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DEFINING THE FUTURE

Integrated Management Operating Model

Processes, Tools, Rhythm, EV Forecasting

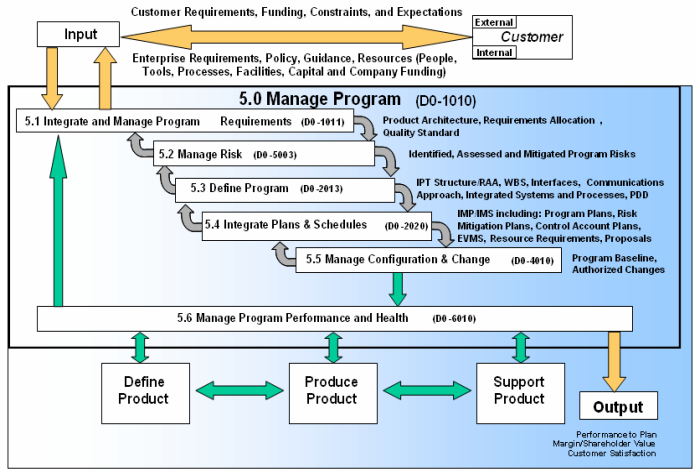
Mr. Douglas J. Shaffer
Director, Program Integration and SEIT
Northrop Grumman ISER
douglas.shaffer@ngc.com
516-575-9928

Agenda

- iMOM - What Is It?
- Case Study - What Has iMOM Done For AHE (ACAT 1D Program)?
- Earned Value and Management Reserve Forecasting
  - What Is EV Forecasting?
  - EV Forecasting Process
  - Management Reserve Forecasting
    - Risk And Opportunity Consequence Management
  - Billing Forecast

Integrated Management Operating Model – What Is It?

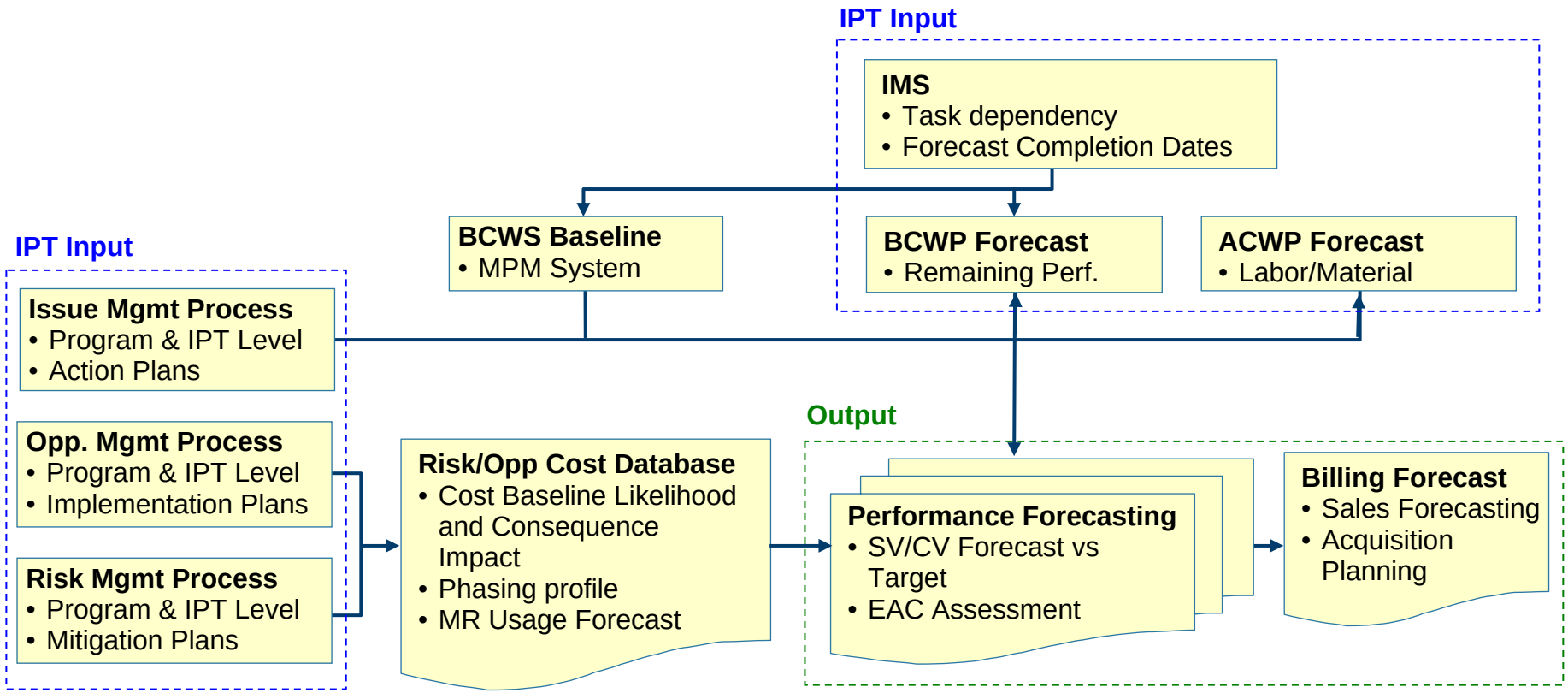
- The Integrated Management Operating Model (iMOM) is the application of Northrop Grumman's Integrated Management Framework (IMF) processes on a program
- The IMF is the foundation for the program management processes provided in our command media
  - Compliance to the IMF processes is an enterprise requirement



