

## LifeLock recognition

● WRTI MEMBER Joe Silver has been presented with The President's Award by Alton Chamber of Commerce & Industry for the success of his LifeLock business.

The citation for the award, which was made at the annual President's Dinner, read: "Joe Silver of LifeLock Limited received the Award for Innovation for developing and producing an innovative portable locking device of special use to business people and travellers who require enhanced personal security within an hotel or office environment."

LifeLock Limited sells the device to a world-wide client list including British Airways. ■

● **LifeLock Limited**  
PO Box 12, Alton,  
Hampshire GU34 4WZ  
Tel: +44 (0) 420 549 829  
[sales@lifelock.co.uk](mailto:sales@lifelock.co.uk)  
[lifelock.co.uk](http://lifelock.co.uk)

## Next WRTI meeting

**WEDNESDAY 14 May**

Guest speaker Eric Lane from tools manufacturer and distributor GreatStarUK.com will give a lecture on 'The buyers' market: how it works and how to reach it,' in room HC 017, Herbert Collins Building, Southampton Institute, commencing at 6.30pm.

● Non-members wishing to attend should e-mail: [secretary@wrti.co.uk](mailto:secretary@wrti.co.uk) or tel: 01420 562 378  
[www.wrti.org.uk/events](http://www.wrti.org.uk/events)  
Map: [www.streetmap.co.uk](http://www.streetmap.co.uk) (SO14 0RP)

# Hi-techs bank on Oxford Innovation

BANK OF SCOTLAND'S £2m CO-INVESTMENT

OXFORD INNOVATION has entered into an agreement with Bank of Scotland Growth Equity (BoSGE) to provide additional funding for the hi-tech startups and SMEs it supports through its three investment networks during 2008.

BoSGE has set aside a £2m co-investment pool to invest alongside members of the Oxford Early Investments, Thames Valley Investment Network and Oxford Investment Opportunity Network.

BoSGE will typically invest from £25,000 to £250,000 per deal, and OION, TVIN and OEI companies that receive funding under the Co-Investment Programme could be eligible for follow-on funding from the bank.

## Up and away

The Co-Investment Programme was launched on 1 January and is already bearing fruit: BoSGE has completed its first investment of £100,000 into an innovative company alongside OION Ltd investors, with a second deal agreed and two more in the pipeline.

Investments are made on the



**OPEN FOR BUSINESS Don McLaverty, Oxford Innovation's Investment Networks director, Malcolm Kpedekpo (Bank of Scotland Growth Equity team) and Nicki Hattingh, Thames Valley Investment Network manager, at the Bank of Scotland Growth Equity scheme's launch at TVIN.**

same terms as those entered into by network angel investors.

Oxford Innovation provides services for the knowledge-based economy and for business growth, technology commercialisation and economic development. ■

● **Oxford Innovation Ltd**  
Mill Street, Oxford OX2 0JX  
Tel: +44 (0)1865 811127  
[enquiries@oxin.co.uk](mailto:enquiries@oxin.co.uk) [oxin.co.uk](http://oxin.co.uk)



## VENTUREFEST 2008

THE TENTH VENTUREFEST and Technology Showcase promotes new technology commercialisation through a series of events, presentations and networking opportunities on 30 June and 1 July.

A free two-day event, Venturefest attracts an audience of entrepreneurs, venture capitalists, scientists and their professional advisers. Highlighting Oxford's commitment to new business innovation and providing free support and guidance to organisations and individuals seeking to start or grow their businesses, it is especially suited to those in high technology and knowledge-based business sectors.

The successful Technology Showcase event gives small and early-stage science and technology companies the opportunity of exhibiting themselves and their products at Venturefest, providing the ideal forum for entrepreneurs to show off their innovative products and for Venturefest attendees to interact directly with new and emerging technology companies.

"We will be including submissions from material science companies right through to companies developing handheld medical diagnostic equipment," said Richard Mercer, Business Support Manager.

"It is a fantastic mix, exposing the breadth of new technology out there, and will make for an interesting snapshot of what the region has to offer."

The Technology Showcase Exhibition is coordinated by The Oxford Trust, a charitable organisation promoting the study, application and communication of science, technology and engineering. ■

● **Venturefest Oxford Ltd**  
**Oxford Centre for Innovation**  
**Mill Street, Oxford OX2 0JX**  
**Tel: +44 (0)1865 327 813**  
**info@venturefest.com**  
**venturefest.com**

**INVENTORATOR** Sir James Dyson

# The business of engineering

DON'T THINK IT DULL OR THAT IT DOESN'T MATTER

**H**ELLO. I'm James Dyson, a designer and engineer, and I'm going to talk about how engineering must change the world.

But I'm here under false pretences. I'm not a businessman. Nor am I into the 'business' of business (*you* know, the bottom line of buying and selling, profit and loss, mergers and acquisitions, shares and shareholders).

