The State of NEPP
NASA Electronic Parts & Packaging Program

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To be presented by P. Majewicz at the NEPP Electronics Technology Workshop (ETW), June 14-17, 2021.

Acronyms

Abbreviation	Definition
AF	Air Force
BGA	Ball Grid Array
BN	Bayesian Network
BoK	Body of Knowledge
CMOS	Complementary Metal Oxide Semiconductor
COTS	Commercial Off the Shelf
CPU	Central Processing Unit
DDR	Double Data Rate
DLA	Defense Logistics Agency
DMEA	Defense Microelectronics Activity
DoD	Department of Defense
DoE	Department of Energy
EEE	Electrical, Electronic, and Electromechanical
ETW	Electronics Technology Workshop
FPGA	Field Programmable Gate Array
GaN	Gallium Nitride
GIDEP	Government Industry Data Exchange Program
GPU	Graphics Processing Unit
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
GSN	Goal Structuring Notation
HQ	Headquarters
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
LaRC	Langley Research Center
LGA	Land Grid Array
MAPLD	Military and Aerospace Programmable Logic Devices (Workshop)
MBMA	Model-Based Mission Assurance
MRAM	Magnetic Random Access Memory
MSFC	Marshall Space Flight Center

Abbreviation	Definition
NASA	National Aeronautics and Space Administration
NEPAG	NASA Electronic Parts Assurance Group
NEPP	NASA Electronic Parts and Packaging (Program)
NESC	NASA Engineering and Safety Center
NODIS	NASA Online Directives Information System
NPR	NASA Procedural Requirement
NRO	National Reconnaissance Office
NSREC	Nuclear and Space Radiation Effects Conference
OCE	Office of the Chief Engineer
OGA	Other Government Agency
PIC	Photonic Integrated Circuit
POC	Point of Contact
PoF	Physics of Failure
RF	Radio Frequency
RH	Radiation Hardened
RHA	Radiation Hardness Assurance
SAPP	Space Asset Protection Program
SDRAM	Synchronous Dynamic Random Access Memory
SEE	Single-Event Effects
SiC	Silicon Carbide
SMA	Safety and Mission Assurance
SMC	Space and Missile Systems Center
SOA	Safe Operating Area
SoC	System on a Chip
SRAM	Static Random Access Memory
SSAI	Science Systems and Applications, Inc.
STMD	Space Technology Mission Directorate
STT	Spin Transfer Torque
SysML	System Modeling Language
TID	Total Ionizing Dose
TSV	Thru-Silicon Via

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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