IMF

- What Makes This Operating Model Unique?
  - Our processes are ***integrated quantitatively*** and are ***forward looking***
    - Forecast performance across all elements of cost
    - Forecast MR usage
      - Quantify risk consequence in dollars
  - Manage ***customer expectations***
    - Simple views for customer and leadership communication
    - Very disciplined transparent rhythm structure

Integrated Management Operating Model



By Making Future Problems Visible Today We Can Improve Future Performance by Addressing the Root Causes Today

Case Study - E-2D Program Overview

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Program Description

- SDD Contract Value: Billion Plus
- Contract Type: CPAF / CPIF
- Program Description: Deliver 2 SDD Next-Generation Airborne Battle Management Aircraft, and 3 Pilot Production Aircraft
- Follow-on Production Potential: 70 Aircraft
- SD&D Period Of Performance: 8/03 – 12/12

Current Status: Oct 2008

- SD&D Program 88% Complete
  - Remaining Scope – Weapon System Verification and Subsystem Qual Testing
  - Major Suppliers
    - All Hardware Delivered
    - BAE 99% Complete
    - Randtron 97% Complete
    - Lockheed Martin 96 % Complete
    - Raytheon 95% Complete
    - NSD 95% Complete
    - Rolls Royce 86 % Complete
- Pilot Production Program
  - Started June 2007
  - On schedule to meet planned deliveries
  - Cumulative SPI is 1.061 and CPI is 1.025
- Received Required LRIP1 Long Lead Funding

Major Milestones

SDD First Vehicle Flight	Complete
SDD First System Flight	Complete
Production Readiness Review	Complete
Production AA4 Keel Start:	Complete
Production AA5 Keel Start:	Complete
Operational Assessment	In Progress
Milestone C	03/2009

Team is Meeting Commitments

Case Study: AHE Performance Challenge – Oct 2006

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- Advanced Hawkeye Program
  - ACAT 1D
  - Billion Dollar Development CPAF Contract
- Technical Performance
  - Meeting/Exceeding all Technical Performance Thresholds
- Significant Negative Cost Performance
  - Oct 2006 CPI Red and trending down
  - OTB put in place within previous 6 months; poor performance to plan
  - Several Month Schedule variance
  - Govt cost estimators projecting Several Hundred Million VAC and significant delay to first flight
  - Threat of losing aircraft to pay for over run
- Poor Subcontract Management
  - Six cost plus suppliers driving negative performance
  - Approximately 50% of program cost
  - Significant and repeated schedule slips
- Customer Perspective
  - Management and Technical Performance was Very Good, But Cost Performance Remained an Issue
- No Cost Performance Forecasting Capability

