

**Program Management Systems Committee  
Program Management Working Group (PMWG)  
Predictive Measures Guide**

**Bill Altman (Battelle)  
Sung Soon Stultz (Rockwell Collins)**

- **PMWG first deliverable**
- **Working Title: “A Guide to Using Predictive Measures to Effectively Manage Programs”**
- **Guide approach**
  - Use the ICPM Predictive Measures (2008) presentation as the basis
  - Update list of measures
  - Use Industry/Government practices, but
  - Don’t affiliate a measure with a contributor
  - Make sure measure is a predictor
  - Approach & strategy instead of program specifics



**STRENGTH THROUGH INDUSTRY & TECHNOLOGY**

*Industrial Committee on Program Management (ICPM)*

# **Predictive Measures of Program Performance**

**November 18, 2008**

# Charter & Objectives

- Common set of predictive measures for use by government and industry program managers to ensure program success
- Help contractors and their government counterparts predict program performance and understand root causes of performance
  - Predictive measures that cover the program's lifecycle from pre-award through contract close-out
  - Predictive measures that can be tailored to the contract characteristic, contract type, and phase of the program
- Recommend an NDIA standard for predictive metrics

# Selected Metrics

Metric Category	Selected Metrics
Program Cost & Schedule	Cost Performance Index Schedule Performance Index Cum CPI vs. $TCPI_{EAC}$ Baseline Execution Index Late/On-time Starts Trip Wire Metrics
Staffing & Critical Skills	Critical Skills Staffing Profile
Risk & Opportunity Management	Risk / Opportunity Summary Risk / Opportunity relative to Management Reserve
Requirements Stability & Completeness	Requirements Completeness Requirements Volatility TBD/TBR Burn down Requirements Traceability
Technical Performance Measures & Productivity Variance	TPM (Summary quick look) TPM (individual) – Linked in Backup TPM Progress/Regress Burn down Chart Defect Containment
Funding Stability & Contract Health	Program Funding Plan Program Funding Status Contract Change Volume
Supply Chain Performance	Parts Demand Fulfillment Supplier Acceptance Rate Supplier Late Starts
Resources	(In Development)

