The State of NEPP
NASA Electronic Parts & Packaging Program

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NEPP Overview – Mission Statement

Provide NASA's leadership in the development and maintenance of guidance to support the reliable use of electrical, electronic, electromechanical, and electro-optical (EEEE) parts through characterization, lot acceptance, screening, and qualification testing in collaboration with academia, industry, international partners, and other government agencies.

NASA Electronic Parts Assurance Group (NEPAG) is a core portion of NEPP

To be presented by P. Majewicz at the NEPP Electronics Technology Workshop (ETW), June 13-16, 2022.

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NASA Directorates

OSMA

NESC

NASA Programs & Projects

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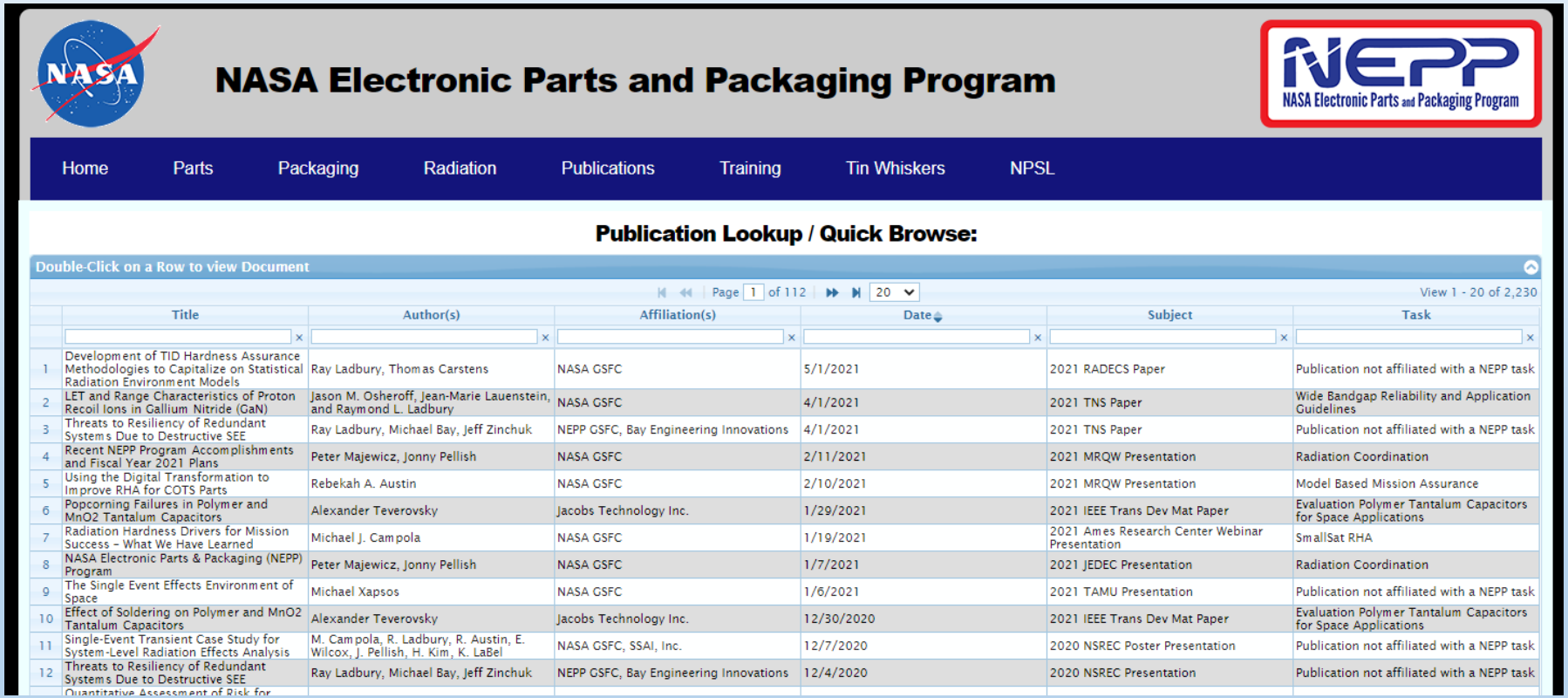
Standards, Policy Documents, Guidance, Procedures and Reports