Case Study: FY07 Performance Model In-Action

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Example Data

Total Program

February 2007 Status

IPT (Total)	March		April		May		June		July		August		September	
EV Performance	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI
Target	1.130	0.962	1.204	0.943	1.190	0.959	1.159	1.003	1.119	0.982	1.078	0.991	1.036	0.966
Forecast	1.132	0.979	1.241	0.878	1.201	0.903	1.182	0.975	1.140	0.959	1.087	0.935	1.050	0.934
Actual														

Sub Tier IPT

IPT (Total)	March		April		May		June		July		August		September	
EV Performance	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI	CUR SPI	CUR CPI
Target	1.178	1.050	1.090	0.974	1.085	1.004	1.071	1.075	0.986	1.041	1.019	1.033	0.988	1.010
Forecast	1.205	1.037	1.241	0.781	1.452	0.804	1.201	0.908	1.212	0.939	1.088	0.816	0.982	0.894
Actual														

IPT Supplier:

Company A

2DS	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
Target Cur SPI	1.078	1.089	1.099	1.075	0.983	1.020	0.986
Target Cur CPI	0.963	0.981	0.993	1.057	1.006	0.993	1.016
Forecast Cur SPI	1.173	1.177	1.446	1.178	1.247	1.112	0.978
Forecast Cur CPI	0.995	0.753	0.758	0.844	0.883	0.739	0.855

Company A

Supplier: Company B

2DS	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07
Target Cur SPI	1.390	1.560	1.590	0.980	0.980	0.980	0.980
Target Cur CPI	0.980	0.830	0.850	0.650	0.540	0.740	2.430
Forecast Cur SPI	1.545	1.415	1.099	0.876	1.641	2.075	0.953
Forecast Cur CPI	0.552	0.417	0.208	0.225	0.192	0.248	0.365

Case Study: Performance Goals vs. Actual Performance for FY07

- Cum CV
  - Goal of 0.946
  - Actual of 0.967
  - Exceeded goal by 0.021
- MR
  - Goal at First Flight 10%
  - Actual 11.0%
  - Exceeded goal by 1%
- Cum SPI 0.992
  - Recovered Schedule Variance
- Monthly CPI goal

	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Nov-Sept 07
Goal	0.886	0.910	0.922	0.969	0.962	0.943	0.959	1.003	0.982	0.991	0.966	0.946
Actual	**0.923**	**1.009**	**0.952**	**1.058**	**1.035**	**0.959**	**0.959**	**0.912**	**0.849**	**1.007**	**0.976**	**0.967**

First Flight AF Milestone
Received Superior Rating

Case Study: Disciplined Transparent Weekly Rhythm Cycle

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- Monday 10:30 AM – Customer call
- Monday 3:30 PM – EV forecast brief with NAVAIR
- Tuesday 11AM – Weekly war room wall walk
  - Focus on total program schedule performance and technical integration
- Tuesday 1:00 PM – Internal IPT forecast meeting
  - Review Monday's action items
  - Incorporate supplier data from prior Friday's ESRs
  - Establish expectations for Thursday "1st Look" EV forecast data
- Monday - Friday Level 2 IPT level forecast meetings and Supplier Management Team meetings
- Thursday 10:00 AM – Internal affordability meeting
  - Review "1st Look" EV forecast data
  - Make final changes for weekly metric package (customer call data)
  - Dry-run Monday's customer call
- Thursday 1PM – AEW financial rhythm
  - Forecast sales, acquisitions and margin Indicated Finals
- Friday Executive Supplier Reviews (ESRs)
  - EV forecast #1 priority for discussion

Blue - VP Attendance

Case Study Summary

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- This Operating Model Integrates Our Processes Quantitatively Which Enable Us To Make Informed Business Decisions

- Advantages Of This Operating Model
  - Keeps The Team Focused On Execution Commitments
  - Always Working Tomorrow's Problems Today
  - Manages Customer And Corporate Expectations
  - Transparent Management

- Customer Response Was Favorable And Evident In Our IPARs And CPARs

Earned Value Forecasting Agenda

- What Is EV Forecasting?
  - Limitations With Existing Best Practices
  - Key Elements Of Forecasting
- EV Forecasting Process
  - BCWP And ACWP Management
- Management Reserve Forecasting
  - Risk And Opportunity Consequence Management
- Billing Forecast

What Is EV Forecasting?

