Earned-Value Panel Discussion

International Space Station (ISS) Implementation / Perspective

9th Forum of Master Project Managers

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Impetus

- *Young Committee findings – program control deficiencies, including lack of across-the-board EVM implementation*
- *"Penalty Box" – halt at US Core Complete unless deficiencies corrected within two years*

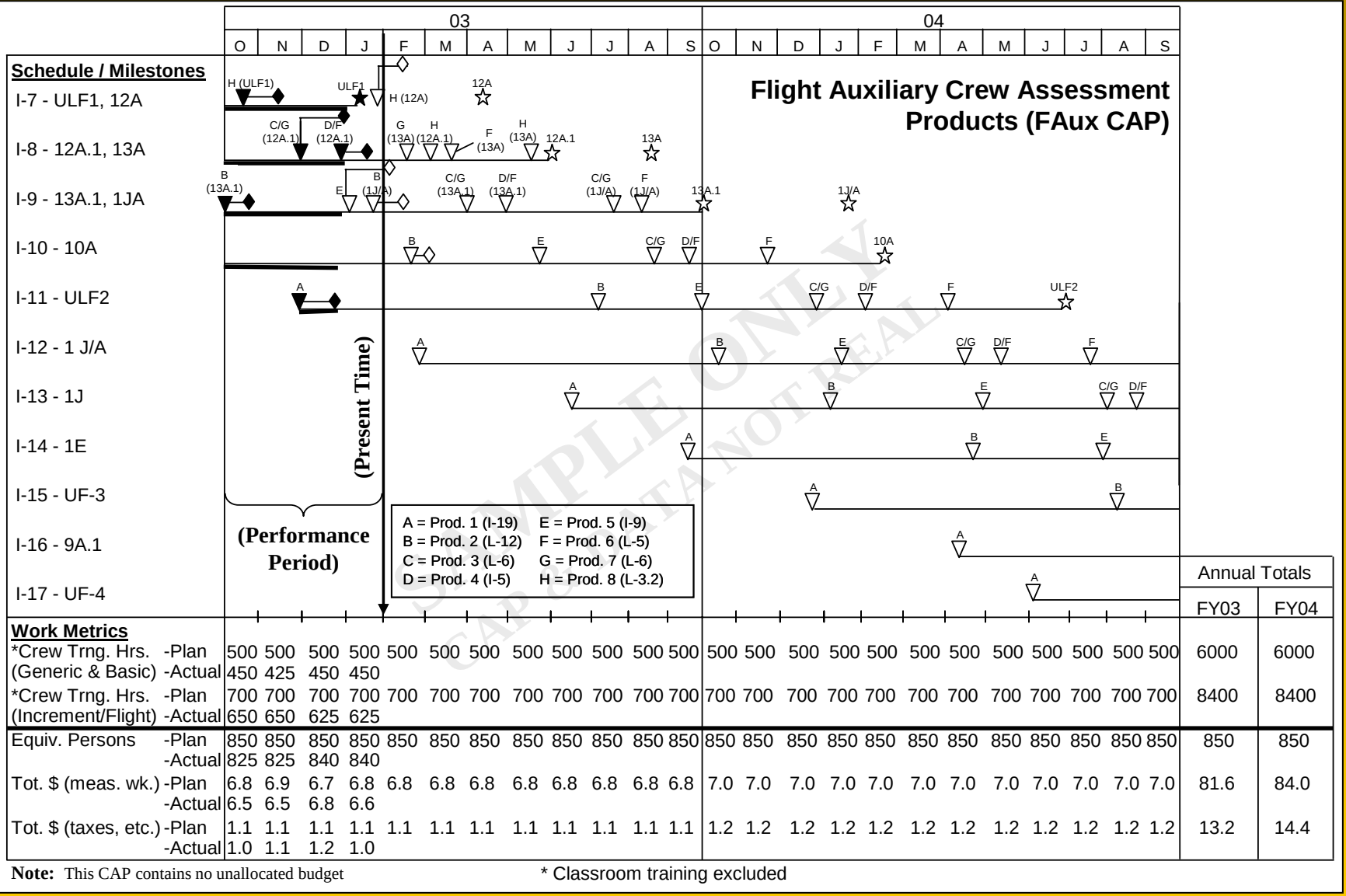
Situation

- *Contractor EVM in place for major contracts (roughly half of program)*
- *Program nearly complete with transition to operations/SE phase*

Challenges

- *Implementation timetable – five months, including three months of dry runs*
- *Mid-program implementation – not to mention ops/SE implementation*
- *Limited resources*
- *Technical obstacles*
- *Make system useful – not just "check-marking a box"*

