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Lead-Free Electronics at BAE Systems

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BAE Systems is an international company engaged in the development, delivery and support of advanced defense and aerospace systems in the air, on land, at sea and in space

BAE Systems' U.S. based entity consists of three operating groups that provide support and service solutions for current and future defense, intelligence, and civilian systems; design, develop and manufacture a wide range of electronic systems and subsystems for both military and commercial applications; and design, develop, produce, and provide service support of armored combat vehicles, artillery systems and intelligent munitions

- Customer Solutions
- Electronics & Integrated Solutions
- Land & Armaments

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WEEE (Waste Electrical & Electronic Equipment) and RoHS (Restriction of the Use of Certain Hazardous Substances in Electrical & Electronic Equipment Directive) legislation is designed to eliminate Pb from landfills across Europe

- The apparent success of several Japanese products built with Pb-free finishes and solders has contributed to the perception that an acceptable alternative to Sn-Pb exists
- To date, no Sn-Pb alternative has proven adequately reliable for critical assembly
- Most high-reliability assembly is exempt. However, the changing parts situation is affecting us all
- Proponents of Pb-free soldering have asserted that Pb in solder is environmentally harmful, with potential to leach from landfills and contaminate groundwater

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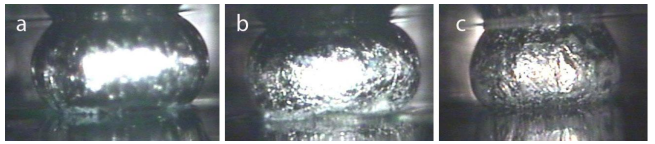
- There is very little evidence that this is true, even though many tons of electronics are buried in existing landfills, and most municipalities monitor lead levels in their drinking water
- There is some evidence that many of the Pb-free solder alloys being proposed, which contain Ag, may be more harmful than Sn-Pb

SACB termination soldered with SnPb

Sn TQFP-144 reflowed with
(a) SnPb, (b) SAC and (c) SACB



SnPb PBGA soldered with
(a) SnPb, (b) SAC and (c) SACB

Like it or not, the electronics industry is changing as a result of WEEE and RoHS

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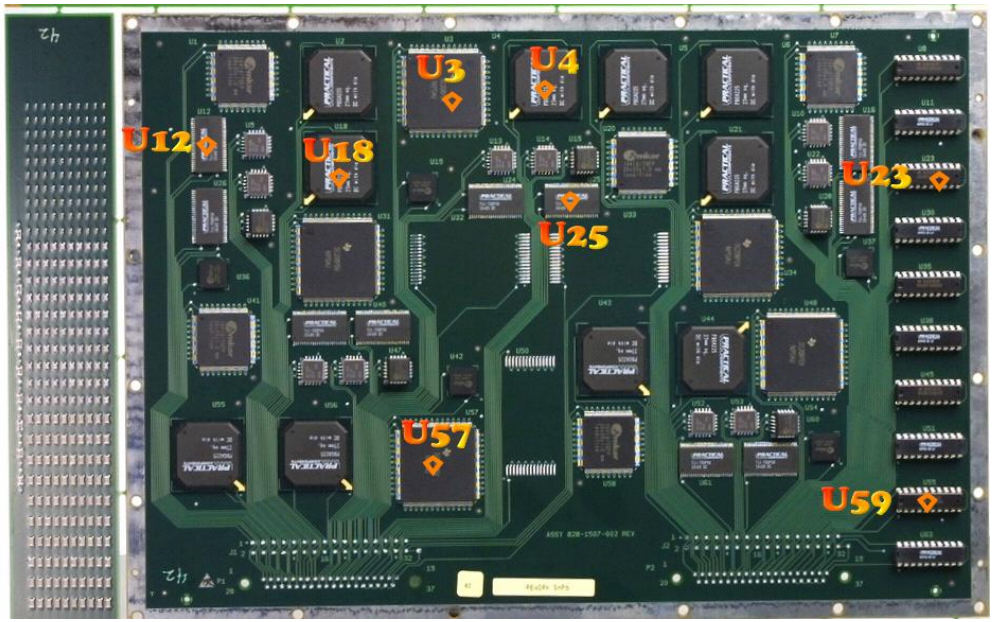
- BAE Systems' Irving, Texas, site has assembled Pb-free assemblies (more than 200) to support the JCAA/JG-PP reliability project. In addition, several other sites have Pb-free capability and experience

