www.eurekamagazine.co.uk July 2013

EUREKA

THE MAGAZINE FOR ENGINEERING DESIGN

In this issue: Sensors, Test & Measurement • Rapid Prototyping • Power Transmission • Defence

Reality check

Meeting the challenges of virtual design

OMEGA Celebrates Over 50 Years of Excellence in Process Measurement and Control

OMEGA

Reaching New Heights in Customer Service

We're 100 Percent Committed to Our Customers

100,000 Products — Temperature, pressure, strain and force, flow and level, data acquisition and automation products

Easy Ordering — Call or visit us at www.omega.co.uk

Fast Delivery — Same-day shipping

World Class Customer Service — Free technical support and literature

omega.co.uk 0800 488 488

OMEGA®
100,000 Measurement Products

CONTENTS

Volume 33 Number 7 July 2013

20

Cover: Oliver Burston, Debut Art

27

41

47

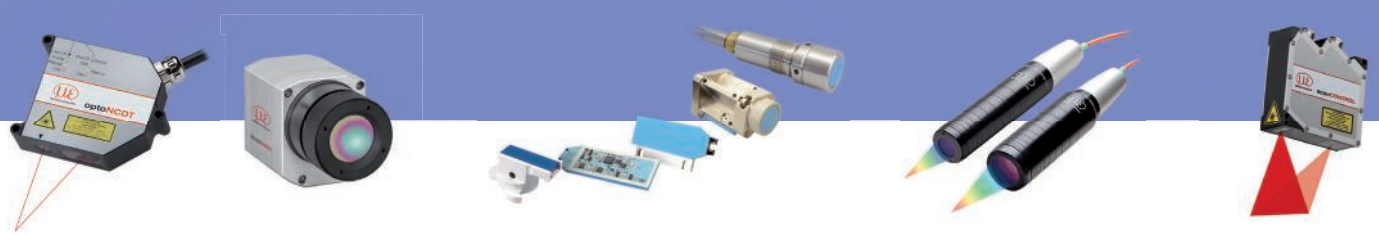
How high are your measurement standards ?

MICRO-EPSILON

In today's challenging environments every µm matters!

Micro-Epsilon keeps ahead of current measurement challenges and takes sensor technology to new heights. Providing a comprehensive range of high precision, customised sensors and measurement systems, the sky, really is the limit. We've even conquered space!!

- Dimension, position, displacement, thickness, temperature and colour
- Extreme precision and resolution
- From nanometres to kilometres
- Highest measuring rates
- Excellent temperature range & stability
- Ethernet, EtherCAT, serial and analogue interfaces
- Wear-free, robust and extremely reliable
- Market leading price-performance ratio



With more than 45 years' experience, Micro-Epsilon understands the importance of providing complete measurement solutions and support services for its customers. Whether it's inspection, test or sensor integration, Micro-Epsilon gives your company innovation and technical advantage.

DSEI

Visit our experts at DSEI, 10-12 Sept. Stand N3-275

+44 (0) 151 355 6070 | www.micro-epsilon.co.uk

Editor
Paul Fanning
pfanning@findlay.co.uk

Deputy Editor
Justin Cunningham
jcunningham@findlay.co.uk

Web Editor
Laura Hopperton
lhopperton@findlay.co.uk

Group Editor
Graham Pitcher
gpitcher@findlay.co.uk

Art Editor
Martin Cherry

Technical Illustrator
Phil Holmes

Advertising Sales
01322 221144

Sales Director
Luke Webster
lwebster@findlay.co.uk

Deputy Sales Manager
Simon Bonell
sbonell@findlay.co.uk

Account Manager
James Slade
jslade@findlay.co.uk

Production Manager
Heather Upton
hupton@findlay.co.uk

Circulation Manager
Chris Jones
cjones@findlay.co.uk

Publisher
Ed Tranter
etranter@findlay.co.uk

SSN-0261-2097 (Print)
ISSN 2049-2324 (Online)

Eureka (incorporating Engineering Materials and Design and Design News) is free to individuals who fulfil the publisher's criteria. Annual subscriptions are £81 UK (£118 overseas or £153 airmail).

If you change jobs or your company moves to a new location, please contact **circulation@findlay.co.uk** to continue receiving your free copy of Eureka.

Origination
CC Media Group
Printed in UK by
Pensord Press Ltd

Published by
Findlay Media, Hawley Mill, Hawley Road,
Dartford, Kent, DA2 7TJ
Tel: 01322 221144
www.eurekamagazine.co.uk

Findlay Media is a member of the Periodical Publishers' Association

No more heroes?

Paul Fanning, Editor (pfanning@findlay.co.uk)

When presenting the winners with her eponymous Engineering Prize recently, Her Majesty The Queen said: "At its heart, engineering is about using science to find creative, practical solutions. It is a noble profession."

At which I think most reading this will raise a hearty 'hear hear!'. However, in the same speech, Her Majesty touched on a fact that has long dogged attempts to improve the image of engineering in this country when she said: "These days, engineering is seldom a solo effort".

This statement is undoubtedly true. However, it does fly in the face of the emphasis engineering in the UK has long put on celebrating individual engineers rather than collaborative efforts. Thus, when asked to offer an example for young engineers to follow, we tend to reach for a Brunel, a Telford or a Stephenson.

There is nothing wrong with this *per se.* These were great men whose achievements deserve celebration. But the awkward fact remains that they all died more than 150 years ago. Inevitably, then, relying on them as the 'poster boys' of UK engineering tends to give the profession a rather old-fashioned image.

These men, of course, were pioneers who lived in a time before huge corporations, meaning that they had to become both engineers and entrepreneurs from necessity. The modern engineer, by contrast, is often subsumed within a corporate structure that, while it affords greater support and finance, also tends to highlight collective over individual achievement. Huge strides are being taken by UK engineers within electronics, aerospace, automotive and defence firms, but we tend to hear about the end results rather than the individuals behind them.

Eureka, of course, is happy to celebrate personal achievement, as the individual categories of the British Engineering Excellence Awards show. However, this is more to do with a desire to give recognition where otherwise it might not be forthcoming than with creating idols.

Perhaps, then, it is time to stop looking for such idols and to seek instead to celebrate the companies, corporations and organisations that foster them? Yes, engineer-entrepreneurs still exist (the obvious example being Sir James Dyson), but they are rare. Surely an emphasis on the collective, collaborative and global nature of the profession rather than on the individual would be more productive than a constant – and often fruitless – search for engineering 'heroes'?

Got a story? Then drop us a line at eurekanews@findlay.co.uk or call us on 01322 221144

Industry gets a good Review

Chancellor George Osborne's recent Spending Review has been positively received by many industry bodies from manufacturing and engineering sectors.

Despite its announcement of £11.5bn cuts in public spending, the Review promised additional resource funding of £185m for the Technology Strategy Board (TSB), as well as a real term increase in science capital funding from £600m in 2012/13 to £1.1bn in 2015/16.

In addition, The Department for Business, Innovation and Skills faced a 6% cut in departmental spending, one of the lowest of any of the non-protected departments.

Expressing the Government's commitment to the sector, the Chancellor said: "Investment in science is an investment in our future. So, yes, from the next generation of jet engines to cutting edge supercomputers, we say, 'keep inventing, keep delivering'. This country will back you all the way."

WHAT THEY SAID

John Cridland,
Director General of the The Confederation of British Industry (CBI)
"The £185 million boost for the Technology Strategy Board - a crucial anchor for innovation - is very welcome. Innovation is a crucial engine of growth and it has been under-resourced for far too long. Protecting the science budget will help maintain growing levels of business investment in R&D."

Iain Gray,
Chief Executive of the Technology Strategy Board (TSB)
"UK business will benefit greatly from this announcement as we will be able to increase the impact we already have on helping to generate UK economic growth. Over half of our funding goes to SMEs and this financial endorsement of our focussed, business-led approach will continue to bridge the gap between concept and commercialisation, helping the innovations of today become the commercial successes of tomorrow."

Sir John Parker,
President of the Royal Academy of Engineering
"I am encouraged that the Chancellor has decided to maintain the current level of public investment in science, engineering and technology through today's spending review. Maintaining support for Britain's great university research base is essential for strong and sustained economic growth. But above all we need to harvest its output – that means continued investment and involvement by the engineering companies that turn the fruits of scientific and engineering research into innovative products and services capable of being marketed."

Ann Watson
Managing Director of EAL (the specialist awarding organisation for industry qualifications)
"The Government is re-emphasising its desire to ensure that education is equipped to meet the needs of industry.

EAL is dedicated to helping dovetail industry and education. We therefore welcome the Government's commitments, such as the announcement that the traineeships programme will be extended to 19-24 year olds, which will help support young people entering into industry."

Terry Scuoler
Chief Executive of the EEF - The Manufacturers' Organisation
"[The funding] demonstrates the importance that Government is now placing on supporting innovation as well as science... If this is a feast for the TSB it must not be followed by famine or uncertainty in the next Review."

Paul Everitt
Chief Executive of ADS (the trade body for UK Aerospace, Defence, and Security)
"The Government has prioritised spending in the areas that will deliver a greater growth dividend. Investing in science and innovation, skills and export promotion is critical to creating a strong, more balanced economy."

Deadline looming for 2013 BEEAs

You have until 31 July to submit your entries for this year's British Engineering Excellence Awards (BEEAs). Do you have what it takes to win?

Now in their fifth year, the Awards demonstrate and promote the quality of UK design engineering and are designed to celebrate those UK companies and individuals that have demonstrated the skills, invention and dedication to succeed and compete on an international stage.

Entries will be judged by a panel chaired by Eric Wilkinson, Chief Operating Officer of Cambridge Consultants. The Awards will be presented at an event at 8 Northumberland Avenue, London on 24 October.

beea
british engineering excellence awards

If you believe you have what it takes to win– or know of a product, company or individual that does – entry forms, detailed entry criteria and additional information on the Awards categories can be found at **www.beeas.co.uk**.

Drayson Racing sets new EV land speed record

Drayson Racing Technologies has broken the world land speed record for a lightweight electric car.

The team's Lola B12 69/EV vehicle hit a top speed of 204.2mph at a racetrack at RAF Elvington in Yorkshire on 24 June. The previous record of 175mph was set by Battery Box General Electric in 1974.

Driver Lord Drayson said the achievement was designed to highlight electronic vehicle technology's potential. Speaking shortly after his victory, he said: "What it, I hope, shows to people is just what the future potential of electric cars is.

"Obviously this is a very special racing car, but by setting this new world record here in Britain we say two things: Firstly, it is a pointer to the future - the technology that we developed for this car will filter down to the cars we use every day.

"And secondly it's a message about how here in the UK we're a world leader with this technology."

Employers 'must do more' to address skills shortage

Employers struggling to recruit engineers with the right skills must tackle the problem themselves and not rely on external sources to do so, the Institution of Engineering and Technology (IET) has said.

An industry report released by the organisation recently reveals that almost a quarter of companies have no plans to recruit the staff they need. A third said they don't engage with the education system because they see no benefit in doing so.

"Companies tell us that they are recruiting for business expansion and diversification, but this will be put in jeopardy if they cannot encourage engineers to join them," said IET president Professor Andy Hopper.

"There are some very good examples of companies getting involved in local schools and working with colleges, but our report indicates a significant minority of companies who do nothing. They know they will have difficulty recruiting the engineers they need but expect someone else will sort it out for them.

"You wouldn't leave it to chance to provide the materials, finance or machinery that you need. Why hope someone else will supply your most important asset that is your people?"

JLR to lead virtual engineering programme

Jaguar Land Rover has joined forces with four of the UK's top universities to develop virtual simulation technologies for the automotive sector.

The £10m, five-year project aims to help manufacturers bring more complex vehicles to market more quickly, by enabling designers to experience and make changes to creations in real time.

The project leaders at the Universities of Cambridge, Leeds, Loughborough and Warwick hope the research will also help save costs and reduce environmental impact in product development by reducing the reliance on physical prototypes.

Bob Joyce, JLR's engineering director, said: "We want to make advances in the simulated driver and passenger experience, including more realistic imagery, sounds and even smells. These projects will help us analyse increasingly complex cars."

** For more on this topic, turn to page 20*

PM backs scheme to boost number of UK engineers

A multi-million pound initiative which aims to create 100,000 registered Engineering Technicians by 2018 has been announced by Prime Minister David Cameron.

The scheme has been created by the Institution of Mechanical Engineers (IMechE), the Institution of Civil Engineers (ICE), the Institution of Engineering and Technology (IET) and the Gatsby Foundation.

Stephen Tetlow, chief executive of the IMechE, said: "The Institution and its partners are concerned that the number of people pursuing engineering careers is just not enough to meet the current and future demands of the engineering, manufacturing and construction sectors.

"To help UK companies succeed in this ever growing competitive global marketplace, we need people with the highest professional skills and abilities. This initiative will ensure that the UK has a growing stream of Engineering Technicians being developed to a level that is recognised and respected around the world."

Airbus' composite aircraft makes maiden flight

The first Airbus A350 XWB has successfully completed its maiden test flight. The aircraft took off from Blagnac airstrip in the French city of Toulouse on 14 June before landing back safely four hours later.

The flight marks the beginning of a 2,500 hour test programme that will lead to the certification of the A350-900 variant for airworthiness, prior to entering service in the second half of 2014.

The aircraft, seen as a direct competitor to US rival Boeing's 787 Dreamliner, is made from 53% carbon fibre composite.

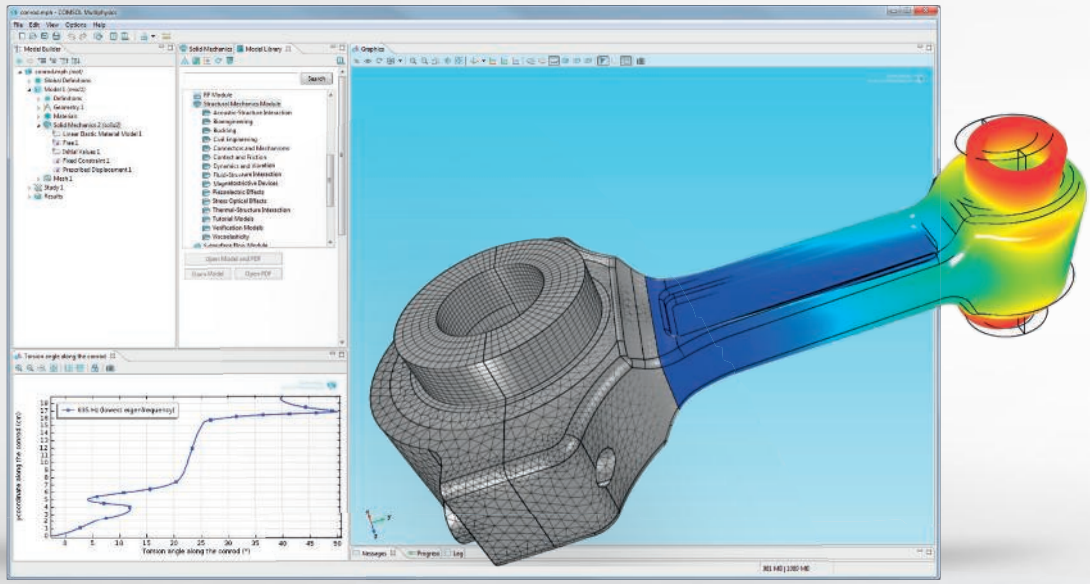
ENGINEERING PRIZE AWARDED

The winners of the inaugural Queen Elizabeth Prize for Engineering have received their trophies from Her Majesty The Queen at a special ceremony at Buckingham Palace.

Robert Kahn, Vint Cerf and Louis Pouzin were recognised for their contributions to the protocols that make up the fundamental architecture of the internet, Tim Berners-Lee, for inventing the World Wide Web, and Marc Andreessen for writing the Mosaic browser.

COMSOL 4.3b
Now Available!
www.uk.comsol.com/4.3b

CONNECTING ROD: Eigenfrequency analysis of a conrod used in an internal combustion piston engine. Results show the torsion angle along the conrod at the lowest eigenfrequency.



Verify and optimize your designs with COMSOL Multiphysics®

Multiphysics tools let you build simulations that accurately replicate the important characteristics of your designs. The key is the ability to include all physical effects that exist in the real world. To learn more about COMSOL Multiphysics, visit **www.uk.comsol.com/introvideo**

Product Suite

COMSOL Multiphysics

ELECTRICAL
AC/DC Module
RF Module
Wave Optics Module
MEMS Module
Plasma Module
Semiconductor Module

MECHANICAL
Heat Transfer Module
Structural Mechanics Module
Nonlinear Structural Materials Module
Geomechanics Module
Fatigue Module
Multibody Dynamics Module
Acoustics Module

FLUID
CFD Module
Microfluidics Module
Subsurface Flow Module
Pipe Flow Module
Molecular Flow Module

CHEMICAL
Chemical Reaction Engineering Module
Batteries & Fuel Cells Module
Electrodeposition Module
Corrosion Module
Electrochemistry Module

MULTIPURPOSE
Optimization Module
Material Library
Particle Tracing Module

INTERFACING
LiveLink™ *for* MATLAB®
LiveLink™ *for* Excel®
CAD Import Module
ECAD Import Module
LiveLink™ *for* SolidWorks®
LiveLink™ *for* SpaceClaim®
LiveLink™ *for* Inventor®
LiveLink™ *for* AutoCAD®
LiveLink™ *for* Creo™ Parametric
LiveLink™ *for* Pro/ENGINEER®
LiveLink™ *for* Solid Edge®
File Import *for* CATIA® V5

Contact: +44 (0) 1223 451580 info.uk@comsol.com

COMSOL

Got a story? Then drop us a line at eurekanews@findlay.co.uk or call us on 01322 221144

DC drives regenerate energy

With its recently extended PLX range, Sprint Electric offers the latest in regenerative three phase digital DC drive technology. The DC drives are able to regenerate energy back to the mains supply under braking without the need for expensive, complex intermediate storage, resistive dumping or additional power bridges. PLX DC drives are compact, powerful, flexible and easy to program, and available in current ratings between 12 and 2250 Amps at supply voltages up to 690VAC.