So in conventional terms I'm not the most qualified person to contribute to this series of articles – except that the business of engineering excites me, and engineering makes good business.

## First things first

Engineering has changed the world, and will continue to change it. Across the globe there are more inventions being developed than ever before – and the pace will get faster, not slower. It will change all our lives, and then change them again, and again.

What do we mean by engineering? Many people think of Mr Fixit – the bloke that fixes your washing machine, or comes to the rescue when you dial the AA. In fact, the most famous engineer in Britain is rumoured to be none other than Kevin Webster, a car mechanic on television's *Coronation Street!*

Yes, maintenance *is* an important part of engineering – thank goodness for the people who take care of our trains, boilers, cars and cookers, for without them the wheels would stop turning, and our dinner would go uncooked – but it's not the main picture.

Engineering for me is about being inventive, solving problems, being creative and actually making things – like making the maglev train, or designing jet engines, or engineering more efficient wind turbines, or saving a life with a new kind of kidney machine. *That's*

engineering. So don't let anyone fool you into thinking it's dull, or that it doesn't matter; it does – but the 'Corrie' model of engineering is being hardwired into the next generation.

## Arbiter versus genius

In many British businesses, the engineer sits way down the food chain. Meanwhile, much further up is the marketing team.

Marketeers have become immensely powerful in influencing what new products should be built, and what features they should include. One reason for their ascent is that their recommendations are usually based on evidence – good, earnestly-gathered evidence – of what sells, and what does not. Armed with these insights into people's behaviour, the marketing director becomes the arbiter of what sells.

Sounds good? Well, I've no problem with market research based on evidence. But too great a swing in power from the engineer to the marketing person would create a static society. Why? Because the reality is that the marketeers are the arbiters of what *has* been selling, not of the unknown breakthrough yet to be invented. That's where the inventor comes in.

The genius of the design engineer is his or her ability to think the unimaginable, and then go ahead and do it, even if potential customers expect something more familiar. ■

© Sir James Dyson 2008

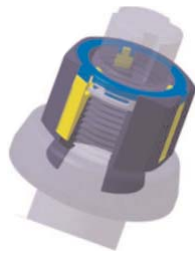
Continued next month...

● *This is an edited extract of a podcast first broadcast in January 2008, reprinted with permission. Sir James Dyson is best known as the inventor of the Dual Cyclone™ bagless vacuum cleaner. With his research team he has developed products that have achieved global sales of over £3bn.* **dyson.co.uk**

# Lock 'em up tight!

**T**HE RISK OF losing a wheel is a major – and expensive – concern for commercial vehicle operators. In the UK alone, 11,000 wheel-fixing defects per year result in 400 wheel detachments and seven deaths, not to mention attendant calls to the emergency services, road closures and extensive damage to the trucks involved; drivers don't realise there is a problem until it's too late.

Innovative Welshpool company VisiLok Limited has now created an ingenious solution to this problem. Their VisiLok 'flag-and-lock' device comprises a nut incorporating a spring-driven lock and a flag mechanism, allied to a modified



**WHEELS OF FORTUNE?** If a truck's wheel-nuts start to slacken, the VisiLock 'flag-and-lock' nut (above left) drops three pins into place to lock it into position – and simultaneously raises three luminous yellow 'flags' to attract attention.

slotted stud. If a wheel-nut slackens – due, for instance, to vibration or rapid temperature change – the mechanism drops three securing pins into slots in the stud while simultaneously raising three yellow flags above the surface of the nut.

In this way, wheel-nuts are locked as soon as they start to slacken, leaving a high-visibility indicator to alert the driver or operator to the problem.

By retaining the original equipment manufacturers' wheel-nut specifications, no time penalty

in fitting or removing a VisiLok nut is incurred and no special tools are required.

Given the impracticality of regularly testing and tightening every wheel-nut while on the road (some rigs have 100 wheel-nuts), a quick visual check of the VisiLock could bring enhanced peace of mind to truck-drivers, operators and other road users alike. ■

● **VisiLok Limited, Henfaes Lane Welshpool, Powys SY21 7BJ**  
**Tel: +44 (0)1938 553380**  
**info@visilok.co.uk visilok.com**



© DURA VERMEER

## Dutch architects plan for a floating future

**A**RCHITECTS in the Netherlands are showing the rest of the world a way of turning adversity into opportunity. The rise in sea level that will come with climate change is going to make it increasingly difficult to control flooding in low-lying countries – but instead of cursing their fate, Dutch architects are designing innovative new homes that appear to float on water.

The curved lines and pastel-coloured wooden planking of the houses being built in Maasbommel, a small town on the Maas River, disguise their unique foundations: the enclosed basements actually sit upon the riverbed. If the river level rises, each house floats upwards with the water level. Flexible pipes keep the houses connected to electrical and sewer lines, and elegant 'poles' keep the structures aligned as they rise with the river.

