





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

Kenneth A. LaBel Michael J. Sampson
 ken.label@nasa.gov michael.j.sampson@nasa.gov
 301-286-9936 301-614-6233

Co- Managers NEPP Program

http://nepp.nasa.gov

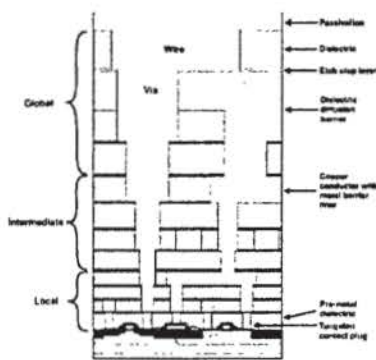
1st NEPP ETW Overview presented by Kenneth A. LaBel at JC 13.4 Meeting, Nashville, TN – May 18, 2010



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

Typical Chip Cross Section



*New – Recently marketed, commercially available

** Emerging – Available in limited quantities for evaluation, on path to commercial products

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



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.

*Electrical overstress failure
in a commercial electronic device*



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

3

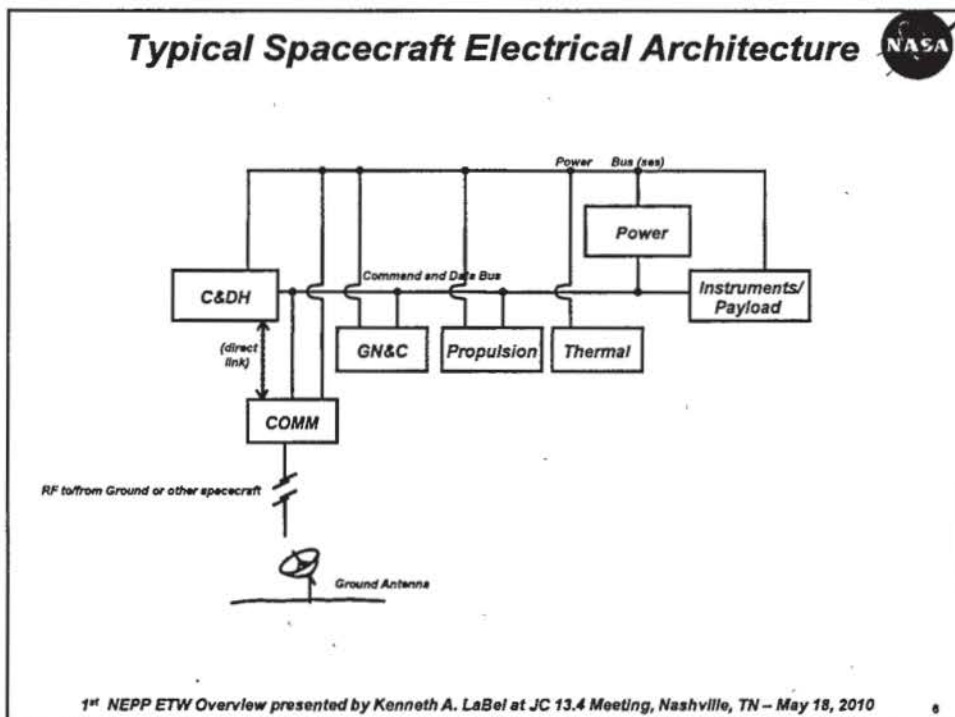
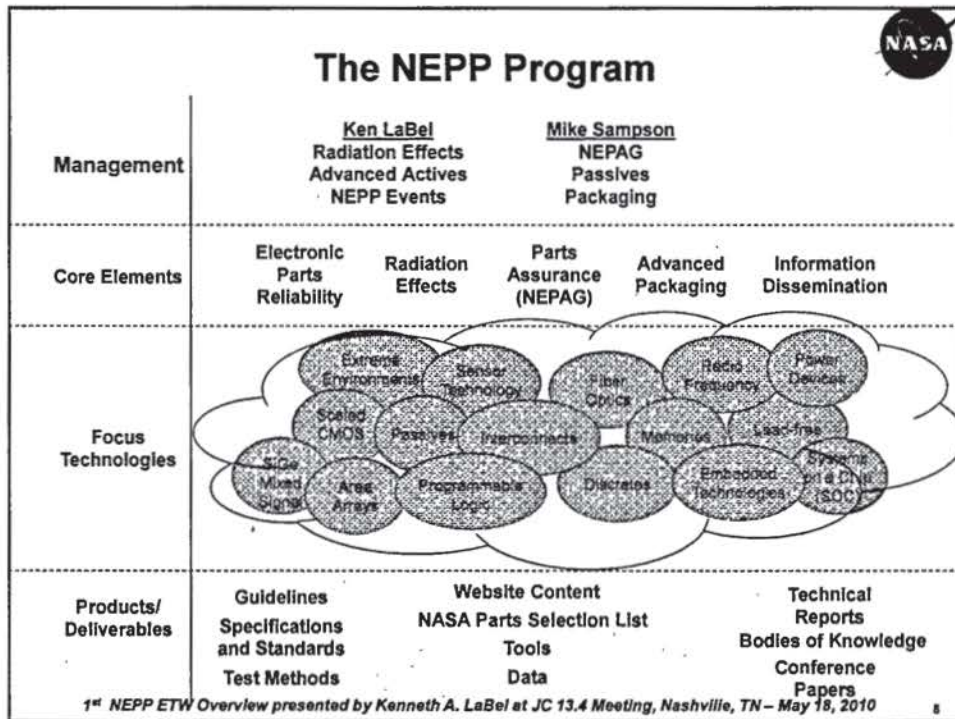


