Acknowledgment:
This work was sponsored by: NASA Office of Safety & Mission Assurance
Acronyms

- Three Dimensional (3D)
- The Aerospace Corporation (Aerospace)
- Air Force (AF)
- Air Force Research Laboratory
- Amkor Technology
- Ames Research Center (ARC)
- Arctic Slope Regional Corporation (ASRC) Federal Space and Defense (AS&D)
- Bayesian Networks (BN)
- Body of Knowledge (BOK)
- Capability Leadership Teams (CLTs)
- Complementary Metal Oxide Semiconductor (CMOS)
- Carnegie Mellon University (CMU)
- Commercial Off-the-Shelf (COTS)
- Cosmic Ray Effects on Micro-Electronics (CRÈME)
- Defense Logistics Agency (DLA)
- Department of Defense (DoD)
- Department of Energy (DOE)
- Electrical, Electronic, and Electromechanical (EEE)
- NEPP Electronics Technology Workshop (ETW)
- Field Programmable Gate Array (FPGAs)
- MSU Facility for Rare Isotope Beams (FRIB)
- Gallium Nitride (GaN)
- Government-Industry Data Exchange Program (GIDEP)
- Glenn Research Center (GRC)
- Goddard Space Flight Center (GSFC)
- Goal Structuring Notation (GSN)
- Headquarters (HQ)
- Integra Technologies, LLC (Integra)
- Joint Electron Device Engineering Council (JEDEC)
- Jet Propulsion Laboratories (JPL)
- Johnson Space Center (JSC)
- Langley Research Center (LaRC)
- Lawrence Berkeley National Laboratories (LBNL)
- Mission Assurance Improvement Workshop (MAIW)
- Model-Based Mission Assurance (MBMA)
- Missile Defense Agency (MDA)
- Michigan State University (Michigan)
- Marshall Space Flight Center (MSFC)
- Michigan State University (MSU)
- National Aeronautics and Space Administration (NASA)
- NASA Electronic Parts Assurance Group (NEPAG)
- NASA Electronic Parts and Packaging (NEPP) Program
- NASA Engineering and Safety Center (NESC)
- United States Navy National Reconnaissance Office (NRO)
- National Superconducting Cyclotron Laboratory (NSCL)
- NASA Space Radiation Laboratory (NSRL)
- NASA Office of the Chief Engineer (OCE)
- NASA Office of Safety and Mission Assurance (OSMA)
- Point of Contact (POC)
- Reliability and Maintainability (R&M)
- Vanderbilt University's Notional RHA Tool (R-GENTIC)
- Radiation Hardened (RH)
- Radiation Hardness Assurance (RHA)
- Society of Automotive Engineers (SAE)
- Space Asset Protection Program (SAPP)
- Systems Engineering and Assurance Modeling (SEAM)
- Single Event Effect (SEE)
- Single Event Upset (SEU)
- Silicon Carbide (SiC)
- Air Force Space and Missile Systems Center (SMC)
- Subject Matter Expert (SME)
- SSL is a business unit of Maxar Technologies (SSL)
- NASA Space Technology Mission Directorate (STMD)
- SUNY Polytechnic Institute (SUNY)
- University of Surrey (Surrey)
- System Modeling Language (SysML)
- Texas A&M University (TAMU)
- To Be Determined (TBD)
- Texas Instruments (TI)
- Technical Operating Reports (TORs)
Outline

• Meeting Introduction and Logistics
• NEPP Program
  – Brief Diatribe: NASA Electrical, Electronic, and Electromechanical (EEE) Structure
  – NEPP Program Structure
• NEPP 2018
  – NEPP Overview
  – Changes in 2018
  – Key efforts, concerns, and status
• NASA Electronics Parts Assurance Group (NEPAG)
• Summary
Ninth Annual ETW!