The houses haven't floated yet, but the prediction is that global warming will cause the Maas to flood once every 12 years on average. In the past, the Dutch only built homes in places where dikes made flooding unlikely.

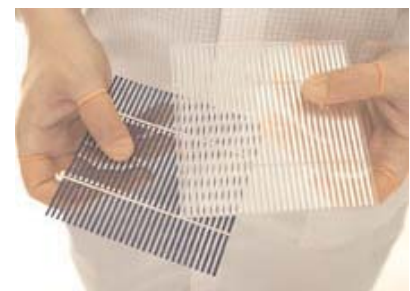
"The concept that you *deliberately* build in an area where floods may occur is completely new," says Chris Zevenbergen of architects Dura Vermeer. New, and attracting attention. Who says you have to live on dry land? ■

● [duravermeer.nl](http://duravermeer.nl)

Source: npr.org / Mike Overy

**Poles help locate the Maasbommel houses as the structures rise with the river.**

● **SILICON COSTS PROMPT INNOVATION** The cost of silicon, the main component of solar panels, has hit the roof, so the drive to invent panels that use less silicon is really hotting up. California startup Solaria's solar panels are thin strips of silicon and moulded plastic grids. The plastic visible between the strips collects light and funnels it onto the silicon to produce energy. Despite generating 10% less power than traditional solar panels, Solaria's product could become 30% cheaper, with further developments also possible. So if this year's initial run is successful, the rest of us could be warming to this new design quite soon. ● [solaria.com](http://solaria.com)



# Guard it with advice

**J**ERSEY-BASED COMPANY Guard Ideas (Globally) Ltd has produced a self-help CD-Rom for inventors, innovators, designers, engineers, entrepreneurs and progressive small businesses.

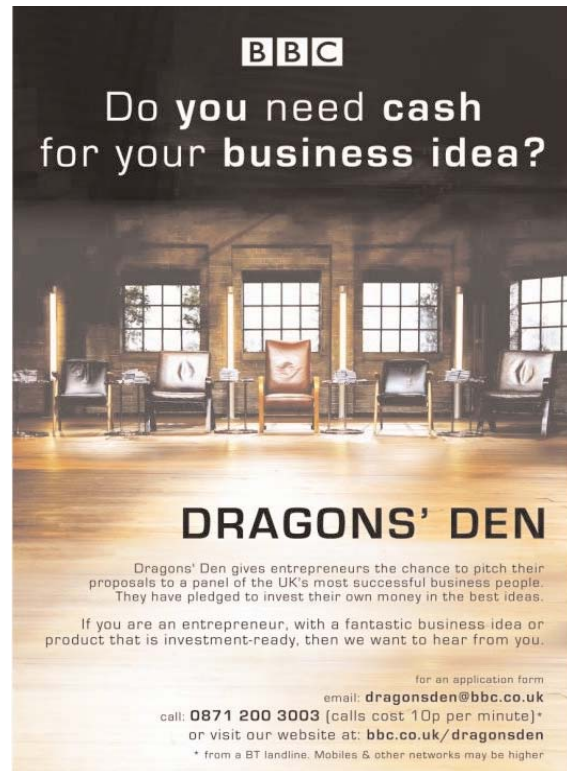
GUARD-IDEAS™ aims to show how you can make money from ideas or business schemes by safeguarding intellectual property, and includes a substantial business advice info-pack to get you started, two pre-drafted international confidentiality agreements, a two-year legal cover offer, plus advice on how to protect your copyright, and how to file for UK or international patents, design or

trademark protection.

GUARD-IDEAS includes a unique 'Ask Alan' feature, where users can seek one-to-one advice from Alan Wilcher, a former director of the Institute of Patentees & Inventors.

Priced at £175, GUARD-IDEAS took three years to research, develop and refine and is the creation of Harry Cole, the author of *'Ideas or inventions can make fortunes – how to make yours!'* and a fellow of the Institution of International Licensing Practitioners and member of the Institute of Management. ■

● [ideasprotected.co.uk](http://ideasprotected.co.uk)



**BBC**

Do you need cash for your business idea?

**DRAGONS' DEN**

Dragons' Den gives entrepreneurs the chance to pitch their proposals to a panel of the UK's most successful business people. They have pledged to invest their own money in the best ideas.