Background

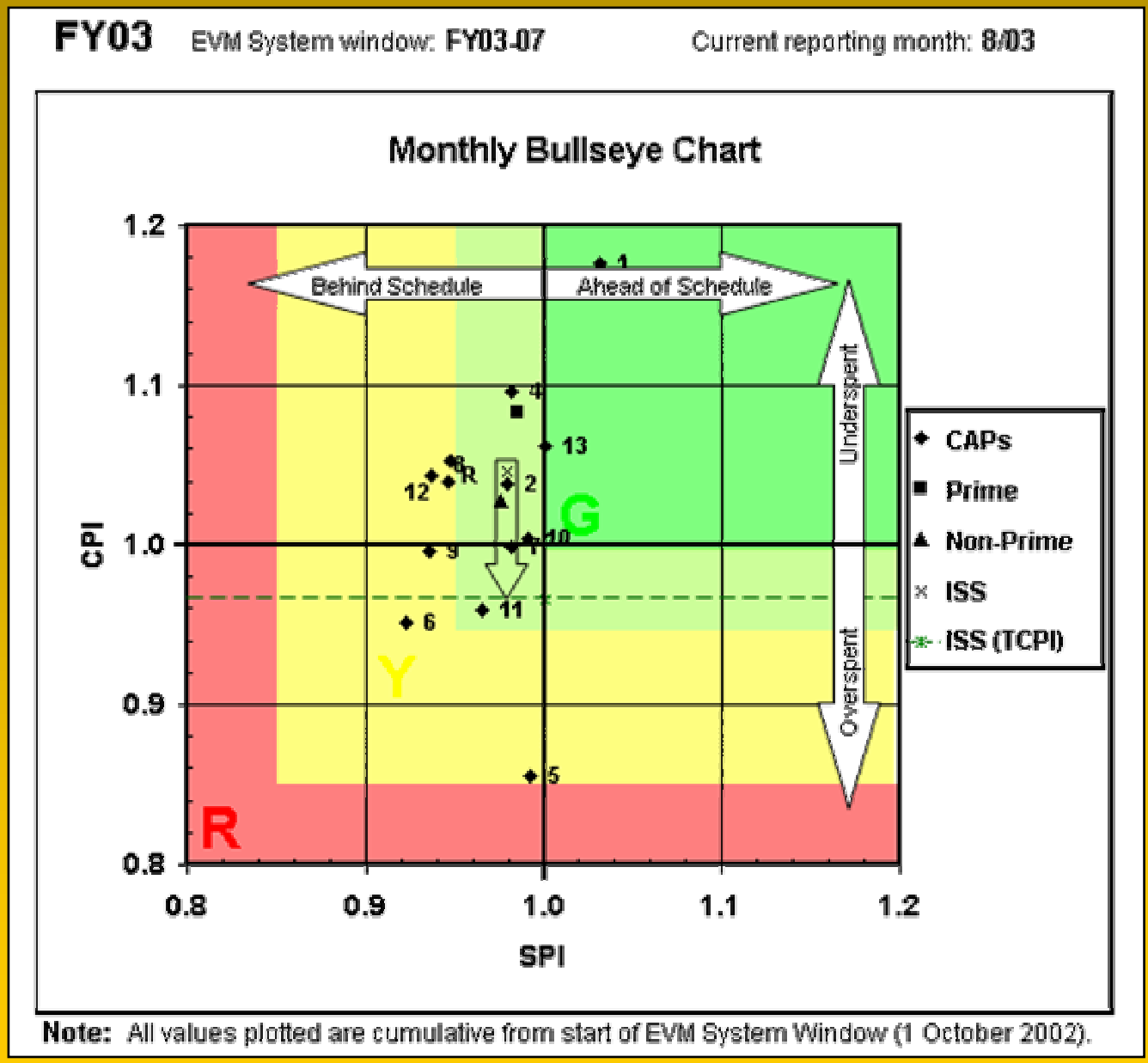


Work Metrics		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	Annual Totals FY03	Annual Totals FY04
*Crew Trng. Hrs. (Generic & Basic)	-Plan	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	6000	6000
	-Actual	450	425	450	450																						
*Crew Trng. Hrs. (Increment/Flight)	-Plan	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	700	8400	8400
	-Actual	650	650	625	625																						
Equiv. Persons	-Plan	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
	-Actual	825	825	840	840																						
Tot. $ (meas. wk.)	-Plan	6.8	6.9	6.7	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	81.6	84.0
	-Actual	6.5	6.5	6.8	6.6																						
Tot. $ (taxes, etc.)	-Plan	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	13.2	14.4
	-Actual	1.0	1.1	1.2	1.0																						

Note: This CAP contains no unallocated budget

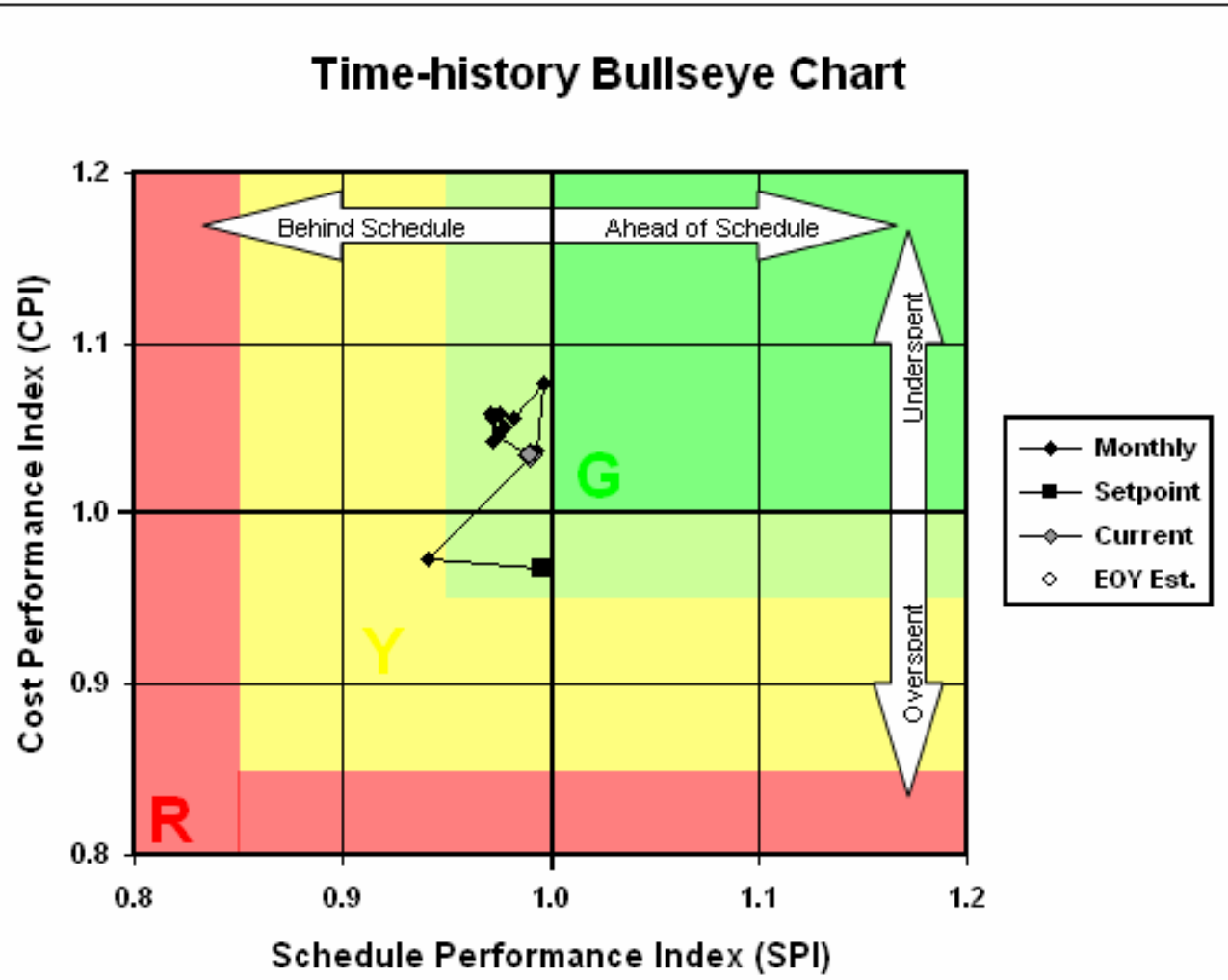
* Classroom training excluded

Sample CAP PMS/EVM Input Data



Data Display: Bullseye Scatter Plot

ISS PMS/EVM Summary (without Research) Current year: **FY03**



$SPI_{previous}$:	0.974	$SPI_{EOY\ Est}$:	0.989	EVM System window:	FY03-07
$CPI_{previous}$:	1.046	$CPI_{EOY\ Est}$:	1.034		

Data Display: Bullseye Time-History Plot

CAP #	CAP	CAM	Current SPI	Current CPI	Reported Status	Current TCPI	$\Delta CPI_{reqd.}$ (%)	Projected EOY R/T ($M)	Projected EOY U/R ($M)	Projected -VAC ($M)	Assessed Status
1			1.032	1.177	G	0.923	-21.6%	0.0	19.8	-13.7	G
2			0.979	1.038	G	0.988	-4.7%	8.3	14.3	12.7	G
3			0.972	1.354	G	0.769	-43.2%	2.5	22.2	-6.9	Y
4			0.982	1.096	G	0.976	-11.0%	1.4	6.5	-1.7	G
5			0.993	0.855	Y	0.749	-12.4%	0.2	-4.8	2.1	Y
6			0.923	0.952	Y	0.880	-7.5%	3.6	-2.2	15.1	Y
7			0.981	0.999	G	0.892	-10.6%	1.7	-0.1	7.3	G
8			0.946	1.039	Y	0.987	-5.0%	3.0	2.0	6.6	G
9			0.936	0.996	Y	1.001	0.5%	7.6	-0.4	22.5	Y
10			0.991	1.004	G	0.999	-0.5%	0.8	0.3	2.4	G
11			0.965	0.959	G	1.031	7.5%	1.7	-2.0	5.2	Y
12			0.937	1.044	Y	0.894	-14.3%	4.0	2.5	8.3	G
13			1.000	1.062	G	1.001	-5.8%	0.0	11.1	-14.5	G
R			0.947	1.052	Y	0.979	-7.0%	6.5	5.8	20.2	N/A
ISS*			**0.979**	**1.046**	G	**0.966**	**-7.7%**	**30.1**	**61.8**	**41.0**	G

***Note:** Denotes Program roll-up without Research

Key: G G = SPI & CPI > 0.95; darker green indicates SPI & CPI > 1.00
Y = SPI &/or CPI between 0.85 & 0.95; neither index < 0.85
R = SPI &/or CPI < 0.85

