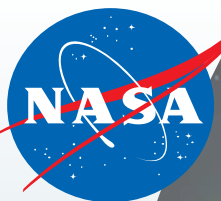


Current NEPP Program Work and the Focus on COTS Utilization

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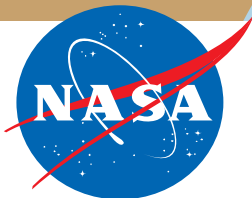
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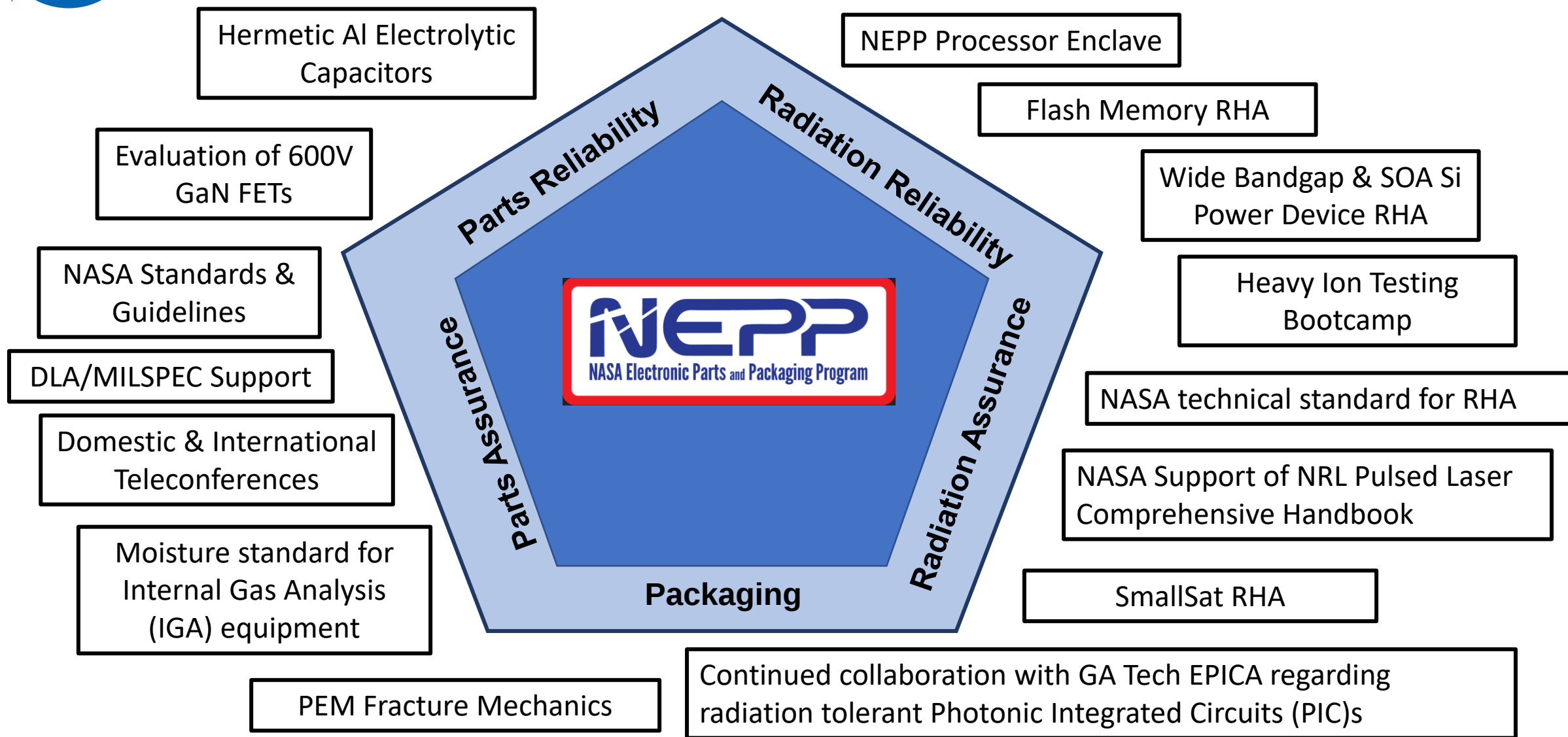


