



Industrial Committee on Program Management (ICPM)

Predictive Measures of Program Performance

February 6, 2008

Agenda

- Charter & Objective
- Definitions
- Concept of Operations
- Commonly Used Predictive Measures
- Applying Predictive Measures
- Recommendations

Charter & Objective – Program Measures & EVM

Charter

- Facilitate the use of predictive measures including earned value to ensure program success
- 2X per month (proposed)
- Six months (proposed)

Objective

- Communicate a set of predictive measures that will help contractors and their government counterparts predict program performance (early enough to make corrective action effective) 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 joint next steps

Members

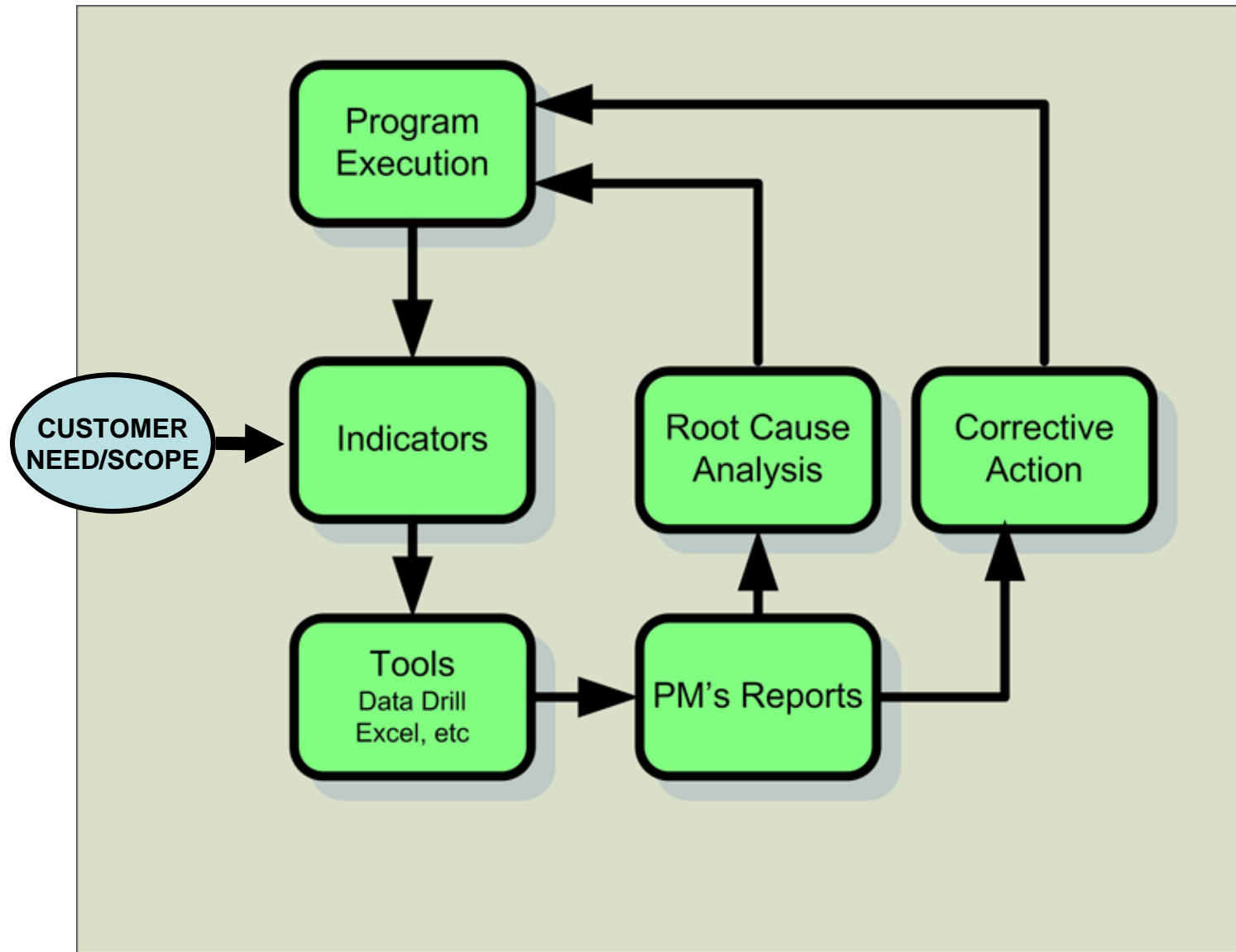
- BAE Systems
 - Battelle
 - Bell Helicopter
 - Boeing
 - Boeing
 - Honeywell
 - Honeywell
 - Lockheed Martin
 - Lockheed Martin
 - MCR
 - Northrop Grumman
 - Northrop Grumman
 - Raytheon
 - Rockwell Collins
 - SI International
- Susan Dong
 - Bill Altman
 - Bob Kenney
 - Steve Goo
 - Randy Steeno
 - Keith Munson
 - Tracie Thompson
 - Peter Wynne
 - Steve Stern
 - Neil Albert
 - Marilyn McAlice
 - Kevin Carpenter
 - Skip Burns
 - Ron Hornish
 - Bill Chadick

Definitions

- **Lagging** indicators are those measures that for the most part can be associated with previous event(s).
- A **Leading** indicator is an individual measure, or collection of measures, that are predictive of future system performance before the performance is realized.

Note: Lagging metrics can be used for predictions when trended.

