

# MacROBERT AWARD 2005

The Royal Academy of Engineering MacRobert Award is the UK's premier prize for engineering and is given annually for an outstanding innovation of benefit to the community which has also achieved commercial success. Described at its launch as 'The Nobel Prize for Engineering', the Award was founded by The MacRobert Trust and first presented in 1969. It honours the winning company with a gold medal and the team members with a prize of £50,000. Every submission for the Award is reviewed by a panel of judges drawn from the Academy's Fellowship and covering all areas of engineering. The four outstanding finalists of 2005 describe their work, starting with this year's winner, CSR plc.

## MacRobert Award WINNER 2005

### WIRELESS BLUECORE™ SINGLE CHIP FAMILY

CSR plc designed and introduced the single chip radio, Blue Core™00, in 2000. The co-founder of CSR, Dr Phil O'Donovan, describes his company's breakthrough.

In 1998, a group of companies including Nokia, Ericsson, IBM and Toshiba launched the Bluetooth Personal Area Network (PAN) standard for wireless communication. CSR joined this consortium in April 1999 and is now one of the largest contributors to the continued development of the Bluetooth standard.

#### INNOVATIVE ENGINEERING

Today's consumers expect products to be highly functional, low cost and easy to use. Bluetooth wireless technology uses short range (up to 100 m) radio links at a frequency of 2.4GHz, and increasingly enables groups of consumer products to exchange data seamlessly without the need for connecting plugs, sockets and wires.

In 2000, CSR was the first company to place a radio transmitter and receiver, microprocessor and memory on a single chip of silicon with the launch of its first Bluetooth chip, BlueCore™00. This chip was a world-first at the time, and CSR's lead has been maintained as CSR's chips are still the smaller and less costly to produce than

those of the large US semiconductor companies with which CSR competes. Since then CSR has designed over 30 types of BlueCore™ silicon chips, and the latest addition to the family is BlueCore4-external, as yet the only solution currently available for enhanced data rate (EDR) Bluetooth, which enables faster data transfer with lower power consumption on multiple wireless applications.

Bluetooth is also being used to create classes of products that were not previously possible, such as wireless medical devices that benefit both patients and healthcare professionals. For example, the LifeSync wireless sensor and ECG monitor from GMP Wireless Medicine Inc gives patients freedom from wires and is suitable for 12-lead ECG continuous monitoring and reporting. Similarly, the Digital Pulse Oximeter from Nonin Medical Inc wirelessly measures and reports the saturation of oxygen in arterial blood. Both of these products use CSR's chips.

CSR's 'fabless' business model (where the actual fabrication of chips is contracted to silicon foundries in the Far East) is appropriate for UK companies because it relies on the country's strength in design and innovation. CSR is now Europe's largest fabless semiconductor company.

#### LEADERSHIP IN THE BLUETOOTH MARKET

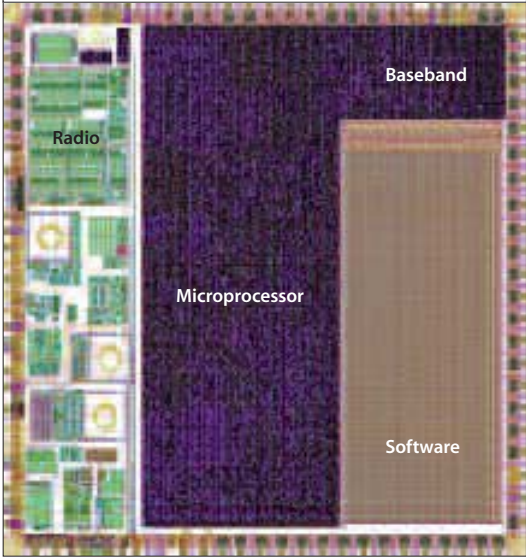
CSR's BlueCore™ chips are incorporated in hundreds of customer designs representing over 60% of all Bluetooth-qualified products. These designs cover a broad spectrum of end products, many of which are found in high street shops, such as mobile phones from Nokia, Motorola, NEC, Panasonic and Sharp; wireless headsets from Hutchison '3; Logitech, Motorola and Plantronics; laptop PCs from Apple, Dell and IBM; mice and keyboards from Logitech; and in-car communication systems from BMW, Saab and Audi.

#### COMMERCIAL SUCCESS

From its foundation in April 1999, CSR became profitable in the second half of 2003, floated on the London Stock Exchange in February 2004 and joined the FTSE 250 list in July of the same year. CSR's revenue for 2004 was \$253 million and the company has now made its first acquisition.

For more information see: [www.csr.com](http://www.csr.com)

CSR's first single chip device BlueCore™00 showing the Bluetooth radio completely integrated on one piece of silicon © CSR plc



acceSS7 Location enables network operators to locate subscribers © Comstock Images



## MacRobert Award finalist 2005 HANDSET LOCATION FROM SIGNALLING MONITORING

Agilent Technology's system enables GSM operators to locate accurately subscribers. David Craig explains what this offers to emergency response services and traffic management services worldwide.