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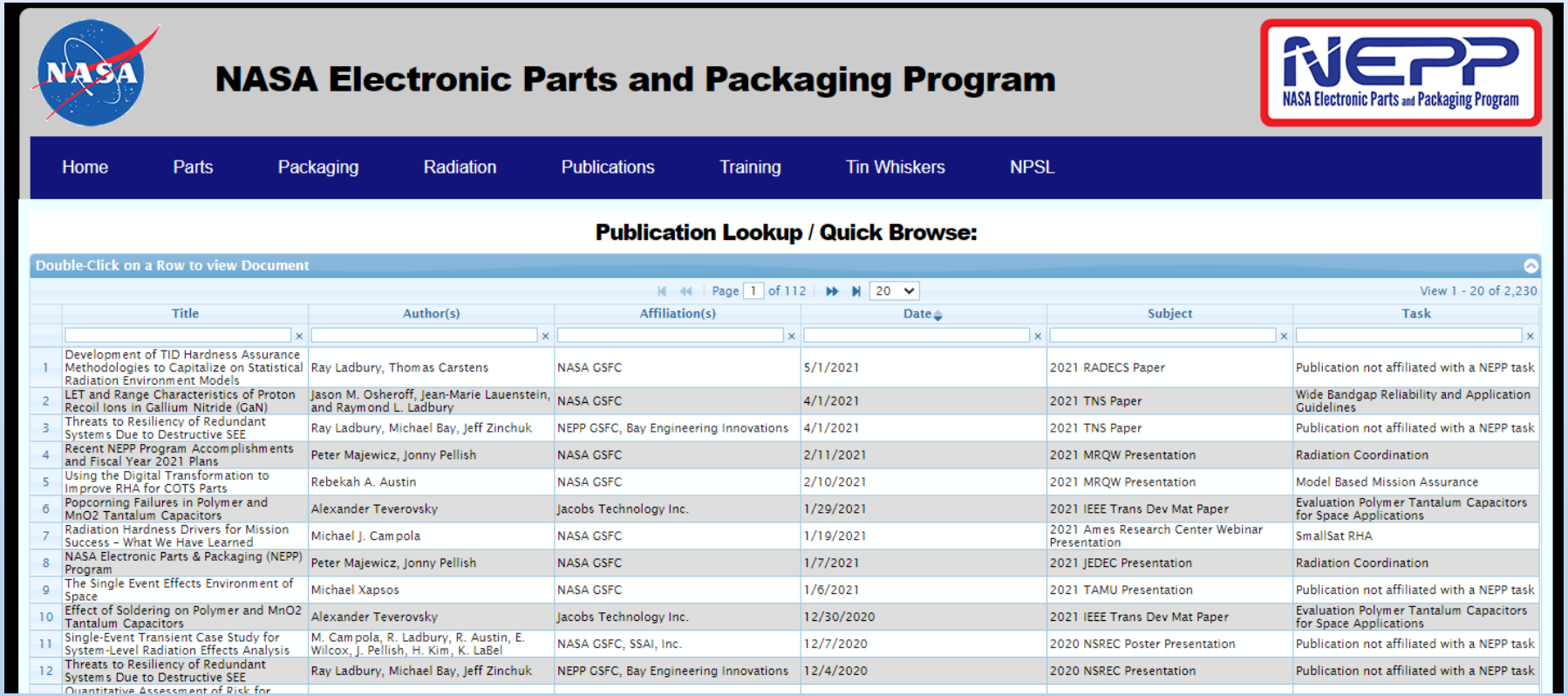
NEPP OSMA NASA Directorates NESC JEDEC SAE

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
    - 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 *
- Body of Knowledge (BoK) documents
  - Gallium Nitride Power Electronics
- Numerous papers and presentations
  - Approximately 100 deliverables a year
  - Posted to NEPP website

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

Documents on NEPP Website are now Searchable !!



NASA Electronic Parts and Packaging Program

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

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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					

http://nepp.nasa.gov/ https://nepp.nasa.gov/pages/pubs.cfm

To be presented virtually by P. Majewicz at the 2021 Space Parts Working Group (SPWG), 3-6 May 2021

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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 - Assurance - Screening - Derating - Physics of Failure *

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"Quad E Parts"

add more emphasis
to Electro-optics/Photonics *

EPICA - New Institute of Electronic-Photonic Integrated Circuits for Aerospace
Prof S. Ralph (GT)

Photonics for Space Flight
Hali Jakeman (GSFC)

NEPP Space Qualification Efforts for Integrated Photonics
Amanda Bozovich (JPL)

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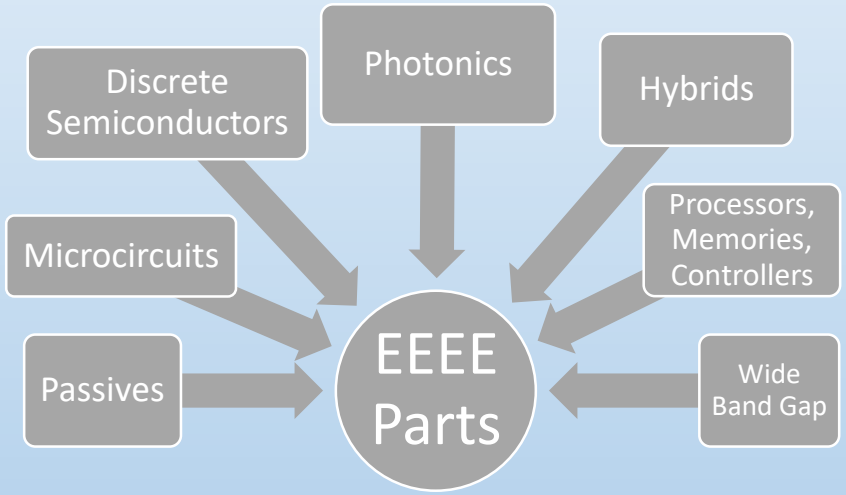
EEEE (Quad-E) Parts