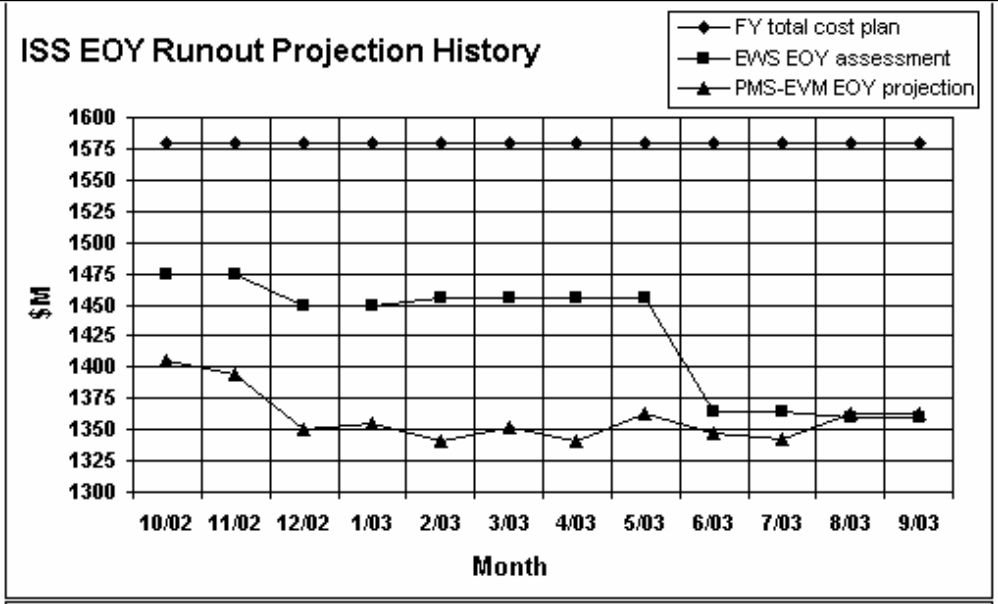
Assessment comments:

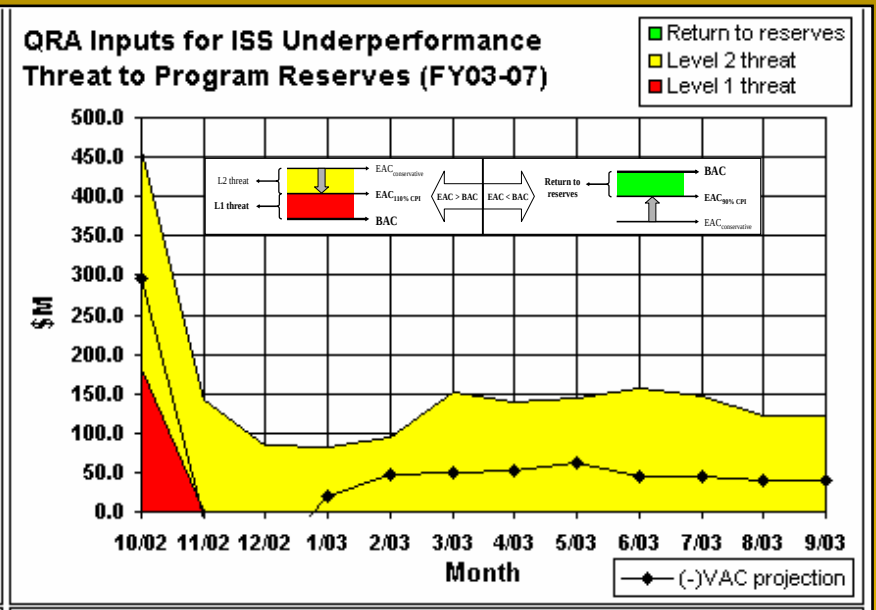
CAP 1:
CAP 2:
CAP 3:
CAP 4:
CAP 5:
CAP 6:
CAP 7:
CAP 8:
CAP 9:
CAP 10:
CAP 11:
CAP 12:
CAP 13:
ISS*:

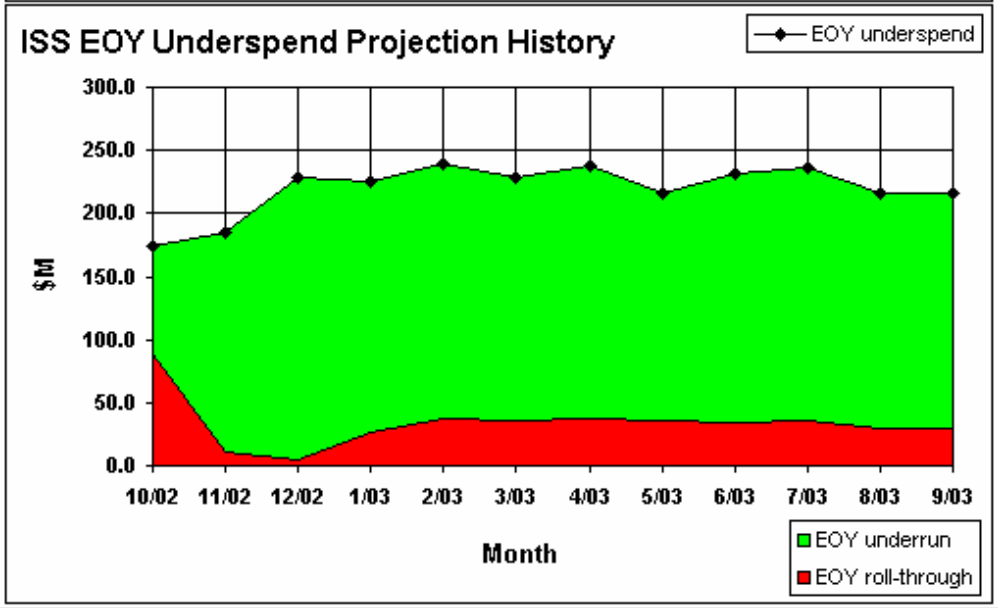
ISS-level EOY projections:

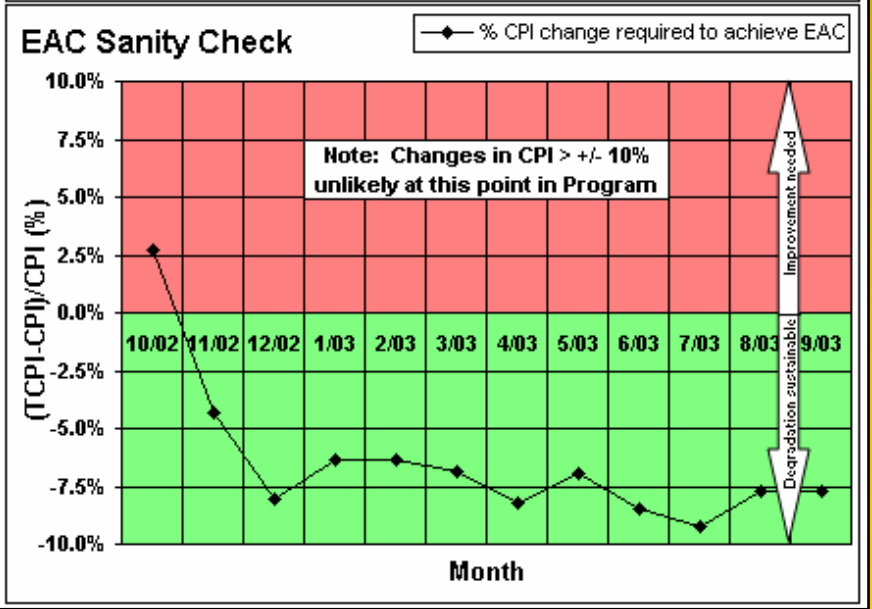
						$\Delta_{PMS-EVMS}$:
Total underspend ($M):	215.5	R/T (content) to next FY ($M):	30.1	U/R ($M to (+)/from (-) reserves):	185.4	0.3%
Current FY cost plan ($M):	1579.0	EWS EOY assessment ($M):	1360.0	PMS-EVM EOY projection ($M):	1363.5	