NEPP Works Two Sides of the Equation

- | | |
|--|---|
| <ul style="list-style-type: none"> • Assurance <ul style="list-style-type: none"> – <i>Issues that are applicable to space systems being designed and built (i.e., currently available technologies)</i> – Examples <ul style="list-style-type: none"> • Cracked capacitors • DC-DC converter reliability • Enhanced Low Dose Rate Sensitivity (ELDRS) – Communication infrastructure via website and working groups <ul style="list-style-type: none"> • NASA Electronic Parts Assurance Group (NEPAG) – Audit and review support | <ul style="list-style-type: none"> • New electronics technology <ul style="list-style-type: none"> – <i>Issues that are applicable to the next generation of space systems in conceptualization or preliminary design</i> – Examples <ul style="list-style-type: none"> • 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 |
|--|---|

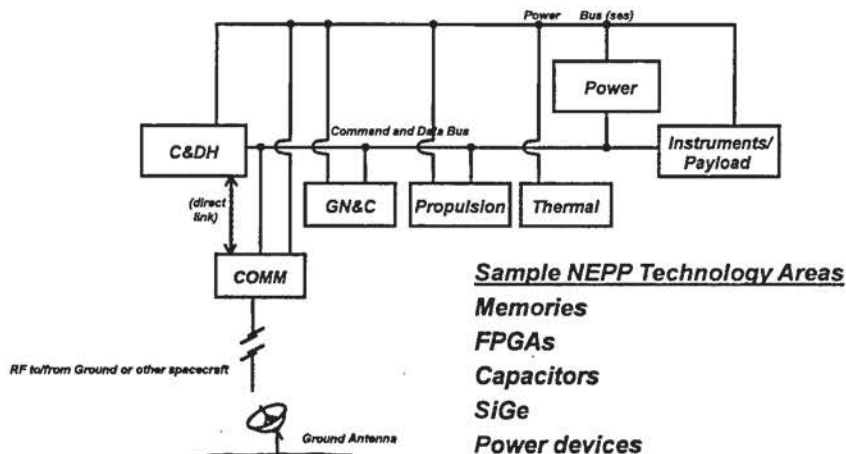
1st NEPP ETW Overview presented by Kenneth A. LaBel at JC 13.4 Meeting, Nashville, TN – May 18, 2010