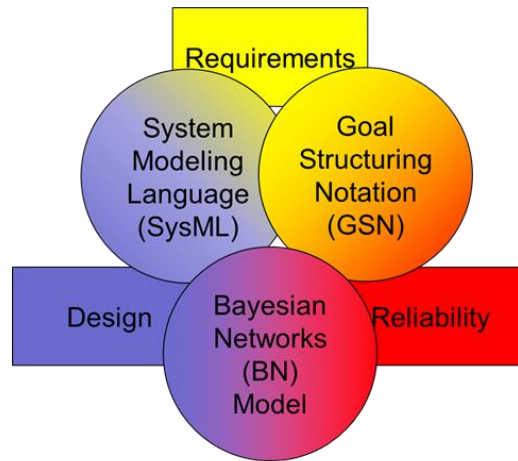
Agenda

- FY23 Work
 - Topics in NEPP Five Focus Areas
 - Assessment: *Recommendations on the Use of COTS for NASA Missions*
 - Challenges in Using Commercial Electronics
 - Steps to Utilize Commercial Electronics
 - Criteria for *Industry Leading Parts Manufacturing (ILPM)*
 - Developing an ILPM Designation Program
 - Radiation Concerns

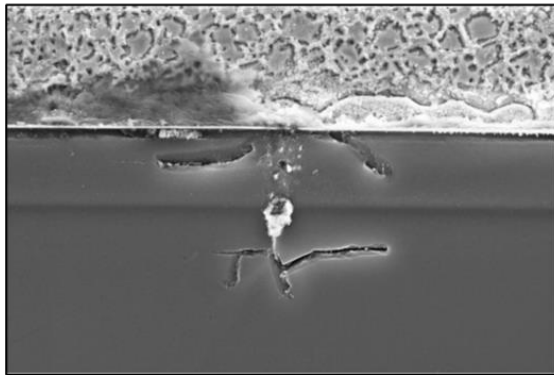


FY23 Work in NEPP Focus Areas





Emerging Assurance Methods
Image Credit: Vanderbilt University

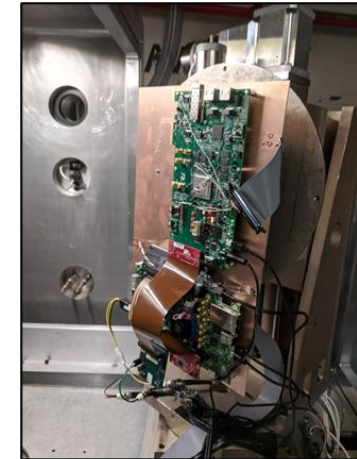


Advanced Technology Reliability
Image Credit: NASA

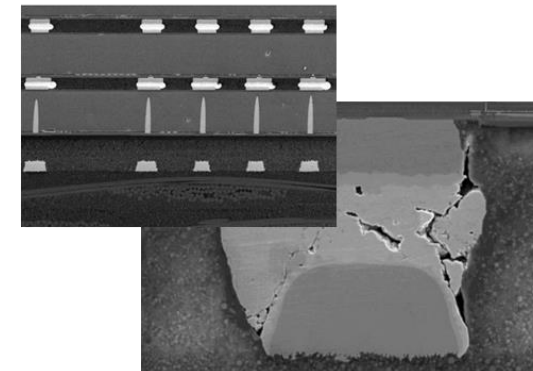
14th Annual NEPP Electronics Technology Workshop (ETW)

Scheduled dates:
June 12-15, 2023

<https://nepp.nasa.gov/>



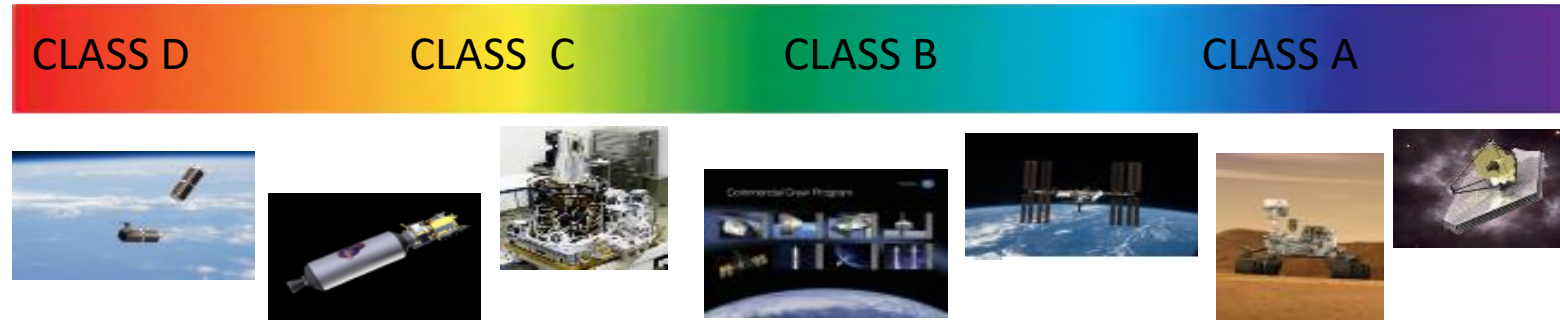
Radiation Testing & Analysis
Image Credit: NASA



