Electronic Parts Challenges in Fuzing Systems

May 15, 2012

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56th Annual Fuze Conference

Baltimore, MD

Cleared for public release

Introduction

- Numerous common issues affect all electronic parts and the products that use them
- But Fuzing is different than consumer electronics – the issues are more critical
- Lets talk about the issues, their impacts, and ways to mitigate them

Common Issues - DMSMS

Diminishing Manufacturing Sources & Material Shortages:

- Commercial needs , not DoD, drive the parts industry
  - More difficult to satisfy unique requirements
- Fewer OEM sources
- Parts obsolescence
  - Custom parts have finite lives, driven by economics & technology
  - COTS parts evolve rapidly, every 2-4 years:
    - Affect performance, size, packaging
- Incremental technology changes to existing parts are a risk:
  - Subtle changes which may have unintended impacts

Common Issues – Counterfeit Parts

Counterfeit parts:

- An emerging threat driven by economics and globalization
  - Affects popular , costly, and scarce parts
- OEM sourcing not always possible
- Maintaining traceability and “chain of custody” to OEM can be difficult
- Forensic verification difficult and costly
- Not just a problem for legacy parts but also affects COTS

Common Issues – Lead Free

Proliferation of lead-free components:

- Increasingly difficult to source components with lead (Pb) finishes
  - Driven by environmental factors affecting commercial industry
- Results in long-term reliability concerns due to tin whisker growth
- Limited sourcing options for Pb finishes necessitates the use of design and manufacturing mitigation strategies

What's Unique About Fuzing?

<u>Safety</u>: The safety criticality of Fuzing applications underscores and complicates how we manage all of the previous issues:

- DMSMS factors requiring component or CCA design changes necessitate extensive review and validation:
  - Affects all changes, however changes to safety-critical devices will drive program technical, schedule, and cost risk
- Subtle or unknown internal changes to parts can impact product performance, adding safety and performance risks
- Because of extensive fuze testing during manufacturing, the primary impact of counterfeit parts is performance over service life and life cycle extremes
- Unlike consumer electronics, failures are not readily detectable and are not low-impact

What's Unique About Fuzing?

<u>Acquisition Realities</u>: Fuzes are often procured as a commodity. As a result, life cycle management approaches to fuze electronic parts often have low visibility and are seldom funded:

- Unlike platforms or complex weapon systems, fuzes are not user-maintainable and are one-shot devices
- Fuze contracts lack requirements and funding for proactive approaches used on major procurements, such as Total Life Cycle System Management or Performance Based Life Cycle Product Support
- Because of safety implications, design changes are intentionally minimized
- The net effect is a reliance on reactive life cycle management approaches to the fuze electronics

What's Unique About Fuzing?

<u>Long Manufacturing Lives</u>: Long-term manufacturing of fuze designs, often by a contractor who was not the developer:

- Product manufacturing life of a fuze may extend for an order of magnitude longer than the manufacturing life of its components
- A contractor who was not the developer may not have a detailed understanding of design rationale and margins, increasing the risk and difficulty of electronic parts changes
- Challenging for the Product IPT to maintain continuity of technical personnel over the fuze‘s life

What's Unique About Fuzing?

Lack of Manufacturing Volume & Consistency: Low quantity or sporadic manufacturing runs, which may extend over many years:

- Uncertain product lifetime and quantities reduces the economic viability of any custom part for any OEM
- Also precludes the ability to make lifetime buys of electronic parts
- Increases vulnerability of the program to changes in the electronics supply base as well as changes/obsolescence of specific parts

Mitigation Strategies

Design Considerations:

- Design with sustainable parts: Include DMSMS considerations in Systems Engineering design trades prior to CDR
- Talk to suppliers: verify selected COTS parts are at early-to-mid life cycle before including them in the design
- Use a common parts library to minimize vulnerability to DMSMS as well as reduce unique parts count
- Work closely with suppliers of custom parts to optimize technology selection for your application and for life
- Reduce tin whisker risks by maintaining minimum CCA conductor spacing; specifying use of solders and CCA's with minimum Pb content; and specifying a robust conformal coat
- On an "inherited" design, spend the Systems Engineering effort to fully understand the design parameters and margins

Mitigation Strategies

Material Procurement Considerations:

- Buy from OEM’s or OEM-authorized distributors
- Survey and select distributors with robust QA systems, including:
  - Documentation accuracy
  - Forensic analysis capability
- Beware of sourcing parts on a secondary market. If you must, be sure to:
  - Insist on solid chain-of-custody documentation to the OEM
  - Use brokers you’ve surveyed
- Use obsolescence forecasting & communication tools:
  - Part Miner, GIDEP
- Establish and maintain Trusted relationships with key OEM’s & distributors

Mitigation Strategies

Manufacturing Considerations:

- Maintain and analyze parametric electronic test data to detect shifts in product performance. Use “in-family” management practices.
- When inducting an “inherited” fuze, obtain and use historical data from the original manufacturer and the Government

Summary

- **There are many issues and potential pitfalls….**
- **Careful consideration of the issues, and employment of appropriate strategies, will mitigate program risks**

Questions and Contact Information

ANY QUESTIONS??

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