A four quadrant DC drive uses two thyristor bridges to enable it to motor and brake in both directions of rotation. This allows it to reverse the torque to slow the load very gently or almost instantaneously, regenerating energy at the same time. Unlike an AC drive, it is able to generate full torque at zero speed, enabling the load to be held stationary in complete safety without the need for mechanical brakes, an especially useful feature for winders and hoists. This means the DC drive is

also ideal for applications requiring high starting torques and accurate control at low or zero speed.

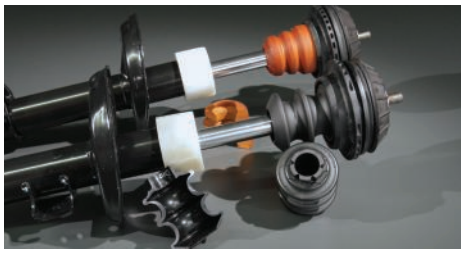
www.sprint-electric.com

Hytrel bumper hits the road

Fiat has adopted an integrated jounce bumper system on its Punto model that integrates several components into one to deliver better performance and a lower system cost.

Part of a vehicle's shock-absorber system, the jounce bumper is designed to absorb impact and dampen noise, vibration and harshness (NVH) by preventing the metal shock absorber spring from fully compacting during shock impacts due to potholes, kerbs and objects in the road.

Using thermoplastics like Hytrel instead of foam polyurethane (PUR) or rubber derivatives delivers high elastic recovery; excellent fatigue and durability; and low stiffness variation over a wide range of temperatures. The design eliminates the need for metal or



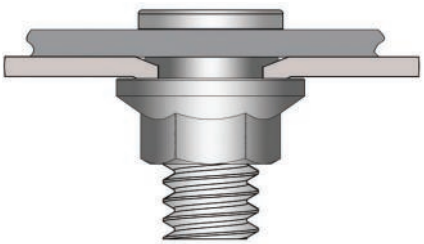
reinforced polyamide saturation cups and acetal or rubber rings normally used to increase energy absorption and can integrate dust protection.

Tests have proven that the new design delivers similar performance to PUR, but with lower part damage.

www.dupont.com

Spinning flare nuts rotate freely

New PEM-Type SFN spinning flare nuts are designed to rotate freely when permanently captivated in thin metal sheets for quick attachment to mating hardware and reduce the need for loose fasteners such as flange nuts. When paired with a self-clinching stud or other fixed externally threaded hardware, all loose hardware can be eliminated from an application to help streamline assembly time and decrease production costs.



PEM Type SFN one-piece flanged steel hex nuts install easily in steel, stainless steel, or aluminum sheets of any hardness and as thin as 1mm. Upon installation, the nut becomes permanently captive and will spin freely in the sheet to accommodate mating hardware for final component attachment.

The fastener installs by inserting it into a properly sized, pre-punched, and embossed mounting hole and then applying sufficient squeezing force to flare the shank.

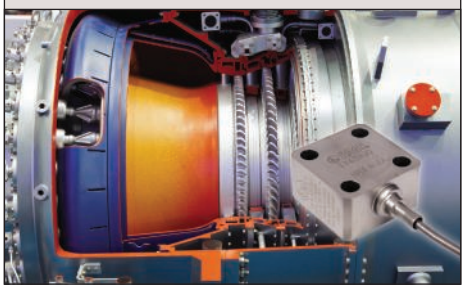
www.pemnet.com

High-temperature accelerometer

PCB Piezotronics has launched a new high-temperature charge output accelerometer designed to withstand the challenges of extreme heat environments such as gas turbines and nuclear power plants.

Designed to survive in temperatures up to 704°C, the new PCB series EX611A20 is ideal for use in various gas turbine applications such as bearing health monitoring, condition monitoring and structural damage monitoring. Other applications include commissioning of nuclear power plants. Packaged in a hermetically-sealed Inconel industrial housing, the EX611A20 is ATEX approved for Ex ia IIC T6 to T710C and comes with integral 3m hard-line cable terminating in a LEMO connector as standard. Other connectors (e.g. two-pin mini MIL) and cable lengths are available to order. The accelerometer is a drop-in replacement for existing competing products but offers significant advantages in warranty, pricing, lead time and height in comparison.

www.pcbsensors.co.uk



Adam Hartles
Elite Applications Engineer

"Massive respect to Adam, not only for his knowledge of the software but his patience as well."

Simon Levett, Managing Director, Sim-Tech.

"RELY ON SOLIDWORKS TO DEVELOP YOUR IDEAS. RELY ON US TO DEVELOP YOUR SKILLS."

The UK's most qualified support team, on the phone, or onsite.

SOLIDSOLUTIONS

For leading 3D CAD design software, and all-round user support – we're Solid.
Find out more on 01926 333777

www.solidsolutions.co.uk/support 3DS SOLIDWORKS reseller of the year 2004 – 2011

Arcus evaluation kit available

LG Motion is offering a competitively-priced evaluation kit based around Arcus Technology's DMX-J-SA series, NEMA 17 frame-sized, integrated microstep motor control and drive. The plug-and-play package has USB 2.0 connectivity and includes everything required to run and test a single-axis motion system including a 24V, 3A power supply, a USB cable, programming and set-up software, and a junction board complete with LEDs, pushbuttons and screw terminals that interface with the DMX's complement of opto-isolated I/O (2x inputs, 2x outputs) with limit and home inputs.

The USB stepper motor evaluation kit is aimed at OEMs and machine builders wishing to assess the many benefits of Arcus' integrated motor technology; where users can minimise cabling and simplify machine layouts – lowering build costs and allowing faster machine development timescales.

The evaluation kit also suits users who have simple, single-axis stepper requirements and wish to purchase all ancillary and machine interfacing components from a single source. The complete DMX range includes 11-, 17- and 23-frame integrated motors with a choice of communication interfaces for RS232/485, CANopen, USB and Ethernet as well as step and direction models.

www.lg-motion.co.uk

Solution to last month's Coffee Time Challenge

SPONSORED BY MICRO EPSILON

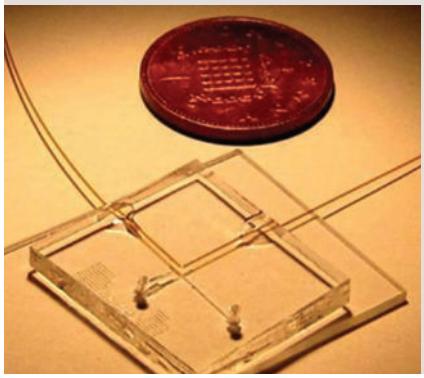
MICRO-EPSILON

The solution to last month's challenge of how to detect counterfeit Scotch and other fake spirits, comes from a team of Scottish researchers that have developed a technique based on the principles of Raman spectroscopy.

The size and need for alignment in a typical Raman spectroscopy machine has previously made it impractical for portable applications. However, improvements in fibre-optical Raman probes as well as lab-on-a-chip (LoC) techniques has lead to the development of an optofluidic method called waveguide confined Raman spectroscopy (WCRS).

The chip is fabricated using soft-lithography that aligns and then embeds two optical fibres in place. One fibre is used to deliver the Raman excitation beam into the chip and the other to collect both the Raman and fluorescence signals from the sample. The cost associated with this technique is at least two orders of magnitude lower than commercially available fibre-optic Raman probes.

The St Andrews University-based team has been able to capture interest from the drinks industry with its patented technology that has demonstrated accurate analyse of a range of spirits from a 20µl sample. It has been able to distinguish single malt Scotch whiskies based on brand, age and even which cask was used - as well as detecting trace toxic additives such as methanol at concentrations of less than 1% by volume.



The system can be used in broad daylight making it more amenable for field applications, and the team continues to develop a handheld device that is able to fire a laser, record the scatter and analyse the particular 'signature' of given liquids.

www.st-andrews.ac.uk

Buffer module offers full system availability

Emparro Cap is Murrelektronik's new buffer module for maximum system availability. The module ensures a stable power supply system and guarantees safe industrial processes. It reliably bridges voltage drops coming from the mains. This avoids time-consuming and cost-intensive interruptions.

Fully-automated production plants experience short-time voltage drops that can interrupt the production and incur high costs and overtime. The Emparro Cap buffer module is a useful means of avoiding these problems. It can be easily integrated into new and existing 24VDC power supply systems. It offers a buffer time of more than one second, even with a full load of 20A. Emparro Cap is equipped with ultra capacitors. Compared with battery-based buffer solutions, they feature the benefit of being permanently maintenance-free.

www.murrelektronik.co.uk

When timing and quality matters, our top brands put you in control.

uk.rs-online.com/automation-control-gear

RS

"This entry just fizzes with energy"

Think you've got what it takes?

Michael Aldridge
4c Design

Young Design Engineer of the Year 2012

Now in their fifth year, the **British Engineering Excellence Awards** has given many products, people and companies the recognition they deserve!

Want to join them?

It's quick and simple to enter!

1. **VISIT** www.beeas.co.uk
2. **SELECT** your category
3. **COMPLETE** the online entry form

Entry deadline – 31st July 2013

Organised by

findlaymedia

EUREKA

newelectronics

Headline sponsors

Cambridge Consultants

Digi-Key Corporation

Gallery sponsor

RS

Sponsors

National Instruments

Mouser Electronics

anglia

igus.co.uk

D Young & Co Intellectual Property

beea

british engineering excellence awards

www.beeas.co.uk

Solutions for efficiency directive

The European Commission has initiated a significant tightening of the energy-efficiency directive for electrical devices, leaving more users of drive technology faced with new challenges. By providing comprehensive information, fast, expert support and suitable drive products, Nord Drivesystems aims to enable machinery and equipment manufacturers to continue producing economically compelling solutions that comply with all regulations.

The exceptions of the 2009/640/EC Directive will be changed substantially as early as autumn 2013. One aspect will be particularly important for most users: the new definition of the range of very high and very low ambient temperatures in which conventional motors may be used. Up until now, IE1 motors could be used in applications with ambient temperatures below -15°C or above 40°C. In the future, the exception only applies to extreme temperatures below -30°C or above 60°C.

This extension of the directive's field of application will increase its impact and ecological sustainability. Nord Drivesystems welcomes this as a mark of the responsible use of limited natural resources. Manufacturers of newly affected machinery can reduce the switching effort by selecting the right suppliers and products. Many recently completed conversions show that Nord drive components with an IE2 or higher rating can be easily integrated. The one-off additional costs are usually redeemed within a short time, since on average energy costs make up 80% of a drive system's total cost of ownership. Nord engineers offer users comprehensive consultation on drive solutions in the new efficiency classes. High-efficiency motors can be ordered by themselves or as part of a complete mechatronic drive solution with gear unit and drive electronics.

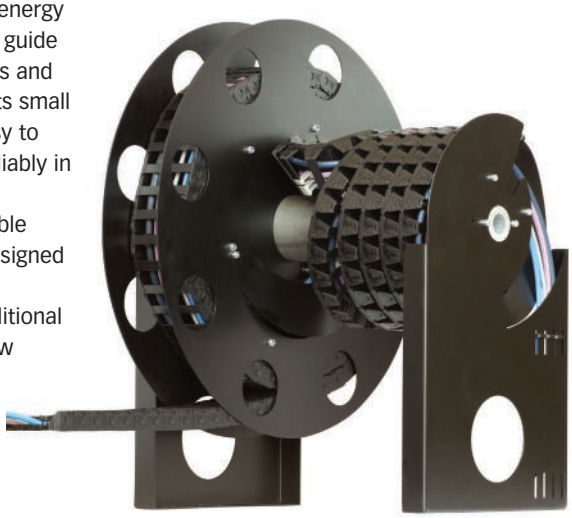
www.nord.com

New energy chain from igus

igus UK has launched a new compact energy chain, e-spool, which enables users to guide many different cables in narrow spaces and allows them to save space thanks to its small footprint. The innovative e-spool is easy to install and flexible, providing cables reliably in any direction for travel up to 14m.

The e-spool is a next generation cable management system that has been designed in response to customer demand for a solution that is more durable than traditional cable drums. As a result, users can now benefit from a system that provides reliable operation for a wide range of lifting applications.

The new energy chain system links two different igus energy chains in an ingenious way: a standard igus e-chain from the E2/000 series is routed via a spool, and a twisterband connects the spool with the shaft bracket, which serves as the interface to the permanently installed cables.



The chain is compactly wound up in its initial position and, thanks to an integrated return spring in the spool, the desired length and tension of the energy chain is always ensured. The e-spool chain is far more flexible than traditional cable drums, because instead of featuring sliding contacts, which are typically found in classic cable drums, the cables for data, compressed air and fluids can be connected without interruption and can be replaced or modified at any time.

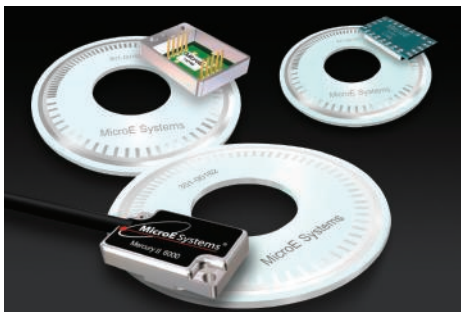
www.igus.co.uk

Encoder confirms precisely at start-up

A newly-available absolute encoder technology platform from Inmoco establishes and confirms precise position data immediately after system power up. Even if motion occurred when power was off, the start-up procedure checks and re-establishes the absolute data, leading to faster and more reliable machine start-up with fewer overall system checks.

The new Micro Motion Absolute technology uses a small initial rotary movement (typically 4-7°) on power-up, which allows the controller to establish the absolute position with certainty. This leads to easy and confident restarting of any system – even those that are particularly sensitive or those which include valuable/delicate workpieces.

The encoders acquire absolute position data from a pre-programmed absolute track on the encoder wheel. By putting position marks at unique locations on the track, as soon as the motion control system moves a small amount the controller is able to confirm the position with certainty.



Position feedback is sent to the controller in a high-speed serial format, where an FPGA and software interprets the signal.

www.inmoco.co.uk

www.engineeringdesignshow.co.uk

Engineering design show

Register now @ www.engineeringdesignshow.co.uk

■ 24 high-level conference sessions ■ Co-located with the Electronics Design Show
■ More than 200 exhibitors ■ 20 practical hands-on workshops ■ Engineering Materials LIVE! feature
■ Three events – one registration ■ Register now to receive regular updates

Headline sponsors

HEIDENHAIN · RS · SCHAEFFLER · LuK · INA · FAG

Co-located with

electronics design show · Engineering Materials LIVE!

2 – 3 October 2013 • Jaguar Exhibition Hall • Ricoh Arena • Coventry

Look, listen & learn at the

FIND THE SOLUTION TO YOUR DESIGN

SENSORS, TEST & MEASUREMENT

Industrial imaging
Thomas Karow, sales manager,
The Imaging Source Europe
Ian Alderton, sales director,
Alrad Instruments

High speed board development and test
Nick Hardy, FAE,
XJTAG

FASTENING

New developments in fastening technology for designers
Jeremy Scholefield, director of strategic business,
TR Fastenings

INTELLECTUAL PROPERTY

Intellectual property protection – a commercial perspective
Ian Harris, partner, chartered & European patent attorney,
D Young & Co LLP

ADHESIVES

Getting to grips with adhesives
Gavin Creech, senior applications engineer,
Scott Bader Company

DESIGN SOFTWARE

Industrial machinery solutions
James Smith, autodesk technical consultant,
Man and Machine

Create synergy – connect processes: Safeguard your competition edge by more efficient engineering
Norbert Ott, product manager,
Aucotec AG

BEARINGS

Minimising noise & vibration in high speed ball bearing applications
Barney Eley, application engineer,
The Barden Corporation (UK)

Let's get the ball rolling with optimum bearing selection
Dan Anderson, applications engineer,
Schaeffler (UK)

3D PRINTING

3D printing: hype or manufacturing technology?
Jurgen Laudus, director - additive manufacturing solutions,
Materialise

Headline sponsors

HEIDENHAIN

SCHAEFFLER

LUK INA FAG

RS

Co-located with

electronics design show

Engineering Materials LIVE!

Workshop sponsors

ALRAD IMAGING

AUCOTEC

Materialise innovators you can count on

man machine

maxon maxon motor uk ltd

SCOTT BADER

NYLACAST ENGINEERING PLASTIC SOLUTIONS

Fastenings

D YOUNG & CO INTELLECTUAL PROPERTY

Engineering Design Show

CHALLENGES IN OUR FREE WORKSHOPS

MATERIALS

Making lightweight parts using the latest long fibre polyamides
Horst Heckel, product manager,
EMS-Chemie GmbH

Materials data and applications for CAD and CAE
Dr Arthur Fairfull, product director,
Granta Design

Nylon - not just for socks!
Dr Malcolm Fox, R&D associate,
Nylacast

MOTORS

Oxford to Minsk on a pint of petrol
Ian Bell, senior sales engineer,
Maxon Motor
Peter Armstrong, DPhil student,
University of Oxford

POWER

Design and analysis of low power MCU applications made simple
Matt Saunders, MCU marketing manager – EMEA,
Silicon laboratories/Avnet Memec

Integrating switchmode power for OEMs
Matt Smith & Keith Barclay application support managers,
TDK-Lambda

ELECTRONICS

Where to begin developing systems for the 'Internet of Things'
Gordon Padkin, microcontroller marketing manager, northern Europe,
Freescale Semiconductor

Managing electronics design data – from concept to production
Robert Huxel, industry specialist – enterprise solutions, EMEA,
Altium Europe

Brewing with Maxim in the 21st century
Keith Welsh, senior applications manager,
Maxim UK

Signal chain designer: A new way to design online
Chris Cokayne, technical solutions engineer,
Analog Devices

Bringing NFC to anything with a micro
Mark Dickson, senior marketing manager for NFC/RFID,
ams AG

COMPONENTS

Exclusive new product launch
RS Components *will be launching a revolutionary new product to the market exclusively at the Engineering Design Show. This will be your first chance to see it and speak to the development team.*

Engineering design show

2 & 3 October • Jaguar Exhibiton Hall • Ricoh Arena • Coventry

For free workshops to assist with your design projects, join us on 2nd & 3rd October by registering at **www.engineeringdesignshow.co.uk**

Physical prototypes and crash testing are both expensive and time consuming, JLR hopes that the virtual world can make these processes much more efficient

Reality

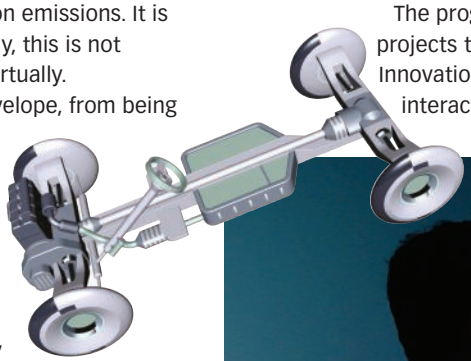
In the future, design could be done entirely within interactive virtual environments that mirror the real world. Justin Cunningham finds out about UK efforts to make the virtual world a reality.

