NATIONAL RECONNAISSANCE OFFICE

Schedule Execution Metrics 2.0 (SEM)

A study of integrated master schedule data from the NRO EVM Central Repository for indicators of program stability, execution of the baseline, and early warning of schedule delay in the completion of major milestones

April 2024

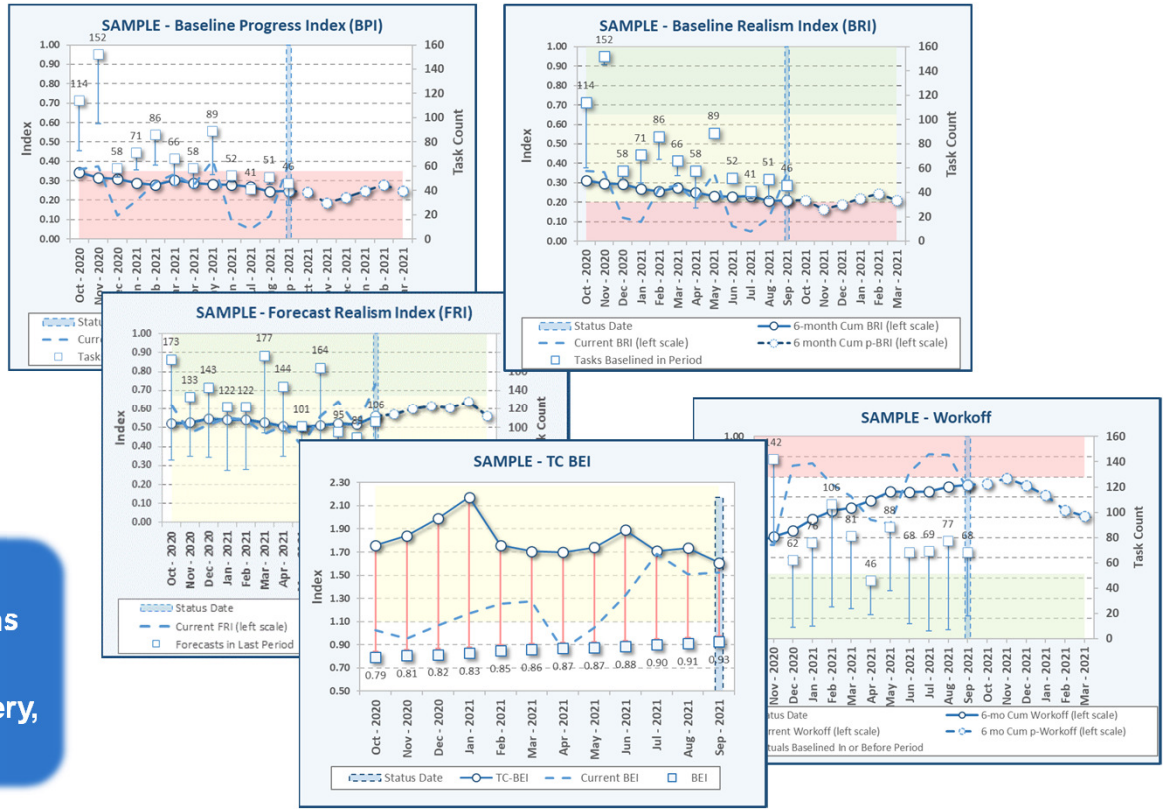
ABOVE AND BEYOND

Schedule Execution Metrics (SEM)

- SEM is a collection of predictive schedule metrics based on data-driven benchmarks using data science methods and statistics. These metrics were developed through an iterative process in conjunction with the Naval Post Graduate School (NPS)
  - 2018-2019: SEM defined at the NRO and tools developed to ensure consistency
  - 2019: Pilot study to establish prelim SEM thresholds
  - 2021: NPS capstone project – data visualization improvements
  - 2023: CAAG developed and deployed SEM 2.0 tool
- Schedule Execution Metrics are a breakthrough in schedule analysis at NRO
  - Shifts the focus from schedule health to schedule execution
  - Provides objective measures to program managers for schedule performance trends and realistic schedule forecasts
- SEM Use
  - Independent Schedule Assessment
  - Program Management Business Rhythm
  - Custom Dashboards

