

# **2<sup>nd</sup> NASA Electronic Parts and Packaging (NEPP) Program Electronic Technology Workshop (ETW)**

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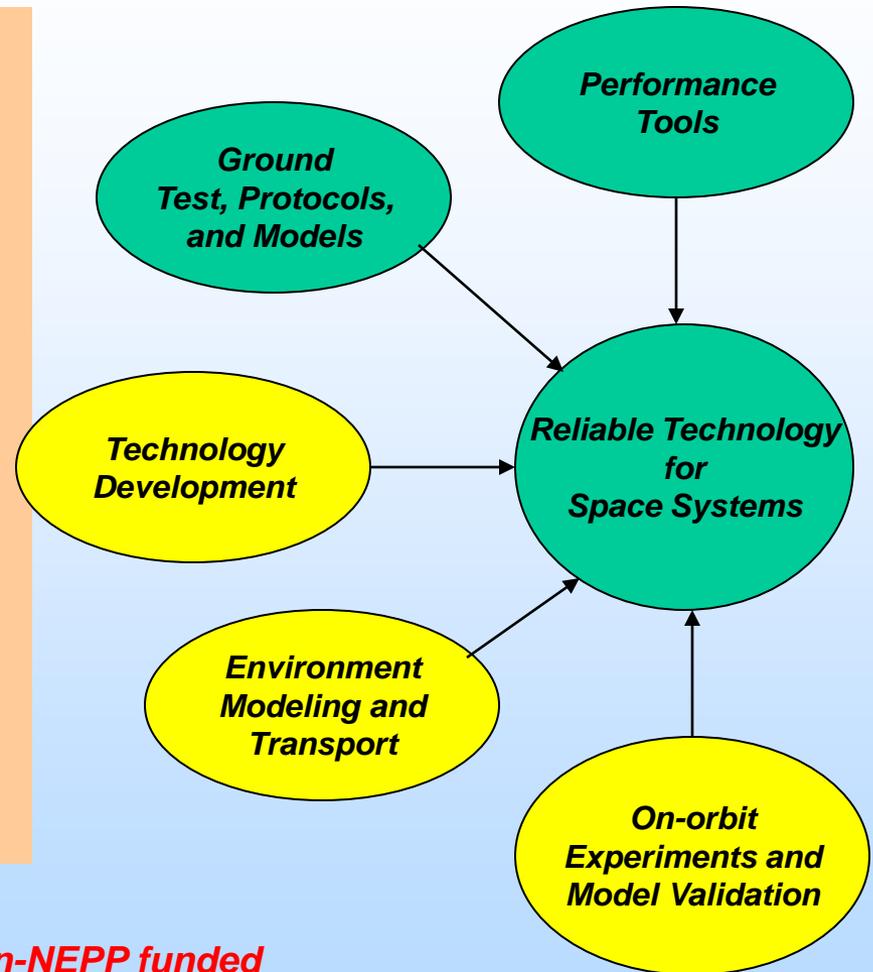
**<http://nepp.nasa.gov>**

# Insertion of New Electronics Technologies



## *The Big Picture Approach*

- Develop knowledge-base of existing technology information
- Determine reliability/radiation gaps
- Perform ground-based tests where appropriate
  - May be sufficient to “qualify” for a specific mission, but not generically for all
- Develop technology-specific models/test protocols
  - Performance Predictions
- Validate models with flight data
  - Requires in-situ environment monitoring



*Non-NEPP funded  
flight hardware*

# Hypothetical New Technology Part Qualification Cost – circa 2007



<i>Item</i>	<i>Cost</i>	<i>Note</i>
<b>Parts Procurement</b> (100+ device samples for testing only)	<b>\$25-1000K</b>	Individual device costs can run from cents to tens of thousands
<b>“Standard” Qualification Tests</b>	<b>\$300K</b>	
<b>Radiation Tests and Modeling</b>	<b>\$200K</b>	Assumes total dose and single event (heavy ion) only
<b>Failure Modes Analysis</b>	<b>\$200K</b>	Out-of-the-box look at the “hows and whats” for non-standard research required for qualification
<b>Additional Tests, Modeling, and Analysis based on Failure Modes</b>	<b>\$300K</b>	
<b>Total cost for one device type</b>	<b>\$1.025-2M</b>	Not all new technologies will meet standard qualification levels: technology limitations document

***Now add inflation and increased complexity and ...***

*2<sup>nd</sup> NEPP ETW Intro presented by Kenneth A. LaBel at NASA/GSFC – June 28, 2011*