They say hindsight is a wonderful thing. This is certainly true of design and engineering. Despite trying to predict how products will be used and testing against those conditions, it is impossible to foresee how everyone will use and treat them in the real world. That means performance is not always as predicted and, in the worst instances, something unexpectedly fails.

While post analysis might reveal the reasons for any failure as obvious, it is nearly impossible to test against thousands of real world uses and environments at the front end – at least without incurring significant cost.

Like many engineering firms, Jaguar Land Rover (JLR) is facing extremely tough challenges going forward. Essentially, these can be categorised as: 'provide more for less more quickly'. On the one hand, JLR is expected to routinely produce better cars with more functionality and all-round capability. However, this is at odds with the other driver of reducing time to market, lowering production costs and meeting stringent European regulations on emissions. It is being asked to move in all directions at once. Clearly, this is not physically possible. However, it might be possible virtually.

As a brand, Land Rover has a wide operating envelope, from being used as a comfortable luxury vehicle to being a highly capable off-road. This generates some 9,000 individual requirements, which in turn generates the need for 30,000 tests.



Mark Stanton, vehicle engineering director at JLR, says: "I can't control all the 'noise' factors in the real world when I'm doing a test. Every time you drive a car on a dirt road you will change the road surface by driving on it, so the next time you go down it doing exactly the same speed, in exactly the same place, it will give different results."

Virtual testing allows much better control of noise factors, which can be analysed over thousands of different operating and climatic conditions. These factors can be controlled, added and removed with ease – which helps get to 'right first time' designs.

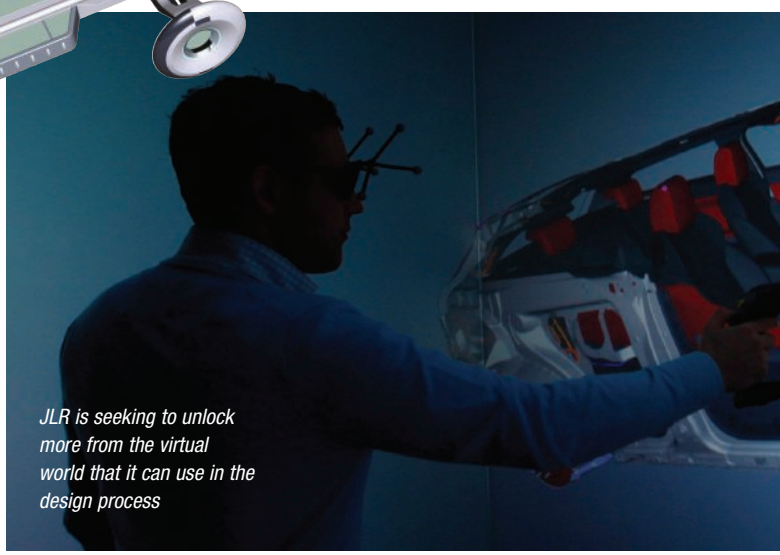
The ideal would potentially involve zero physical prototypes of vehicles. Engineers would be so confident in the virtual vehicle that they could start full production and use the first vehicles off the production line for the necessary certification and testing. Though this is some way off yet (especially for the automotive industry), there is progress.

"We are doing more tuning work in the software, but we still have to tune the physical vehicle," says Stanton. "However, by doing it virtually first we are much closer to that final sign off when we get in to the physical world. And that saves time and money.

"Many engineers talk about the need to do a test on a certain component, but in the virtual world we can do thousands of tests around that one particular part and look at all the factors. That gets a much more robust design when we come to build it physically for the first time. We can simulate, for example, all the use cases in the 178 countries we sell in. We couldn't possibly go to all these countries for tests."

JLR is seeking to unlock more of the potential from the virtual world to use in its design process. This was highlighted last month as JLR announced it will lead a five-year £10 million research programme in conjunction with the Engineering and Physical Sciences Research Council (EPSRC) and four leading universities to develop the UK's virtual engineering capability.

The programme will be made up of a number of projects to form part of the Programme for Simulation Innovation (PSI). JLR describes this next generation of interactive simulation and design capability as



JLR is seeking to unlock more from the virtual world that it can use in the design process

check

Jaguar Land Rover's VR 'Cave' is one of the UK's most advanced virtual design environments

virtual realisation, and it is hoped the programme will help JLR and the wider engineering community to exploit the technology.

JLR is already a keen user of virtual design environments and is known for its 'Cave', a large, wall-sized curved screen that is used to view CAD models with tracked 3D glasses. However, a major part of this programme centres on providing improved realisation to CAD and simulation data.

For example, instead of running a simulation of a new suspension set up on screen, engineers could perhaps instead upload data to a driving simulator and take a car for a realistic test drive. They would be able to see how the new design performs, to see how it affects handling, cornering, the ride, and all sorts of other attributes.

"They can look for and try to find the issues that would only normally show up in the physical testing of a vehicle," says Stanton. "You can feel how it drives down the road, simulate the sound produced across a bonnet and front wing to hear the noise produced by the engine, wind and road. Before we build a car, we can drive it, hear what it sounds like and feel how it handles."

It is early days but virtual tools are increasingly being used in real applications. Augmented reality, the use of haptics and numerous other interfacing tools are coming to market that are better able to immerse users in to an interactive virtual world. The results are eerily realistic in the way they convince the senses that a virtual environment is real.

London-based Inition specialises in developing bespoke real-time 3D graphic applications to create interactive experiences. It recently opened its studio to the public to show just what is possible when it comes to augmented and virtual reality.

"Augmented reality really started as a marketing gimmick," says Jonathan Tustain, communications manager at Inition. "But, it is a really good way of presenting information and designs. Before you would always have glitches, bits would disappear and it was not reliable enough. However, as iPads have become more advanced, you can do some really high-quality graphics."

Indeed, this could become a useful viewing tool for engineers. By looking through the screen of a tablet, a computer-generated image is superimposed on whatever the camera is looking at. Ford has used it to allow people to see how its EcoFlow engine works, while JLR has used it for internal presentations. Done well, it allows people to get up close to designs and strip away or isolate certain parts like the engine, powertrain or suspension.

However, the greatest area of interest for a design engineer is being in a virtual environment that is so realistic that they are able to develop and test products as if they were real. This is a major area of interest for Inition going forward.

"One of things we are looking at with virtual reality is ways of simulating the senses" says Tustain. "We are looking at gloves that have individual bubbles on the fingers that compress to make it feel like you are touching objects. However, this kind of technology is still a way off."

Trigger reactions

A major part of PSI looks to assess and find out if there are mechanisms that will make people interact with a simulated situation as if it were real. Indeed, it might be that the user knows a situation is not real, but the simulation will trigger the same interaction and reaction as it would in the real world.

Professor Alan Chalmers from the Warwick Manufacturing Group is a principal investigator on one of the projects that make up the programme. He says: "We want to improve the level of realism so we can make confident decisions about how something will behave in reality. Once you understand it, you can apply it to all manner of designs.

"We want the decision you make in a virtual environment to be exactly the same as the one you make in the real environment as you have all the same multisensory information."

A vital part of the programme is looking at the human factors involved and the behaviours generated between a person and the environment. It is hoped that by better understanding this aspect of virtual engineering, it will improve confidence in the decisions made in virtual simulations as they will closely correlate with the real world.

Dr Hamish Jamson from the University of Leeds is carrying out work to assess driving simulators as part of PSI. He says: "It is a huge challenge getting everything in a full interactive simulation. And to be able to simulate the complete complexity of the real world is really an unachievable goal.

"So, how much of the prototyping and testing can we do virtually? How much can we do with human and machine interface developments, vision design and those kinds of aspects, and how much driving simulation can we do? One of the reasons that interactive driving simulations are such a challenge is because, as humans, we are really good at perceiving things. There are an awful lot of perceptual cues that we need to create in simulators to convince the brain it is a realistic environment."

Part of Dr Jamson's work will involve finding out the limits of the technology and advising JLR on how much prototyping and development can be achieved virtually. This is in addition to providing an insight in to what the certain triggers are for real world behaviours and reactions.

"We want to model perceptions, understand why drivers make certain decisions, and begin to model that process," he says. "Not just the visual, but also motion systems such as haptics and the cues that drivers use to create the manoeuvres that they do."

www.jaguarlandrover.com
www.epsrc.ac.uk
www.inition.co.uk
www.warwick.ac.uk
www.leeds.ac.uk

Augmented reality

Augmented reality uses smartphones or tablets to overlay computer generated imagery (CGI) in real-time on a real background. An example where this might be used in the engineering world is looking at a drawing, sketch or concept design on paper. By looking through a tablet, for example, the image would come to life and a CAD model would appear on screen that tracks the movements of the user as they walk and look around it.

Jonathan Tustain, communications manager at bespoke 3D graphic specialists Inition explains how it works: "There are very small points on the floor mats which act as markers that an iPad will pick up. The rest of the pattern has to be completely randomised, which is why they look the way they do."

It is gathering momentum among architects that are using it to show future developments. It can show airflow around buildings, shadows at different times of day, internal systems, local traffic, and you can even go in to each room and see what the view will be like. This has proved a powerful marketing tool and the same sorts of applications could no doubt be done with engineering firms.

True believer

Relatively new as it is, additive manufacturing nonetheless has a number of veterans. Paul Fanning asks one of them about the technology's potential.

When it comes to additive manufacturing, Jeff DeGrange does not hesitate to nail his colours to the mast. "I'm a true believer in the technology," he says, "and I think we're in the early stages of it. So I have to put my biases on the table early on."

These biases, however, are not indicative of the wide-eyed enthusiasm of the recent convert to 3D printing. They are instead predicated on the better part of two decades at the cutting-edge application of the technology.

Having worked at McDonnell-Douglas and Boeing for the first 20 years of his career, DeGrange spent a number of years in Boeing's 'Phantom Works' advanced manufacturing facility. Here, between 1997 and 2008, he led the company's additive manufacturing technologies division. "My biggest claim to fame and success was getting actual parts onto the F18 fighter programme as well as a number of UAVs and ultimately parts on the 787 programme," he says.

In 2008, though, he moved to Stratasys to become the company's vice president of direct digital manufacturing. Here he has responsibility for application development in product management – particularly in the aerospace, defence and automotive sectors.

So there aren't many people better qualified to assess the future when it comes to additive manufacturing and, in general, DeGrange is very positive about AM's role in the future. He does concede, however, that there are still factors limiting its adoption. One of these, he feels, lies in the fact that design engineers do not truly understand the technology.

"With a disruptive technology, you don't just turn up with a machine and expect it to deliver straight away," he says. "One of the big limiting factors is that design engineers have to learn to design to it. It's very different to conventional processes and a lot of people don't know how to design to it. There have to be design guidelines and information that take design engineering departments through that particular learning curve."

But it's not just designers who have to change. Says DeGrange: "The manufacturing departments also need to learn the processes such as how you need to adjust the build orientation in the machine. Because, depending on how you orient the product in the machine, you're going to get different mechanical properties. And a lot depends on how you place your file – it is, after all, an anisotropic [having different properties according to the direction of measurement] process."

However, DeGrange believes these problems are already being overcome. "I think you're already seeing significant growth in a lot of these 'early maturity' companies who are starting to 'get it'. I think one aspect of that will be generational. The younger generation coming through worldwide live in an on-demand world where the younger people are so tech-savvy that this feeds right into that. It's just going to be a natural expectation for the 20-something workforce."

Another factor he believes is making a major difference is the sheer number of initiatives supporting the technology from a governmental perspective. In particular he cites the US National Additive Manufacturing Innovation Institute, which was referenced by President Obama in his 2013 State of the Nation address.

In fact, though, there are already significant (and growing) levels of adoption taking place. In part this is coming about through the need for rapid design evolution in military applications, but also because of more fundamental cost implications – particularly when it comes to tooling. Says DeGrange: "You no longer need to invest in hard metal tools and keep them in a warehouse. In many cases, if you're making tools with the additive process, it's often so much less expensive than the hard metal tooling that you can actually throw them away when you're done and thus not have the need to inventory, track and maintain them over the years. If you need to use them again in the future, you can just call up the CAD file…essentially, your computer becomes your warehouse."

"It is very different and a lot of people don't know how to design to it"

DeGrange also cites the US Navy's Fleet Readiness Centers as a good model of the effectiveness of AM. At these, any vehicles that have suffered fatigue or battle damage come in for repair and, for obvious reasons, are 'on the clock' to get the vehicle back in battle-ready condition. Here, claims DeGrange, is "where AM technologies can come in and shine".

"A lot of these repairs that have to happen are usually one-off repairs requiring specialised tools to fix," he says. If you have to make a new repair panel, for instance… What's interesting is that the civil aviation folks are seeing this and realising that it could apply to them. They suffer things like birdstrike or service vehicles bump into them and they have to be pulled out of service. Every hour they're not operating is an hour they're not making money for the airlines, so how can you reduce the amount of time they spend out of action? Additive manufacturing is one of the answers as it can respond to this sort of unique, unplanned repair."

www.stratasys.com

Rapid fire

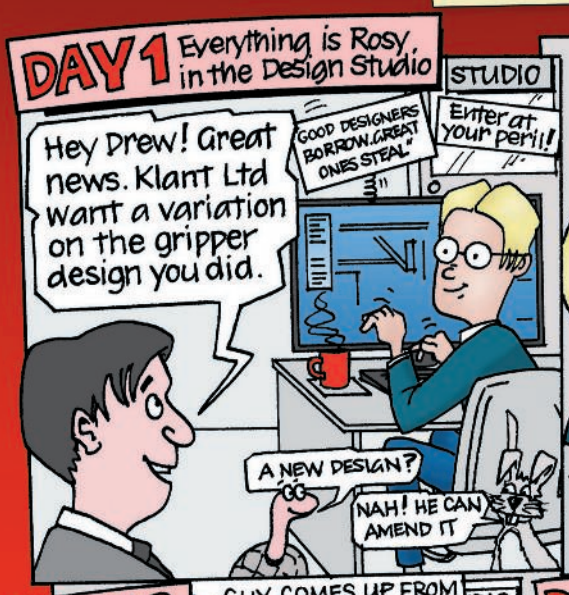
With more than 20 years' experience in manufacturing technology, including leading an advanced manufacturing research and development programme at Boeing, Jeff DeGrange has also held positions at McDonnell Douglas Aircraft and Raytheon. He has been listed among the 'Top 25 most influential people in the world in rapid product development and manufacturing', receiving this honour because he pioneered production flight applications for rapid manufacturing and additive fabrication tooling applications.

Jeff holds a B.S. degree in industrial engineering from the University of Iowa and an M.S. degree in manufacturing engineering from Washington University in St. Louis, Missouri.

nt CADCAM SOLIDWORKS
ELITE RESELLER

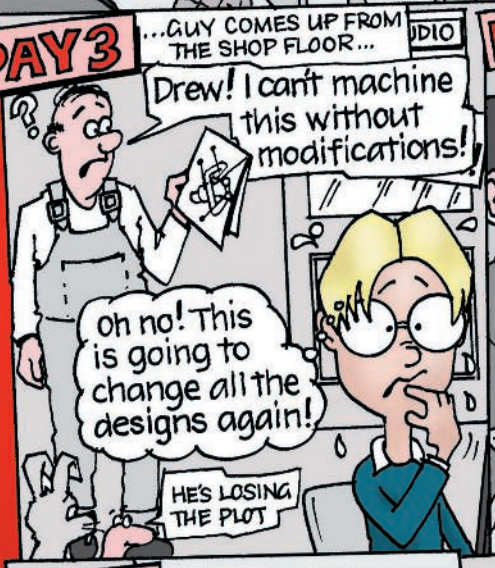
Drew Cadman

DAY 1 Everything is Rosy in the Design Studio

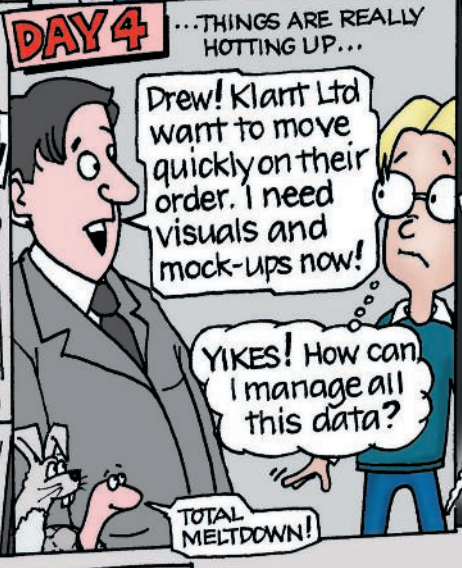


DAY 2 ...THE BUYER VISITS...

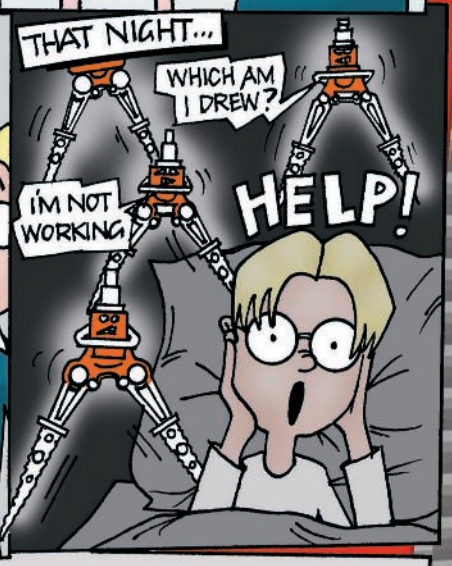
DAY 3 ...GUY COMES UP FROM THE SHOP FLOOR...



