National Aeronautics and Space Administration

Recent NEPP Program Accomplishments and Fiscal Year 2021 Plans

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NEPP
NASA Electronic Parts and Packaging Program

Agenda

- NEPP Mission
- Focal Points
- FY20 Highlights
- FY21 Plans
- NASA NEWS

NEPP – Mission Statement

Provide NASA's **leadership** for developing and maintaining guidance for the **screening, qualification, test**, and reliable use of EEE parts by NASA, in **collaboration** with other government agencies and industry.

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

NEPP Charter



Standards & Policy and Guideline Development



Updating NPR-8705.4, *Risk Classification for NASA Payloads*

- Appendix D – Recommended SMA-Related Program Requirements for NASA Class A-D Payloads
- Contains a mapping for EEE Parts that recommends parts with respect to payload class (A-D), mission criticality (critical/noncritical) to part assurance level (screening and lot qualification testing)

Participated in the Development of a NASA Engineering and Safety Center (NESC) Technical Assessment Report

- Title: *Recommendations on Use of Commercial-Off-The-Shelf (COTS) Electrical, Electronic, and Electromechanical (EEE) Parts for NASA Missions*
- Available for public download at NASA Technical Reports Server https://ntrs.nasa.gov/

Standards & Policy and Guideline Development

Development of the *NASA EEEE Parts Selection, Testing and Derating Standard (NASA-STD-8739.11)*

- Original (based on EEE-INST-002) :
  - GSFC document (used by other Centers)
  - 3 Screening and Qualification Levels
  - 18 Device Specific Sections
  - Last update 2003

- Update:
  - 4 Screening and Lot Acceptance Testing Levels
  - Plan is 27 Device Specific Sections
  - Status: In Approval Process

- Capacitor
- Connectors
- Crystal
- Crystal Oscillator
- Detector
- Fiber Optics
- Filter
- Fuse
- Heaters
- Laser Devices
- Magnetics
- Microcircuit Hybrid
- Microcircuit Monolithic
- Microcircuit PEM
- Microcircuit RF / Microwave Devices
- Microcircuit Hybrid PEM
- Motors
- Optoelctronics
- Printed Circuit Boards
- Relays
- Resistors
- Semiconductor Devices - Discrete
- Semiconductor Devices - PES
- Switch
- Thermister RTD
- Wire and Cable

Red: New sections

Working Groups / Collaborations

NASA Electronic Parts Assurance Group (NEPAG)



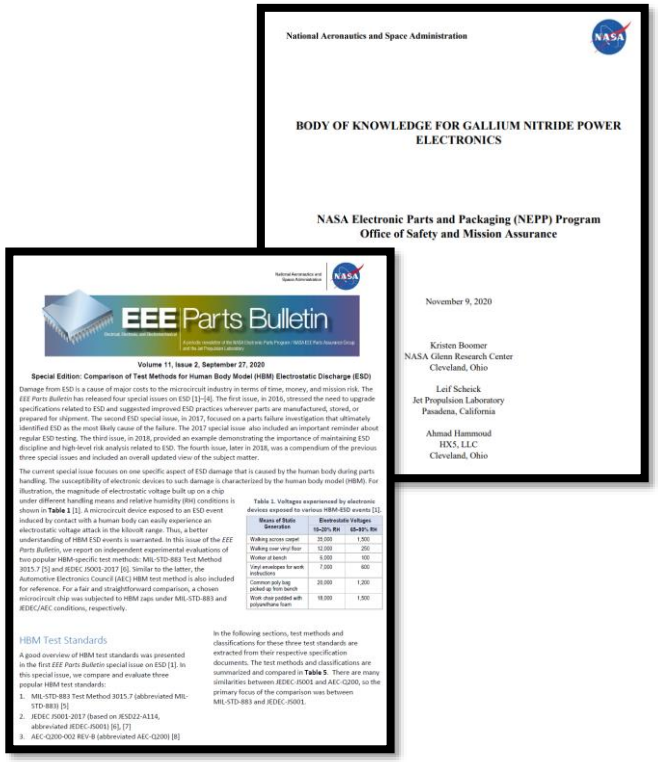
Government Working Group (GWG)