# NEPP:



## *If we used Purely Commercial parts*

	Purely Commercial	Space
<b>Lifetime</b>	1-3 years, then replaced or thrown out	1-20 years and rarely replaceable
<b>Thermal</b>	0-70C	-55 to +125C with extremes much higher and lower
<b>Shock</b>	Oops! I dropped it. Time to get an upgrade...	Launch vibration
<b>Radiation</b>	Dude, where's my SPF?	Protons, electrons, galactic cosmic rays, solar, particles, plasma,...
<b>Anomaly</b>	Reboot or power cycle or return to dealer	Anomaly or failure

- **NEPP is the only entity at NASA that**
  - Trains young engineers in the difference and provides a growth path for developing project parts and radiation engineers
  - Develops and validates qualification methods
    - Military and commercial standards do not cover ALL of NASA's interests
  - Provides knowledge allowing insertion of modern devices into space systems
  - Shares and gathers knowledge with all the industry
    - If the flight projects don't know there's a problem...

# 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.
- Applied research and guideline/qualification method development

*Electrical overstress failure  
in a commercial electronic device*



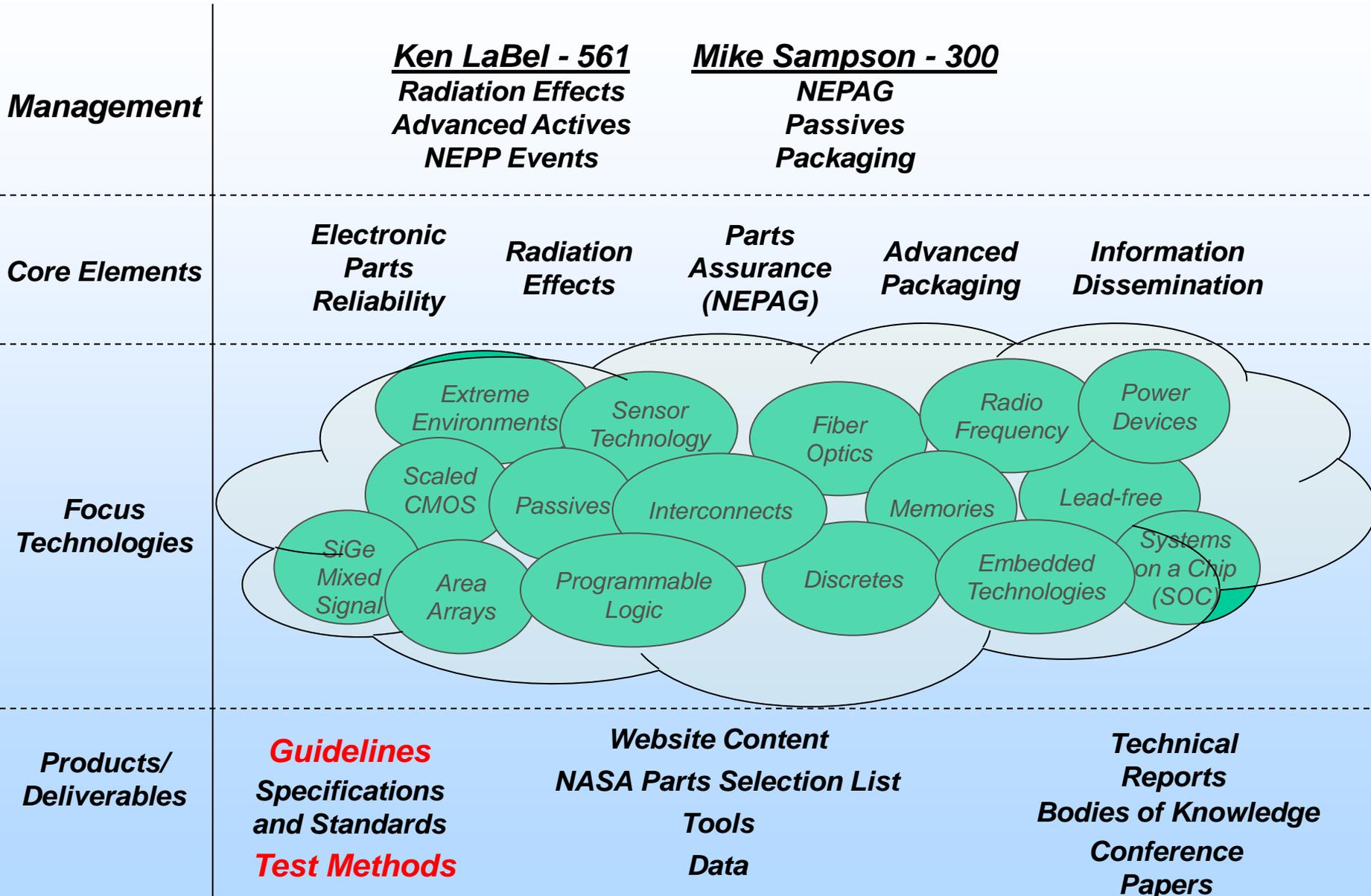


# NEPP Works Two Sides of the Equation

- **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 NEPP 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**
    - 22-45 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





# Collaboration

- “Promote enhanced cooperation with international, industry, other U.S. government agency, and academic partners in the pursuit of our missions.” – *Charles Bolden, NASA Administrator*
- NEPP has a long history of collaboration. For radiation efforts:
  - Direct funding from DTRA (co-fund many radiation tasks) and NRO as well as in-kind from AFRL, NRL, SNL, etc...
  - Multiple universities including Vanderbilt, Georgia Tech, ...
  - Too numerous manufacturers to mention!
  - International with ESA, JAXA,...
- *We do not perform mission specific tasks*



# Commercial Evaluation – The “Rules” of Engagement

- **NEPP works with many manufacturers on evaluating new and emerging product**
  - However, funding does not allow us to “do it all”!
- **The “rules”**
  - Must be of general interest to NASA (i.e., not mission-specific)
  - Industry must be willing to:
    - Provide samples,
    - Understand NASA “data rights”, and,
    - Understand that this is evaluation, not qualification.
