Effective Schedule and Cost Management As a Product Development Lead

Instructor: Cynthia Simmons, Code 550
The PDL is ultimately responsible for successful execution of their product: on time, within cost, meeting all specifications with acceptable risks.

Source: GSFC Product Development Lead Training Program – Leadership
A Bridge Not Too Far?

We have learned how to do the job when everything goes right,

but…
Managing to Your Commitment

How do we ensure that everything will go as planned?
What do we do when something goes wrong?

“I know it’s wrong, I’m just waiting for the autocorrect.”
SOME BASICS...
EFFECTIVE SCHEDULE AND COST MANAGEMENT

“I can complete the project under budget and ahead of schedule, but you’ll need to allocate additional time and money for that.”

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Cynthia Simmons
Do I Know What Problem I Am Solving...?

“If a bus built in 1987 leaves Pittsburgh at 9:14 and Robert sets his crockpot to start cooking a 6 pound roast at 2:09, how long will it take your parents to stop helping with your homework?”

Source: GSFC Product Development Lead Training Program – Cost Estimating
The Customer’s Swing

Source: TMT-37 Dave Scheve, “The Customer’s Swing”
We Can Do It!

Source: TMT-37 Dave Scheve, “The Customer’s Swing”
Isn’t It Just a Matter of Semantics?

Source: TMT-37 Dave Scheve, “The Customer’s Swing”
Do I Know Who Knows What?

- Testers
- Operators
- Technicians
- Manufacturing
- Observatory Manager
- Designers
- Mission Systems Engineer
- S&MA
- Scientists
- Project Manager
- Interfacing Subsystem PDLs
- Spacecraft SE
- Line Management
- Instrument SE
- Manufacturing

Source: GSFC Product Development Lead Training Program—Managing to Your Commitments

TFAWS August 2015

NASA Goddard Space Flight Center
Which Is Most Important?

Cost

Subsystem Success

Time

Scope/Technical Performance

Source: GSFC Product Development Lead Training Program – Schedule Matters
What Are The Risks?

Does the plan make sense?
  Do I need to wait for somebody to do something?
What could reasonably go wrong?
  Is the plan a feasible path forward?
FIRST THINGS FIRST
Develop a Credible Plan

Credible = Executable
Make an Executable Schedule

Map out what needs to be done

- Requires a "widget" integration stand and handling frame
- Requires a "widget" testing fixture and facility hardware (Ransome table)
- Requires an acoustic test chamber
- Requires a space environmental simulator
- Requires an EMI/EMC chamber
- Requires a "widget" fixture to emulate the Observatory "backplane"

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**Make a List….Check It Twice**

- Itemize activities and associated tasks
  - Capture critical information and risks for each task

<table>
<thead>
<tr>
<th>Event</th>
<th>Tasks needed to get done</th>
<th>Staffing skill set required</th>
<th>Key interim milestone</th>
<th>Duration</th>
<th>Facilities needed</th>
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</thead>
<tbody>
<tr>
<td>Flight TVAC test</td>
<td>design mounting plate</td>
<td>mid-level mech designer</td>
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<td></td>
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<td>fabricate harnesses</td>
<td>mid-level EE technician</td>
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<td>procure fasteners</td>
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<td>schedule TVAC chamber with 549</td>
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<td>Chamber 235</td>
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<td></td>
<td>generate mounting plate drawings</td>
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<td></td>
<td>install mounting plate</td>
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<td>acquire test power supplies</td>
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<td>create Labview data displays</td>
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<td></td>
<td>obtain data acquisition system</td>
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<td></td>
<td>create 24/7 shift staffing plan</td>
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<tr>
<td></td>
<td>create list of required materials &amp; supplies</td>
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<tr>
<td></td>
<td>develop test harness specifications</td>
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</table>
Schedule Enough Time

- **Electronics Power Module Environmental Test**: 29 days duration
- **Baseline Functional Test**: 5 days
- **EMI/EMC Test**: 10 days
- **Vibration Test**: 5 days
- **Thermal Vacuum Test**: 7 days
- **Final Inspection**: 2 days

Source: GSFC Product Development Lead Training Program – Schedule Matters
Chapter 1: Introduction
Chapter 2: Schedule Management Overview
Chapter 3: Schedule Management Tool Considerations
Chapter 4: Pre-Schedule Development Activity
Chapter 5: Integrated Master Schedule Development
Chapter 6: Status Updates and Schedule Maintenance
Chapter 7: Schedule Assessment and Analysis
Chapter 8: Schedule Control
Chapter 9: Schedule Reporting
Chapter 10: Schedule Data & Lessons Learned Archival

Download the NASA Schedule Management Handbook at: http://evm.nasa.gov/handbooks.html
Develop a Realistic Spending Plan

If you have to do it…it will cost $$

Take time to itemize the spending plan – ensure it includes an estimated cost for each and every activity and task

“Everyone agreed the old way of budgeting took too long.”
STAYING WITHIN YOUR COMMITMENT
1. Evaluate plan against the Commitment

*Is it real...or is it Memorex?*
Examine the Profile – Does It Make Sense?

