The Business Case for COTS EEE Parts Data Sharing

Brian Kosinski
Aerospace Corp. Chief Eng. Office

November 2024

Approved for public release. OTR 2025-00124.

COTS Mission Success Improvement Workshop (MSIW)

- COTS MSIW Charter:
  - *"Define and develop practical guidance and tools to navigate through the complicated process of assessing the viability and use of COTS for space applications"*

- Active since January 2023

- Industry and US Government team including reps from:
  - *BAE Systems, Blue Canyon, Boeing, GDMS, Interga, L3 Harris, Lockheed Martin, MAXAR, Northrop Grumman, Raytheon, SEAKR Engineering, SwRI*
  - *NASA: JPL, Goddard Space Flight Center, OUSD*
  - *Aerospace Corporation*

We welcome additional participation!

COTS MISW

So far…and next steps

- Two documents produced:
  - Expanding Space Design Options Using COTS, ATR-2023-01935
  - Acquisition Considerations to Expand Space Design Options Using COTS Electrical, Electronic and Electromechanical (EEE) Parts and Units, ATR-2023-01981
- Currently performing 90-day sprint to define the business case for EEE part data sharing
  - Goal: Enable programs to significantly minimize cost and schedule associated with the testing and qualification required for incorporating non-standard (i.e., non-QPL) piece parts into a space design baseline
  - Approved by Space Collaboration Council (SCC)
  - Interim status presented here
  - Results will be presented to SCC in January 2025

Data sharing Business Case Status presented in the following slides

EEE Parts Issues are Impacting NSS and Civil Space Programs

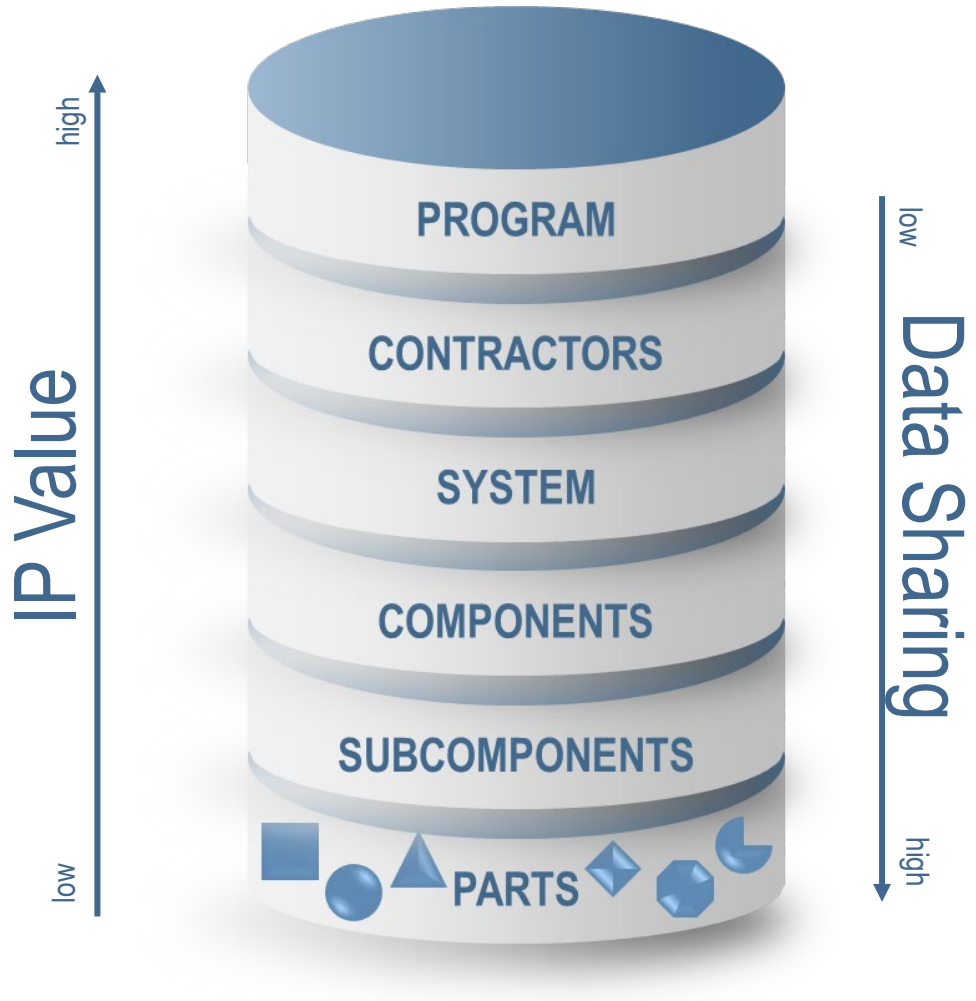
Parts issues are coming at program offices like a freight train …