DAY 4 ...THINGS ARE REALLY HOTTING UP...

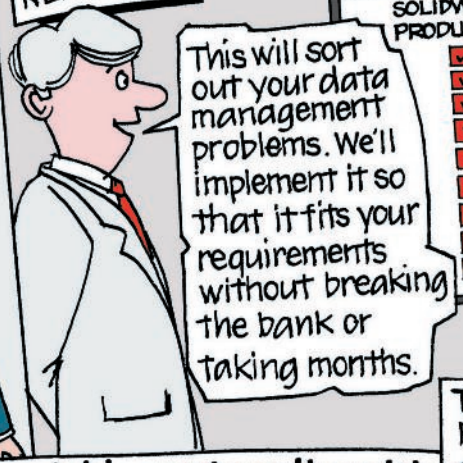


THAT NIGHT...



DAY 5 ...A TIRED DREW PHONES NTCADCAM...

NEXT DAY...



SOLIDWORKS ENTERPRISE PRODUCT DATA MANAGEMENT

- ☑ SECURITY
- ☑ PRE-CONFIGURED VAULT
- ☑ STANDARD LIBRARIES
- ☑ REVISION CONTROL
- ☑ FILE STATUS
- ☑ FILE NUMBERING
- ☑ STANDARD REPORTING
- ☑ ISO900 COMPLIANCE
- ☑ WORKFLOWS

THE MORAL OF THE STORY...
Right data to the right people at the right time with EPDM

MANAGE your data quickly and easily with SOLIDWORKS ENTERPRISE PDM and NT CADCAM's EPDM FOUNDATION IMPLEMENTATION **FIND OUT HOW**

CALL **0800 018 6957** or visit Drew at www.ntcadcam.co.uk/drewcadcam

Changing the face of defence

Is defence the sector in which additive manufacturing is first going to become mainstream? Or is it already? Paul Fanning reports.

The defence industry has traditionally been at the cutting edge of technology – and for good reason. The need to stay one step ahead of the enemy has meant that defence industries are not only able to be, but are actively required to be somewhat less risk-averse than some of their civil counterparts.

This need to be flexible and quick to respond has long meant that the defence sector has been an early adopter of certain technologies, being able to circumvent many of the assessment and evaluation processes that necessarily delay other sectors.

This peculiar set of circumstances has made defence a fertile breeding ground for innovation in the use of additive manufacturing (AM) technologies. In some senses, of course, there is a near-perfect fit between AM and defence. Defence often requires parts quickly, in low volumes (often singly, in fact) and to allow for rapid reconfiguration, modularity and even 'on the fly' redesigns. These and other factors mean that additive manufacturing is moving further and faster in the defence sector than elsewhere.

Jeff DeGrange, Stratasys' vice president, new business development in direct digital manufacturing, says: "The necessity for the design process to move quickly is a huge pull for AM. You can reconfigure vehicles very quickly based on additive manufacturing and in the CAD process."

One area where AM has seen rapid and extensive adoption is in Unmanned Aerial Vehicles (UAVs). Their unmanned nature means that safety concerns are somewhat lessened, of course, while the constant and pressing need to adapt them makes them ideally suited to the application of AM.

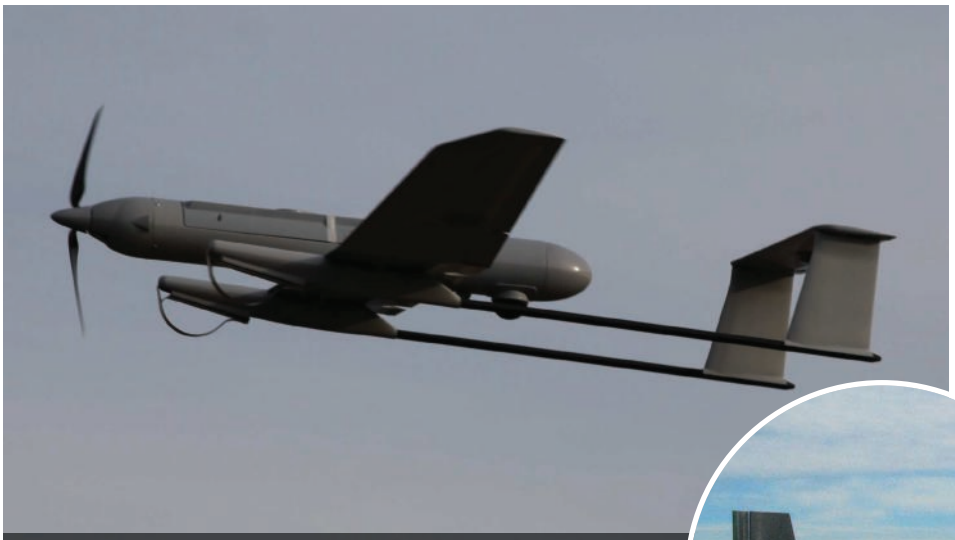
"Adoption of additive manufactured parts in unmanned vehicles is much, much easier," says DeGrange. "But also, the designers are always trying to push five pounds of stuff into a three-pound area. So how can you do that from a product design point of view? Well now you can actually optimise design and have freedom of design. You can do that in such a way that you can get as much electronics or hardware as you need to get into a structure. It gives you the ability to design what you need to do with the additive processes. In the UAV and drone community there has been a huge pull for the technology and one of the main reasons is in order to put that five pounds of stuff into a three-pound area."

Survey Copter uses two Stratasys machines for the production of components for mini-UAVs

One example of a company doing precisely this is France-based Survey Copter. A subsidiary of the European Aeronautic Defence and Space Company NV (EADS), specialises in the design, production and integration of complete remote systems for surveillance photography and video service applications for UAVs and other airborne craft, as well as for sea and overland vehicles.

Having previously outsourced its prototyping requirements, Survey Copter turned to Stratasys for an in-house solution that could reduce costs and ensure greater efficiency and autonomy, granting the company the means to rapidly produce very small quantities within 24 hours. Via Stratasys' French distributor CADvision, Survey Copter subsequently installed two 3D printing solutions – a Stratasys Dimension Elite 3D Printer and Stratasys Fortus 400mc 3D Production System, which offers nine production-grade engineering thermoplastics using Stratasys' patented Fused Deposition Modelling (FDM) technology.

"Effectively meeting our 3D printing needs



UAVs are proving a fertile sector for the adoption of additive manufacturing

can only be achieved via machines that are capable of producing quality parts with high reliability," explains Jean Marc Masenelli, managing director of Survey Copter. "Stratasys' reputation for delivering 3D printers that meet these criteria head on made them the logical company with which to partner."

Spearheading Survey Copter's prototyping and short-run manufacturing activities, the Stratasys Fortus 400mc and Dimension Elite 3D Printers are deployed in the production of component parts for the company's mini-UAV systems, including both helicopter and fixed-wing variants weighing up to 30kg and 10kg respectively. Ranging from a few millimetres up to parts measuring 40cm x 10cm, these components comprise mechanical structures for optical turrets, structural elements of aircraft, battery compartment housing, supporting structure, as well as scale models.

For Masenelli, the ability to utilise different materials according to specific application needs offers key advantages for producing durable 3D printed parts. Such materials include FDM thermoplastics polycarbonate, ABS and high-performance ULTEM 9085 which boasts superior strength and lightweight properties, as well as other desirable characteristics including FST (flame, smoke and toxicity) rating. This safety standard, particularly valued within the aerospace and transportation industries, ensures a material won't promote a fire, release harmful smoke, or emit toxic fumes.

"That we are able to print production-grade materials such as high-performance FDM thermoplastics like ULTEM, which is qualified for aerospace applications, is a definite plus for our operations," he explains.

"The Stratasys 3D Printer can produce parts with complex shapes – for us a highly sought after requirement and a principle differentiator that sets Stratasys' proposition apart from that of other providers," he adds. "This specific capability enables us to produce parts of wide-ranging dimensions and hollow forms, as well as full honeycomb structures."

"The necessity for the design process to move quickly is a huge pull for additive manufacturing. You can reconfigure vehicles very quickly based on additive manufacturing and in the CAD process"
Jeff DeGrange

Featuring two material bays for maximum uninterrupted production, the Stratasys Fortus 400mc 3D Production System produces accurate, durable, repeatable 3D parts with superior throughput. It is available in two configurations: the basic system which builds parts as large as 355mm x 254mm x 254mm, and an optionally upgraded system which builds parts as large as 406mm x 355mm x 406 mm. With four layer thicknesses to choose from, users can fine-tune their desired balance between FDM's finest possible feature detail and the fastest build.

The Stratasys Dimension Elite 3D Printer features the finest resolution of any Stratasys Design Series Performance 3D Printers and produces nine colours of real ABSplus thermoplastic. When the finest dimension resolution of 0.178 mm is not required, the Dimension Elite allows users to accelerate printing with a layer thickness of 0.33 mm.

According to Jeff DeGrange, the impact of AM in the defence sector is only just beginning to be felt. He believes, in fact, that it will fundamentally alter the way in which products are made completely. He says: "I think in the defence industry that you're not going to see tens of thousands of military products being produced anymore. I think you're going to see maybe a thousand of the objects being produced and then maybe a faster evolution of those original products."

He continues: "The enemies are finding a way to counter defence innovations, so that evolution has to be matched and bettered. So, for instance, if you're using small UAVs in the Middle East and you're using a lot of those and they're being shot down, you may need a redesign to allow you to fly at a greater altitude or a greater airspeed. So you're going from model one to models two and three very quickly. Alternatively, what if you need to have a base system that you can reconfigure to do multiple missions – ie putting on different wings to allow you to have extended ranges or to carry a greater payload? So the idea is to be able to do that easily. AM can achieve that."

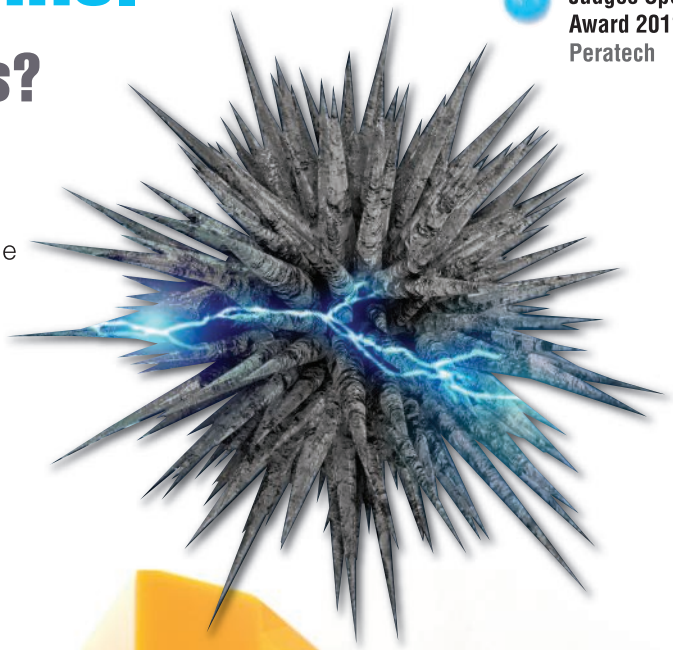
www.stratasys.com
www.survey-copter.com
www.eads.com

** For an interview with Jeff DeGrange, please turn to page 24 of this month's issue.*

"This material is something technologically terrific."

Think you've got what it takes?

Judges Special Award 2011
Peratech



Now in their fifth year, the **British Engineering Excellence Awards** has given many products, people and companies the recognition they deserve!

Want to join them?

It's quick and simple to enter!

1. **VISIT** www.beeas.co.uk
2. **SELECT** your category
3. **COMPLETE** the online entry form

Entry deadline – 31st July 2013

Organised by

findlaymedia

EUREKA

newelectronics

Headline sponsors

Cambridge Consultants

Digi-Key Corporation

Sponsors

National Instruments

Mouser Electronics

anglia

igus.co.uk

D Young & Co Intellectual Property

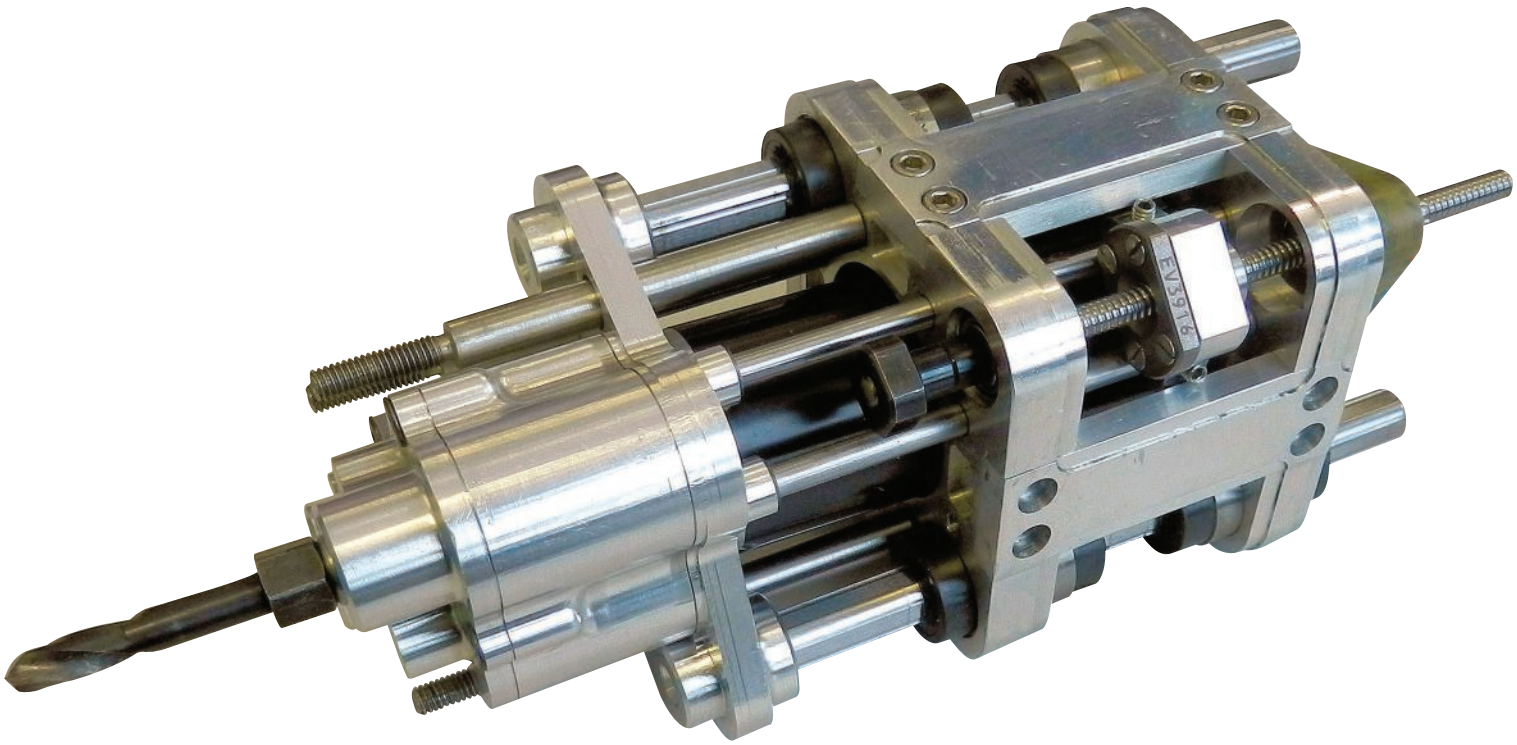
Gallery sponsor

RS

beea

british engineering excellence awards

www.beeas.co.uk



Gearbox design is not child's play

A highly complex gearbox for an innovative robotic drilling application has been developed using Meccano. Paul Fanning reports.

Engineers in the new Design & Prototyping Group of the University of Sheffield's Advanced Manufacturing Research Centre (AMRC) have developed a compact gearbox for an innovative robotic drilling system. This invention, which allows the automated system to adjust its parameters quickly when drilling complex aerospace structures containing both metal and composite materials, was developed in part using Meccano to develop the prototype.

The latest aircraft use an increasing amount of carbon fibre and other composites. By using these lightweight materials instead of metals, aircraft can be made lighter and more fuel efficient. In some applications where extra structural strength is required, layers of composite are stacked with layers of titanium or aluminium alloy. Often, such a layered stack has to have holes drilled through it so that fasteners can be attached.

These composite and metallic materials have very different material properties, and would normally require different drilling parameters. For example, drilling a carbon fibre composite commonly requires high speed and low torque, while drilling titanium typically requires low speed and high torque. Drilling a hole through a stack of both materials demands a tool that is capable of switching quickly and efficiently between these various modes.

Designing such a tool is made more complicated by the fact that it will often have to be deployed in confined spaces, such as within wing boxes or engine intake ducts. In conjunction with Boeing, Researchers at the AMRC have previously developed flexible robots carrying lightweight tools to do essential tasks in such awkward spaces, including a confined space drill.

By definition, the confined space drill has to be small in size. The motor which can be fitted to it also has to be limited in size, and cannot necessarily cover the range of speeds and torques required for optimised stack drilling.

One solution to this problem would be to develop a compact, lightweight gearbox which could fit between the drill bit and the motor (a maxon Powermax in the prototype system), and provide the required range of output torque and speed. The gearbox would need to provide two gear ratios to vary the speed and torque of the

"Its design was particularly demanding because we had to fit it onto our existing confined space drill. It had to be as small and light as possible, while still covering a wide range of output speeds" Dr Garth Nicholson

drill, without using electrical, hydraulic or pneumatic actuators and control systems which would increase the bulk and weight of the system.

The challenge fell to the AMRC's new Design & Prototyping Group as part of an internal generic project backed by Boeing. The project was led by senior design engineer Dr Garth Nicholson, who said: "Our solution was what we have called a passive input gearbox, which automatically changes gear ratios depending on the rotation direction of the drive motor, while always maintaining the same drill rotation direction," says Nicholson. "Its design was particularly demanding because we had to fit it onto our existing confined space drill. It had to be as small and light as possible, while still covering a wide range of output speeds."