Applying the Study Results, NRO Uses These Benchmarked Schedule Execution Metrics to Analyze Contract Schedule Performance

SAMPLE Schedule Execution Metrics (SEM)					
Dashboard	10/1/2021			Trip Wire	Red
SEM	Metric Value	Reporting Cycle	Green Threshold	Yellow Threshold	Red Threshold
BRI	0.35	current period			
	0.21	6-month cumulative	> 0.65	<= 0.65	<= 0.20
BRI Trend	0.00	BRI 6 month rate of change		< 0.0	< -0.05
BPI	0.39	current period			
	0.25	6-month cumulative			<= 0.35
FRI	0.74	current period			
	0.56	6-month cumulative	>= 0.67	< 0.67	
Workoff	0.74	current period			
	0.76	6-month cumulative	<= 0.32		>= 0.80
TC_BEI	1.61	cumulative		> 1.10	
Delta TC-BEI	-0.68	cumulative			< -0.05



- Predictive analysis to identify when a schedule may be delayed, 6-12 months in advance of the schedule slip
- Early warning to allow time for recovery, trade-off, and acquisition decisions

Color bands in the graphs are data driven thresholds developed using historical NRO data

Metric Definitions

Metric	Definition	Analytic Value	Range
Workoff 6-month moving average	Workoff counts the number of finishes that are more than 30 calendar days late in a period, compared to the total number of finishes in that same period.	How much of the work being done is "catch-up"?	Lower is better Theoretical Bounds: 0.00 to 1.00 Dataset: 0.00 to 0.94
Workoff Trend	Linear trend representing 6-month increment of Workoff	Is the program catching up or falling further behind?	Negative is better Dataset: -0.63 to 0.24
BRI 6-month moving average	Baseline Realism Index BRI identifies how many tasks have been executed to plan, either within a single period or cumulatively. Of the specific tasks planned for the period, only counts tasks completed on time.	Is the contractor executing the plan?	Higher is better Theoretical Bounds: 0.00 to 1.00 Dataset 0.00 to 1.00
BRI Trend	Linear trend representing 6-month increment of BRI	Is performance falling off of the plan, or getting back on plan?	Positive is better Dataset: -0.24 to 0.42
BRI cum	Cumulative Baseline Realism Index Percentage of planned events that actually finished since the beginning of the program. This is an indicator of how well the contractor is following the plan.	Cumulatively, is the program on plan?	Higher is better Dataset: 0.34 to 1.00
BPI 6-month moving average	Baseline Progress Index The Baseline Progress Index (BPI) is the percentage of planned tasks that actually finished in or before the planning period. It is similar to BRI, but allows early completions to be counted even for the current period.	Is the contractor keeping up with planned work?	Higher is better Theoretical Bounds: 0.00 to 1.00 Dataset: 0.00 – 1.00
BPI Trend	Linear trend representing 6-month increment of BPI	Is the program falling behind or catching up?	Positive is better Dataset: -0.20 to 0.47
FRI 6-month moving average	Forecast Realism Index Percentage of forecasted events that actually finished in the forecast period. This is an indicator of how well the contractor is accomplishing the forecast for the period.	Can the contractor achieve last month's forecasted finishes?	Higher is better Theoretical Bounds: 0.00 to 1.00 Dataset: 0.21 to 0.96
FRI Trend	Linear trend representing 6-month increment	Is forecast execution getting better or worse?	Positive is better Dataset: -0.18 to 0.20