Photo below is of the JCAA/JG-PP Test Board



- Dr. Stephan Meschter of Johnson City New York, lead the GEIA-HB-005-2 reliability team

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- The E&IS Pb-Free Technical Forum (LFTF) was formed in January 2005 to consolidate Pb-free experience and consists of representatives from all BAE Systems electronics sites
- The following E&IS sites are represented:
  - Austin, Texas
  - Cheshire, Connecticut
  - Ft. Wayne, Indiana
  - Greenlawn, New York
  - Irving, Texas
  - Johnson City, New York
  - Lansdale, Pennsylvania
  - Lexington, Massachusetts
  - Los Angeles, California
  - Manassas, Virginia
  - Nashua, New Hampshire
  - Rochester, United Kingdom
  - Rockville, Maryland
  - San Diego, California
  - Wayne, New Jersey
- LFTF is made up of a diverse group with engineering, scientific, and manufacturing backgrounds

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- *The major areas of concern were:*
  - Products driven to be Pb-free by use of COTS components
  - Most of E&IS designs use COTS components
  - Piece-meal implementation of Pb-free components by component suppliers
  - Perception by suppliers that pure Sn is acceptable in all applications
  - Lack of reliability data to support transition
  - Cost impact – materials, engineering, logistics
  - Public image – environmental visibility
  - Higher processing temperatures of Pb-free solders can impact reliability
  - Recycling procedures may impact contract obligations
  - Fielded product must be maintained with proper materials and processes
  - Immaturity of durability models and acceleration factors

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- *LFTF Accomplishments were as follows:*
  - Created an internal position paper for use by the various business groups
  - Created an external position paper for use with customers and suppliers
  - Created standardized purchase notes for use in procurement
  - Created special customer memo based on external position paper
  - Created level matrix to convert position papers into working philosophy
  - Created standardized receiving inspection scheme
  - Created a common data repository using SharePoint software
  - Created an internal website to communicate with non-LFTF co-workers
  - Created writings for several internal publications
  - Created draft plan in accordance with still unreleased GEIA template
  - Assembled internal Pb-free development assemblies (still in test)

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- *Future Short term actions are:*
  - Continue with Sn/Pb assembly until a reliable alternative is available
  - Continue struggling with rapid pace of component termination finish changes
  - Continue refining procedures by site/program for identifying and controlling Pb-free components of concern.
  - Maintain heightened awareness of changes to legislation and exemption status
  - Continue working with customers to mutually agree on win-win approach
  - Continue mitigation plans to insure proper controls are in place for managing Pb-free components and assemblies.
  - Continue engineering development of internal Pb-free assembly capability
  - Continue participating in industry consortiums to leverage efforts

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- *Long term actions are:*
  - Continue monitoring trends and participating in industry consortia
  - Continue studying lead-free solders and finish reliability
  - Continue evaluating the cost impact to customers for transition/implementation
  - Continue proactive approach to component purchase and vendor management
  - Control metallurgical configuration through the engineering drawings
  - Continue revision of the E&IS position paper, as data becomes available

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- *Lack of data on the reliability of products using lead-free solder inhibits E&IS's adoption of Pb-free soldering at this time for high reliability hardware.*
  - We have the ability to build Pb-free product, but most likely at a higher cost than current Sn-Pb product
  - The reliability of Pb-free assembled product is less predictable than that of the currently used Sn-Pb product

Continue with Sn/Pb assembly until a reliable alternative is available

Questions