- EEE parts are impacting cost, schedule and performance of NSS and civil space programs
- These impacts will continue to degrade without strategic investment and process improvements
- COTS MSIW identified data sharing as the biggest potential impact to programs
- This presentation establishes the business case for EEE parts data sharing
  - *Builds on COTS and other MSIW products*

Data Sharing has been identified as the most important area for improvement

COTS = Commercial off the Shelf EEE =Electrical, Electronic, and Electromechanical MSIW = Mission Success Improvement Workshop NSS = National Security Space

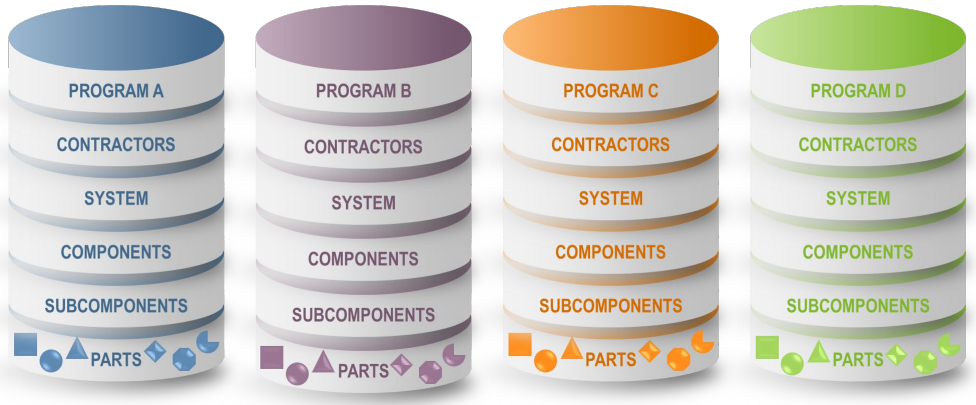
From Data Sharing to Knowledge to Decisions



- System and contractor decisions become weightier as they move up the stack towards program
- Data sharing decreases as intellectual property value increases
  - Knowledge increases as you go up the stack;
  - Parts information is the least valuable information in terms of “secret sauce”

