National Aeronautics and Space Administration

Why EVMS Surveillance Matters

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Agenda

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What is EVMS Surveillance?

- The continuous process of reviewing the health of the EVM System (EVMS) to ensure:
  - The EVMS is effectively used to manage cost, schedule, and technical performance
  - The performance data generated is accurate and reliable
  - Key elements of the system are repeatable on subsequent applications

History of EVMS Surveillance at NASA

November 2012

GAO Audit: EVM Implementation across Major Spaceflight Projects is Uneven.

Recommendation: Modify the NPR 7120.5 to require projects to implement a formal surveillance program

July 2017

EVM Surveillance Recommendation re-opened and identified as Priority

December 2018

APMC Approves CAP to Include "Enhance EVM Implementation

October 2019

NASA-led EVMS surveillance begins at APL, JPL and SwRI

October 2020

NASA-led EVMS surveillance begins on NASA Centers – Orion, SLS and PACE

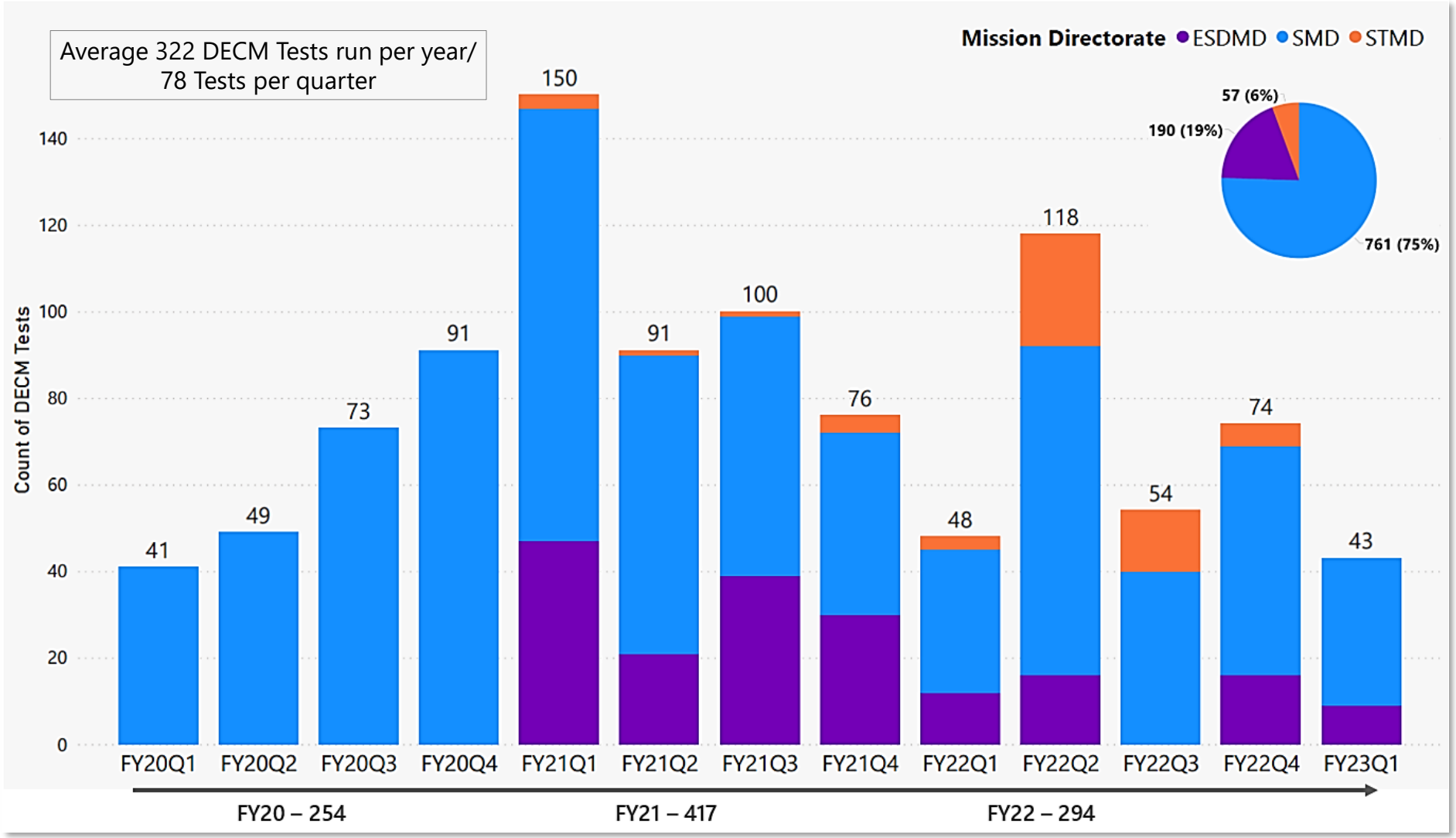
February 2022

GAO formally closes audit recommendation

EVMS Surveillance Summary

Surveillance Stats*

- 1,008 Tests run over 13 quarters
- ~61 Surveillance Events
- 16 Projects



Surveillance Results through FY23Q1

Estimate at Completion (EAC) Realism

Count of Outcome Unique Test Metric ID	Test Definition	Outcome NoOOT	OOT	Watch Item	Grand Total
27A101a	Are comprehensive EACs completed at least annually?	5			5
27A101b	Are comprehensive EACs performed according to the standards described in the EVM system description?	3		1	4
27A102a	Are time-phased estimates to complete aligned with the remaining tasks in the integrated master schedule?	6	3	6	15
27A103a	Do EACs exist at the control account level?	10	3		13
27A104b	Are ETCs generated for completed WPs?	3	4		7
27A105a	Is ACWPCUM greater than EAC?	4	4	6	14
27A106a	Do EACs consider performance to date?	1	7	6	14
27A401a	Is the program EAC substantiated from the risk and opportunity management process and/or the PM's assessment?	1		1	2
27I101a	Are ETCs generated for WPs/PPs/SLPPs?	6	4		10
27I201a	Are EACs reviewed and updated as needed for UB and SLPPs?	3	2		5
Grand Total		42	27	20	89
		47%	30%	22%	

- **Testing Statistics:** 108 tests run for *GL 27: Maintain EAC** since FY20Q1.
- **Why it Matters:** EVM is a leading indicator when performance to date is considered in the EAC. A realistic EAC is needed to ensure NASA's ability to provide sufficient funding and enhance internal management's visibility into critical issues for informed decision making and corrective action. It reduces the element of surprise, an unwelcome guest in project management.
