

# IOP INNOVATION AWARDS 2015

Innovative physics. Winning solutions.



The Institute of Physics is a leading scientific society. We are a charitable organisation with a worldwide membership of more than 50,000, working together to advance physics education, research and application. We engage with policymakers and the general public to develop awareness and understanding of the value of physics and, through IOP Publishing, we are world leaders in professional scientific communications.



# WELCOME TO THE AWARDS

Physics has been at the heart of innovations from the light bulb to the Large Hadron Collider. Today, physics and physicists drive the success of the best and brightest companies.

The IOP Innovation Awards are the only awards recognising companies in the UK and Ireland that have built success on the innovative application of physics – companies that have generated profit, secured jobs and improved efficiency across a range of sectors, from oil and gas to renewable energy, medical technologies to high-tech manufacturing.

## Introduction



**Professor Roy Sambles**  
FRS CPhys FInstP  
President, Institute of Physics

Many solutions to the challenges the UK faces today – from increasing national productivity and driving economic growth, to ensuring energy security and national security – have their roots in physics. If we are to meet these challenges in the future, we must continue to invest in education, research and training to ensure that the UK retains its position of providing world-leading physics and innovation.

The winners of the 2015 IOP Innovation Awards are excellent examples of how innovative physics can address national challenges. The success of these companies drives not only employment, economic growth and productivity, but also advances in such disparate sectors as energy, quantum technologies and national security. Their physics-based innovations have revolutionised equine welfare, enabled advances in biomedical research, increased the security of prisons, allowed safer inspections of pipelines deep beneath the oceans and utilised optical fibres to detect earthquakes.

This wide range of impacts is not unusual for physics. We know that physics-based sectors, sectors critically dependent on new physics knowledge ranging from medical imaging to oil, to aerospace to advanced manufacturing, employ more than a million people in the UK alone and contribute £77 bn to the UK economy. The productivity of these sectors is twice the national average and they account for more than £100 bn of UK exports. One thing that all these sectors and businesses have in common is skilled, physics-trained workers to drive their success, as well as the opportunity to access the UK's world-leading research base.

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The strength of the UK's physics-based businesses reflects previous sustained and secure investment in the UK's education and research base. If the UK is to maintain its position, this investment in science education and pioneering research has to be at the very least maintained, although from an economic perspective it should be increased to ensure that the technological challenges of tomorrow will be met by the UK physics of today.

I congratulate all of the winners for their outstanding achievements and I wish them every success in the future.

*“ Securing a 2014 IOP Innovation Award has added significant credibility to our product offerings, providing further differentiation in the market place. ”*

**Des Gibson**, Chairman and Director, Gas Sensing Solutions  
IOP Innovation Award 2014 winner

## The winners

# HALLMARQ VETERINARY IMAGING

For the development of an MRI scanner and motion correction software used to image the lower leg of a horse while it is conscious and standing. The scanner has revolutionised equine lameness diagnosis and improved animal welfare.

Accurate MRI scanning of horses is notoriously difficult. Laying a horse down under anaesthesia carries significant risk, making conventional methods unsuitable for routine MRI scanning of horses. However, MRI scanning of a standing horse is also problematic: even with excellent positioning and sedation, the limb will move slightly during image acquisition, which can degrade the resultant images and compromise diagnosis.

Hallmarq's solution allows for horses to be accurately scanned while standing. It uses a small U-shaped moveable magnet that can fit around one leg of a standing horse and advanced motion-correction software to create a stable and reliable image. The software uses one-dimensional MR navigators with adaptive edge detection to interact in real-time with the data-acquisition process and assess the degree of patient motion. If this movement is excessive, the scanner rejects and repeats data fragments and moves the slice positions. The scanner can produce diagnostic images even when there has been significant movement near the edges of the imaging field of view.



The innovation has greatly improved the welfare of horses. As well as eliminating the risks involved with placing a horse under general anaesthetic, Hallmarq's system is being used preventatively to monitor bone density in racehorses and provide crucial insights into which animals are at risk of fatal fractures while racing.