- EM Deliverables Complete
- EM & FM Detectors complete
- EM CSI & elec. ship
- FM CSI and ebox I&T
- FM’s ship
- Support System Tests
- Launch
- Science

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2. Metrics, tracking, controls, forecasting
Can You Really Do It?

- Is the forecast realistic?
- Do the resources support the forecast?

Baseline

Forecast

Actual

<table>
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<tr>
<th>Month</th>
<th>Cum Baseline</th>
<th>Cum Actual</th>
<th>Cum Forecast</th>
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<td>Sep '06</td>
<td>65</td>
<td>56</td>
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</table>
3. Mitigate, mitigate, mitigate…!

*Before it rains…*
OUT OF THE BOX?

CONTRIBUTORS TO OVERRUNS
Lower Than Expected Technology Maturity

- Ensure the development/demonstration plan is well thought-out
- Fully cost the development/demonstration plan, independently verify appropriateness, secure adequate funding, provide some contingency
- Properly bound what needs to be demonstrated: hardware, interfaces, environmental exposure
- Develop clear performance requirements to demonstrate technology readiness (maturity)
- Identify key milestones and track progress
Requirements / Scope Creep

- Ensure requirements and scope are well understood, well-defined and documented
- Understand science/mission objectives with respect to subsystem hardware performance
- Follow formal control process for requirements and scope changes
- Realistically assess design complexity and technology maturity
- Work to meet requirements; not to exceed expectations
  - ‘Better is the enemy of good enough’
Better Than What You Wanted!

Source: TMT-37 Dave Scheve, “The Customer’s Swing”
Paralysis...

ESSENTIALS OF RISK MANAGEMENT:
1. DON'T DO ANYTHING WRONG TODAY.
2. DON'T DO ANYTHING WRONG TOMORROW.
3. REPEAT.
25 Hours In a Day...

- Develop executable build/test flow
  - Use past experience to determine realism of activity durations and de-scope options
- Plan the most cost-effective path forward applying resources efficiently
  - Ensure there is adequate funding to complete required activities according to plan
- Eliminate activities rather than reduce activity durations
  - Use risk-based decision making
- Know key receivables required to meet critical milestones
Holding On a Little Too Long...

Know when it’s time to cut
De-scope early and before it’s a life or death situation

"I'm sorry, Henderson - but profits are down and we have to make sacrifices."
It Costs How Much…?

• Use most current fully-loaded labor rates for contractor engineering support
  – Use actual labor rate tables
• Include fees (lab, calibration, software licenses, etc.), taxes and miscellaneous costs (consumables, computer equipment, lab supplies, etc.) in spending plan
• Use current vendor ROMs and bids
• Assume inflation for costs in ‘out years’
• Ensure spending plan includes cost estimates for every activity planned in the schedule
GOOD, BETTER, BEST
HELPFUL TIPS
Communicate Problems…Early!

“So what you’re saying is that we’ve been defunct and out of business for over two years and you’ve just been waiting for the right time to tell me?”
“Make it work”
Does my product meet customers needs and objectives?
- Ensure the design meets required performance
- Ensure the constraints and technical resources are acceptable

“Make it safe”
How will my product fail and how can it be improved?
- Ensure the design has appropriate level of margin, predictable and sufficiently reliable to meet mission success

“Make it affordable”
How will my product impact costs?
- Ensure to understand the schedule and cost impact for all design decisions

Any decision resulting in the design solution being out of the box is potential risk

Source: GSFC Product Development Lead Training Program – Cost Estimating
Guiding Principles

- Is it good enough?
- Are the right people doing the right thing?
- Work not done today means higher cost tomorrow

Never catch up in I&T phase

- Delays are not automatic withdrawals from the contingency/reserve bank account
- “Can do” means we can implement the right engineering solution within schedule and cost

Sound Engineering Techniques
Balance
Requirements/Performance, Cost, Schedule, and Risk
Conservatism and optimism must be balanced with programmatic expediency, but only realism is your friend.