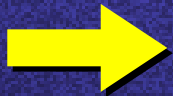




# Agenda

1. Lead Free Transition and Impacts
2. **Lead Free Failure Modes**
3. A Comprehensive Lead Free Strategy
4. **GEIA Lead Free Standards and Handbooks**
  - GEIA-STD-0005-1 Performance Standard
  - GEIA-STD-0005-2 "Tin Whisker Document"
  - **GEIA-HB-0005-1 Program Management Guidelines**
  - GEIA-HB-0005-2 Technical Guidelines
  - GEIA-STD-0005-3 Performance Testing
  - GEIA-HB-0005-3 Rework and Repair
  - GEIA-HB-0005-4 Reliability Assessment
5. **Summary**
  - Acknowledgements
  - Lead Free Links
  - Points of Contact

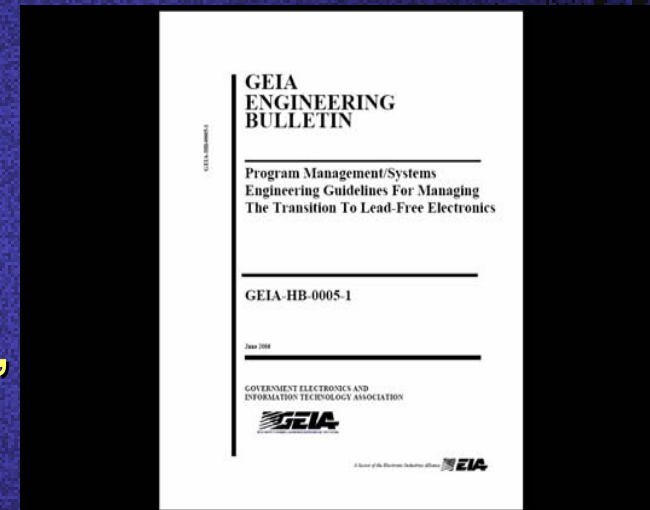




# GEIA-HB-0005-1

## GEIA-HB-0005-1 Program Management / Systems Engineering Guidelines for Managing the Transition to Lead-free Electronics

- Handbook for program management / systems engineering management to use for managing the transition to lead-free electronics
- To assist the program manager / systems engineer in assuring that the performance, reliability, airworthiness, safety and certifiability of product(s), in accordance with GEIA-STD-0005-1





# GEIA-HB-0005-1

## Program Management / System Engineering Guidelines for Managing the Transition to Lead-free Electronics

**Team Leader:** Pat Amick, Boeing

**Team:** Boeing, ACI, AIA, Bombardier, EADS, FAA,  
Lockheed-Martin, Raytheon, Parker, USN

### Scope:

- Handbook for program management / systems engineering management to use for managing the transition to lead-free electronics.
- To assist the program manager / systems engineer in assuring that the performance, reliability, airworthiness, safety and certifiability of product(s), in accordance with GEIA-STD-0005-1.
- Intended for guidance only.



# Program Management Concerns

- Reliability
- Configuration Control
- Risk Management
- Detrimental Effects of Tin
- Rework / Repair and Maintenance
  
- Cost
- COTS
- Quality
- Contractual Language
- Program Constraints
- System Engineering Management Plan

***We care about what we've always cared about !!!***



## PM Concerns - Reliability

- Understand how the transition to Pb-free may affect the reliability of the program.
- Need to understand:
  - If units and/or systems will include both Sn/Pb and Pb-free assemblies, piece parts, printed wiring boards
  - Effects of mixing Sn/Pb and Pb-free solder
  - Effects on package types/geometry
  - Reaction to the program's use environment
- Should consider a common reliability data collection during all phases of the program to facilitate systems performance improvement.



## PM Concerns – Configuration Control

- Understand the appropriate configuration controls necessary for the program's environment and at what level (i.e., piece part, assembly, unit, system)
- Ensure that appropriate and demonstrated processes are in place at suppliers
- Consider requiring a Parts, Materials, and Processes (PMP) Plan with appropriate Quality Control Procedures.
  - The plan should include sub-contractor controls that affect the reliability of the end product.



## PM Concerns – Risk Management

- Risk identification and risk assessment need to be performed for the Pb-free transition for the particular environmental conditions of the program.
- Risks need to be identified early and a mitigation strategy engaged.
- Should ensure that a complete risk management plan is in place.



## PM Concerns – Detrimental Effects of Tin

- Pb-free tin finishes in an avionics or high performance system can have **detrimental effects to functionality** of the system as **tin whiskers** can spontaneously grow from the surfaces.
- **Understand and agree to the supplier's plan for either:**
  - **Eliminating use of Pb-free tin** in their product (through life-time buys or reprocessing piece parts),

**OR**

- **Accepting Pb-free tin** in their product (and addressing and mitigating the risks).



## PM Concerns – Rework / Repair and Maintenance

- Concern if Sn/Pb and Pb-free solders and/or piece parts are used on the same assemblies.
- Should be aware of the higher risks associated with field rework/repair and maintenance when standard solder materials (i.e. 60% tin/40% lead or 63% tin/37% lead) are used on Pb-free assemblies and/or piece parts or visa versa.



## PM Concerns – Cost

- The costs of the Pb-free transition need to be quantified and decisions need to be made as to who will assume the costs.
- The PM should be aware that the situation is likely to be dynamic over the next several years.
- Added costs may come from additional risk management determination, configuration controls, rework/repair and maintenance changes, drawing changes, possible redesign, re-qualifying/delta qualifying, etc.



## PM Concerns – COTS

- **Commercial-off-the-shelf (COTS) is always a critical concern for a program manager.**
  - **The very nature of COTS may allow Pb-free substitution irrespective of program requirements.**
  - **The product may contain COTS Pb-free soldered assemblies as well as Pb-free-finished piece parts.**
- **Understand the supplier's controls to mitigate the risks associated with Pb-free finished piece parts and COTS assemblies.**
- **Ensure that the PMP Plan for the program is being adequately updated and addresses how lead-free piece parts and assemblies will be identified and tracked.**



## PM Concerns – Quality

- **Quality is a critical consideration in the transition to Pb-free.**
- **The PM needs to be assured that the final product meets the technical and operational requirements with the specified reliability at all levels.**
- **This includes flow of requirements, implementation and documentation through and to subcontractors.**



## PM Concerns – Contractual Language

- Appropriate contractual language needs to be included in new contracts that **describe the customer requirements** regarding Pb-free parts.



## PM Concerns – Program Constraints

- The PM needs to be proactive in understanding all of the impacts to the program schedule (including all integrated master schedule line items).
- Consideration needs to be paid to changes in the delivery schedule due to requalification/delta qualification of Pb-free parts, additional reliability testing, lifetime buys of long-lead SnPb-finished piece parts, etc.



## PM Concerns – SEMP

- The PM should reassess the program's **System Engineering Management Plan**, if one exists, and ensure that it has been updated to include the Pb-free transition controls for the program.



# Appendices

- **Appendix A** describes a matrix of product tier level versus associated risks with respect to a Pb-free transition.
- **Appendix B** contains links to the European Union Directives and Executive Order 13148.
- **Appendix C** contains a General Program Manager Checklist for dealing with Pb-free Issues, based on GEIA-HB-0005-1.
  - Requirements Issues
  - Supplier Management Issues
  - Schedule Issues
  - Cost Issues
  - Configuration Control Issues
- **Appendix D** contains a General Manufacturing Process Assessment Checklist to assess supplier compliance to GEIA-STD-0005-1.
- **Appendix E** describes recommended program language to assure performance, reliability, airworthiness, safety, and certifiability of Pb-free products.