1st NASA Electronic Parts and Packaging (NEPP) Program
Electronic Technology Workshop (ETW)

Kenneth A. LaBel
ken.label@nasa.gov
301-286-9936

Michael J. Sampson
michael.j.sampson@nasa.gov
301-614-6233

Co-Managers NEPP Program

http://nepp.nasa.gov

NEPP Mission

• To provide guidance to NASA:
  - Selection and application of microelectronics technologies
  - Improved understanding of risks related to the use of these technologies in the space environment
  - Appropriate evaluations to meet NASA mission assurance needs for electronic systems
• NEPP evaluates new* and emerging** electronic parts technologies and provides assurance support for technologies in current use in NASA spaceflight systems

*New – Recently marketed, commercially available
**Emerging – Available in limited quantities for evaluation, on path to commercial products
NEPP Overview

- NEPP supports all of NASA for >20 years
  - 7 NASA Centers and JPL actively participate
- The NEPP Program focuses on the reliability aspects of electronic devices
  - Three prime technical areas: Parts (die), Packaging, and Radiation
- Alternately, reliability may be viewed as:
  - Lifetime, inherent failure and design issues related to the electronic parts technology and packaging,
  - Effects of space radiation and the space environment on these technologies, and
  - Creation and maintenance of the assurance support infrastructure required for mission success.

NEPP Works Two Sides of the Equation

- Assurance
  - Issues that are applicable to space systems being designed and built (i.e., currently available technologies)
  - Examples
    - Cracked capacitors
    - DC-DC converter reliability
    - Enhanced Low Dose Rate Sensitivity (ELDRS)
  - Communication infrastructure via website and working groups
    - NASA Electronic Parts Assurance Group (NEPAG)
  - Audit and review support
- New electronics technology
  - Issues that are applicable to the next generation of space systems in conceptualization or preliminary design
  - Examples
    - 45-90 nm CMOS
    - SiGe
    - State-of-the-art FPGAs
  - Collaboration with manufacturers and government programs for test, evaluation, and modeling
  - Development of new predictive performance tools
## The NEPP Program

<table>
<thead>
<tr>
<th>Management</th>
<th>Ken LaBel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Elements</td>
<td>Ken LaBel</td>
</tr>
<tr>
<td>Focus Technologies</td>
<td>Ken LaBel</td>
</tr>
<tr>
<td>Products/ Deliverables</td>
<td>Ken LaBel</td>
</tr>
</tbody>
</table>

- Radiation Effects
- Advanced Actives
- NEPP Events
- Electronic Parts Reliability
- Radiation Effects
- Parts Assurance (NEPAG)
- Advanced Packaging
- Information Dissemination

**Guidelines**
- Specifications and Standards
- Test Methods

**Website Content**
- NASA Parts Selection List
- Tools
- Data

**Technical Reports**
- Bodies of Knowledge
- Conference Papers

---

### Typical Spacecraft Electrical Architecture

![Diagram of Typical Spacecraft Electrical Architecture](image)

- C&DH
- Command and Data Bus
- GN&C
- Propulsion
- Thermal
- Power

---

To be presented by Kenneth A. LaBel at JEDEC Solid State Technology Association
JC-13 Meeting, Nashville, TN, May 17-21, 2010
Typical Spacecraft Electrical Architecture

The 90/90 Goal

Sample NEPP Technology Areas
- Memories
- FPGAs
- Capacitors
- SiGe
- Power devices

90% of NEPP efforts should support 90% of NASA flight missions

1st NEPP ETW Overview presented by Kenneth A. LaBel at JC 13.4 Meeting, Nashville, TN – May 18, 2010

To be presented by Kenneth A. LaBel at JEDEC Solid State Technology Association
JC-13 Meeting, Nashville, TN, May 17-21, 2010
NEPP Has a Wide Range of Efforts

- Tasks vary extensively in the technologies of interest
  - Building blocks like capacitors
  - Standard products like DC-DC Converters, linear bipolar devices, and A-to-D Converters
  - New commercial devices such as FPGAs and memories
  - Test structures on emerging commercial or radiation hardened technologies
  - Specialized electronics such as IR arrays and fiber optics
  - New assurance methods and investigations
- NEPP ETW provides forum to present recent results, as well as current and future plans
- Currently in FY11 planning cycle
  - PRELIMINARY PLANS FOLLOW
FY11 Radiation Plans for NEPP Core (1)

Core Areas are Bubbles; Boxes underneath are variable tasks in each core

NEPP Research Categories – Active Electronics

- SIGs, Mixed Signal
- Scaled CMOS
- Sensor Technologies
- Photonics
- Performance Tools

Develops students at
Georgia Tech,
Vanderbilt, Auburn,
Actel, Atmel, Xilinx, Altera, Cypress

Partners at:
AFRL, Cypress, Ball
DoD, IBM, TI, Intel, Boeing,
Vanderbilt, Auburn, Actel, Atmel, Xilinx, Altera, Cypress

Develops students at Vanderbilt

Partners include: AFRL, Cypress, Ball
DoD, IBM, TI, Intel, Boeing,
Vanderbilt, Auburn, Actel, Atmel, Xilinx, Altera, Cypress

FY11 Radiation Plans for NEPP Core (2)

Core Areas are Bubbles; Boxes underneath are variable tasks in each core

NEPP Research Categories – Hardness Assurance

- BLDRS Test
- Temperature Effects
- Power Devices
- Combined Effects
- Guidelines

Other Overguide Tasks
Education/training modules
Microwave Technologies
Additional SOC Testing

Develops students at
NSWC, IR, Fuji,
STM, Microsemi

Partners at
vendors listed,
RLP Research, ASU

Partners at
NSWC, IR, Fuji,
STM, Microsemi

To be presented by Kenneth A. LaBel at JEDEC Solid State Technology Association
JC-13 Meeting, Nashville, TN, May 17-21, 2010
1st NEPP ETW

This meeting will focus on the presentation of the work being performed under the NEPP Program for the betterment of NASA and the greater aerospace community. This meeting will describe NEPP tasks that provide critical guidance, qualification methodologies, risk trades, and technology insertion information for current and new electronic technologies. This meeting will be of specific interest to flight project managers, system and design engineers, technologists, parts, packaging, and radiation specialists.

The meeting will be held at NASA/GSFC in Greenbelt, MD on June 22-24, 2010 and open to all US citizens from NASA, other government agencies, industry, and academia. Pre-registration is required. We are currently taking people for an overflow waiting list.

Details can be found at http://nepp.nasa.gov
ETW Format

- 2.5 days of presentations
  - Invited talks on NASA and technology, power system architectures, FPGA studies, counterfeit electronics, workmanship, and more
  - Oral and poster presentations from task and area leads
    - Topical: Ex., Dealing with next generation of device complexity
    - Task specific: Ex., On-Going Radiation Effects on FPGAs - Lessons Learned and Plans
  - Preliminary program at NEPP website
- Breakout sessions on the last day
  - Talk to the experts
    - We will have ~4 breakout meetings to discuss issues and challenges in specific topic areas
    - This should be set shortly

QUESTIONS?