# METRIC DEFINITION

**Creation Date:** 09/19/08  
**Revision Date:**

<p><b>Metric Name:</b>  <b>Estimate at Completion (EAC) – Cum CPI vs. TCPI EAC</b></p> <table border="1"> <caption>Estimated Data from Chart</caption> <thead> <tr> <th>Months</th> <th>TCPI</th> <th>cum CPI</th> </tr> </thead> <tbody> <tr><td>1</td><td>1.01</td><td>0.97</td></tr> <tr><td>2</td><td>1.02</td><td>0.98</td></tr> <tr><td>3</td><td>1.03</td><td>0.96</td></tr> <tr><td>4</td><td>1.04</td><td>0.97</td></tr> <tr><td>5</td><td>1.05</td><td>0.99</td></tr> <tr><td>6</td><td>1.06</td><td>0.98</td></tr> <tr><td>7</td><td>1.07</td><td>1.00</td></tr> <tr><td>8</td><td>1.08</td><td>1.01</td></tr> <tr><td>9</td><td>1.09</td><td>1.00</td></tr> <tr><td>10</td><td>1.12</td><td>1.02</td></tr> <tr><td>11</td><td>1.13</td><td>1.01</td></tr> <tr><td>12</td><td>1.14</td><td>1.05</td></tr> </tbody> </table>	Months	TCPI	cum CPI	1	1.01	0.97	2	1.02	0.98	3	1.03	0.96	4	1.04	0.97	5	1.05	0.99	6	1.06	0.98	7	1.07	1.00	8	1.08	1.01	9	1.09	1.00	10	1.12	1.02	11	1.13	1.01	12	1.14	1.05	<p><b>Metric Backup</b></p> <p><b>Purpose of Chart:</b>          Measure the estimate of total cost for authorized work (EAC) including actual costs plus estimated costs to complete</p> <p><b>Deployment Criteria / Linkage:</b>          Commonly utilized program EAC measure.</p> <p><b>Source of Data:</b> Finance</p> <p><b>Benchmark/Comparative Data:</b>          None at this time</p> <p><b>Applicable Life Cycle Phase:</b>          All (Development, Production, Sustainment)</p> <p><b>Usage Assumption:</b>          EAC should be used in conjunction with other metrics: 1) schedule completion, 2) performance to date, 3) remaining work and its anticipated performance, 4) rates, 5) outstanding commitments, 6) approved and/or pending scope changes, 7) funding constraints, 8) subcontractor EACs, and 9) program risks and opportunities</p> <p><b>Predictive / Leading Qualities:</b>          When trended, provides a comparative analysis (objective indicator) of projected outcomes based upon actual performance</p> <p><b>Warning Signs &amp; Actions to Take:</b>          If cum CPI and TCPI EAC diverge, understand the differences; if not rationalized, take management reserve against EAC to align with cum CPI EAC.</p>
Months	TCPI	cum CPI																																						
1	1.01	0.97																																						
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12	1.14	1.05																																						
<p><b>Metric Definition:</b>          Compares cumulative CPI (realized performance) with the TCPI EAC (performance required to achieve the reported EAC). The degree of variation between the two indicates the extent to which future performance must differ from past performance.</p> <p>If Cum CPI-TCPI <math>\leq</math> (+/-) 2% TCPI condition is green. Indicates efficiency is as required.          If Cum CPI-TCPI <math>&gt;</math> (+/-) 2% and <math>\leq</math> (+/-) 5% TCPI condition is yellow. Indicates efficiency is out of tolerance.          If Cum CPI-TCPI <math>&gt;</math> (+/-) 5% TCPI condition is red. Indicates efficiency is out of tolerance.</p>																																								

# METRIC DEFINITION

Creation Date:

05/16/0

Metric Name:  
**Program Funding Plan**

8 **Metric Backup**

Purpose of Chart:  
 The Funding that was planned for the program versus the funding actually provided for contract performance

Deployment Criteria / Linkage:  
 NDIA Industry Standard Metric.

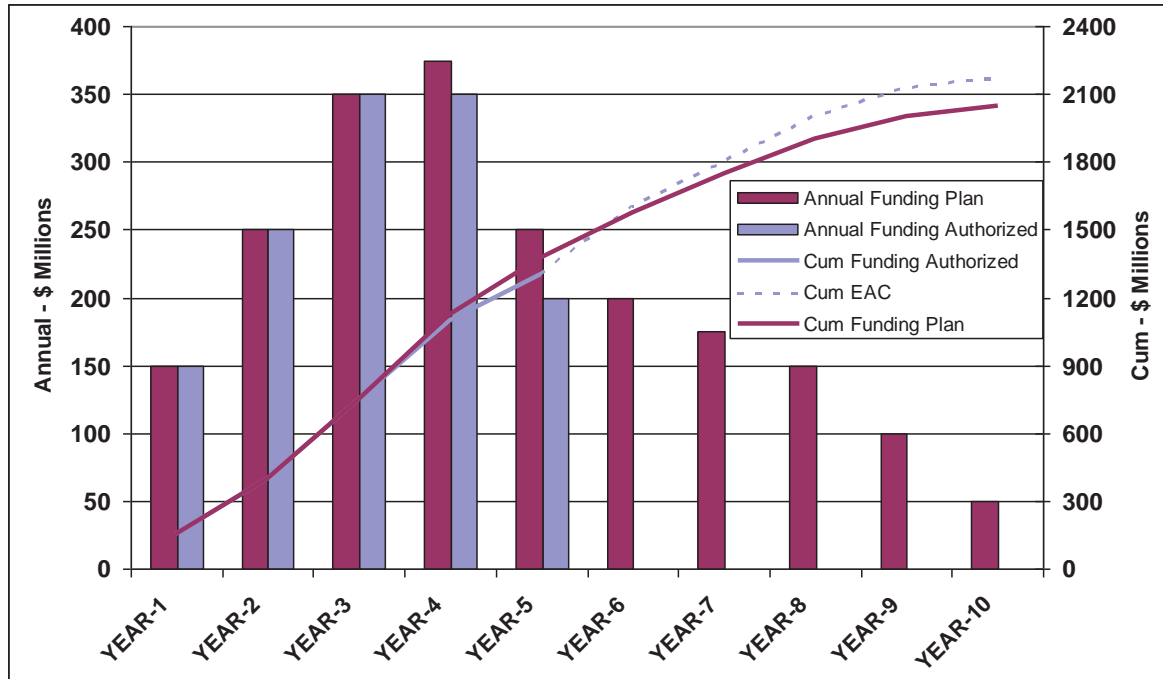
Source of Data:  
 Program Management, Program Control Finance

