NASA Electrical, Electronic, and Electromechanical (EEE) Parts Management Overview

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# Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AFRC</td>
<td>Armstrong Flight Research Center</td>
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<tr>
<td>ARC</td>
<td>Ames Research Center</td>
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<tr>
<td>BNL</td>
<td>Brookhaven National Laboratory</td>
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<tr>
<td>BPA</td>
<td>Blanket Purchase Agreement</td>
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<td>CNL</td>
<td>Crocker Nuclear Laboratory</td>
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<td>COTS</td>
<td>Commercial-off-the-shelf</td>
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<tr>
<td>EEE</td>
<td>Electrical, electronic, &amp; electromechanical</td>
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<tr>
<td>ETW</td>
<td>Electronic Technologies Workshop</td>
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<td>FY</td>
<td>Fiscal Year</td>
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<td>GRC</td>
<td>Glenn Research Center</td>
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<td>GSFC</td>
<td>Goddard Space Flight Center</td>
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<tr>
<td>IAA</td>
<td>Interagency Agreement</td>
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<td>JPL</td>
<td>Jet Propulsion Laboratory</td>
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<td>JSC</td>
<td>Johnson Space Center</td>
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<td>KSC</td>
<td>Kennedy Space Center</td>
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<td>LaRC</td>
<td>Langley Research Center</td>
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<td>LBNL</td>
<td>Lawrence Berkeley National Laboratory</td>
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<td>MSFC</td>
<td>Marshall Space Flight Center</td>
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<td>NEPP</td>
<td>NASA Electronic Parts &amp; Packaging (Program)</td>
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<td>NESC</td>
<td>NASA Engineering &amp; Safety Center</td>
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<td>NSCL</td>
<td>National Superconducting Cyclotron Laboratory</td>
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<td>NSRL</td>
<td>NASA Space Radiation Laboratory</td>
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<td>OCE</td>
<td>Office of the Chief Engineer</td>
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<td>OSMA</td>
<td>Office of Safety and Mission Assurance</td>
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<td>RFI</td>
<td>Request for Information</td>
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<td>RFP</td>
<td>Request for Proposals</td>
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<td>SEE</td>
<td>Single-event effects</td>
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<td>SEUTF</td>
<td>Single-Event Upset Test Facility</td>
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<td>TAMU</td>
<td>Texas A&amp;M University</td>
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<tr>
<td>TRIUMF</td>
<td>Formerly known as the Tri-University Meson Facility</td>
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• Background on Agency EEE parts management
  – Recap 2018 status and look forward to rest of 2019 and beyond
• Changing radiation test facility landscape & radiation block buy
  – Preserve required capabilities
  – Establish effective & efficient access for all
• Examples of EEE parts management efforts
  – Exchange data & develop workforce
• Summary and forward work
EEE Parts Management
History of Agency EEE Parts Management

- Continued activities and Center discussions, Fall 2016 – Fall 2017
- Hired Agency EEE Parts Manager, November 2017

- Covers EEE parts and radiation engineering (on EEE parts) functions
  - Crosscuts engineering and safety & mission assurance
- Focuses on new ways to do business in light of workforce challenges and the demands of characterizing, qualifying, and deploying new technologies
• Manage EEE parts workforce at the Agency level
  – Radiation effects on EEE parts are in scope, as is management of the Agency radiation facility block buy (later slides)
  – GSFC is lead Center, with support from JPL

• Provide resources for Centers to acquire EEE parts workforce expertise and a forum to coordinate activities with stakeholders (e.g., OCE, OSMA, etc.) and customers

• Track the state of the Agency EEE parts workforce, including Center expertise, demand, and capacity

• Support Agency policy and technical decision-making processes

• Evolve management functions as needed
NASA EEE Parts – Interfaces

Agency EEE Parts

(NASA Electronic Parts Manager – Steward & Advocate for Capability)

Assurance

Office of Safety & Mission Assurance

- NEPP Program
  - Quality
  - Reliability
  - Workmanship

Development

Office of the Chief Engineer

Capability Leadership

NESC

Facilities

Flight Projects

Field Centers

Mission Directorates

Mission Support

Space Environments Testing Management Office

Customers

Partners

National Aeronautics and Space Administration / EEE Parts & Radiation Engineering

