National Aeronautics and
Space Administration

NEPP Hybrid Working Group

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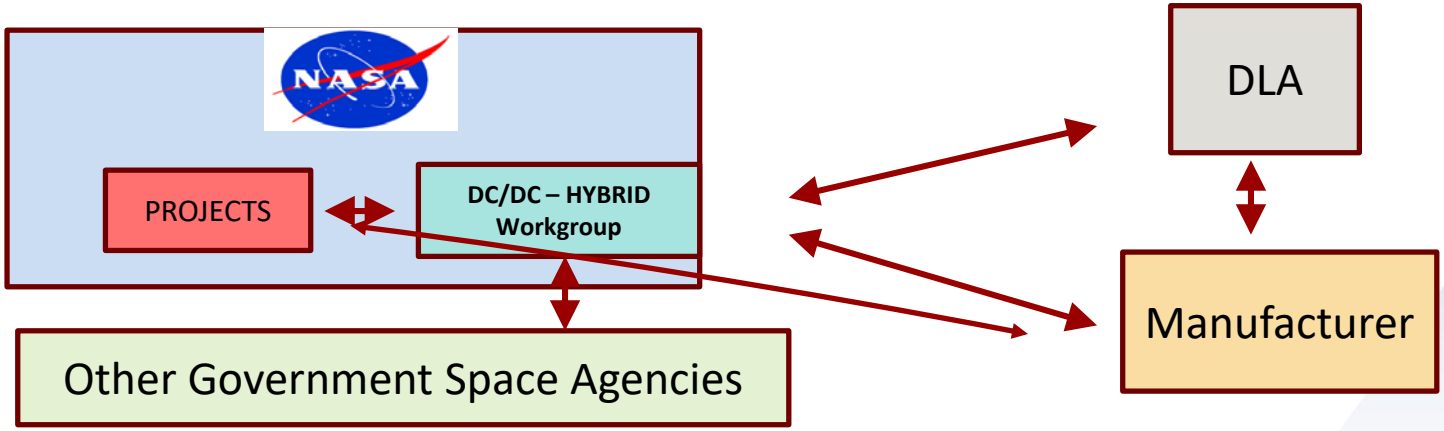
Key Points

- **Mission:** To communicate information on key issues regarding the reliability of Hybrid Microcircuits & DC/DC Converters with specific emphasis on manufacturing, specifications & procurement (**both good news and bad news**).

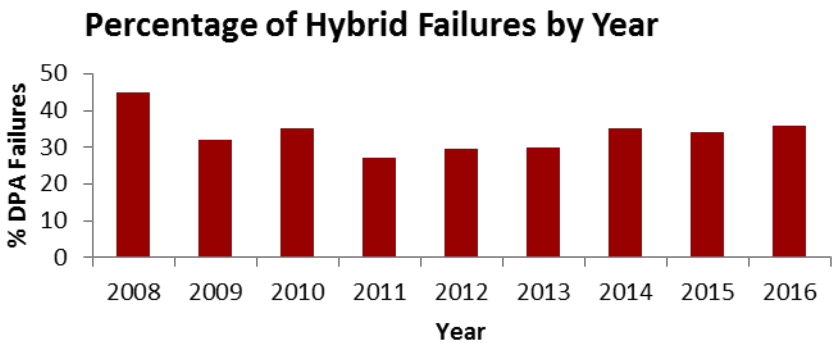
- **Monthly Teleconferences**
  - First Wednesday of every month @ 1:00p.m. EST
  - Usual Attendees: NASA Centers, Aerospace Corporation, NAVSEA & DLA(L&M)

