NASA Electrical, Electronic, and Electromechanical (EEE) Parts Manager Overview

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Electrical, Electronic & Electromechanical (EEE) Parts & Radiation Engineering Management

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Acronyms

Abbreviation	Definition
AFRC	Armstrong Flight Research Center
ARC	Ames Research Center
BNL	Brookhaven National Laboratory
BSA	Business Services Assessment
CNL	Crocker Nuclear Laboratory
COTS	Commercial-off-the-shelf
DOE	Department of Energy
EEE	Electrical, electronic, & electromechanical
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
LBNL	Lawrence Berkeley National Laboratory

Abbreviation	Definition
MAP	Mission Support Future Architecture Program
MGH	Massachusetts General Hospital
MSFC	Marshall Space Flight Center
NAS	National Academies of Sciences, Engineering, & Medicine
NEPP	NASA Electronic Parts & Packaging (Program)
NESC	NASA Engineering & Safety Center
NSCL	National Superconducting Cyclotron Laboratory
NSRL	NASA Space Radiation Laboratory
OCE	Office of the Chief Engineer
OSMA	Office of Safety and Mission Assurance
SEE	Single-event effects
SEUTF	Single-Event Upset Test Facility
TAMU	Texas A&M University
TCAT	Techincal Capability Assessment Team
TRIUMF	Formerly known as the Tri-University Meson Facility

Outline

- Background on Agency EEE parts management
  - Describe Agency operating model & capability leadership
  - Outline Agency relationships
    - Technical & institutional interfaces
- Changing radiation test facility landscape & radiation block buy
  - Preserve required capabilities
  - Establish effective & efficient access for all
- Examples of EEE parts management efforts
  - Exchange data & develop workforce
- Summary and forward work

EEE Parts Management

NASA's Operating Model



Image credit: NASA

"Establish a more efficient operating model that maintains critical capabilities AND meets current and future mission needs"

Brief History of Agency EEE Parts Management

Agency Operating Model
- April 2014
- Memo from Associate Administrator

Avionics Capability Leadership Team Recommendations
- 2014-2015

Executive Council Decision
- November 2015
- GSFC lead with support from JPL

Agency Program Management Council Decision
- September 2016
- Draft implementation

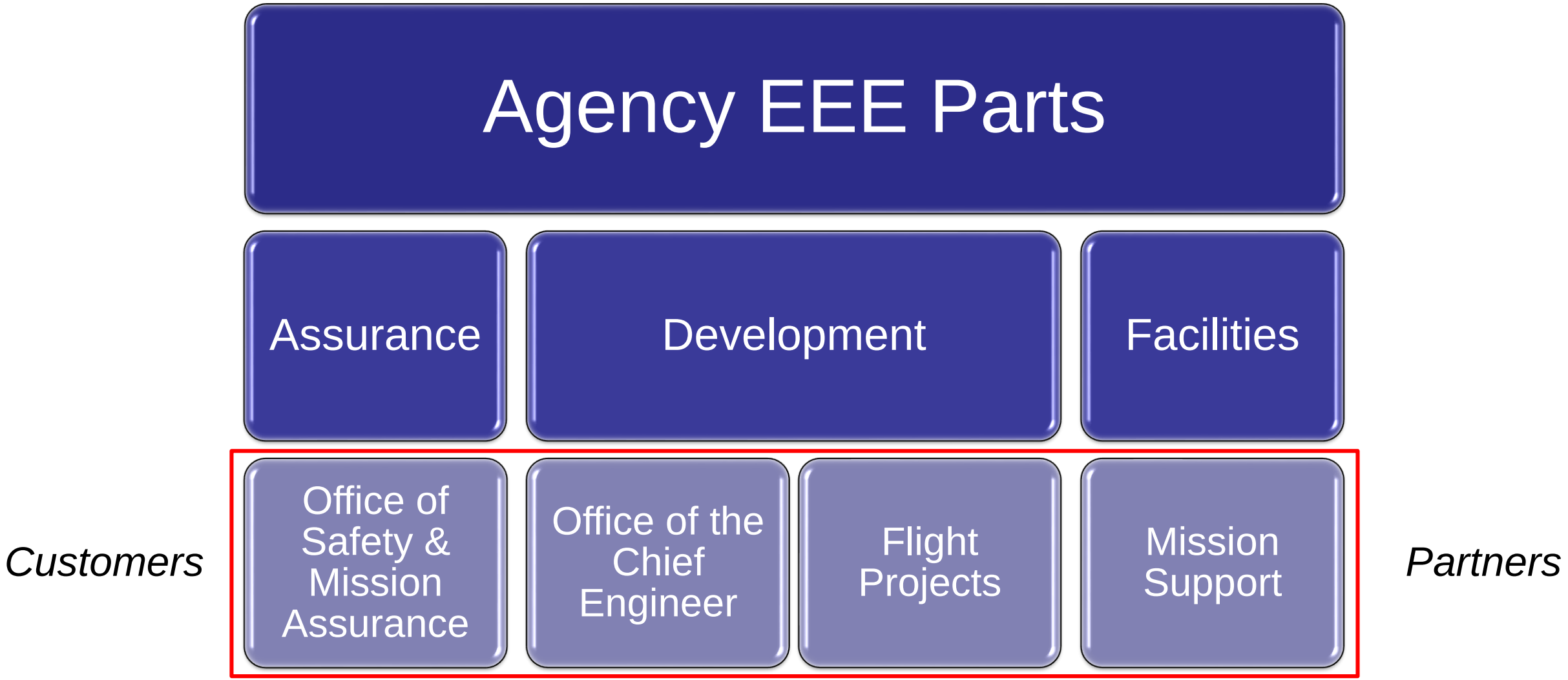
- Continued activities and Center discussions, Fall 2016 – Fall 2017
- Hired Agency EEE Parts Manager, November 2017