If you are an entrepreneur, with a fantastic business idea or product that is investment-ready, then we want to hear from you.

for an application form  
email: [dragonsden@bbc.co.uk](mailto:dragonsden@bbc.co.uk)  
call: 0871 200 3003 (calls cost 10p per minute)\*  
or visit our website at: [bbc.co.uk/dragonsden](http://bbc.co.uk/dragonsden)  
\* from a BT landline. Mobiles & other networks may be higher

## Marketing definitions

- If a circus comes to town and puts up a poster saying: 'Circus, Sunday, 3pm'... – that's Advertising.
  - If they place the poster on an elephant and walk it through the town... – that's Promotion.
  - If the elephant sits on the bonnet of the Mayor's car... – that's Publicity.
  - If the Mayor has a good laugh about it... – that's Public Relations.
  - If the circus planned the whole thing... – that's Marketing.
  - If the circus captured the email addresses and mobile phone numbers of everyone who responded to the elephant, so they could send them an annual interactive preview of the circus with a personalised invitation to attend, and it was all done automatically, 24/7... – that's Digital Marketing.
  - If they post the story on various internet blogs and chat rooms for other people to propagate... – that's Viral Marketing.
- Source: [cjdigital.com](http://cjdigital.com) / Mike Overy

## GO NUTS WITH

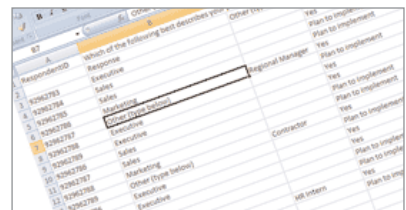
**D**OES YOUR small business need to conduct surveys on a new product launch, analyse customer responses etc?

SurveyMonkey gives you all the tools you need to create your own surveys – and enables you to get it done quickly and easily.

With both a free version or a professional version (for \$19.95 per month), SurveyMonkey could pay for itself many times over if it helps you to clarify your customers' needs.

Design features include twenty question templates, survey templates, any-language support, custom themes and response validation.

With collection features to help you manage your lists, plus analysis features (view your results in real-time, browse individual responses etc),

you could start creating your own surveys immediately.

SurveyMonkey claims to be so easy to use that you'll be able to start collecting valuable responses in minutes – there's no software to install, and no complicated manual, allowing people at all experience levels to create professional surveys.

SurveyMonkey is the leading survey tool on the web (ranked by Alexa), with over 80% of the Fortune 100 companies currently using it. ■

● [surveymonkey.com](http://surveymonkey.com)

## ● SOLENT SYNERGY HOSTS FREE BUSINESS SEMINAR

**A FREE business seminar entitled 'Addressing the Challenges of Managing a High Growth Business' will be held in Conference Room 4, Millbrook Technology Campus, Nicolson House, University of Southampton, S015 0DJ on Wednesday 7 May.**

The three-hour programme commences at 4pm and includes presentations on the growth company jigsaw by Chas Morrison of Business Link, sound financial management by Tim Bentall of BDO Stoy Hayward, and team development by David Bream of Southampton University.

● To register, contact Katy Patterson Tel: 01489 889 882 [katy@solentsynergy.co.uk](mailto:katy@solentsynergy.co.uk)

SPECIAL OFFER

GRASS SNAKE **CABLE GRIP**



**Buy two, get a third FREE!**

**AVOID SEVERED CABLES, TRIPS AND FALLS WITH THIS AWARD-WINNING SAFETY DEVICE!**

The Grass Snake Cable Grip tows electric cables safely behind you, away from cutting blades.

It can be fitted and removed in seconds, won't pull out of your waistband, and alerts you if the cable snags on entanglements.

**Suitable for electric lawnmowers, hedge trimmers, chainsaws, strimmers, power tools etc.**



**THREE FOR £9.99\***

Inventique Special Offer Pack contains Green, Orange & Purple Grass Snake Cable Grips.

\*Post paid (normally £3.99 each + p&p).

Simply write your name and address on the back of your £9.99 cheque (made out to Grass Snake Limited) and post to:

Inventique Offer  
42 South Way, Lewes  
East Sussex BN7 1LY

Delivery within 14 days of receipt.

**GrassSnake.co.uk**

# \$10m X Prize is 'go!'

**T**HE DEADLINE for teams to register for the Automotive X Prize has arrived. The X Prize Foundation – best known for its competitions promoting space flight – is offering a share of its \$10m purse to the teams that can produce the most production-ready automobiles capable of achieving 100 miles per gallon.

More than 60 teams from ten countries – including students, start-up companies and large manufacturers – have signed letters of intent to compete for a share of the prize purse and attendant global publicity. They include US electric car manufacturers Aptera and Tesla, German diesel manufacturer Loremo and Delta Motorsport from the UK.

Applications will be narrowed down to those who can prove they would build production-ready, consumer-friendly cars. Qualifiers will race their vehicles in cross-country races to test speed, distance, urban driving and overall performance criteria in 2009/2010.

The purse is split into mainstream and alternative categories. Mainstream cars must carry four or more passengers, have four or more



wheels, reach 60 mph in less than 12 seconds and have minimum top speed of 100 mph. Alternative vehicles will be required to carry two or more passengers, with a top speed of at least 80 mph.