Concept of Operations



Cost & Schedule Baseline Stability Measures

Baseline Stability affected by:

- **Program Authorization**
 - Work Description (BOE's), Product Description (WBS), Period of Performance, Team Assigned (OBS)
- **Technical parameters defined**
- **Schedule connectivity**
- **Change Control**
 - Baseline updates/re-plans
 - OTB's
 - Retroactive changes
- **Reorganizations**
 - Outsourcing/Insourcing
 - Challenge budgets/targets
 - Baseline movements
- **Management Reserve**
 - "Harvesting" opportunities
 - Funding scope/risk

Measures Volume and/or Tempo

Root Causes of Instability:

- **Contract Authorization**
 - UCA's, Partial Funding, T's&C's
- **Changes to requirements**
- **Change Board Activity**
- **PCO Direction**
- **Funding ability**
- **PM's managing the work and aligning the team/resources**
- **Risk & Opportunity Management**

Predictive Measures Affecting Stability

Commonly Measured Predictive Metrics

Metric Category	Examples
EVM Cost Performance	CPI vs TCPI
Estimate at Completion (EAC)	IEAC vs Program EAC
Staffing (Critical Skills)	Open Requisition/Aging, Fill Rate
Risks and Opportunities	Risk Burndown & Opportunity Capture integrated with MR; MR Burndown, %ETC, Risk Register
Schedule (IMS) Quality & Performance	SPI, BEI, CPLI, Float, Late Starts/Finishes
Requirements Definition & Stability	Added, Changed, Deleted Requirements, Volatility, Validation, TBD Burndown
Technical Performance Measures	SLAs, TPP, KPP
Contract Health	UCAs, Volume, Traffic, Requests, Funding Profile
Supply Chain Performance	Cost, Schedule, Quality, Delivery Performance, Process Compliance
30/60/90 Day Look Ahead	Significant Upcoming Milestones/Events Comparison
Top Issues & Action Items	Corrective / Preventive, Latency,
Product Quality	Defect Rate (Actual vs Predicted), Timeliness of delivery
Program Financial Summary	Billings, Expenditure Profile, Funding
Resources	Infrastructure, Availability of PP&E, GFE Availability & Quality
Customer Satisfaction	CPAR, BPAR, Award Fee, Survey
Productivity Variance	Plan vs Actual Component per Unit

Applying Predictive Measures

Metric Category	Phase				
	ACQ	Development	Production	Sustainment, OSM, Services	Modernization
EVM Cost Performance		✓	✓		✓
Estimate at Completion (EAC)		✓	✓	✓	✓
Staffing (Critical Skills)	✓	✓	✓	✓	✓
Risks and Opportunities	✓	✓	✓	✓	✓
Schedule (IMS) Quality & Performance	✓	✓	✓	✓	✓
Requirements Definition & Stability	✓	✓			✓
Technical Performance Measures		✓			✓
Contract Health		✓	✓	✓	✓
Supply Chain Performance	✓	✓	✓	✓	✓
30/60/90 Day Look Ahead		✓	✓	✓	✓
Top Issues & Action Items		✓	✓	✓	✓
Product Quality		✓	✓	✓	✓
Program Financial Summary		✓	✓	✓	✓
Resources		✓	✓	✓	✓
Customer Satisfaction		✓	✓	✓	✓
Productivity Variance		✓	✓	✓	✓

Recommendations

- Collaborate across industry and Government
 - Select team members from Government and industry
 - Create common definitions for a set of leading indicators
 - Provide documented guidance

Leading Program Indicators used at Raytheon Company - Examples

Gate Review Process Discipline

Gate Reviews	System Function Review	Prelim Design Review	Critical Design Review	Test Readiness Review
→				
Was gate review planned, held & with follow up?				

Cost & Schedule Trends

Earned Value Management System

	May 07	Jun 07	Jul 07	Aug 07	Sep 07
CPI					
SPI					
TCPI					

} Specific Criteria

Requirements volatility by phase

Requirements changes from out of phase defects

Development Phase	System Design	Product Design	Product Implem't	Product IV & V	System IV & V
→					
> = < Threshold					

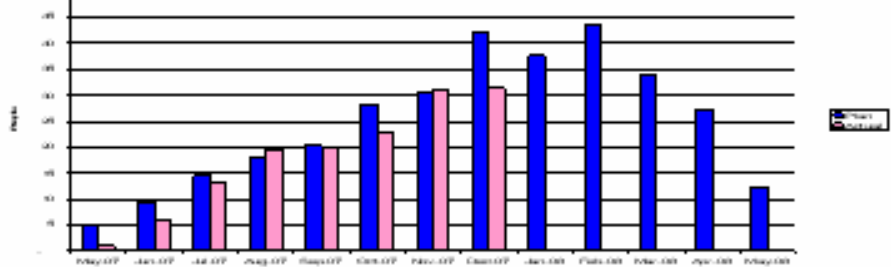
Elevated Program Risk Criteria

"Watch List" Program for greater oversight, e.g.

- ❖ Priced production options in development Contract
- ❖ Multiple program rebaselines
- ❖ Degrading earned Value
- ❖ Overage undefinitized contract actions

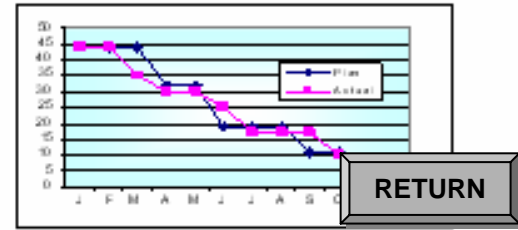
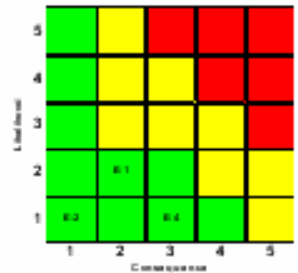
Program Staffing