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- EV forecasting is the program's ability to predict cost and schedule performance that meets the estimate at complete cost for the program while managing the customer's expectation
- Existing EV forecasting limitations
  - Current best practices use only statistical analysis tools which uses past performance data
  - Typical statistical EV forecasting tools fall short in this area, since they assume past performance will continue indefinitely
  - For development jobs, past performance is not always a good predictor of future performance since technical challenges vary non-linear over time

AHE Program Created An EV Forecasting Approach To Overcome These Limitations

AHE Program View

Example Data

		Jan '08 to Complete Target	Jan '08 to Complete IF	Jan '08 thru Apr '08 Actual Performance	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08
IPT Performance	Target SV	$2,994,213			($21,889)	$181,619	$199,156	$224,694	$454,722	($15,000)	($10,000)
	Target CV	($338,246)			$242,035	($132,797)	($194,101)	($141,860)	($215,495)	$0	$0
	Forecast SV		$2,400,227		($21,889)	$181,619	$247,959	$118,531	$460,727	($15,000)	($10,000)
	Forecast CV		($724,768)		$242,035	($132,797)	($231,078)	($593,095)	($215,495)	($160,000)	($140,000)
	Actual SV			($13,646)	($38,507)	($54,847)	($141,579)	$221,287			
	Actual CV			$732,997	$624,934	$117,846	$227,801	($237,584)			
	Target / Forecast SPI	1.061	1.051		0.988	1.122	1.179	1.053	1.164	1.169	1.107
	Target / Forecast CPI	0.994	0.986		1.162	0.926	0.876	0.798	0.938	0.871	0.969
	Actual SPI			0.998	0.981	0.969	0.926	1.108			
	Actual CPI			1.104	1.447	1.073	1.147	0.905			
	MPM BCWS (Prime $)	$48,803,520	$47,075,131		$1,759,627	$1,488,598	$1,386,353	$2,219,754	$2,805,657	$1,739,874	$2,150,922
	Forecast BCWP (Prime $)	$51,797,733	$49,475,357		$1,737,737	$1,670,218	$1,634,312	$2,338,285	$3,266,384	$2,033,911	$2,381,674
	Forecast ACWP (Prime $)	$52,135,979	$50,200,125		$1,495,702	$1,803,014	$1,865,391	$2,931,380	$3,481,879	$2,335,731	$2,457,192
	Actual BCWS (Prime $)			$7,824,471	$2,060,953	$1,791,793	$1,916,545	$2,055,180			
	Actual BCWP (Prime $)			$7,810,825	$2,022,446	$1,736,946	$1,774,966	$2,276,467			
	Actual ACWP (Prime $)			$7,077,828	$1,397,512	$1,619,100	$1,547,165	$2,514,051			

Actual	Actual	Actual	Actual	W/E	W/E	W/E	W/E	Average	Plan				
Jan	Feb	Mar	Apr	May 9	May 16	May 23	May 30	May	May	Jun	Jul	Aug	Sep
428.3	416.0	416.2	420.7	402.2				402.2	410.2	384.3	351.5	337.2	325.9

- **The program view is a roll-up of every IPT's element of cost, including suppliers**
- **How do we manage the BCWS, BCWP, and ACWP?**

EV Forecasting Process: BCWP

- The program's Integrated Master Schedule (EV schedule) is the primary tool for accomplishing BCWP forecasting
- BCWP forecasting process
  - Labor hours
    - Hours are loaded in the EV IMS by work package with a start and finish date
    - Control account managers assess work package EV percent complete and forecast completion date per their baseline plan
    - Automated tool calculates when the unearned hours will be earned based on the forecast completion date
    - Control Account Managers (CAMs) adjust BCWP where required
  - Material costs
    - For fixed price suppliers, performance is forecasted based on when work will be completed and not when the invoices hit the books
    - For cost plus suppliers, performance is forecasted using the same IMS process above

EV Forecasting Process: ACWP

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- How Much ACWP (Manpower Resources) Will It Take To Earn The BCWP Forecast (Work To Be Accomplished)?
- How Do We Manage/Monitor The ACWP Forecast?