Advanced Microelectronics Packaging
Image Credit: NASA

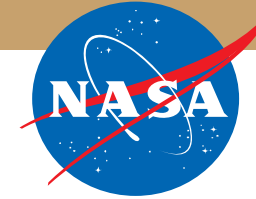


Standards & Policy and Guideline Development



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***
- Phase II of Assessment includes more government agencies (FAA, NAVSEA, MDA, etc.) and manufacturers to discuss COTS manufacturing
 - Objectives: Define term *Industry Leading Parts Manufacturers*, understand methods that manufacturers use to measure quality, assurance, and reliability, and to develop flows for part verification based on mission classification.
 - Phase II Report: <https://ntrs.nasa.gov/citations/20220018183>



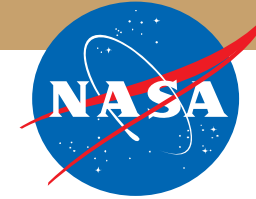
NASA Current Practice/Approach

- **Definitions**

- **COTS Part:** A part for which the manufacturer solely establishes and controls specifications for configuration, performance, quality, and reliability. This includes design, materials, processes, assembly, and testing with no Government-imposed requirements (i.e., no Government oversight).
- **NASA-screened COTS part:** A COTS part that, after procurement, is screened, and in many cases qualified, per NASA Agency, Center, or Program parts requirements documents, such as EEE-INST-002 or equivalent documents, by NASA, NASA contractors, a third-party, or the part manufacturer.

- **Process for Standard vs non-standard parts**

- Primarily specific classes of MIL-SPEC parts, are considered "standard". Standard parts typically are used without further testing ("use-as-is").
- All other parts, including COTS parts, are nonstandard. Nonstandard parts are subjected to initial screening and subsequent lot acceptance testing of representative samples from each procured lot per MIL-SPEC or similar requirements. Parts that pass these screens are then considered NASA-screened COTS parts.