Plan versus Actual

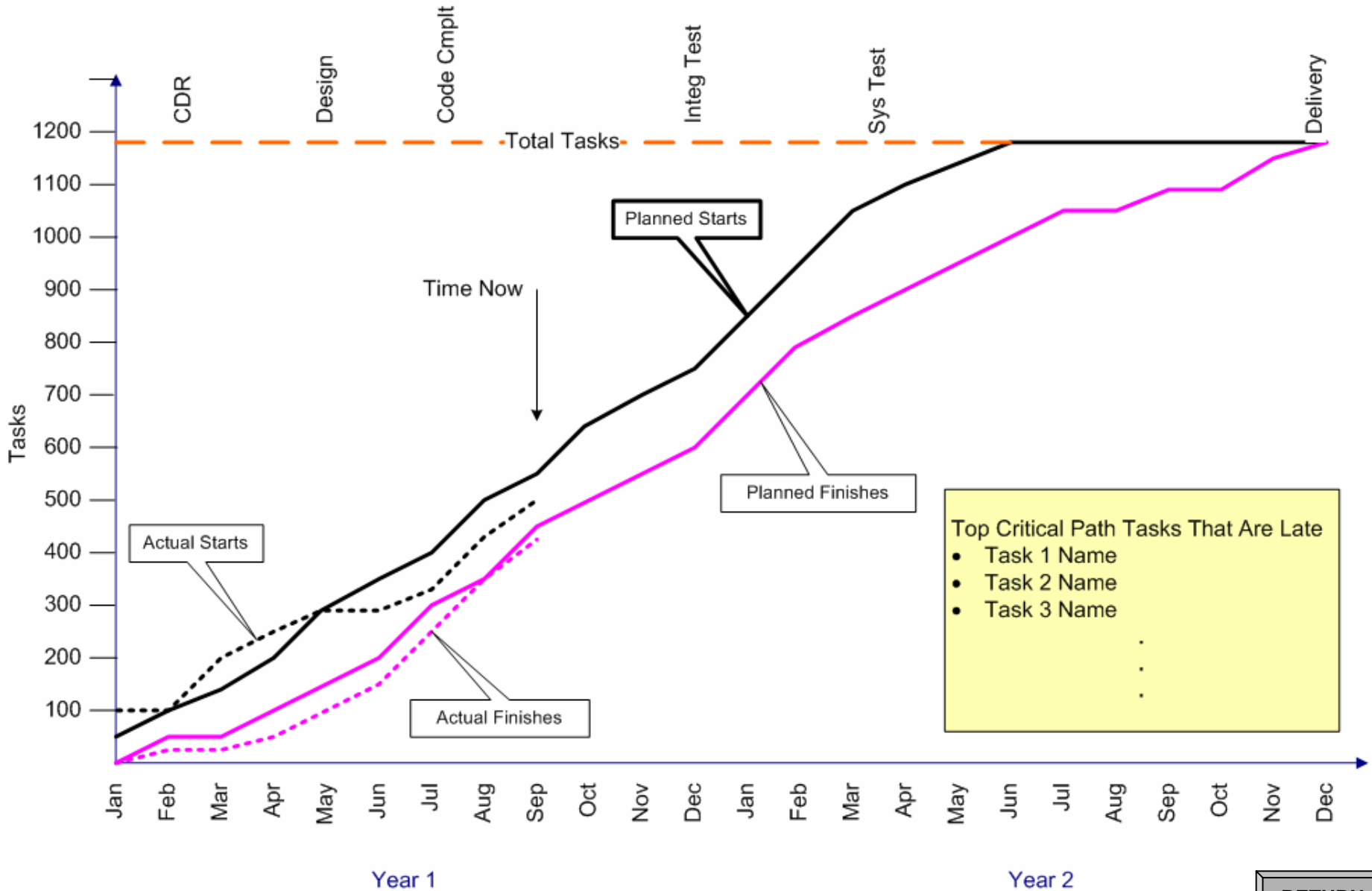


Risk & Opportunity Management

Top Risks and Mitigation Progress



Late Starts / Late Finishes



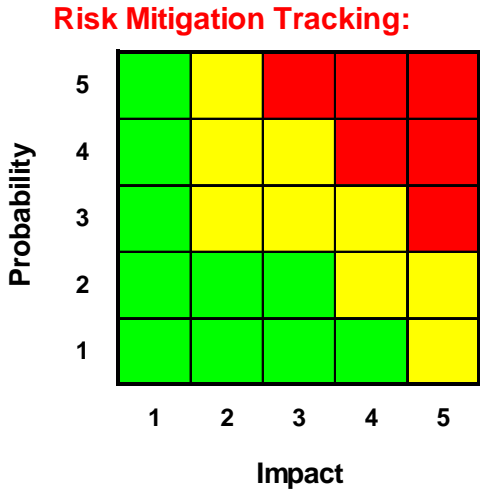
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<<Program Name>> Risk Management Worksheet

Risk ID#:	Risk Statement:				
Date Risk Identified:		Risk Originator:			
Risk Type:	Technical <input type="checkbox"/>	Cost <input type="checkbox"/>	Schedule <input type="checkbox"/>	Risk Action:	Risk Assigned to:
				Accept <input type="checkbox"/>	Watch <input type="checkbox"/>
				Mitigate <input type="checkbox"/>	

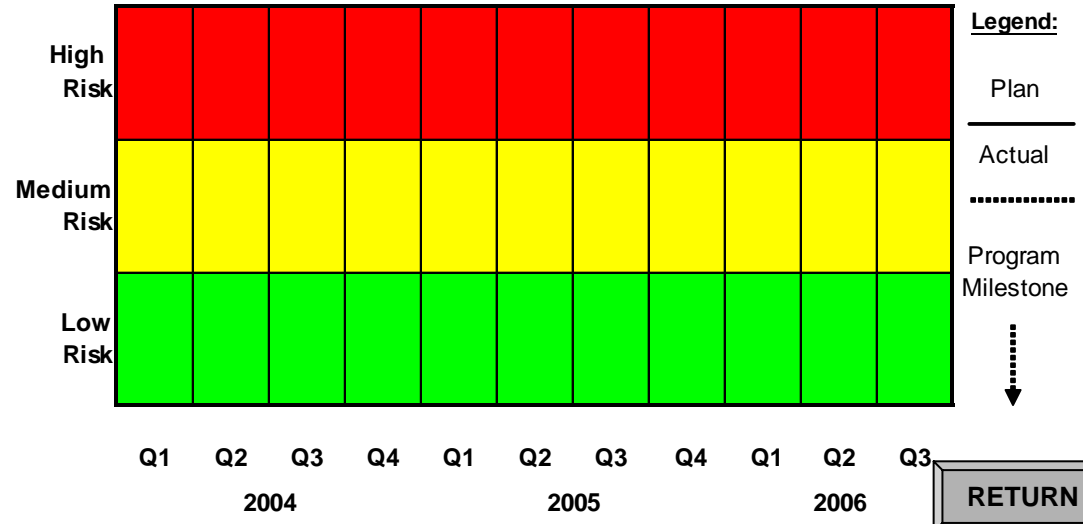
Mitigation Strategy:
Mitigation Completion Metric:

Mitigation Plan:		Milestone Dates		
#	Mitigation & Critical Program Milestone Descriptions	Due	Completed	Status Description



Legend:

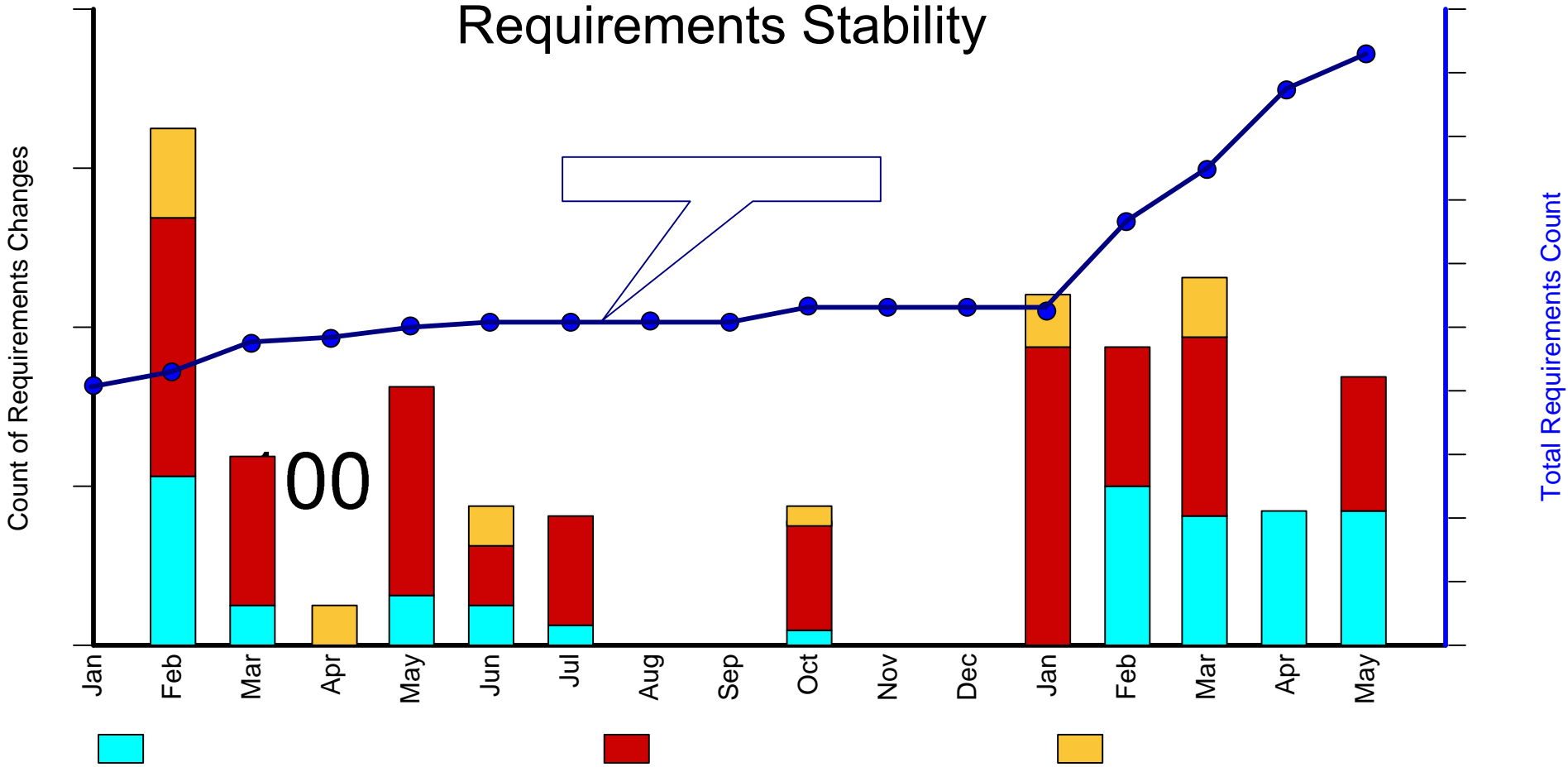
- X Start
- 1P Plan
- 1A Actual



RETURN



Requirements Stability



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Key Supplier Status

SAMPLE PROGRAM SUPPLIER STOPLIGHT SUMMARY

3/2/2006

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Trend Line Legend

No change	Better	Worse
→	↑	↓

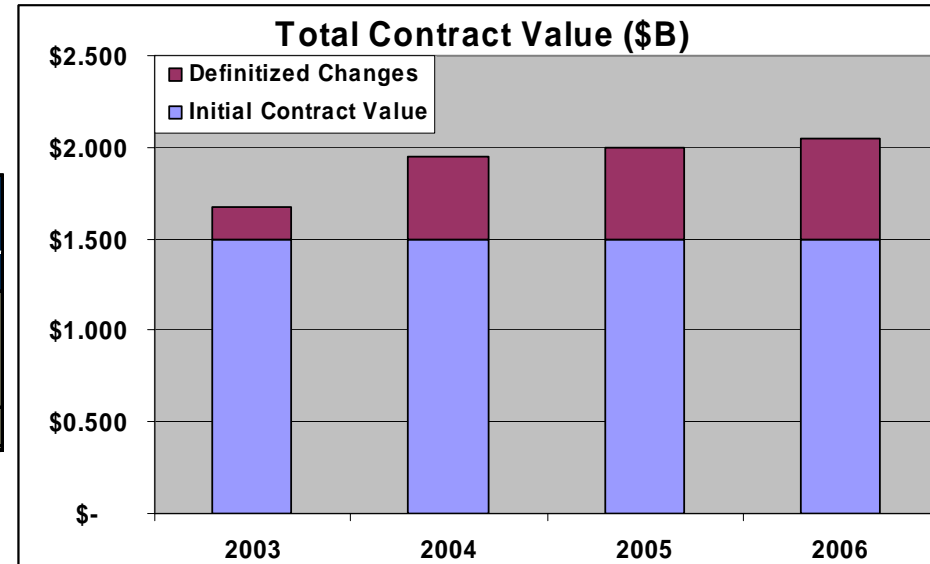
SUBCONTRACTOR	EFFORT	Cost	Schedule	Technical	Quality	Mgmt	SPMS Quality	SPMS Delivery	Comments (Y & R)
Supplier	Deliverable Description	G →	G →	Y →	G →	G →	Gold (100%)	Gold (100%)	Late submittal of Stress Data
Supplier	Deliverable Description	G →	G →	Y →	Y →	G →	Silver (99.9%)	Red (50.4%)	Concern about Equip LRU deliveries
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Red (84.7%)	Late deliveries for SIU
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Gold (100%)	
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Bronze (96.3%)	
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Silver (98.8%)	Red (90.4%)	Wichita performancce is gold/gold
Supplier	Deliverable Description	Click on metric for Excel Worksheet							
