PROJECT RESOURCES CONTROL

PRESENTATION TO PI TEAM MASTER'S FORUM

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Understanding the Environment

- NASA is in the discretionary part of the Federal budget
- Support is generally broad, but the NASA budget is not a “voting issue”
- Earth Science budget has increased, but growth in other themes is modest and in some cases does not keep pace with inflation
- New content/growth must be accommodated within the available budget
- Greater emphasis has been placed both externally and internally on cost and schedule control

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NASA Authorization Act of 2005

- Established Nunn-McCurdy type controls on NASA projects
- Thresholds established for Congressional notification
  - 15% cost growth over approved baseline
  - 6-month launch slip beyond approved baseline
  - If cost growth exceeds 30% over the baseline, an 18-month timeline starts after which specific Congressional approval is required to continue the project

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Establishing Cost and Schedule Baselines

- An early pitfall in the resources control process
- Estimates at Phase A/B transition and the baseline at confirmation (B/C transition) are usually based on parametric models
  - Cost estimating relationships from historical data
  - Complexity factors based on engineering judgment
- Plenty of opportunity for error
- A recent change in NASA policy is to require the use of Joint Confidence Level estimating to establish cost and schedule baselines
  - Respond to internal and external demands for better cost/schedule performance
  - Enable NASA to assert that programs/projects have executable plans

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Joint Confidence Level (JCL)

- JCL is the probability that cost will be less than or equal to the targeted cost AND that schedule will be less than or equal to targeted schedule
- It is a process that combines project cost, schedule, and risk into a complete picture
- It is a process and product that helps inform management as to the likelihood of a project's success

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Joint Confidence Level (JCL)

- What JCL is not
  - A specific methodology (although triangular probability distributions and Monte Carlo simulations are often used)
  - A product from a specific tool (although the results of a JCL analysis are customarily displayed on scatter plots and on an S-curve graph)
- The implementation of JCL is a work in progress
- For additional details and examples see:

http://www.nasa.gov/pdf/394931main_JCL_FAQ_10_12_09.pdf

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- Joint Confidence Level (JCL)
  - So what are the numbers?
    - Each major program should be baselined (or re-baselined) and budgeted so that there is a 70% probability of achieving the stated life cycle cost and targeted launch date
    - At a minimum, projects are to be funded at a 50% confidence level
  - Key points:
    - It is an SMD responsibility to demonstrate how we budget at a 70% confidence level; the PI/Project Manager may be (and usually is) given a baseline/budget control below this level
    - There may also be a difference between the targeted launch date given to the PI/Project Manager and the date to which we commit externally

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Some Key Cost/Schedule Risk Factors

- Early key technology developments
- Software development
- Integration and test
- Workforce does not come down from development peak as quickly as planned
- Externalities
  - ELV's
  - External partners
  - Sole supplier loses critical skills or goes out of business

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Reducing Cost and Schedule Risk Inherent in Mission Baselines

- Heavily discount the possible benefits of “heritage” hardware
- Establish ample unencumbered cost reserves and funded schedule reserves
  - Base on assessed risk, not fixed rules
- Have de-scopes available at different points in the development cycle

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Additional Thoughts on Reducing Cost and Schedule Risk

- "Can-do" mentality can be a strong asset but it can also be a detriment if it leads to "if everything goes right we'll just make it" (everything won't go right)
- Traditional thinking: "Schedule concurrency saves time, time=money….." but this isn't true if there is a significant problem in the critical path of a key development activity
- Do not repeat the tactics which have gained you one victory, but let your methods be regulated by the infinite variety of circumstances - *Sun Tzu c. 490 BC*

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Monitoring Resources Utilization

- Earned Value Management (EVM) is required for all NASA projects >$20M life cycle from KDP-C to KDP-E per NPR 7120.5
- EVM is an integrated management control system for quantifying, assessing, and understanding what is being achieved with financial resources
  - Integrates cost, schedule, and technical performance with risk management
  - Allows objective assessment and quantification of current project performance
  - Helps predict future performance based on current trends
- Very useful as an “early warning system” for emerging problems
- Best seen as an “agenda setter” that identifies areas to probe in depth rather than as a system that provides quantitative answers

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Earned Value Management

- Three major elements
  - ***The Plan:*** Budgeted Cost of Work Scheduled (BCWS) or "how much do we plan to spend by a point in time?" BCWS = hourly rate x hours planned or scheduled
  - ***The Investment:*** Actual Cost of Work Performed (ACWP) or "how much did we actually spend by a point in time?" ACWP = hourly rate x hours spent
  - ***Earned Value:*** Budgeted Cost of Work Performed (BCWP) or "how much of the planned work has actually been completed?" BCWP = the cost originally budgeted to accomplish the work that has actually been completed, often expressed as baselined cost x actual % complete
- Two major variance measures
  - Cost Variance = BCWP – ACWP (negative CV is bad)
  - Schedule Variance = BCWP – BCWS (negative SV is bad)

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Earned Value Management

- Two major performance indices
  - Cost Performance Index CPI = BCWP / ACWP (CPI < 1 is bad)
  - Schedule Performance Index SPI = BCWP / BCWS (SPI < 1 is bad)
  - Many additional metrics derive from these basic measures
- An inescapable EVM truth:
  - The SPI must eventually = 1 assuming the mission is launched
  - Reserves will be expended to “buy back” SPI; we tend to look at the rate of reserve depletion to assess whether the project can “get there”
- An inescapable EVM limitation:
  - EVM does not assess the quality of the product
- For additional information and a tutorial see:

  http://evm.nasa.gov/index.html

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Monitoring Resources Utilization

- In addition to EVM, many different metrics are available
  - Reserves on cost/schedule to go
  - Cost burn rate
  - Workforce utilization
  - Accomplishment of key milestones
  - Liens against reserves
  - Etc.
- Assess at least on a monthly basis
- All are meaningless unless followed by prompt management action

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Summary

- Successful project resources control is an on-going process requiring continual management attention
  - A careful and well-informed balance between implementing cost control measures while at the same time identifying and managing risks at an acceptable level

"*A little risk management saves a lot of fan cleaning.*" – *Author unknown*