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



COTS ----------Automotive-------Industrial----- " New Space"-----MILSPEC

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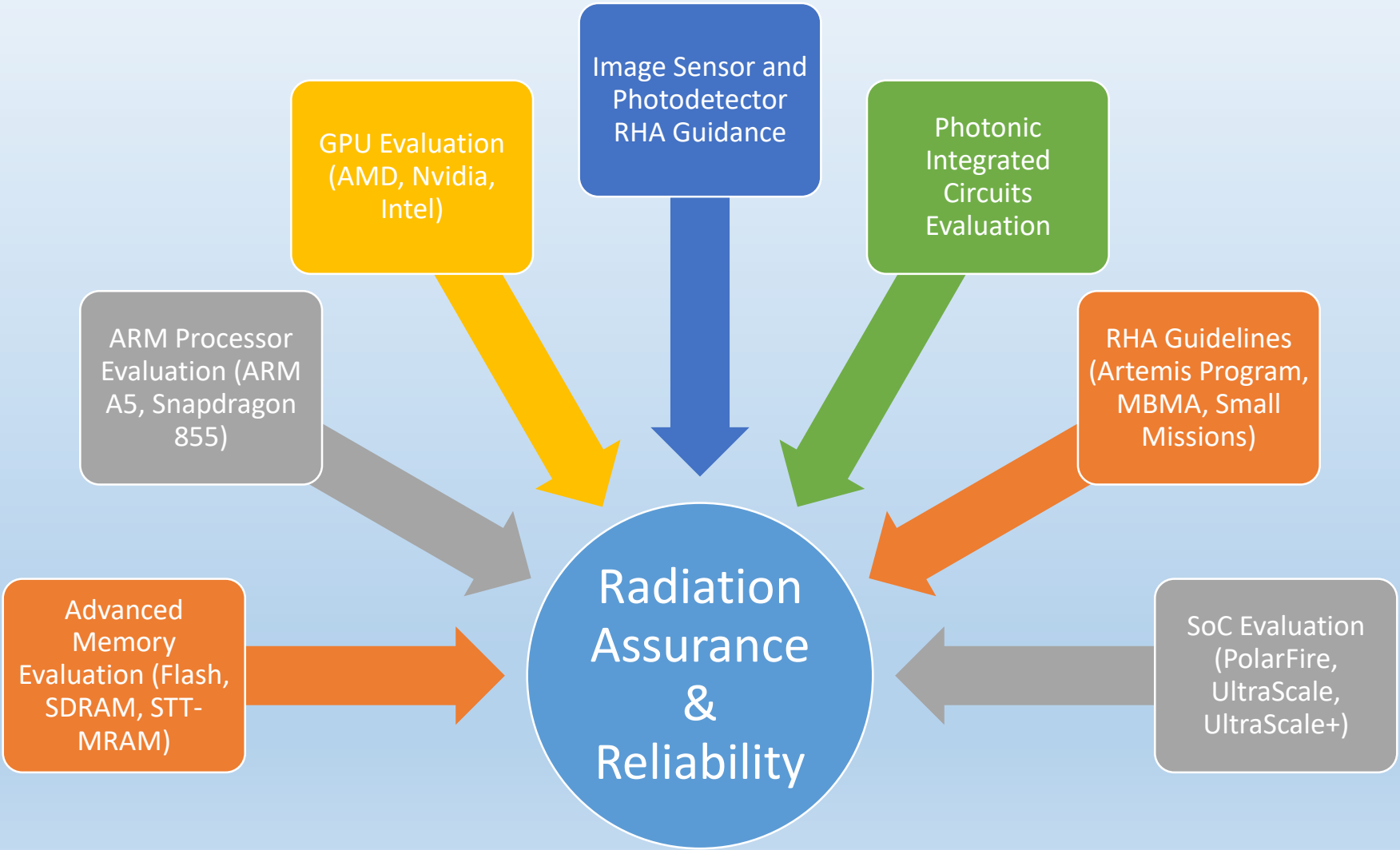
Radiation Work *



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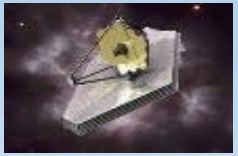
CLASS D CLASS C CLASS B CLASS A



