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Defense And Aerospace Try To Get The Lead Back In

[Rob Spiegel](#) | ED Online ID #16315 | August 3, 2007

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The defense and aerospace industries need highly reliable leaded parts, but they also want to buy commercial off-the-shelf (COTS) components. The problem is that most parts suppliers have shifted to lead-free versions. That leaves defense and aerospace scrambling for older leaded inventory or switching to more expensive components that meet military specifications (mil-spec).

It all began with the \$900 hammer. In the 1980s, defense contractors were criticized for buying exorbitantly priced custom parts, including a hammer that reportedly cost \$900. These parts were mil-spec, highly reliable, and manufactured in small quantities.

In a move to drive costs down, defense and aerospace manufacturers started using inexpensive commercial parts. Since these parts were always produced using lead solder, reliability was not a problem, even in the harsh environments common for defense and aerospace products.

"The military and aerospace manufacturers figured out there was room in the specs to use more inexpensive parts," says Don Schlidt, president of Arrow/Zeus Electronics, the military and aerospace division of Avent Inc. "Many of the COTS they use are commodity parts such as passives and connectors."

COTS Go Lead-Free Only

In the last few years, most of the COTS suppliers have shifted to lead-free versions of their parts. Typically, the parts now use solder that's either pure tin or a tin alloy. Since military and aerospace manufacturers make up a small portion of their customer base, many of these companies simply discontinued the leaded versions of their parts.

"Most suppliers are no longer making leaded components, so it's almost impossible to get leaded product," says Gerry Roth, director of operations at TEK Microsystems, which produces computing systems for defense contractors. Parts suppliers found the demand for leaded parts was small, so producing two lines, one lead-free and one leaded, was not economically feasible.

"Some suppliers find compliance with RoHS (Restrictions on Hazardous Substances) was significantly costly if they were going to maintain two product lines," says Arrow's Schlidt. "In response, many suppliers converted to lead-free versions of their components and simply discontinued the leaded versions."

Defense And Aerospace Insist On Lead

The defense and aerospace industries are exempt from the European Union's RoHS directive, so they haven't had to shift to lead-free parts. The exemption was granted based on the need for the high reliability of leaded solder in the high-stress environment and long shelf life of defense and aerospace equipment. Lead helps mitigate the growth of tin whiskers, which can grow on pure-tin solder, then break off, potentially causing shorts.

"The government is very concerned with tin whiskering," says TEK's Roth. "And there is not enough long-term data for them to be comfortable with the lead-free solutions of the past five years. So, they're still using leaded processes."

The lead-free parts are plenty reliable for most commercial applications. Your cell phone or TV will be obsolete long before tin whiskers begin to grow. Plus, your consumer product will not face the stress of a satellite in space or a tank computer that spends 10 years in 115°F weather in the Mid-East.

"For commercial people, lead-free parts are more than reliable," says Roth. "But the military manufacturers don't think there is enough data, so they still want product that uses the leaded process."

Those in defense and aerospace don't expect they will switch in lead-free parts any time soon. The potential cost of a failure due to tin whiskers far outweighs the costs of buying more expensive mil-spec parts.

"When you get into a harsh environment, the risk of tin solder is a huge issue," says Arrow's Schlidt. "The capacitor is a penny, so what's that compared to the failure of a satellite?"

Defense and aerospace customers have tried demanding that their suppliers and distributors continue to provide leaded parts.

"A number of our military contractor customers have requested that we sign an agreement ensuring that we provide product with lead," says Jeff Shafer, VP of product at components distributor Newark InOne. "One military contractor I talked to at a supplier conference said, 'Just send us what we want.'"

But those demands don't necessarily mean the components industry is going to comply by providing leaded parts to the small portion of component buyers that insist on leaded product.

"If our supplier has discontinued the leaded version of the COTS product, we will offer a form/fit/function product match from another supplier if applicable," says Shafer. "If no other supplier that we carry manufactures a similar product, we inform the customer they will need to consider other sources or convert to a compliant product."

Some component manufacturers concede that pure tin could be a problem in harsh environments, so they use tin alloys that replace the lead with nickel, silver, or other metals. The exempt industries claim there hasn't been sufficient studies to ensure that tin whiskers won't form.

"There are finishes that give us a high level of confidence, and there are tin-whisker mitigation strategies out there, but they aren't proven," says Tom Barnum, VP of sales for VersaLogic Corp., which sells rugged computers to military and aerospace customers.

Dipping Lead-Free Parts In Lead

One solution the exempt industries are trying is dipping lead-free parts in lead to add the lead back into the solder. "There are third parties that provide the services of dipping components in lead solder," says Arrow's Schlidt.

One of the problems with the dipping solution is that it changes the part sufficiently to kill the warranty. "One contractor whose conference I attended recoats the finish of the compliant product with lead termination," says Newark InOne's Shafer. "That act voids the warranty unless the third-party supplier that adds the finish provides its own warranty."

One of the frustrations for the exempt industries is that they also want the benefit of new technology that comes with COTS components. The mil-spec products are less likely to include cutting-edge technology. "One of the objectives in using COTS was to accelerate the adoption of technology," says VersaLogic's Barnum.

Going forward, some of those in the components industry believe the defense and aerospace industries will eventually bite the bullet and buy lead-free components. But those in the exempt industries insist it will take many years before they gain confidence in parts that don't include lead.

"We have to have studies that verify the durability of the tin alloys," says Barnum. "I'm looking at a world where RoHS-compliant doesn't mean lower quality, but even so, the military prefers to have lead in their product."

TEK's Roth agrees that RoHS-compliant parts will not be acceptable to the exempt industries for a long time. "It will take years before the military and aerospace industries are comfortable with lead-free parts," he says. "After all, we've been using the leaded process for over 100 years."


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