- Developing the NASA EEE Parts Selection, Testing and Derating Standard *
  - Massive effort across the Agency
  - *Trying to paint a portrait of a moving target*.
- Technical Assessment Reports
  - Sponsored by NASA Engineering & Safety Center (NESC)
    - Title: Recommendations on Use of Commercial-Off-The-Shelf (COTS) Electrical, Electronic, and Electromechanical (EEE) Parts for NASA Missions.
      - Phase I Complete - Phase II In Progress *
    - Title: Avionics Radiation Hardness Assurance (RHA) Best Practices
      - NASA Radiation Hardness Assurance (RHA) Standard *
- Radiation Testing Guidelines
  - Pulsed Laser Testing Guidelines *
- Numerous papers and presentations
  - Approximately 100 deliverables a year
  - Posted to NEPP website

* Denotes that topic will have a separate presentation during NEPP ETW

Postings on NEPP Website



NASA Electronic Parts and Packaging Program

Home | Parts | Packaging | Radiation | Publications | Training | Tin Whiskers | NPSL

Publication Lookup / Quick Browse:

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	Title	Author(s)	Affiliation(s)	Date	Subject	Task
1	Development of TID Hardness Assurance Methodologies to Capitalize on Statistical Radiation Environment Models	Ray Ladbury, Thomas Carstens	NASA GSFC	5/1/2021	2021 RADECS Paper	Publication not affiliated with a NEPP task
2	LET and Range Characteristics of Proton Recoil Ions in Gallium Nitride (GaN)	Jason M. Osheroff, Jean-Marie Lauenstein, and Raymond L. Ladbury	NASA GSFC	4/1/2021	2021 TNS Paper	Wide Bandgap Reliability and Application Guidelines
3	Threats to Resiliency of Redundant Systems Due to Destructive SEE	Ray Ladbury, Michael Bay, Jeff Zinchuk	NEPP GSFC, Bay Engineering Innovations	4/1/2021	2021 TNS Paper	Publication not affiliated with a NEPP task
4	Recent NEPP Program Accomplishments and Fiscal Year 2021 Plans	Peter Majewicz, Jonny Pellish	NASA GSFC	2/11/2021	2021 MRQW Presentation	Radiation Coordination
5	Using the Digital Transformation to Improve RHA for COTS Parts	Rebekah A. Austin	NASA GSFC	2/10/2021	2021 MRQW Presentation	Model Based Mission Assurance
6	Popcorning Failures in Polymer and MnO2 Tantalum Capacitors	Alexander Teverovsky	Jacobs Technology Inc.	1/29/2021	2021 IEEE Trans Dev Mat Paper	Evaluation Polymer Tantalum Capacitors for Space Applications
7	Radiation Hardness Drivers for Mission Success – What We Have Learned	Michael J. Campola	NASA GSFC	1/19/2021	2021 Ames Research Center Webinar Presentation	SmallSat RHA
8	NASA Electronic Parts & Packaging (NEPP) Program	Peter Majewicz, Jonny Pellish	NASA GSFC	1/7/2021	2021 JEDEC Presentation	Radiation Coordination
9	The Single Event Effects Environment of Space	Michael Xapsos	NASA GSFC	1/6/2021	2021 TAMU Presentation	Publication not affiliated with a NEPP task
10	Effect of Soldering on Polymer and MnO2 Tantalum Capacitors	Alexander Teverovsky	Jacobs Technology Inc.	12/30/2020	2021 IEEE Trans Dev Mat Paper	Evaluation Polymer Tantalum Capacitors for Space Applications
11	Single-Event Transient Case Study for System-Level Radiation Effects Analysis	M. Campola, R. Ladbury, R. Austin, E. Wilcox, J. Pellish, H. Kim, K. LaBel	NASA GSFC, SSAI, Inc.	12/7/2020	2020 NSREC Poster Presentation	Publication not affiliated with a NEPP task
12	Threats to Resiliency of Redundant Systems Due to Destructive SEE	Ray Ladbury, Michael Bay, Jeff Zinchuk	NEPP GSFC, Bay Engineering Innovations	12/4/2020	2020 NSREC Presentation	Publication not affiliated with a NEPP task
	Quantitative Assessment of Risk for					