4



Typical Spacecraft Electrical Architecture

The 90/90 Goal

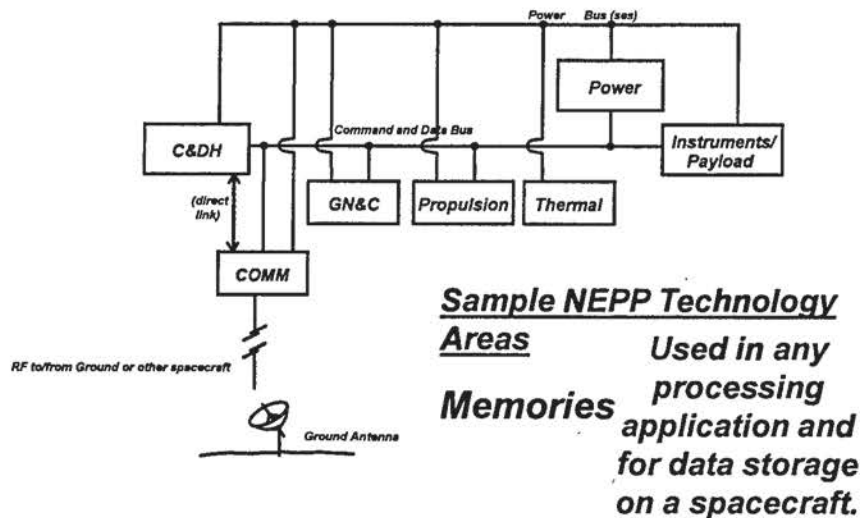


**90% of NEPP efforts should support
90% of NASA flight missions**

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

Typical Spacecraft Electrical Architecture

The 90/90 Goal - Example



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

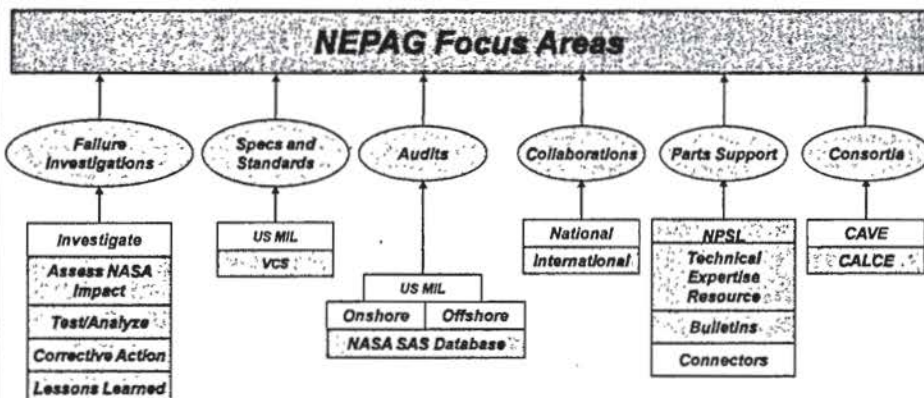
1st NEPP ETW Overview presented by Kenneth A. LaBel at JC 13.4 Meeting, Nashville, TN – May 18, 2010

NASA Electronic Parts Assurance Group (NEPAG)



Core Areas are Bubbles
Boxes underneath are elements in each core

Legend	
	DOD and NASA Funded
	NASA-only funded
	Overguide



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

10

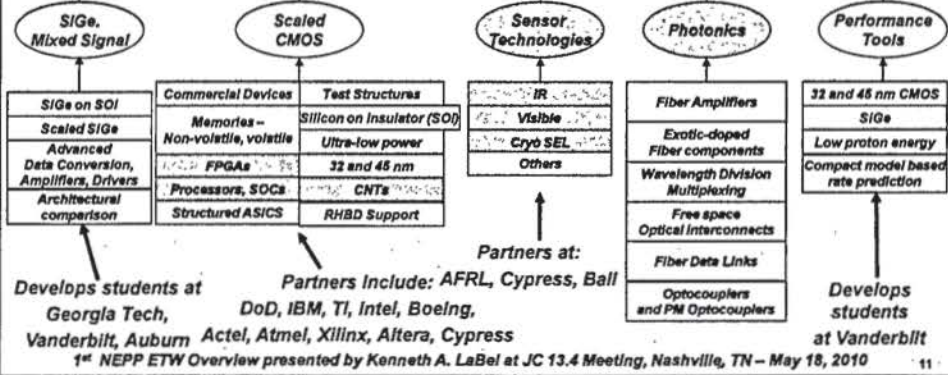
FY11 Radiation Plans for NEPP Core (1)



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

Legend	
DoD and NASA funded	
NASA-only funded	
Overguide	

NEPP Research Categories - Active Electronics



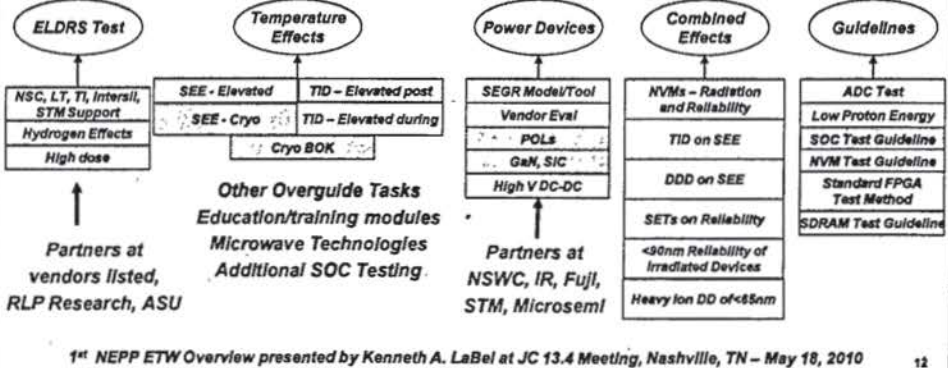
FY11 Radiation Plans for NEPP Core (2)



