

# Essential Views of the Integrated Program Management Reports

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& TRAINING WORKSHOP

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ICEAA

# Agenda

- Background
- Twenty-five metrics are proposed
- Twelve are demonstrated with asserted value to the government PM
- Audience feedback

# Background

- When contractually required, DoD acquisition contractors are obligated to submit IPMRs electronically per Data Item Description DI-MGMT-81861.
- Government stakeholders must acquire “reader/viewers” of the data to understand status and help control.
- Several vendors provide multiple metrics/views of these data:
  - Some data more useful than others.
  - Different users have different interests.
- Easy for the government PM to be overwhelmed"
  - Key question is which metric/views are considered “Essential” to accomplish the stated goal of helping the material developer to “keep the program green”?

# Background (Concluded)

- We synthesized research and possible metrics and distilled them to three fundamental categories
  1. Evidence of a credible plan at the outset; one that is based on technical objectives and deliverables, available staffing and adjusted for risks
  2. Periodic data to ensure that cost and schedule performance are in line with technical and contract deliverables progress
  3. Periodic data (in addition to the technical performance data) that helps the PM identify current and likely future problem areas so they can be controlled
- We demonstrate the value of the metrics using a notional UAV program called the Tactical Situational Awareness System or TSAS
- Twenty-five metrics/views are proposed; twelve are shown and discussed in this presentation

# The Proposed Metrics/Views

<input type="checkbox"/>	1. Key Technical Performance Measures plan(s)
	2. Deliverables plan
✓	3. Summary level of the Integrated Master Schedule (IMS) and proposed spend plan
	4. Labor FTE utilization plan
✓	5. Schedule health and performance checks
✓	6. Risk register and mitigation actions
✓	7. Computation of initial management reserves (MR)
	8. Risk burn down plan
✓	9. Computation of schedule reserves aka margin (SM)
<input type="checkbox"/>	10. TPM plan vs estimated actuals vs cost and schedule performance metrics (CPI, SPI)
✓	11. Deliverables plan vs actuals vs CPI, SPI

# The Proposed Metrics/Views

✓	12. FTE plan vs actuals
✓	13. Cumulative BCWS, BCWP, ACWP against IBR spend plan, earned schedule with percent spent, percent complete, and percent scheduled (Enhanced Gold Card)
	14. Risk burn down plan vs actual
✓	16. C/S Performance Informed by Risk Burn Down Actuals
	17. Schedule health and schedule performance related data on the “go-forward” IMS (similar to view # 5)
	18. Cumulative BCWS, BCWP, ACWP against IBR spend plan with Earned Schedule and status dates, percent spent, percent complete, and percent scheduled (same as # 13)
	19. Tornado (or Galaxy) chart that shows the relative percentage of Budget at Complete to total for any level of WBS

# The Proposed Metrics/Views

Periodic Data That Indicates Current and Likely Future Problem Areas  
(Concluded)

	20. Management Reserve usage and balance
	21. Sources and uses of MR and Undistributed Budget
	22. Updated Risk Register (same as metric/view # 5)
✓	23. Forecast of EAC and ECD
✓	24. Confidence level of meeting contractor best case, worst case and most like EACs and ECDs
	25. Schedule and cost crucially indices

# Six Steps To Creating a Credible PMB

Step`	Outcome
<b>1</b> Define WBS	<ul style="list-style-type: none"><li>▪ With SOW, SOO, ConOps, WBS, and other program documents, develop CWBS of system deliverables and work processes to produce the program outcomes.</li><li>▪ Develop CWBS Dictionary describing scope of work and Criteria for the successful delivery of these outcomes.</li></ul>
<b>2</b> Build IMP	<ul style="list-style-type: none"><li>▪ Develop Integrated Master Plan (IMP), showing how each system element in the CWBS moves through the maturation process at each Program Event.</li><li>▪ Define Measures of Effectiveness (MOE) for each Accomplishment.</li><li>▪ Define Measures of Performance (MOP) for each Criteria.</li></ul>
<b>3</b> Identify Reducible Risk	<ul style="list-style-type: none"><li>▪ For each key system element in the CWBS, identify reducible risks, probability of occurrence, mitigation plan, and residual risk in the Risk Register.</li><li>▪ Risk mitigation activities placed in IMS and PMB to assure probability of occurrence and probability of impact reduced.</li><li>▪ For risks without mitigation plans, Management Reserve (MR) (calculated) will be used to handle risk when it becomes an Issue.</li></ul>



# Six Steps To Creating a Credible PMB (Concluded)

Step	Outcome
<b>4</b> Build the IMS	<ul style="list-style-type: none"><li>▪ Arrange Work Packages and Tasks in a logical network of increasing maturity of the deliverables.</li><li>▪ Define exit criteria for each Work Package to assess planned Physical Percent Complete to inform BCWP using TPM, MOP, MOE, and Risk Reduction activities in support of Accomplishments in the IMS.</li></ul>
<b>5</b> Adjust for Irreducible Risks	<ul style="list-style-type: none"><li>▪ For irreducible risks in the IMS, use Reference Classes for Monte Carlo Simulation anchored with Most Likely duration to calculate needed schedule reserve (margin).</li><li>▪ Assign schedule margin tasks in the IMS, to protect the key system elements, per DI-MGMT-81861 guidance.</li></ul>
<b>6</b> Establish PMB	<ul style="list-style-type: none"><li>▪ Using risk adjusted IMS, calculate needed Management Reserve (MR) to account for the latent risks in the Risk Register.</li><li>▪ With deterministic IMS and its embedded Schedule Reserves and Management Reserve for latent risk, determine the resulting confidence level of the PMB.</li></ul>