- Covers EEE parts and radiation engineering (on EEE parts) functions
  - Crosscuts engineering and safety & mission assurance
- Focuses on new ways to do business in light of workforce challenges and the demands of characterizing, qualifying, and deploying new technologies

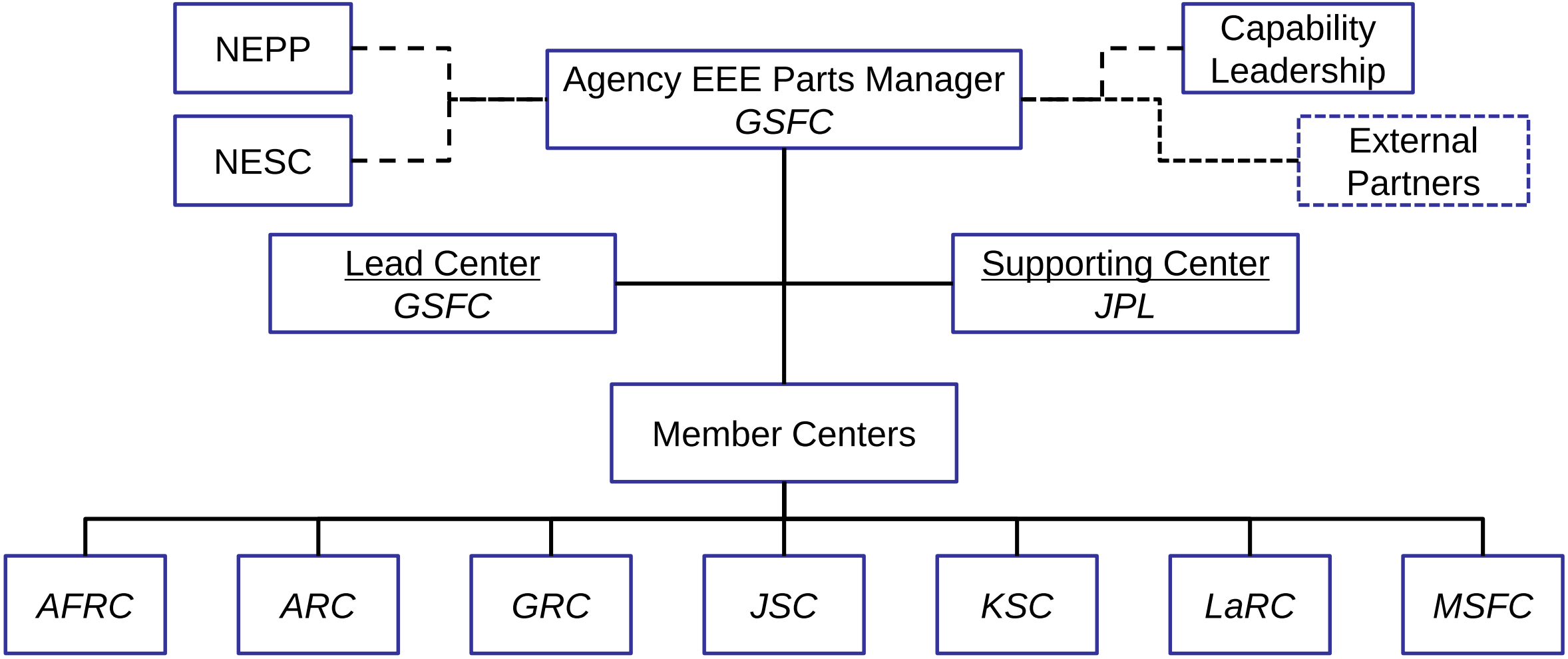
EEE Parts Manager Duties

- Manage EEE parts workforce at the Agency level
  - Radiation effects on EEE parts are in scope, as is management of the Agency radiation facility block buy (later slides)
  - GSFC is lead Center, with support from JPL
- Provide resources for Centers to acquire EEE parts workforce expertise and a forum to coordinate activities with stakeholders (e.g., OCE, OSMA, etc.) and customers
- Track the state of the Agency EEE parts workforce, including Center expertise, demand, and capacity