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The probability that a system ... will function as intended over a specified period of time under specified environmental conditions. (Human-Rating Requirements for Space Systems NPR 8705.2B)

Reliability

Describes the ability of a system or component to function under stated conditions for a specified period of time. (IEEE Computer Dictionary)

Quality - Robustness - Screening - Derating - Physics of Failure

Mission, Environment, Application and Lifetime (MEAL)

Risk Classification for NASA Payloads NPR 8705.4A

CLASS D CLASS C CLASS B CLASS A

Image credit: nasa.gov

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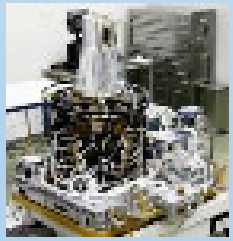

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Mission, Environment, Application and Lifetime (MEAL)

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CLASS D CLASS C CLASS B CLASS A

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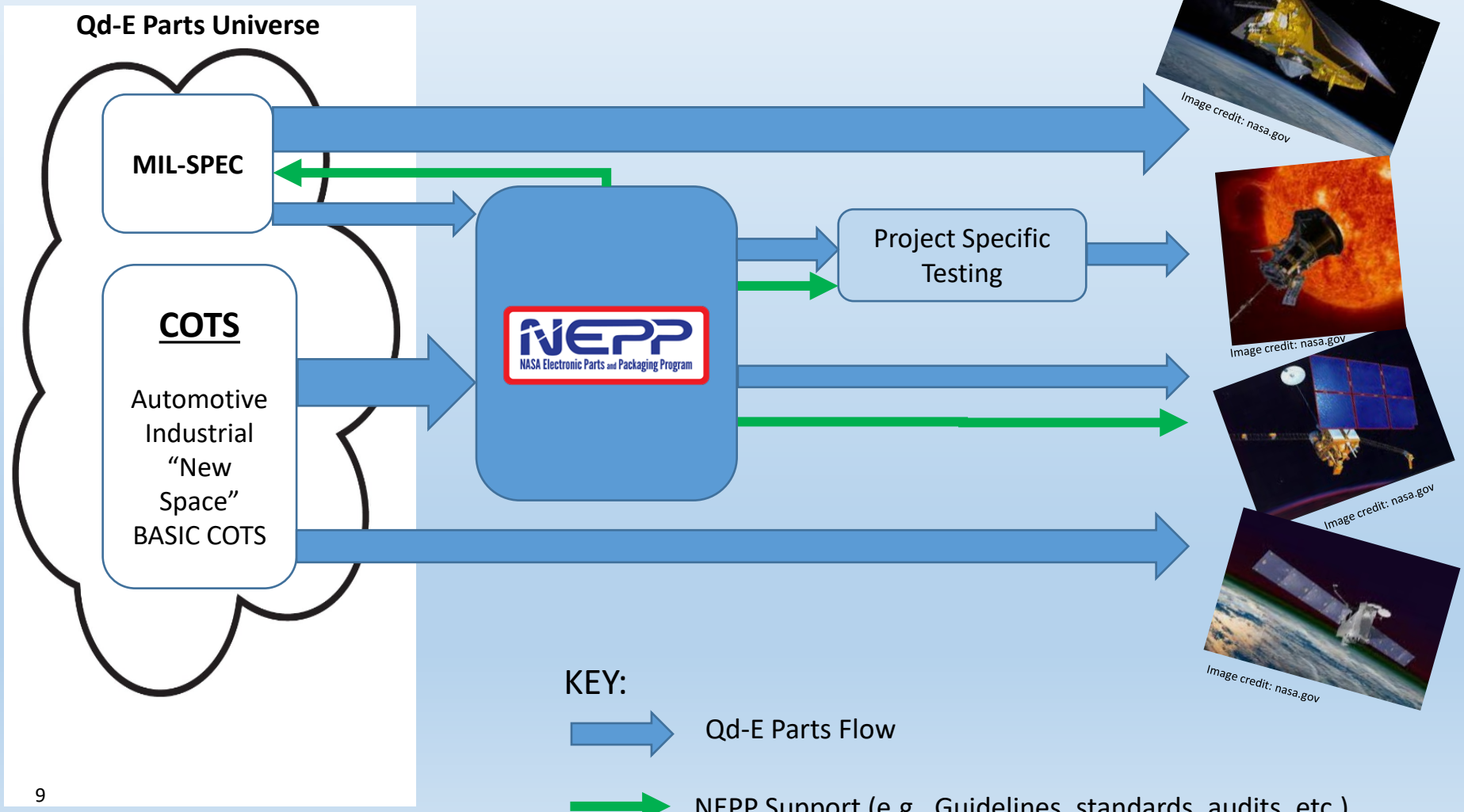
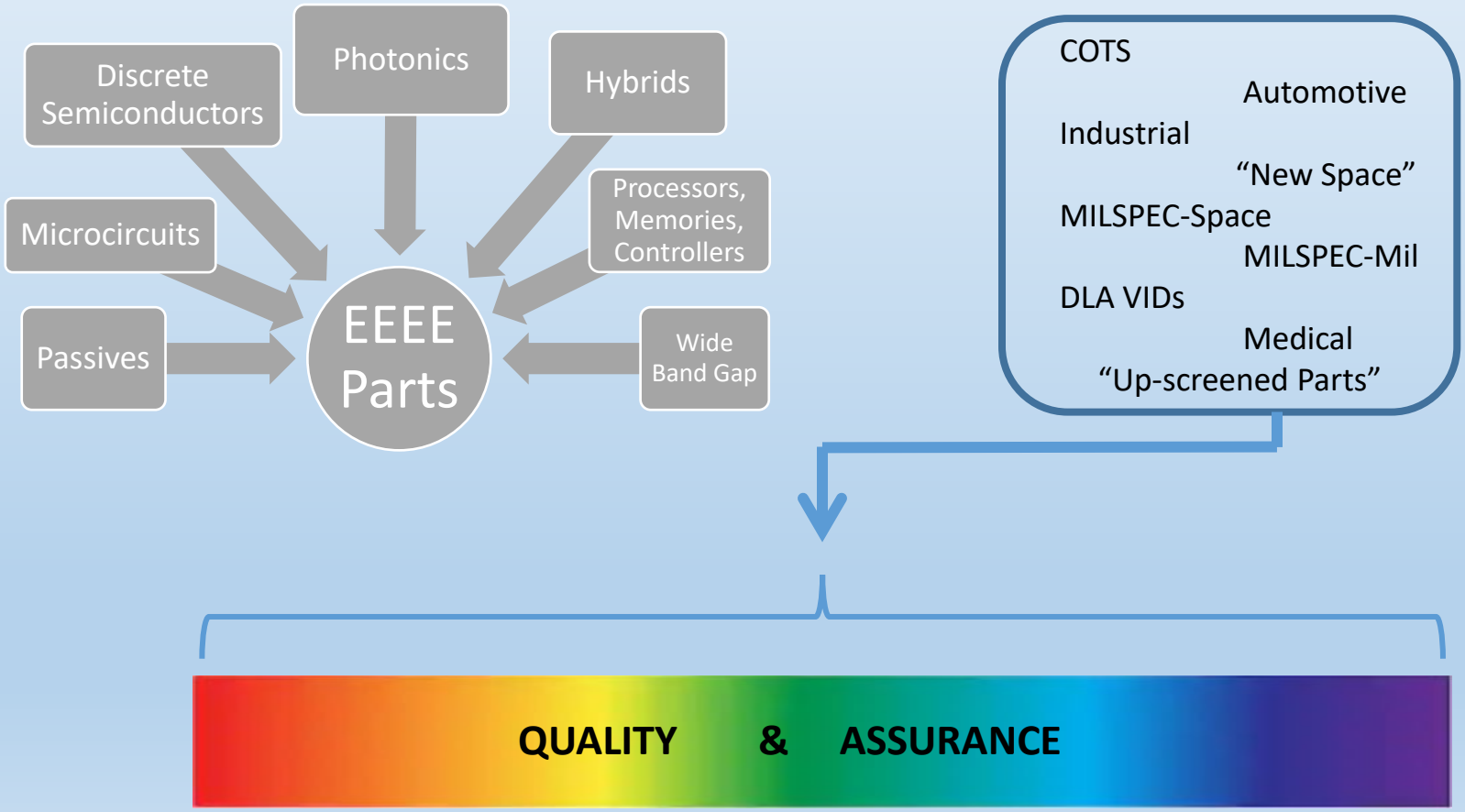
Providing Qd-E Part Options for NASA Programs and Projects