Program Status & Data Assessment: Assessment Scorecard



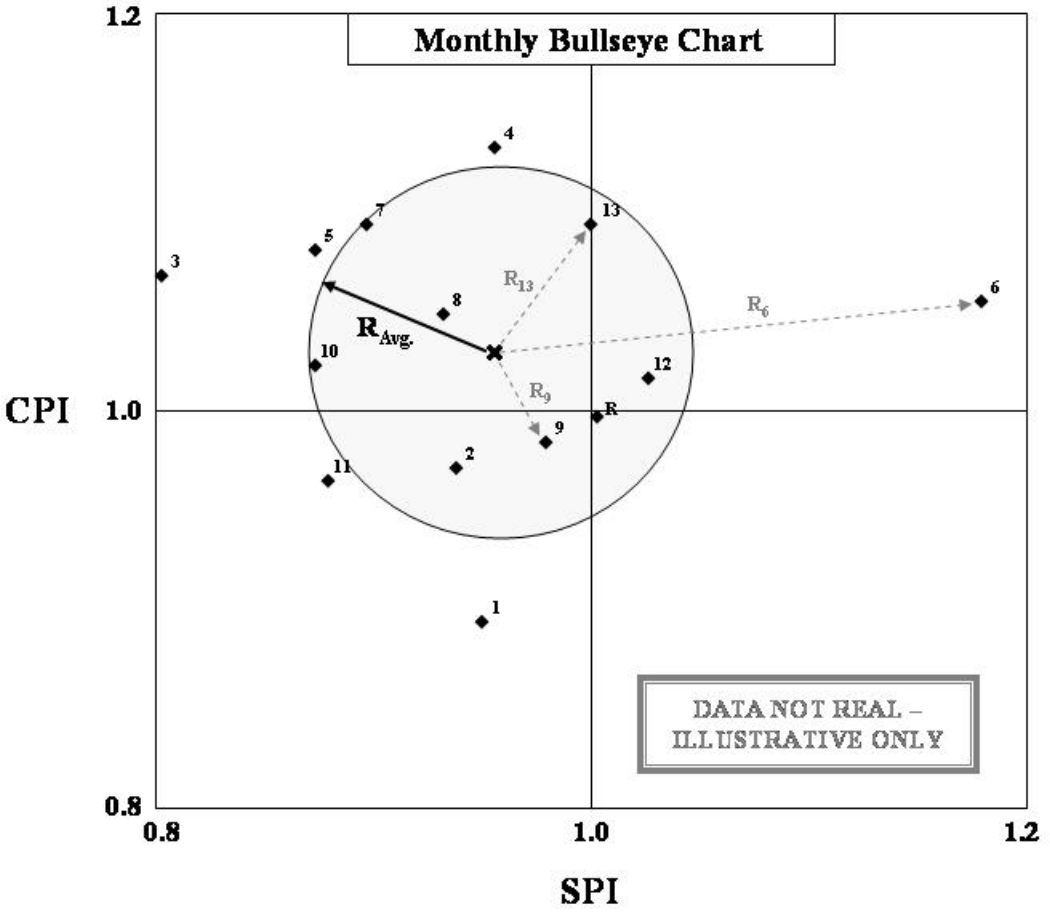




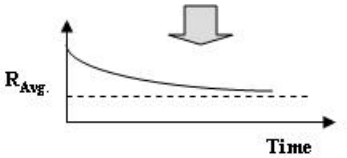


Data Assessment: Program Health & FY Projections

ISS PMS/EVM System Convergence Metric #1
(CAP Scatter About ISS Aggregate)