British Columbia-based Fuelvapor Technologies is among the competitors. Its gas-powered car (above) has three wheels and two seats and an aerodynamic 'jet fighter cockpit' design. It saves fuel through a proprietary technology that replaces traditional fuel injection. The car currently achieves 92 mpg, but the company believes a hybrid version could achieve up to 400 mpg. ■

● [xprize.org](http://xprize.org)

● **BARCLAYS TRADING PLACES AWARDS** Entries for the £10,000 Barclays Trading Places Awards must be in by 30 May. The increasing number of men and women who are turning their lives around by choosing to start up a new business are highlighted in the government-backed Awards, presented in association with The Prince's Trust, which feature practical examples of people who have taken control of their lives by deciding to go it alone.

Previous winners include a single mum who overcame physical abuse to set up a successful beauty business and a policeman who lost an arm – and his career – but went on to establish a driving school for the disabled. The Awards are open to anyone who has been trading for a minimum of three months and a maximum of three years, with an annual turnover of less than £1m. ■

● For further information, contact [Rebecca Deeny](mailto:Rebecca.Deeny@aspectcommunications.com) or [Kate Polson](mailto:Kate.Polson@aspectcommunications.com), Aspect Communications Tel: 0208 673 2020 | Mob: 07795 694 863 or 07852 902 719

● **THE INNOVATION EDGE** NESTA's flagship conference at The Royal Festival Hall, London on 20 May will include dozens of the world's leading academic, political and industry experts to consider the latest developments in innovation. Admission is free upon advance registration. ■

● [innovationedge08.co.uk](http://innovationedge08.co.uk)

## Removing lead from solder may seem a smart idea environmentally, but the resulting microscopic growths called tin whiskers could be just as problematic, says Kurt Jacobsen.

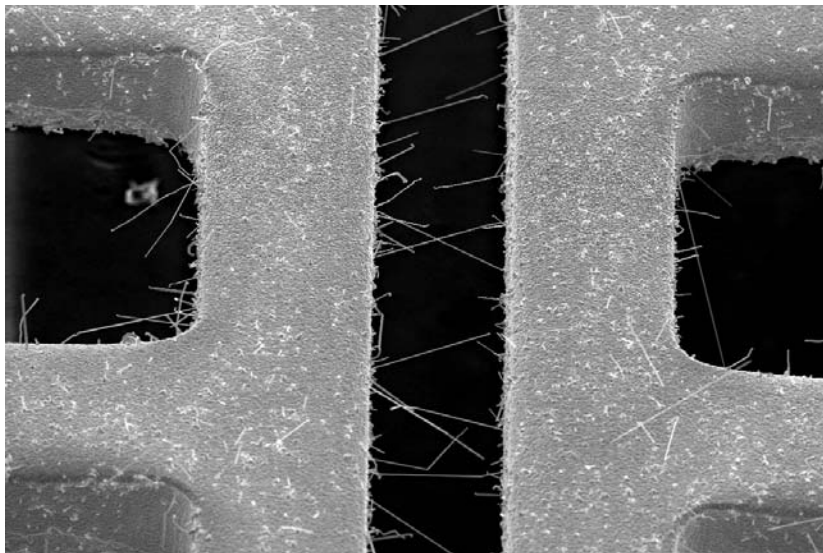
**O**n 17 April 2005, the Millstone nuclear generating plant in Connecticut shut down when a circuit board monitoring a steam pressure line short-circuited. In 2006, a huge batch of Swatch watches, made by the eponymous Swiss company, were recalled at an estimated cost of \$1bn (£500m). In both cases, ‘tin whiskers’ – microscopic growths of the metal from soldering points on a circuit board – were blamed for causing the problems.

It’s not the first time these mysterious growths have been blamed for electronics failures. In 1998 the Galaxy IV communications satellite sputtered out after just five years; engineers diagnosed its failure as due to ‘whiskers’.

The US military blamed them for malfunctioning F-15 radar systems and misguided Phoenix and Patriot missiles. In 1986, the US Food and Drug Administration recalled a number of pacemakers because of these same whiskers. In fact, they’ve been known about since the 1940s, and happen with cadmium and zinc, too. During the second world war, similar whiskers would short the cadmium tuning capacitors in aircraft radios. A decade later, tin-based relays in AT&T telephone switching centres were found to cause shorts.

### Pushing tin

The solution to ‘whiskering’? Mix lead into the solder, as was done from the 1950s. Colin Hughes, a physicist who worked on the first British nuclear bomb, told me that the whiskering problem never came up during his career. But now the lead is gone, by legal mandate, and whiskers are back – causing potential problems for us all.



© PETER BUSH, STATE UNIVERSITY NEW YORK AT BUFFALO

Since 2006, lead has been banned from solder in the European Union under the 2003 Reduction of Hazardous Substance (RoHS) directive, which gave manufacturers three years to phase out lead.

The logic seemed reasonable. Removing lead from petrol (where it was used to prevent engine mistiming) brought clear health and environmental benefits, taking a harmful chemical that can affect intelligence out of the atmosphere. Removing lead from solder – the 37% lead, 63% tin alloy used to join metal objects in everything from plumbing to circuit boards – was an obvious next step to prevent it leaching into ground water from dumped items in landfills.