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Red (60.7%)	Honeywell has contested red rating.
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Gold (100%)	
Supplier	Deliverable Description	Click on metric for Excel Worksheet							
Supplier	Deliverable Description	G →	G →	→	G →	G →	Silver (98.1%)	Silver (99.6%)	Quality Issue
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Red (92.5%)	Late WHA deliveries
Supplier	Deliverable Description	G →	G →	G →	G →	G →	Gold (100%)	Red (90.0%)	Late panel d
Supplier	Deliverable Description	G →	G →	→	G →	G →	Bronze (96.2%)	Red (79.6%)	Nutplate hol on a delivered part. Late

RETURN

Contract Health – Change Volume

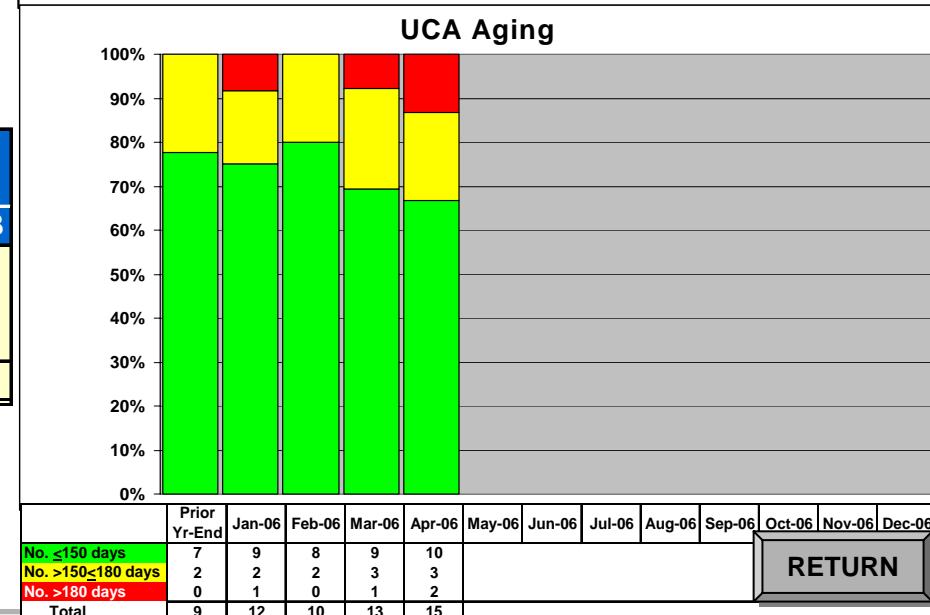
Unauthorized Change Proposals

\$ in Millions	At Prior Year End		Current Period		
	No.	Value	No.	Value	CCB
Proposals In-Process	2	\$ 40	2	\$ 60	1
Proposals Submitted	1	\$ 25	4	\$ 135	4
Negotiated/Pending Definitization	1	\$ 50	1	\$ 10	1
Total Unauthorized Undefined	4	\$ 115	7	\$ 205	6



Undefined Contract Actions (UCAs)

\$ in Millions	At Prior Year End		Current Period		
	No.	Value	No.	Value	CCB
Proposals In-Process	5	\$ 175	1	\$ 25	-
Proposals Submitted	3	\$ 75	9	\$ 125	9
Negotiated/Pending Definitization	1	\$ 35	5	\$ 200	5
Total Authorized Undefined	9	\$ 285	15	\$ 350	14