# Schedule Health Checks at IBR

<input checked="" type="radio"/>	Baseline Execution Index	(0 tasks)	0.00	0.85 - 0.95		Off
<input checked="" type="radio"/>	Effort Tasks	(177 tasks)	53.5%		80	Off
<input type="radio"/>	Incomplete Critical Tasks	(104 tasks)	No Grade			Off
<input type="radio"/>	Incomplete Tasks	(177 tasks)	No Grade			Off
<input checked="" type="radio"/>	Milestone Tasks	(79 tasks)	23.9%		20	Off
<input checked="" type="radio"/>	Missing Predecessors	(1 task)	0.4%	2 - 6		Off
<input checked="" type="radio"/>	Missing Successors	(1 task)	0.4%	2 - 6		Off
<input checked="" type="radio"/>	Out of Sequence Tasks	(0 tasks)	Compliant			Off
<input checked="" type="radio"/>	Predecessors Complete, Task Not Started	(0 tasks)	0.0%	10 - 15		Off
<input checked="" type="radio"/>	Project Has Status Date	(0 tasks)	Compliant			Off
<input type="radio"/>	Should Start Tasks	(0 tasks)	No Grade			Off
<input checked="" type="radio"/>	Summary Tasks With Resources	(0 tasks)	Compliant			Off
<input checked="" type="radio"/>	Summary Tasks	(75 tasks)	22.7%		20	Off
<input checked="" type="radio"/>	Summary Tasks With Predecessors	(0 tasks)	Compliant			Off
<input checked="" type="radio"/>	Summary Tasks With Successors	(0 tasks)	Compliant			Off
<input checked="" type="radio"/>	Task With Duration < 5d	(45 tasks)	25.4%		25 35	Off
<input checked="" type="radio"/>	Task With Duration > 20d	(8 tasks)	4.5%	5 - 10		Off
<input checked="" type="radio"/>	Tasks with Constrained Dates	(0 tasks)	0.0%	5 - 10		Off
<input checked="" type="radio"/>	Tasks With Missing WBS	(0 tasks)	0.0%	2 - 5		Off

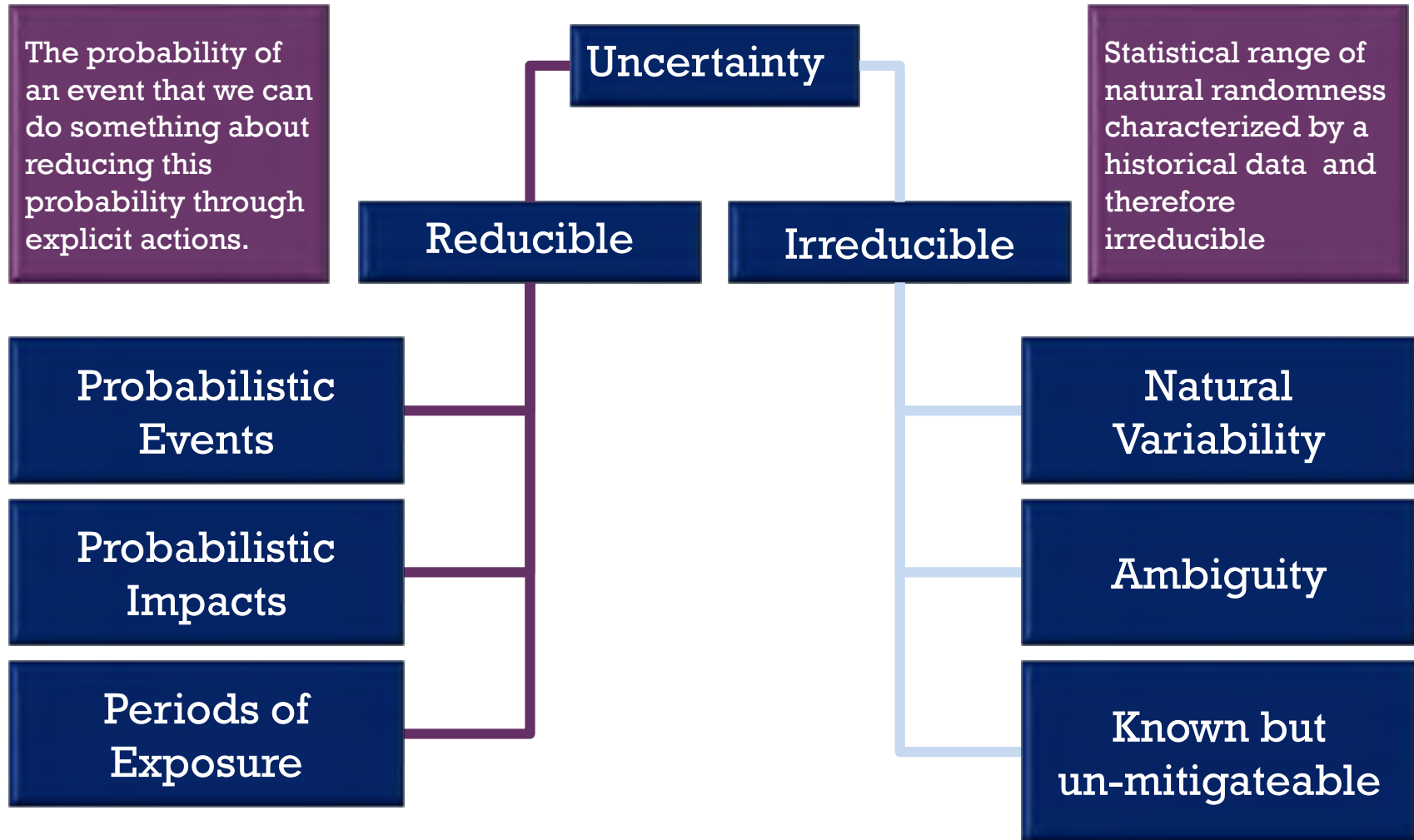
**Value:** Provides evidence that the contractor's initial plan meets quality schedule standards. Project success is not possible without a quality schedule.

# Schedule Health Checks at IBR (Concluded)

5

<input checked="" type="radio"/>	Tasks with Total Slack < -200d	(0 tasks)	Compliant		Off
<input checked="" type="radio"/>	Tasks with Total Slack < -20d	(0 tasks)	0.0%	10 - 15	Off
<input checked="" type="radio"/>	Tasks with Total Slack > 200d	(0 tasks)	Compliant		Off
<input checked="" type="radio"/>	Tasks with Total Slack > 30d	(43 tasks)	24.3%	25 70	Off
<input checked="" type="radio"/>	Tasks Without Assigned Resources	(0 tasks)	0.0%	5 - 10	Off
<input checked="" type="radio"/>	Tasks Missing Baseline Dates	(0 tasks)	Compliant		Off
<input checked="" type="radio"/>	Tasks Without Finish-to-Start Predecessors	(0 tasks)	0.0%	10 20	Off
<input checked="" type="radio"/>	14 Point - Missing Logic	(0 tasks)	0.0%	5	Off
<input checked="" type="radio"/>	14 Point - Have Leads (Negative Lag)	(0 tasks)	0.0%	0	Off
<input checked="" type="radio"/>	14 Point - Have Lags	(0 tasks)	0.0%	5	Off
<input type="radio"/>	14 Point - Relationship Types	(0 tasks)	No Grade		Off
<input checked="" type="radio"/>	14 Point - Hard Constraints	(0 tasks)	0.0%	5	Off
<input checked="" type="radio"/>	14 Point - High Float	(28 tasks)	15.4%	5	Off
<input checked="" type="radio"/>	14 Point - Negative Float	(0 tasks)	0.0%	5	Off
<input checked="" type="radio"/>	14 Point - High Duration	(0 tasks)	0.0%	5	Off
<input checked="" type="radio"/>	14 Point - Invalid Forecast Dates	(0 tasks)	0.0%	0.1	Off
<input checked="" type="radio"/>	14 Point - Invalid Actual Dates	(0 tasks)	0.0%	0.1	Off
<input checked="" type="radio"/>	14 Point - No Assigned Resources	(5 tasks)	2.7%	0.1	Off
<input checked="" type="radio"/>	14 Point - Missed Tasks	(0 tasks)	0.0%	5	Off
<input checked="" type="radio"/>	14 Point - Baseline Execution Index (BEI)	(0 tasks)	0.0%	0.95	Off