- Support Agency policy and technical decision-making processes
- Evolve management functions as needed

Agency Capability Relationships



Current EEE Parts Management Team Members



Radiation Test Facilities and Block Buy

Focus on single-event effects (SEE)

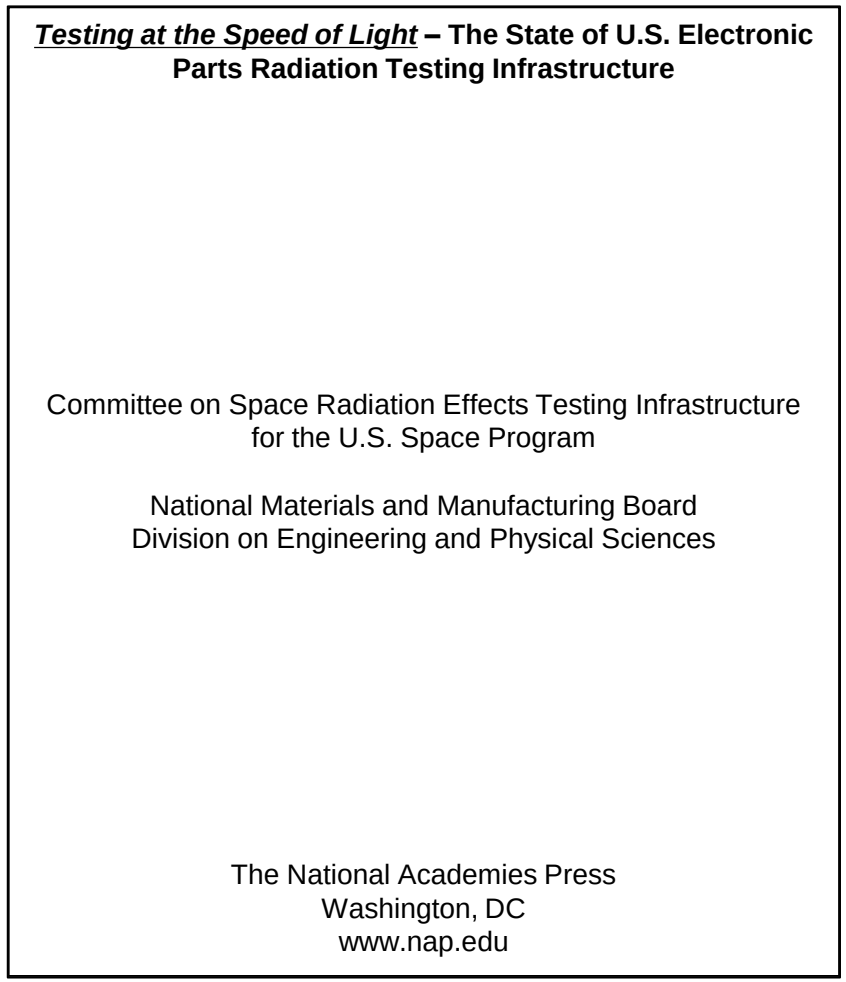
Domestic Radiation Facilities – SEE Testing

- Distributed across the United States
  - More than 15 states
  - International facilities too
- Split into several general categories
  - Heavy ion
    - For example: BNL (NSRL & SEUTF), LBNL, and TAMU
  - (Traditional) High-energy protons
    - For example: Loma Linda Cancer Treatment Center, Massachusetts General Hospital, Northwestern Medicine, and NSRL
  - Medium-energy protons
    - For example: BNL (SEUTF), CNL, LBNL, and TAMU
  - New medical therapy facilities
    - Dynamic
- Require various procurement mechanisms and agreements