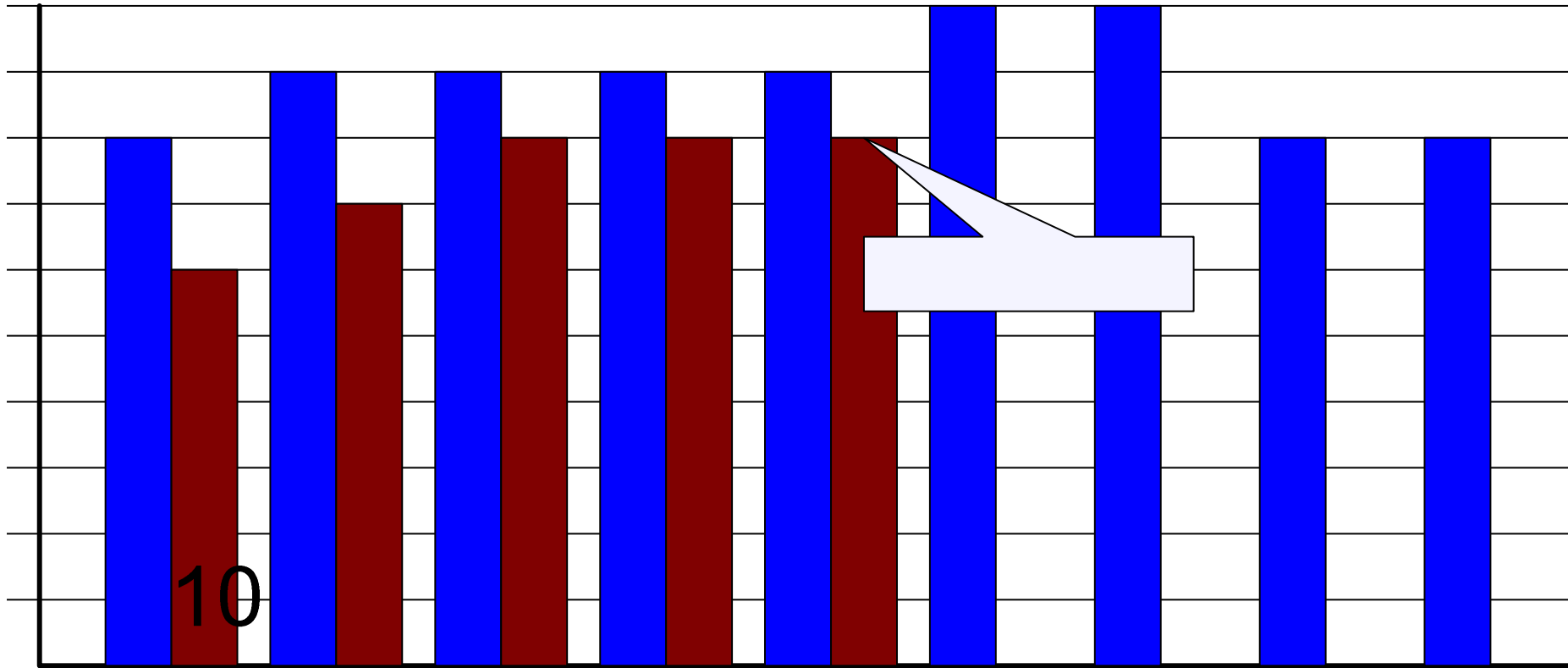


Click this table for Excel worksheet for all four panels of chart

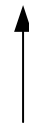
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Critical Staffing Position Closure



■ 9
■ 8



Form with two input fields and a RETURN button.

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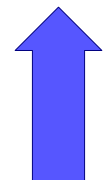
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Technical Performance Measures (TPMs)

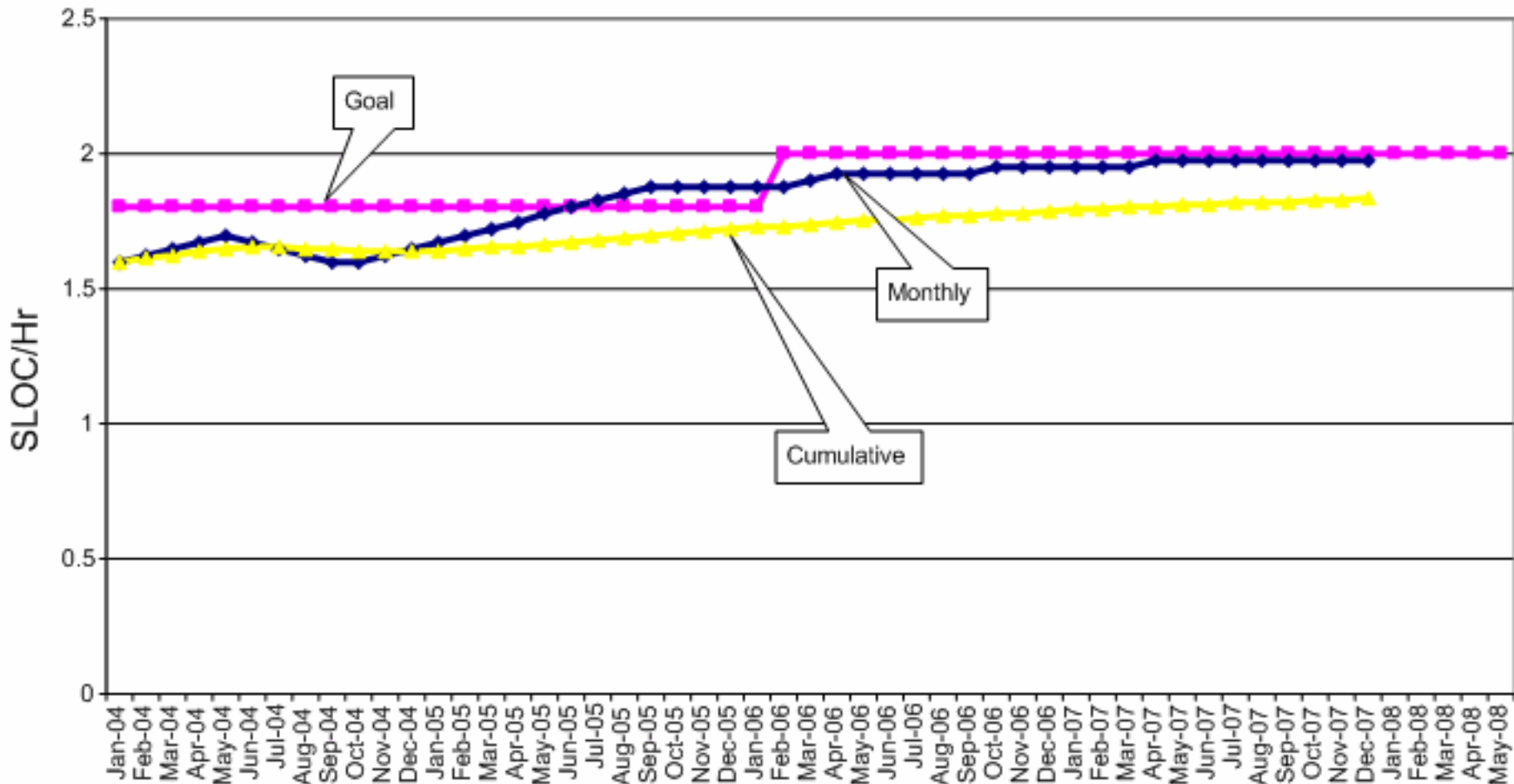
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
TPM1	G	G	G	G	Y	Y	Y	G	G	G
TPM2	G	G	G	G	R	R	R	R	Y	Y
TPM3	G	G	G	G	G	G	G	G	G	G
TPM4	G	Y	Y	Y	G	G	G	G	G	G
TPM5	Y	Y	Y	Y	Y	Y	Y	G	G	G
TPM6	G	R	R	R	Y	G	G	G	G	G
TPM7	G	G	G	G	G	Y	Y	Y	Y	G



