

## **March 2005**

### **Boeing Position Statement on Lead-free Aerospace Electronics**

As you may know, the global electronics industry is moving toward lead-free solder and lead-free electronics in order to meet several objectives, including an obligation to comply with evolving environmental regulations. The scope and timing of this transition is strongly influenced by European Union Directive 2002/95/EC, which directs Member States to ensure that, from July 1, 2006, new electrical and electronic equipment put on the market does not contain certain hazardous materials, including lead.

The Boeing Company endorses “design for the environment,” and therefore supports the broad goal of eliminating hazards from lead and other hazardous materials in products offered in our industry.

The Boeing Company is aware of many unanswered questions regarding applicability of the EU Directive to aerospace products, and its implementing legislation in EU Member Countries. We also are aware that legislation, and interpretations thereof, are subject to change. From our review of the best information available today, The Boeing Company believes that the EU directive and implementing legislation in the various EU Member States will not in the end be understood to apply to commercial and military aerospace products.

Boeing also is mindful that the aerospace industry is dependent in many respects on the global electronics industry and eventually may be required to accommodate the transition to lead-free electronics even if the EU directive and legislation do not apply to its products. In the face of these trends, however, Boeing is absolutely committed to ensuring that its products avoid defects in performance, safety, and reliability. These competing concerns and the escalating pace and dynamic nature of the industry transition prompts us to issue this interim position statement.

Although the industry currently is evaluating a variety of lead-free alternative materials for use in electronics, and some have already begun to be implemented across the global consumer electronics sector, to date no industry standard has emerged that is sufficiently well characterized to allow unrestricted use in commercial and military aerospace systems. There are several specific concerns.

First, the metallurgy and mechanical properties of candidate lead-free solder material systems are substantially different from the tin-lead eutectic solder systems that have been the specified aerospace standard for several decades. For components with plated leads the electronics industry preference for pure tin plating presents a greater risk due to “tin whiskers,” especially for very high altitude and space-based systems.

Second, reliability data for the most prominent lead-free solders varies greatly based on component type, processing parameters, and operating environment. As a result, there is no consensus on valid test protocols for evaluating long-term reliability of the new lead-free materials in aerospace applications.

Third, the higher processing temperature required for lead-free solders raises concerns about the introduction of latent defects that may not be detected during the initial inspection.

Fourth, there are no generally accepted standards for component materials identification, and there are many lead-free material systems currently in use. There are some known incompatibilities with current tin-lead solders. It therefore may not be possible to guarantee reliable repairs and rework.

In summary, with limited exceptions for selected special applications, to date no lead-free materials system for electronics assembly has been demonstrated to comply with Boeing standards for reliability, and long service life in aerospace applications. At the same time, we expect that with continued development, new electronics, that are designed and qualified with lead-free materials, eventually will be acceptable for aerospace products.

In light of this situation, Boeing reminds its suppliers to validate that their deliverables meet current contractually required performance and qualification requirements (including environmental and reliability) and verify that their procured materials and products likewise support these requirements. The suppliers should notify Boeing in writing of any deviations from current performance requirements discovered in the process of validating acceptability. Suppliers are requested to notify Boeing of any transition to lead-free electronics, even where required to accommodate obsolescence situations.

The Boeing Company will continue to monitor and participate in the development of technology, test protocols, and standards for aerospace and defense applications. We expect this situation to continue to evolve, and will update our position as lead-free electronics technology matures. Boeing encourages the aerospace system integrators, our electronics supplier partners, and our civil and military customers to actively participate in the broadly sponsored\* aerospace industry Lead-free Electronics in Aerospace Project (LEAP) working group.

\* Aerospace Industries Association (AIA); <http://www.aia-aerospace.org/>  
ARINC-Avionics Maintenance Conference (ARINC-AMC); <http://www.arinc.com/amc/>  
Government Electronics and Information Technology Assoc. (GEIA); <http://www.geia.org/>