Meanwhile, the US and Japan have also been moving to lead-free solders. It’s a huge shift; the US Environmental Protection Agency (EPA) estimates that 80m kilograms of lead solder was used worldwide in 2002. Environmental groups have applauded the move. “In the US we’ve been surviving without lead solder for many years,” says

Rick Hind, legislative director of Greenpeace’s toxics campaign. “With less exposure to lead we will all benefit by being smarter and making safer and more durable products.” (The US has not made lead-free solder obligatory, but does offer tax benefits for doing so.)

But without lead to tame it, tin behaves oddly on circuit boards. Left alone, tin plating, like cadmium and zinc, spontaneously generates microscopic shreds of metal – about one to five microns in diameter, or less than one-tenth as wide as a human hair – which push up from the base. If they grow far enough to touch another current-carrying location, they’ll cause a short that can wreck the equipment while leaving barely any trace.

The cause is becoming clearer. “I believe the mechanism of whisker formation is now understood: it is due to compressive stress – caused by, say, diffusion of copper into the tin – being built up in the tin layer which breaks through the tin oxide barrier layer [to the air],” says Steve Jones of Circatex, in South Shields.

Continued on page 7...

Critics cite reports that solder substitutes – pure tin, tin-zinc, tin-silver-copper – simply cannot match the lead mixture for reliability, coverage ('wetting' terminals), and cost (silver is especially pricey). Therefore, the US military, Nasa and medical and high-level research equipment are exempt from what authorities view as untrustworthy commercial components.

"I still use lead-tin solder – it works better," says John Ketterson, a solid state physicist at Northwestern University in Illinois. He notes the tradeoffs of "cost, materials, strength of the solder and all that" during this mandated changeover, and that manufacturers "have to get an experience base" with new processes.

### Double standards

This means the unwitting consumer bears the cost of the experimental burden. "So Nasa does not want the economic risk of having the Hubble [Space Telescope] go down. But if one personal computer in a thousand goes down because of the whiskers, no one is going to do anything much about it," says Ketterson.

One in a thousand may be a generously low estimate. Besides whiskering, lead-free solder is more brittle. Substitute solders also may be applied too thinly or with too little heat – or, for that matter, with too much heat (lead substitutes have higher melting points), stressing the circuit board laminate.

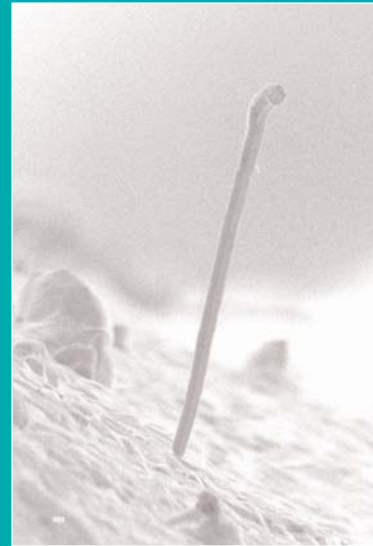
The question is, are the products we are using now being affected by tin whiskers? When your computer stops working, could that be the cause? Certainly, some in the computer industry know about it: representatives from IBM and Sun Microsystems were among those presenting at a tin whisker workshop in 2006; a second was due last month.

Using a matt finish, removing contaminants from the solder and surfaces, and reducing mechanical stress on the components being soldered all mitigate the growth of whiskers. But Bob Willis, an opponent of the EU directive and technical director for the SMART (Surface Mount and Related

## TIN WHISKERS: COMING TO A PC NEAR YOU?

- They can grow at ambient temperature and humidity, or in a vacuum.
- They can grow in steady or varying temperatures (though the latter may encourage growth).
- Whiskers' tips are atom-sharp. They will push through any coating, given time.
- They are a prevalent cause, only now being identified, of many past equipment failures.
- One whisker can carry about 30mA – more than enough to cause havoc in digital circuits.
- Silver-tin-copper (SAC) solder slows but doesn't stop whisker growth.
- SAC solder has more environmental impact than the lead-tin version.
- Older 37%-63% lead-tin solder mix merely deforms, reducing stress and hence minimising whiskering.
- Whiskers can grow indefinitely.

Source: Howard Johnson, Signal Consulting



© NASA GODDARD SPACE FLIGHT CENTER

Technology) Group in the UK, says that so far there is "no definite solution to the problem".

More than 80% of all electronic components are made in Asia but specifications are imposed by the brand-name company. I rang eight manufacturers to enquire about encounters with whiskers and related problems. Only one tech support person – and no spokesperson – knew anything about it. Yet Google 'tin whiskers' and you get 40,000 hits.