ORGANIZATIONAL INTERFACES



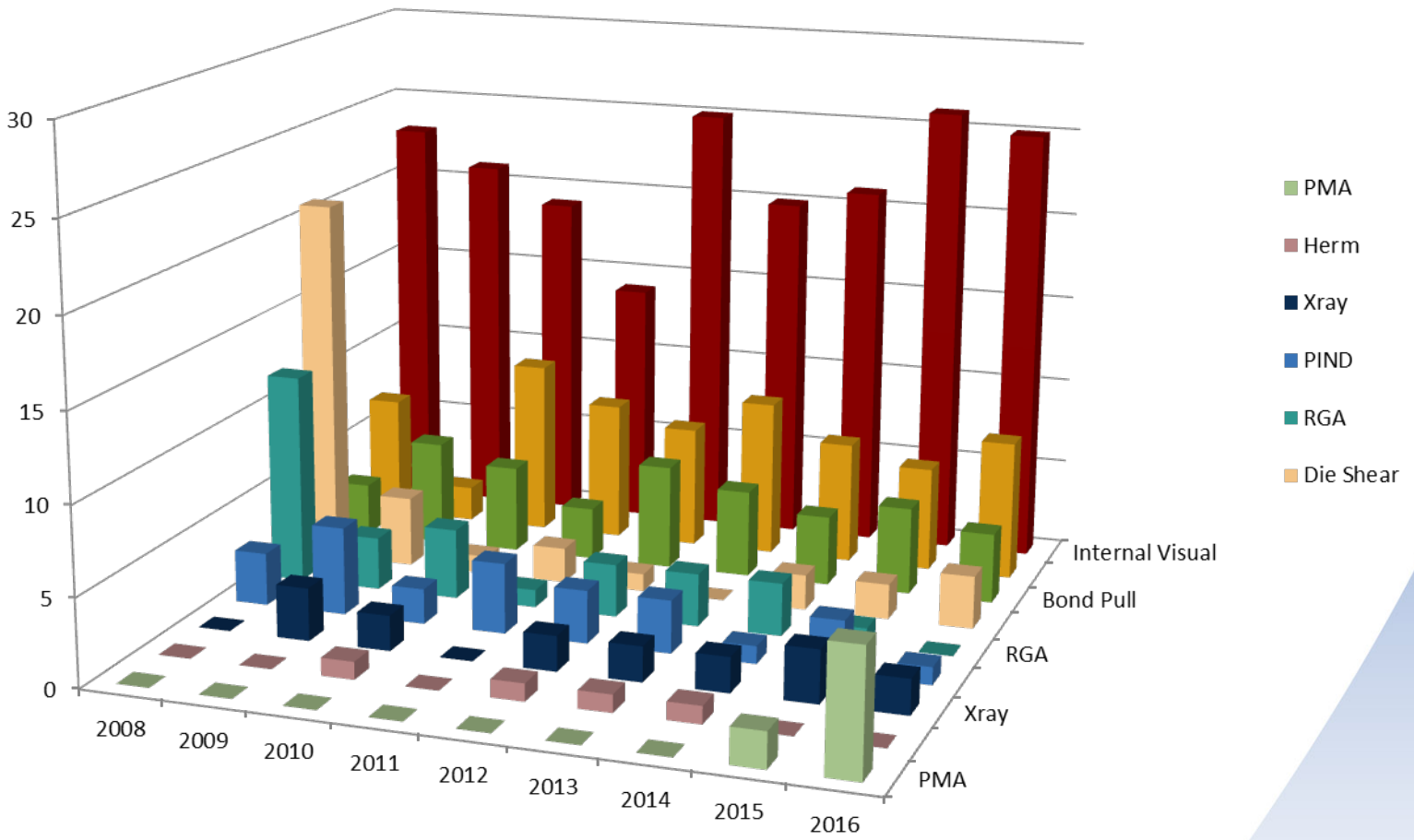
Motivation

- **Switch Mode Power Supplies (DC/DC Converters)**
  - Enormously Complex due to Extreme Miniaturization
  - Paramount Programmatic Penalties [Budget, Time]
  - Manufacturing challenges
    - Assembling hundreds of components using various techniques in a hermetic package (typically $1in^2$ – $5in^2$)
    - Low production numbers
    - High reliability in extreme environments [qualified designs verified by sampling & screening]



* Data compiled from Hi-Rel Laboratories at Space Parts Working Group Conference presentation (2009-2014)

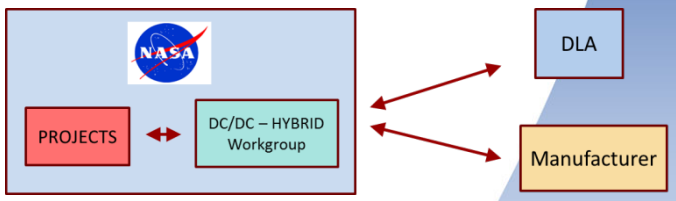
Classification of DPA Failure Causes – (Percentages)



* Data compiled from Hi-Rel Laboratories presentations at Space Parts Working Group Conference (2009-2016)

Hybrid WG - Key Points

- **General Topics**
  - Sharing of data on purchases, requirements, specifications (SMDs vs. SCDs)
    - Customizations by Centers and Product Performance Issues
    - Discussions on Failure Mechanisms, purchase lead time and delay issues
  - Sharing of information on failures, delays, GIDEPs, vendor notifications, etc.
  - Updates from Defense Logistics Agency
    - Audit reviews
    - Moves, Consolidations, New ownership
    - Alternate Methods
  - Review / revising of current Military Specifications
  - Attendance at JEDEC / G-12 Conferences (JC-13* Government Liaison)
    - Attend 13.5 Hybrid Working Group Meetings



* JC-13 is responsible for standardizing quality and reliability methodologies for solid state products used in military, space, and other environments requiring special-use condition capabilities beyond standard commercial practices. This includes long-term reliability and/or special screening requirements.

Current & Future Actions

- **Audits**
  - 6 Class H & K Hybrid Manufacturer Audits since last year
    - Under review during typical audit
      - Review of any current issues
      - Design Analysis: Derating / Stress
      - Failure Analysis (Customer returns)
      - Testing
      - Traceability
      - Organizational QA Program
    - Reports available on NASA SAS website
  - We need to better communication between Projects and WG
    - Target manufacturers projects use
    - Review current project issues

Current & Future Actions

- **Military Specifications**
  - MIL-STD-883 TM 2017 (Hybrid Internal Visual)
    - Foreign Material Control Programs
  - MIL-STD-883 TM 2020 (PIND)
    - New equipment
  - Gen Spec for Hybrids (MIL-PRF-38534)
    - Rev K Draft Revision
      - 27 comments (24 accepted, 2 retracted, 1 still under debate (WCCA)
    - Revision of Periodic Requalification Requirements (<= 5 years)
    - Appendix D (Non-Hermetic Hybrids)
      - 2 new classes (L = higher quality class, F = standard quality class)
      - 3 technologies (cavity, non-cavity and open architecture)
- **Current Issues**
  - GIDEPS, DLA & Project Input
- **Continued Communications**
  - Need information on procurements, failures, CSI's , lessons learned, etc.

Conclusions

- **Hybrids are considered "High Risk"**
  - Mitigation
    - Fostering communication among Government Space Agencies, Manufacturers and DLA
      - **Need involvement from all NASA Centers!**
    - Appropriate level of requirements (Procurement)
      - Class H, K, E… (using the Mil-Spec System)
      - **PreCap Inspections** [Provide data to DLA]
      - Traveler / Test Data Review
    - Appropriate level specifications
      - What do we want to make standard practice WRT Project Requirements/Risk?
      - What gives up the most value with modern budgets/schedules?

QUESTIONS / FEEDBACK