• Annual meeting
  – Originally, “just” a Program Review
  – Has morphed intro a Program Review with multiple focused and timely technical and infrastructure topics
    • Examples include: Space Radiation Test Facilities, Copper Bond Wires, 2.5/3D Packaging, Small Mission Success, and more!
• Four full days
  – All presentations will be posted on the NEPP website after appropriate release by presenters and their organizations
• Long breaks and on-your-own lunch periods to foster networking opportunities
• Coffee is supplied by hosts (but Starbucks across the street)
• >350 registrants this year
NASA EEE Parts – New Structure

- New NASA EEE Parts Manager:
  - Leads efforts related to EEE Parts workforce and capabilities
  - Jonathan Pellish is the new EEE Parts Manager*

- NEPP remains *virtually* the same:
  - Owns the EEE parts assurance processes (and related technical efforts)

- Increased NASA-wide documents
  - NASA Standard 8739.10, *Released*
  - EEE-INST-002 update and unification underway*

* = on the agenda
NEPP Mission Statement

Provide NASA’s leadership for developing and maintaining guidance for the screening, qualification, test, and reliable use of Electrical, Electronic, and Electromechanical (EEE) parts by NASA, in collaboration with other government agencies and industry.

Note: The NASA Electronic Parts Assurance Group (NEPAG) is a key portion of NEPP

- Standards, working groups, guidance, problem parts, …
NEPP Program – Organization Chart

NEPP Program Executive, John Evans/OSMA HQ

NEPP Program Manager, Ken LaBel/GSFC

NEPP Deputy Program Manager, Peter Majewicz (acting)

NEPP Program Support, Freda Kagere/GSFC – resources
Martha O'Bryan, GSFC/AS&D
Donna Cochran, GSFC/AS&D

NEPAG Manager, Mike Sampson/GSFC

Senior NEPAG Staff, Shri Agarwal/JPL, Jay Brusse, GSFC/AS&D

Senior NEPP Staff, Jonathan Pellish/GSFC

NEPP GSFC POC, Chris Green
NEPP JPL POC, Doug Sheldon
NEPP MSFC POC, Jeff Martin (acting)
NEPP LaRC POC, John Pandolf
NEPP GRC POC, Kristen Boomer
NEPP JSC POC, Carlton Faller

NEPP Sys Admin, Carl Szabo/GSFC/AS&D

EEE Parts Manager, Jonathan Pellish, GSFC

NESC, Multiple
NEPP - Charter

Mission Assurance

Agency Leadership
• NASA Policies and Procedures
• Agency Guidelines, Body of Knowledge (BOK) documents, and Best Practices
• Coordination of Government and Industry Standards
• Audit Coordination with AF, NRO, DLA
• Partnering within NASA and other Agencies, Industry, University, and International

Tech Evaluation
• Advanced/new EEE parts/technologies
  • Ex. Advanced CMOS, GaN, SiC
• Working Groups (NASA, government, aerospace)
• Screening/qualification/test/usage guidelines
• Partnering: NASA, Government Agencies, Industry, University, International

EEE Parts Problem Investigations
• Agency/Industry-wide problems
• GIDEP and NASA Alert development

Trusted and RH Electronics
• Collaboration with NASA and other Agency Supply Chain and Trust/Counterfeit Electronics Organizations
• Support DoD efforts on Trusted Foundries and FPGAs (w/NASA STMD and OCE/Space Asset Protection)
• Support DoD RH efforts

Agency Priorities – Independent Support
• Commercial Crew
• Small Mission Reliability
• Coordination with NASA Consolidation, CLTs, NESC, STMD, SAPP, and radiation block buy
• Collaborate with DoD/DOE on space radiation test infrastructure

EEE Parts Infrastructure
• NEPAG Telecons and Working Groups
• SME Capabilities
• Communication and Outreach within NASA and to the greater aerospace community

Technology Evaluation
• Advanced/new EEE parts/technologies
  • Ex. Advanced CMOS, GaN, SiC
• Working Groups (NASA, government, aerospace)
• Screening/qualification/test/usage guidelines
• Partnering: NASA, Government Agencies, Industry, University, International

To be presented by Kenneth A. LaBel at the 2018 NEPP Electronics Technology Workshop (ETW), NASA GSFC, Greenbelt, MD, June 18-21, 2018.
NEPP – Product Delivery

Best Practices and Guidelines
- Test, usage, screening, qualification
- Radiation facility studies

Body of Knowledge (BOK)
- Technology and product status and gap analysis

NASA EEE Parts Policy and Standards

Government and Industry Standards Representation
- SAE CE-11 and CE-12
- JEDEC JC13
- Aerospace TORs

NEPP Standard Products
- Test, summary, and audit reports
- Conference and workshop presentations
- Alerts

Assurance

Related task areas:
Technology/parts evaluations lead to new best practices, guidelines,…

To be presented by Kenneth A. LaBel at the 2018 NEPP Electronics Technology Workshop (ETW), NASA GSFC, Greenbelt, MD, June 18-21, 2018.
What’s New for NEPP?