- **We would like to test more, but are resource limited.**



# 2nd NEPP ETW

This meeting will provide a wide dissemination to the aerospace community beyond the parts, packaging, and radiation specialists on current and future issues impacting space system design and reliability.

Why attend? This meeting will discuss the two sides of the NEPP Program's efforts agency-wide.

- Assurance:
  - o Issues that are applicable to space systems being designed and built (i.e., currently available technologies)
- New electronics technologies:
  - o Issues that are applicable to the next generation of space systems in conceptualization or preliminary design



# ETW Format

- **2.5 days of presentations**
  - Invited talks on specific topic areas such as counterfeit electronics and AFRL/NRO's HiREV
  - Oral presentations from task and area leads
    - Topical: Ex., Dealing with next generation of device complexity
    - Task specific: Ex., On-Going Radiation Effects on FPGAs
- **Panel sessions/discussion on topical areas of interest**
- **We encourage informal discussions during the breaks**
- **We encourage questions during the talks, however, please bear in mind that we need to keep on schedule**



# ETW Program - Tuesday

Tuesday, June 28, 2011					
Start	Finish	Session	Topic	Presenter(s)	Organization
8:15	8:30	Overview	NEPP and the Goals of the Workshop, Logistics	Michael Sampson, and Kenneth LaBel	NASA/GSFC
8:30	9:00	System Issues - Complex Electronics	Class Y - NEPP Championed Approached to Advanced Package Qualification	Shri Agrawal	JPL
9:00	9:45	System Issues - Complex Electronics	FPGA - Overview of JPL Efforts under NEPP	Douglas Sheldon	JPL
9:45	10:15	System Issues - Complex Electronics	Discussion: FPGAs and new Alternatives	Kenneth LaBel	NASA/GSFC
10:15	10:45	Break			
10:45	11:45	System Issues - Complex Electronics	Taming the SEU Beast - Approaches and Results for FPGA Devices and How To Apply Them	Melanie Berg	MEI
11:45	13:15	Lunch			
13:15	14:15	System Issues - Complex Electronics	Status and Plans for Vanderbilt's SEU Tools and Research	Kevin Warren	Vanderbilt
14:15	14:45	Power	SEE Issue Update for Power MOSFETs	Jean Marie Lauenstein	NASA/GSFC
14:45	15:00	Break			
15:00	15:45	Power	NEPP POL Consortia Report	Philippe Adell, and Dakai Chen	JPL, NASA/GSFC
15:45	16:15	Power	Emerging Power Device Technologies and Radiation	Steve McClure	JPL
16:15	17:15	Power	Panel Session: Next Generation Power Devices and Systems	TBD	TBD
17:15		Discussion			



