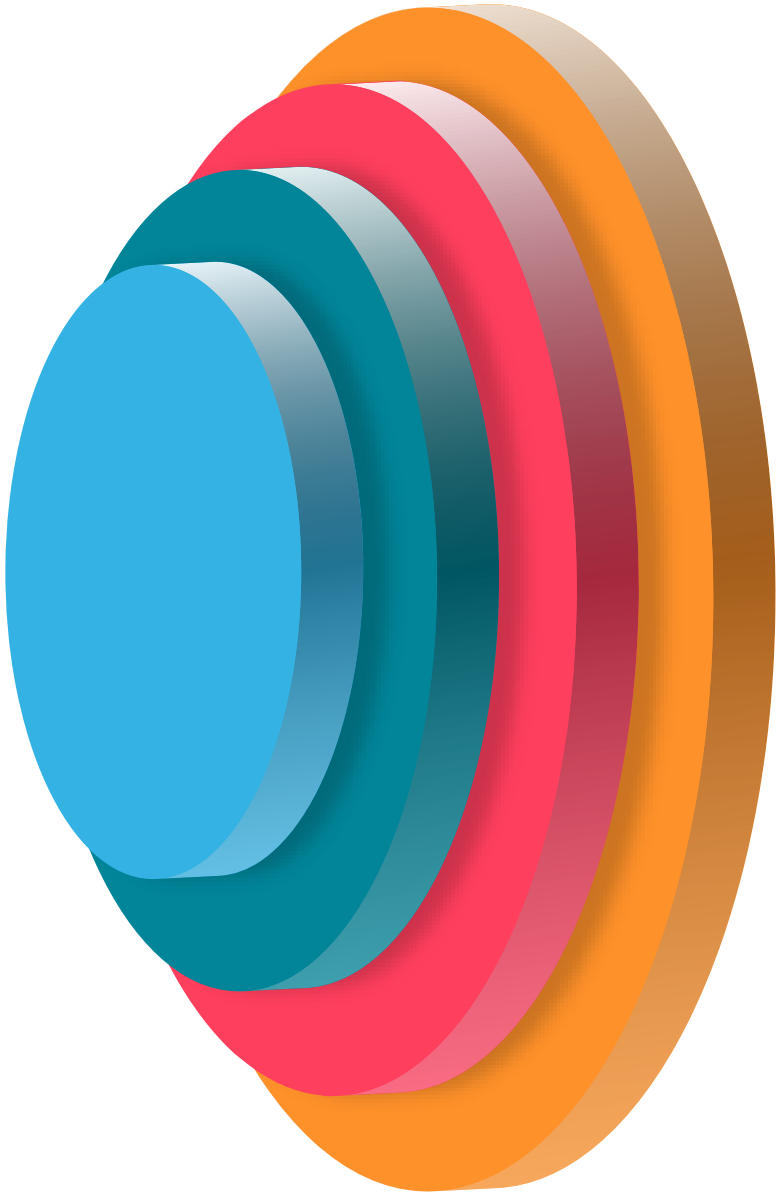
- Identify who the stakeholders are and when they see the data
- Highlight when some data may be stale and possibly needs a refresh

Identify need dates for:

- Identify freeze dates
- External schedule readiness dates

Highlight other significant events:

- Project events
- HQ schedule repository submissions



Schedule Maintenance and Control

Reporting tables establish internal planning timelines and capture the history of the project