Apple was the only manufacturer to respond, stating that the company "has been using lead-free solders since 2004 without issue". Perhaps manufacturers haven't developed an "experience base", or perhaps it isn't registering as a problem. Many customers will probably chalk failed devices off to their own isolated tough luck, when the cause might really have been microscopic whiskers inside their machines.

### Lessons learned

Overall, was it sensible to go lead-free? "I would say no," says Willis. Earlier obsolescence means more discarded devices. Critics argue that substitutes are more toxic and energy-wasteful than the lead they replace – and that lead doesn't leach from

circuit boards, because it doesn't migrate as lead in paint or petrol does.

The National Electronics Manufacturing Centre for Excellence, sponsored by the US Navy, did find that modifying the temperatures at which soldered items are bathed and stored diminished whiskering, but nevertheless recommends the "use of lead in conflict with future industrial practice." And Swatch, after its expensive recall, won a permanent exemption from the RoHS directive for its exports to the European Union.

Perhaps a reliable lead-free process will be conjured up soon – though experts doubt it.

Companies such as IBM and National Instruments say they are now achieving RoHS compliant techniques even for exempt products. But this debate among professionals looks like it needs to come out in the open. So far, the last source to count on for information about this looming problem is the manufacturers. ■

● This article first appeared in the *Technology news & features* section of the *Guardian* on Thursday 3 April 2008.

[guardian.co.uk/technology](http://guardian.co.uk/technology)

**O**NE QUESTION that has fascinated biomimetic engineers is: How did nature make the squid's beak so hard and sharp, yet enable the squid to bite without causing damage to its own soft body?

Engineers, biologists and marine scientists at the University of California, Santa Barbara – a mecca for this type of interdisciplinary study – joined forces to study the question more closely. The results of their research were published in the March issue of *Science*.

Humboldt squid, *Dosidicus gigas*, are about three feet wide, and their sharp beak is one of the hardest and stiffest organic materials known. The squid can injure a fish with one swift motion – or as the article dryly notes: “A squid beak can sever the nerve cord to paralyse prey for later leisurely dining.”

The squid's main predator after humans is the sperm whale, and these animals frequently show the scars of battle with the squid's sharp suckers.

“Squid can be aggressive, whimsical, suddenly mean, and they are always hungry,” said researcher Herb Waite. “You wouldn't want to be diving next to one. A dozen of them could eat you, or really hurt you a lot.”

The creatures are very fast and swim by jet propulsion.

### Gelatinous buccal mass

The key to the squid's beak appears to lay in its gradations of stiffness. The tip is extremely stiff, yet the base of the beak – the muscular



buccal mass – is 100 times more compliant, allowing it to blend with surrounding tissue. This only occurs when the base is wet; if the base dries out it becomes as stiff as the tip.

“I've always been sceptical of whether there is any real advantage to ‘functionally graded’ materials, but the squid beak turned me into a believer,” said Waite's fellow researcher Frank Zok.

“Here you have a cutting tool that is extremely hard and stiff at its tip and is attached to a material that has the consistency of gelatine.

“You can imagine the problems you'd encounter if you tried to attach a knife blade to a block of jelly and tried to use that blade for cutting. The blade would cut through the jelly at least as much as the targeted object.

“In the case of the squid's beak, nature takes care of the problem by changing the beak composition progressively rather than abruptly, so that its tip can

**The sharp tip of the Humboldt squid's beak is one of the hardest and stiffest organic materials known – yet its base, the buccal mass, has the consistency of gelatine.**

pierce prey without harming the squid in the process. It's a truly fascinating design.”

### The properties mark it

Zok explained that most engineered structures are made of combinations of very different materials, such as ceramics, metals and plastics. Joining them together requires either some sort of mechanical attachment like a rivet or a nut and bolt, or an adhesive such as epoxy. But these approaches have limitations.

“If we could reproduce the property gradients that we find in squid beak, it would open new possibilities for joining materials,” Zok explained.

“For example, if you graded an adhesive to make its properties match one material on one side and the other material on the other side, you could potentially form a much more robust bond,” he said. “This could really revolutionize the way engineers think about attaching materials together.”

So now the original question appears to have changed from how the squid avoids damaging itself to this: Can engineers mimic the squid beak's design of progressive stiffness by reverse-engineering this remarkable feature? ■

Source: University of California, Santa Barbara

## The diving experience and underwater safety

An Israeli SME has developed and produced a unique innovative device designed to enhance the diving experience and underwater safety, using a combination of technologies for digital communication and navigation. The device uses sophisticated ultrasound technology, advanced digital signal processing, innovative application software, small acoustic antennae and lightweight power units.

The SME is looking for joint venture agreements and commercial agreements with technical assistance (ref: 08 IL ILMI 0JVO).