- **Evidence:** EVMS Surveillance SME's found OOT or Watch Items on eight (8) NASA projects across multiple Center/Suppliers. These projects showed little or no evidence of calculating an independent EAC to determine if the EAC is realistic.

* *NDIA Earned Value Management Systems Intent Guide to the EIA Standard for EVMS (EIA-748)*

Estimate at Completion (EAC) Realism

Example:

Budget at Completion (BAC)	=	$400
Budgeted Cost of Work Performed (BCWP)	=	$320
Estimate At Completion (EAC)	=	$410
Actual Cost of Work Performed (ACWP)	=	$356

Work Remaining				
BAC		BCWP		
$400	-	$320	=	$80
Cost Remaining				
EAC		ACWP		
$410	-	$356	=	$54

Work Remaining		Cost Remaining		TCPI *To Complete Performance Index*
$80	/	$54	=	1.48

The project must perform at **1.48** of the originally planned performance in order to maintain (or achieve) the EAC goal of $410.

TCPI should be compared to the CPI to gauge the realism of the Estimate at Completion (EAC). CPI in this example case is **0.90**.

BCWP		ACWP		CPI *Cost Performance Index*
$320	/	$356	=	0.90

This means that efficiency must significantly improve to meet the EAC of $410.

This effort is 80% complete and 89% spent. 20% of the work remains to be performed.

BCWP		BAC		% Complete
$320	/	$400	=	80%
ACWP		BAC		% Spent
$356	/	$400	=	89%

Is this realistic??

VAR Quality

Count of Outcome		Outcome			
Test Metric ID	Test Definition	NoOOT	OOT	Watch Item	Grand Total
23A101a	Are required VARs being generated for control accounts and SLPPs that exceed established internal thresholds?	6			6
23A201a	Are Rate & Volume (Labor) and Price & Usage (Material) Variance formulas correctly applied at the control account level?			1	1
23A301a	Does the Schedule Variance (SV) analysis include documented impact to future tasks/activities on the critical path, near-critical paths, or driving paths?	5	1	2	8
23A401a	Do the root cause analysis, impact and corrective action address the variance/issue?	7			7
Grand Total		18	1	3	22
		82%	5%	14%	

- **Testing Statistics:** 29 tests run for *GL 23: Analyze Significant Variances* since FY20Q1.
- **Why it Matters:** The quality of the VARs is an indicator of how well the EVMS is performing and supporting informed decision making and corrective action. The ability to analyze deviations from the PMB allows stakeholders to implement corrective actions quickly and effectively. Without the visibility into and the understanding of deviations, success of the program/project is at risk.
- **Evidence:** EVMS Surveillance SME's found OOT or Watch Items on three (3) NASA projects across multiple Center/Suppliers. These projects do not consistently address root cause analysis, impacts to the critical path, or corrective actions that address the root cause.