Key Programmatic Events	2023 POP IMS	2023 Report	EXT ME SCHD Avail	ME IMS to PGM	PROJ Monthly Review	PROG Monthly Review	Center Monthly Review	HQ Schedule Repository
	ME-Dec (2022)	Jan	✓ 1/13	✓ 1/18	✓ 1/31	✓ 2/7	✓ 2/16	Dec ME file
	ME-Jan	Feb	✓ 2/15	✓ 2/17	✓ 3/2 (CO)	✓ 3/7	✓ 3/16	
Arch Replan	ME-Feb	Mar	✓ 3/15	✓ 3/17	✓ 3/30	✓ 4/12	✓ 4/20	
Arch Replan	ME-Mar	Apr	✓ 4/17	✓ 4/19	✓ 4/27	✓ 5/2	✓ 5/18	Mar ME file
Arch / IMS Replan	ME-Apr	May	✓ 5/16	✓ 5/22	✓ 5/30 (CO)	✓ 6/6	✓ 6/15	
IMS Replan	ME-May	Jun	✓ 6/15	✓ 6/22	✓ 6/29 (CO)	✓ 7/4	✓ 7/20	
IMS Replan	ME-Jun	Jul	✓ 7/17	✓ 7/19	✓ 7/27	✓ 8/1	✓ 8/17	Jun ME file
IMS Replan / PDR 90d	ME-Jul	Aug	✓ 8/15	✓ 8/21	✓ 8/31	✓ 9/6 (CO)	✓ 9/14	
IMS Replan / PDR 60d	ME-Aug	Sep	✓ 9/13	✓ 9/18	✓ 9/28 (CO)	✓ 10/3	✓ 10/19	
	ME-Sep	Oct	✓ 10/16	✓ 10/18	10/26	11/7	11/16	Sep ME file
	ME-Oct	Nov	11/14	11/16	11/28	12/5	Electronic	
PROJ PDR	ME-Nov	Dec	12/14	12/18	12/26	1/2/24		
	ME-Dec	Jan (2024)	1/17/24	1/22/24	1/30/24	2/6/24		Dec ME file

Schedule Maintenance and Control

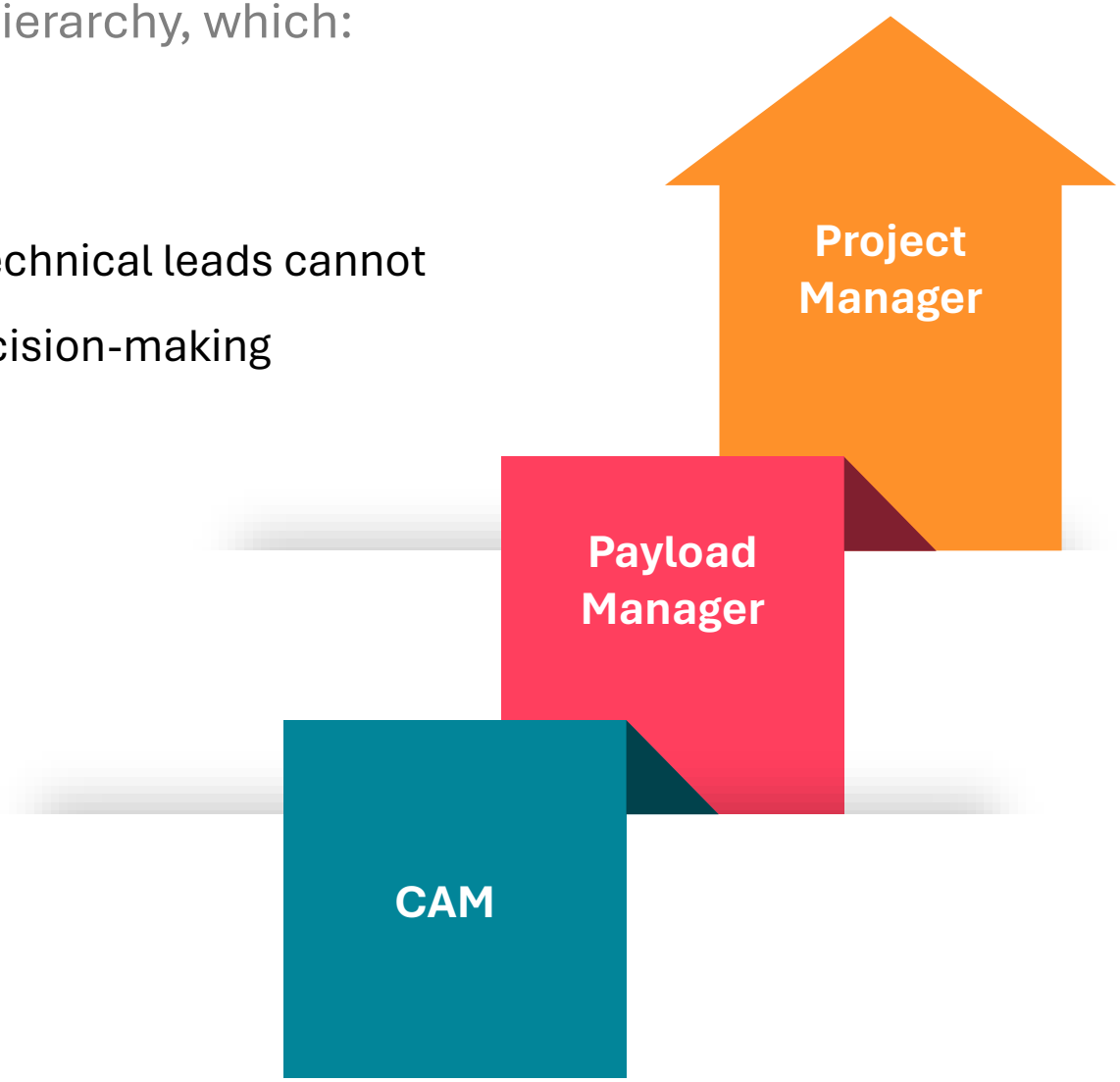
A monthly product cycle highlights what/when stakeholders see data and when updates may be required