Threat of Losing Access to LBNL

- The Department of Energy's (DOE) Lawrence Berkeley National Laboratory (LBNL) 88-Inch cyclotron is one of the two primary facilities utilized by NASA and other U.S. government space programs for heavy ion testing of electronics – the Texas A&M University (TAMU) Cyclotron Institute being the other
- By the end of FY17, LBNL had lost sufficient funding for radiation effects testing
- DOE funding is limited to science runs and maintenance periods in between runs
  - Radiation testing operations had been buoyed by funding from other U.S. Government agencies since the mid-1990s
  - Funds were also used for technology development, university research, and assurance guideline development efforts
- Loss of access to LBNL would result in additional delays to access a heavy ion test facility – could also put undue pressure on remaining limited resources

Phased Radiation Block Buy – Spurred by National Academies Report, Feb. 2018


Testing at the Speed of Light **– The State of U.S. Electronic Parts Radiation Testing Infrastructure**

Committee on Space Radiation Effects Testing Infrastructure for the U.S. Space Program

National Materials and Manufacturing Board
Division on Engineering and Physical Sciences

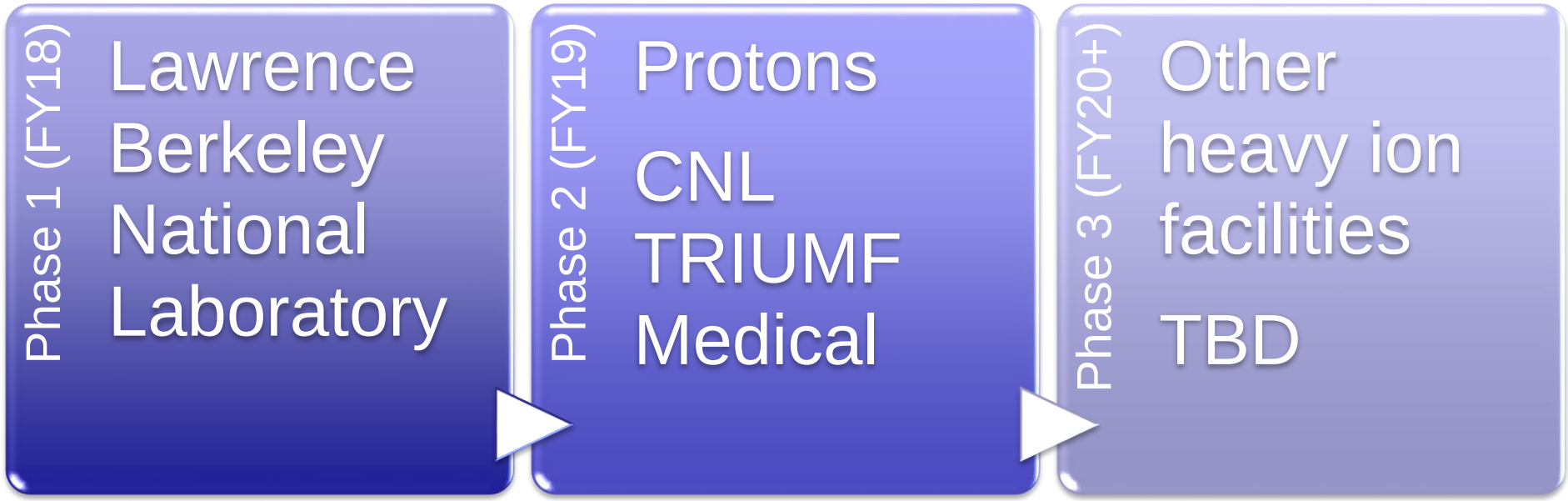
The National Academies Press
Washington, DC
www.nap.edu