- Purpose – To discuss in detail, topics from NEPAG that require additional in-depth technical solutions
- Objective – To establish a single government position applicable to both terrestrial and space programs
- Attendees – 7 Government User Agencies and DLA

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

FY20 Highlights

Body of Knowledge Document for Gallium Nitride Power Electronics



EEE Parts Bulletin
- PEMS
- ESD

MILSPEC System Support
- Class Y expansion
- PEMS
- 8 DLA Audits supported

NSWC Crane Division Industrial Base Assessment (IBA) of Key EEE Parts Suppliers
-Semiconductors
- Passives

New Specification for Established Reliability Surface Mount Foil Resistors (MIL-PRF-32663)

Numerous occasions of SME support for manufacturers' "Alt Methods" requests to DLA

Published: *Breakdown and Self-healing in Tantalum Capacitors*

Ultrascale and Ultrascale+ FPGA Radiation Effects Testing

Status of all US Medical Proton Therapy Facilities used for parts testing

2020 NEPP Electronic Technology Workshop

MILSPECs – Incorporation of Plastics (4)

Processors, FPGAs & Memories (6)

Photonics (2)

Collaborations/Working Groups (4)

GaN & Sic (3)

Advanced Packaging (2.5/3D, etc.) (6)

Passives: Capacitors and Resistors (5)

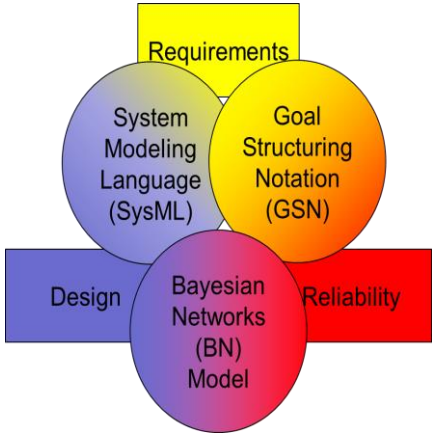
Training / Tutorials (2)

Small Sats & COTS Utilization (7)

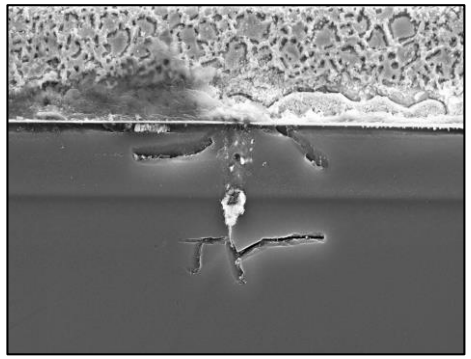
Model Based Mission Assurance (MBMA)

All NETW presentations for 2020 and past years are at https://nepp.nasa.gov/

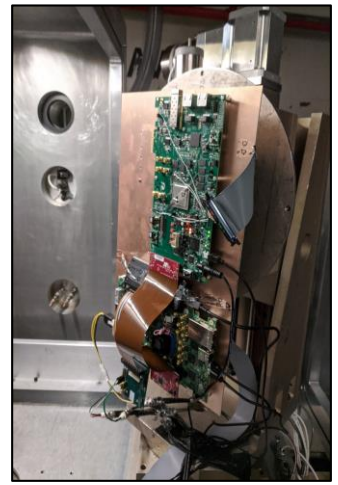
12th Annual NEPP Electronics Technology Workshop (ETW)



Emerging Assurance Methods
Image Credit: Vanderbilt University



Advanced Technology Reliability
Image Credit: NASA

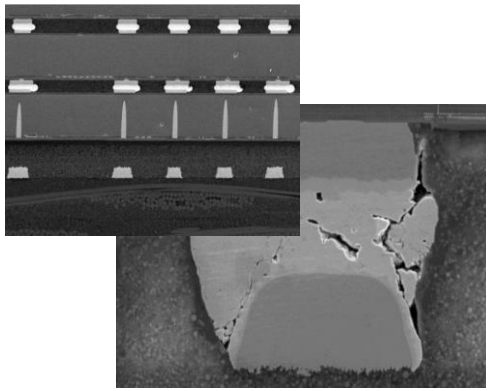


Radiation Testing & Analysis
Image Credit: NASA

Scheduled dates:

June 14-17, 2021

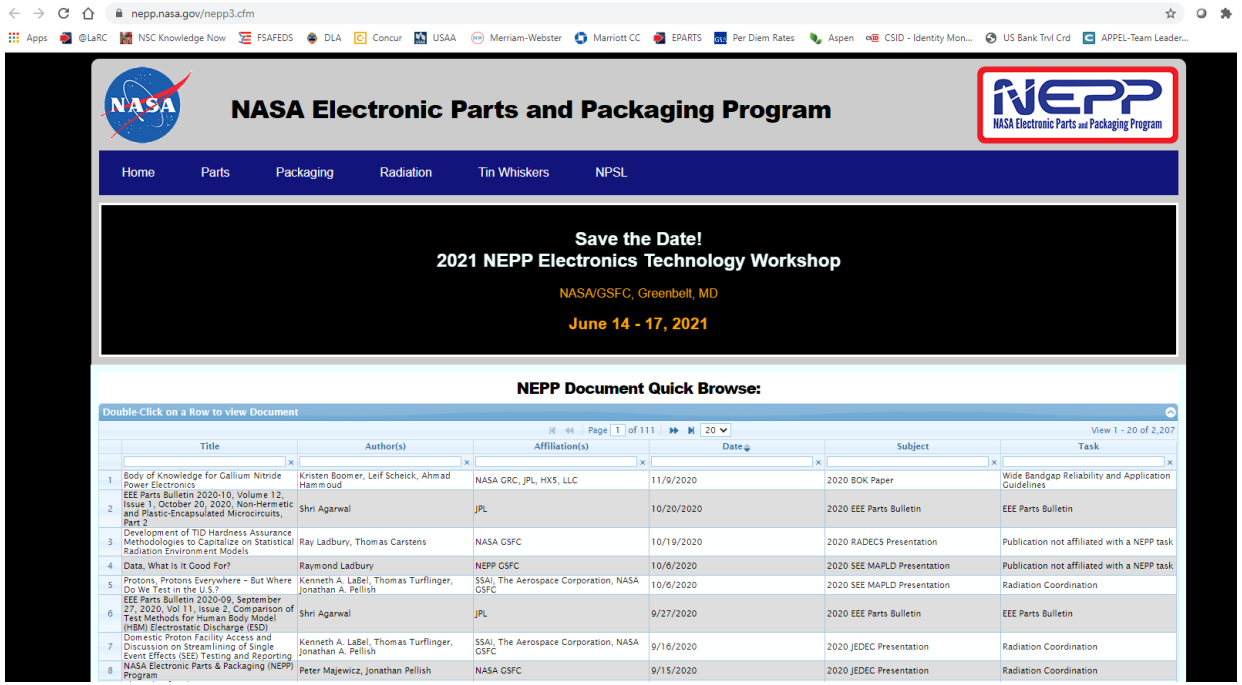
https://nepp.nasa.gov/



Advanced Microelectronics Packaging
Image Credit: NASA

NEPP Website: nepp.nasa.gov

- Significant change in ability to search posted documents
  - Over 2,200 documents
  - Fields (include):
    - Title
    - Author(s)
    - Affiliation
    - Date
  - Fields are searchable and sortable



FY21 Plans

Integrated Photonics for Next Generation Optical Communication Links

Radiation Effects Testing
- Scaled CMOS
- NVM (3D NAND Flash)