EEEE (Quad-E) Parts

Electrical, Electronic, Electromechanical & Electro-Optic (EEEE) Parts



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COTS UTILIZATION STEPS

- Relationship with COTS manufacturers
  - Industry Leading Parts Manufacturers (ILPM)s
  - Data sheets
  - Process control data
  - Qualification & Screening
  - Sampling
  - Change process

- Parts Evaluation & Analysis Capability
  - Initial motivation for NEPP Program's predecessor in the 70s
  - Failure rate determination
    - Failure mechanisms/Physics of Failure/Acceleration Factors
  - Environmental testing geared towards NASA missions (MEAL)
  - Not re-inventing the wheel

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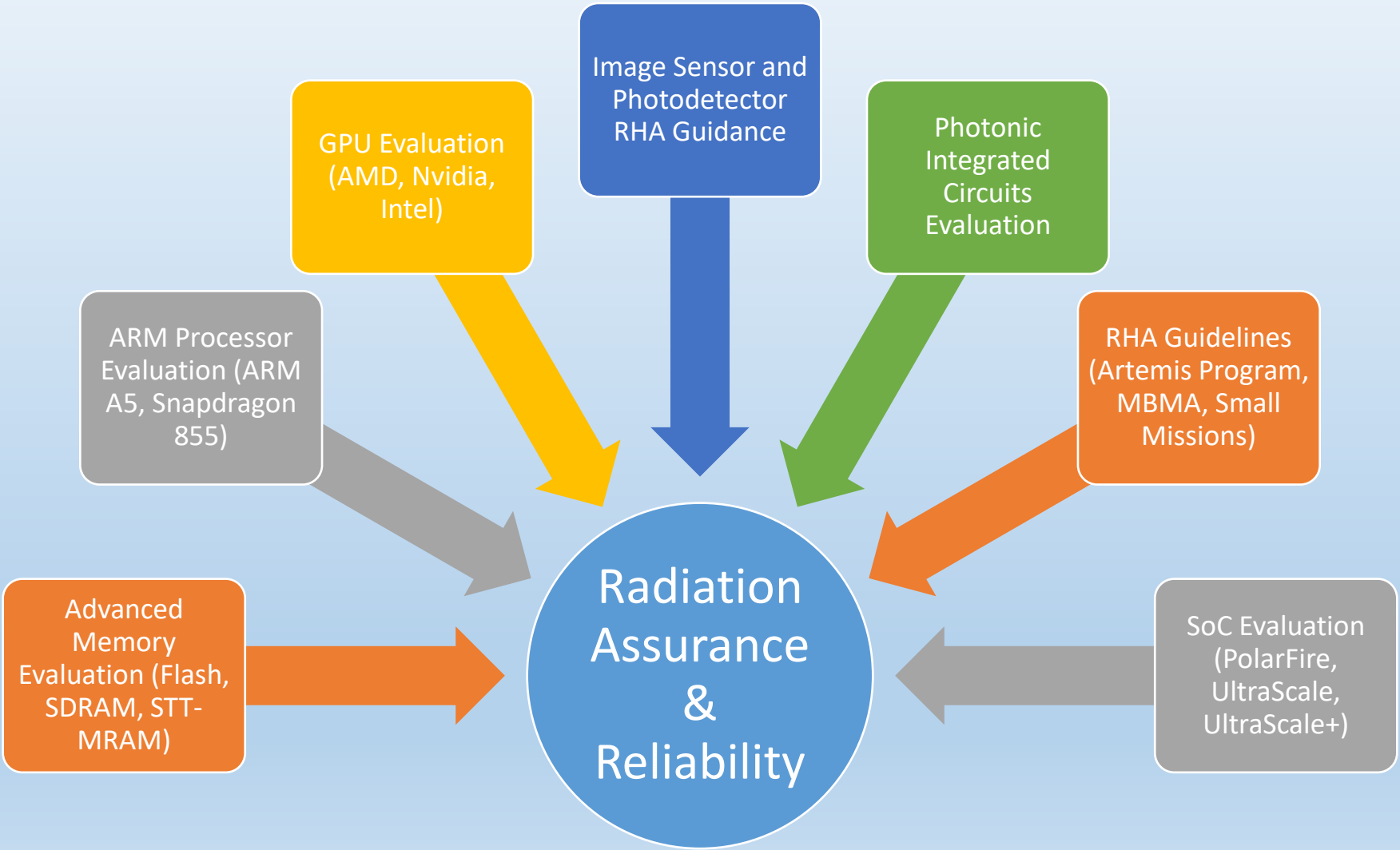
Radiation Work *