EV Forecasting Process: ACWP

- Name plan variance report is the primary tool for managing labor ACWP forecasting
- ACWP forecasting process
  - Internal labor hours: Employee planned hours is tracked weekly and adjusted based on work accomplished
  - Material costs
    - For fixed price suppliers, actuals are forecasted based on BCWP forecasting
    - For cost plus suppliers, actuals are forecasted using suppliers' similar labor forecast

By-Name Plan (no actuals)

		6/6/2008			6/13/2008			6/20/2008			6/27/2008		
Emp ID	Emp Name	Plan	Actual	Variance	Plan	Actual	Variance	Plan	Actual	Variance	Plan	Actual	Variance
177332		40			40			40			40		
177472		40			40			40			40		
75429		40			40			40			40		
155588		40			40			40			40		
250509		20			20			20			20		
250518		20			20			20			20		
250550		40			40			40			40		
250620		10			10			10			10		
250658		40			40			40			40		
250778		40			40			40			40		
68822		30			30			30			30		
96277		40			40			40			40		
119361		40			40			40			40		
132798		25			25			25			25		
250350		40			40			40			40		
250404		40			40			40			40		
250527		20			20			20			20		
250675		20			20			20			20		
143631		15			15			15			15		
250393		40			40			40			40		
250516		40			40			40			40		
250738		40			40			40			40		
250810		40			40			40			40		
250900		40			40			40			40		
GRAND TOTALS		800.0	0.0		800.0	0.0	430.0	800.0	0.0	430.0	800.0	0.0	430.0
CUM DATA		800.0	0.0		1600.0	0.0		2400.0	0.0		3200.0	0.0	

By-name plan is aligned w/ the BCWP and ACWP forecast.

Affordability Model

	Jun-08	Jul-08	Aug-08	Sep-08
Manpower (Forecast)	22	22	21	23
Manpower (Actual)				
MPM BCWS (hrs)	3,500	3,400	3,300	3,200
Forecast BCWP (hrs)	3,200	3,200	3,000	3,203
Forecast ACWP (hrs)	3,200	3,200	3,000	3,203

Example Data

Management Reserve Forecasting and Risk Consequence Management

Risk Management

Risk Mitigation Plan

Risk #88 – Delayed AFMC SW Build 4.0 Delivery

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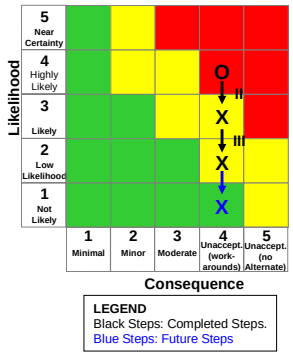
Update Date: **07-21-08**

Risk # **88**	Risk Title: **AFMC SW Build 4.0 Schedule Delay**	Risk Lead(s): **Flowers/Guida**
Risk Description: **If AFMC Build 4.0 Is Delayed, Flight Test Program Schedule Will Be Impacted, Cost Will Increase**		
Consequence If Not Mitigated: **Schedule Delay, Cost Increase**		



LEGEND
Black Steps: Completed Steps.
Blue Steps: Future Steps

Step	Mitigation Activities	Date of Transition to Next Step
I	Prioritize SW discrepancies (ITT DRs, SIL DRs, Supllier SARs) for build 3.0.2 in accordance with IMC and OA needs	01/16/08
II	Optimize DR Correction Quantity With Schedule For Build 3.0.2	01/16/08
III	NGIS / NSD Optimize MIDS Execution	03/15/08
IV	Monitor NSD Build Progress (ESR, On Site Support, Dual FQT)	10/31

Last Update: 3/11/08

- Most Programs Account for the Cost Associated with Risk Mitigation Steps
- What If the Mitigation Plan Is Not Successful
- Risk #88 Cost Consequence is Captured in a Register

Risks Consequence / Opportunities

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ROD

Mitigation Step Confidence	High Probability for mitigation step to occur	
	Chance for mitigation step to occur	
	High Probablity for mitigation step not to occur	