● For further information, log on to: [www.marinesoutheast.co.uk/news](http://www.marinesoutheast.co.uk/news)

"The greatest danger for most of us is not that our aim is too high and we miss it, but that it is too low and we reach it" – Michelangelo

# www.wrti.org.uk

THE INVENTORS WEBSITE

**CENTRE OF EXCELLENCE** Ten Fingers Limited

## They'll handle it

AND THEY'RE MORE THAN A SAFE PAIR OF HANDS

**A** FINALIST at this year's BFIIN Inventor of the Year Awards, Glasgow-based Ten Fingers Limited offers a service for stressed entrepreneurs by helping them turn an off-the-top-of-the-head idea into reality.

And for those juggling a variety of tasks, with a 'to-do' list as long as their arm even as they struggle to keep the existing the balls in the air, help is also at hand.

Ten Fingers' support service can handle the unexpected project that just won't fit into your schedule, sort out a crisis that threatens both your business and personal life, find stuff that people don't usually sell and help get a new venture going in double-quick time.

Bringing entrepreneurial skills to the task of helping clients manage their complex entrepreneurial lives, they have tackled a huge variety of

projects, from the little – introducing a client to a senior cabinet minister, leading to a meeting with Holyrood MSPs – to the large: investigating the planning, engineering and financials for an Ayrshire wind farm.

Founder Angela Beattie's broad experience includes project-managing a \$900m flotation on the Singapore Stock Exchange. ■

● **Ten Fingers Limited**  
**George House, George Square**  
**36 North Hanover Street**  
**Glasgow G1 2AD Tel: 0141 572 8333**  
**www.tenfingers.co.uk**

### WEBSITE OF THE MONTH

**www.mentorsbynet.co.uk**

A programme that helps people realise new business ideas and ventures, and encourages them to develop and grow their businesses, via e-mentoring from successful business leaders.

### E-BOOK OF THE MONTH

**The Mind Mapping Manifesto** by Chuck Frey

www.mindmappingmanifesto.com  
\$19.95

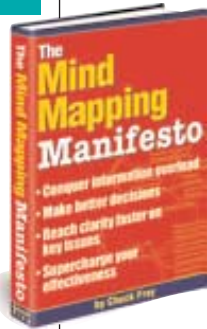
A mind map is a diagram used to represent words, ideas, tasks or other items linked to and arranged radially around a central key word or idea. It is used to generate, visualise, structure and classify ideas, and as an aid in study, organisation, problem solving, decision making, and writing.

Written by the founder of InnovationTools.com, this e-book aims to help business people understand what a powerful business tool mind mapping software is, and how it can help them to conquer information overload, reach clarity faster on key issues, make better decisions, become more creative problem-solvers and enhance their effectiveness.

*'Chuck Frey displays his uncanny knack of distilling all that's relevant to mind mapping software and presenting it in a single, accessible publication.'*

*This e-book is aimed at the general business user and accurately describes the benefits and opportunities for more creative and efficient working.'*

– Steve Rothwell



## BUSINESS LINK INNOVATION CLINICS

Are you thinking about developing a new product, process or service? Have you invented something and don't know what to do next? Through its series of free Innovation Clinics, Business Link provides confidential and impartial guidance on such subjects as investigating an innovative idea, product development, working with universities, R&D funding sources, protecting intellectual property rights and licensing. Innovation Clinics are held throughout the SEEDA region.

● **Advice Hotline: 0845 600 9 006** [innovation@businesslinksoutheast.co.uk](mailto:innovation@businesslinksoutheast.co.uk) [www.businesslink.gov.uk/southeast](http://www.businesslink.gov.uk/southeast)

**WRTI PATRON** Trevor Baylis OBE **WRTI CHAIRMAN** Peter Hebard [chairman@wrti.co.uk](mailto:chairman@wrti.co.uk)

**DEPUTY CHAIRMAN** Richard Little [deputychairman@wrti.co.uk](mailto:deputychairman@wrti.co.uk) **SECRETARY** Mike Overy [secretary@wrti.co.uk](mailto:secretary@wrti.co.uk)

**TREASURER** Mike Wright [treasurer@wrti.co.uk](mailto:treasurer@wrti.co.uk) **MEMBERSHIP SECRETARY** Professor Richard Penson [membership@wrti.co.uk](mailto:membership@wrti.co.uk)

**INVENTIQUE EDITOR** Frank Landamore [editor@wrti.co.uk](mailto:editor@wrti.co.uk) **WEBMASTER** Mike Overy [webmaster@wrti.co.uk](mailto:webmaster@wrti.co.uk)

To receive free online editions of *Inventique*, simply follow the instructions on the 'Inventors newsletter' page at [wrti.co.uk](http://wrti.co.uk).

*Inventique* © Frank Landamore 2003-2008. Text © the authors 2008.

All material in *Inventique* is copyright and may not be reproduced without permission or distributed other than in its entire original electronic and printed forms. Back issues of *Inventique* are available at [www.wrti.org.uk](http://www.wrti.org.uk)

Edited, designed and produced by Frank Landamore, 42 South Way, Lewes BN7 1LY on behalf of WRTI.