	Mon	Tue	Wed	Thu	Fri
Weekly Events	Project, Payload & PP&C Weekly ↓↓↓↓↓↓↓↓↓↓↓	PM Schedule Meeting ↓↓↓↓↓↓↓↓↓↓↓	Weekly Reports ↓↓↓↓↓↓↓↓↓↓↓	Schedule Team Meeting Risk Board (3rd week) ↓↓↓↓↓↓↓↓↓↓↓	↓↓↓↓↓↓↓↓↓↓↓
Week #4		Program Monthly Review			**End of PoP**
Week #1	Start of PoP |<----------	Center Monthly Review ----------	**Collect Month End Schedule Status**	----------	----------\>|
Week #2	|<----------	**Deliver Schedule to Program**	----------\>|	|<----------	**Finish Schedule Book**
Week #3	----------\>|	**Project Monthly Review**		Risk Board	
Week #4		**Program Monthly Review**			End of PoP
Week #1	Start of PoP |<----------	**Center Monthly Review** ----------	Collect Month End Schedule Status	----------	----------\>|
Week #2	|<----------	Deliver Schedule to Program	----------\>|	|<----------	Finish Schedule Book
Week #3	----------\>|	Project Monthly Review		Risk Board	
Week #4		Program Monthly Review			End of PoP

Schedule Maintenance and Control

Establish the schedule status reporting authority hierarchy, which:

- **Provides clarity of roles and responsibilities:**
  - Identifies who provides status when normal technical leads cannot
  - Establishes accountability for actions and decision-making
- **Establishes clear communication channels**
- **Resolves conflicts and provides a framework for escalating concerns**
- **Helps to align individuals/teams with the overall Project goals and objectives**



Schedule Maintenance and Control

Maintain a Schedule Action Item List (SAIL):

A communication tool between the scope owners, management, and the schedule team

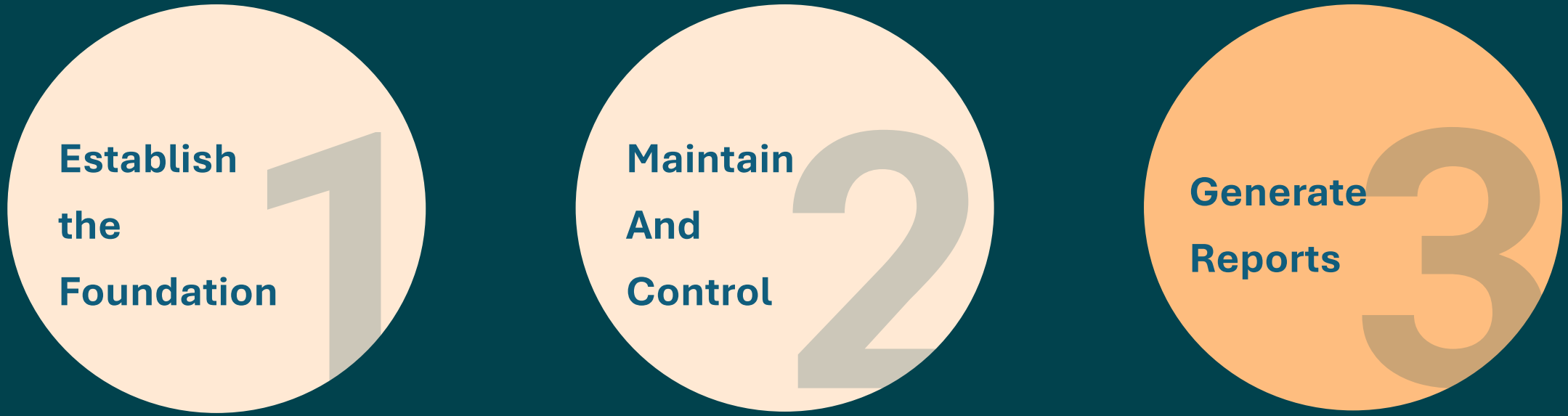
Owned by the scheduling team and made available to the entire Project