EEE Parts Management Team Members

Formal Connection

- NEPP
- NESC

Agency EEE Parts Manager
GSFC

Lead Center
GSFC

Supporting Center
JPL

Member Centers

- AFRC
- ARC
- GRC
- JSC
- KSC
- LaRC
- MSFC

Capability Leadership

External Partners

National Aeronautics and Space Administration / EEE Parts & Radiation Engineering

Radiation Test Facilities and Block Buy

*Focus on heavy ion and high-energy proton single-event effects (SEE) testing*
Domestic Radiation Facilities – SEE Testing

• Distributed across the United States
  – More than 15 states
  – International facilities

• Split into several general categories
  – Heavy ion
    • For example: BNL (NSRL & SEUTF), LBNL, NSCL, NSRL, and TAMU
  – (Traditional) High-energy protons
    • For example: Loma Linda Cancer Treatment Center, Massachusetts General Hospital, Northwestern Medicine, and NSRL
  – Medium-energy protons
    • For example: CNL, LBNL, and TAMU
  – New medical therapy facilities
    • Dynamic

• Require various procurement mechanisms and agreements
Phased Radiation Block Buy – Spurred by National Academies Report, Feb. 2018

- Background on space environment and its effects on electronics
- Current state of single-event effects hardness assurance and infrastructure
- Future infrastructure needs and a path towards them
- Status on workforce and development recommendations
- Detailed outbrief at 2018 NEPP ETW

• NASA’s Mission Support Council approved multi-phase plan to begin coordinating access to external radiation test facilities in February 2018
  – Phase 1 centrally-funded, Phase 2+ will be PayGo with blanket purchase agreements
  – Looking at options for international facilities too

• Assessing funding / procurement model based on needs and available budget
Recent Radiation Test Facility Activities

- Project-funded
- PayGo

- Mission-funded FY18-FY19
- Agency coverage FY20-FY24

LBNL 5-year IAA

CNL 5-year BPA

Medical Facility RFI

- Sources sought FY19Q2
- Final RFP FY19Q3
- Project-funded
- PayGo
Select EEE Parts Management Efforts

Communication strategy, data management, & workforce development
• Define stakeholders, engagement options, and outreach opportunities that facilitate access and efficient use of limited resources

• Migrate away from person-to-person and mass email defaults
  – Efficient knowledge capture & dissemination across enterprise
  – Utilize existing technology

• Highlight factors that enable efficient execution of work between NASA Centers
Lacking centralized information for EEE parts usage – particular issue for COTS
- Data are often stovepiped (even within orgs.)
- Can affect design process & quality assurance

Tracing EEE part usage, testing, and history may be difficult

Re-testing and/or re-ordering EEE parts with prior history may happen without *reasonable* knowledge symmetry

Assessing different potential internal and community-based solutions
Workforce Challenges – Next Generation

• EEE parts and radiation engineering are niche fields with crosscutting subject matter
  – Bulk of current workforce not specifically developed – mostly built with on-the-job-training

• Accelerating use of commercial-off-the-shelf (COTS) electronics and other advances (e.g., 2.5D/3D packaging, heterogeneous integration, sub-10 nm feature sizes, wide bandgap semiconductors, etc.) for flight hardware requires more commodity & discipline experts

• Among others, there is a persistent, across-the-board shortage of radiation effects (on EEE parts) engineers
  – Long-term needs will likely have to focus on training early career engineers and scientists while maintaining and transferring current knowledge base
Workforce Development – Two-Fold Strategy

- Engage academic community (new look)
- Informed by program, technology, and development needs
- Leverage parallel efforts

Develop sustainable workforce with acceptable baseline capability – be practitioner independent daily and maintain subject matter expertise

Grow New Community Members

- Hands-on experience (rotations?) with mentoring
- Curriculum study with conference participation
- Baseline assessment

Train Potential Community Members

Workforce Development
Summary & Forward Work

• Continuing NASA EEE parts management evolution
  – Capability structure, cross-Center workflow
  – Relationships with both internal and external stakeholders

• Proceeding with multi-phase Agency radiation block buy
  – Completed Phase 1 at LBNL; executing Phase 2 for proton test facilities; considering options for Phase 3
  – Evaluating facility maintenance needs & upgrade possibilities

• Implementing strategies for workforce development and other capabilities to meet current and future mission needs
Thank you for your attention
Questions welcome!

Image credit: NASA
International Space Station is seen in this twenty-second exposure as it flies over the Washington National Cathedral, Wednesday, Nov. 29, 2017.