The market for mobile phone services is becoming increasingly crowded and competitive, and the money generated per subscriber is not rising. Mobile operators must therefore look for new value-added services to maintain customer levels and increase their competitive edge. ABI Research has predicted that the market for location-aware services will grow to \$4 billion by 2009, an attractive market for operators to target.

### THE CHALLENGES

Each location-aware service demands different location accuracy, for example, emergency caller location needs to be more accurate than the information needed for local road traffic reports. It is reasonably easy to establish in which cell of a mobile network a subscriber is located. However, an individual mobile cell may cover a large area, and therefore does not provide precise or consistent accuracy for many of the new value-added services.

Other requirements are equally important, such as the ability to handle bulk

location requests, speed of processing and universal availability. Any location system must be able to function with legacy and new mobile equipment, and should not require expensive hardware or handset upgrades.

### AGILENT OSS ACCESS7 LOCATION SYSTEM

The Agilent Location solution enables GSM operators to locate subscribers to the varying levels of accuracy required for emergency response services, mass-market location-aware services and traffic management – all potentially strong growth markets.

It is a network-based solution rather than part of the handset, which uses non-intrusive probing to collect, correlate and filter data in real time from links between the radio transmitter and the base station controller in the operator's network. The rich source of data from these signalling links provides vital information used to derive the location of all mobile handsets all the time, tracking calls in progress across the network and providing consistent up-to-date information. The accuracy obtained can range from 50 to 250 metres, depending on the location technologies used. acceSS7 Location is also engineered to support large

numbers of position requests, allowing the subscriber to be located in the network any number of times for as many applications as required. As the monitoring is independent of the core network, it does not disrupt the network's operation or performance in any way.

acceSS7 Location is based on specialised hardware and patented software, and is totally scalable and self-configuring on installation or when the network updates. Location information passed to end-applications can be altered dynamically through flexible filters and triggers, and it is compatible with both existing and next-generation networks and works with all handsets from day one, so no upgrade is required to the subscriber's handset.

### COMMERCIAL SUCCESS

Since its launch in 2003, acceSS7 Location has had substantial commercial success. It helps locate 78% of GSM subscribers making emergency calls in the USA and is deployed in Europe for traffic planning and capacity exercises, using each mobile to extrapolate use and congestion on road and rail networks.

For more information see: [www.agilent.com/comms/oss](http://www.agilent.com/comms/oss)

## MacRobert Award finalist 2005

# CONTROLLED SOURCE ELECTROMAGNETIC IMAGING

Offshore Hydrocarbon Mapping's new method reduces the considerable drilling costs associated with oil and gas exploration in deep water frontier areas, as Pete Reilly explains.

Wells in deep water environments can cost in excess of \$50 million, increasing the pressure on exploration companies to deliver success. Controlled Source Electromagnetic Imaging (CSEM) is a non-invasive technology which minimises the risk of creating unsuccessful exploration wells by confirming the presence of hydrocarbons prior to drilling. It can also provide a cost-effective way of proving many more prospects within a portfolio and preventing potentially economically-viable reserves of hydrocarbon from being overlooked.

CSEM bridges the gap between traditional seismic exploration methods and drilling. Once a discovery has been made, the CSEM method can also be applied to reservoir appraisal, reducing the need for extensive appraisal drilling. CSEM has been developed in the academic sector over the last 25 years as a tool for investigating fluid properties within marine hydrothermal and volcanic systems.

## OFFSHORE HYDROCARBON MAPPING PLC

Offshore Hydrocarbon Mapping plc (OHM) was formed in 2002 to commercialise the CSEM source, receiver and data-processing technology – developed at the Oceanography Centre at the University of Southampton – specifically for use in the hydrocarbon industry. Since its formation OHM has further developed both survey hardware (by increasing the source power by a factor of 30) and interpretation algorithms (by developing or enhancing 1-3D forward and inverse algorithms for the OHM parallel Linux cluster, and developing a fast imaging tool for CSEM data). The technique works well in deep water and OHM has recently made progress in research and development focused on applying the method in shallow water such as the North Sea.