Metric Definitions Continued

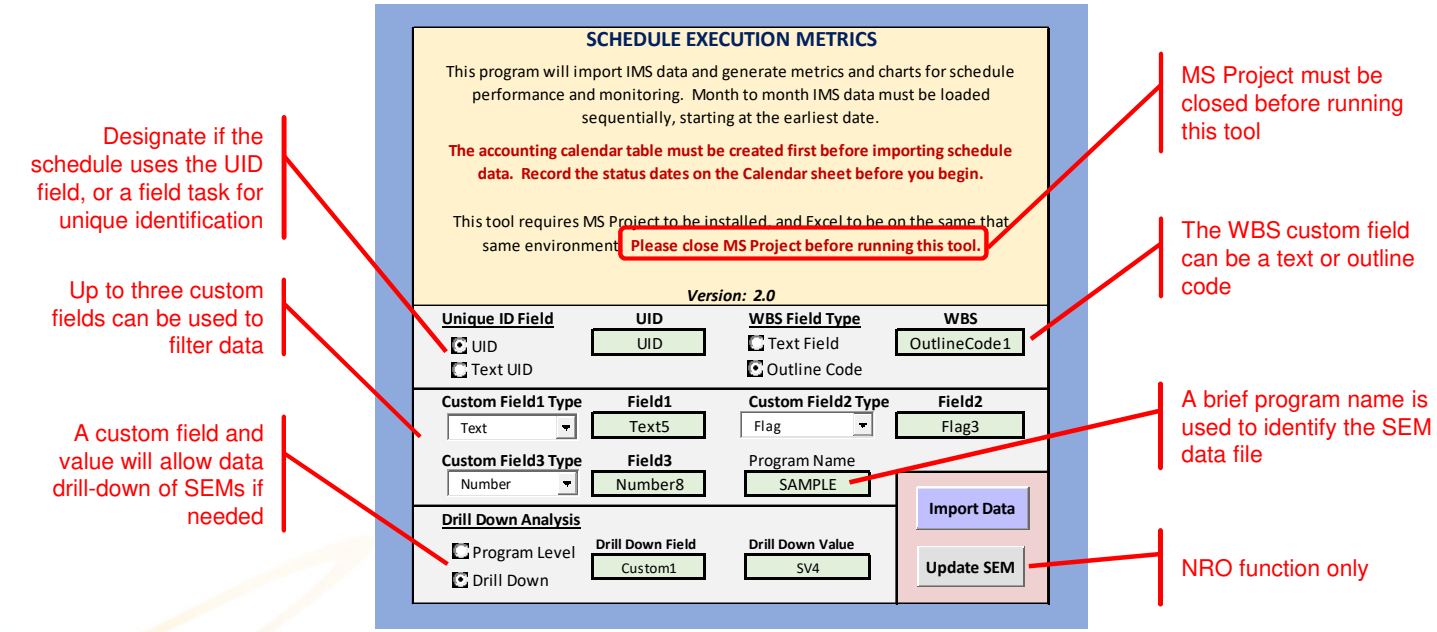
Metric	Definition	Analytic Value	Range
BEI cum	Cumulative Baseline Execution Index Percentage of total events that actually finished in the planning period. This is an indicator of the contractor's pace of work	Pace of work to date	Higher is better <1.0 indicates falling behind =1.0 indicates on plan >1.0 indicates catch-up Dataset: 0.66 to 46.41
TC-BEI	To-Complete Baseline Execution Index Number of all Remaining finishes divided by number of remaining baseline finishes	Provides insight into how many more activities are left versus what was planned Can identify compression of significant activity in the remaining time	Above 1.00 indicates potential performance risk <1.0 indicates fewer than planned =1.0 indicates on plan >1.0 indicates more than planned Dataset: 0.00 to 2.02
Delta (BEI vs TC-BEI)	Change in efficiency needed to achieve the forecast	Assess whether the forecast is realistic based on pace of work to date	> 0.00 indicates potential performance risk > 0 indicates more efficiency in future than in past (potentially unachievable forecast) Dataset: -1.35 to 46.25

