Process Improvement for Next Generation Space Flight Vehicles

MSFC Lessons Learned

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Southeastern Software & Systems Engineering Conference

May 2008
MSFC Lessons Learned Agenda

- Organizational Profile
- Process Improvement History
- Appraisal Preparation
- The Appraisal Experience … Good, Bad, and Ugly
- Tools We Found Useful
Organizational Profile

NASA MSFC Flight & Ground Software Division

Ares Upper Stage Flight Software
- Human-Rated flight software used for Ares I Crew Launch Vehicle
- Requirements Definition

Materials Science Research Rack
- Modular facility for materials science research in the micro-gravity environment of the International Space Station
- System Test

Orbital Express
- Space Satellite Mission Support Modeling Retirement
- Requirements Definition

Systems Integration Laboratory (New)

Appraisal Scope
- 3 Projects
- 2 Branches

May 2008
Process Improvement History

1997 SPI Initiative
Began w/ SEI’s CMM

1st NASA Center to Achieve CMM Level 2

December 2000
Achieved CMM Level 2

May 2003
Achieved CMM Level 3

October 2005
Achieved CMMI Level 2

August 2007
Achieved CMMI Level 3

1st NASA Center to Achieve CMMI Level 3
Appraisal Preparation

- Established early on relationship with Lead Appraiser
- Established sponsorship across departments
  - Management Steering Group
- PIID development and artifact collection
  - SEPG members responsible for
    - Populating PIIDs for assigned process areas
    - Interfacing with project teams to collect artifacts and work products relating to those process areas
  - SEPG-developed list of expected artifacts for generic practices helped facilitate consistency across organization
  - Internal review of PIIDs/artifacts (by SEPG and senior management) prior to the appraisal helped verify appraisal readiness
PIIDs and artifacts were maintained on a server for ease of access and review

- One PIID file per project for each process area group
- One PIID file for organizational process areas
- For each practice of each Level 2 and Level 3 process area, PIIDs contained
  - File name of artifact (some links used)
  - Location reference for expected data (if not obvious)
- Referenced artifacts were placed in project Software Development Library (SDL)
- Minimum use of hardcopies
Appraisal Preparation

- Project Briefings
  - Developed standardized Project Briefing template
    - To address as many specific and generic practices as possible
    - Provide verbal affirmations for most of the practices – allowing many interviews to be cancelled
  - Conducted briefing dry runs (project and organizational)
  - Hardcopy of each briefing was on hand for reference
Interview preparation and training

- Presented Interview do’s and don’ts
- Familiarized project teams with typical appraisal questions
Appraisal Preparation

- Developed Appraisal Plan to identify
  - Team members
  - Interview schedule
  - Facility requirements

- Ensured facility readiness
  - Reserved and configured conference rooms
  - Identified required tools and verify availability
  - Provided necessary equipment/supplies
The Appraisal Experience

What Worked …

- Strong Senior Management support
- Well-established process improvement infrastructure
  - Project teams fully engaged
  - SEPG active and effective
- One appraisal team instead of mini-teams
  - Provided experience depth/breadth
  - Consistency in evaluating practices and artifacts
  - Continuity in case team member had temporary conflict
The Appraisal Experience

- More of What Worked …
  - Appraisal preparation (time well spent)
  - Software Assurance participation
    - Product/Process Audits
    - SEPG and SRB support
  - Relationship with Lead Appraiser
The Appraisal Experience

- Improvement opportunities …
  - Employ an appraisal toolkit to reduce pain of PIID development
  - Accelerate institutionalization via checklist to identify work products appropriate for each life cycle phase
  - Conduct an internal mini-appraisal every year to determine the current state of the practice
Useful Tools

- PIID reviews for each process area
- Detailed schedule
- Project briefing template
- Generic Practice institutionalization (list/chart)
- Templates and Checklists
- Written/verbal Affirmations
- SCAMPI Method (C, B, Readiness Review, A)
# More Useful Tools

## SDPDD Stakeholder Matrix

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<thead>
<tr>
<th>STAKEHOLDERS</th>
<th>INTERNAL</th>
<th>EXTERNAL</th>
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<tr>
<td>Process/Activity/Work Products</td>
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# More Useful Tools

- **Level of Control Table (Data Mgt. Plan)**

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**Artifact Location**

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Is CMMI Working?

- New projects are clearly reaping the benefits of past experience and lessons learned
- Better project planning due to more visibility into engineering life cycle processes
- Reduced training time and learning curve for new employees
- Better understanding of organizational and project interdependencies
- More awareness of stakeholder relationships and interfaces