To create a first conceptual prototype, Nicholson turned to a well-proven technology: Meccano. Says Dr Nicholson: "We built a simple physical model out of Meccano, just to prove that the concept could work," Nicholson explains. "We investigated several basic designs, and settled on a multiple-stage spur gearbox as the most efficient and compact concept."

The final design featured a combined two-stage and seven-stage gear train, using a constant-mesh design to make the most efficient use of space. The two gear trains give a difference in output speed of around 10:1 for the two equal but opposite input speeds. Each gear train includes a one-way 'sprag' clutch, so a change in input direction automatically causes a shift of drilling mode.

"It is a relatively simple matter to automate the reversing of the drive motor at the appropriate time," Nicholson notes. "We can either pre-programme material thicknesses into the drill's feed motor controller, or use the current-sensing mode of the maxon motor controller to detect the changes in power consumption as the drill tip reaches material interfaces."

Nicholson used a range of software tools to design a gearbox which would fit onto the confined space drill. The casing was then machined from aluminium in the AMRC's workshop, while the internal gears were produced by HPC Gears Ltd of Chesterfield to Nicholson's specifications.

The assembled gearbox is now being evaluated at the AMRC. Following successful tests with the drill motor, the gearbox is now being integrated into the confined space drill chassis. A full test programme will trial the different options for material detection, and investigate the process capability of the whole system for stack drilling.

The AMRC Design & Prototyping Group was created in 2012 to address a severe shortage of exceptional engineering designers. The UK has a rich heritage of industrial design, but top-tier manufacturers and suppliers alike are struggling to secure the design expertise they need to bring new products and components to market.

In high-value manufacturing sectors such as aerospace, energy, motorsport and medical technology, designers need to work closely with their R&D, prototyping and testing centres if they are to perfect their designs through a series of extremely intense product development cycles.

"Creating such a complex gearbox within very tight constraints was a challenging project, but shows the capabilities of our new Design & Prototyping Group," says Dr Nicholson. "We are open for business and would love to hear from anyone who needs help with any kind of design project."

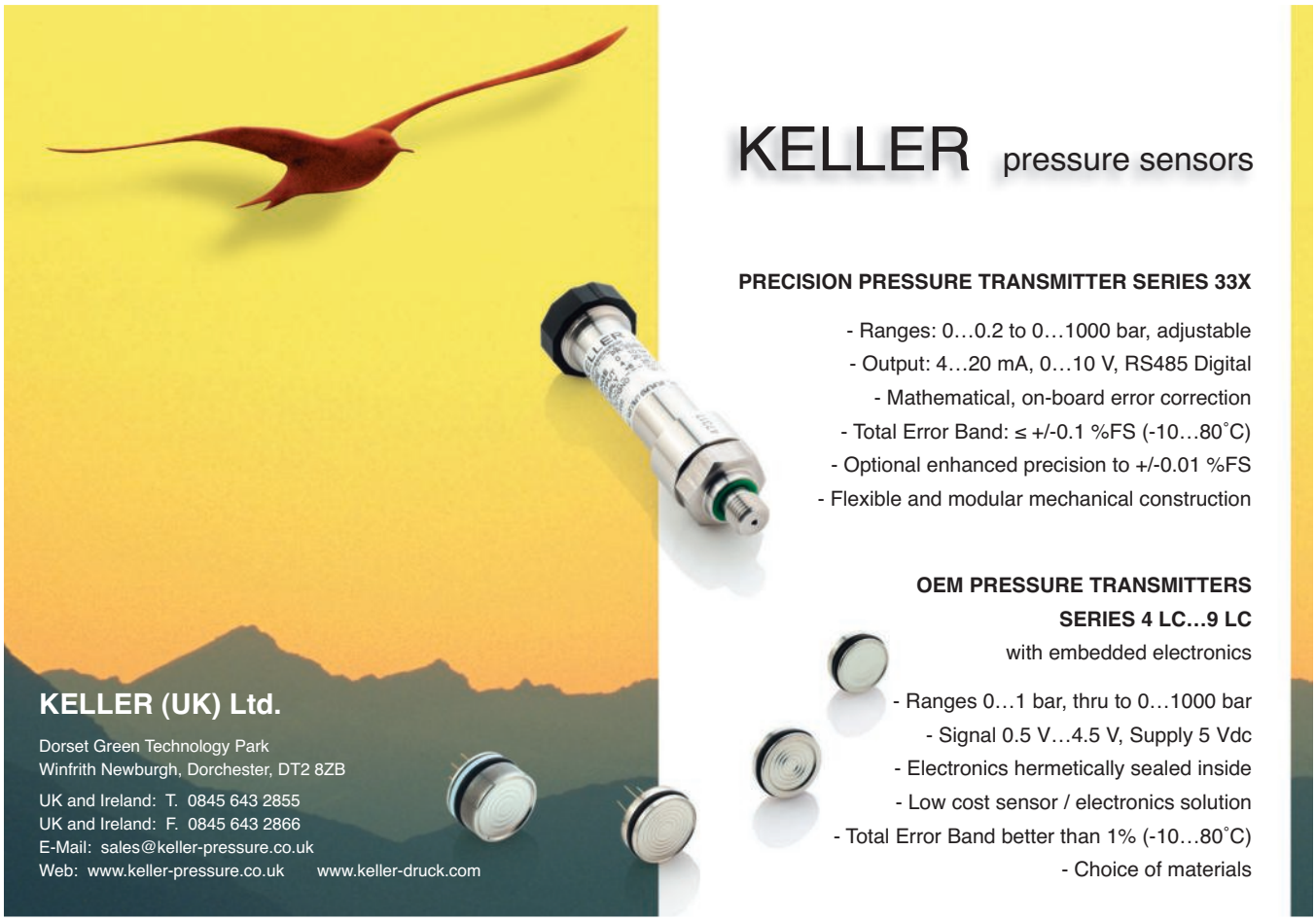
www.amrc.co.uk

Highly motor-vated

The EC-4pole brushless motor from maxon motor proved to be ideal for this project, manufactured in a 22mm and 30mm version its high power density and speeds of up to 25,000 rpm make it ideal for high performance drill applications.

Paul Williams, a senior sales engineer at maxon comments: "The brushless motor with MR (magnetic reluctance) encoder allows the customer to quickly control the exact speed and torque on the drill; AMRC innovative two-speed gearhead allows high-speed drilling with low torque and to high-torque, low speed to meet the different drilling parameters within one drill tool."

www.maxonmotor.co.uk



Sensors for Harsh Environments

Gill Sensors design and manufacture precision sensors for measurement of position, liquid level, speed and flow. We supply products worldwide to defence, motorsport, industrial, off-highway and other industries that demand robust, accurate control and measurement in extreme operating conditions.

Liquid Level Sensors

Rotary & Linear Position Sensors

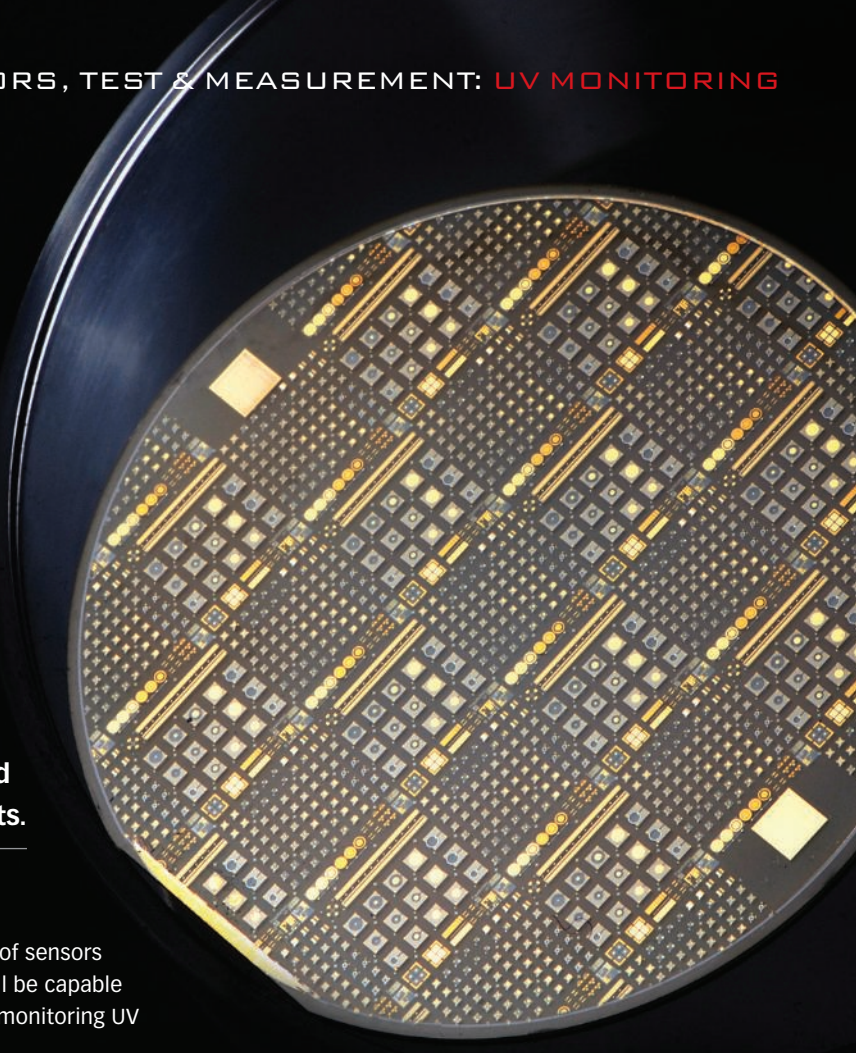
Speed Sensors

Flow Sensors

Sensors & Instrumentation
for Test, Measurement & Control
25th & 26th September 2013 / NEC/ Birmingham
STAND F7

www.gillsensors.com
Saltmarsh Park, 67 Gosport Street, Lymington, Hants, UK
+44 (0)1590 613400 • info@gillsensors.com

Continuous measurement made possible



Monitoring ultraviolet light is important for many industrial curing applications but it can have a detrimental effect on the sensing components and surrounding equipment. Justin Cunningham reports.

There are many industrial manufacturing processes that require the use of UV lamps to cure coatings or adhesives. Its use is particularly prominent in the UK's food industry where it is commonly used to cure the adhesive around packaging containers and to disinfect water.

These processes often require the precise measurement of the UV light on a surface. Special sensors are normally used but these tend to quickly age under constant exposure to the UV light, and deteriorate in performance as a result. To combat this problem they are normally used intermittently, taking short snapshots to monitor UV levels.

Often these sensors are made of silicon, which can only deliver useful results if visible light is blocked out while measurements are taken. This is usually done using external filters that are both expensive and not particularly resistant to UV.

Silicon carbide sensors on the other hand have the advantage of being able to withstand longer exposure to UV light, but they usually only operate within a narrow spectral band. In the majority of industrial curing processes it is the longer wavelengths that are of interest, precisely the area that silicon carbide sensors are least accurate.

As a result, researchers at Germany's Fraunhofer Institute have been considering the problem and have been able to develop a new generation of sensors that they say will be capable of continuously monitoring UV light.

"Our sensor is based on aluminium gallium nitride technology and can withstand continuous exposure to UV light without damage," says project manager, Dr. Susanne Kopta. "This enables it to be used not only for intermittent snapshots but also for permanent inline monitoring."

A sapphire wafer serves as the substrate for the sensors and researchers have been able to apply epitaxial growth to deposit layers of the active material onto the substrate. In other words, the layers have a crystalline structure.

The detectors can be set to operate in two different ways, the first is to define a maximum wavelength threshold where the sensor detects all UV light emitted at wavelengths below the set limit. The alternative is to define two wavelength thresholds, blocking out certain parts of the spectrum. The narrowest range researchers have been able to achieve is a separation of just 20nm. The researchers set the wavelengths to be detected by the sensor by varying the ratio of gallium to aluminium in one of the aluminium gallium nitride layers.

A key challenge has been the growing of aluminium gallium nitride crystals in such a way that they are free of structural defects and impurities, which would result in unreliable measurements as different areas of the sensor absorb different wavelengths.

The UV sensors can work individually or can be made into an array by placing more than 100 detectors side by side in a strip. This produces a 'UV camera' that can monitor plasma deposition processes such as those employed to coat solar cells with an anti-reflective film.

The sensor strip can also serve as a spectrometer where the UV light is first passed through a diffraction grating to split the light into its various spectral components. Each individual sensor detects a specific wavelength and provides information on the intensity of light at that wavelength. This allows for aging tests of mercury lamps commonly used for water disinfection or UV checking if lamps are still emitting light at the desired intensity throughout the entire spectrum.

The sensing technology is now entering a period of refinement before it is rolled out to wider industrial applications. The next stage of the project is to optimise crystal growth and obtain more defined wavelength limits.

www.fraunhofer.de

Image sensors find space

British-designed imaging sensors are being deployed aboard many of the latest spacecraft. Paul Fanning reports.

Imaging sensors from UK company e2v are being deployed on board some of the latest and most advanced spacecraft being launched.

Essex-based e2v is a leading supplier of high-sensitivity image sensors to the global space sector. Launched into orbit with satellite missions, e2v's sensors transmit back to Earth detailed images of new scientific discoveries. These include the detection of new extra-solar planets, findings from investigations into black holes and detailed astronomical information on significant environmental climate changes. Custom sensor designs and packaging from e2v are recognised for their technical excellence by the world's major space agencies, including NASA, ESA, JAXA and CSA.

In April, e2v's high-performance imaging sensors were launched into space on board the European Space Agency's (ESA) Albert Einstein spacecraft, the fourth Automated Transfer Vehicle (ATV) to be sent to the International Space Station (ISS).

The e2v CCD47-20 imaging sensors were selected by instrumentation company Sodern as part of the two key systems it delivered for the ATV: These were an SED16 star tracker, an optical device used for determining the orientation of the spacecraft by measuring its position relative to stars, and a Videometer, which is the primary rendezvous and docking sensor for the spacecraft. Built under Astrium prime contractorship, the first three ATVs (Jules Verne, Johannes Kepler and Edoardo Amaldi) were also equipped with these e2v imaging sensors and successfully completed their missions in 2008, 2011 and 2012 respectively.

The Albert Einstein ATV was carried into orbit on board an Ariane 5 rocket from French Guiana and hauled almost 7 tonnes of cargo to the ISS 360km above the Earth. The spacecraft is the most powerful automatic spaceship ever built and is equipped with its own propulsion and a high-precision navigation system. e2v imaging sensors will automatically guide it into dock at the ISS, playing a key part in the approaching and docking manoeuvres that are so precise that, when 249m away from the ISS, the ATV will slow down to 7cm/sec.

The ISS relies on frequent deliveries of equipment, fuel, spare parts, food, air and water for its permanent crew. The unmanned ATV is essential in delivering supplies to the ISS and will stay attached to the station, providing reboost and attitude control. Once undocked, it will be commanded to burn up in the atmosphere over an uninhabited area of the southern Pacific Ocean.

e2v's marketing manager, Jon Kemp says: "Albert Einstein is the fourth ATV to have been launched into space. e2v's imaging sensors are a key component in enabling the ATV to successfully dock with the ISS and provide essential wet and dry cargo to the astronauts on board."

More recently in May, e2v sensors were launched into space on board Proba-V, an Earth observation microsatellite operated by ESA that has been specifically designed to chart global vegetation. The satellite was carried into orbit from French Guiana by VERTA 1, the second Vega launcher.

For almost 15 years the instruments on board the Spot 4 and 5 Earth observation satellites have monitored and mapped worldwide vegetation, providing essential information on crops, droughts, desertification, changes in vegetation and deforestation. These instruments will become unavailable later this year and, whilst ESA's Sentinel 3 satellites will eventually take over the supply of this information, they will not be operational in time to take over. ESA has therefore specifically designed Proba-V, which is equipped with a miniature version of the vegetation sensor that is on board Spot 5, to chart global vegetation every two days and provide a continuity of service to the community of more than 10,000 users.

Proba-V's instrument is equipped with an e2v AT71547 Charged Coupled Device (CCD) image sensor. This particular sensor is made up of four lines of 6000 pixels each and benefits from a long space heritage, having been used in a number of Earth observation missions. e2v provided a custom solution for this mission by mounting and positioning the window on the image to meet the stringent requirements of this multispectral application.

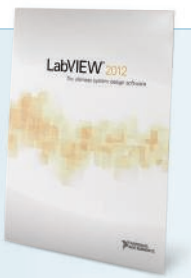
www.e2v.com
www.esa.int

The Trusted Leader

for Any Measurement

NI data acquisition products are the most trusted computer-based measurement devices available, offering superior accuracy and maximum performance. NI CompactDAQ systems feature more than 50 measurement-specific modules and complete breadth and depth of I/O. Coupled with the analysis and signal processing capabilities of NI LabVIEW software, this platform puts the power of graphical system design at your command so you can build any measurement system faster.

LabVIEW offers powerful analysis functions for sensor and signal data, simplifies GUI development and helps you program the way you think–graphically.



>> Accelerate your productivity at ni.com/measurements-platform

01635 517300 | **uk.ni.com**

Explore the world of NI LabVIEW and the graphical system design approach through the 12-part Summer of LabVIEW webcast series. Register now at **uk.ni.com/summeroflabview**

Follow us on *Search* **niukie**

NATIONAL INSTRUMENTS

Precision angle measurement

With its lightweight WAL 315 potentiometer, Contelec now supplies an innovative angle measuring device tailored to the specific needs of joystick applications.

One of the key characteristics of the potentiometer is the peripherally arranged centre of rotation – just 5.5 mm from the edge. Combined with the noticeably compact, slim design, this allows complete joystick systems to be kept small. The WAL 315 enables the measurement of electrical angles up to 100° with ±1% linearity.

To meet high safety requirements, a fully redundant version of the WAL 315 is available. Power supply, ground and signal output are in duplicate. The redundant outputs can be used either as two independent output signals or, alternatively, the second signal output can implement application-specific switching functions (for example to define forward or reverse).

