

## Unsolved - The Continuing Saga of Lead-Free Electronics in Aerospace, Defense and High Performance Products

European Directive 2002/95/EC on the Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)<sup>i</sup> and the Waste electrical and electronic equipment WEEE) Directive (2002/96/EC)<sup>ii</sup> have changed the global supply chain for materials used in aerospace products. The result of this market shift is of high concern for our industry, forcing the transition away from tin-lead alloys used in the assembly and coating for high performance electronics known as lead-free (Pb-free) electronics.

Uncertainty prevails with respect to the implementation of Pb-free electronics in Aerospace Defense and High Performance (ADHP) products. Despite some success in commercial applications, knowledge gaps of Pb-free electronics used in harsh environments are significant<sup>iii</sup>. The solutions expected years ago have not materialized. Awareness continues to be lacking. Moreover, unlike counterfeit parts, the requirement for Pb-free electronics has not resonated with the U.S. Government, so no stated policy currently is forthcoming.

At this point, the ADHP industry lacks the knowledge and a consistent policy to confidently adopt the available materials emerging from the global transition to Pb-free electronics. Additional resources must be allocated to fill these knowledge gaps and to develop acceptable materials for high performance platforms.

ADHP products are subjected to some of the most extreme environmental conditions known. While Pb-free materials and processes have been successfully used in commercial applications, the limited research completed to date has shown there is cause for concern regarding long-term reliability in typical ADHP environments. Consequences of unintended intrusions of Pb-free materials could be catastrophic in safety of flight and mission critical applications.

While industry groups have attempted to coordinate research efforts dedicated to developing technical solutions, these efforts have fallen short of what is needed. It is imperative high-level management at ADHP companies, along with the U.S. Government, make it a high priority to support research performed by our leading subject matter experts. Another effort necessary to overcome the risks inherent with Pb-free electronics is a common database to facilitate the sharing of sensitive Pb-free data and failure experiences, in a protected manner. The global ADHP industry must move toward finding acceptable Pb-free solutions to continue development of state-of-the-art technologies and to keep our products affordable and sustainable for the foreseeable future.

Research, awareness and policy efforts continues to progress at a slow pace. AIA, in cooperation with critical partners, is planning a government industry executive exchange forum to address the issues raised in our following recommendations and will need the support from the senior leadership of our membership to participate and invite complementary representatives from their customer base.

It is highly recommended the CEOs of ADHP companies work with the U.S. Government to:

1. Increase awareness of the criticality the Pb-free issue has on industry, defense, transportation, energy and critical infrastructures;
2. Establish policy recognizing the risks associated with Pb-free materials and the need for risk management;
3. Allocate funding for a coordinated research program to address gaps in the Pb-free knowledge database; and
4. Set priorities for finding acceptable Pb-free solutions.

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<sup>i</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0095:EN:HTML>.

<sup>ii</sup> <http://www.eea.europa.eu/policy-documents/waste-electrical-and-electronic-equipment-1>.

<sup>iii</sup> “The Lead Free Electronics Manhattan Project - Phase 1,” Completed under U.S. Government Contract No. N00014-08-D-0758, The Benchmarking and Best Practices Center of Excellence at ACI Technologies, Inc, Philadelphia, PA, July 30, 2009.