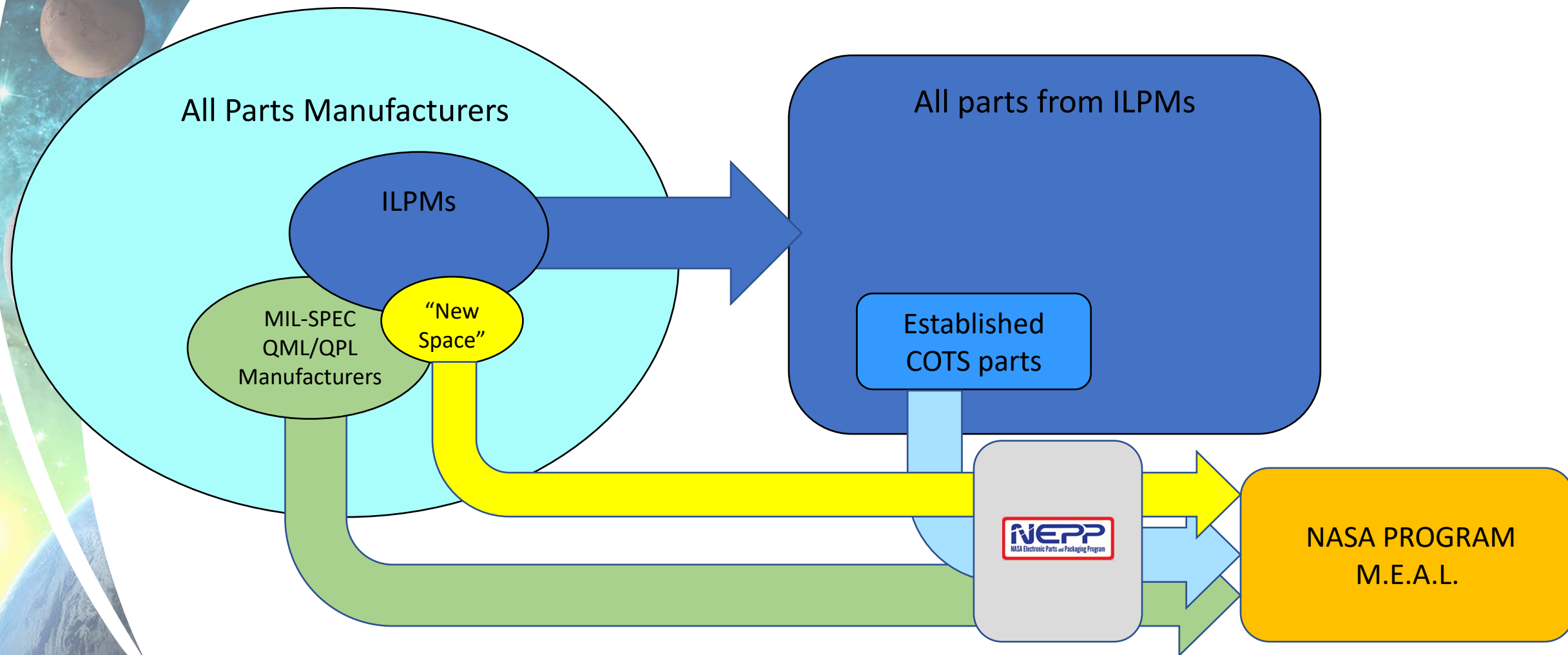


New Terminology Defined

- Phase I defined an *Industry Leading Parts Manufacturer (ILPM)*
 - A parts manufacturer with high volume automated production facilities and which can provide documented proof of the technology, process, and product qualification, and its implementation of the best practices for “zero defects” for parts quality, reliability and workmanship.
 - Take advantage of what commercial industry does the best - high volume automated production and best practices for “zero defects.”
- Phase II
 - Define additional terminology “Established COTS parts.”
 - Provide characteristics and criteria of an ILPM and part-level verification criteria for NASA missions.
 - Phase II recommendation is to select Established COTS parts category from ILPMs; updated from Phase I recommendation of “select parts from ILPMs”.