- Background on space environment and its effects on electronics
- Current state of single-event effects hardness assurance and infrastructure
- Future infrastructure needs and a path towards them
- National Academies debrief at the NEPP Program Electronics Technology Workshop
  - Tuesday, June 19

https://www.nap.edu/catalog/24993/testing-at-the-speed-of-light-the-state-of-us

Phased Radiation Block Buy

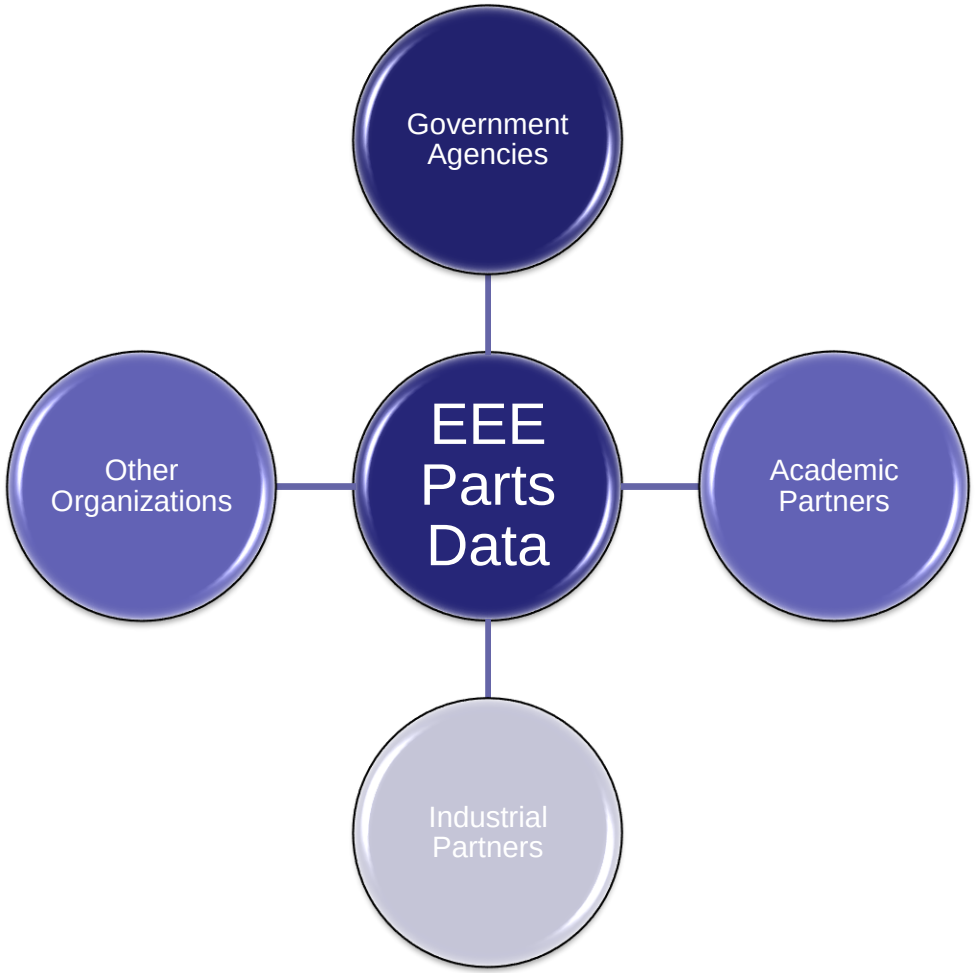
- NASA's Mission Support Council approved multi-phase plan to begin coordinating access to external radiation test facilities in February 2018
  - Phase 1 centrally-funded, Phase 2+ will be PAYGO with blanket purchase agreements
  - Looking at options for international facilities too
- Assessing funding / procurement model based on needs and available budget