## THE CSEM METHOD

OHM deploys a 125 kVA horizontal electric dipole source towed 30 m above the seafloor in up to 3 km of water. This transmits a low frequency signal (typically in the range 0.01–10 Hz) to an array of seafloor receivers. Each receiver detects and records the nanovolt per metre electromagnetic field at the seafloor. The variation of the received

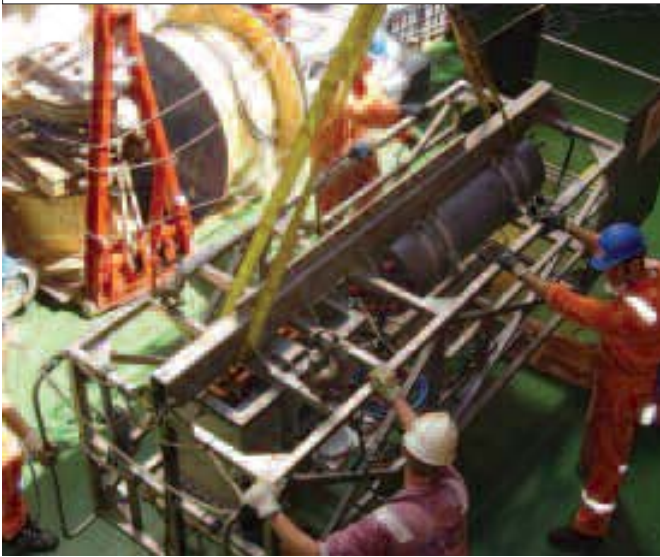
signal as the source is towed allows the resistivity of the underlying seafloor to be determined. The presence of hydrocarbons in a reservoir typically increases its resistivity compared to the surrounding water-saturated sediments. CSEM uses this data to provide a method of determining the resistivity within an identified prospect before drilling, thus avoiding the costs of drilling unsuccessful targets.

## COMMERCIAL SUCCESS

Offshore Hydrocarbon Mapping, which listed on AIM in March 2004, has developed and successfully applied the suite of tools necessary to deliver high quality, value-adding results derived from careful survey planning, data gathering and interpretation. A recent report by Morgan Stanley described CSEM as game-changing technology, with a predicted market likely to be in excess of \$600–900 million within three to four years.

For more information see:  
[www.ohmsurveys.com/index.php](http://www.ohmsurveys.com/index.php)

DASI III on deck: the deep-towed Active Source Instrument transmits a controlled electromagnetic field into the ground © OHM



GTWave® fibre being inspected at the bottom of the fibre drawing tower © SPI



## MacRobert Award finalist 2005 HIGH EFFICIENCY, ULTRA-BRIGHT FIBRE LASERS

Christine Skellon describes the single-mode fibre lasers and amplifiers invented by Southampton Photonics Ltd, a team in the Optoelectronics Research Centre at Southampton University.

Southampton Photonics Ltd (SPI) fibre lasers are rapidly replacing traditional lasers in many manufacturing processes as they have superior performance and are more economical to run. Kilowatts of optical power can be generated, making the laser suitable for cutting, welding, micro-machining, materials processing, marking and printing. Extraordinarily intense, delivering all their optical output into a tiny spot less than 10 thousandths of a millimetre in diameter, these lasers have many new applications ranging from the manufacture of medical devices, semiconductor processing and laser machining of small features.

### GTWave® TECHNOLOGY

SPI has underpinned its fibre laser platform with GTWave® technology, which enables separate laser- and pump-carrying glass fibres to be drawn in a single operation. Fibre Bragg gratings (optical filters that are written into an optical fibre using UV lasers) form a resonator in the laser fibre, while the

pump fibres are connected to diode lasers. GTWave® technology enables the manufacture of highly reliable fibre lasers using simple operations suitable for high volumes, thus sidestepping the disadvantages of other fibre laser technologies, such as the removal of fibre coatings or splicing fibres which are often sources of potential product failures.

SPI's 50 W and 100 W lasers are displacing diode-pumped solid-state (DPSS), disk lasers, and other fibre lasers in, for example, stent manufacture for the medical device industry. Through better beam quality, higher operating efficiency, reliable instantaneous start-up, and low maintenance, 25% improvement in productivity has been achieved. SPI's kW fibre lasers are targeted at new processes, providing greater power efficiency, less material consumption and reduction of harmful side products.

### APPLICATIONS

The impact of fibre lasers on the environment cannot be overstated. For example, Volkswagen's plant in Wolfsburg produces 2,000 cars per day and uses 150 4 kW Nd:YAG lasers. However, it could reduce its power consumption from 47 MW to under 5 MW, and replace the 18,000

multi-kW CO<sub>2</sub> laser workhorses sold every year with lower power (100 W) fibre lasers that would save 20 to 60 kW per installation and considerably reduce floor space.

The market for fibre lasers will continue to grow as a result of their pinpoint accuracy and cost and efficiency savings. This will reach many areas of everyday life, for example the newspapers we read might be printed using a fibre laser, and the cars we drive may have parts cut or welded with a fibre laser. Increasingly, the medical market is also taking up fibre lasers for micro machining medical stents, needles and guidewires etc. A future development will be the use of fibre lasers to grow joint replacements in a selective laser melting process which accurately maps the original joint and provides immense flexibility with the finish of the final surface.

### COMMERCIAL SUCCESS

The current penetration of fibre lasers into traditional laser sales stands at \$104 million, with a growth of more than 100% per year. With the total laser market at \$1.2 billion, SPI is well positioned to change radically the way we operate in many fields.

For more information see: [www.spioptics.com](http://www.spioptics.com)