The NASA Electronic Parts and Packaging (NEPP) Program – CubeSats

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To be published on nepp.nasa.gov previously presented by Kenneth LaBel at the NASA Electronic Parts and Packaging (NEPP) Electronics Technology Workshop (ETW), Greenbelt, MD, June 17-19, 2014.
Outline

- Acronym List
- Frame of Reference
- Plans for FY14/FY15
- EEE Parts for Small Missions

http://www.triy.org/ENG/learning4a/images/TRIY_46.jpg

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# Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Bldg</td>
<td>Building</td>
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<tr>
<td>COP</td>
<td>Community of Practice</td>
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<tr>
<td>DC</td>
<td>Direct Current</td>
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<tr>
<td>EEE</td>
<td>Electrical, Electronic, and Electromechanical</td>
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<tr>
<td>FY</td>
<td>Fiscal Year</td>
</tr>
<tr>
<td>GaN</td>
<td>Gallium Nitride</td>
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<tr>
<td>IP</td>
<td>Intellectual Property</td>
</tr>
<tr>
<td>MOSFET</td>
<td>Metal Oxide Semiconductor Field Effect Transistor</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<td>NEPP</td>
<td>NASA Electronic Parts and Packaging</td>
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<tr>
<td>POL</td>
<td>Point of Load</td>
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<tr>
<td>RF</td>
<td>Radio Frequency</td>
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<tr>
<td>SEU</td>
<td>Single Event Upset</td>
</tr>
<tr>
<td>SiC</td>
<td>Silicon Carbide</td>
</tr>
<tr>
<td>specs</td>
<td>specifications</td>
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<tr>
<td>TI</td>
<td>Texas Instruments</td>
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Frame of reference

- NASA, like many other organizations, is showing increasing desire to develop smaller, cheaper missions. NEPP is active in supporting this direction.
  - Open EEE parts workshop to be held in Sep 2014.
- This area is more appropriately called “small missions” of which CubeSats are a sub-category.

Notional “swarm” – NASA Edison project

http://www.nasa.gov/sites/default/files/styles/226xvariable_height/public/744216main_edsn_image1.jpg?itok=plm6J5Qq
NEPP Proposed Plan for Small Missions

• Driving factors
  – Low power consumption and small volume electronics,
  – Cost-consciousness, and
  – Limited radiation risks (unless outside low earth orbit).

• EEE parts needs:
  – Alternate grade and advanced electronics (metrics: power and volume/performance) and
  – Improved EEE parts guidance: tailored standard approach (Class D) and “first exposure” to space/reliability of EEE parts (university CubeSats).

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FY14 NEPP Core –
Automotive/Commercial Electronics (Small Missions)

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

NEPP Research Category – Automotive/Commercial Electronics

Automotive Electronics

Body of Knowledge on specs, standards, and vendor approaches
Reliability evaluation of ceramic capacitors, discrete transistors, and microcircuits

Work performed by Navy Crane in collaboration

Alternate Test Approaches

Effectiveness of Board Level Testing for Piecepart Qualification (will utilize boards with processors and microcontrollers)

Mobile Processors

Intel Atom, Qualcomm Snapdragon Processors (radiation only)

Microcontrollers

Freescale Automotive Microcontroller (+ board)

CubeSat vendor Microcontrollers: Tyvak (TI microcontroller), Pumpkin (Atmel microcontroller) (radiation only)

Advanced Processors

Freescale P5040 Network Processor (+board)
(IP for next generation BAE Systems Rad Hard Processor)

Legend

NEPP Ongoing Task
FY14 Proposed New Start

Requirements collaboration with Freescale

Guidance, Documents

Rule of thumb documents
Policy, Guidelines
Microcontroller recommendations
CubeSat Parts Database
COP

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FY14 NEPP Core - Power Devices

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

NEPP Research Category – Power Devices

- Power Converters
  - DC-DC Converter Working Group
  - POL SEU Susceptibility

- Power MOSFETS – Silicon
  - New Mil/Aero Product Evaluation (Radiation)
  - (CubeSat) Commercial Power MOSFET Evaluation (Radiation)

- Widebandgap Power and RF
  - Widebandgap Working Group
  - GaN Radiation Test
  - SiC Radiation Test
  - Combined Effects Reliability

- Assurance
  - Standards Support

Legend
- NEPP Ongoing Task
- FY14 Proposed New Start

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EEE Parts for Small Missions

• Meeting Dates: Sep 10-11, 2014
• Location: NASA/GSFC Greenbelt, MD Bldg. 3 auditorium and via web participation. On-site participation will be limited to US/green card participants as well as auditorium capacity.

As a follow-on to an internal NASA EEE parts workshop held in FY13, the NEPP Program will be hosting an open workshop entitled “EEE Parts for Small Missions.” The focus of this workshop is two-fold:

– Provide small mission designers (and new designers) exposure to reliable use of EEE parts in small missions (i.e., “rules of thumb” for parts usage, testing/qualification, and design), and,
– Provide a forum for discussion of recent efforts, plans, and accomplishments. This will include, for example, a discussion on the use of automotive electronics.

• While there is not a formal “call for presentations,” we seek participation from industry, universities, and other government agencies. Volunteers welcome.

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