

# Alternative approach

**Nolan Fell** reports on how Japan is using lead-free solder

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The Smart Group delegation travelled throughout Japan.

**T**he banning of lead in solders used in the electronics industry is likely in the next few years. In one of the most significant changes to production processes since the industry's inception, companies throughout the world are working on alternative alloys, anticipating EU legislation outlawing lead some time between 2004 and 2008.

Despite the legislative drive coming from Europe, it is Japanese companies that are in the forefront of the development of alternative alloys. A number of Japanese consumer products have been produced with lead-free solder, and Matsushita is advertising a mini-disk player by highlighting its lead-free status, "because even the smallest details help the planet".

In order to learn from the work done in Japan, the Smart Group, a technology transfer organisation with more than 500 corporate members, sent a group of experts to the country. The team will present its detailed report at Nepcon.

The team was led by Bob Willis, a consultant who specialises in surface mount technology. It also included Malcolm Warwick, director of soldering materials product development at Multicore Solders; Robert Horsley of Celestica; Christopher Hunt from the National Physical Laboratory; Phil Fulker, founder of Invicta Contract Engineering; and Phillip White and Nick Jolly of the DTI.

Willis said: "We wanted to get perceptions from each person on Japan's status as regards lead-free soldering and then compare that with reality. We visited companies that represent a who's who of the Japanese electronics industry. We looked at issues such as materials manufacturing processes, reliability and proof of use. And we asked suppliers if they knew whether the products were lead-free."

During the five days the group visited manufacturers, users and suppliers including Jeita Forum, Sony, Senju Metals, Matsushita, Koki, TDK, NEC Denso, Osaka University and Japan's Ministry of Economy, Trade and Industry.

What is clear from their findings is that Japan's electronics industry is well ahead of Europe in developing lead-free solders and processes, even though it is the coming European legislation that has driven senior executives to push for lead-free development. The drive in Japan has come from the top rather than from consumer pressure. Curiously, the Matsushita advert, which has only just started



appearing on Japanese TV, is the first example of lead-free production being used for marketing.

"There is a different philosophy in Japan," said Warwick. "In Europe, you look at lead-free and say 'how much is it going to cost me?' And then end up not doing anything. In Japan, the attitude is 'we are going to produce lead-free product, let's make it as efficiently as we can'."

Companies have worked on different alloys and developed processes based on the constraints each alloy poses. There has been a lot of work on tin, silver and copper alloys, but NEC has been working on tin, zinc and bismuth mixes.

"The selection depends on the market," said Hunt. "For example, in the consumer market, the product does not have to be so reliable. In other markets, such as telecoms or the Internet backbone, it has to be more robust. Tin, silver and copper alloys are most reliable; others are less so but not necessarily unacceptable."

A major problem with lead-free solders is that the alternative alloys require significantly higher temperatures. This has major process implications. Most lead-free solders also require nitrogen in the process, another complication. Ironically, both these problems have environmental implications; higher process temperatures require more energy consumption and nitrogen produces compounds in the air and in soil which have health implications. With pressure to reduce energy consumption, Japanese companies are also working on improving process efficiencies, reducing the variation in temperature that occurs during the process.

Most Japanese companies are likely to start producing lead-free products within 18 months. Once established in Japan, they are likely to introduce lead-free processes in their plants in the rest of the world. The Smart Group's findings could be crucial in ensuring that the UK adapts to this coming change in time.

Jolly urges industry to prepare: "We're very resistant to change, we question everything. I don't actually think the environmental case for lead-free soldering is proven, but that is irrelevant. It is going to happen."

## Roadmap for implementation of a lead-free assembly process

Company	Action	Target	Products
Panasonic	Complete abolition	March 2003	Mini-disk player, stereo headphone
Sony	Full implementation in Japan Start lead-free process overseas	March 2001 March 2002	Camera, built-in VTR, TV, mini-disk player
Hitachi	Full implementation for in-house evaluation Complete abolition, except overseas	March 2002 March 2004	8mm camera, notebook PC, washing machine
NEC	Complete abolition	End, 2002	Pager, notebook
Mitsubishi	Establishment of lead-free technology	2002	Refrigerator
Electric	Reduction to half present use Complete abolition	2004 2005	
Fujitsu	Reduction to half present use Full-scale application	End 2001 End 2002	PC, LCD, server
Sanyo	Produce one lead-free product at each company Implementation for main products produced in Japan	March 2001 April 2002	
Sharp	Implement for products produced in Japan Implement for overseas production	April 2001 April 2002	
Seiko Epson	Complete abolition	End 2001	
Car industry	Reduction to one-third present use, except battery	2005	

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