IPT/ Supplier	Description	Previous Risk/Opp Total Value $	Current Risk/Opp Value $	Next Transition Step on Mitigation Plan	Plan To Implement Or Retire
	BFD Transfer Alignment	$80,000	$80,000	**Aug-08**	Dec-08
⇨	DCP Hardware SOF Modifcations	$800,000	$800,000	**Jul-08**	Jul-08
⇨	Radar Altimeter EMI	$600,000	$600,000	**Jul-08**	May-09
⇨	: Risk Profile	$900,000	$900,000	**Jul-08**	Jul-08
⇨	: Opportunities	-$2,960,000	-$2,960,000	**Jul-08**	Jul-08
		-$580,000	**-$580,000**		

⇨ = within next 30 days

Management Reserve Forecast

Example Data

EV Performance Forecast
EAC / ETC Summary ($M)

	Affordability Summit 10/30/07	02/11/08	06/23/08	06/30/08	07/07/08	07/14/08	07/21/08	07/28/08	Forecast 08/04/08
CBB	$	$	$	$	$	$	$	$	$
- EAC	$	$	$	$	$	$	$	$	$
VAC	$	$	$	$	$	$	$	$	$
+ CV to be Assessed	$	$	$	$	$	$	$	$	$
- Target VAC	$	$	$	$	$	$	$	$	$
ETC MR	***$ 26.6***	***$ 21.5***	***$ 16.3***	***$ 15.9***	***$ 16.8***	***$ 16.0***	***$ 15.9***	***$ 15.9***	***$ 13.8***
Risks	$ 15.7	$ 10.4	$ 13.2	$ 12.8	$ 12.6	$ 11.8	$ 11.3	$ 11.3	$ 11.3
Opportunities	$ (0.5)	$ (1.9)	$ (28.1)	$ (28.1)	$ (28.1)	$ (28.1)	$ (28.3)	$ (28.3)	$ (28.3)
Net Risks / Opportunities	**$ 15.3**	**$ 8.5**	**$ (14.8)**	**$ (15.3)**	**$ (15.4)**	**$ (16.3)**	**$ (16.9)**	**$ (17.0)**	**$ (17.0)**
Unknown / Unknowns	**$ 11.3**	**$ 13.0**	**$ 31.2**	**$ 31.2**	**$ 32.3**	**$ 32.3**	**$ 32.9**	**$ 32.9**	**$**
ETC (July '07 to Complete)	$ 381.1	$ 389.6	$ 392.9	$ 393.3	$ 393.6	$ 394.4	$ 436.0	$ 436.0	$ 4

Last Week's 7-21-08 Changes

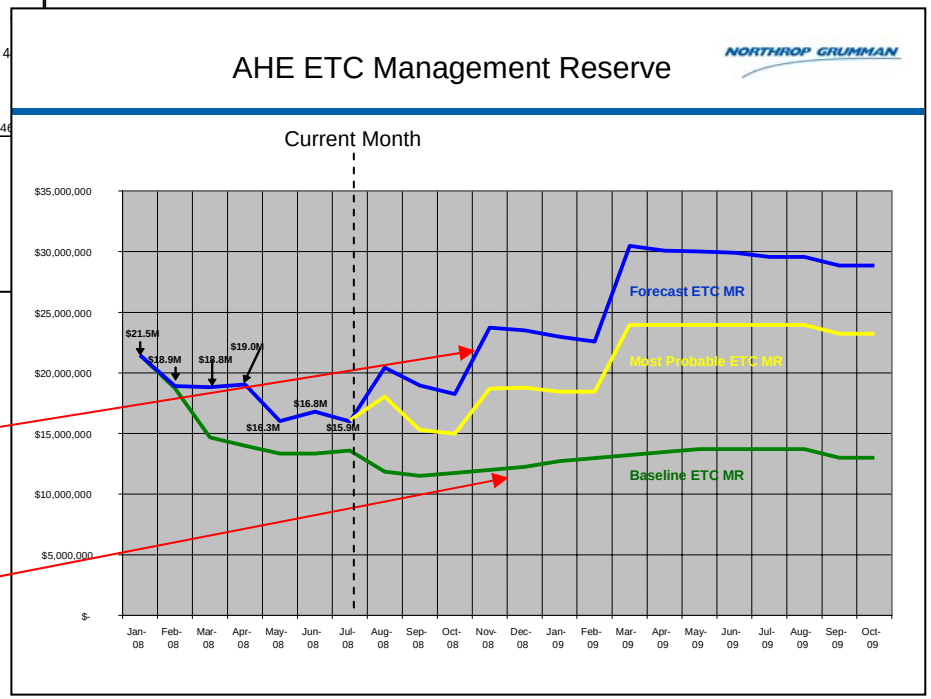
7PI AHE QA Transfer to SQ Prior to Qual completion	retire Jul 08 value	($12,000)
7PI Additional Quality PAL Support Risk	retire Jul 08 value	($14,400)