Ultrascale and Ultrascale+ FPGA Radiation Effects Testing

Evaluation of multi-anode polymer and MnO2 capacitors

Commercial Surface Mount Ceramic Feedthrough Capacitors for Space Applications

MILSPEC System Support
- PEMS
- Developing “Remote Auditing” Process with DLA

NASA News

Perseverance & Ingenuity Landing date: Feb. 18, 2021

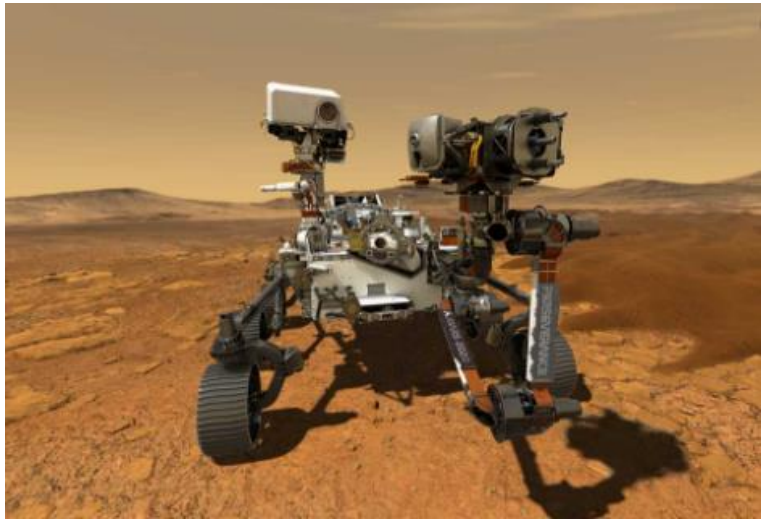


Photo credit: NASA/Bill Ingalls

Entry, Descent & Landing Process: Seven Minutes of Terror

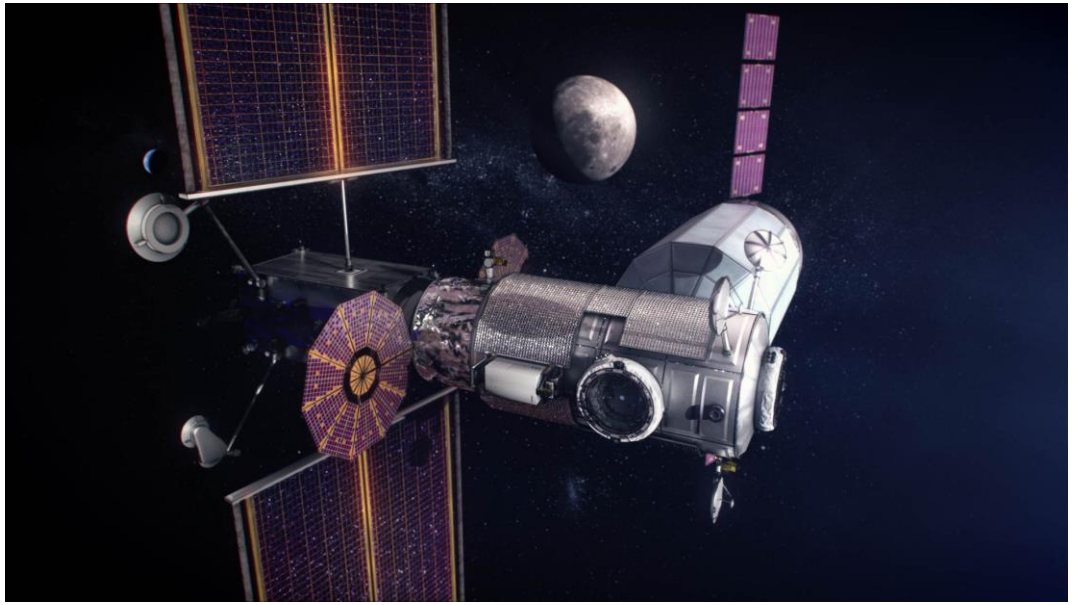
https://www.jpl.nasa.gov/video/details.php?id=1090