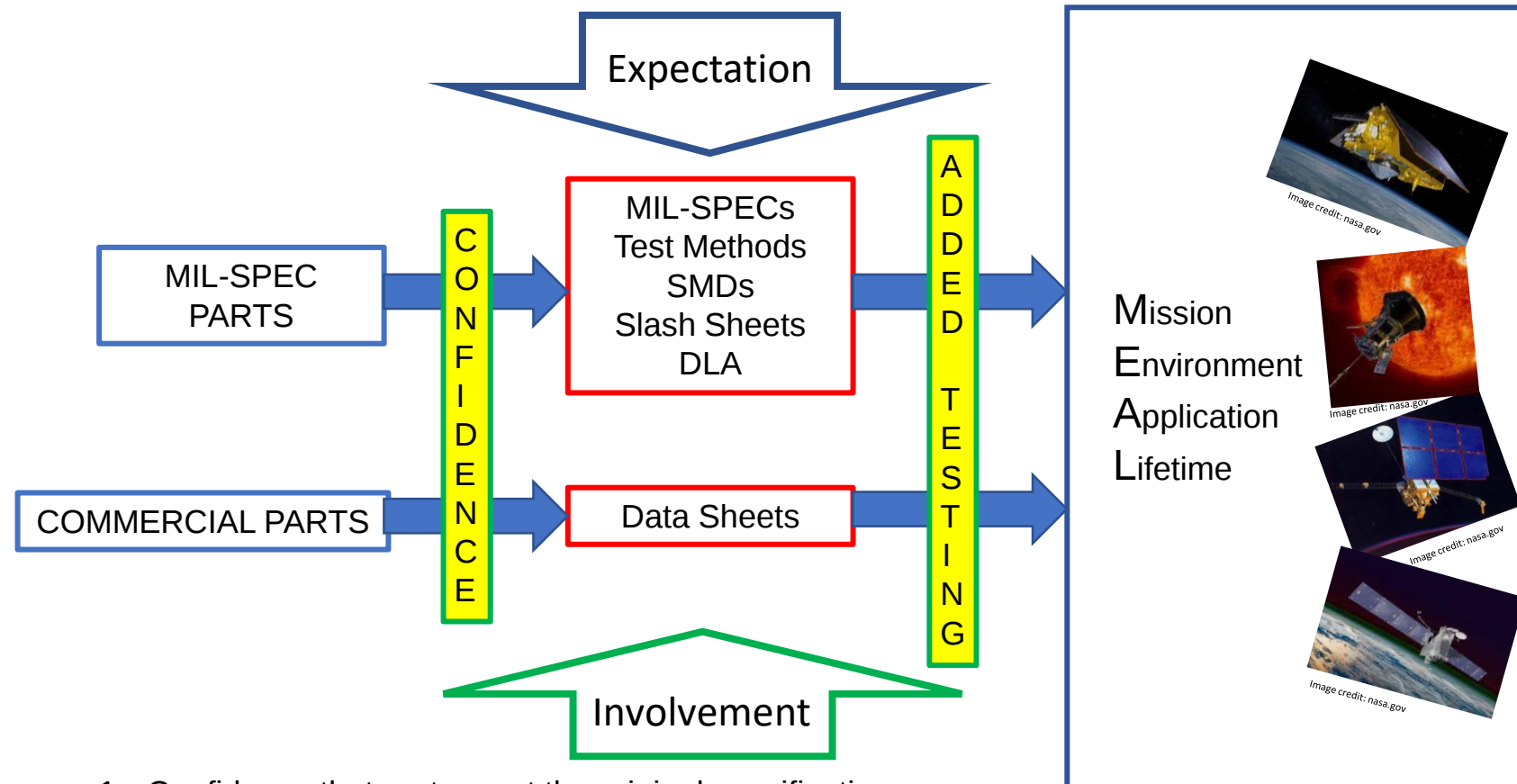


Big Picture





Concerns for Picking Parts

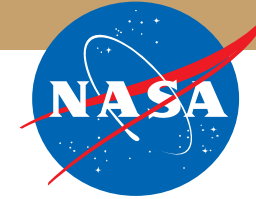


1. Confidence that parts meet the original specifications.
2. Analysis to ensure mission requirements are being met, especially if requirements are above data sheet/SMD limits.
3. Added testing should be done with extreme caution



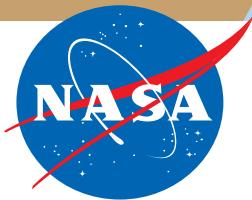
COTS UTILIZATION STEPS

- 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
 - Attempt at "Standardization"



Criteria for an ILPM

- Will share parts quality and reliability data
 - DPPM (defective parts per million), field failure DPPM and/or part failure rates (FITs), FMEAs, Design Practices, etc.
- Will provide NASA how unscreened parameters are guaranteed.
- Will allow NASA to visit on-site and/or to work with NASA to maintain a strong customer-manufacturer relationship.
- Will describe the parameters that are being monitored to maintain process controls.



What We Will Not Request

- The intent of the ILPM process is to utilize the manufacturer's established methods of quality and product assurance, not to impose additional data requests. Therefore, we will not request:
 - Lot travelers with fallout numbers **BUT** Mfg should be willing to divulge tests performed and respective conditions
 - Extra electrical test data at hot (or cold) **BUT** Mfg should be willing to provide proposal/feedback for extra customer testing as needed
 - Changes to device (fab, test, assembly) **BUT** Mfg should be able to provide device qualification relevant to the product lines used for fab, test, and assembly

Take advantage of what commercial industry does the best.



ILPM Designation Program - Initial Strategy

- Pick QML Manufacturer we have a very good relationship with
- Met with Texas Instruments Inc. for initial ILPM discussion
- Parts list developed to target part numbers/types highly used in NASA missions
- Reviewing online information and requesting part specific data. Planning future virtual meetings and onsite visits

**** ILPM Designation Program – Open to all Manufacturers ****



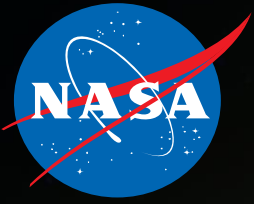
Radiation Concerns



- Parts levels in EEE-INST-002 and equivalent documents **do not indicate the level of radiation tolerance**, and thus the selection of parts level 1, 2, or 3 does not imply or provide any type of radiation hardness or mitigation of radiation effects.
- **MIL-SPEC** parts may or may not include a radiation hardness designator signifying **TID performance** but may be sensitive to SEE.
- Lot-to-lot variation of radiation sensitivity may be larger for non-radiation-hardness-assured (non-RHA) parts than for RHA parts, since space radiation tolerance is typically not designed and optimized for parts without radiation addressed in their datasheets.
- RHA mitigations must include system-level techniques and solely depend on part-level robustness.