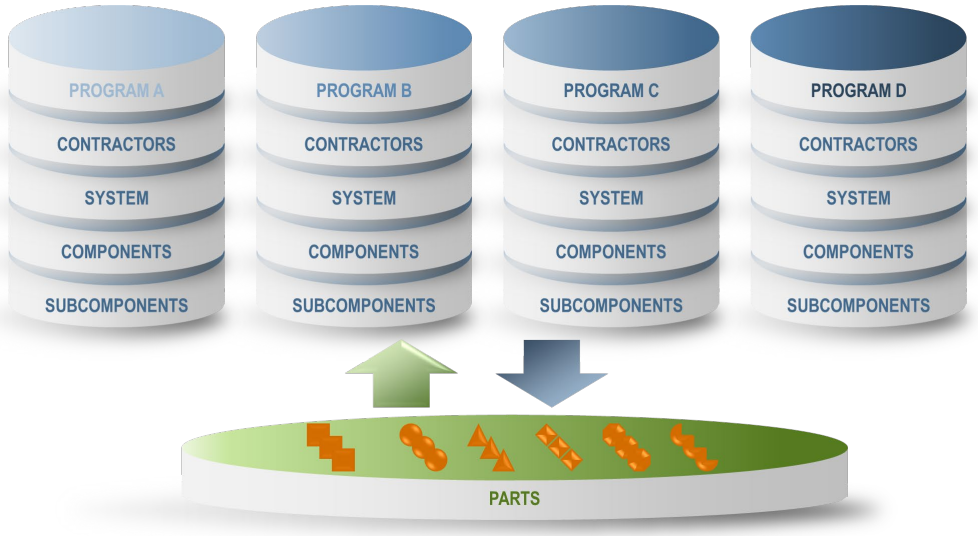
IP = Intellectual Property

From Data Sharing to Knowledge to Decisions



Today

- Siloed programs, no or very limited data sharing, limited knowledge development
- Decision weight limited to individual program
- Current data sharing is point-focused on problems, not preemptive (more)



Future State

- Data sharing enables us to operate more like vertically integrated commercial entities, even in our siloed system
- Parts level data sharing minimizes duplication of parts test activities
- Unify and disseminate knowledge previously closely held in independent sources

Why Now?

What's different? Why do we believe we can succeed now?

Acquisition Imperative – We Can't Afford Not to Succeed

- Increasing pressure to field more systems – and more types of systems – with increasingly compressed schedules and budgets
- Space Acquisition Guidance: **3 years to launch**, maximizing NRE and use of fixed price contracts[1]
  - We can't consistently meet a 3-year development timeline doing things the way we've always done them
  - Parts activities today are time consuming: parts selection, parts lead times, parts test
  - Data sharing helps get us there by accelerating informed decision making by programs

Improved IT, Data Tools

- More cloud-based DoD authorized IT systems available
- Those systems enable multiple access profiles (i.e., not all users can see all data)
- Improved tools for categorizing, analyzing, querying, and understanding data (data analytics)

Building on Established Efforts

- Leverage existing efforts (more) and their successes with legal and liability issues (e.g., NDAs)
- Parts data sharing must extend beyond radiation data
- Industry exploration of data sharing and data marketplaces in support of critical infrastructure requirements (e.g., GSA-TIES)

Data sharing is a *critical enabler* to manage risk even while accelerating programs

DoD = Department of Defense EAR = Export Administration Regulations IT = Information Technology ITAR = International Traffic in Arms Regulations NDA = Non-Disclosure Agreement

Data Sharing Business Case - Cost Model

Development of a data driven cost model predicting the financial and schedule impact on the USG space industry

Business Case

- Lack of quantitative data to justify investment in data sharing.

Model Fidelity Highlights

- Part classes
  - Passives
  - Actives - Simple
  - Actives - Complex
- Risk profiles: mission classes and part assurance levels are included
- Excluding ground and launch costs (space segment only)
- Period of performance excludes post launch operational costs
- Model separated into labor, material, and test costs
- **Real-world cost data**
  - Testing and associated labor data sourced from test vendors and aerospace contractor records

Cost Model Methodology

Estimate total cost of all space programs.

Estimate cost contributors.

Estimate schedule impact and investment required.

Calculate output.

Total Available Market (TAM)
- Maximum, minimum, and median values for Class A to D programs
- Program count and percentage of labor vs. material
- Period of performance

Labor Impact
- PMP, supply chain, and engineering EEE support
- Potential savings through data sharing

Material Impact
- Material spent on EEE parts
- Savings from common data and parts

Test Impact
- Qualification and screening costs per lot based upon industry ROM actuals
- Radiation segregated and estimated
- Lot counts estimated and incorporated

Schedule Impact
- Lead, test and up-screening times included
- Radiation segregated and estimated

Investment (Cost of Data Sharing)
- NRE and RE for data sharing system subtracted from gross cost savings

Model Outputs
- Cost avoidance from data sharing and associated ROI
- Schedule risk avoidance

The model can be shared with the community and is easy to customize for a specific program or organization

NRE = Non-Recurring Engineering PMP = Parts, Materials and Processes RE = Recurring Expense ROI = Return on Investment ROM = Rough Order of Magnitude

Summary of the Case for COTS Data Sharing

Annual Cost Savings: $125M - $1.9B*
Schedule Improvement: more than a year*
*Findings are in line with the independent NASA PEAL study