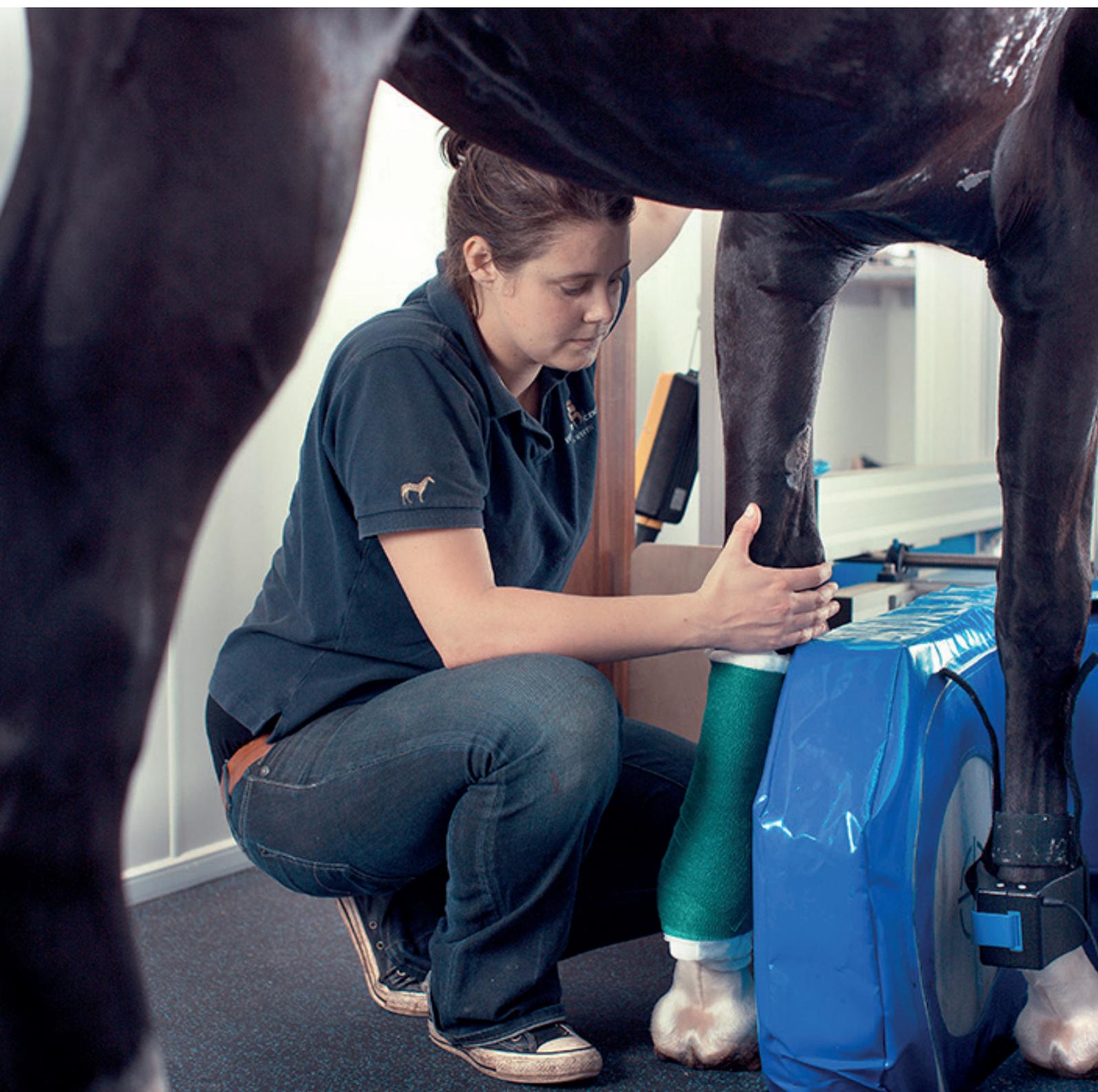
### The company

Hallmarq, based in Guildford, was established in 2000 to satisfy the need for a standing equine MRI product. This system is now firmly established and has been installed at 84 locations in 23 countries. The company employs 30 people, with a subsidiary in the USA and a second about to be established in Australia.