# The PMB Must Be Adjusted for Uncertainty



# Plan at IBR Must Be Adjusted for Reducible Risks

Risk Name	Open	Risk/Issue	Threat	Risk Assigned To	Pre-Mitigation Baseline			Post-Mitigation Baseline			Description	
					Pro.	Imp.	Score	Pro.	Imp.	Score		
1 Resolution of Selected FMV COTS	Opened	Risk	Threat	Task 234 Document FM	80.0%	43.8%	35.0%	10.0%	0.0%	0.0%	\$25,000	Discovered uncertainty \
2 Computations in JATCO	Opened	Risk	Threat	Task 302 Migrate Altim	50.0%	42.3%	21.2%	20.0%	15.0%	5.0%	\$0.00	Most programs establis
3 Inadequate EO/IR Engineers	Opened	Risk	Threat	Task 79 Develop IRS Dr	25.0%	14.0%	3.5%	15.0%	15.0%	2.3%	\$0.00	High demand on the ser
4 EO/IR development	Opened	Risk	Threat	Task 316 (AC) Avionics	35.0%	0.0%	0.0%	10.0%	5.0%	0.5%	\$50,000	Specifications are string
5 Funding instability	Opened	Risk	Threat	Task 200 Develop EO/IR	25.0%	0.0%	0.0%	25.0%	0.0%	0.0%	\$0.00	FY 16 funding may be n
6 Image Processing Algorithms	Opened	Risk	Threat	Task 316 (AC) Avionics	35.0%	0.0%	0.0%	5.0%	20.0%	1.0%	\$250,000	Contractor team has de
7 Parallel sensor designs during PDR phase	Opened	Risk	Threat	Task 154 Create Missio	40.0%	0.0%	0.0%	5.0%	25.0%	1.3%	\$0.00	Parallel preliminary desi
8 SAR COTS Supplier Reliability	Opened	Risk	Threat	Task 214 (AC) FMV Fur	50.0%	0.0%	0.0%	5.0%	0.0%	0.0%	\$50,000	Since the proposal was

Note Pre and Post Mitigation Risk Scores

**Value:** Showing the Risk Register at the IBR provides evidence that all major risks have been considered and that the contractor has incorporated plans into the baseline to mitigate those risks. It also provides transparency about risk that have not been mitigated which can impact the probability of success.

# Example of One Mitigation Strategy

The screenshot displays the 'Risk Information' window in RiskyProject Professional. The risk name is 'Resolution of Selected FMV COTS' with Risk ID 'R00000022'. The mitigation plan table is as follows:

	Mitigation Plan	Date	Probe	Impact	Score	Cost (Mti)
1	Pre-mitigation	03/17/14	80.0%	43.8%	35.0%	\$0.00
2	Acquire current model and perform bench test	02/01/15	70.0%	15.0%	10.5%	\$0.00
3	Develop simulation for in-development unit	04/01/15	50.0%	5.0%	2.5%	\$0.00
4	Quality other vendors	06/01/15	10.0%	0.0%	0.0%	\$0.00

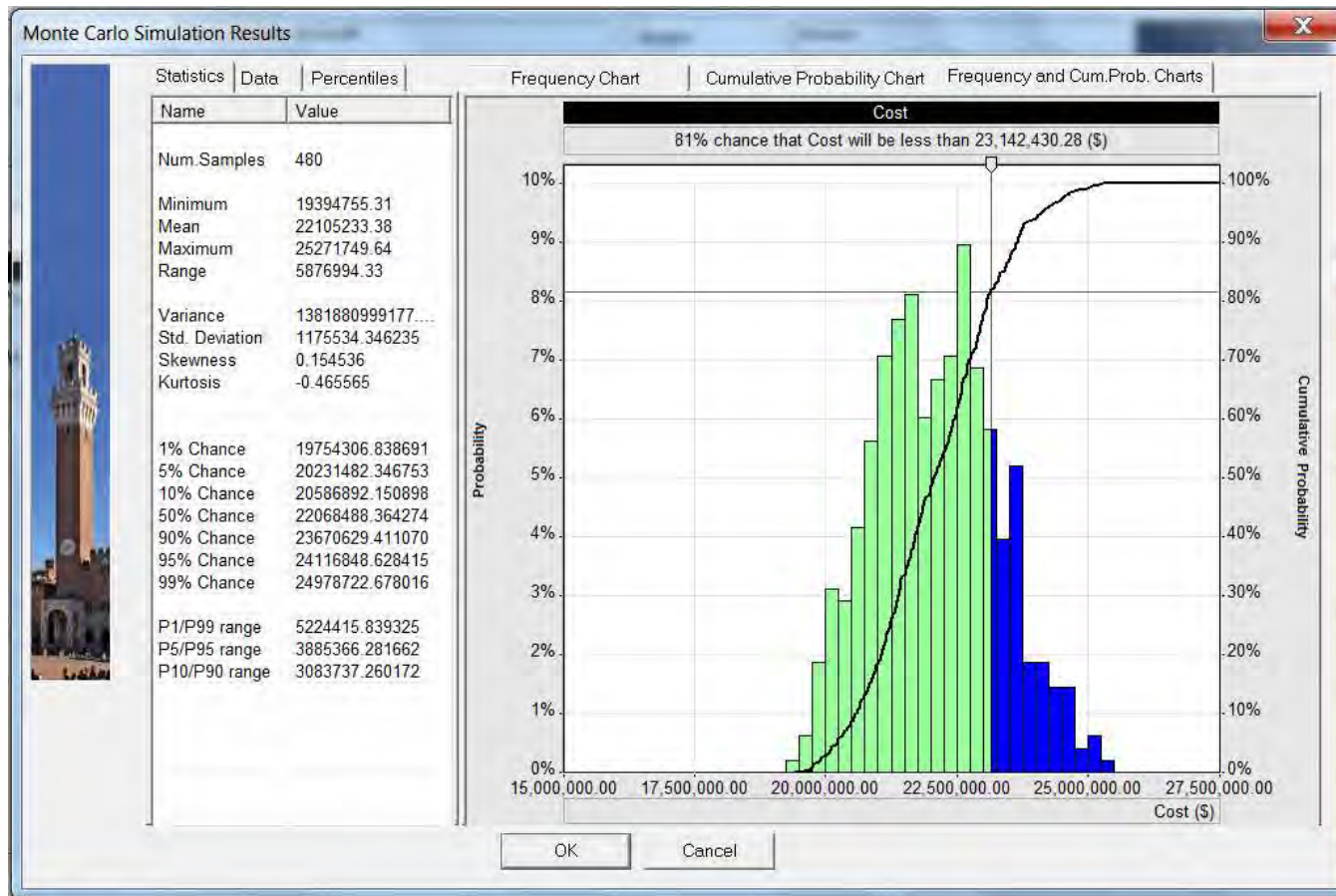
The interface also shows a risk matrix with 'Pre-Mitigation' and 'Post-Mitigation' views, a total mitigation cost of \$0.00, and a timeline chart for 2015 showing the risk score decreasing from 35% to 0% through the mitigation steps. The timeline chart has a y-axis for 'Risk score' from 0% to 48% and an x-axis for months from Feb to Jun. A red bar at the top indicates a risk score of 48% from Feb to Jun. A horizontal line at 35% is labeled '1' in March. A vertical line drops to 10.5% in February, labeled '2'. A horizontal line at 10.5% is labeled '3' in March. A vertical line drops to 2.5% in April, labeled '4'. A horizontal line at 2.5% is labeled '4' in May. A vertical line drops to 0% in June.