Problem Analysis

- Separate Analysis of Schedule Variance and Cost Variance (both current & cumulative)
- Clear & Concise Root Cause
- Cost Element Analysis that includes:
  - Labor (rate and volume) analysis
  - Material (price and usage) analysis
  - Subcontracts – schedule and/or requirements changes
  - Other Direct Costs – in-house vendor, travel

Impacts

- Cost, Schedule, & Technical impacts that tie back to the root cause
- Addresses impacts to the following:
  - Downstream tasks
  - Critical path and/or driving paths
  - Risk mitigation tasks
  - Other control accounts or P-CAMs
  - Major milestones or delivery dates
  - Schedule margin

Corrective Action

- Corrective action to resolve each root cause
- Describes specific actions taken or to be taken to alleviate or minimize the impact of the problem
- Responsible individual or organization
- Estimated Completion Date (ECD)
- Status or results of correction actions from previous VARs
- If no corrective action is possible, then clearly explain why

Key Elements of Variance Analysis

Cost-Schedule Integration

Count of Outcome		Outcome			
Test Metric ID	Test Definition	NoOOT	OOT	Watch Item	Grand Total
03A101a	Do baseline dates align between the work authorization documentation (WAD) and IMS? (count)	5	6	1	12
03A101c	Does BAC (hours or dollars) within the EV cost tool reconcile to the work authorization documentation (WAD)? (count)	4	5	1	10
03A101e	Does discrete WP EV percent complete align between the IMS and EV cost tool?	2	7	2	11
03A101f	Do the baseline dates in the IMS align with the dates in the EV Cost Tool?	1	7	4	12
03A101g	Do the CA baseline dates align between the WAD and the EV cost tool?	8	2	1	11
03A101h	Does the OBS align between the IMS and EV Cost Tool?	7	2		9
03A101i	Does the WBS align between the IMS and EV cost tool?	9			9
03A102a	Do the subcontractor/supplier EVM data elements reconcile to the prime EV Cost Tool?	4	1	1	6
03A103a	Do the forecast start and finish dates in the subcontractor/supplier IMS reconcile to the prime IMS?	3			3
03A103b	Do the baseline start and finish dates in the subcontractor/supplier IMS reconcile to the prime IMS?	2	1		3
Grand Total		45	31	10	86
		52%	36%	12%	

- **Testing Statistics:** 112 tests run for *GL 3: Integrate Processes* since FY20Q1.
- **Why it Matters:** The period of performance for piece of work in the schedule must align with the period for the budget or the project has work planned but no budget and vice versa. Can not measure performance without a plan. Integrated management systems helps ensure that reliable program information is available to support management insight and control.
- **Evidence:** EVMS Surveillance SME's found OOT or Watch Items on nine (9) NASA projects across multiple Center/Suppliers. These projects do not adequately establish checks for alignment of EV Cost Tool resources and performance to the IMS when establishing the PMB. In addition, these projects lack the simple mapping methods to ensure the planning, scheduling, budgeting, work authorization, and cost accumulation processes are integrated.

Cost-Schedule Integration

DCMA Sample Data DEC 20 WBS Dollars [0 : DCMA]
EVMS / IMS Integration

WBS	WBS	PCT CMP	IMS BL START	FIRST BCWS	IMS BL FINISH	LAST BCWS
1A1	WP	75	11/29/2019	11/1/2019 11/30/2019	11/29/2019	11/1/2019 11/30/2019
1A2	WP	50	5/1/2019	11/1/2019 11/30/2019	6/28/2019	12/1/2019 12/31/2019
1A4	WP	0	5/1/2019	10/1/2019 10/31/2019	11/28/2019	4/1/2020 4/30/2020
1B2	WP	0	12/3/2019	12/1/2019 12/31/2019	1/31/2020	1/1/2020 1/31/2020
1C3	WP	4.17	5/1/2019	11/1/2019 11/30/2019	7/31/2019	1/1/2020 1/31/2020
1D1	PP	2.1	2/3/2020	2/1/2020 2/29/2020	4/30/2020	4/1/2020 4/30/2020
1D2	PP	0	11/1/2019	11/1/2019 11/30/2019	12/31/2019	5/1/2020 5/31/2020
2A2	WP	0	1/1/2020	1/1/2020 1/31/2020	2/28/2020	2/1/2020 2/29/2020
2A3	WP	33.33	7/31/2019	7/1/2019 7/31/2019	12/31/2019	4/1/2020 4/30/2020
2A4	WP	0	4/1/2020	4/1/2020 4/30/2020	5/29/2020	5/1/2020 5/31/2020
2C1	PP	0	3/31/2020	1/1/2020 1/31/2020	3/31/2020	3/1/2020 3/31/2020
3C2	WP	5.83	12/3/2019	12/1/2019 12/31/2019	2/28/2020	4/1/2020 4/30/2020
4D3	PP	0	3/2/2020	3/1/2020 3/31/2020	4/30/2020	4/1/2020 4/30/2020
5B1	WP	65.38	5/1/2019	5/1/2019 5/31/2019	12/31/2019	2/1/2020 2/29/2020

Proper EVMS integration should occur in the implementation stage of the project

Surveillance testing can identify clear cost-schedule integration issues

- Baseline dates in IMS do not align with EV Cost data

Lack of cost/schedule integration leads to inaccurate resource management, product coordination and results in inaccurate performance reporting

Conclusion

- Surveillance ensures the EVMS provides timely, accurate, and reliable integrated project management information for internal and customer use
  - Encourages a culture of continuous process improvement for EVM systems processes
  - Enhancing project performance management by identifying project controls weaknesses

Questions?