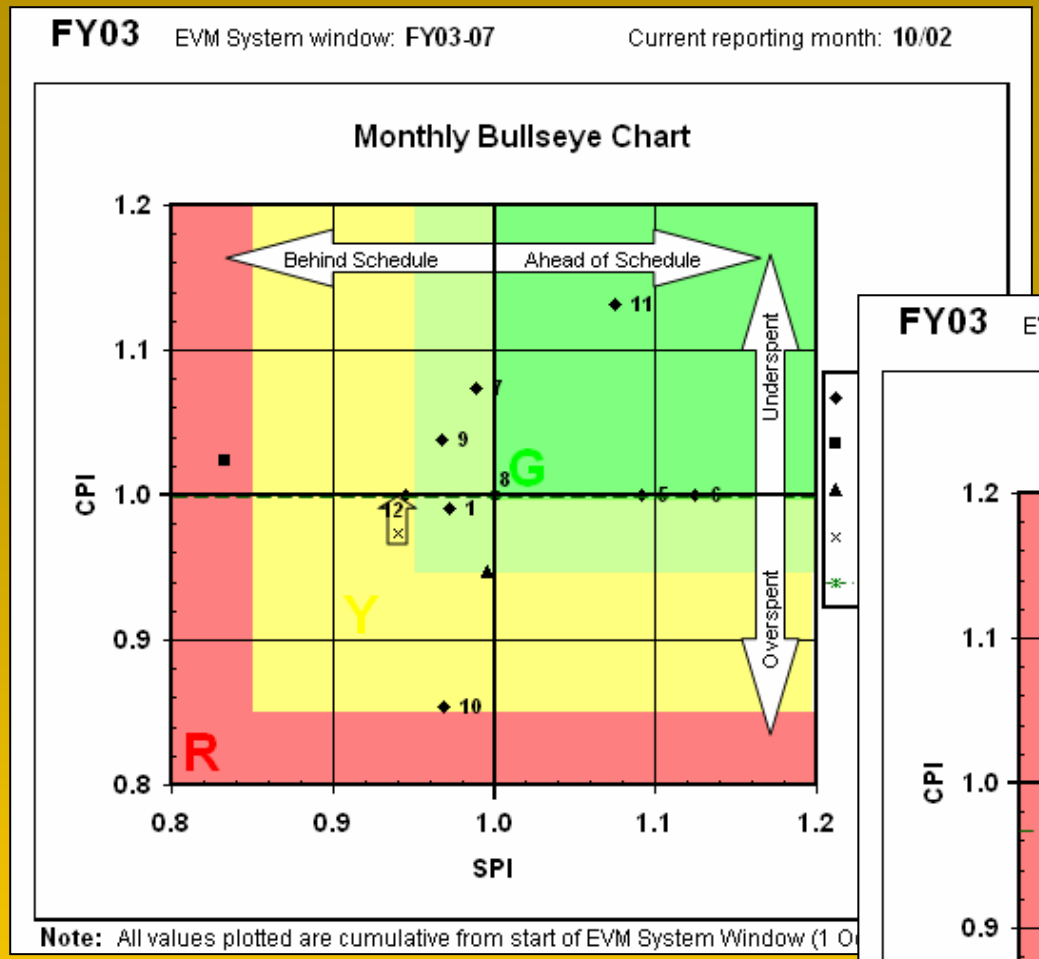


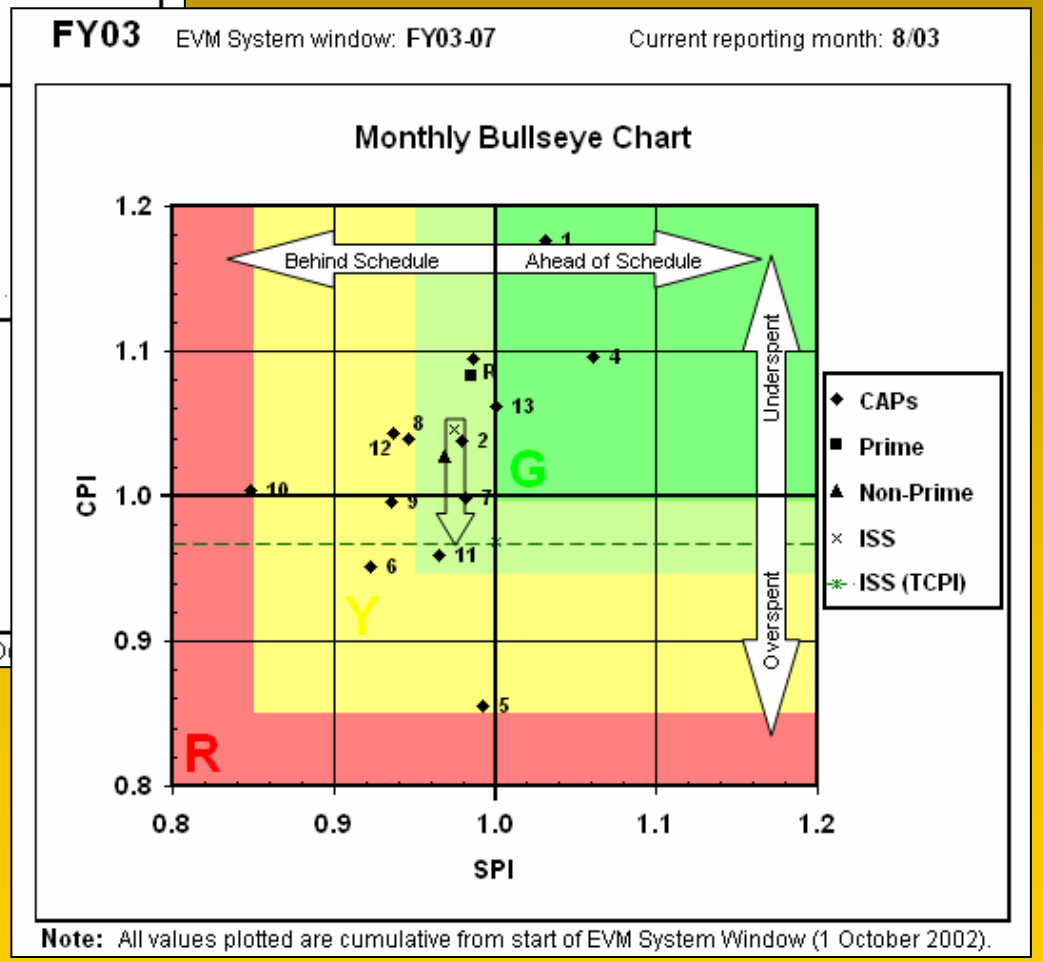
- $R_{Avg.}$ indicates the average radial distance from the ISS CPI/SPI aggregate point (✖) to any given CAP's CPI/SPI datum (♦)
- As ISS PMS/EVM system matures, the expected behavior is for $R_{Avg.}$ to decrease & asymptotically approach some finite (i.e., non-zero) value



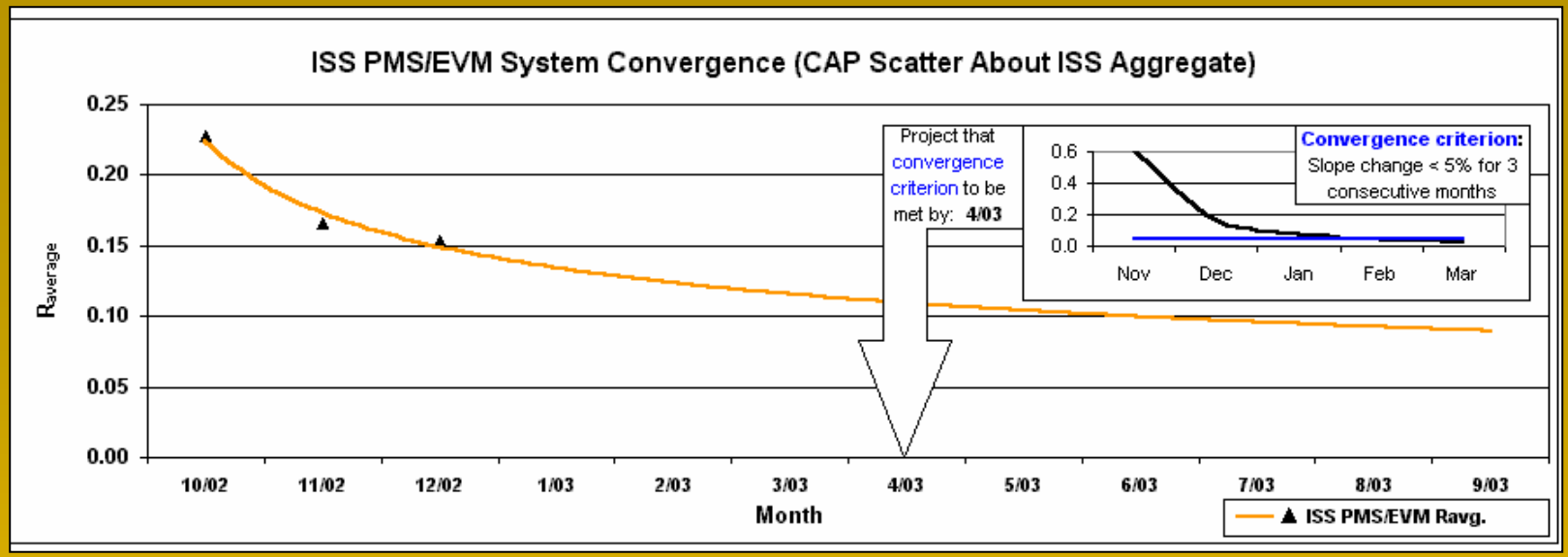
- $R_{Avg.}$ will always > zero since CAPs will always perform at different efficiencies/levels/etc. relative to each other
- Maturity criterion: $R_{Avg.}$ monthly rate of change is < 5% for 3 consecutive months

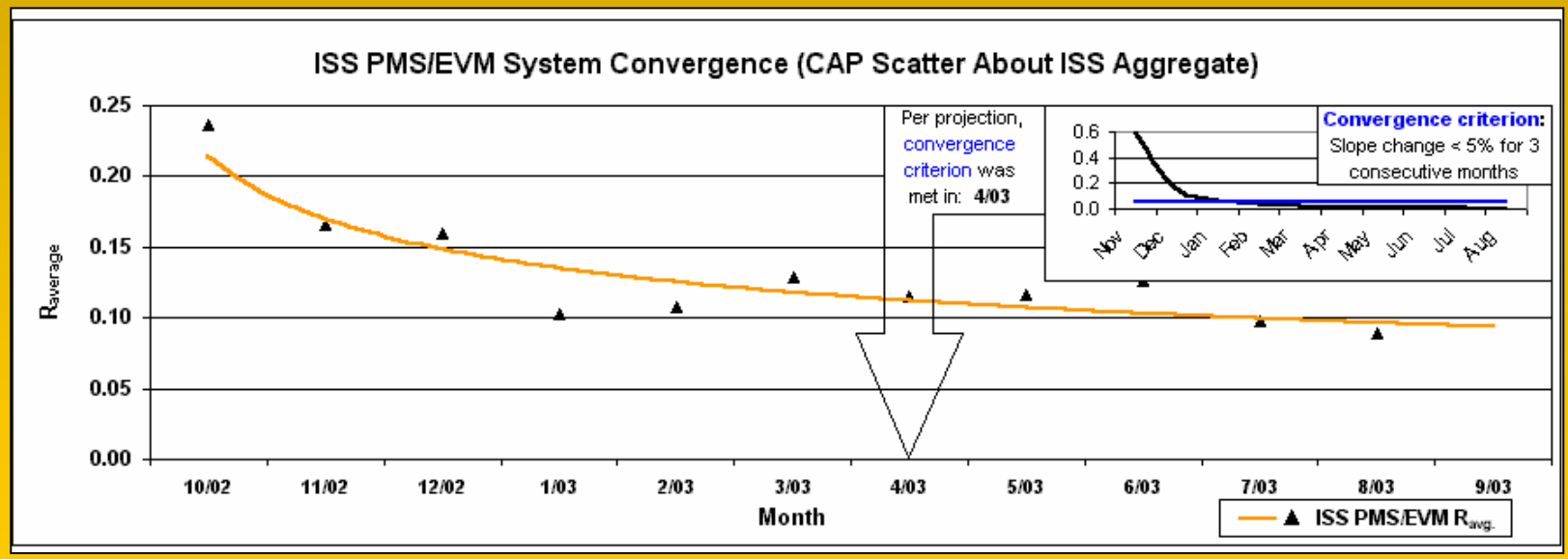
Quality Metric 1: CAP Scatter Convergence