**Value:** Provides evidence that the contractor has a realistic risk buy down plan and has planned “way points” to reassess the mitigation actions and remaining risks.

# Management Reserve Calculation Principles

- **Management reserve (MR)** is held for growth within the currently authorized work scope, for rate changes, and for other program unknowns. **MR** is not used to offset accumulated overruns or underruns and it is not a contingency budget than can be used for new work or eliminated from the contract price during subsequent negotiations. The management reserve budget is *not* included as part of the **Performance Measurement Baseline (PMB)**. Source: ACQuipedia
- Operational Definition: Management Reserves (MR) covers in-scope known reducible risks that were not mitigated. It is for in-scope work that may or may not materialize.

# TSAS Monte Carlo Simulation for Unmitigated Reducible Risks Only





# TSAS Management Reserve Calculation

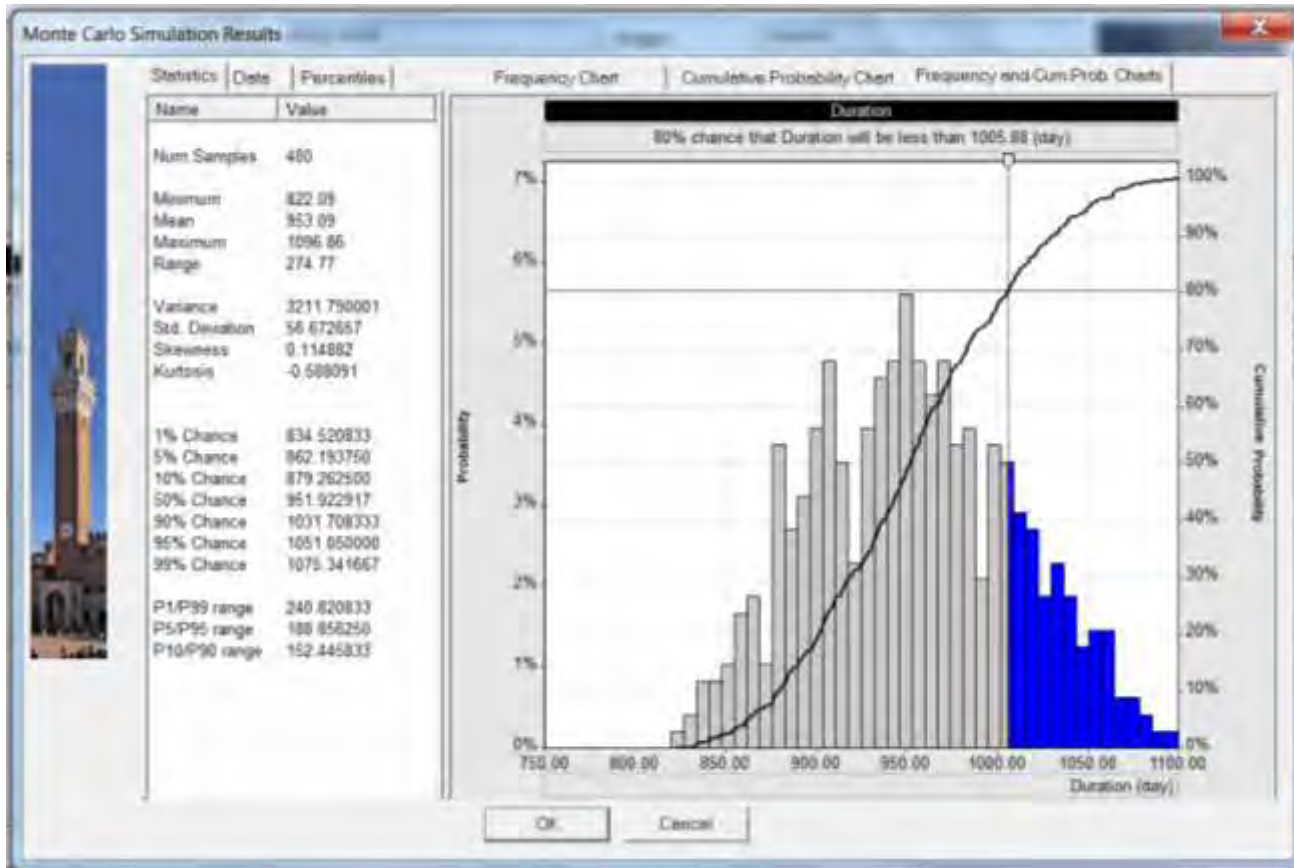
Element	Cost	CL	Comments
Contract Price	\$ 25,000,000		This is the Contract Price awarded
Fee @ 8%	1,851,852		This is the assumed fixed price fee based on the deduced TAB
Contract Budget Baseline (CBB)	23,148,148		Calculated from the Contract Price and assumed fee
P80 Cost	23,140,000	80%	This is the cost at the 80% CL assuming only non-reducible risks in the RR
Deterministic BAC <sub>f</sub>	\$19,595,480	< 1%	Final BAC based on the resource-loaded schedule
MR (CBB - BAC <sub>f</sub> )	3,552,668		Calculated MR (TAB - PMB)
MR as a percent of BAC <sub>f</sub>	18.1%		Calculated MR % of BAC <sub>f</sub>