Credit: NASA/GSFC



The End



Latest images from JWST



Image credit: NASA

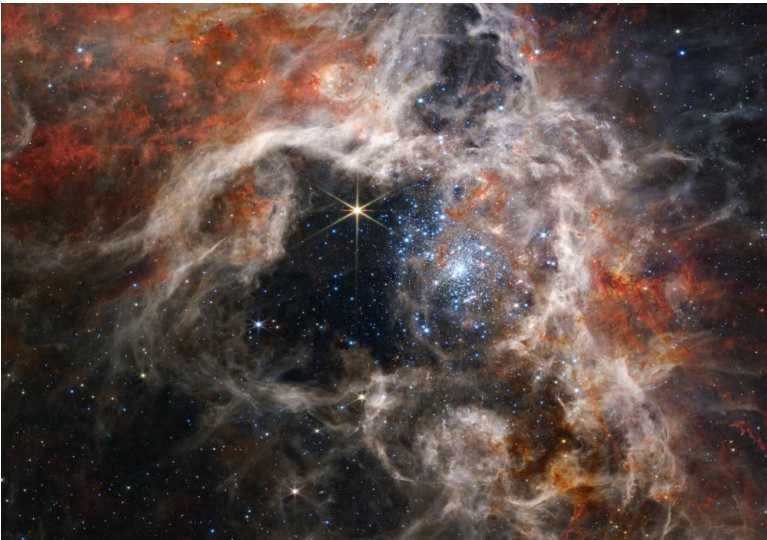


Image credit: NASA



Image credit: NASA

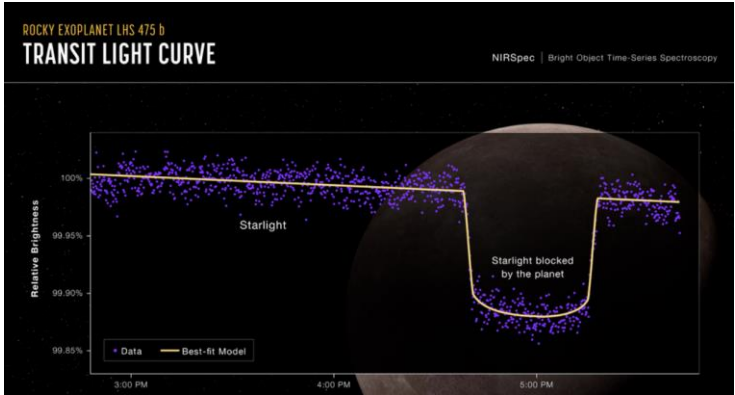


Image credit: NASA



Latest images from JWST



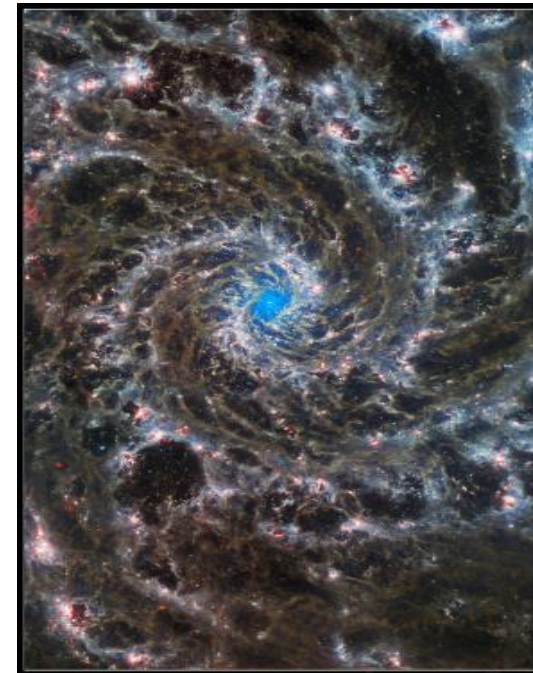
Comparison

Image credit: NASA

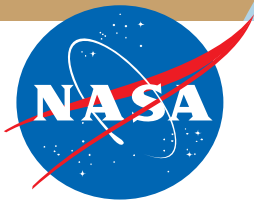


Hubble optical

Image credit: NASA



JWST Infrared



ARTEMIS I

**Launch:
Nov 16, 2022**



**Splash Down:
Dec 11, 2022**