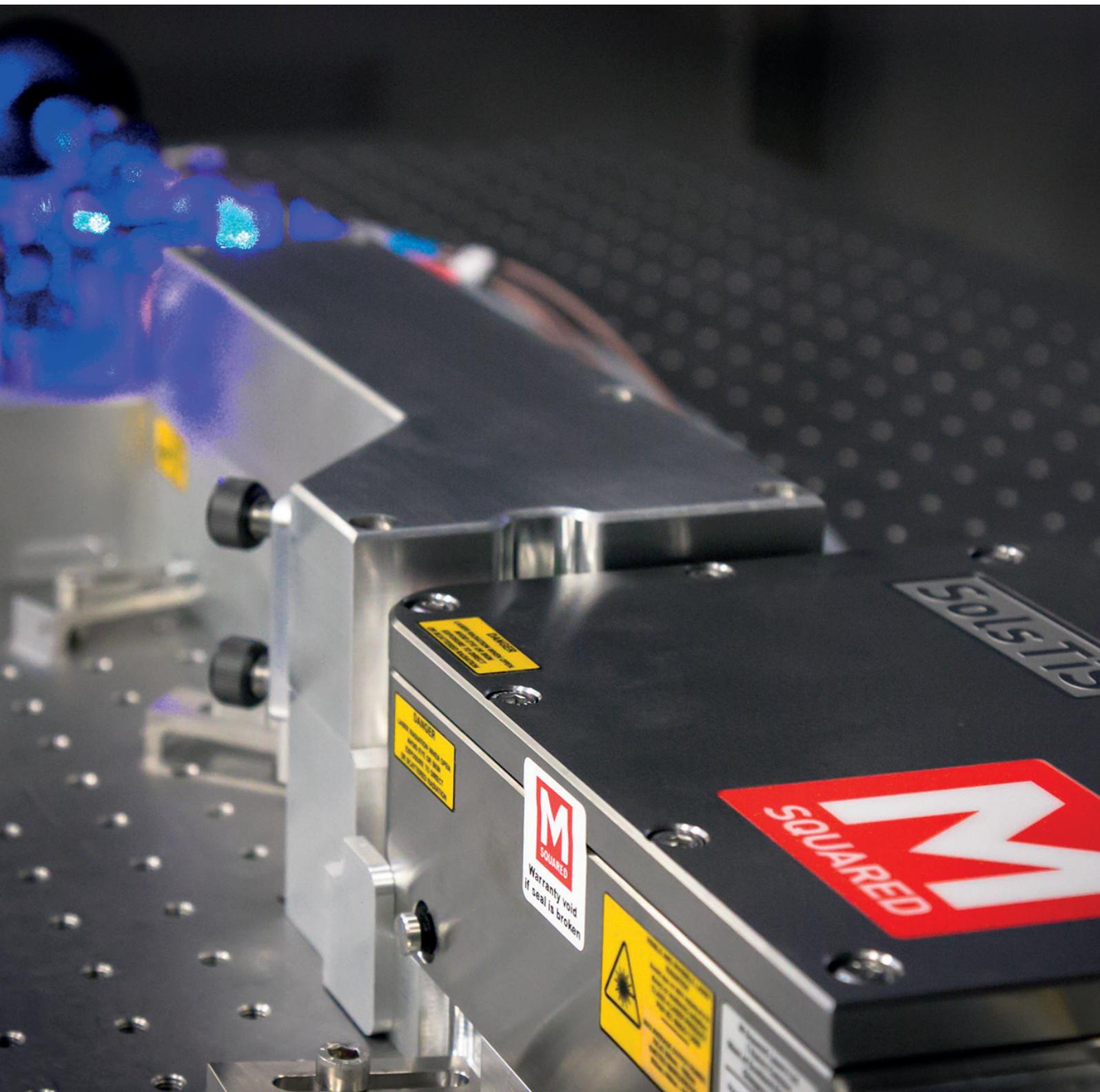


# 39%

compound annual  
growth rate since 2010



## The winners



# M SQUARED LASERS

For the development of an automated laser toolkit based on continuous-wave Ti:Sapphire laser technology. Leading researchers around the world are using SolStiS to explore new concepts in quantum and material science technology.

Lasers are a vital tool for driving scientific understanding and making new discoveries. The demanding requirements of cutting-edge science have meant that research lasers can now be highly complex and many require careful adjustment before use. This is time-consuming and makes it difficult to accurately repeat experiments.

SolStiS was designed by M Squared Lasers as a highly detailed instrument to help scientists spend more time focusing on experiments, and less time focusing on their equipment. It is a super-compact, fully automated, modular system based on continuous-wave Ti:Sapphire laser technology, with a sealed, alignment-free cavity. After precision alignment, the laser cavity optics are “frozen” in place and never need to be adjusted again. This is made possible through a specific choice of materials and sophisticated thermo-mechanical design.

SolStiS has enabled new discoveries and opened up new areas of experimentation. With more than 150 customers globally, SolStiS has reached sales of more than £14 m. Research in atomic clocks, teleportation demonstrations and antimatter experiments are just some examples of where leading researchers around the world are using this breakthrough technology.