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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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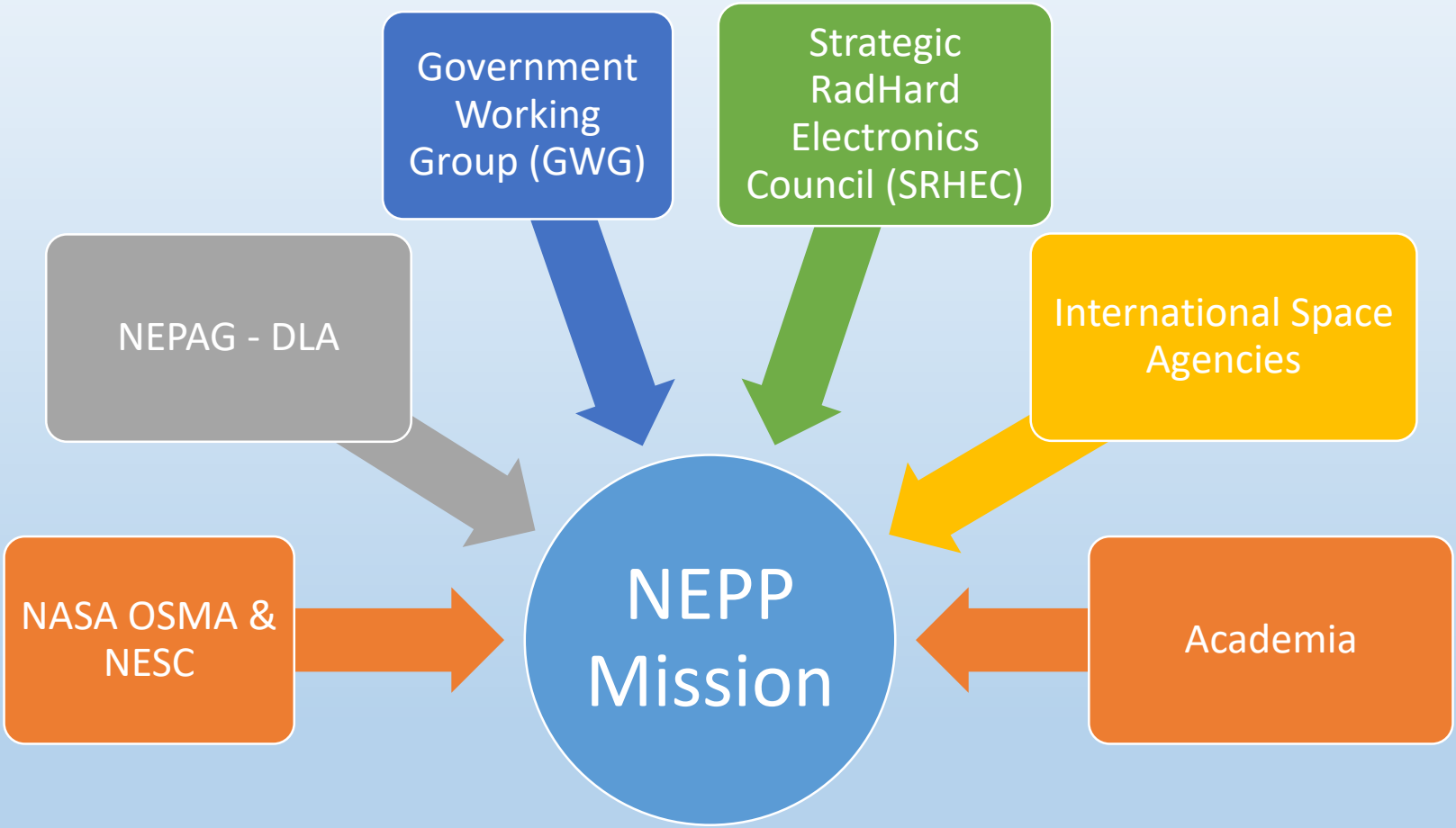
NEPP Collaborations *



Air Force – SMC/The Aerospace Corporation; Air Force – Wright-Patterson; Army; MDA; NASA Centers; Navy – NSWC Crane Division; NRO/The Aerospace Corporation