The WAL 315 potentiometer is potted in high-grade, temperature-resistant epoxy resin, making it extremely rugged and able to withstand harsh environmental conditions. This is evident in the specified protection rate of IP65 and permissible temperature range of -25 to +85°C.

www.variohm.com

Wind sensor uses corrosion-free bearings

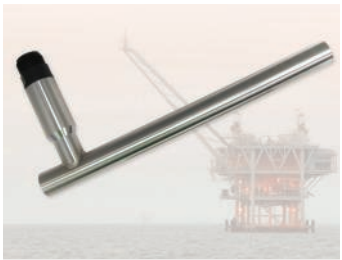
An innovative wind speed and direction sensing unit has been developed by Autonnic Research. Intended for use on yachts but also suitable for fixed applications such as airports, the A5120 has high performance bearings that are highly resistant to corrosion.

Intended as a front end for OEM applications, the unit uses magnetic sensing technology to deliver a digital output via a cable up to 30 m long to interface with manufacturers' navigation and display systems.

The use of all-polymer bearings for both the wind speed and the direction sensors without the use of stainless steel means that the unit is not affected by corrosion from seawater.

The unit has a robust mounting between body and support pole and can be easily removed from the masthead when the mast is removed. The power supply required is 10-30 Vdc with a maximum consumption of 20 mA.

www.autonnic.com



SENSORS FOR SUBSEA MEASUREMENT

Macro Sensors has developed a line of submersible LVDT position sensors for use as part of subsea measurement systems. Macro Sensors LVDTs are proven to offer reliable measurement and feedback for continuous monitoring. The SSIR 937 Series Submersible LVDT Position Sensor is now a standard design available from stock for fast turnaround.

The SSIR 937 series can withstand deep sea environments with external pressures up to 5000 psi while still offering excellent repeatability. Inconel construction enhances the already high reliability of the LVDT assembly, ensuring the submersible transmitters can meet life requirements of at least 20 years, even if the device is fully exposed to seawater at depths greater than 10,000 feet.

Designed for use in either pressure-balanced, oil-filled containers or directly in seawater, these rugged, 0.94 inch (24 mm) diameter LVDT Position Sensors are available in standard ranges of 2.00 inches (50 mm), 3.00 inches (75 mm) or 4.00 inches (100 mm).

www.macrosensors.com

Fibre amplifiers deliver stability

Omron has expanded its N-Smart portfolio of smart laser sensors and amplifiers with the launch of the E3NX-FA range of fibre amplifiers. Available with a single output as standard and two outputs on advanced models, these innovative amplifiers offer fast and effective auto-tuning, comprehensive support for manual tuning, and the industry's widest dynamic range to ensure stable detection of targets.

With advanced Smart tuning, the user just needs to press the tuning button once with the target present, and again with the target absent to automatically set the optimum incident level and threshold. Comprehensive manual tuning options are also supported to enable the detection mode and the threshold to be optimised.

Further, the dynamic range has been increased by a factor of 40,000 compared with conventional amplifiers to provide enhanced detection reliability.

www.omron.com

MOTION & CONTROL™
NSK

PARTNERSHIP BASED ON TRUST – AND TRUST BASED ON QUALITY

Bearings for the food and beverage industry: compliant with the strictest hygiene requirements

NSK bearings for the food industry are robust, made from corrosion-resistant stainless steel, and have extended relubrication intervals. NSK's special solid lubricant, Molded-Oil, is suitable for use in areas where hygiene is paramount. Molded-Oil guarantees reliable lubrication without oil leaks, safeguarding uninterrupted production and a long service life.

NSK – one of the world's leading manufacturers of bearings and linear systems. A premium brand since 1916.
To find out more about NSK, visit www.nskeurope.com or call us on +44 (0) 1636 605123

NSK UK Ltd · Northern Road, Newark, Nottinghamshire, NG24 2JF · info-uk@nsk.com

Bearings of a behemoth

As NASA looks forward to its next generation of spacecraft, it needs to beef up its existing ground transport vehicle to cope. Justin Cunningham finds out more.

One of the world's largest tracked vehicles is getting a much-needed overhaul after 45 years of service.

The colossal Crawler Transporter 2 (CT-2) was built by the US space agency, NASA, in the 1960s to transport spacecraft to the launch pad that included the Saturn V rockets, used for the Apollo missions to the moon, as well as the more recent Space Shuttles.

The behemoth CT-2 creeps along at just 1mph and is designed to lift the mobile launcher platform that has a spacecraft mounted on top. It moves this entire integrated stack from the Vehicle Assembly Building where launch vehicles have been assembled since the Apollo era to the ocean-side launchpads.

NASA is currently developing its next generation space launch vehicle called the Space Launch System (SLS). This will carry, among others, the Orion spacecraft in to orbit and beyond. The new rocket system will have the heaviest lift capability and be the most powerful rocket system ever produced.

The heaviest SLS – including its mobile launcher platform – is estimated to weigh around 6,441 tonnes. The Apollo Saturn V, by comparison, had a rollout weight of approximately 5,579 tonnes. With the SLS due to launch in 2017, it means the CT-2 needs its massive roller bearing assemblies replaced if it going to take the additional weight of future rockets and carry on operating for another 50 years. The overhaul will take place around the crawler's four 'feet', the part of the carrier that holds and drives the tracks. These will also be modified and further strengthened with structural reinforcements.

Mary Hanna, CT project manager in the vehicle integration and launch branch of ground systems development and operations programs at NASA, says: "We've already begun the process of removing the treads and jacking two of the crawler corners four feet off the ground. The next step is to remove and replace the roller bearing assemblies.

"The rollers, shaft assemblies, sleeves and other hardware needed will amount to about a 500,000lbs (226 tonnes) of steel."

Once the old roller bearing assemblies are removed, engineers will inspect the structure and integrity of the mounting holes and openings to see if any repairs are needed. After this, installation of the newly designed and fabricated bearing assemblies can take place.

"We expect installation to begin in August," says Hanna. "Testing should then take place near the end of this year."

The crucial nature of the roller bearings surfaced on one of the first Crawler Transporter 'test drives' back in 1965. The machine was being tested using a launch tower and was being taken along two short stretches of specially prepared and maintained surfaces known as 'crawlerways'. During the test, metal fragments were discovered on the ground.

"The original rollers were simply ball bearings," says Hanna. "The roller bearing and associated assembly, including roller shafts and new sleeve bearings were redesigned and installed, and that hardware was then successfully used throughout the Apollo and Space Shuttle programs."

Need to modify

However, after extensive tests in November 2012, engineers identified flaws in the roller bearing design and concept. However, for one of the biggest tracked vehicle in the world, using stock bearings is unlikely to be an option. As a result, the engineers have had to redesign the assemblies and develop a number of modifications to the original to get the improvements in performance needed.

"The new assemblies will help the CT-2 carry the heavier loads," says Hanna, "and will also be better lubricated. And that should provide a longer operational life."

The CT-2 on its own weighs around 2,948 tonnes, but will be able to carry the 4,672 tonne mobile launcher with the attached 1,996 tonne SLS rocket (without liquid propellants). The result will be a vehicle lumbering toward the launchpad weighing just under 10,000

The CT-2 is one of the world's largest tracked vehicles

tonnes. Needless to say, this creates incredible pressure and strain on the bearing assemblies.

"When you have that much metal on metal, carrying such huge loads, there is a tremendous amount of heat and friction," says Hanna. "That creates much of the wear and tear that we see on the Crawlers."

Currently, engineers are redesigning and upgrading the units with modern roller and plain bearings, and lubrication systems, which are much more advanced than the previous assemblies. The main purpose of the work is to increase the durability and life of the bearings, which need to be able to cope with payloads of around 6,700 tonnes.

The redesign will also allow the easy replacement of broken bearings during the operation. Work on the modernisation of bearing units are planned to be completed by August 2013, with testing due to take place at the end of the year.

Other modifications include overhauling and updating many of the onboard systems such as upgrades to the jacking, equalisation and levelling cylinders. In addition the AC power generators are also being replaced to increase the available power from 750kW to 1,500kW.

www.nasa.gov

The original bearing design dilemma

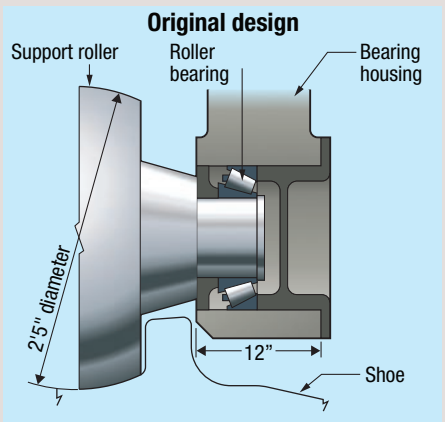
in 1965, the CT-2 was tested on two short stretches of road, one surfaced with washed gravel and the other with crushed granite. Preliminary data on steering forces, acceleration, vibration, and strain pointed to the gravel as the better surface. While the carrier was making its run, members of the launch team found pieces of bronze and steel on the 'crawlerway'.

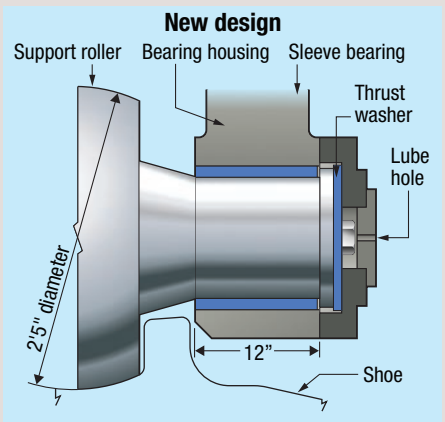
When more metal fragments were discovered and a thorough search disclosed pieces of bearing races, rollers, and retainers from the crawler's traction support roller assembly, a check of the roller assemblies was ordered. This revealed that 14 of the 176 tapered roller bearings were damaged.

Engineers attributed the failure primarily to thrust loads encountered during steering. The anti-friction support bearings, about the size of a drinks can were under designed for the loads exerted during turns.

The designers had assumed an equal load distribution on all traction support rollers and perfect thrust distribution over the entire bearing. This meant an axial thrust equivalent to the radial load and a coefficient of sliding friction of 0.4.

However, engineers discovered an unequal load distribution on the traction support rollers. At times as many as four of the eleven rollers on one truck were under no load at all. However, the thrust, or side load, proved greater than expected. Finally, tests revealed that the estimated coefficient of sliding friction was far below the actual resistance experienced.





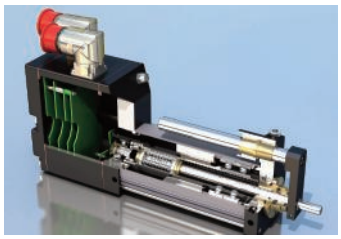
A more pertinent answer was to develop a new bearing, a hydraulically lubricated sleeve bearing made of Bearium B-10. Engineers selected the bronze alloy after testing a half-dozen other materials and the new design provided separate bearings for axial thrust and radial loads.

Engineers retained in the design the original supporting shafts that housed the bearings. Although the sleeve bearings would not reduce the amount of friction, they would eliminate the possibility of a sudden, catastrophic failure.

It meant that periodic inspection could determine the rate of wear and if any replacement was needed. The disadvantages of the sleeve bearing were that it led to lubrication difficulties. It also made it difficult to determine useful life.

These compromises are now looking to be removed by the latest stage of redesign.

Integrated actuator gives simple solution



Olsen Engineering has launched the new Exlar Tritex II DC TDM/X integrated actuator in the UK. Already available in AC rotary and linear versions, the new Tritex II can operate from 12V, 24V, 48V and 60V DC supplies in five different motion modes. It features an integrated energy efficient PM motor, high-resolution position controller and amplifier as standard.

The Exlar Tritex II's built in non-volatile memory stores programmed functions for motion requirements for linear and rotary motion control applications, product configurations and motion parameters. The specifically designed free of charge 'Expert' software allows very fast commissioning of actuator applications, configuring position or force control using a 0-10V or 4-20mA control signal or digital inputs or now even with the new EtherNet IP fieldbus options amongst others. An onboard RS/485 interface as standard provides control, programming and monitoring of all aspects of the motor or actuator.
www.consultolsen.com

LG MOTION CHOSEN FOR SPACE TEST RIG

LG Motion was recently commissioned by Astrium to supply a custom-designed support structure to automate the positioning of large microwave components for integration testing, calibration and tuning of microwave transmitters integrated on satellites. Ultimately the assembly, known as a PCT Support System, is used to optimise the quality and consistency within Astrium's manufacturing processes.

The mobile structure can support and vertically position off-centre loads of up 20 kg with extreme sensitivity under operator guided push-button control – over a travel range of 2400 mm with pre-set speeds of 0.1mm/sec and 10 mm/sec. Much of the structure was completed with standard aluminium machine framing components from MiniTec UK Ltd – which works very closely with LG Motion on such projects. With an overall height of 3.6m and width/depth of 1.5m, the structure includes a microstepping motor driven custom-designed linear actuator with a fine leadscrew drive and two parallel linear rail bearings supporting the large test-piece mounting plate. Further aluminium framing components brace the assembly and outrigger supports with adjustable feet are also included to ensure stability for overhung loads.

The control system is based around the Arcus Technology ACE-SDE series intelligent microstepping drive, pre-programmed for manual pushbutton control. Arcus is exclusively represented by LG Motion Ltd as one of a select number of global distribution partners that provide state-of-the-art motion control components. The single-axis controller and drive provides I/O interfacing and RS232/485 or Modbus communication with an easy to use interface and programmable S-curve acceleration profile that suits large load positioning.
www.lg-motion.co.uk

Linear actuator tracks the sun

By offering its linear actuator and bearings for swivel drives as a complete system, Schaeffler has taken another step towards the full integration of precision solar tracking systems for azimuth and elevation axes.

The linear actuator responsible for stroke movements in the system's elevation axis was custom designed to withstand the harsh operating conditions typically found in solar power plants. The linear actuator is designed for dynamic loads of up to 5kN and static loads of up to 15kN. The actuator can reach a stroke travel of up to 1,000mm at a stroke speed of 5mm/s.

The complete mechatronics system comprises the rolling bearings for the individual bearing positions, screw drive spindle and spindle nut, extension tube, compact housing with cover, seal, drive technology (motor and gearbox unit), the sensors, and rod end for connecting the actuator. The innovative design and high flexibility of the unit allow the stroke length and mounting to be matched precisely to individual customer requirements.

The linear actuator can operate in high temperatures and is protected from dust, sand, wind and rain. Due to an encapsulated housing, a reduced number of fully-sealed joints, as well as an integrated motor, gearbox unit and entire drive technology, the linear actuator is able to operate maintenance-free. The sealing components provide the actuator with an IP66 protection rating, which prevents the ingress of contaminants.
www.schaeffler.co.uk

SKF strengthens BeyondZero portfolio

A new range of SKF Extended Life spherical plain bearings and rod ends has been launched. These bearings, which are aimed primarily at applications in the farm, forestry and construction sectors are virtually maintenance-free, which means that they do not need to be relubricated. This product is a part of the SKF BeyondZero portfolio.

SKF Extended Life spherical plain bearings help reduce the cost of ownership and reduce environmental impact because they last longer and do not require relubrication. For example, a single bearing with a 100 mm bore can save up to 876 g of grease per year. A tractor with six bearings of this type and size can save up to 5.2 kg of grease per year. This translates into a savings of 7.7 kg of CO_2 per year. The calculations are based on grease savings and do not include the 37% reduction in frictional losses.

SKF Extended Life plain bearings are equipped with heavy-duty triple lip seals which are the key to reducing total cost of ownership. These seals virtually eliminate the ingress of contaminants and the resulting poor lubrication condition that causes premature bearing failure.
www.skf.com

Tools for exploitation

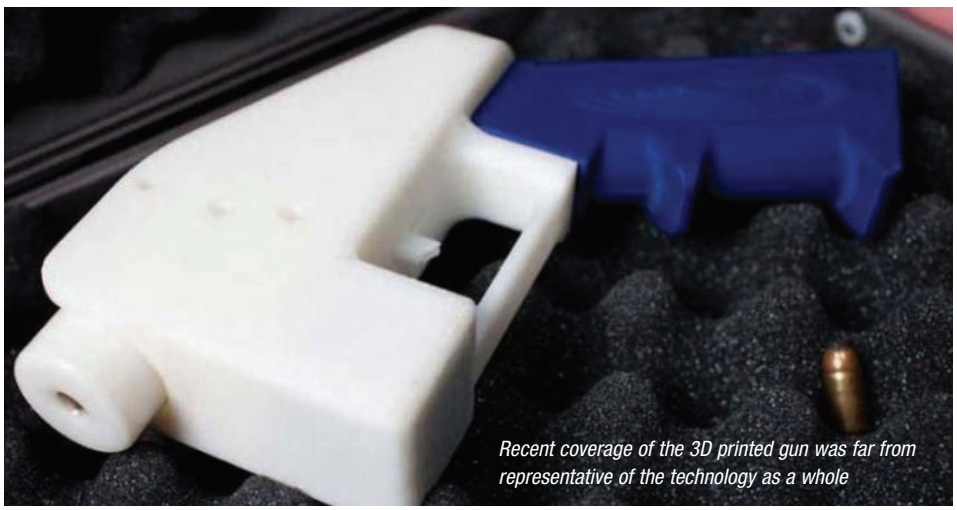
Despite being overhyped and misunderstood, additive manufacturing is still making real headway as an engineering tool. Justin Cunningham reports on the current developments.

The mainstream media furore around 3D printing seems to have calmed somewhat since we last covered the subject in May. Indeed, just two months ago, the talk in newspapers was around the possibilities of making 3D printable firearms and the need to get this emerging technology swiftly under control.

For some perspective, the gun that has done the rounds on YouTube was not made by a £2000 home 3D printer, but an industrial machine that costs in the region of £100,000. Principally we are talking about the same technology that has been available for some 25 years. The plastic guns also unsurprisingly fail after just a few shots.

"The things we are seeing in the press are ridiculous," says Professor Richard Hague, director of the EPSRC Centre for Innovative Manufacturing in Additive Manufacturing and head of additive manufacturing and 3D printing research group at the University of Nottingham. Speaking recently at the Advanced Manufacturing exhibition, he said: "There is nothing novel in this [gun] at all. It is a dreadful design that in no way maximises the design freedom of additive manufacturing and it could easily have been done 20 years ago. This is just an application that is feeding the hype. It is nothing novel."