- Savings from sharing test and qualification data required for non-standard EEE parts realized by:
  - Reduced or eliminated duplication of test efforts on the same parts used across multiple USG programs
  - Reduced wait time for access to test houses and radiation test facilities
  - Reduced timeline associated acceptance of a new, non-standard parts into a program design baseline
- Data sharing will also enable:
  - Improved acquisition schedule confidence
  - Accumulated part risk, supply chain, industrial base, etc. knowledge accessible to stakeholders, contractors, program managers, PEOs
  - Integration of part data into Digital Engineering and digital thread efforts in commercial and defense industries
- Assumptions:
  - The database includes robust and relevant parts data supporting space programs
  - Participating companies contribute their data and use the aggregated data to realize cost and schedule savings
  - Barriers are successfully addressed

While the solution may be complex, the benefits of data sharing are clear.

NASA = National Aeronautics and Space Administration PEAL = Parts Evaluation and Assessment Laboratory PEO = Program Executive Office

Defining Data Sharing

Recommended Next Steps for Implementation Plan

LOE: Contracts Language

Establish candidate contracts language for parts data sharing on future contracts

- Identify established efforts that can be leveraged, learned from
- Data rights – what are the expectations, considerations?
- Scope of data – types, amounts, contracts language and/or DID
- Challenge: flow down of requirements, data rights
- Challenge: handling IRAD or proprietary data – separation vs. “contamination”
- Align parts data deliveries to program reviews, acquisition milestones
- DIDs (data item descriptions) – none, one standard, or a library of options for access profiles and data type?

LOE: Legal & Liability

Propose an approach to data sharing that overcomes historical legal and liability concerns

- Identify barriers to data sharing (e.g., NDAs, adverse financial implications)
- Data anonymization – removing associations
- Data sanitization – mission profiles, etc.
- Data quality
- Data governance

This LOE has the highest risk to meeting its schedule, budget

LOE: High Level Requirements

Document high-level requirements for data sharing infrastructure and access

- Identify must haves and deal breakers for infrastructure
- Infrastructure: leveraging established options – how to interface (e.g., API, data compatibility, data structures) and lessons learned
- Infrastructure: access vs ownership of data (pointers vs actual data)
- Infrastructure: where does the data live – map ATO / enclave approach
- Data quality – data entry and approval, data maintenance, data obsolescence
- Access: assign data types to access profiles
- Data governance

LOE: Identify Incentives

Identify candidate incentive structures for data sharing

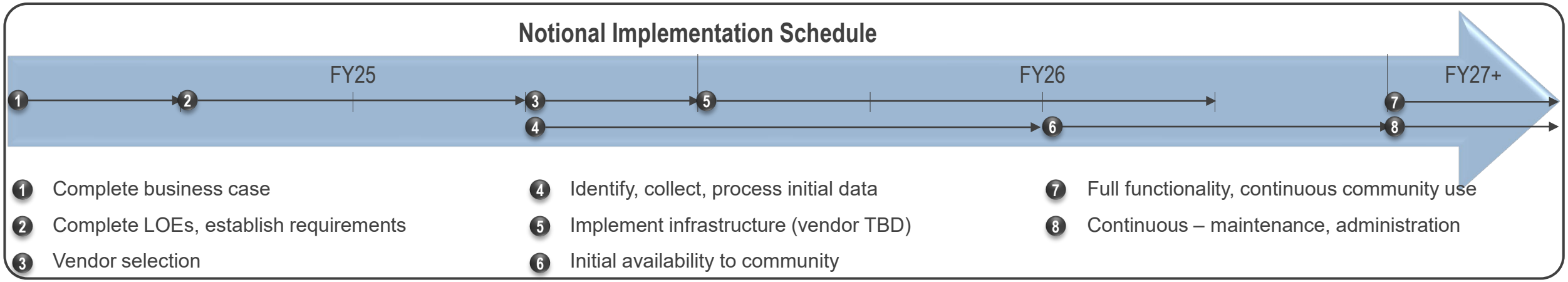
- Identify barrier to sharing past / current data
- Incentives: what makes you willing to share?
- Scope: what makes [retroactive] data useful?
- Rank most useful data for retroactive data sharing