SEM 2.0 Tool Introduction

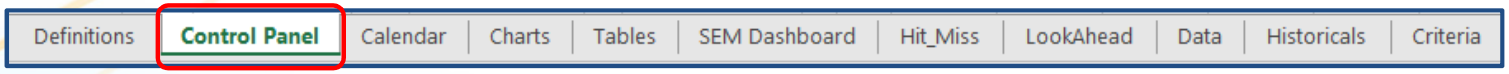
- The SEM tool is Excel based
  - It will collect data from an Integrated Master Schedule (IMS) in MS Project
  - Must have MS Project installed on the environment from which SEM is run in Excel
  - Project file size is limited to a total of 50,000 lines (including subprojects)
- The SEM control panel only needs to be set up one time
  - Subsequent reporting periods are run from the last reporting period SEM file
  - The SEM template Control Panel is only used once to setup the customer fields used in the IMS
  - Each program must have a unique SEM file setup (including any drill-down custom categories e.g. CAM, WBS element, IPT, etc.
- A unique SEM file is created for each reporting month
  - This creates an automatic archiving file system for past reporting months
  - Historical SEM metrics are accumulated in each SEM file

SEM 2.0 Control Panel

- The Control Panel is the starting point for the first-time creation of SEM from the template or to update an older SEM tool
- The Control Panel will be deleted after the first run of the SEM tool, and setup values are stored in the tool



SEM Tool Excel Sheets



SEM Workflow – First Run Only

1) Setup the financial calendar (enter financial reporting dates)

   [*Calendar sheet*]

2) Fill in WBS, program name, custom fields (optional), and a drill-down value (optional) on the Control Panel

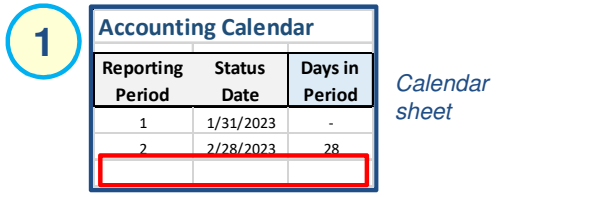
   ✓ Press the *Import Data* button

   [*Control Panel sheet*]

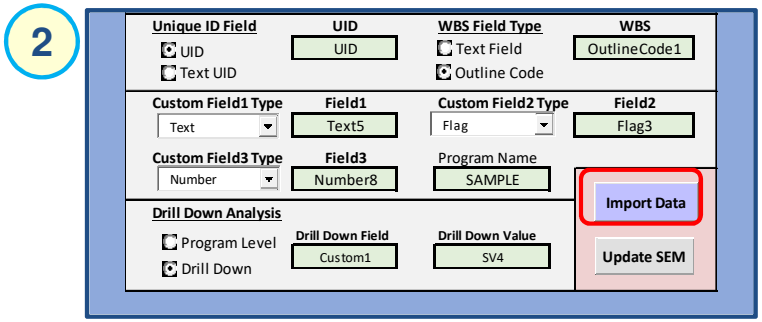
3) Export SEM charts to PowerPoint to build your schedule briefing

   1) Press the *Export Charts* button

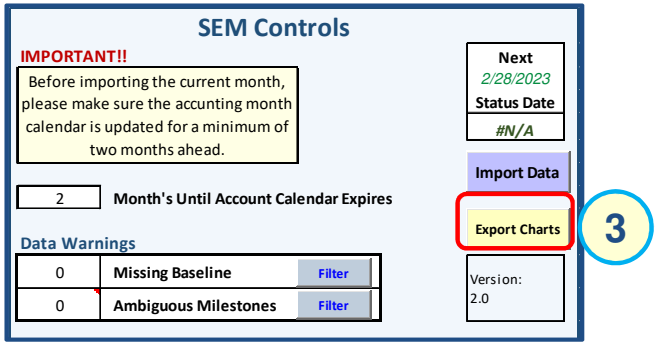
   [*Charts sheet*]



Calendar sheet



Charts sheet



SEM Workflow – Monthly Updates

1) Maintain the dates for each subsequent reporting cycle on the Calendar sheet before importing a new reporting month

   [*Calendar sheet*]

2) When the schedule is available for each reporting month, import the schedule data