# TSAS IMS Prior to Adjustment for Irreducible Uncertainty

ID	Task Name	SchMargin	Duration	Work	Start	Finish	Cost	Timeline									
								4th Quarter	3rd Quarter	2nd Quarter	1st Quarter	Oct	Aug	Jun	Apr	Feb	Dec
1	TSAS Avionics	No	859 days	101,668 hrs	Mon 3/17/14	Wed 8/9/17	\$19,595,480.00										
2	Contract Award	No	0 days	0 hrs	Mon 3/17/14	Mon 3/17/14	\$0.00										
3	TSAS CA - IBR Phase	No	140 days	6,600 hrs	Mon 3/17/14	Wed 10/1/14	\$1,218,600.00										
49	TSAS Avionics IBR - SFR Phase	No	84 days	6,524 hrs	Thu 10/2/14	Mon 2/2/15	\$1,264,080.00										
116	TSAS Avionics SFR-PDR Phase	No	200 days	23,304 hrs	Tue 2/3/15	Mon 11/16/15	\$4,494,720.00										
274	TSAS Avionics PDR-CDR Phase	No	215 days	24,600 hrs	Tue 11/17/15	Thu 9/22/16	\$4,703,680.00										
308	TSAS Avionics CDR-TRR Phase	No	220 days	40,640 hrs	Fri 9/23/16	Wed 8/9/17	\$7,914,400.00										

This is the revised TSAS IMS after adjustments for reducible uncertainty that remain in the Risk Register after mitigation actions.

# Monte Carlo Simulation Results to Adjust the PMB for Irreducible Risks and Set Schedule Margin



**Value:** Ensuring the project plan accounts for the experience of historical projects (irreducible risks) yields a higher probability of meeting the planned delivery date.

# Schedule Margin Calculation

	Duration		Finish Date	Confidence Level
	Months	Days		
IMS Deterministic P <sub>f</sub> Duration and Date:=	41	859	8/9/2017	20%
Need Duration and Date:=	48	1006	3/17/2018	80%
Schedule Reserve (Margin):=	7	147		

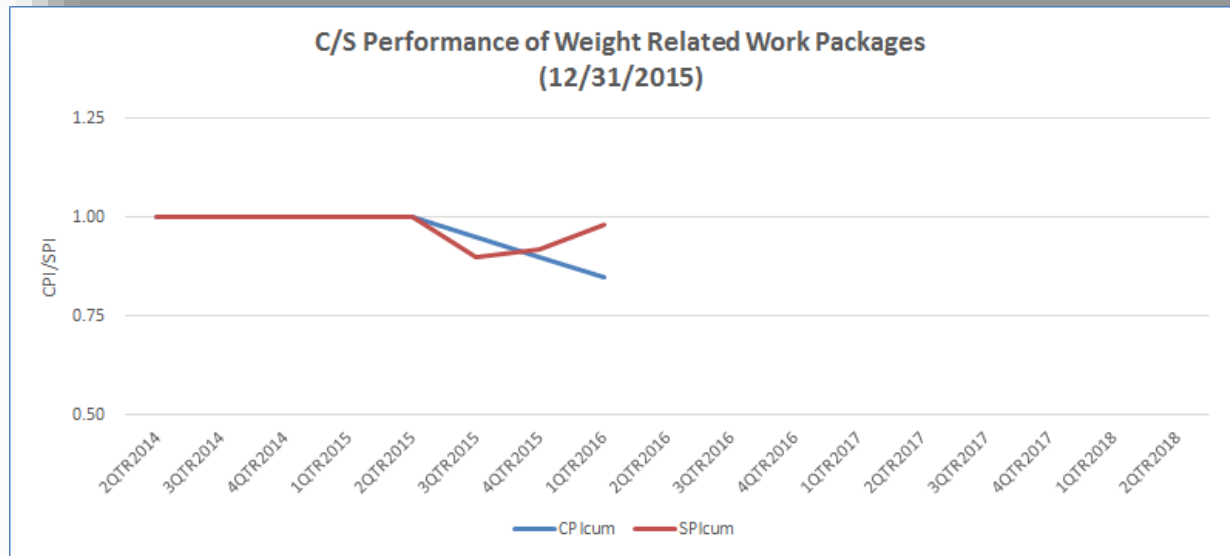
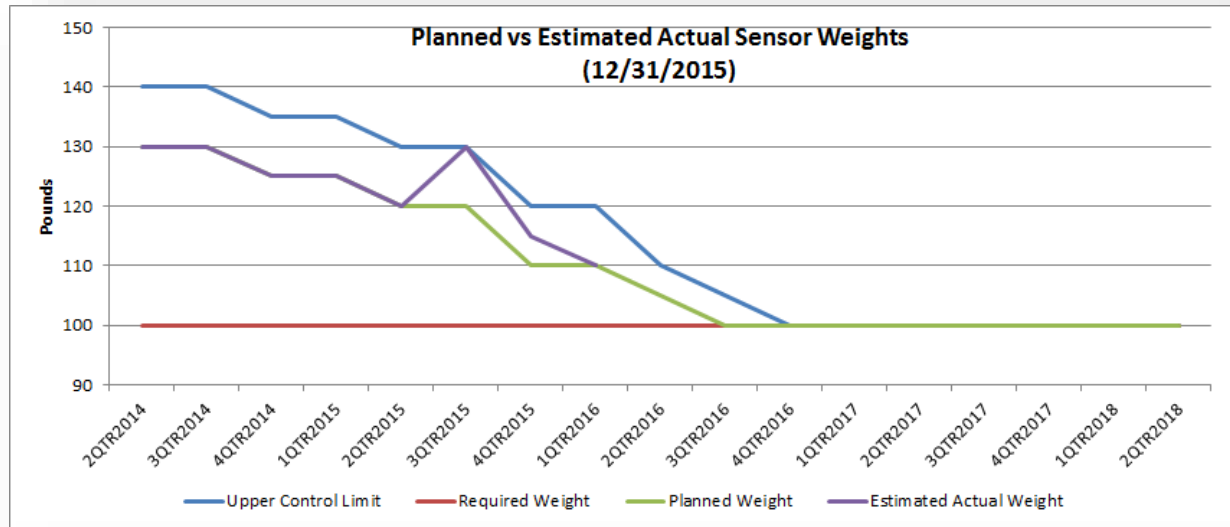
**Value:** Including schedule reserve or margin, ensures the project possess a realistic probability of meeting the targeted delivery date. It is derived by running a Monte Carlo Simulation with the irreducible risks and resource-loaded IMS as inputs.