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KEY FOCUS POINTS

TELECONFERENCES

NEPAG *
- Weekly Domestic
- Monthly International

Government Working Group *
- Biweekly

Other specialty areas
- Hybrids *
- 2.5 & 3D Packaging *
- Small Mission Success *

SUPPORT DEFENSE STANDARDIZATION PROGRAM / DEFENSE LOGISTICS AGENCY (DLA)
- DLA audits
- Review MILSPEC Changes
- Attend JEDEC and SAE WG meetings
  - Class Y, PEMS, PEDS incorporation into MIL SPECS

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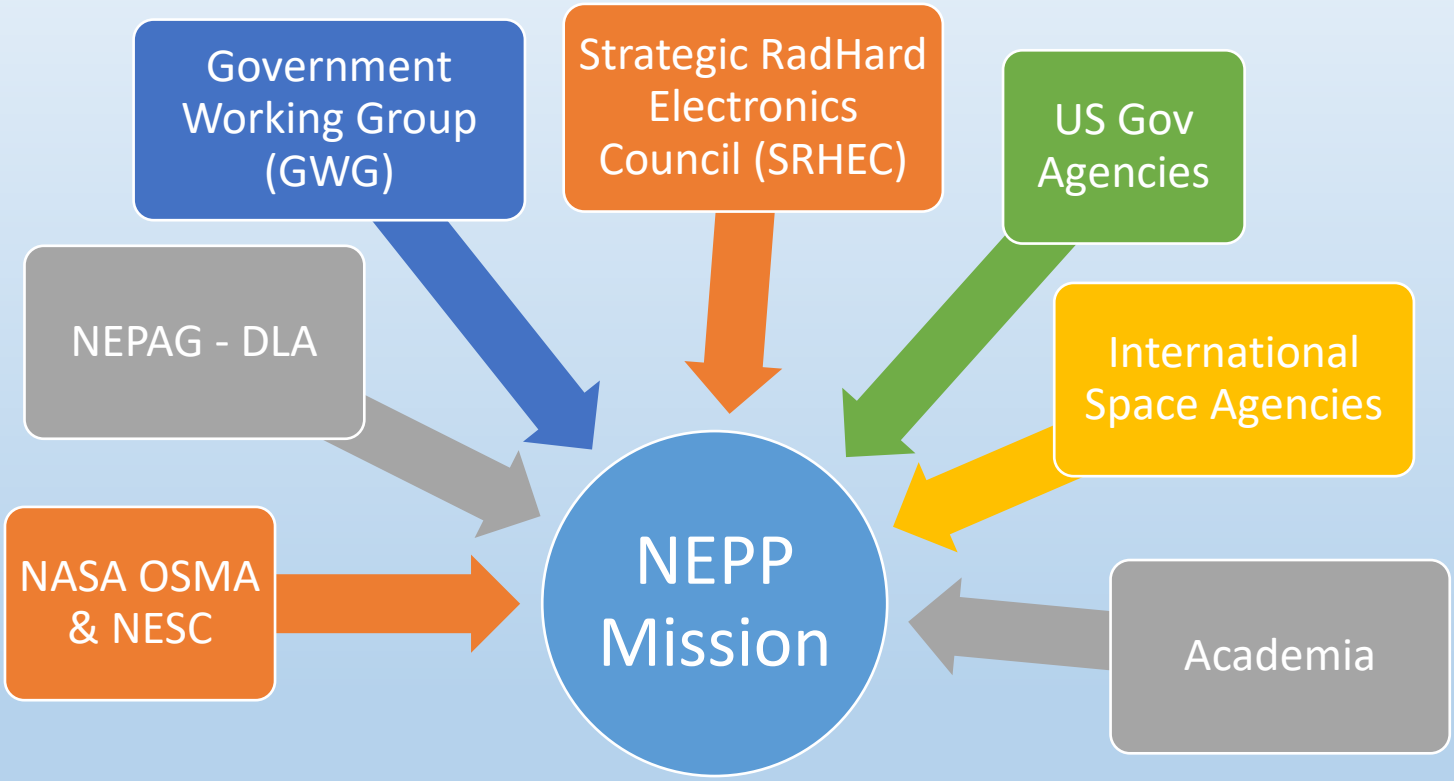
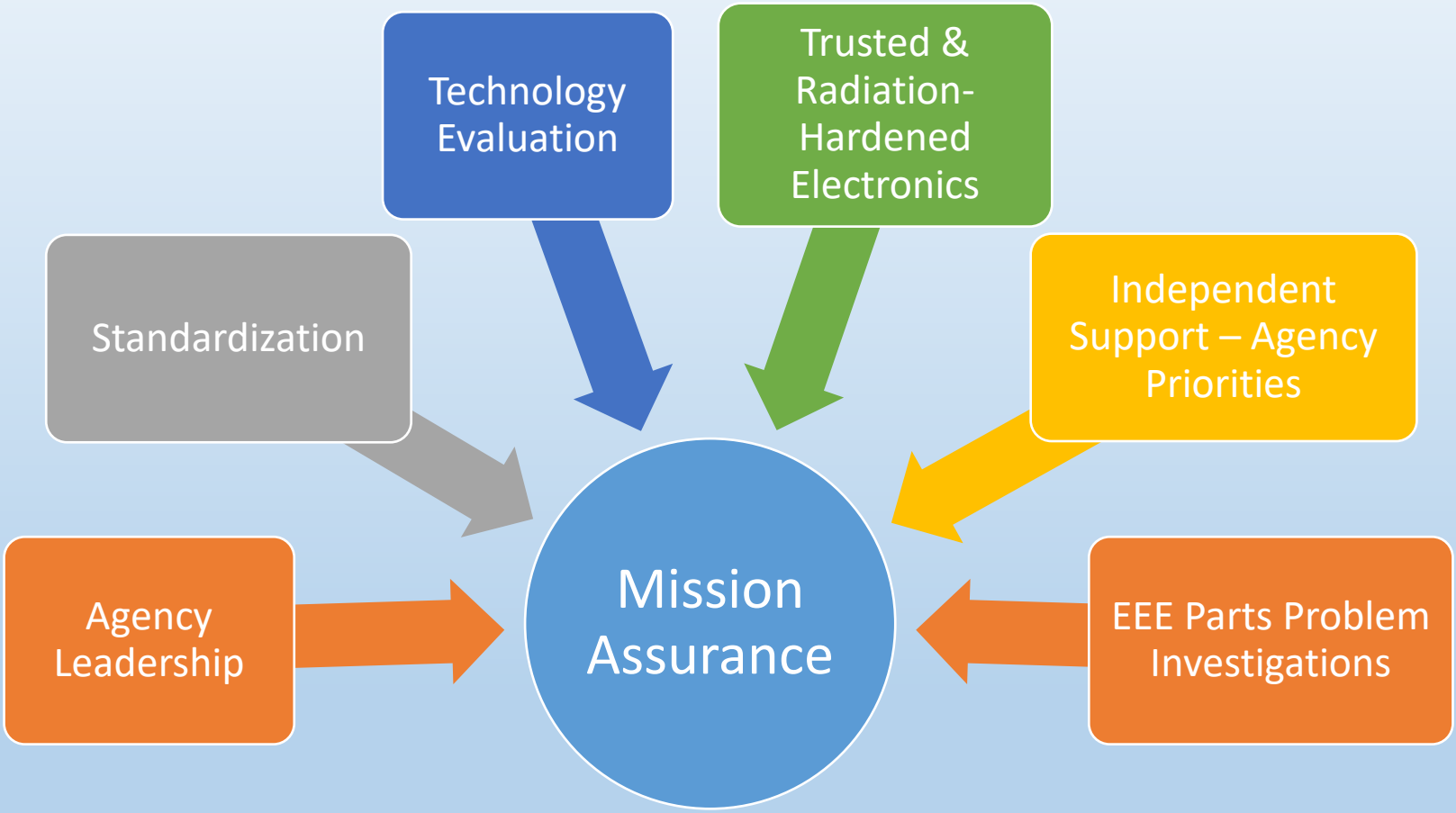
NEPP Collaborations *