API = Application Programming Interface ATO = Authority to Operate DID = Data Item Description IRAD = Internal Research and Development LOE = Line of Effort NDA = Non-Disclosure Agreement

Recommended Next Steps

The benefits to data sharing are clear. The solution is complex

- Identify or establish a body that has responsibility for the administration and maintenance of the parts data sharing infrastructure that
  - Is a trusted broker that is independent from data providers and user (defense industrial base, suppliers, etc.)
  - Can provide necessary subject matter expertise in the areas of data management, MIL / Aero policies, contracts / legal (e.g., NDA compliance, acceptance of data deliveries), and is familiar with the areas of space and electronics (e.g., assess data conformance quality)
  - Is funded to perform administration and maintenance tasks
- Deliver necessary information (programmatic plans, technical requirements) by **Q3FY25** to support **Q1FY26** infrastructure development start
  - Establish and fund small cross-organizational, cross-functional working groups for each proposed LOE
  - Plan forward should be well socialized across and inside NSS programs and industry to smooth path for successful LOE execution



FY = Fiscal Year LOE = Line of Effort NDA = Non-Disclosure Agreement Q = Quarter TBD = To Be Determined


Thank You

Key Considerations for Cost Model Elements

Sample of model ground rules and assumptions

Total Available Market (TAM)	Labor	Material	Test	Schedule
• Constellations and bus/payload size or complexity not directly addressed • No escalation rates have been included • Labor skill or availability not factored into labor percentage of program • Labor and material values may vary between unit and system builders	• Data sharing labor is a percentage of total labor • Single labor rate assumed to simplify model outputs • Level loaded with no spend profiles addressed • Program deliverables assumed addressed by Mission Class and Parts grade variance • Savings are a percentage since program will always require some effort	• Material spend is fraction of total material spend and broken into 3 identified areas • Legal and IP issues with sharing of procured data not specifically addressed in model • Material assumed 1st pass success from testing or other costs • Obsolescence and other DMSMS issues are not specifically addressed	• Cost inputs driven by industry ROM values not TAM values • Costs broken down by qualification, screening and up-screening • Radiation segregated and added to qual • Per part costs multiplied by lot count inputs to captured costs • Single bus and payload assumed	• Program unique schedule risk mitigations not addressed • Schedule impacts assumed to be serial and additive • Impacts primarily from mil-spec procurement lags with limited impacts for COTS shown for Class C/D

Investment (Data sharing costs)

- Non-recurring Engineering (NRE) Fixed costs of est. $4.4M assumed for labor, HW and data system implementation
- Recurring costs of est. $200K/Year assumed as annual hours to maintain and manage data system with assumed USG ownership
- No specific costs identified for data cleaning or other potential labor to ensure high quality data entry to maximize return

The Cost Model was designed to be readily shared and customizable for specific programs and applications

DMSMS = Diminishing Manufacturing Sources and Material Shortages HW = Hardware IP = Intellectual Property ROM = Rough Order of Magnitude T&AM = Total Addressable Market

Data Sharing – Present Day

Parts data sharing today is primarily in response to known problems

Name	Purpose	Benefits	Challenges
Aerospace SQIC (Space Quality Improvement Council)	• Part anomaly data sharing	Articulated NDAs/protections to properly share parts data amongst and only to industry stakeholders	- Slow - Significant concerns over perceived liability/ damaged reputation
NSSA EPAP (Enterprise Early Problem Alert Process)	• Part anomaly data sharing	Articulated NDAs/protections to properly share parts data amongst and only to industry stakeholders	- Slow - Significant concerns over perceived liability/ damaged reputation
US Government GIDEP (Government Industry Data Exchange Program)	• Part anomaly data sharing • Communication of Parts Obsolescence • Communication of Safety Issues • Published Consumer Product Recalls	Articulated NDAs/protections to properly share parts data amongst and only to industry stakeholders	- Very Slow - Cumbersome - Significant concerns over perceived liability/ damaged reputation
NASA Alert System	• Part anomaly data sharing for only NASA programs	Articulated NDAs/protections to properly share parts data amongst industry stakeholders	- Slow
Contractor-Specific Enterprise Efforts: (e.g. Lockheed Martin MSB)	• Mission Success Bulletins leverage SQIC, NASA alerts, GIDEP, internal alerts	Closed loop system – data shared across Lockheed.	- Limited access / impact