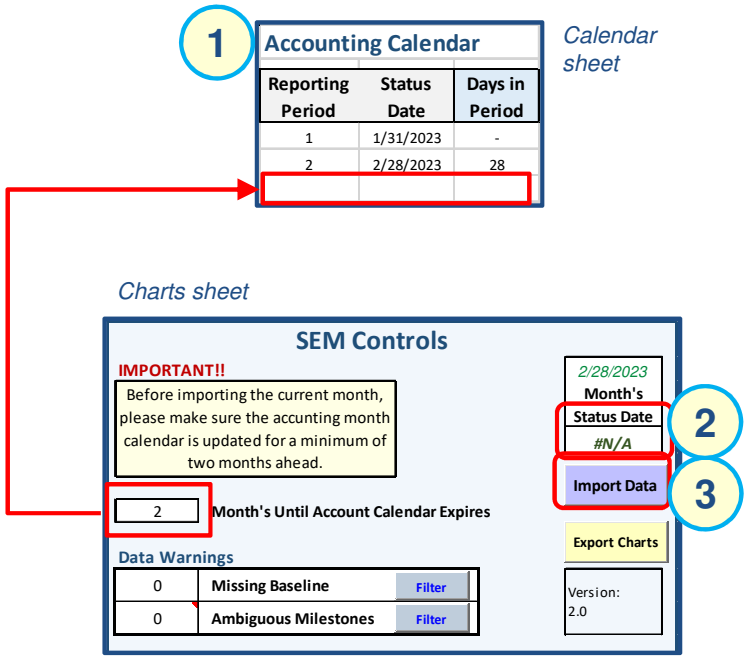
   ✓ Press the *Import Data* button

   [*Charts sheet*]