# Weights vs. C/S Performance (as of 1QTR2016)

**Value:** Showing the technical progress such as weight against the cost and schedule performance data of the associated work packages is a leading indicator. 3QTR2015 weight is above plan and both CPI and SPI reflect this. By 1QTR 2016, weight is on plan, because contractor spent more resources. C/S indices reflect same.



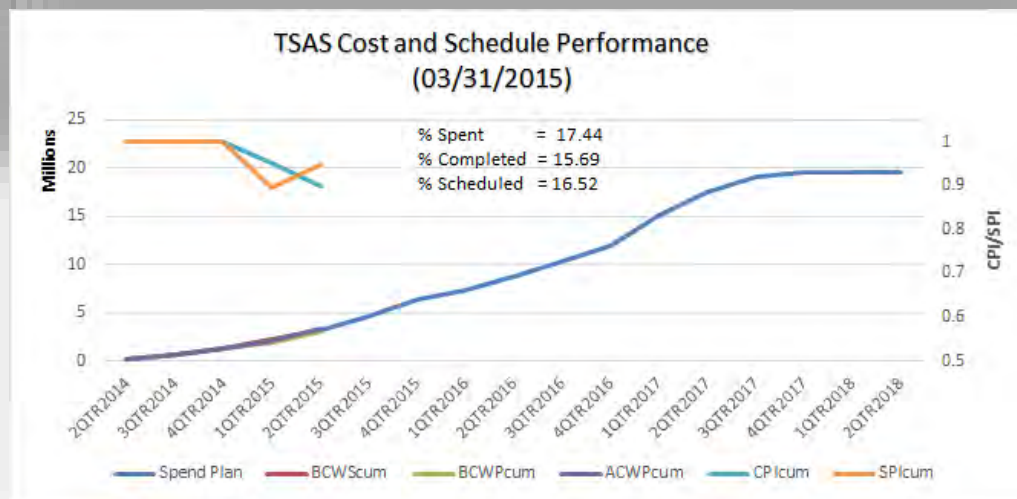
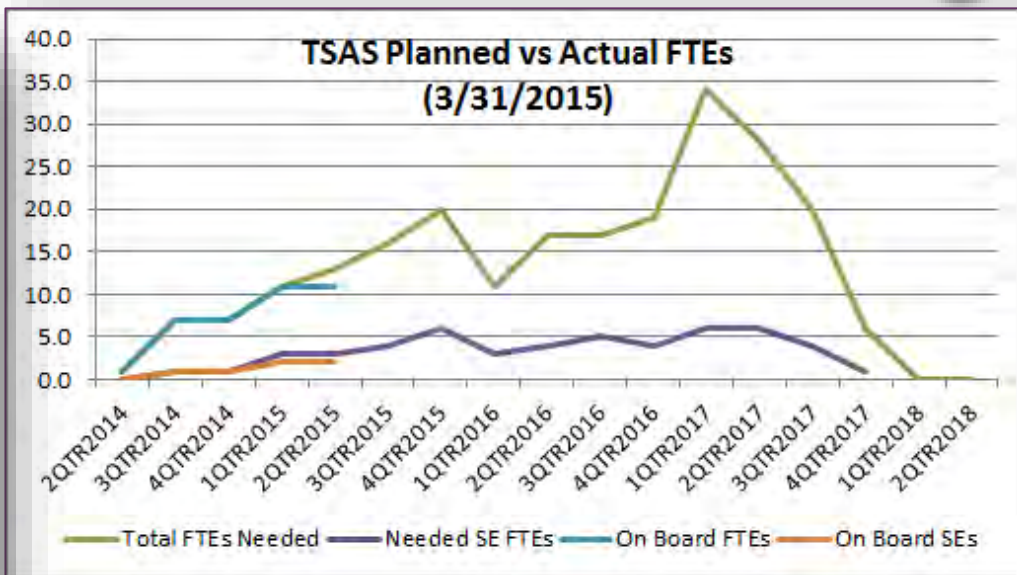
# Deliverables and FTEs vs. C/S Performance (as of 3/31/2015)

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Contract Deliverable	3QTR2014	4QTR2014	1QTR2015	2QTR2015
Documented Contract/Program Baseline	✓			
DCMA Validation of EVMS		✓		
Resource-Loaded IMS		✓		
Configuration Management Plan Delivered			✓	
Documented DoD Architecture Framework (DoDAF)			✗	✓
Scientific and Technical Reports			✗	✓
Interface Requirements Specification (IRS)			✗	✓
Electromagnetic Interference Control Procedures Completed and Delivered			✗	✓
Product Support Plan Completed				✓
Systems Engineering Management Plan (SEMP) Completed				✓
System / Subsystem Specification Completed				✗
Cumulative Planned Contract Deliverables	3	3	8	11
Cumulative Actual Contract Deliverables	1	3	4	10

**Value:** Showing the deliverables and planned vs actual personnel helps tell the story of the negative cost and schedule performance since labor is usually the largest component of cost. The contractor is more likely to be meet technical, cost and schedule objectives if the right personnel are put on the effort when planned. These data provide the PM an early warning signal.

12

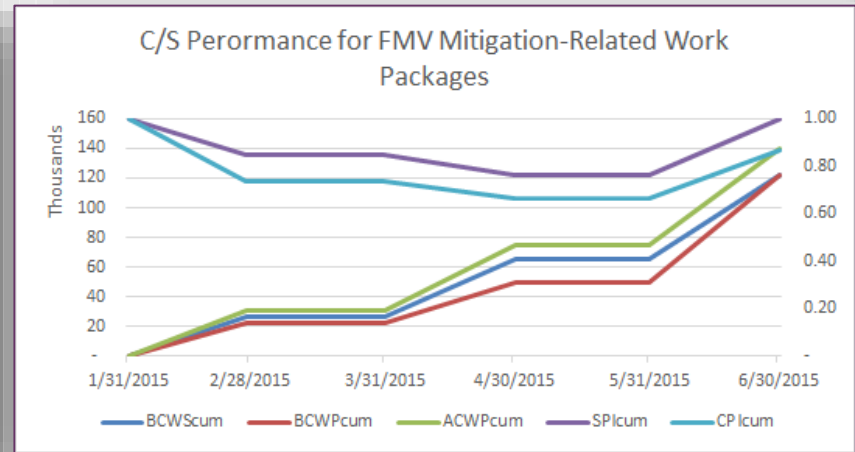
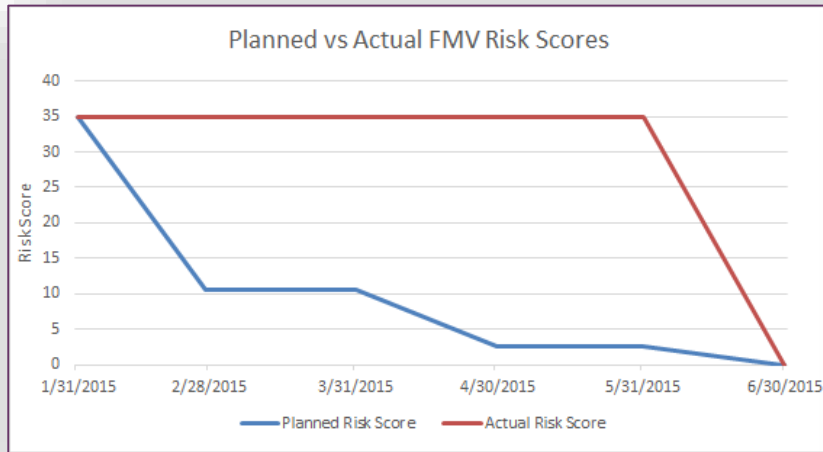