Sharing parts data on issues minimizes potential cost and schedule and capability impact to other contractors/ programs

Traditional data sharing shows that we *can* resolve protection issues … but that alone doesn't drive participation, program benefits

Newer initiatives that share radiation data across the enterprise

Data Sharing Across the Enterprise

Name	Purpose	Benefits	Challenges
SRHEC Radiation Test Database	Recommendation and initial database infrastructure created to share radiation test data across DoD	• Goal of sharing multi-classification-level radiation test data • Administered by same team as RaPID DB	• 5,000 entries; currently primarily overlaps with MDA RaPID • Access is limited (does not address breadth of space enterprise) • Limited flexibility for access profiles
MDA RaPID	Initial database infrastructure created to share radiation test data across MDA as part of DECEPTR program.	• Goal of sharing multi-classification-level radiation test data • Administered by same team as SRHEC DB	• Access is limited (does not address breadth of space enterprise) • Limited flexibility for access profiles
ESA Radiation Test Database	Database of radiation test effects on EEE components by ESA or by European partners under ESA contracts	• Goal of sharing data within the radiation effects on EEE components community	• Non-ESA members can only access data categorized as Public Use • Limited public use data (< 350 parts)
Aerospace PMPedia	Initial database infrastructure created to share radiation test data across COTS components maintained by U of Colorado	• Goal of sharing unclassified radiation test data of COTS components • Public access	• Limited test data • Public access

At least one program has implemented a DID (Data Item Description), the Radiation Hardened Parts Data Sharing List (RHPDSL) that extends standard parts data collection to include radiation data

Commercial consortiums are working to overcome data sharing barriers (e.g., incentives, common elements) for assurance and quality related information in support of USG critical infrastructure requirements

Data sharing pre-emptively – vs with a focus on anomalies – can significantly improve cost, schedule for USG

DB = Database ESA = European Space Agency MDA = Missile Defense Agency SRHEC = Strategic Radiation Hardened Electronics Council

Benefits of Data Sharing

Data Sharing For Electronics – The Business Case

- The goal of the data sharing is to enable programs to significantly minimize cost and schedule associated with the testing and qualification required for incorporating non-standard (i.e., non-QPL) piece parts into a space design baseline.

- In addition to saving cost and schedule for programs, we anticipate that electronics data sharing across the USG and space enterprise will
  - Reduce duplication of test efforts for the same part across USG efforts
  - Reduce capacity demand for both internal and third-party test houses and radiation test facilities
  - Extend beyond radiation data sharing to include environmental and manufacturing data required for space programs
  - Unify and disseminate knowledge previously closely held in independent sources
    - Curated evidence, risk assessments of parts, assemblies, subsystems, supply chains, industrial base, etc.
    - Accumulated knowledge accessible to and disseminated across stakeholders, contractors, program managers, PEOs
  - Serve as an enabler for programs that are accelerated (e.g., rapid replenishment) as time required for test can be a nonstarter for these programs
  - Shift left on decision making for insertion of novel technologies, backed by data
  - Save time across the community by understanding what is not promising or has failed
  - Support and improve data analytics for space parts usage, developing actionable information from raw data
    - Enable aggregation of discrete data that aims to improve risk management across programs
  - Promote common understanding and shared best practices for electronics test, use
  - Align with NASA's Industry Leading Parts Manufacturer (ILPM) and Parts Evaluation and Assessment Laboratory (PEAL) initiatives to determine suitable commercial electronics utilizing thorough manufacturer vetting and part testing/analysis
  - Provide benefits to parts users, academia, and have some utility for parts suppliers

- Electronics data sharing across the USG and space enterprise will not replace the need for thoughtful, risk-informed parts selection and PMP activities

Data sharing has a strong long term value proposition – it just gets better

ILPM = Industry Leading Parts Manufacturer PEAL = Parts Evaluation and Assessment Library PMP = Parts, Materials and Processes QPL = Qualified Parts List USG = United States Government