3) Export SEM charts to PowerPoint to build your schedule briefing

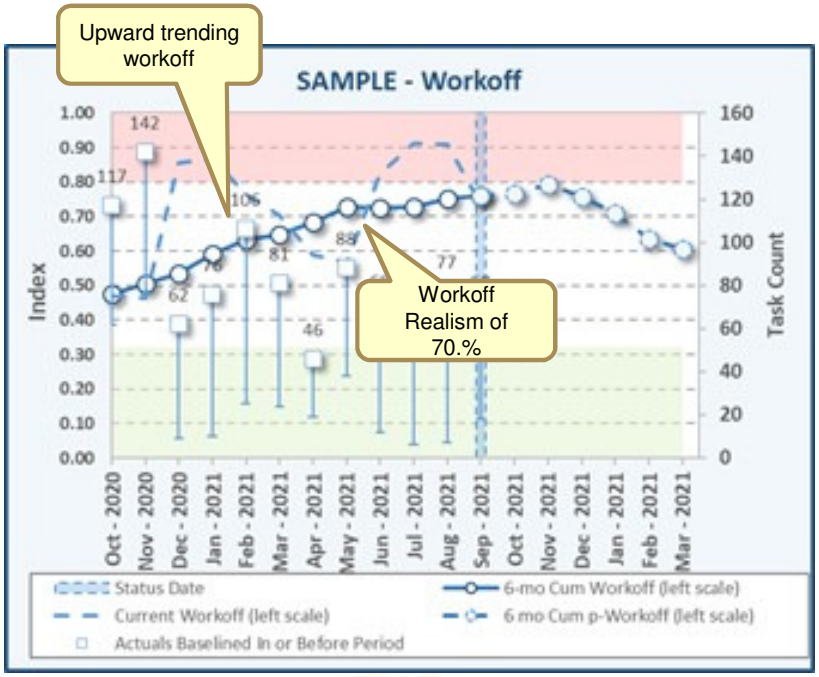
   1) Press the *Export Charts* button

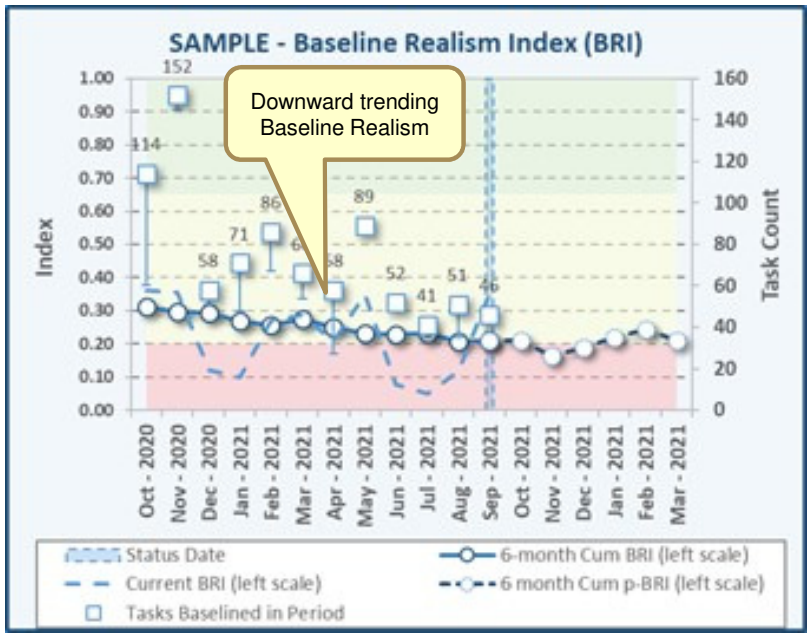
   [*Charts sheet*]



1 Reminder: The tool requires at least the *NEXT* month's reporting date to be entered on the Calendar sheet. You may enter as many future reporting dates as you wish.

SEM Example: *objective, performance driven independent schedule assessment*



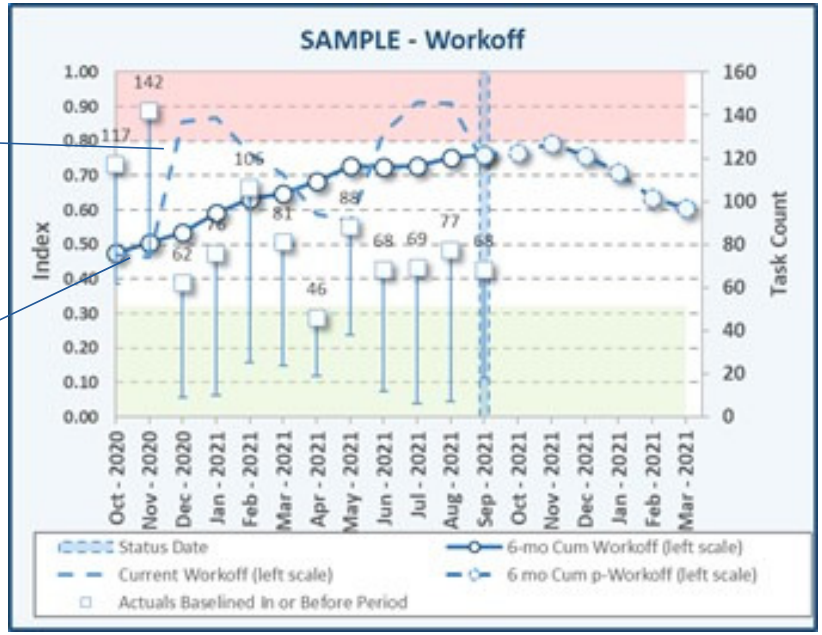


SEM quantifies schedule performance and supports acquisition decisions

SEM Example: Schedule Workoff Forecast *supporting Program Management*

The dotted line shows the % of tasks forecast to be more than 30 days late for the current month.

The dotted line shows the % of tasks forecast to be more than 30 days late for the 6 month cum



Interpretation and Next Steps: Are there resources available to complete the months already planned tasks plus the % of tasks from previous months. Is there a plan to catch up? Has the ETC been updated to reflect tasks finishing later?

Additional analysis can identify tasks that keep slipping, float of late activities, and margin to recover schedule

How To Apply SEM Going Forward?

- Shifting focus from schedule data quality and compliance to schedule performance
- Providing objective measures to program managers for schedule performance trends and realistic schedule forecasts
- Strengthens program office capabilities, independent schedule assessments and portfolio dashboards by providing data-driven benchmarks and thresholds for decision makers
- Early warning of schedule growth creates decision-window for timely course corrections

SEM enables data-driven predictive analysis and early warning indicators of schedule performance problems, potential schedule slips, or impending schedule re-plans

SEM 2.0 Tool Availability

- SEM 2.0 is available for dissemination, please email us at BPO-CAAG-ECE@nro.mil