Time Now

RETURN

Productivity Variance



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Metrics Test / Demonstration Charts

Integrated Schedule 60/90 Day Lookahead Gantt Chart (.JPG images) All Schedule Tasks
Team 00000: AIR SYSTEM

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3/12/02

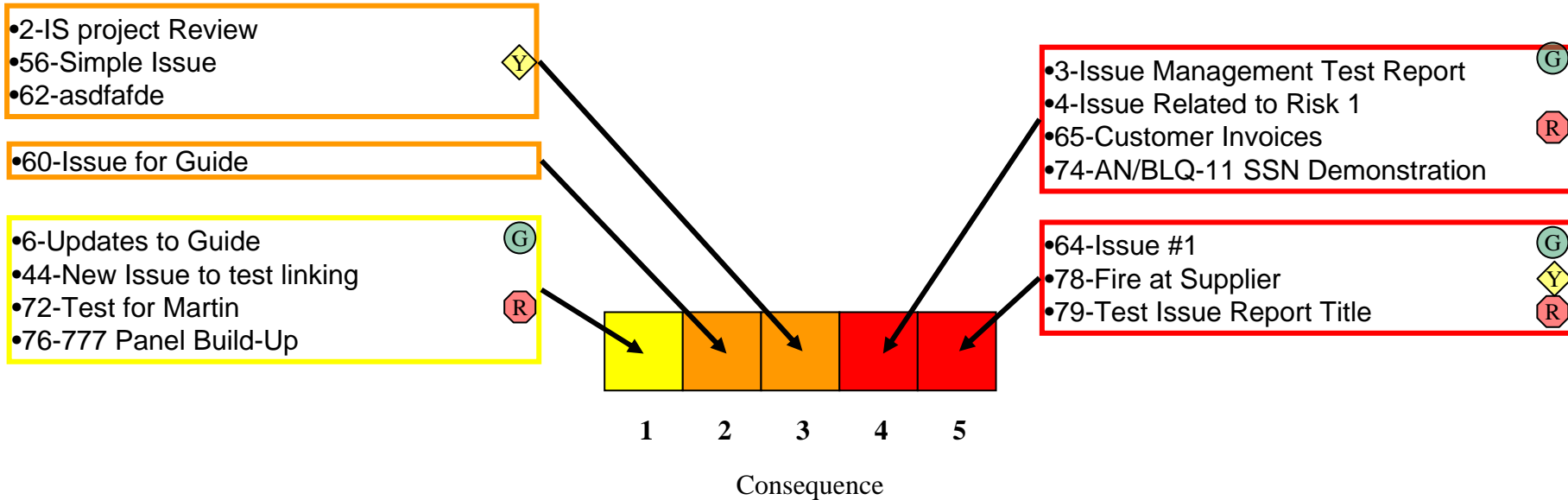
Trend		Task	RAA	BAC	SV	2002				
						F	M	A	M	J
➔	CP	RWR SW Requirements	Gardiner	210	-32	Complete on plan?				
➔		A/C Cable	Elhoffer	501	98	Complete early?				
⬆		RFCM Rqmt Defination	Elhoffer	288	104					
➔		Mux Bus Rqmts	Piwowarski	585	0	Why change in duration?				
⬇	CP	RFCM System Dsn Req	Byington	944	-125					
⬇	CP	RFTF Prel Design	Andert	554	-48					
⬇		RF Compatibility Risk	Andert	650	-100					
➔		Support RFCM SW Rqmts	Gardiner	832	0	Completion estimate valid?				
➔	CP	EIBU Req Definition 2	Kirchner	811	0	Impact to float?				
➔		Fiber Chnl Rqmts	Kirchner	593	0					
⬇		EIBU ICD Final	Tiemann	811	0					
➔		RFCM SW Requirements	Tiemann	27	0					
➔		RFTF Detail Design	Gardiner	554	0					
➔		A/C Drawings - EW	Gardiner	810	0					
➔		RFCM ICD Intermediate	Gardiner	648	0					

Contact

BAC (Budget at Complete) and SV (Schedule Variance) are reported in hours

RETURN

Top Issues



Resolution Plan Status

- On Plan (G)
- Marginally off plan (Y)
- Significantly off plan (R)

- High (Red)
- Moderate (Orange)
- Low (Yellow)

RETURN

Financial Summary

	Year to date - Mar 2006		Year end 2006		
	Actuals	B/(W)	Fcst	B/(W)	
		Plan		Prior	Plan
Orders	\$ 2,736	\$ 1,499	\$ 9,820	\$ 309	\$ 32
Revenue	3,073	(152)	11,575	225	(710)
Operating Earnings	410	132	945	162	(39)
Operating Margins	13.3%	4.7 pts	8.2%	0.6 pts	0.2 pts
Economic Profit	140	97	101	105	1
Operating Cash Flow	462	(128)	861	-	201
Net Assets	4,768	359	4,768	(43)	359
After Tax RONA	11.4%	(1.0) pts	12.5%	2.1 pts	0.1 pts
IR&D / B&P	50.2	-	233.9	-	(2)