Credits: NASA/JPL-Caltech

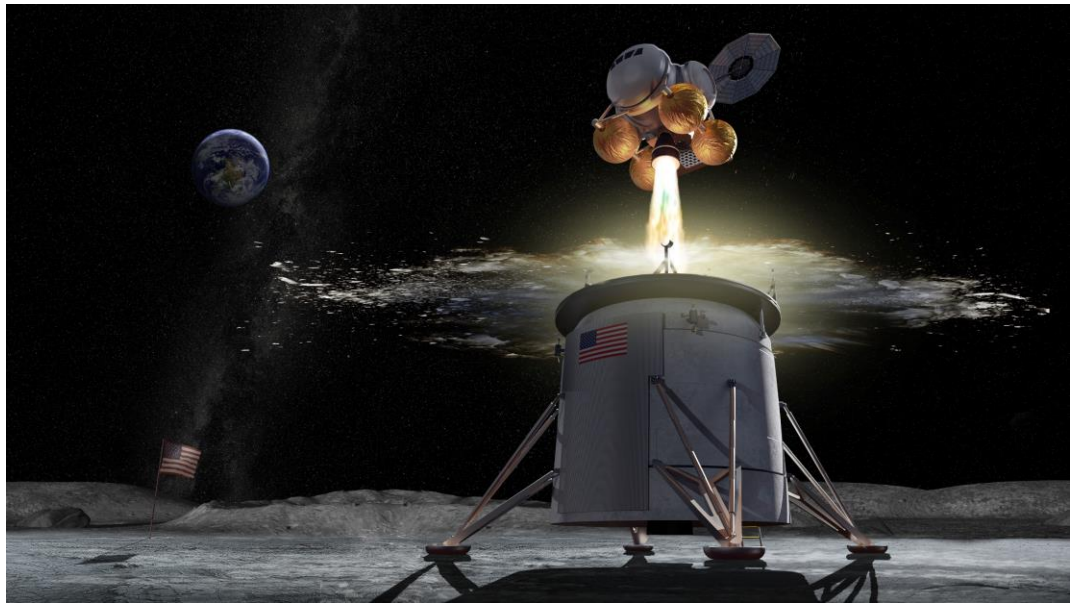
Artemis Program

Gateway



Credit: NASA, Artist's concept

Human Landing System



Credit: NASA, Artist's concept

Acronyms

Abbreviation	Definition		Abbreviation	Definition
AF	Air Force		NASA	National Aeronautics and Space Administration
BGA	Ball Grid Array		NEPAG	NASA Electronic Parts Assurance Group
BN	Bayesian Network		NEPP	NASA Electronic Parts and Packaging (Program)
BoK	Body of Knowledge		NESC	NASA Engineering and Safety Center
CMOS	Complementary Metal Oxide Semiconductor		NODIS	NASA Online Directives Information System
COTS	Commercial Off the Shelf		NPR	NASA Procedural Requirement
CPU	Central Processing Unit		NRO	National Reconnaissance Office
DDR	Double Data Rate		NSREC	Nuclear and Space Radiation Effects Conference
DLA	Defense Logistics Agency		OCE	Office of the Chief Engineer
DMEA	Defense Microelectronics Activity		OGA	Other Government Agency
DoD	Department of Defense		PIC	Photonic Integrated Circuit
DoE	Department of Energy		POC	Point of Contact
EEE	Electrical, Electronic, and Electromechanical		PoF	Physics of Failure
ETW	Electronics Technology Workshop		RF	Radio Frequency
FPGA	Field Programmable Gate Array		RH	Radiation Hardened
GaN	Gallium Nitride		RHA	Radiation Hardness Assurance
GIDEP	Government Industry Data Exchange Program		SAPP	Space Asset Protection Program
GPU	Graphics Processing Unit		SDRAM	Synchronous Dynamic Random Access Memory
GRC	Glenn Research Center		SEE	Single-Event Effects
GSFC	Goddard Space Flight Center		SiC	Silicon Carbide
GSN	Goal Structuring Notation		SMA	Safety and Mission Assurance
HQ	Headquarters		SMC	Space and Missile Systems Center
IC	Integrated Circuit		SOA	Safe Operating Area
IEEE	Institute of Electrical and Electronics Engineers		SoC	System on a Chip
JPL	Jet Propulsion Laboratory		SRAM	Static Random Access Memory
JSC	Johnson Space Center		SSAI	Science Systems and Applications, Inc.
LaRC	Langley Research Center		STMD	Space Technology Mission Directorate
LGA	Land Grid Array		STT	Spin Transfer Torque
MAPLD	Military and Aerospace Programmable Logic Devices (Workshop)		SysML	System Modeling Language
MBMA	Model-Based Mission Assurance		TID	Total Ionizing Dose
MRAM	Magnetic Random Access Memory		TSV	Thru-Silicon Via
MSFC	Marshall Space Flight Center			

Questions?