Informal identification and closure of open work

SBS Area	SAIL#	Rank	Category	Action Item	Comments	Status	Open Date	Close Date
PM	5	x	SCHD Dev	Confirm Road to PDR Plan		Closed	MAY 2023	JUN 2023
SE	6	X	SCHD Dev	Confirm Road to PDR Plan		Closed	MAY 2023	JUN 2023
MECH	7	1	SCHD Dev	Add second non-FLT structure	08/2023: included initial version, working disconnects	Open	JUN 2023	
THRM	8	2	SCHD M&C	Update w/new vendor schedule	08/2023: waiting for vendor to make additional updates	Open	JUN 2023	
ELEC	9	3	SCHD M&C	Update for card descope	08/2023: done, needs final confirmation	Open	JUN 2023	
I&T	10	X	SCHD Dev	Confirm updated receivables list	08/2023: in progress	Open	JUL 2023	

Reporting

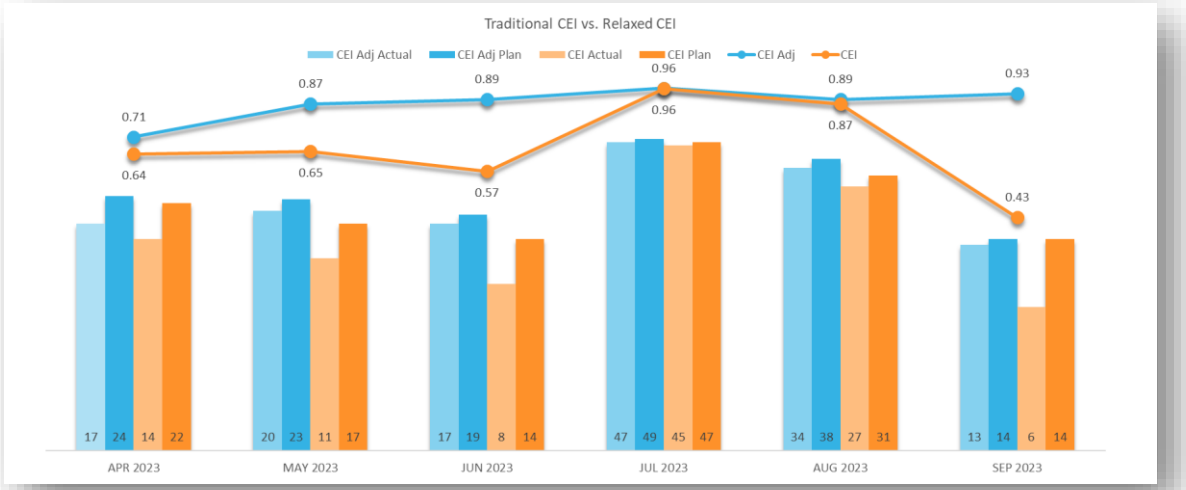
Once the schedule is ready, the focus is placed on generating reports