Note: \$ in Ms

B > 117% of plan
 G 100%-117% to plan
 Y 95.1%-99.9% to plan
 R ≤ 95% to plan

RETURN

Official Performance Assessment Report February 2006

					Technical	Product Performance	Systems Engineering	Software Engineering	Logistics	Product Assurance	Other Technical	Schedule	Cost Control	Management	Management Responsiveness	Subcontract Management	Prog. Control & Other Management	Other Areas
Contract Description	Program Manager	Assess Date	Period of Performance	Next PAR														
Program Name																		
Contract #1	J. Doe	May-05	Apr-04-Apr-05	May-06	3				3		4	4	4	4	4	3	4	
Contract #2	J. Doe	May-05	Apr-04-Apr-05	May-06	3				3		4	4	4	4	4	3	4	
Contract #3	J. Doe	Jan-06	Dec-04-Dec-05	Jan-07	3	3	3	4	4	3	5	3	3	4	5	3	3	
Contract #4	J. Doe	Jul-05	Jun-04-Jun-05	Jul-06	5	3	3			3	3	4	4	3	4	3	4	
Contract #5	M. Smith	Jul-05	Jun-04-Jun-05	Jul-06	3	2	4			3	3	3	3	4	3	3	4	

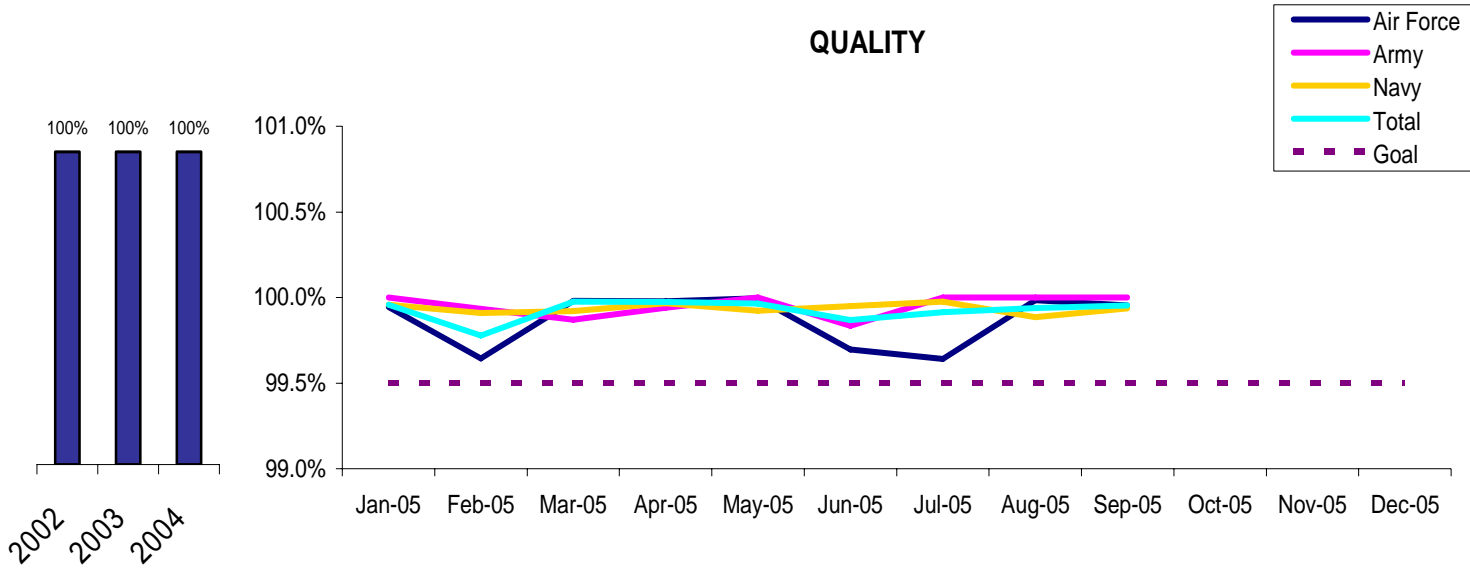
5 Exceptional
 4 Very Good
 3 Satisfactory
 2 Marginal
 1 Unsatisfactory
 N/A

Program Scores	Actual	Forecast
Total Program	3.5	3.5

 = 4.3 to 5.0 score
 = 2.8 to 4.2 score
 = 1.2 to 2.7 score
 = < 1.2 score

RETURN

QUALITY



	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	Nov-05	Dec-05	YTD
Air Force	99.944%	99.643%	99.981%	99.979%	99.996%	99.697%	99.641%	99.985%	99.954%				99.939%
Army	100.000%	99.933%	99.871%	99.941%	100.000%	99.835%	100.000%	100.000%	100.000%				99.992%
Navy	99.958%	99.909%	99.920%	99.966%	99.924%	99.950%	99.975%	99.885%	99.936%				99.944%
Total	99.958%	99.778%	99.975%	99.973%	99.964%	99.868%	99.915%	99.939%	99.954%				99.945%

RETURN

Working Capital							
	February				Q1		
	Plan	Actual/Est	Delta		Plan	Actual/Est	Delta
Billed Sales	200,000	2	(199,998)		600,000	6	(599,994)
Unbilled Sales	20,000	20	(19,980)		90,000	60	(89,940)
Gross Inventory	200	200	-		600	60	(540)
Advanced Payments	(2,000)	(20)	1,980		(6,000)	(60)	5,940
Total WC	218,200	202	(217,998)		684,600	66	(684,534)
WC Percentage	21.8%	18.4%			22.8%	2.0%	

Working Capital - Risks & Opportunities						
Category	Actionee	Prob %	Gross	Net	Due Date	Action
Billed Sales	Pat S.	80.0%	500,000	400,000	3/1/08	Complete milestone and generate invoice
Gross Inventory	Chuck	85.0%	500	425	3/24/08	Receive/stock material for making cookies
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
			Net Risk/Opps	400,425		
			Estimate	400,491		
				12136%		