Benchmark/Comparative Data:  
 None at this time

Applicable Life Cycle Phase:  
 All (Development, Production, Sustainment)

Predictive / Leading Qualities:  
 When trended, indicates whether the contract is being funded as originally planned

Warning Signs & Actions to Take:  
 When actual funding is less than planned funding, work must be delay or deferred resulting in program disruption.



**Metric Definition:**

This metric measures the funding planned in the initial bid or current budget baseline and the actual funding authorized by the customer over the live of the program as well as the EAC implications for funding differences between funding planned and authorized. It is a measure of the funding stability on the program. The implications of underfunding situations should show up in the Earned Value metrics (CPI/SPI).

This metric is only valid for incrementally funded contracts and should not be used for fully funded programs or IDIQ type contracts that are funded by task/delivery order.

# METRIC DEFINITION

Creation Date: 9/15/08

<b>Metric Name:</b> <b>Risk Management Summary</b>								<b>Metric Backup</b> Purpose of Chart: Summarize risk posture of program  Deployment Criteria / Linkage: NDIA Industry Standard Metric.  Source of Data: Program risk management tool/process  Benchmark/Comparative Data: None at this time  Applicable Life Cycle Phase: All (Development, Production, Sustainment)  Usage Assumption:  Predictive / Leading Qualities: Status of potential risks and risk plan status  Warning Signs & Actions to Take: If Risk is red or yellow, review Risk Item Summary, current and past rating, Mitigation Plan details, and performance to plan . Focus on Red and Yellow risks and progress on mitigation plan. Specify cost, schedule, technical, or combined risk.																																																	
<table border="1"> <thead> <tr> <th>Risk No.</th> <th>OPR</th> <th>Risk Title</th> <th>Score</th> <th>L</th> <th>C</th> <th>Con Type</th> <th>Plan Status</th> </tr> </thead> <tbody> <tr> <td>172</td> <td>MSER</td> <td>Solar Array Rotary Joint</td> <td>R</td> <td>5</td> <td>3</td> <td>TSC</td> <td>G</td> </tr> <tr> <td>115</td> <td>BUSM</td> <td>Contract Closeout</td> <td>Y</td> <td>3</td> <td>3</td> <td>C</td> <td>R</td> </tr> <tr> <td>062</td> <td>SMP</td> <td>Program Sub-Contractor Integrated Close-out Costs</td> <td>Y</td> <td>5</td> <td>2</td> <td>C</td> <td>G</td> </tr> <tr> <td>111</td> <td>PO</td> <td>Flight Delays Result in Unplanned Costs</td> <td>Y</td> <td>3</td> <td>2</td> <td>CS</td> <td>R</td> </tr> <tr> <td>110</td> <td>A&amp;S/W</td> <td>Maintenance Of Non-Propulsive Control</td> <td>Y</td> <td>3</td> <td>2</td> <td>CS</td> <td>G</td> </tr> <tr> <td>192</td> <td>BUSM</td> <td>Staffing</td> <td>Y</td> <td>3</td> <td>2</td> <td>T</td> <td>R</td> </tr> </tbody> </table> <p><i>Current Plan Status:</i>                      Red = No plan or 1 month + behind schedule                      Yellow = Behind schedule or plan with less than 3 steps                      Green = 3 or more steps in the plan and is current.</p>	Risk No.	OPR	Risk Title	Score	L	C	Con Type	Plan Status	172	MSER	Solar Array Rotary Joint	R	5	3	TSC	G	115	BUSM	Contract Closeout	Y	3	3	C	R	062	SMP	Program Sub-Contractor Integrated Close-out Costs	Y	5	2	C	G	111	PO	Flight Delays Result in Unplanned Costs	Y	3	2	CS	R	110	A&S/W	Maintenance Of Non-Propulsive Control	Y	3	2	CS	G	192	BUSM	Staffing	Y	3	2	T	R	
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<b>Metric Definition:</b> The metric shows open program risks and their mitigation plan status.																																																									