## The company

SolStiS is responsible for the creation of around 60 full-time jobs (50 across Scotland and 10 globally) for M Squared Lasers, based in the West of Scotland Science Park, Glasgow. The company explores, develops and manufactures lasers and photonic instruments that bring new capabilities, higher reliability and greater ease of use to a diverse range of application areas and industries.



Sales of more than

# 14m

## The winners

# METRASENS

For the development of detection systems that can identify tiny fluctuations in large magnetic fields caused by ferromagnetic moving objects. The portable technology is being used to ensure the safe use of MRI scanners and to detect contraband in prisons.

Under the strong magnetic attraction of an MRI scanner, ferromagnetic objects such as scissors or medical gas cylinders can become dangerous projectiles; while medical implants such as pacemakers, brain stimulators and shunt valves can have their functions severely affected, leading to patient harm.

Metrasens's ferromagnetic detection systems (FMDS) can sensitively detect tiny fluctuations in large ambient magnetic fields caused by ferromagnetic moving objects and so can detect the presence of "risk items" before they approach the MRI scanner. The system factors out unwanted magnetic influences – which can be caused, e.g., by traffic – and uses secondary optical sensors to determine whether people are in the immediate vicinity of the sensors, ensuring that alarms are only set off in potentially dangerous circumstances.

In prisons, the technology is being used successfully for contraband detection. FMDS have superior detection performance for mobile phones and can be used anywhere within a prison, in contrast to conventional metal detectors and X-ray technologies. The use of FMDS has been recommended by both health and security organisations such as the American College of Radiology and the National Offender Management Service.



### The company

The Metrasens team in Malvern are world leaders in ferromagnetic detection and now provide MRI safety solutions globally through expert local distributors. As a result, the company has seen a strong consistent annual revenue growth since being founded in 2005.