# ETW Program - Wednesday

Wednesday, June 29, 2011					
Start	Finish	Session	Topic	Presenter(s)	Organization
8:30	9:15	Invited	An Update on the NRO/AFRL's National High Reliability Electronics Virtual Center (HiREV)	Chris Bozada	AFRL
9:15	9:30	Power	Commercial Vendor Experience with GaN and SiC	Alan Tasker	Microsemi
9:30	10:15	Mixed Signal	Reliability of SiGe, SOI, and Advanced Mixed Signal Devices for Cryogenic Space Missions	Richard Patterson	NASA/GRC
10:15	10:30	Break			
10:30	11:00	Memories	Challenges of Developing Qualification Methods for DDR class Memories - Part 1	Ray Ladbury	NASA/GSFC
11:00	11:30	Memories	Challenges of Developing Qualification Methods for DDR class Memories - Part 2	Steve Guertin	JPL
11:30	12:00	Invited	Counterfeit Electronics - NASA Update	Phil Zulueta	JPL
12:00	13:30	Lunch			
13:30	14:00	Systems on a Chip	Status on Radiation Qualification Methods for SOC	Steve Guertin	JPL
14:00	14:30	System Issues - Complex Electronics	Reliability Testing of Advanced Area Array Packages for Space	Reza Ghaffarian	JPL
14:30	15:00	System Issues - Complex Electronics	NEPP Program at MSFC - Advanced Packages and CAVE Consortia	Jim Blanche	Jacobs Technology
15:00	15:30	Break			
15:30	16:00	Passives	Capacitor Test, Evaluation, and Modeling within NEPP	Alexander Teverovsky	MEI Technologies
16:00	17:00	Passives	Panel: What's Next for Capacitors for Space?	Mike Sampson	NASA/GSFC
17:00		Discussion			

**1st NEPP ETW Intro presented by Kenneth A. LaBel at NASA/GSFC – June 22, 2010**



# ETW Program - Thursday

Thursday, June 30, 2011					
Start	Finish	Session	Topic	Presenter(s)	Organization
8:30	9:00	Invited	When is Qualification not Qualification?	Mike Sampson	NASA/GSFC
9:00	9:30	Advanced Electronics	Radiation Status on Sub-65nm Electronics	Jonathan Pellish	NASA/GSFC
9:30	10:00	Photonics	Status of Qualification Guidelines for Fiber Optic Components and Systems	Melanie Ott	NASA/GSFC
10:00	10:30	Photonics	Update on Cryogenic Latchup and Detectors	Cheryl Marshall	NASA/GSFC
10:30	11:00	Break			
11:00	11:30	Radiation Effects	SiGe Technology - Radiation Update	Paul Marshall	Consultant
11:30	12:00	Discussion	What Are We Missing?	Mike Sampson, and Ken LaBel	NASA/GSFC
12:00		End of workshop			



# ETW - Logistics

- **Emergency Exits**
- **Restrooms**
- **Breaks**
- **On-line feedback**
- **Wireless Access**
  - NASA Guest
- **Cell phones/PDAs**
  - PLEASE TURN OFF or on SILENT mode
- **Lunches**

# ETW - Lunch

## Lunch Options

### Here on center @ GSFC (see map on other side)

- Bldg. 21 Cafeteria
- Bldg. 1 Cafeteria (limited menu)
- Bldg 34 Café (limited menu, limited seating)

### Directly across the street from NASA/GSFC (K-Mart shopping center)

- 5 Guys – Hamburgers/Fries - American
- Osaka – Sushi
- Papa John's Pizza – (no seating)
- Chicken Rico - Peruvian-style charcoal broiled (limited seating)
- Maharaja - Indian Cuisine
- Orion Gourmet Take-Away (Sub/sandwich deli) – limited seating
- Ruby Tuesday – American casual dining
- Burger King – fast food



### Greenway Center

- Greenbelt Road & Hanover Parkway
- Turn right out of NASA/GSFC Main Gate.
- Travel 2.02 miles
- Greenway Center will be on your left.
- Chesapeake Bagel Bakery
- Chevy's Fresh Mex Restaurant
- Denny's Restaurant
- Hunan Treasure
- Jasper's
- Starbucks Coffee
- Subway Sandwich Shop
- Wendy's

### Eastgate Shopping Center

- Glenn Dale Rd & Lanham Severn Rd
- Turn left out of Main Gate – approx 1.8 miles,
- shopping center on Right.
- Chanan's Buffet (Chinese food – Mongolian Grill)
- Pizza Hut
- McDonalds





# QUESTIONS?