EEE Parts Management Efforts
Broad, crosscutting examples – not inclusive

EEE Parts Data Exchange

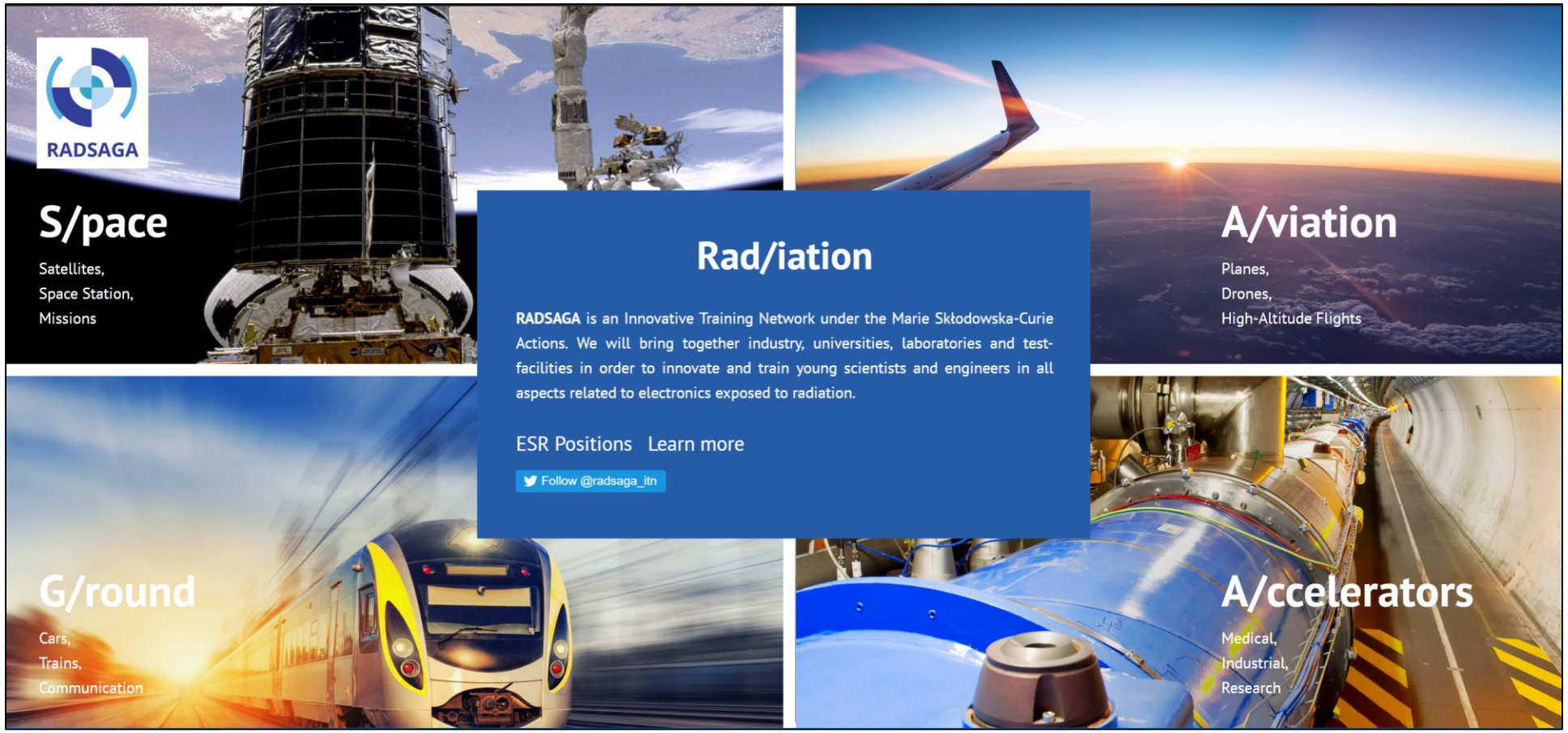
- Lacking centralized information for EEE parts usage – particular issue for COTS
  - Data are often stovepiped (even within single orgs.)
  - Can affect design process & quality assurance
- Tracing EEE part usage, testing, and history may be difficult
- Re-testing and/or re-ordering EEE parts with prior history may happen without **reasonable** knowledge symmetry
- Assessing different potential internal and community-based solutions
  - COTS data exchange talk, Thursday, June 21



Workforce Challenges – Next Generation

- EEE parts and radiation engineering are niche fields with crosscutting subject matter
  - Bulk of current workforce not specifically developed – mostly built with on-the-job-training
- Accelerating use of commercial-off-the-shelf (COTS) electronics and other advances (e.g., 2.5D/3D packaging, heterogeneous integration, sub-10 nm feature sizes, wide bandgap semiconductors, etc.) for flight hardware requires more commodity & discipline experts
- Among others, there is an across-the-board shortage of radiation effects (on EEE parts) engineers right now
  - 10s of job openings; preference for mid-career (global community is «1000 people)
  - Long-term needs will likely have to focus on training early career engineers and scientists while maintaining and transferring current knowledge base

Workforce Challenges – Possible Solution



https://radsaga.web.cern.ch/

Summary & Forward Work

- Continuing NASA EEE parts management implementation
  - Developing capability structure, cross-Center workflow
  - Refining relationships with both internal and external stakeholders
- Proceeding with multi-phase Agency radiation block buy
  - Executing Phase 1 at LBNL; planning Phase 2 for proton test facilities
  - Evaluating facility alteration / upgrade possibilities
- Considering future strategies for workforce development and other capabilities to meet current and future mission needs

Thank you for your attention
Questions welcome!



Image credit: NASA
International Space Station is seen in this twenty-second exposure as it flies over the Washington National Cathedral, Wednesday, Nov. 29, 2017.