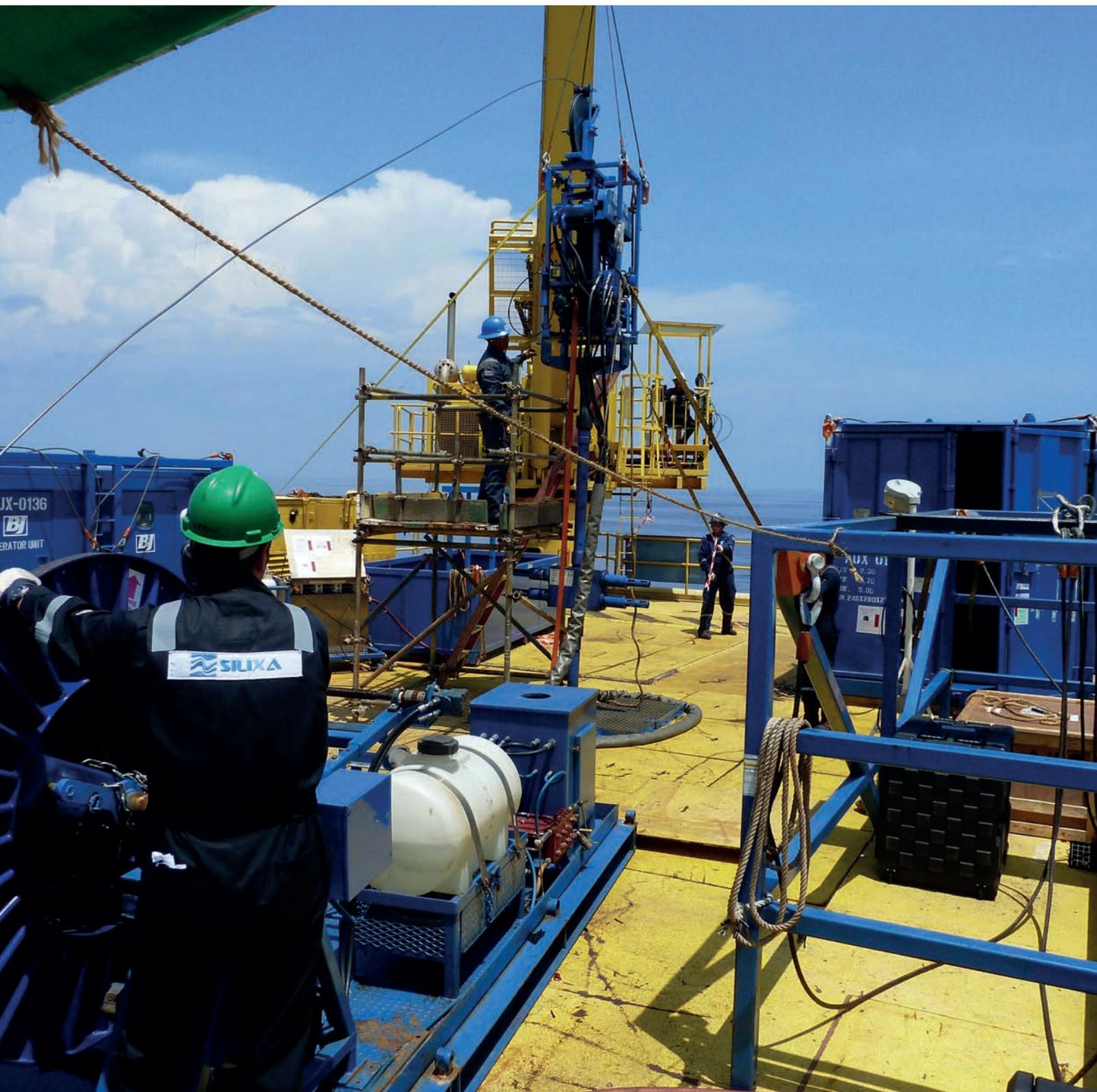


# 65%

average year-on-year  
growth since 2005



## The winners



# SILIXA

For the development of a distributed acoustic sensor that turns a length of standard optical fibre into a string of precision microphones. The accuracy of the technology allows it to be used for a wide range of applications, including seismic imaging.

Seismic sensor arrays – used in oil and gas fields to monitor and optimise hydrocarbon extraction – are normally laid on the ground or on the seabed. More reliable data can be collected from within wellbores, but this is not usually possible when the well is producing.

Silixa's Intelligent Distributed Acoustic Sensor (iDAS) turns optical fibres into a string of precision microphones. This enables the acquisition of high-resolution seismic data from within oil wells, where optical fibres are already used to provide communication to pressure and temperature gauges. The iDAS launches pulses of light down the fibre and analyses the small amount of light backscattered to determine the change in fibre strain. The innovation relies on this random light scattering to record the full acoustic signal simultaneously at every 1 m over a distance of 40 km.

This technology has enabled iDAS to successfully detect a number of earthquakes and to quantify the earthquake's distance and magnitude. iDAS has a wide range of other applications including pipeline leak detection, intruder detection, flow metering and monitoring for seismicity around carbon capture and storage wells.



## The company

Silixa was founded in 2007 in the garage of one of the three iDAS inventors, who went on to develop and commercialise the technology. Silixa now employs 60 full-time staff and has been recognised in the Deloitte Fast 50 index as the fastest growing UK electronics company in 2013, and the second fastest in 2014.



# 1068%

growth in 2014

## The winners

# TRACERCO

For the development of an instrument that uses gamma ray tomography to inspect subsea pipelines from the outside of a pipeline through protective coatings. Discovery™ produces high-resolution images that allow customers to make informed decisions regarding issues including blockages and erosion, leading to huge operational savings.

Inspecting subsea pipelines can be difficult and costly. Limited information can be obtained through intrusive inspection, but typically, production needs to be stopped to do this and there are risks of creating blockages with inspection instruments.

Tracerco's Discovery™ uses gamma ray tomography to produce high-resolution images, enabling the non-intrusive inspection of complex subsea structures to measure contents and metal walls from the outside of a pipe. It locates blockages, distinguishes between different types of build-up within pipes and identifies when there is the potential for damage to the walls of the pipe. Discovery™ is able to operate at depths of up to 3000 m, under immense pressures and in harsh offshore conditions. The innovation allows customers to make informed decisions to resolve issues such as blockages, build-up and corrosion of pipes.

The technology is providing Tracerco's customers with a unique inspection capability to diagnose numerous previously unmeasured properties, leading to huge operational savings. Discovery™ has created more than 30 jobs to grow the R&D product team. Two instruments are currently in operation and four more are being manufactured this year to meet growing demand.



