



Media release

Scotland's global sensor capabilities enhanced through innovative collaborative R&D project

A groundbreaking new collaborative research and development (R&D) project will place Scotland at the forefront of the £70 billion global sensors and imaging systems market, deliver significant economic growth and onshore 41 highly skilled research and manufacturing jobs from Asia.

The initiative, the first of its kind in Scotland and backed by Scottish Enterprise and CENSIS, the Scottish Innovation Centre for Sensors and Imaging Systems, will bring together companies and organisations to collaborate on the production of materials integral to manufacturing a variety of goods that use sensors, ranging from asthma inhalers to infrared cameras.

Four companies - Cascade Technologies (lead company partner), Compound Semiconductor Technologies Global (CSTG), Gas Sensing Solutions Ltd (GSS), Amethyst Research Ltd - and the Research Division of Electronics and Nanoscale Engineering at The University of Glasgow will combine their expertise in different aspects of manufacturing next generation sensing technologies to produce a wide range of products for different end markets. The project will also see high performance III-V infrared detector specialists, Amethyst Research Ltd, continue to locate its operations in Scotland to gain access to Europe.

Aiming to cumulatively boost turnover for the businesses by £135 million over the next 10 years, and cut their production costs by up to 50%, the project will give them a critical competitive edge in the global mid-IR sensors¹ market. The project is expected to deliver £56 million to the Scottish economy over the next 10 years.

Dr Lena Wilson, Chief Executive of Scottish Enterprise, said: "This ground breaking project is further evidence of Scotland's global competitiveness. The companies involved are great examples of the innovative supply chain in Scotland, highlighting why we continue to be an attractive location for technology manufacturing investment."

Deputy First Minister John Swinney said: "This project is an excellent example of how collaborative working can support the development of advanced manufacturing technologies, boosting productivity and driving growth. Innovation Centres have a unique role to play in engaging with businesses to identify new solutions and we would like to see more of these types of projects develop in the future."

The project will provide the organisations with access to III-V semiconductors², allowing the companies involved to create cutting-edge, quality mid-IR sensors in high volumes with greater sensitivity, lower cost, reduced energy use and a longer lifespan than existing products. These can be employed in a wealth of applications including: gas analysers, methane sensors, distributed feedback lasers³ and a vast array of industrial processes.

Working at locations across central Scotland, each company will bring expertise in the growth of these materials and play an important collaborative role in the supply chain. The businesses will then take the materials and produce a variety of different products relevant to their specific end markets – none of them will compete with each other.

Bringing significant production capability back to the UK, access to these materials and the technology used to produce them will help to develop Scotland's technical skills in advanced sensors and imaging systems. This will also allow further innovation and breakthroughs with the materials through continuing collaborative research and the sharing of expertise.

Combined with the dozens of indigenous companies which could make use of the facility and Glasgow's academic landscape, the project presents a globally unique proposition for manufacturing mid-IR sensor devices.

The project is supported with almost £6 million in funding over the next three years, comprising £2.8 million from the companies participating, £2.6 million from Scottish Enterprise's collaborative R&D support and £241,000 plus capital equipment provided by CENSIS.

Ian Reid, chief executive of CENSIS, said: "This project will have a momentous impact on Scottish industry and is a game-changer for collaborative R&D. Not only will it underpin the development of Scotland's sensors and imaging sector, which already accounts for £2.6 billion in annual revenues, but it will also provide the academic community with access to cutting edge technology; allowing further innovation and collaboration.

"Scotland has the potential to be at the forefront of the global sensors and imaging systems sector, and this project could make that a reality. We have the opportunity to innovate continually from the design and growth of the materials, right through to the wide variety of products which can be manufactured and their extensive applications.

"Collaboration between these companies and the academic community will put both of these groups at the forefront of global trends and in a unique position to access new markets, ultimately creating a globally competitive supply chain of businesses."

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1 About sensors in Scotland

Sensors underpin 'smart' products and are tipped to be the principle data capture systems of the future internet. Many of the informatics analytics engines are fed by raw data streams from sensors, so they also require excellent real world interfaces so users can manage complex situations as they develop in real-time.

'Rugged engineering' principles also need to be used in sensor design to ensure they can survive and operate in harsh and remote environments for many years at the lowest possible costs.

2 About mid-IR sensors:

Mid-infrared sits between near and far infrared and can cover a range anywhere from 1.5 μm to anywhere between 8 μm and 25 μm , depending on definition. These types of sensors cover a wide-range of laser applications, ranging from military detection to medical sensing. The market for these devices has risen rapidly in recent years and looks set to grow even further in the future, with technological developments bringing costs down and increasing potential for new applications.

The NDIR CO₂ sensor comprises a narrow bandgap III-V LED light source and photodiode detector. Mid-infrared radiation is launched into an optical structure which defines the lightpath and a chamber into which gas diffuses, causing a reduction in light transmission at the sensing wavelength. Electronics and intrinsic firmware control LED/PD drive current/voltage, pulsing and signal processing. The output parameter is CO₂ gas concentration, stabilised over the sensor operating temperature range. Sensitivity is determined by the optical pathlength. Typical mid-infrared absorption spectra 2.5-6 μm range which also covers other commercially relevant gases e.g. Carbon Monoxide, Methane etc.