## Intended Audience

*The intended audiences for this guide are organizations (government and industry) that are looking for standard approaches to manage programs. This guide is not intended to necessarily provide a new set of standards that would be required to assess program performance, but instead provide a “menu” of typical measures that could be applied. Each organization should decide which measures are most appropriate for their environment and select only those measures suitable for them.*

- Commonly used in ACQ phases (MSA, TD, EMD, PD, O&S)
- Metric Definition – *Not an Exhaustive Description*
- Calculations
- Output / Threshold
- Predictive Information – *Most Critical*
- Possible Questions – *what a PM or LM could ask*
- Caveats / Things to Watch For / Limitations / Cautions

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  - 5.4 **Schedule Margin Burn Down**
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  - 9.4 **Production Line of Balance**
- 10 **Rayleigh Estimator**
- 11 Contributors
- 12 References

**Appendix A: Predictive Measures Commonly Used in the DoD Acquisition Phases**

## Contributors

- **Bill Altman, Battelle**
- **Blake Crenshaw, Raytheon**
- **Renee R. Frazier, Rockwell Collins**
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- **Brad G. Temple, Rockwell Collins**
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- **Yancy Qualls, Bell Helicopter**

*Metrics not associated with contributor*



# Senior Reviewers

- **Ivan Bembers, NRO**
- **Tom Coonce, IDA**
- **Reginald Goodman, NAVAIR**
- **Gordon Kranz, PARCA**
- **Walter Lipke, AF (retired)**
- **Sandra Smalley, NASA Headquarters**

# Senior Reviewers Inputs

- **Very active / responsive / timely inputs by the Senior Reviewers**
- **Valuable insight and constructive comments**
  - Comments received on all chapters
  - e.g. Chapter 4 Staffing: Identified that the order of the discussion was confusing and specific comments on definitions
  - e.g. Trip wire discussions; merit of some of the “predictive measure” as a true “predictive” measure

# “Dispositioning” Reviewers

- **Bill Altman, Battelle**
- **Blake Crenshaw, Raytheon**
- **Charmaine Narciso-Jiao, SPAWAR**
- **Sung Soon Stultz, Rockwell Collins**
- **Stewart Tague, UTC Aerospace Systems**
- **Yancy Qualls, Bell Helicopter**

## Schedule

- |                                  |          |
|----------------------------------|----------|
| ✓ Announce Intent                | Feb 2013 |
| ✓ Develop Introduction & outline | Mar 2013 |
| ✓ First Draft                    | Aug 2013 |
| ✓ Second Draft                   | Oct 2013 |
| ✓ Senior Reviewers               | Nov 2013 |
| ✓ NDIA Workshop at IPMC          | Nov 2013 |
| • Submit to Board for comment    | Feb 2013 |
| • Submit to PMSC for comment     | Apr 2014 |
| • PMSC Comments Due              | May 2014 |
| • PMSC Approval                  | Aug 2014 |