



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AERONAUTICAL SYSTEMS CENTER (AFMC)  
WRIGHT-PATTERSON AIR FORCE BASE OHIO

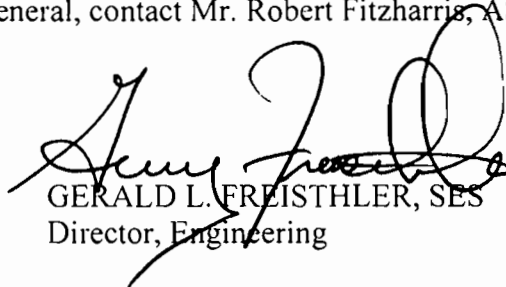
**MAR 31 2008**

MEMORANDUM FOR SEE DISTRIBUTION

FROM: ASC/EN  
2530 Loop Road West  
Wright-Patterson AFB OH 45433-7101

SUBJECT: Airworthiness Advisory AA-08-02, Lead-free Electronics

1. Operational Safety, Suitability, and Effectiveness (OSS&E) policy gives the Aeronautical Systems Center product-line technical responsibility for air systems. Airworthiness Alerts and Airworthiness Advisories have been established to notify the product-line community about the flight safety issues. Airworthiness Advisories contain guidance and information that describe a new flight safety hazard or condition and provide early warning of potential action.
2. Attached is Airworthiness Advisory AA-08-02, which conveys advice and concerns related to the use of lead-free solders and termination finishes on electronics used in United States Air Force aircraft. Please distribute this throughout your organization.
3. For further information on AA-08-02, contact the POC cited in the advisory. For information on OSS&E policy, the Airworthiness Certification Criteria Control Board, or Airworthiness Alerts and Advisories in general, contact Mr. Robert Fitzharris, ASC/ENSI, (937) 255-7224 or DSN 785-7224.

  
GERALD L. FREISTHLER, SES  
Director, Engineering

Attachment:  
AA-08-02

## **AIRWORTHINESS ADVISORY**

### **Lead-Free Electronics**

#### **PURPOSE:**

Legislated prohibitions to using or importing Lead in electronic systems are causing manufacturers worldwide to transition from Tin-Lead (SnPb) to Lead-free (Pb-free) solders and termination finishes. This Airworthiness Advisory provides advice to acquisition, procurement, and logistics managers to address impacts of Pb-free solders and termination finishes.

#### **SCOPE:**

This Airworthiness Advisory applies to the concerns of using Lead-free electronics in all USAF aircraft, both manned and unmanned, including those operated by the Air National Guard and the USAF Reserve. Its scope encompasses systems, subsystems, piece parts, and associated support equipment. It also pertains to depot, fielding/deployment, operational support activities, upgrades, and temporary or permanent modifications.

#### **REFERENCED DOCUMENTS:**

AA-05-01 dated May 2005  
GEIA documents

#### **BACKGROUND:**

See AA-05-01 dated May 2005.

#### **DISCUSSION:**

Pb-free solders and finishes may decrease the reliability of systems or subsystems. System performance and safety impacts may result from the following:

- Pb-free solders may be common in commercial-off-the-shelf piece parts.
- SnPb solders and finishes on assembly piece parts may be difficult to procure.
- SnPb solders and finishes may not be available regardless of contract or specification.
- SnPb versus Pb-free piece parts may be difficult to identify in pre-assembled subsystems.

- System production and maintenance personnel may inadvertently mix SnPb and Pb-free solders.

### **GUIDANCE/RECOMMENDATIONS:**

The following recommendations are intended to help program managers plan for and meet the challenges imposed by the transition to Pb-free solders and finishes. Addressing these key areas of concern should provide assistance to all personnel.

#### Acquisition Actions:

- Be aware no single replacement for SnPb solder currently exists.
- Address management planning for Pb-free solder and finishes through appropriate market surveys.
- Ensure requirements in proposals and contracts address the implications of Pb-free solder and finishes prior to contract award.
- Maintain electronic piece part, assembly, and system reliability standards.
- Reassess reliability test method requirements and inspection procedures to ensure they adequately evaluate Pb-free and mixed solder piece parts, assemblies, and subsystems.
- Ensure reliability test methods and inspection procedures are pushed down to lowest-tier piece part, assembly, and subsystem vendors.
- Require the identification of those electronic piece parts, assemblies, and subsystems considered to be critical to mission performance.
- Conduct operational risk assessments associated with the introduction of Pb-free solder or finishes into critical piece parts, assemblies and subsystems to identify potential risks from failure due to Pb-free solder or finishes and mixed solders or finishes.
- Differentiate electronic piece parts, assemblies, and subsystems based on the potential impact on performance of Pb-free or mixed material.
- Provide design guidance for critical piece parts, assemblies, and subsystems to mitigate reliability risks to an acceptable level.
- Provide guidance for use of Pb-free piece parts, assemblies, and subsystems and address maintenance reliability in the event that solder and finishes cannot be identified following maintenance procedures.
- Require suppliers to identify Pb-free solder and finished parts using the Institute for Printed Circuits (formerly Institute for Interconnecting and Packaging Electronic Circuits) IPC Standard 1066. Maintain documentation of solder and finish materials as necessary to support repair and rework, maintenance, and logistics requirements.
- As an interim measure pending a technological fix for Tin whiskers, 100% re-tinning using a SnPb solder alloy should be considered for pure Sn coated surfaces to ensure the reliability and longevity of hardware.