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# TSAS Full Motion Video (FMV) C/S Performance Informed by Risk Burn Down



Task Name	Start Date	End Date	BCWS	BCWP	ACWP	Performance Explanation
Acquire current Model and Bench Test	2/2/2015	2/27/2015	26,540	22,559	30,521	Vendor current model did not meet the resolution rqmt
Develop Simulation for "In-Development" Unit	4/1/2015	4/30/2015	38,820	27,174	44,643	Simulation did not meet the resolution requirement
Qualify Other Vendors	6/1/2015	6/30/2015	56,320	56,320	64,768	Found other vendor who provided product that did meet the requirement @ 15% more \$

**Value:** Tells PM whether contractor's mitigation plans were successful and ensures that cost and schedule performance reflect those actions.

# Example of Traditional Method of Forecasting EAC and ECD

The Plan: Twelve month effort for \$36K

The Performance at status date (5/31/2015):

$BCWS_{cum} = \$15K$

$ACWP_{cum} = \$18K$

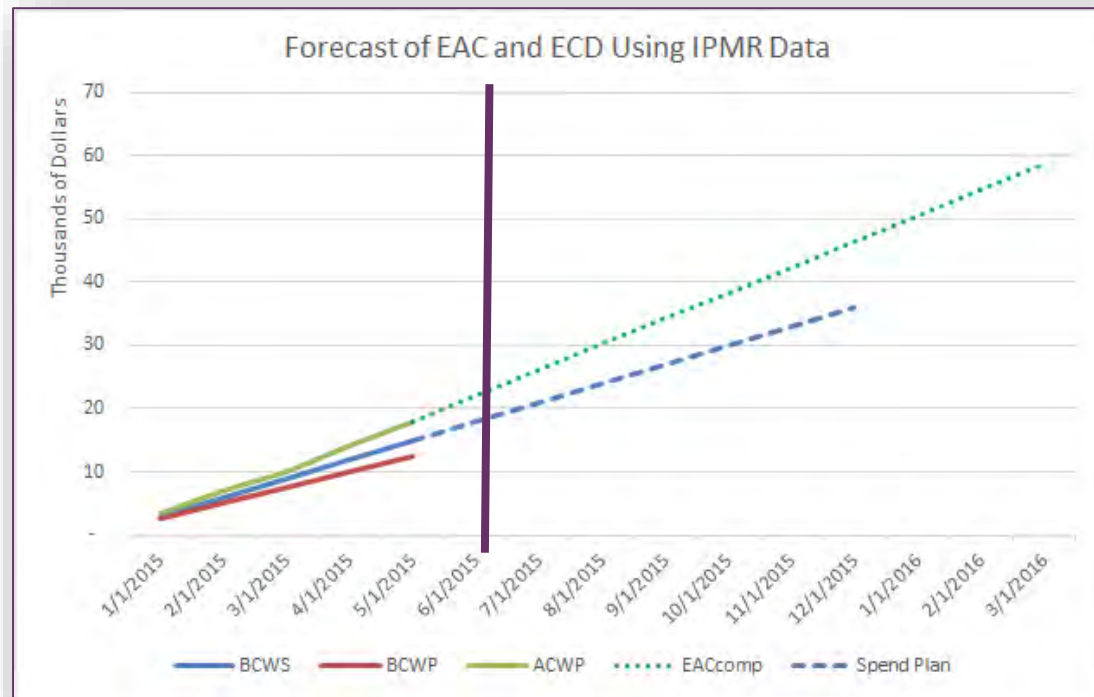
$BCWP_{cum} = \$12.5K$

$SPI_{cum} = .833$

$CPI_{cum} = .694$

$ES = 124d$

$SPI_t = .824$



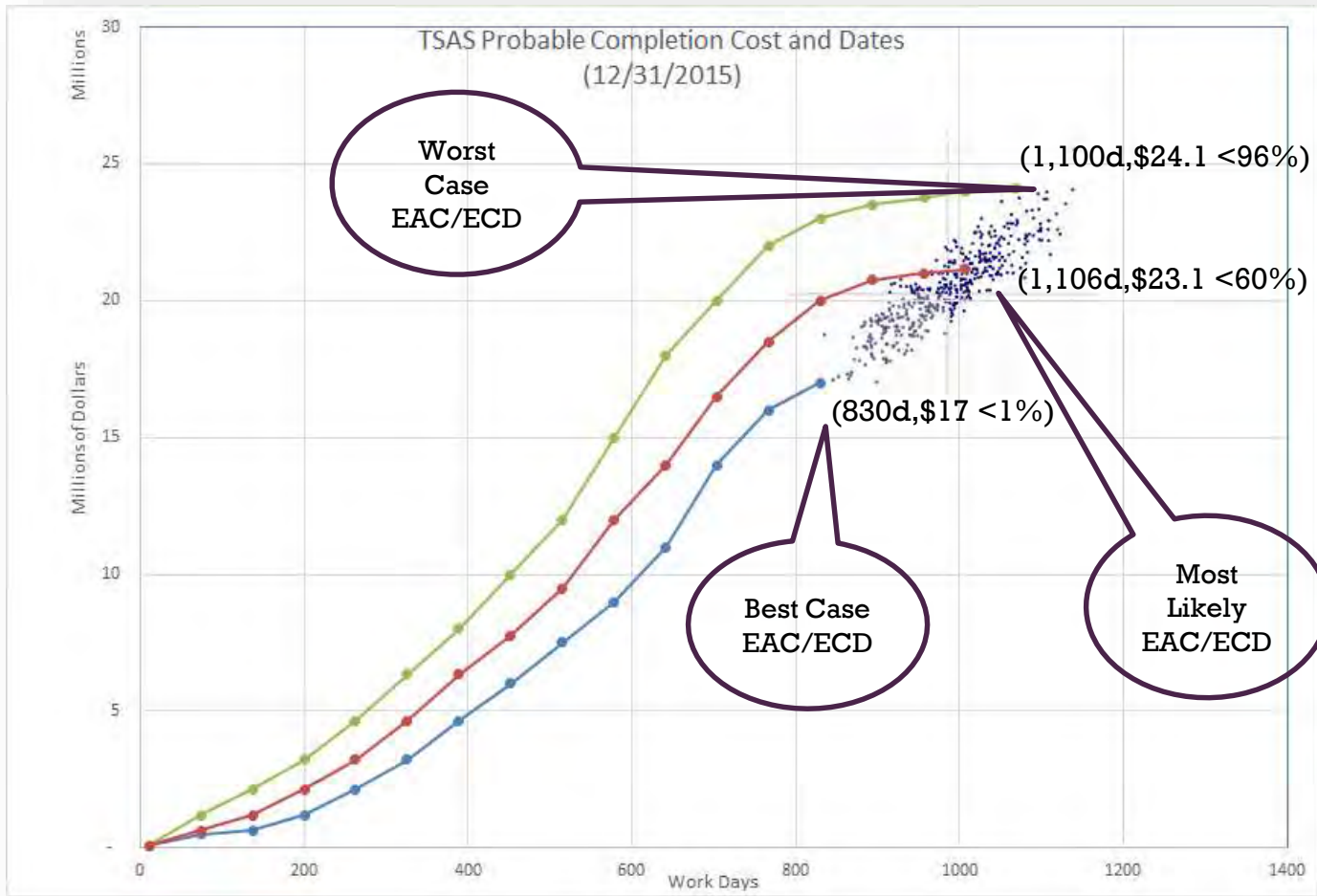
EAC Forecast:  $EAC_{composite} = ACWP + [(BAC - BCWP_{cum}) / (CPI_{cum} \times SPI_{cum})] = \$58.6K$

ECD Forecast Duration:  $Status\ Duration + (PD - ES) / SPI_t = 150d + (366 - 124) / .824 = 444d$

ECD Forecast Date: Date Format of  $(42005 + 444) = 3/19/2016$

**Value:** Tells PM the final cost and delivery date IF the contractor continues to perform exactly as it has done in the past (rearward focus). Facilitates problem diagnosis and discussions with the contractor.