Changes Pending 7-28-08 Review

RN 8.2 Impact to Program	add to EAC/ETC	$1,446

- All risks and opportunities consequences are summarized at the program level

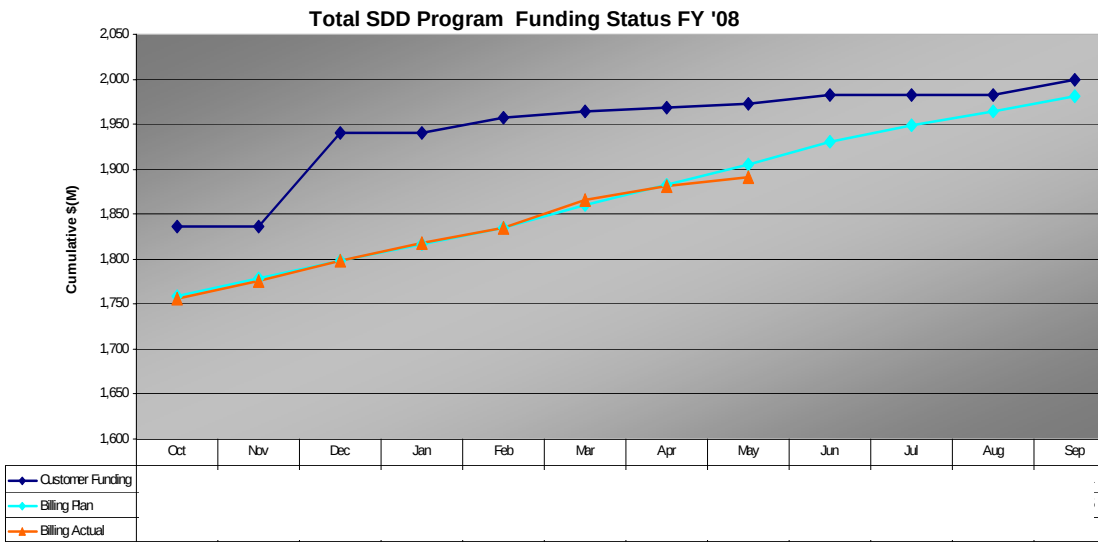
- We plot future use of ETC MR based on all risk and opportunities being realized as well as a most probable outcome
- This is tracked against a baseline established at the last EAC



Billing Forecast

- Billing forecast is a function of ACWP
  - We add risk consequences, fee and the balance of MR for unknown/unknowns
- This helps our customer plan ahead and report obligation/expenditure status to their leadership

AHE SDD Cumulative Billing Plan vs. Actual ($M thru Fee)



Example Data

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Summary

- iMOM - What Is It?
  - Application Of Northrop Grumman's Integrated Management Framework (IMF) Processes On A Program
  - This Integrated Management Operating Model Integrates Our Processes Quantitatively Which Enable Us To Make Informed Business Decisions
- Case Study - What Has It Done For AHE?
  - Helped Us Meet Our Performance Execution Commitments
  - Significantly Improved Our Customer's Satisfaction Rating
- Earned Value Forecasting
  - Critical Element Of The iMOM
  - Gives Us The Insight To Work Tomorrow's Problems Today