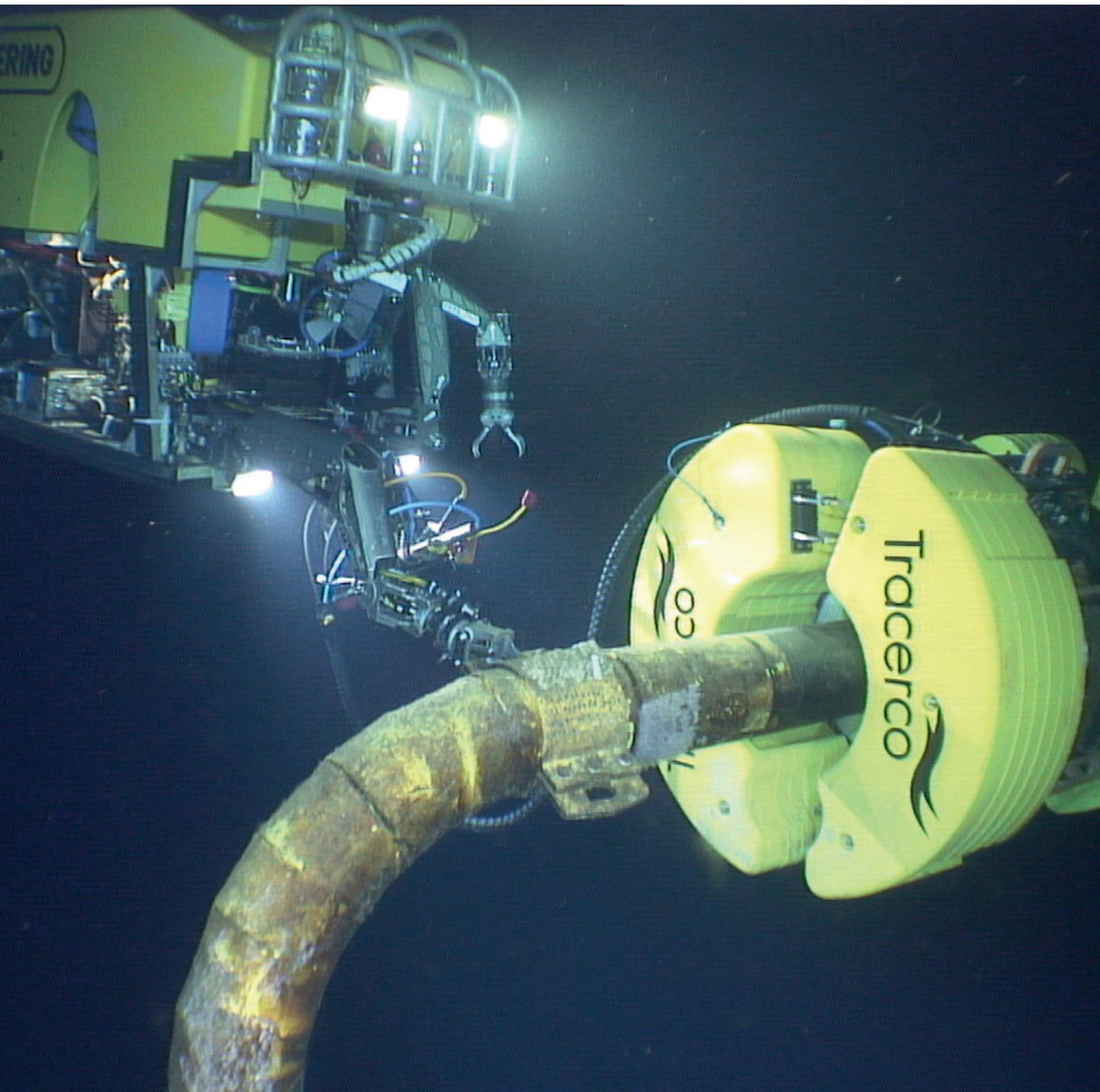
### The company

Tracerco, based in Billingham, is part of the Process Technologies Division of Johnson Matthey. The company is a world leader in its field with a reputation for innovation: they are a past winner of an IOP Innovation Award, having been recognised in 2013 for the development of a gamma radiation-based thickness measurement system.



# 3 million

sales generated



# PAST WINNERS

## 2012

Aurox  
Displaydata  
Naneum  
The Technology Partnership

## 2013

Coherent Scotland  
Elekta  
Simpleware  
Tracerco  
Zephir

## 2014

Gas Sensing Solutions  
Gooch & Housego  
Magneox  
MBDA UK

“*Our IOP Innovation Award has been very useful for us in developing our business over the past year. The international reputation of the Institute of Physics has particularly helped us as we continue to expand our sales in markets such as the US and China.*”

**Dr Philippe Young**, Managing Director and CEO, Simpleware  
IOP Innovation Award 2013 winner

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