# Quantification of EACs and ECD From MCS of Remaining Reducible and Irreducible Risks



**Value:** Tells PM the range of possible final cost and delivery dates and probabilities of the contractor-stated projected EACs and ECDs based on a forward focus of the impact of reducible and irreducible remaining risks. Fosters pro-active management with the contractor.

# Summary

- Proposed an enhanced set of key, or essential, program management metrics that a government program manager ought to have as a minimum to proactively manage and help control contracted efforts
- Demonstrated selected metrics with a notional UAV program
- Received suggestions for improvements



# Process to Calculate Management Reserves

```
Calculate Contract Budget Base (CBB) from Price and Fee:  $CBB = \text{Price} / (1 + \text{fee percent})$   
 $BAC_i$  (from initial resource-loaded IMS)  
DO WHILE P80 Cost > CBB  
    Run Monte Carlo Simulation for reducible risks in the Risk Register  
    Revise Cost Plan ( $BAC_i$ )  
END DO  
Final cost plan =  $BAC_f$   
 $MR = CBB - BAC_f$ 
```

# Schedule Margin Calculation Steps

Create Bottom-up IMS Plan (P) after adjusting for reducible risks

DO WHILE P80 Date > Need Date (contractually required date)

    Run Monte Carlo Simulation for Irreducible Uncertainty

    Revise IMS Plan (P)

END DO

$P_f$  = PMB Final Finish Date

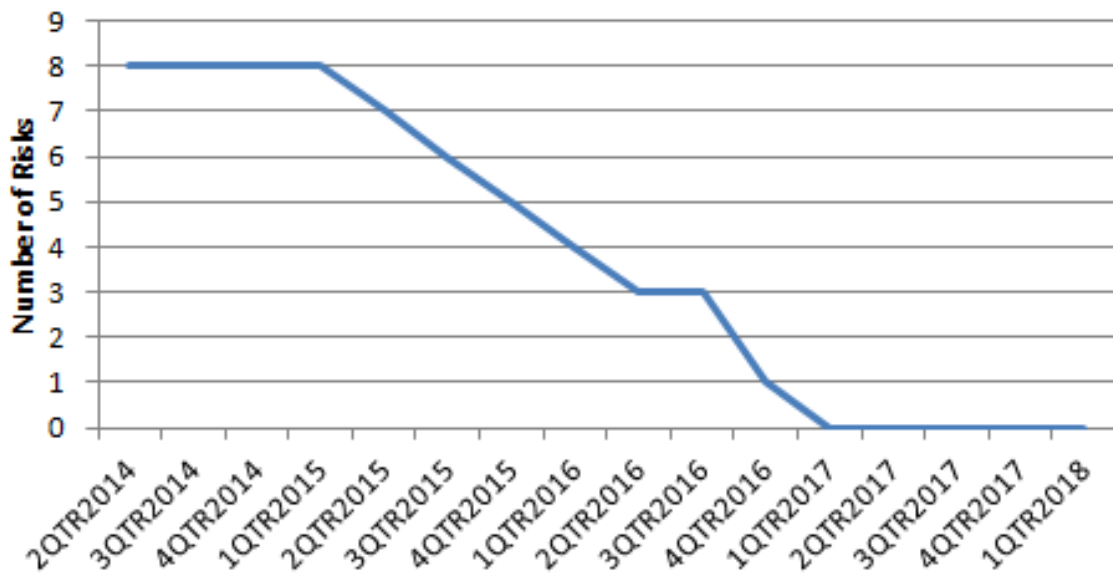
Schedule Margin = Need Date Duration (P80 duration) –  $P_f$  Duration

WHERE

Irreducible Duration Uncertainty is determined from historical data

# TSAS Risk Burn Down Plan

## TSAS Risk Burn Down Plan



Risk	Estimated Manifestation Date	Status
Inadequate Systems Engineers	2QTR2015	
Resolution of FMV	3QTR2015	
SAR Reliability	4QTR2015	
FY 2016 Funding Instability	1QTR2016	
Image Processing	2QTR2016	
EO/IR HW Difficulty	4QTR2016	
Parallel Sensor Designs	4QTR2016	
IATCO	1QTR2017	



# TSAS Schedule Margin Burn Down Plan