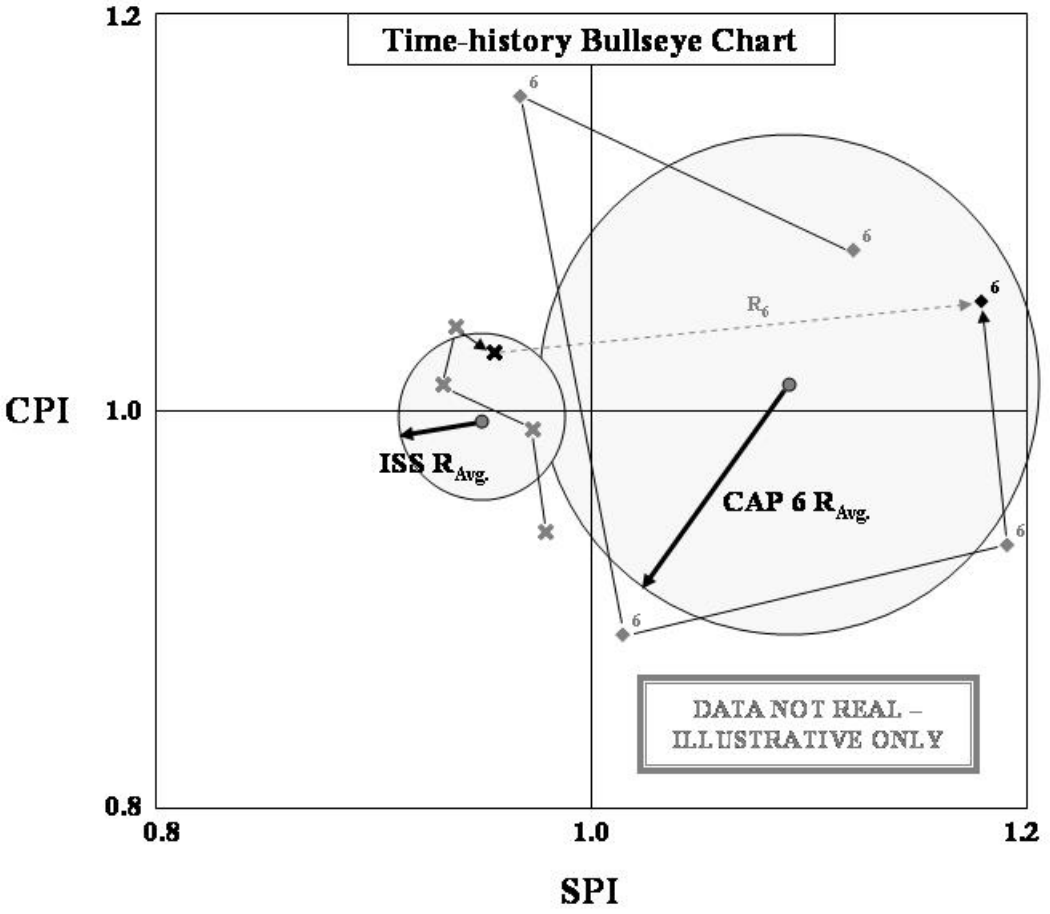
Quality Metric 1: Illustration



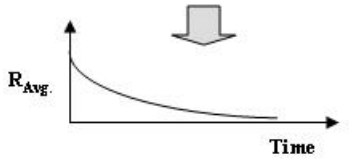


Quality Metric 1: Illustration

ISS PMS/EVM System Convergence Metric #2
(Time-history Scatter Convergence)

