Cost Analysis, Assessment & Control

Developing training for NASA workforce

Bill Dimmer (and others)
NASA Cost Symposium
August 2014
$3.6B cost increase & 4+ yr slip to LRD

400% cost increase + repair mission

$700M cost increase from KDP-C

~$10-12 billion cost increase
Doomed to repeat?
Cost Overruns are Everywhere

A “Worldwide phenomenon that affects both the private & public sectors.”

Green Book - English Government

2010 Olympic village construction cost overruns worry critics

US: Big defense programs face cost overruns

(Associated Press WorldStream Via Acquire Media NewsEdge) WASHINGTON Costs are likely to keep growing for two of the Pentagon's biggest weapons programs as the military pushes to field fighter jets and high tech Army units even before fully proving the technology, according to Government Accountability Office reports released Thursday.

“Confidential project documents from 1995 reveal Bechtel willingly hid costs to present a more favorable view of Big Dig's financial picture at the behest of top state officials seeking a more publicly acceptable bottom line.”

Source - Boston Globe
It’s all about

Cost
Typically as a result of overruns scope must be cut
How does NASA control costs?

- By practicing Program Planning, Assessment & Control (PP&C)
  - Cost Estimating
  - Scheduling
  - Monitoring (EVM, etc.)
  - Acquisition & Contract Management
  - WBS
  - Budget
  - Funds Control
  - Risk Management
  - Configuration Management
  - Integration/Analysis
What else is NASA doing?

• Once
• REDSTAR
• Cadre
• JCL
• Cost models
• IPAO/SRB
• NPD 7120.5e
• APPEL
• PM (VPM) Challenge
• NASA Cost Symposium
WHAT’S THE PROBLEM?

1. NASA doesn’t fully use the tools, personnel, capabilities to manage major development missions?

2. NASA buys into an unrealistic mission cost that cannot be met?

3. NASA keeps changing requirements due to insufficient initial definition?

4. Something else/combo of all 3?
One more solution…

- Practical training
- In the hands of the practitioners
- Offering
  - Tools
  - How to’s
  - What if’s
  - Common pitfalls
  - Formats
  - Models

- ALL FOCUSED ON COST, including…
Cost estimating, analysis & assessment

Pre-Phase A Estimated Cost → Phase A/B Estimated Cost → Budgeted Cost → Bid Price → Awarded Price → Base Cost → Actual Cost

- Additive cost growth, requirements growth
- Growth due to cost realism, make-it-work changes

Funding Constraints
Competitive Pricing & Requirements Understanding
Cost control tools, processes and systems

Earned Value Management ‘Gold Card’

VARIANCES
- Cost Variance: \( CV = BCWP - ACWP \) \, CV \% = \( (CV / BCWP) \times 100 \)
- Schedule Variance: \( SV = BCWP - BCWS \) \, SV \% = \( (SV / BCWS) \times 100 \)
- Variance at Completion: \( VAC = BAC - EAC \)

PERFORMANCE INDICES
- Cost Efficiency: \( CPI = BCWP / ACWP \)
- Schedule Efficiency: \( SPI = BCWP / BCWS \)

OVERALL STATUS
- % Schedule: \( = (BCWS_{CUM} / BAC) \times 100 \)
- % Complete: \( = (BCWP_{CUM} / BAC) \times 100 \)
- % Spent: \( = (ACWP_{CUM} / BAC) \times 100 \)

ESTIMATE AT COMPLETION
- \( EAC = \) Actuals to Date + [(Remaining Work) / (Efficiency Factor)]
- \( EAC_{CPI} = ACWP_{CUM} + [(BAC - BCWP_{CUM}) / CPI_{CUM}] = BAC / CPI_{CUM} \)
- \( EAC_{Composite} = ACWP_{CUM} + [(BAC - BCWP_{CUM}) / (CPI_{CUM} \times SPI_{CUM})] \)

TO COMPLETE PERFORMANCE INDEX (TCPI)
- \( TCPI_{EAC} = \) Work Remaining / Cost Remaining = \( (BAC - BCWP_{CUM}) / (EAC - ACWP_{CUM}) \)

# To Determine Either TCPI or EAC; You May Replace BAC with TAB
Integrating cost with schedule

Integrated Master Schedule (IMS)

- Master Schedule
- Intermediate Schedule
- Detailed Schedules (Control Acct & Work Pkg, Network Logic Included)

**VERTICAL INTEGRATION**

**HORIZONTAL INTEGRATION**

Source: NASA Scheduling Handbook
The cost associated with risk

Risk data is converted into useable information for determining priorities, budgets and decisions

Risk Statement
- Condition
- Consequence
- Context

List of risks

Risk statement
- Context
- Impact
- Probability
- Timeframe
- Classification
- Rank

Classification

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Class 2</th>
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<tbody>
<tr>
<td>Risk</td>
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<td>Risk</td>
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<td>Risk</td>
<td>Class 3</td>
</tr>
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NASA & Industry Standards
Project Data
Managing and monitoring cost contracts

To avoid this
About This Training

• Course objective: to provide PP&C/Cost Control personnel an understanding of
  – Cost in NASA terms
  – Elements which drive cost
  – How tools and systems help us estimate and control costs
  – Analysis which can be conducted on typical NASA projects
    • Leads to better program control and a successful outcome

• We have organized instruction over 2 ½ days into emphasizing Cost and Assessment of elements which impact cost
Course delivery

- Conducted under CFO University
  - [http://www.ksc.nasa.gov/nasa-only/finance/CFOU/cfou7.htm](http://www.ksc.nasa.gov/nasa-only/finance/CFOU/cfou7.htm)
  - Sponsored by NASA OCFO

- Curriculum of vendor-provided, online and NASA developed and delivered training

- Nearly 5,000 participants to date

CFO University
Founded 2008
Topics include (not necessarily in this order)…

- NDP 7120.5e
- NASA Cost & Cost Planning
- Cost estimating
- Integrating cost & schedule
- Risk assessment
- EVM
- Cost contract mgmt
- Elements of cost
- Statistics
- Data sources
- Cost research
- Trends

- Fixed/variable cost
- Basis of estimate (cost/sched)
- EVM analysis
- Quality risk assessments
- Contract analysis
- Schedule analysis
- Pareto
- Excel analysis tool
- JCL
- Reporting
- Communicating the story
- “One Pager”
Who’s involved?

- Bill Dimmer / KSC
- Glenn Butts / KSC
- John Biddix / KSC
- Trey Reilly / KSC
- Cathy Claunch / JSC
- Jonathan Bryson / GSFC
- Kevin Rice / JPL
- Jon Fleming / MSFC
- Other Contributors
  - Fred Lim / GSFC
  - Lesley Young / GSFC
  - Gary Rawitscher / HQS
What do we need?

• Your input…
  – something we should include
  – peer review / dry run participants

• Your contributions…
  – Tool, model, format you’re willing to share

• Your support…
  – Gather participants and schedule class at your Center
And some more NASA isms for the collection

• I’ll throw my badge on table
• That’s how we always do it
• That’s how shuttle did it
• It will be different this time
• We can always get a waiver
• You can’t fix stupid
• That’s what the contractor told me
• We got some workarounds for that
• It will fix itself next month
• It’s within family
• We’re waiting on the contract to be definitized
• We’re working the issue
• Looks like an accounting error
• It was a small sample size
• That was a bad plan
Summary

• Objective: provide a set of knowledge, tools, and techniques to NASA practitioners of project management and cost control

• Expect to have initial rollout in early 2015

• Delivered by NASA personnel

• Will be available to all Centers, upon request

• We solicit your support