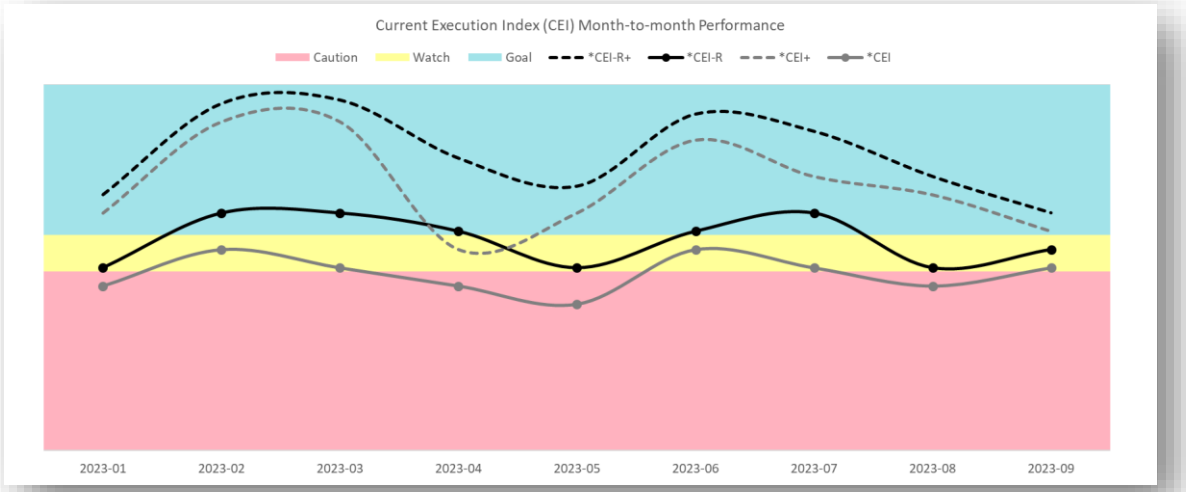


Reporting

Evaluate variations and/or alternatives

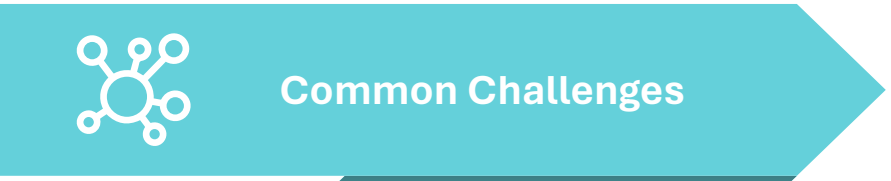
- **Focus on why elements are not performing as well, don't limit reports to reasons for variances**
- **Add supplemental data points to reports:**
  - Examples: finish date slip rate and failed task repeat count
  - Helps reduce calculation bias since all tasks may be equally weighted
- **Adjust calculation parameters to accept substandard quality schedules:**
  - Provides an alternative perspective and flexibility when it's needed
  - Fact: not all schedules are perfect, but we can't afford to disregard them while we wait





Reporting

Produce a single dashboard chart

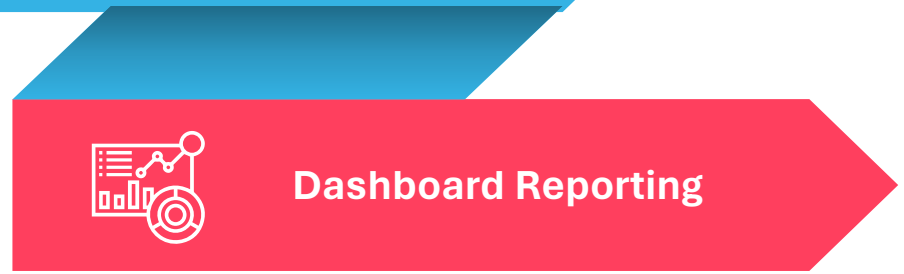


Addressing a common challenge – reporting scope creep:

- Monthly reporting packages easily increase in size throughout the project life cycle
- New requests are made, stale charts are moved to backup, and often not enough time is dedicated to monthly reviews to discuss all provided material

This effort is answered by two questions:

- If the chart is created, will it be used/discussed correctly?
- How can we consolidate two or more charts into a single chart?