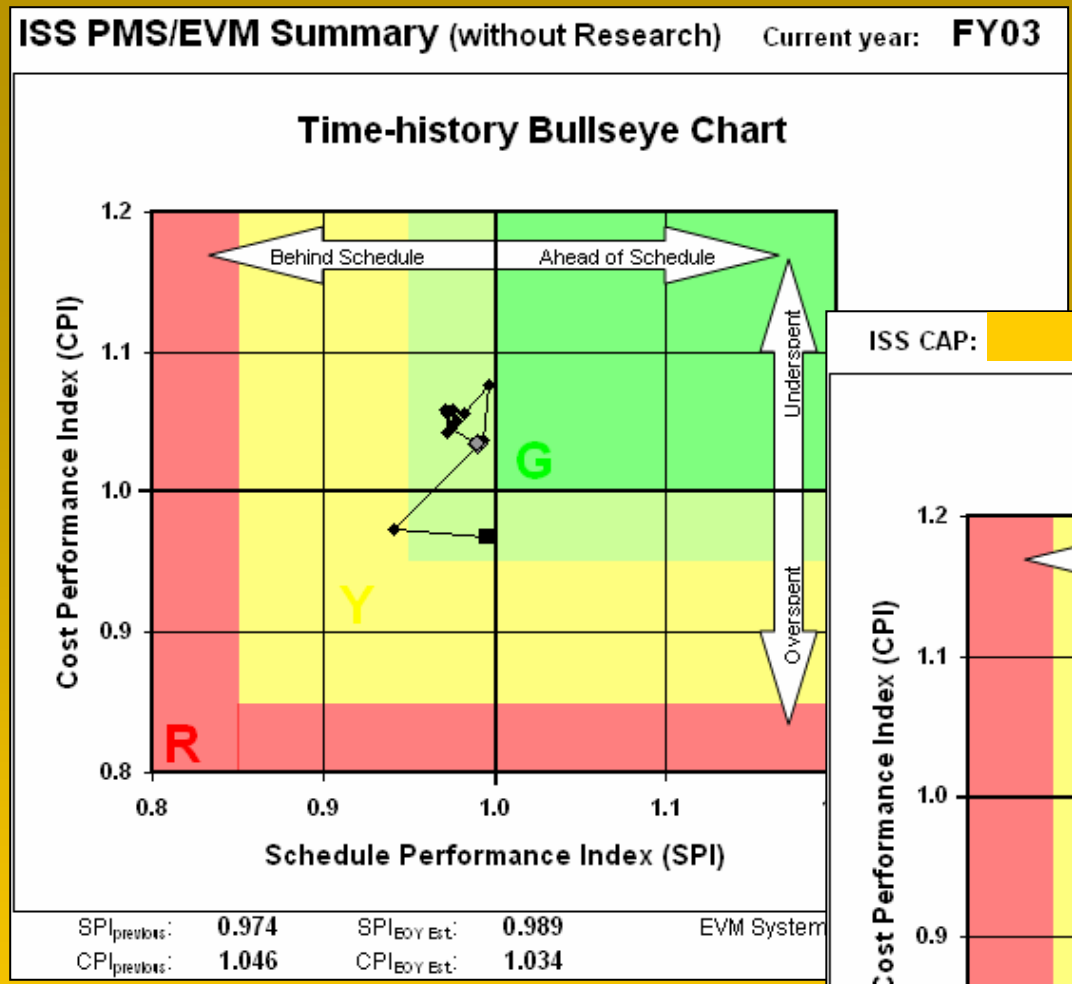


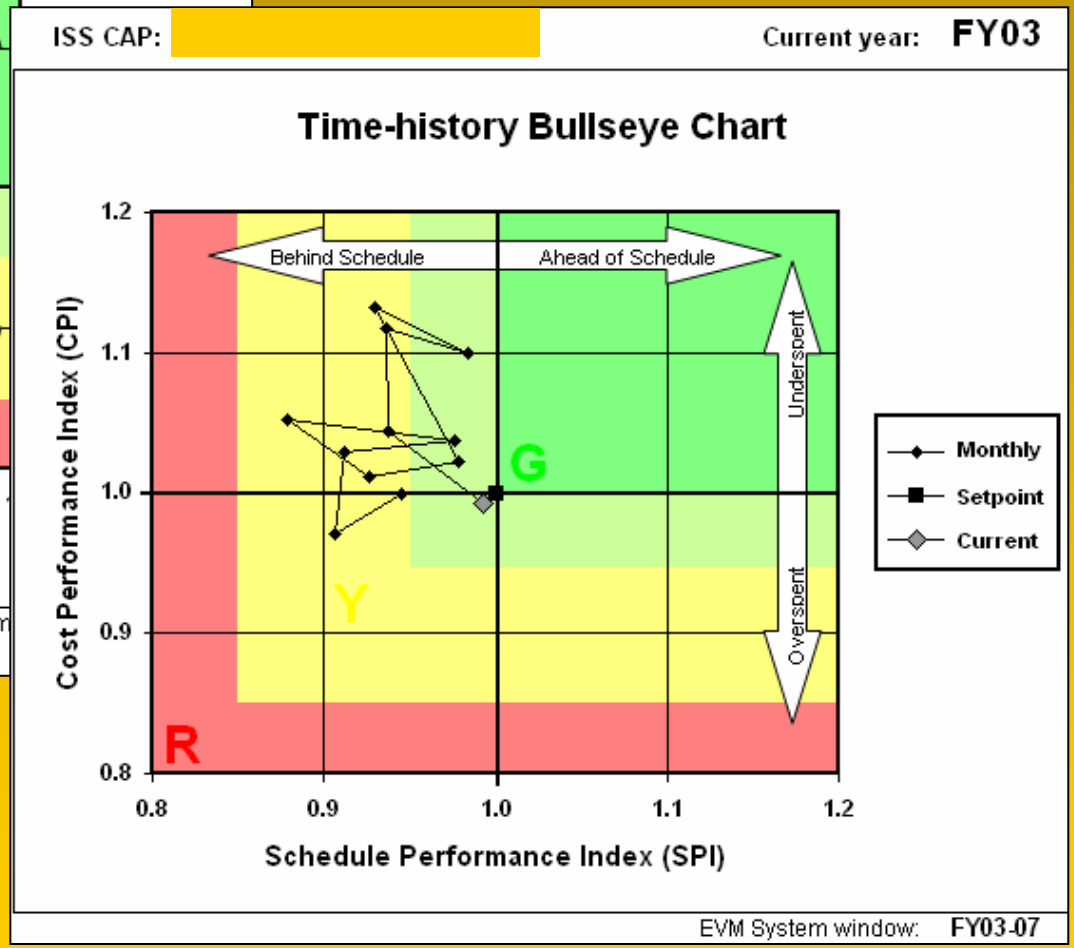
- As time progresses, the ISS CPI/SPI aggregate point (×) migrates, eventually settling down to its "true" value; the same holds for any CAP (◆)
- $R_{Avg.}$ (whether for CAPs or ISS aggregate) here measures average radial distance from centroid of CAP or ISS CPI/SPI time-history data (●) to any given CPI/SPI datum
- As ISS PMS/EVM system matures, the expected behavior is for $R_{Avg.}$ to decrease & asymptotically approach zero



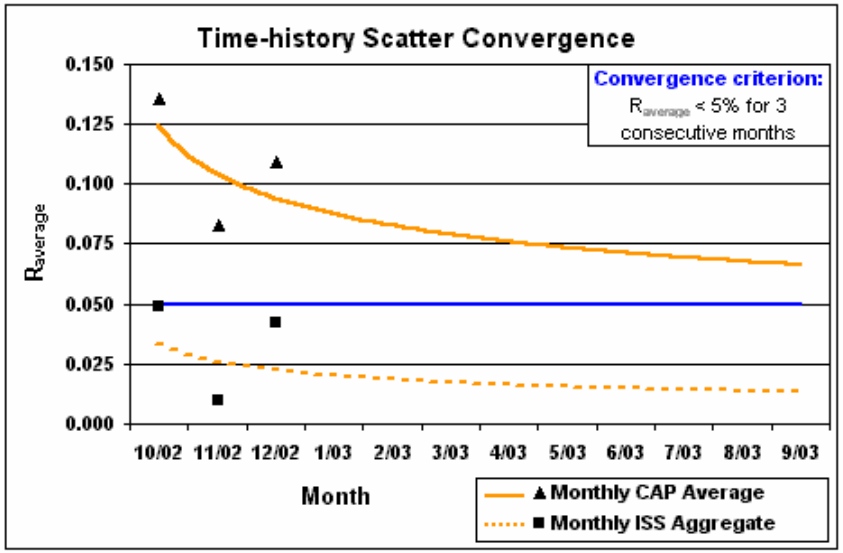
- Maturity criterion: $R_{Avg.}$ is < 5% for 3 consecutive months

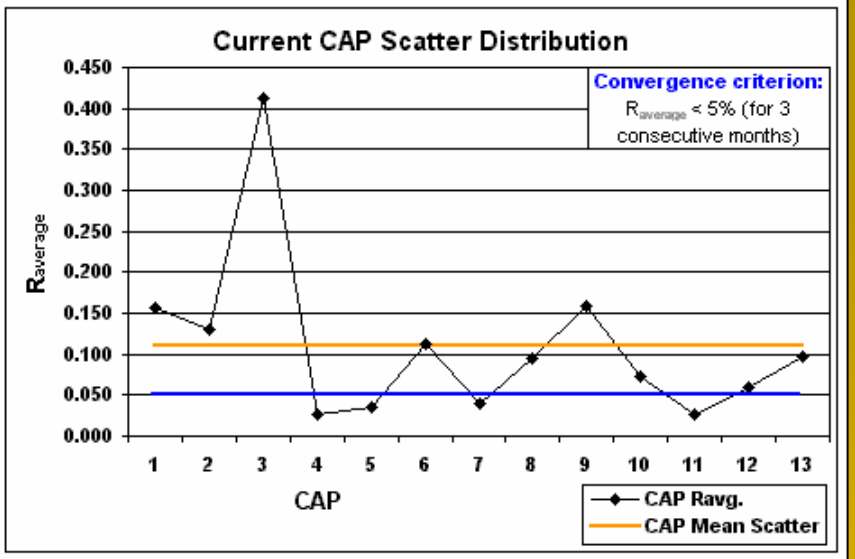
Quality Metric 2: Program, CAP Time-History Convergence