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

Legend	
DoD and NASA funded	
NASA-only funded	
Overguide	

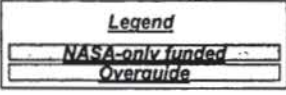
NEPP Research Categories - Hardness Assurance



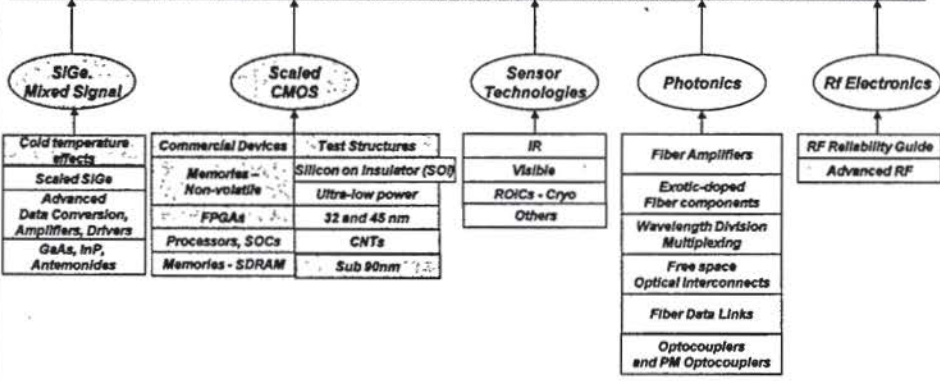
FY11 Parts Plans for NEPP Core (1)



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



NEPP Research Categories – Parts Assurance

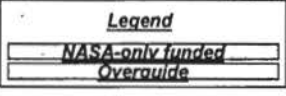


1st NEPP ETW Overview presented by Kenneth A. LaBel at JC 13.4 Meeting, Nashville, TN – May 18, 2010

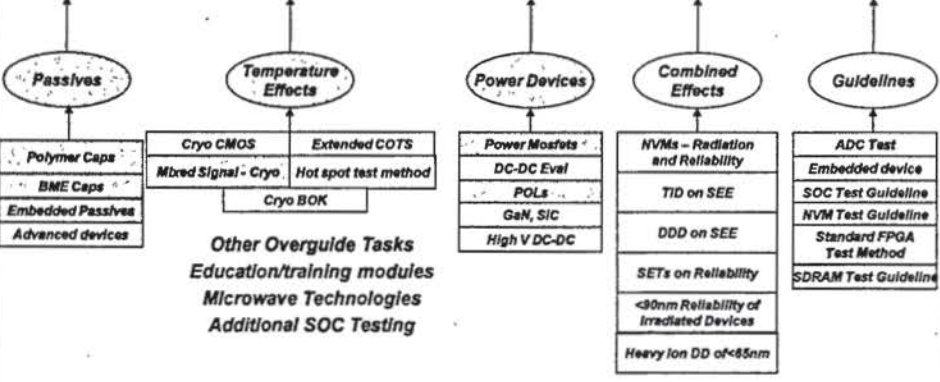
FY11 Parts Plans for NEPP Core (2)



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



NEPP Research Categories – Parts Assurance



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

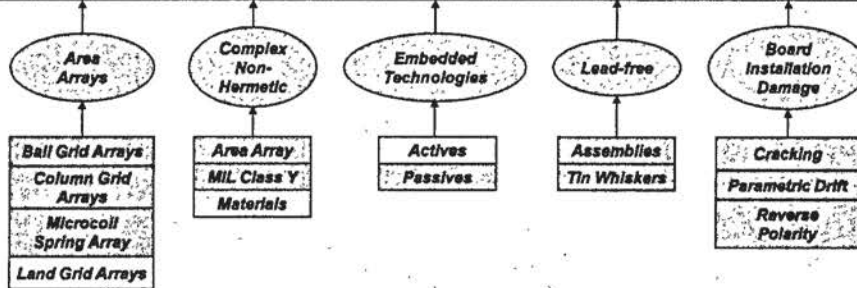
Core Element - Packaging



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

Legend
NASA-only funded
Overview

NEPP Research Categories - Advanced Packaging



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

15

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>

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

16

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

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

17

QUESTIONS?



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

18