- Agency EEE Parts Manager
  - Support efforts on workforce, facilities, etc…
- Increased delivery of assurance products
  - BOKs, Guidelines, Tools, Information Sharing, Training
  - Unification of NASA documentation (NEPAG)
- Increased discussion on the role of standardization processes (NEPAG) and data sharing
- Increased emphasis on
  - Guidance and understanding of small missions such as CubeSats
  - Model-based mission assurance (MBMA) and radiation tool “standardization”
  - Changing EEE parts industry such as the move to “mid-space”
  - Partnering with other NASA organizations, Agencies, and universities
    - Expansion of outreach in all these areas
- Significant update of the NEPP website planned
  - Easier to find guidance and search for data
  - New tie-ins to the SmallSat community
- First look at “big data” analyses…

To be presented by Kenneth A. LaBel at the 2018 NEPP Electronics Technology Workshop (ETW), NASA GSFC, Greenbelt, MD, June 18-21, 2018.
Providing Guidance Based on Function and Exposure since 2014

<table>
<thead>
<tr>
<th>Criticality</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<td>Medium</td>
<td>High</td>
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<td>Level 1 or 2 suggested. COTS upscreening/testing recommended. Fault tolerant designs for COTS.</td>
<td>COTS upscreening/testing recommended. Fault-tolerance suggested</td>
<td>Level 1 or 2, rad hard suggested. Full upscreening for COTS. Fault tolerant designs for COTS.</td>
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| Level 1 or 2, rad hard suggested. Full upscreening for COTS. Fault tolerant designs for COTS. | Level 1 or 2, rad hard suggested. Full upscreening for COTS. Fault tolerant designs for COTS. |}

Low COTS upscreening/testing optional. Do no harm (to others)

Rad hard suggested. COTS upscreening/testing recommended. Fault tolerance recommended

To be presented by Kenneth A. LaBel at the 2018 NEPT Electronics Technology Workshop (ETW), NASA GSFC, Greenbelt, MD, June 18-21, 2018.
The Future of Radiation Hardness Assurance (RHA)?

Integration of tools, knowledge, and processes

- Standard radiation tools (ex., CREME96)
- Requirements and environment definition and development
- New assurance approaches (ex., MBMA)
- Emerging assurance concepts (ex., Bayesians, confidence, and SEU reliability)
- Validation (device and system)
- Test approach standards and guidelines
- Data sharing, analysis, and dissemination (ex., “big” data, repositories, etc…)

Bottom line goal:

*Provide appropriate and stream-lined approaches for flight projects (of all sizes)*

To be presented by Kenneth A. LaBel at the 2018 NEPP Electronics Technology Workshop (ETW), NASA GSFC, Greenbelt, MD, June 18-21, 2018.
Tenet: the best ideas will die on the vine without integration into standard approaches or tools. It’s all about access.
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<thead>
<tr>
<th>Mon</th>
<th>18-Jun</th>
<th>Tues</th>
<th>19-Jun</th>
<th>Wed</th>
<th>20-Jun</th>
<th>Thurs</th>
<th>21-Jun</th>
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<tbody>
<tr>
<td>NEPP Overview</td>
<td>LaBel - NASA NEPP</td>
<td>National Academies of Science Outbrief of Testing at the Speed of Light - Nielsen - CMU (study co-lead), et al</td>
<td>Guertin - NASA JPL, Wyrwas - NASA-GSFC/Lentech</td>
<td>Small Spacecraft Systems Virtual Institute (S3VI)</td>
<td>Yost - NASA ARC</td>
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<td>NASA Parts Standard and Plans Moving Forward</td>
<td>Majewicz - NASA NEPP</td>
<td>Radiation Test Facilities</td>
<td>Processors</td>
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<td>Capacitors, Resistors</td>
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<td>COTS diodes in Hi-rel applications</td>
<td>Loman - SSL</td>
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<td>Program: Utility of EEE Parts Audits</td>
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<td>Integration of tools</td>
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<td>Witulske or Sierawski - Vanderbilt</td>
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Questions?

https://nepp.nasa.gov