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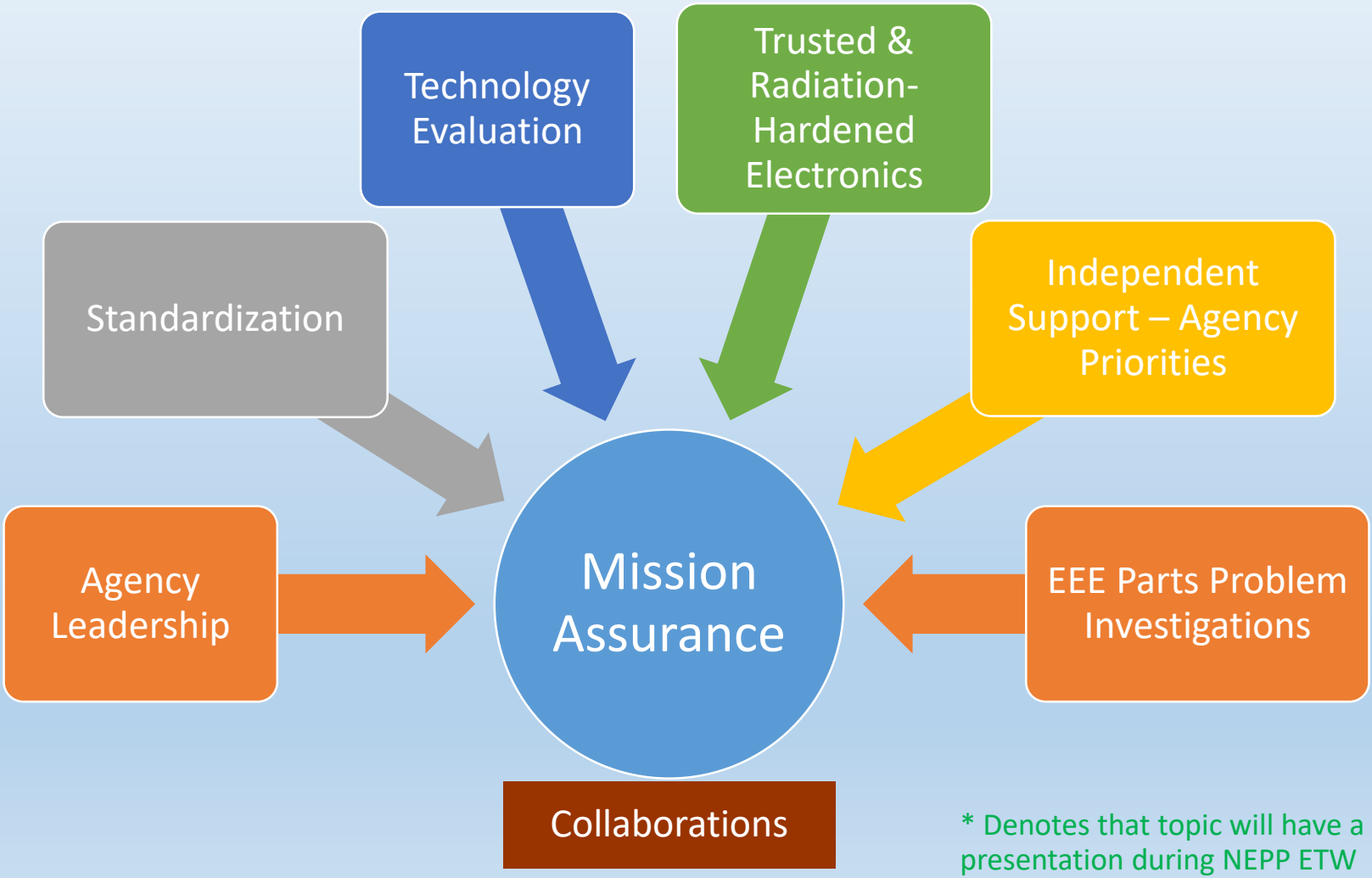
Conclusion: NEPP Program *



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STATE of NEPP

- These have been challenging times!!!
  - COVID-19
  - Radiation Testing
- These are exciting times!!!
  - James Webb Space Telescope
  - The Artemis Program
  - Mars: Perseverance – Ingenuity – Sample Return *
  - Venus Exploration
  - Advances in Electronics
- EXCELLENT
  - Strong support from NASA leadership
  - Fulfilling the goals of our mission statement
  - Collaborations
  - Most importantly…the PEOPLE

Questions?