The Government Electronics and Information Technology Association (GEIA) developed handbooks provide guidance for the transition to Pb-free electronics. GEIA-HB-0005-1 assists program managers and systems engineers in managing this transition, especially in the areas of acquisition and logistics. GEIA-HB-0005-2 focuses more on technical design issues for aerospace and military systems.

In addition, GEIA released two standards suitable for inclusion in contract requirement packages. GEIA-STD-0005-1 outlines a plan to minimize the impact of the supply chain Pb-free transition. It addresses performance, reliability, airworthiness, safety, and certifiability of electronic systems. GEIA-STD-0005-2 specifically addresses the Tin whisker phenomenon that results from using Tin finishes without elemental Lead and provides control-level guidance that may form a basis for a program's risk management procedures. These resources may be applicable to source selection evaluations. Additional information is available from <http://www.geia.org/>. Specific references related to Pb-free solder and finishes are:

- GEIA-STD-0005-1 *Performance Standard for Aerospace and High Performance Electronic Systems Containing Lead-free Solder*
- GEIA-STD-0005-2 *Standard for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems*
- GEIA-STD-0005-3 *Performance Testing for Aerospace and High Performance Electronic Interconnects Containing Pb-free Solder and Finishes* (draft)
- GEIA-HB-0005-1 *Program Management/Systems Engineering Guidelines for Managing the Transition to Lead-Free Electronics*
- GEIA-HB-0005-2 *Technical Guidelines for Aerospace and High Performance Electronic Systems Containing Lead-free Solder and Finishes*
- GEIA-HB-0005-3 (in process draft) *Repair and Rework of Aerospace and High Performance Electronic Systems Containing Lead-Free Solder*
- GEIA-HB-0005-4 (in process draft) *Reliability Assessment for Lead-Free Electronics*

Additional information about Pb-free solder and finishes is also available from NASA Technology Evaluation for Environmental Risk Mitigation Principal Center (TEERM). NASA TEERM managed the JCAA/JGPP Lead-Free Solder Project. All data and information from this project can be found at - [http://www.teerm.nasa.gov/projects/NASA\\_DODLeadFreeElectronics\\_Proj2.html](http://www.teerm.nasa.gov/projects/NASA_DODLeadFreeElectronics_Proj2.html)

NASA TEERM is also managing a follow-on Lead-Free Electronics Project; the NASA-DoD Lead-Free Electronics Project. Information on this project can be found at – [http://www.teerm.nasa.gov/projects/LeadFreeSolderTestingForHighReliability\\_Proj1.html](http://www.teerm.nasa.gov/projects/LeadFreeSolderTestingForHighReliability_Proj1.html)

#### Procurement Actions:

- Advise Defense Contracting Management Agency (DCMA) offices that electronic piece parts, assemblies, and subsystems identified as Waste Electrical and Electronic Equipment (WEEE) or Restriction on Hazardous Substances (RoHS) compliant will likely be Pb-free. Note that piece parts, assemblies, and subsystems that are not identified as RoHS or WEEE compliant *may be* Pb-free.

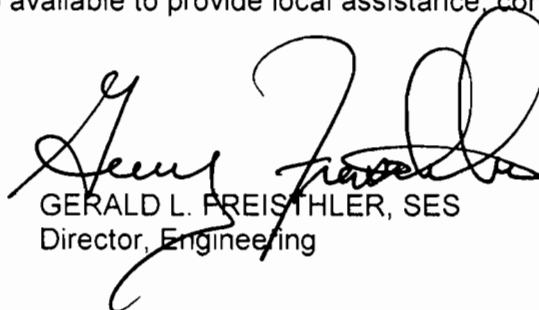
- Immediately notify the requiring activity to ensure applicable reliability test methods and inspection procedures are instituted when Pb-free piece parts, assemblies, or subsystems have been identified.
- Put procedures in place to assure locally purchased piece parts are properly identified as containing Pb or Pb-free. In some cases, solders labeled as “environmentally friendly” or “green” may be required by local environmental managers. This action should not prohibit the purchase of Pb-containing solders, but instead encourage proper identification of materials.

**Logistics Actions:**

- Survey depots, test, and electronics maintenance locations to determine whether planning and capitalization are required to accommodate introduction of Pb-free solders and finishes in process areas. A multi-service depot survey was conducted by the Joint Council on Aging Aircraft and is available from the point of contact below.
- A leadership training presentation that summarizes issues relevant to the transition to Pb-free solders and finishes needs to be developed. The USAF Lead-Free Team is currently working this need (see point of contact below). Once available, program executive officers and program managers should review this presentation with supporting technical staff.
- Assess inspection procedures, test methods, maintenance processes (e.g., Technical Manuals, Technical Bulletins) equipment and processes, personnel qualifications, and training needed to address Pb-free solder and finishing as part of their planning process.
- Guarantee that critical information about electronic piece parts, assemblies and subsystems are made available to supply managers and to maintenance managers who need to ensure configuration management and electronic reliability following maintenance processes.

**POINTS OF CONTACT:**

Technical questions on the subject of this advisory should be directed to Mr. Tim Kalt, 312/326 AESW, (937) 656-5095, ([timothy.kalt@wpafb.af.mil](mailto:timothy.kalt@wpafb.af.mil)). Additional USAF Lead-Free Electronics Team members are also available to provide local assistance; contact Mr. Kalt for a team member referral.



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