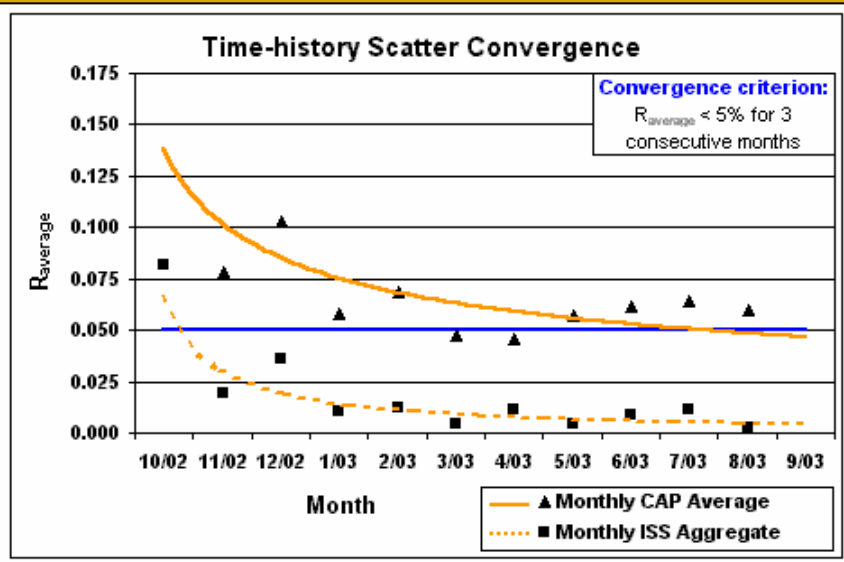


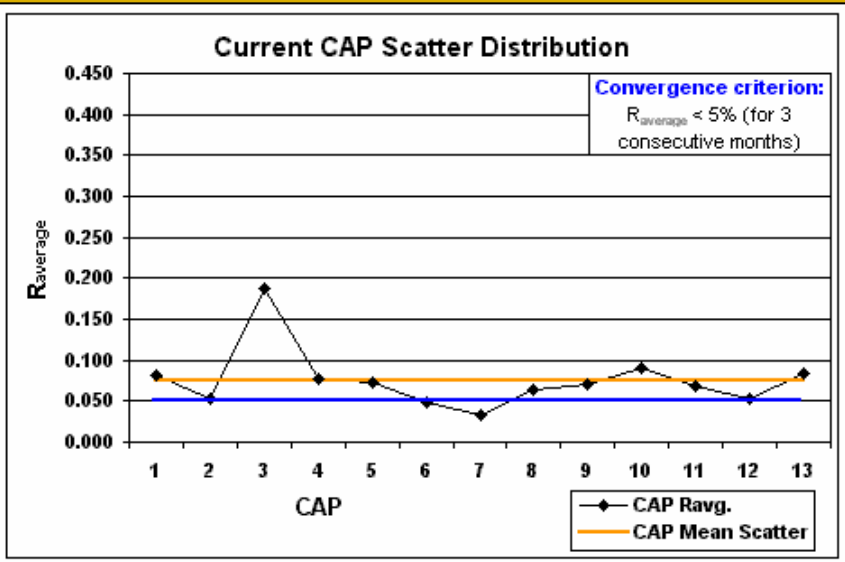


Quality Metric 2: Illustration

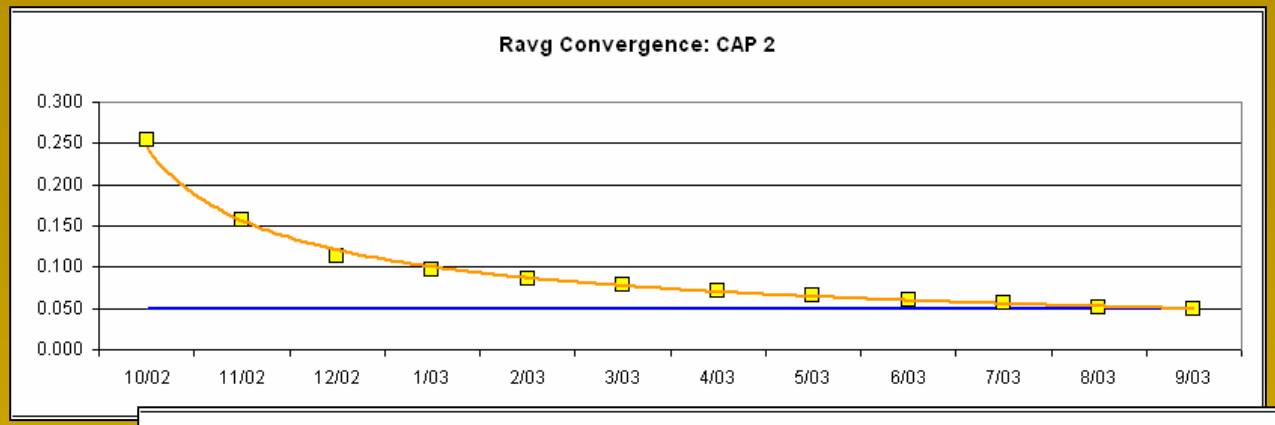


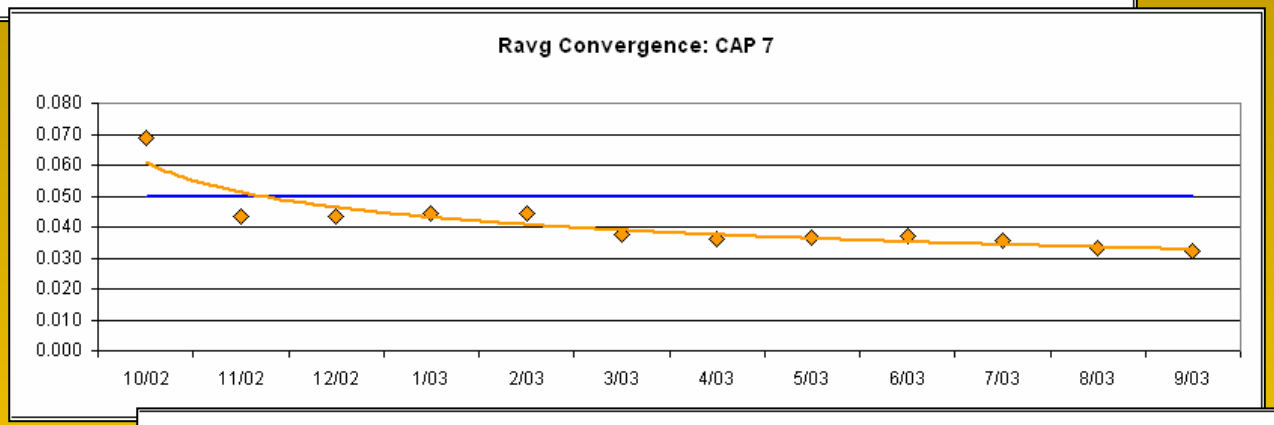


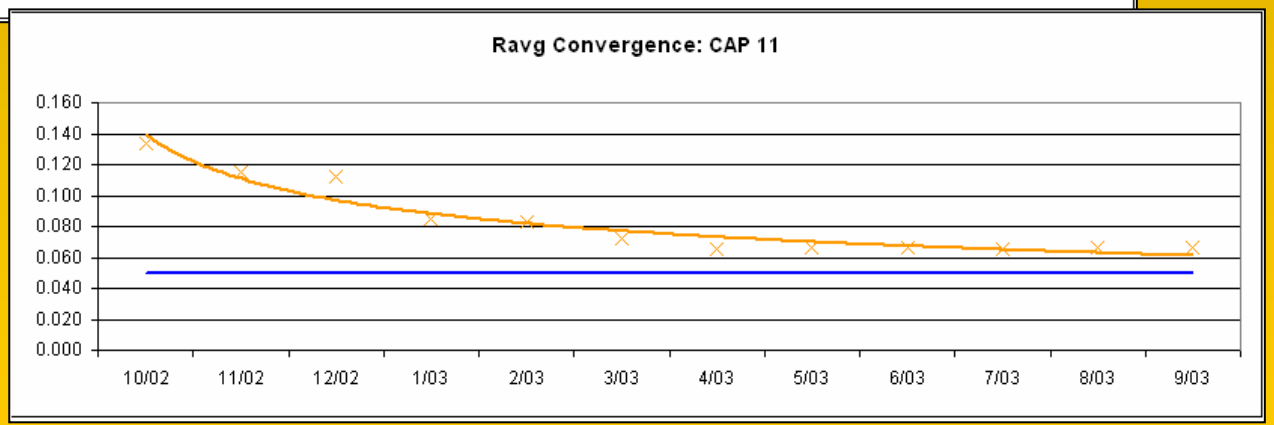




Quality Metric 2: Illustration







Quality Metric 2: Illustration

Current usage

- *MIS – Key Program Performance Indicator (KPPI)*
- *Early Warning System (EWS) – Assessment & Projections*
- *ISS Monthly Program Review (IMPR) – Status to PM*
- *Special assessments*

Evolving usage

- *Contractor award fee evaluation*
- *Underperformance threat – potential reserves impact assessment*

Enhancements in work / under consideration

- *Toolbox upgrade*
- *Multi-use resource-loaded schedules – automatic link*
- *Link to cost/schedule QRA tool*

Summary