An internal mesh covered by an outer layer could give the best combination of mechanical properties and aesthetics



Recent coverage of the 3D printed gun was far from representative of the technology as a whole

It serves as a good example to highlight that additive manufacturing is not going to change manufacturing as we know it. In this case, surely laser scanning and then using a micro CNC home machining centre would be more advantageous as you could make genuine established designs out of steel. This is the thing about additive manufacturing: it is misunderstood and most do not know when or how to use it.

"It will not replace or overtake every other manufacturing process, but it will become a growing part of the manufacturing landscape," says Professor Hague. "For designers, it allows personalisation, more design freedom than ever before and potentially allows increasing functionality."

Much of the coverage around additive manufacturing discusses it as a single technology and process. Of course, there are numerous processes and material possibilities that include plastic, metal, ceramic and increasingly, multi-material machines are coming to market.

There is a great deal of potential for additive manufacturing going forward as the technologies mature and they begin to become more widely used by design engineers. However, many conventional design techniques and geometries don't really transpose to 3D printing, which makes it difficult to get the most from additive manufacturing today.

"Standard CAD software such as Solidworks, Creo, CATIA, NX, Inventor; those kinds of design systems are excellent, but they have been designed for conventional manufacture," says Professor Hague. "They don't account for the design freedoms available from additive manufacturing. A lot of our work is about making new design tools.

"Many of the complex geometries that are possible from additive manufacturing processes would be very difficult to produce in conventional CAD modelling software. At the moment there is a lot of geometry that we could easily print, but in many cases we don't as modelling that geometry would be so long-winded and difficult."

A heat exchanger has been produced to show the huge potential for multifunctional functional parts that combine intricate geometric shapes with internal channels to allow fluid flow

Within the new tools being developed, Professor Hague and his team want to incorporate the ability to move from what he calls 'passive additive manufacturing' to, 'multifunctional additive manufacturing'. The theory is that different functional properties can be built in to printed objects such as electrical conductivity, flow patterns and even optical connections. To put this in to practical terms, the team wants to take the technology from being able to print a mobile phone case to be able to print an entire mobile phone.

Design for additive

The ability to print the complexity, and many materials, needed to produce a typical mobile phone is probably 10 years away or more. However, an interesting example of where more elaborate and complex geometry can be used is within internal fluid flow channels of components like heat exchangers.

At the moment any flow through metallic parts has to be machined in and that restricts the possible geometry. However, additive manufacturing allows the flow to be optimised around the part rather than creating a part and machining the flow in to it.

"It is a different way of designing things that gives you a different type of structure," says Professor Hague. "A good example of complex internal flow channels comes from 3T RPD when it produced a heat exchange system. This kind of design freedom would be almost unobtainable using conventional design and manufacturing techniques.

"The heat exchanger was produced on an EOS 270 and that has very nice surface finish but there would have been various post-processing routines that would have happened."

There is a lot more potential on the horizon as more valid design tools and techniques become available. One method that is likely to be increasingly used is topology optimisation. This is a complex mathematical approach that is able to optimise material layout within a structure for a given set of loading conditions. For example, it is traditionally used to remove weight from items

Parts might look strange, but are in fact highly optmised

such as bulkheads and crossbeams. The analysis highlights areas that can have material removed, while the part retains the necessary strength.

Topology optimisation techniques can produce parts that are often difficult, expensive and even infeasible to make using traditional manufacturing processes. However, these constraints do not readily apply to additive manufacturing.

"We have no manufacturing constraints and can pretty much produce any shape," says Professor Hague. "However, the surface finish is often terrible."

Topologically optimised parts often yield peculiar geometric layouts that would never be acceptable as a visual part. Many design engineers use these optimised parts as a starting point, which they then tidy up and make more 'regular' in appearance. However, additive processes open up the possibility of having a topologically optimised structure that is then covered by a thin outside layer of material giving the best combination of appearance, weight and strength.

"One of the challenges is getting people and companies to accept that this kind of topology analysis and resulting geometry is typical," says Professor Hague. "The weight reduction potential of using this technique is dramatic, and assuming loading conditions are correct, a weight reduction of 40 to 50% is not uncommon."

An aerospace bracket that followed this analysis and was subsequently made by a selective laser melting (SLM) metal sintering additive manufacturing process yielded a weight reduction of over 40%. However, one of the issues around using metallic additive manufacturing processes is the fatigue life. It is a real issue and is holding back more widespread implementation.

"Surface finish and fatigue are big issues," says Professor Hague. "There is a lot of work to be done in improving fatigue life, but it's not insurmountable. What we do at the moment is post heat treating [and annealing] of parts.

"The ideal from an environmental point of view is to take the part off the machine, and there is your part. But at the moment the micro structure is terrible so you get this awful fatigue. However, there is a lot of work going on with various companies to enable control of the microstructure as a part is being built."

Many consider the most interesting and relevant additive manufacturing technology to engineers and industrial applications is indeed using techniques around metals. At the moment there is much development towards higher power lasers to increase production speed to overcome the other major barrier to entry, cost. Varying layer thickness, particle size and laser power results in different surface finishes, but this is still a process that is being refined.

Additive manufacturing has the potential to democratise manufacturing by making the production of components – using these processes – competitive with much lower labour cost countries. However, there is still a long way to go and it is likely to be sometime before genuine fears should be raised over the possibilities of 3D printing firearms.

www.epsrc.ac.uk
www.nottingham.ac.uk
www.3trpd.co.uk

Microbatteries enable miniature devices

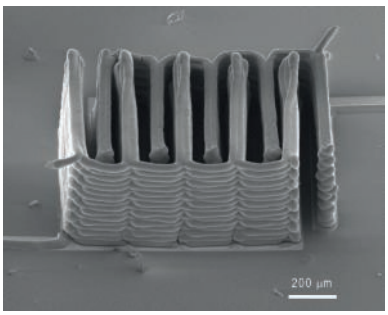
Lithium-ion microbatteries the size of a grain of sand can now be 3D printed. Paul Fanning reports on this potentially game-changing development.

The microbatteries could supply electricity to tiny devices in fields from medicine to communications, including many that have lingered on lab benches for lack of a battery small enough to fit the device, yet provide enough stored energy to power them.

To make the microbatteries, a team based at Harvard University and the University of Illinois at Urbana-Champaign printed precisely interlaced stacks of tiny battery electrodes, each less than the width of a human hair. The results have been published online in the journal Advanced Materials.

"Not only did we demonstrate for the first time that we can 3D-print a battery; we demonstrated it in the most rigorous way," says Jennifer A Lewis, senior author of the study, who is also the Hansjörg Wyss Professor of Biologically Inspired Engineering at the Harvard School of Engineering and Applied Sciences (SEAS), and a Core Faculty Member of the Wyss Institute for Biologically Inspired Engineering at Harvard University. Lewis led the project in her prior position at the University of Illinois at Urbana-Champaign, in collaboration with co-author Shen Dillon, an assistant professor of Materials Science and Engineering there.

In recent years, engineers have invented many miniaturised devices, including medical implants, flying insect-like robots, and tiny cameras and microphones that fit on a pair of glasses. But often the batteries that power them are as large or larger than the devices themselves, which defeats the purpose of building small.



The microbatteries comprise precisely interlaced stacks of tiny battery electrodes

To get around this problem, manufacturers have traditionally deposited thin films of solid materials to build the electrodes. However, due to their ultra-thin design, these solid-state micro-batteries do not pack sufficient energy to power tomorrow's miniaturised devices.

The scientists realised they could pack in more energy if they could create stacks of tightly interlaced, ultra-thin electrodes that were built out of plane. For this they turned to 3D printing.

To print 3D electrodes, Lewis' group first created and tested several specialised inks. Unlike the ink in an office inkjet printer, which comes out as droplets of liquid that wet the page, the inks developed for extrusion-based 3D printing must fulfill two difficult requirements. They must exit fine nozzles like toothpaste from a tube, and they must immediately harden into their final form.

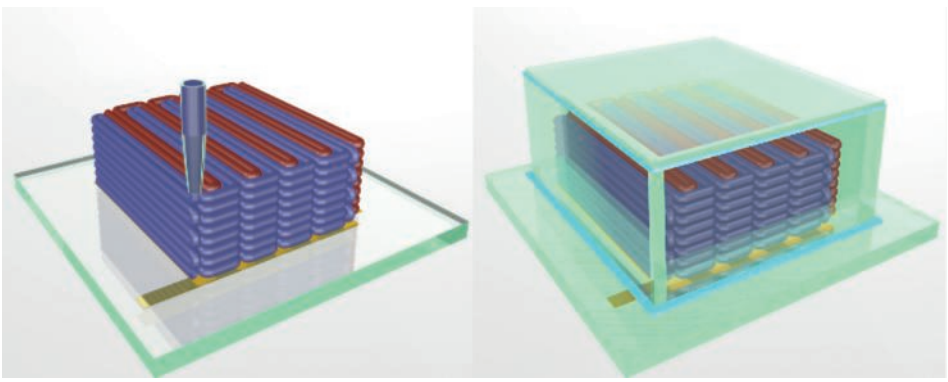
In this case, the inks also had to function as electrochemically active materials to create working anodes and cathodes, and they had to harden into layers that are as narrow as those produced by thin-film manufacturing methods. To accomplish these goals, the researchers created an ink for the anode with nanoparticles of one lithium metal oxide compound, and an ink for the cathode from nanoparticles of another.

The printer deposited the inks onto the teeth of two gold combs, creating a tightly interlaced stack of anodes and cathodes. Then the researchers packaged the electrodes into a tiny container and filled it with an electrolyte solution to complete the battery.

Next, they measured how much energy could be packed into the tiny batteries, how much power they could deliver, and how long they held a charge. "The electrochemical performance is comparable to commercial batteries in terms of charge and discharge rate, cycle life and energy densities. We're just able to achieve this on a much smaller scale," Dillon says.

"Jennifer's innovative microbattery ink designs dramatically expand the practical uses of 3D printing, and simultaneously open up entirely new possibilities for miniaturisation of all types of devices, both medical and non-medical. It's tremendously exciting," said Wyss Founding Director Donald Ingber, who is also a Professor of Bioengineering at Harvard SEAS.

www.seas.harvard.edu

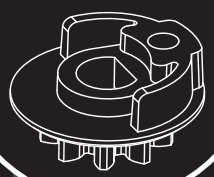


Real parts. Really fast.

A product development team needs parts to meet its rapidly approaching deadline.

Upload 3D CAD file.

How Many Parts?



10–10,000+ parts

Receive a ProtoQuote® interactive quote.

Finalise quote and submit P.O.

Receive order confirmation with gate and ejector layout. Approve.

protomold®
Injection Moulding Service

In 1-15 days

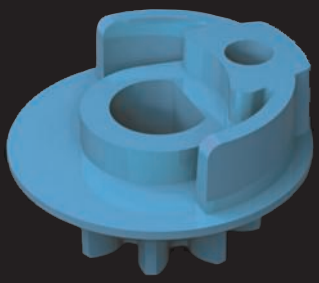
Mould design and milling.

Part production.

Parts ready for shipping.

1–10 parts

firstcut®
CNC Machining Service



In 1-3 days

Receive FirstQuote® interactive quote.

Finalise options, order.

Machining begins.

Parts ready for shipping.

It's easy to work with Proto Labs. Just upload your 3D CAD model and choose the best process for your project: CNC machining from £50 or injection moulding from £995. Real parts in real materials, in days—not weeks. And that's the real story. Call +44 (0) 1952 683047 or **visit www.protolabs.co.uk**

Rapid Prototyping Technologies

Visit **www.protolabs.co.uk/parts** today to receive your FREE copy of our comprehensive comparison of rapid prototyping technologies. Enter source code EUEU13B

Check out our video design tips!

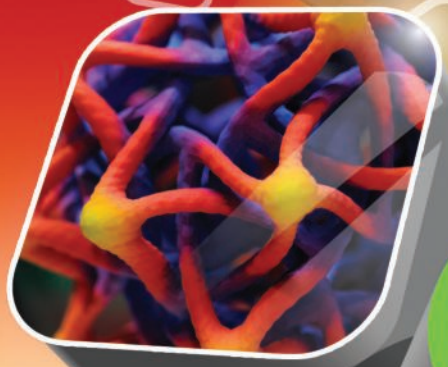
THE QUEEN'S AWARDS FOR ENTERPRISE 2010

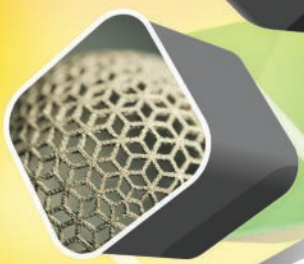
THE QUEEN'S AWARDS FOR ENTERPRISE 2013

proto labs®
Real Parts. Really Fast.™

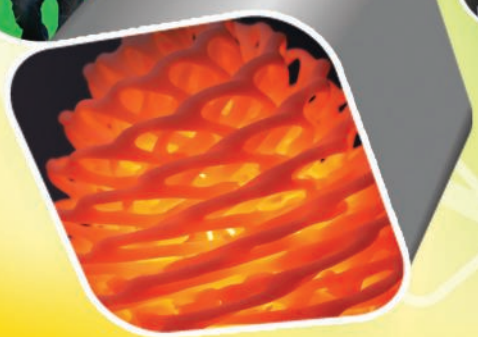
 ISO 9001:2008 Certified

Additive Manufacturing
3D Printing
Prototyping
Product Development
Software
Scanning
Digitising





tct SHOW
+personalize.



inspire.
design.
make.

REGISTER NOW...

25-26 September 2013
NEC, BIRMINGHAM, UK
www.tctshow.com

Doing the light thing

Justin Cunningham crosses industries to ask how engineers can unlock the full potential of lightweight solutions.

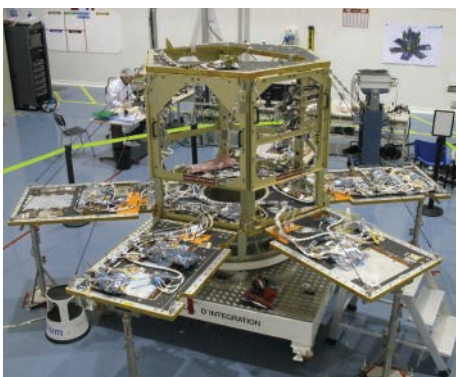
Clichéd as it may sound, some of the best engineering minds in the world are thinking hard and losing sleep over the matter of getting more 'bang for their buck'. Much of the talk these days centres on using materials to get lighter end products. In most cases this boils down to efficiency. We need to reduce the costs associated with various kinds of transit and transportation, which comes down to making fossil fuel go further.

Engineers are increasingly being asked to work even smarter and, as resources shrink, most sectors will eventually have to get on board. The automotive and aerospace sectors are for now leading the field in many developments, so what advice can they pass on?

"Our focus every day is on mass saving," says Patrick Wood, director and head of engineering and industrial operations at Astrium Satellites. "Customers are looking for very high reliability and very high performance. Space systems do not have the same aesthetic demands as other industries. Our customers just want highly-integrated engineering solutions."

This emphasises the point that a lightweight solution is not simply a material in isolation, but a systems design philosophy that must take into account the inherent properties of materials from both a structural and manufacturing point of view.

And lightweighting is not purely about technical hurdles. One of the biggest problems is cultural. Any engineer who designs and specifies a product to be made with an unfamiliar material in a completely different way that demands new tooling is going to see more than a few eyebrows raised along the way.



The space industry integrates parts to minimise weight

One vital lesson that has been learned by both the aerospace and automotive sectors is that for lightweighting to really work, top-level management must buy into it and show solid support for its engineers. Aircraft manufacturers Boeing and Airbus have shown this buy-in and have made a sustained move toward lightweighting that has been implemented and supported from the highest levels of management. Both have now successfully developed primary composite structures for their next generation of aircraft, but both have also experienced significant problems and delays along the way, encountering unforeseen technical challenges and escalating costs. This is another key issue with lightweighting: while its implementation is essential, for the moment it is neither cheap nor easy.

To the layman, the design of a civil airliner has not changed all that much in 50 years: it remains a cigar tube with low-mounted wings and a tail plane. Of course this is a gross oversimplification with the Boeing 787 Dreamliner and Airbus A350 showing some of the most advanced engineering capability of our day. However, the layout is

fundamentally an evolutionary design based on a structure that was originally conceived to be made out of aluminium, not carbon fibre composites. Composite parts and structures now account for 50% and 52% of the Dreamliner and A350 respectively. The point is that while materials might seem to present fantastic new opportunities, it is important to be sure of each step forward and not get lost in the excitement.

While military aviation has been more able to embrace new layouts enabled by material technologies, something like a blended wing body for the airline industry has been deemed too radical. Indeed, despite flying some scale prototypes, Boeing has shelved its development plans for a blended wing airliner.

Colin Sirett, head of research and technology at Airbus, says: "Certainly in aerospace, we are at a watershed in terms of how we approach the design and build of aircraft. But, this is down to how we introduce new materials and manufacturing techniques.

"It is not so much a question of whether the technology is here, but about the willingness of industry and companies to apply it. In a lot of cases we are asking for completely different methods and approaches. It is often the technology part that is the easy bit."

The further use of composites could unlock as much as 20-25% latent improvement in Airbus' manufacturing capability. An example is the possibility of reducing the 60,000,000 holes Airbus UK alone drills each year. Composites allow the possibility of larger, single-skin parts and Airbus wants to achieve a smooth skin by eliminating the rivet heads and fasteners that are often visible on the outer surface. Aerodynamics is key for any material to be embraced by the aerospace industry, but this must be considered against manufacturability and structural design from day one.

"You can't treat any one aspect in isolation," says Sirett. "It is pointless coming up with an application of a new material that is incredibly lightweight if you haven't got the tools to properly design, simulate or make it. What is absolutely key to a lightweight solution is a complete integrated design and manufacture process."

The large, single-body side pressing of a Range Rover

Composites alone will not yield a lightweight solution

Jaguar Land Rover has been at the forefront of the lightweight challenge and has been something of a trailblazer with the application of aluminium on its cars. However, it differs from the aerospace industry in that the aesthetics of its vehicles are absolutely vital.