3 About III-V semiconductors:

A III-V compound semiconductor is an alloy, containing elements from groups III and V in the periodic table, including: boron, aluminium, nitrogen and phosphorus. They are particularly useful for optoelectronics given their high carrier mobilities and direct energy gaps, and cannot be grown directly onto silicon wafers. Doing so will enable lots of new applications and is a key part of the University of Glasgow's involvement with the Mirage project.

4 About distributed feedback lasers:

A distributed feedback laser is a type of laser diode, quantum cascade laser or optical fiber laser. The active region of the device is structured as a diffraction grating, splitting light into several beams travelling in different directions.

5 About the organisations involved:

1. About CENSIS

CENSIS is the Scottish Centre for Sensors and Imaging Systems, which aims to bring together commercial innovation and academic research, to drive economic activity in Scotland. Established in April 2013 with an initial £10 million funding, it expects to deliver 150 collaborative R&D projects and assist Scotland's 170 companies in the industry which, between them, contribute £3.6 billion to the economy. It is funded by the Scottish Funding Council, with additional support from the Scottish Government, Scottish Enterprise and Highlands & Islands Enterprise.

2. About Innovation Centres

The Innovation Centres, which were launched in 2014 and in the latter part of 2013, sit within the construction industry, oil and gas, stratified medicine, digital health,

industrial bio-tech, and sensors and imaging. Each Centre aims to establish bonds between Scotland's universities and their respective industry sectors, translating the knowledge and expertise into commercially viable products and companies to benefit the country's economy.

3. About Scottish Enterprise

[Scottish Enterprise](#) is Scotland's main economic development agency and aims to deliver a significant, lasting effect on the Scottish economy. Our role is to help identify and exploit the best opportunities for economic growth. We support ambitious Scottish companies to compete within the global marketplace and help build Scotland's globally competitive sectors. We also work with a range of partners in the public and private sectors to attract new investment to Scotland and to help create a world-class business environment.

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4. About Cascade Technologies

Stirling, Scotland-based Cascade Technologies Ltd. is a leading manufacturer of gas analyzers and monitoring systems using Quantum Cascade Laser (QCL) technology. QCL technology provides a step change in gas analyzer performance through its increased sensitivity, speed of response, and fingerprinting capability. These technology advancements in the gas analysis market space provide a powerful solution for customers in various industries such as petrochemical, food and beverage, marine, automotive and pharmaceutical. Cascade has recently been acquired by Emerson (NYSE: EMR), based in St. Louis, Missouri (USA), a global leader in bringing technology and engineering together to provide innovative solutions for customers in industrial, commercial, and consumer markets around the world.

5. About Gas Sensing Solutions Ltd

Gas Sensing Solutions (GSS) Ltd is Scottish-based high-technology gas sensor company established by Alan Henderson in 2006. The company aims to develop and manufacture unique, high performance carbon dioxide sensors. GSS trades globally and has shipped to 44 countries with distribution agreements across the world, including in China, North America, Japan, France and South Korea. In 2014, the firm won a national Innovation Award from the Institute of Physics for its low-powered, fast, and wireless carbon dioxide gas sensor which has delivered more than £2 million in turnover and created over 22 jobs.

6. About the University of Glasgow

The University of Glasgow has been inspiring people to change the world for over 550 years and is a member of the prestigious Russell Group of leading UK research universities. As a world top 100 university with annual research income of more than £181m and overall student satisfaction rate of 91%, the University of Glasgow is committed to delivering world class research at the same time as the highest standards of teaching and education.

The Research Division of Electronics and Nanoscale Engineering Research Division has 80 researchers working on electronic, photonic, microsystem and nanofabrication technologies for applications in sensors; telecommunications; quantum information processing; terahertz and millimetre wave technology; advanced microelectronic devices; device simulation; metrology; and instrumentation.

7. About Compound Semiconductor Technologies

Compound Semiconductor Technologies (CST Global) is a supplier of III-V semiconductor based Optical devices. It provides a Custom Design and Foundry Manufacturing service to a worldwide customer base. Starting 15 years ago as a University Spin-out it attracted private equity and developed as a specialist provider bespoke III-V semiconductor lasers. These custom products are found in the Industrial, Security, Consumer, Solar and Medical markets with spanning applications requiring wavelengths from 400nm to 4.6 microns.

Since acquiring an industrial chip Fabrication company in 2010 it has enjoyed 15% CAGR to present and expanded its manufacturing capability to deliver high volume products for the Communications markets in Asia and North America. CST has had a continuous and expanding relationship with academic and industrial research through which it retains its leading edge technology capability.

8. About Amethyst Research Ltd.

Amethyst Research Ltd. was established in Glasgow, Scotland in 2013, with the purpose to develop and manufacture high performance infrared detectors, based on our proprietary III-V based barrier diode technology, and to supply both customised solutions for demanding imaging needs as well as 'plug and play' solutions for multiple customers seeking to utilize the superior technology in their own systems. Amethyst Research brings together the world's leading infrared talent and know-how; with unique manufacturing capability and infrastructure already in place in Europe that is delivering a globally competitive infrared focal plane array technology that offers significant advantages over existing technologies. Amethyst is delivering this solution rapidly by working with existing infrared imaging manufacturers, rather than competing. This allows us to offer 'plug and play' solutions to a very wide range of customers and platforms.