Provide consolidated visual representations of multiple data sets:

- Use Key Performance Indicators (KPIs) to quickly and easily interpret and understand information
- Trend/correlate data to quickly make informed decisions across all levels of an organization based on evidence rather than intuition or guesswork

Reporting

An example of dashboard reporting for CEI/M2M Missed Task Variance Explanation

SBS L1	APR 2023	MAY 2023	JUN 2023	JUL 2023	AUG 2023	SEP 2023	Total
CEI Actual Count	19	15	30	20	25	41	150
CEI Fail Count	20	14	7	7	22	44	114
CEI Plan Count	39	29	37	27	47	85	264
CEI	0.49	0.52	0.81	0.74	0.53	0.48	0.57
AVG SR of Fails	1.65	1.11	0.84	1.12	1.23	1.11	1.18
BEI	---	---	---	---	---	---	---
SPI	---	---	---	---	---	---	---

SBS L2	Actual	Fail	Plan	CEI	(Actual+)	(CEI+)	AVG SR of Fails
CLM	25	20	45	0.56	1	0.58	0.51
CC	0	2	2	0.00	0	0.00	0.90
CSE	2	6	8	0.25	0	0.25	1.46
LTM	2	7	9	0.22	0	0.22	1.20
NRE	3	2	5	0.60	0	0.60	1.52
OM/LTM	0	5	5	0.00	0	0.00	2.34
GSE	9	2	11	0.82	0	0.82	2.52
Total	**41**	**44**	**85**	**0.48**	**1**	**0.49**	**1.11**

DCC Category	%
N/A CLM	45
Staffing/Workforce	11
Paperwork	9
Priority (controlled)	7
Supply Chain D/NR	7
Tech Challenge	7

DCC Category	%
Vendor NCR	5
General Inefficiency	2
Priority (uncontrolled)	2
Scope Growth	2
Sys Req/Uncertainties	2

PUID	S/S CP	# CEI Fails	Task Name	Previous Finish	Current Finish	Total Slack	Finish Date Slip Rate (SR)	Delay Cause Code	Notes
CLM-2538		3	Potentiometers (Betatronix)	9/11/2023	10/20/2023	10	1.00		07/19/2023: Updated with new delivery date from Vendor....
CLM-2609		3	Potentiometer - Leads	10/2/2023	10/26/2023	5	0.63		
GSFC-31825		3	FMS Calibration - Test Data Processing	9/13/2023	10/30/2023	1219	1.57	Staffing/Workforce	10/11/23: Resource limitation, de-prioritized for other more critical activities...
GSFC-31889		2	C&C HDRM - Paperwork (Create SOW / DILs / Sole Source Justification)	9/1/2023	10/31/2023	150	1.95	Paperwork	10/12/23: exp to complete late Oct. SOW Completed but still working approvals from CCB members...
GSFC-31900		2	EDU GoT - Testbed assembly drawing (frame and cone coupons)	9/25/2023	11/22/2023	114	1.95	Staffing/Workforce	10/11/23: re-prioritized due to staffing changes...
GSFC-32020		2	Sensors ETU - Assemble LED Subassembly (Incl Bonding)	9/20/2023	10/27/2023	93	1.29	Tech Challenge	10/16/23: bonding issues, extend to late Oct...
GSFC-7390	CSE	2	Sensors ETU - Fab Sensor Array Bracket (Generative Design Parts)	9/18/2023	11/20/2023	80	2.10	Vendor NCR	10/16/23: now likely delayed to mid-Nov due to continuing vendor quality challenges. ...
CLM-2746	CLM	1	Order TVAC Stand Material	10/2/2023	10/17/2023	0	0.40		
GSFC-35279	CSE	1	Sensors ETU - Sensor Array Bracket Post/Receiving Metrology	9/21/2023	11/27/2023	80	2.14	Vendor NCR	
CLM-2554		1	Bushings	10/2/2023	10/17/2023	7	0.40		JW 08/09/2023: Reached out to vendor on 7/19, and again 8/9/23. Past due on promised delivery date. Will continue checking in. ...
CLM-2563		1	Coating	10/4/2023	10/26/2023	184	0.57		

Conclusion

Improve your Project's potential for success by implementing enhanced schedule maintenance and control measures

- A solid schedule management foundation provides insightful reporting data through simple, deliberate, and consistent Integrated Master Schedule (IMS) coding.
- An initial investment early in the Project life cycle to focus on establishing these best practices will return their results during later Project phases when free time may be less available.
- Effective schedule maintenance and control plays a crucial role in enhancing project outcomes by ensuring that timelines are adhered to, resources are optimized, and potential risks are proactively managed.
- The results are an improved quality IMS, clear monthly procedures, valuable data sets, and alternative data points to correlate, all of which culminate into valuable reports that can be analyzed and discussed more efficiently.