"Our products sell on how they look, that is fundamental," says Dai Jones, architecture leader – research (senior manager) at Jaguar Land Rover. "Our designs have been both evolutionary and revolutionary. The body construction used on the Range Rover has gone from steel to aluminium. So we still press them but there are considerations with the different performance of material through pressing and simulation.

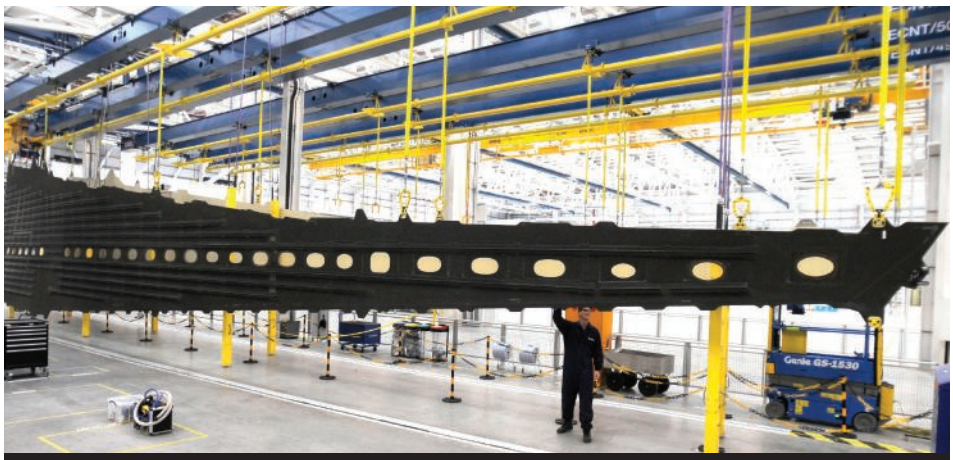
"We have the largest single-body side pressing on the front edge of the front door all the way to the rear tail lamps. That pressing made out of aluminium was traditionally made out of three or four pieces. Now it is made out of a single piece as the optimisation and simulation techniques have improved enough to allow us to do that."

Lightweighting is not just about taking material considerations on board, but is also about optimising parts and components. Can several parts be integrated in to one or deleted all together, can anything be downsized, what has been over designed or designed with too much performance. For example, does a seat really need four or five motors to adjust its position?

However, even with the best design engineering and materials, there are limits on how much economical optimisation is possible before a step change is necessary. Jones uses the analogy of wringing a flannel.

"With the aluminium bodies now we have managed to wring 90% of the water out," he says. "Lightweighting raises the fundamental question of affordability. Most vehicles travel on average 18km a day in Europe. For probably 95-97% of the day cars are sitting on the tarmac unused. In the aviation industry it needs to be the other way round. You want it 2-3% on the tarmac and the runway. So the real question is what can you afford to put into lightweighting?"

www.astrium.eads.net
www.airbus.com
www.jaguarlandrover.com



There is a trend toward producing larger single parts to remove the weight associated with joining and assembly

Your IP questions. Answered.

We have a proud history of supporting pioneering companies in emerging technologies.

From SMEs to global businesses, whatever your invention, technology or brand, we will help you get the best protection for it.

Talk to us at...

Engineering Design Show
02-03 October
Coventry, UK

Electronics Design Show
02-03 October
Coventry, UK

D YOUNG & CO
INTELLECTUAL PROPERTY
www.dyoung.com

What Can My Business Protect?

Knowing what is possible under IP law is half the battle. Here, Jonathan DeVile, partner with leading IP law firm D Young & Co LLP, explains.

In a situation in which the design or innovation within a product is something which provides a unique selling point or a product improvement, then the intellectual property in that product becomes very valuable to a company. In this article we want to look at what can be protected within an engineering product and how.

Some IP rights exist automatically such as copyright. If the product is a software program, for example , then copyright will exist in the source code produced by the author. Similarly, drawings of a product will attract copyright, which will exist automatically. However one of the key limitations of copyright is that you have to prove copying. Not only do you need to prove that the copier had access to your product, but that they took a substantial part of the original, which can be a difficult test to meet. If the innovation that makes products sell is an idea or concept built around a combination of technical features, then copyright will not protect a product having those features unless there has been copying. It will also not protect the innovation in that product if someone reproduces the same innovation or concept without copying the same expression of that innovation or concept. This is because copyright protects an author's original expression in a literary or artistic work rather than technical innovation.

One of the most powerful intellectual property rights is the patent. The patent is an absolute monopoly right. This is because a patent is infringed whether or not the infringer was aware of the patent. Furthermore, there does not have to be copying in the sense that the copier does not have had available the original article or indeed that anything embodying the invention has been made. This makes the patent extremely powerful for technical inventions.

The patent protects innovation with respect to the 'state of the art'. If you have ever seen a patent, you will notice that it is formed from different parts. It is composed of a front-page providing bibliographic details such as the inventor's names, the name of the patent owner or applicant and a short abstract. There is then usually a lengthy description written in some legal terms followed by a set of drawings. However the most important part of the patent is the patent 'claims', which come between the end of the description and the drawings. This is the established legal practice in which the inventor stakes his claim (as in what he claims his intention to be) and then a list of features or steps defining the contribution made by the inventor to the state of the art.

"Some IP rights exist automatically such as copyright. If the product is a software program, for example, then copyright will exist in the source code."
Jonathan DeVile

One of the key areas of innovation for engineering businesses is to develop software programs, whether running on a PC, an application program, an embedded controller or signal processing algorithm running on a dedicated chip. There is a common misunderstanding amongst those who know a little that patents are not available for software. This is not true. The European Patent Office (EPO) grants many hundreds of patents, which are based on innovation in some aspect of software. Only a very few patents are rejected for being based on software and this only because the claimed invention does not include an aspect of technology or the includes an aspect of known technology and the innovation relates to something non-technical.

One example where companies innovate and where the exclusion might apply is where an invention relates to a software-generated graphical user interface such as that produced by a set-top box. This was the subject of litigation between Virgin media and Gemstar for infringement of three patents to a graphical user interface for Virgin's set-top boxes brought by Gemstar. The European patents related to the organisation of channels and data on a television screen. The patents were granted by the EPO, but subsequently held invalid by the High Court for the reason that the claimed invention related to the non-technical presentation of information that did not provide a technical effect. The absence of technical features in the claims can make the job of the patent office difficult in terms of prior art, because a keyword search of prior art will be meaningless. On the other hand a search that does not identify relevant prior art can lead to a false conclusion that the claimed invention is new and has an inventive step.

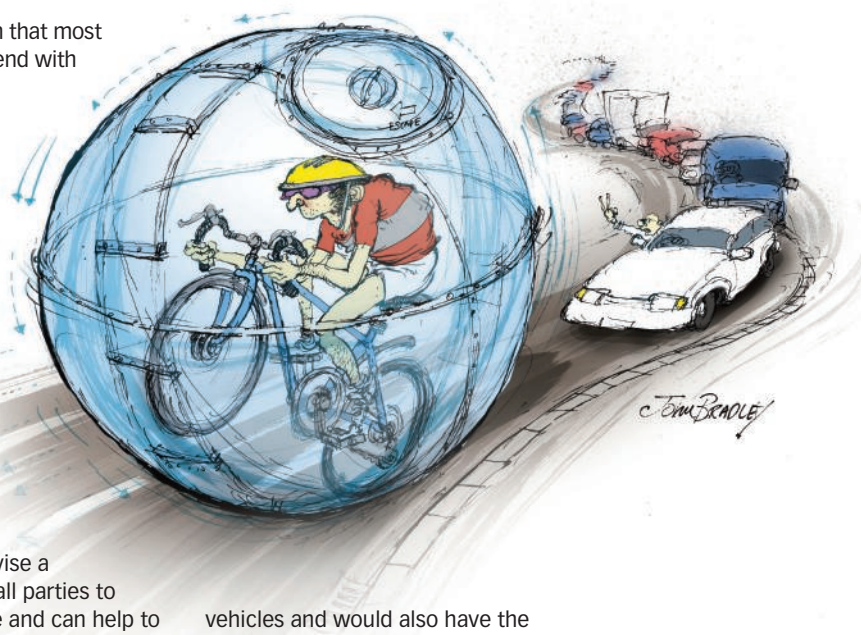
By contrast, as soon as an invention includes some technical aspect that combines with a graphical user interface, then the exclusion should not apply. For example the 'slide to open' feature of a smartphone should be patentable, because the invention requires an interaction between the touch sensitive sensor and the smart phone's processor to detect conditions for unlocking the smartphone.

For more information, please contact Jonathan DeVile, Partner, on:
Tel: 020 7269 8550
Email: jdv@dyoung.com www.dyoung.com

D YOUNG & CO INTELLECTUAL PROPERTY

Bike it or not

Being a cyclist on Britain's roads can be a dangerous business. How can it be made safer?



Sadly, it is hardly news that cyclist are in near-constant danger on our roads. In 2011 (the most recent year for which statistics are available), 107 cyclists died on the UK's roads, with an additional 3,085 suffering serious injury and another 16.023 being slightly injured. In the vast majority of cases, the accident involved collision with a motor vehicle.

One of the most common factors in such collisions is a failure by either the motorist or the cyclist accurately to appreciate what constitutes a safe distance between the cyclist and the car. Sometimes this can be a question of a frustrated or impatient motorist overtaking a cyclist when there isn't sufficient room to do so, but can also be a result of a cyclist electing to overtake (or sometimes undertake) a motorist having failed to judge the gap or anticipated the larger vehicle's movement accurately.

Of course, one of the main ways of ensuring such a thing is to have cycle lanes sufficiently wide to accommodate cyclists while allowing motor traffic to flow freely and safely. However, as any cyclist will ruefully tell you, cycle lanes in the UK are often few and far between and, even where they do exist, are often seen as little better than supplementary road width by motorists. Factor in that most cycle lanes start and end with an alarming degree of arbitrariness and you have a less than satisfactory current situation.

Wherever blame lies, one thing on which all parties can doubtless agree is that anything that can prevent such accidents can only be a good thing.

The Challenge

The challenge this month, then, is to devise a device that can help all parties to gauge a safe distance and can help to ensure the safety of cyclists.

Clearly any such device would need to establish a clearly-defined area of safety for the cyclist whilst in no way impeding the progress of other road users. Perhaps the bicycle could be attached to some sort of transparent plastic screen that offers a physical barrier on the side where motorists are likely to want to pass? However, such a device would have the potential to damage other vehicles and would also have the highly undesirable effect of rendering the bicycle highly unstable.

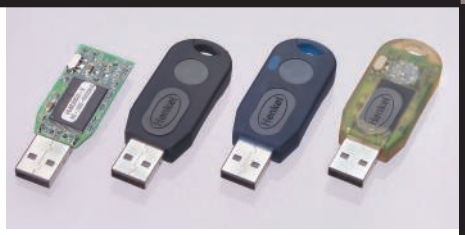
So what is the answer? Well, the device we have in mind uses a simple, but highly effective premise to delineate just how far apart cyclist and motorist need to be to ensure a happy, collision-free and above all safe journey for both.

But, however ingenious we believe this device to be, there is nothing to say that your alternative won't be superior. The solution will appear online or in the August issue of Eureka. However, if you can come up with something better, please let us know.

The answer to last month's Coffee Time Challenge of how to distinguish real Scotch whisky from its counterfeits can be found in our Technology Briefs section on page 12.

Adhesives

Low Pressure Hot Melt Adhesive Moulding



Superior sealing, better protection of electronic/electrical components and higher productivity are the benefits of Henkel's Macromelt moulding. It's a highly cost-effective alternative to epoxy potting and also a low pressure process so breakages are minimised; one PCB manufacturer virtually eliminated a 65% reject rate by switching to this method.

Henkel

@: technicalservice.loctite@henkel.com
✆: 01442 278100

www.loctitesolutions.com

Coatings

WS2 Stops galling of SS and Titanium

Stainless Steels and Titanium are both prone to galling and seizing. WS2 is a very low friction dry lubricant surface treatment, developed by NASA for use in deep space. It has been shown to provide a very cost effective solution, preventing both problems on threads and other sliding surfaces.

WS2 works well from -273° to 450° C and down to 10-14 Torr. WS2 has been applied to bearings and gears to extend life.

Design Out maintenance problems with WS2!

@: sales@ws2.co.uk
✆: 01430 861222

www.ws2.co.uk

Configurators

Bifold, Official Partner of the Marussia F1™ Team have developed sophisticated configurators to make valve selection effortless

Unique Valve and Manifold Configurators

With Bifold, you can use our unique online drag and drop Modular Manifold Configurator to design highly bespoke manifold systems effortlessly. The manifold can be designed from the circuit sequence down to the orientation of individual modules to your exact specification.

You can use our Valve Model Configurator to create the valve you require and download a bespoke configured datasheet with a single click. The 3D CAD model is then automatically emailed. The datasheet contains a tracking image which enables you to view the rendered image in real time, in augmented reality and to scale using the Bifold Model Viewer.

Effortless Selection Process

1. Configure your product
2. View interactive 3D model online
3. Print bespoke data sheet or save to your system
4. Receive 3D CAD model by email
5. Contact sales department with your order

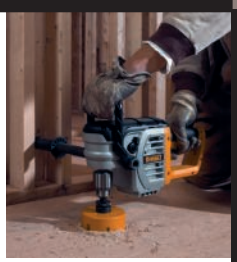
Visit us at **Offshore Europe 3rd - 6th September 2013, stand number 3B60.**

@: gbancroft@bifold.co.uk
✆: +44 (0) 161 345 4777

www.bifold.co.uk

Disc Springs

Spirol Disc Springs Extend the Cycle Life Requirements of a Dewalt Heavy Duty Right Angle Drill



DEWALT is a brand with a reputation for providing high quality professional power tools, contractor tools and accessories. The company's lead design engineer for drills was tasked with designing a high power right angle drill that was lightweight, compact, and portable. Special Spirol Disc Springs were ideal for this demanding, high performance application and design where the goal was to maximize performance while minimizing the size of the tool.

The design would incorporate a mechanical clutch built to limit maximum torque output to 95 Nm. Without the huge gear reduction of 75:1, the drill would be capable of producing a lock rotor torque at the spindle of 237 Nm, transmitted directly to the operator of the tool.

@: uksales@spirol.com
✆: +44 (0) 1536 444800

www.spirol.com

Multiple Diaphragm Pumps

Pumping thin, low viscosity liquids with Hydra-Cell

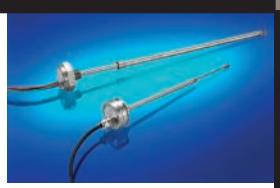
Much is written about the difficulties associated with pumping high viscosity liquids but pumping fluids with exceptionally low viscosity, such as solvents, is even more of a problem for the majority of pump types. Not so with Hydra-Cell seal-less, multiple diaphragm pumps that handle liquid viscosities from 0.1 cps to 20,000 cps with ease. Very low viscosity liquids are 'searching', penetrating materials that seek out potential leak paths in pumps such as piston and plunger pumps that depend on dynamic seals. Offering little in the way of lubrication, these low viscosity liquids provide minimal wear protection. Wear in seals and bearings reduces pumping efficiency and can lead to catastrophic failure. Hydra-Cell pumps have no dynamic seals and consequently no potential leak paths. They do not require lubrication from the pumped liquid, which makes them wear resistant and able to maintain pumping efficiency over a lifetime, with little maintenance.

@: NHerrington@wannerint.com
✆: +44 (0)1252 816847

www.hydra-cell.eu

Transducers

Integrated electronics in new Penny + Giles in-cylinder transducer simplifies installation and eliminates cabling



Penny + Giles – a product brand of Curtiss-Wright Controls Industrial and leading designer and manufacturer of position sensors, solenoids and joysticks – has introduced two new in-cylinder linear transducers suitable for intelligent mobile hydraulics. The ICT800 and ICT820 models combine the best features of the company's LVDT and potentiometer technologies into a single, rugged and reliable displacement transducer which, using contactless inductive coil technology, means both provide an almost limitless and maintenance-free working life with a class-leading body-to-stroke length ratio. Additionally, both the ICT800 and ICT820 models have signal conditioning integrated into the transducer's flange, which simplifies installation and eliminates interconnecting cables that can reduce the reliability of a control system.

@: sales@pennyandgiles.com
✆: 01202 409499

www.pennyandgiles.com

Water technology

Brunel BEng Mechanical Engineering students win Xylem's Engineering Insight programme

Engineering Insight

Engineering Insight, an initiative set up by leading global water technology provider Xylem Inc., manufacturer of a global brand portfolio, including Midland-ACS, a leading supplier of control systems to the oil and gas industry, sponsored Brunel University's "Made in Brunel" event in London last month following the success of a group of Brunel BEng Mechanical Engineering students in Xylem's Engineering Insight scheme. The Engineering Insight initiative was set up by Xylem to promote closer links between industry and mechanical engineering students at leading universities and iMechE accredited institutions. The Brunel team undertook a real-life engineering challenge from Xylem engineers to re-design a pneumatic regulator valve used on offshore oil production facilities, adding functionality and further safety features.
For further details on Engineering Insight, see www.engineeringinsight.co.uk.
For futher information on Xylem please visit: www.xylemflowcontrol.com

@: www.xylemflowcontrol.com
✆: +44 (0)1992 450145

www.xyleminc.com

2013 Most Preferred DISTRIBUTOR

DIGI-KEY CORPORATION 51.3%

Source: 2013 Distributor Customer Evaluation Study, North America, May 2013, UBM Electronics

Digi-Key® CORPORATION

0800 587 0991 • 0800 904 7786

DIGIKEY.CO.UK

3 MILLION PARTS ONLINE | 650+ INDUSTRY-LEADING SUPPLIERS | 100% AUTHORIZED DISTRIBUTOR

*A shipping charge of £12.00 will be billed on all orders of less than £50.00. All orders are shipped via UPS for delivery within 1-3 days (dependent on final destination). No handling fees. All prices are in British pound sterling and include duties. If excessive weight or unique circumstances require deviation from this charge, customers will be contacted prior to shipping order. Digi-Key is an authorized distributor for all supplier partners. New product added daily.

ecia ecsn member CEDA