Air Force – SMC/The Aerospace Corporation; Air Force – Wright-Patterson; Army; MDA; NASA Centers; Navy – NSWC Crane Division; NRO/The Aerospace Corporation Air Force Research Laboratory; Naval Research Laboratory; Joint Forces Assurance C; Sandia National Laboratories

Conclusion: NEPP Program *



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STATE of NEPP

- These have been challenging times!!!
  - COVID-19
  - Supply Chain Issues
  - Radiation Testing Limits
  - Shifting Paradigm Regarding COTS

- These are exciting times!!!
  - James Webb Space Telescope
  - The Artemis Program
  - Mars: Perseverance – Ingenuity – Sample Return
  - Advances in Electronics

- STATE of NEPP: ***EXCELLENT***
  - Strong support from NASA leadership
  - Fulfilling the goals of our mission statement
  - Collaborations
  - Most importantly…the PEOPLE

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Acronyms

AFRC	Armstrong Flight Research Center
ARC	Ames Research Center
BNL	Brookhaven National Laboratory
EEEE	Electrical, Electronic, Electromechanical, Electro-Optical
ETW	Electronics Technology Workshop
DoD	Department of Defense
FRIB	Facility for Rare Isotope Beams
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC	Langley Research Center
MDA	Missile Defense Agency
MSFC	Marshall Space Flight Center
MSU	Michigan State University
NASA	National Aeronautics and Space Administration

NEPP	NASA Electronic Parts & Packaging (Program)
NESC	NASA Engineering & Safety Center
NSRL	NASA Space Radiation Laboratory
OCE	Office of Chief Engineer
OCIO	Office of Chief Information Officer
OSMA	Office of Safety and Mission Assurance
SAE	Society of Automotive Engineers
SCALE	Scalable Asymmetric Lifecycle Engagement
SCRM	Supply Chain Risk Management
SDA	Space Development Agency
SEE	Single Event Effects
SOTA	State of the Art
SRH	Strategic Radiation-Hardened
SRHEC	Strategic Radiation-Hardened Electronics Council
TAMU	Texas A&M University
U.S.	United States (of America)
UTC	University of Tennessee Chattanooga

Questions?