

## XGEN CONSORTIUM PARTNERS



From Left to right: Nadeem Rizvi (LML), David Barrow (metaFAB) and Robert Hoyle (MicroBridge)

# What is XGEN?

Since its foundation in 2007 by the Welsh Assembly, XGEN – a unique amalgamation of the UK's top micromachining and MNT organisations – has established an international reputation for technical innovation and expertise.

The three organisations that make up XGEN (Laser Micromachining Limited, MicroBridge and metaFAB) solve complex applications problems. By combining their skills, experiences, know-how and technology XGEN is able to meet specialised customer requirements and enable the development of practical, successful and cost-effective solutions for large and small businesses alike.

### PUT SIMPLY:

XGEN is one-stop-shop that ensures a streamlined service and increased manufacturing efficiency through collaboration and innovation.

The three centres that unite under the XGEN brand are:

**Laser Micromachining Limited (LML) provides high-quality laser manufacturing services for demanding applications, a rapid turnaround and ultra-reliability on deadlines.**

LML, the St Asaph-based company, provides effective and economic solutions and shortens time-to-market for new product ideas using laser manufacturing techniques. Wherever there is a need to produce precision microstructures in any material, LML will evaluate design ideas quickly and then establish a rapid route to manufacturing using its world-class laser facilities.  
[www.lasermicromachining.com](http://www.lasermicromachining.com)

**MicroBridge Services Limited offers a comprehensive range of micro engineering and fabrication services enabling the design, development and manufacture of micro-enhanced products from one point of call.** MicroBridge is a design, prototyping and small-volume manufacturing solutions provider using micro engineering and machining. Companies developing new and innovative products can gain competitive advantage by incorporating micro technology. Product development and time-to-market can be shortened

## WHAT'S NEW?

### INTRODUCTION //02

Why XGEN is forging the way...

### NORTH WALES COMPANY ON MISSION TO MARS //02

Welsh high-tech company to play a crucial role in a European Space Agency mission...

### THE BIONIC MAN: SCIENCE FICTION OR REALITY? //04

Welsh engineers develop ground-breaking technology that may make the futuristic myth a future reality...

### PAY-AS-YOU-GO //06

metaFAB provides industry with access to a range of NIKON microscopes...

### WHERE TO FIND US //07

Meet us at events during 2009...

### XGEN MEMBERS //08

Introducing the Team...



by MicroBridge's cost-effective and comprehensive range of micro machining and micro moulding services.  
[www.microbridge.cf.ac.uk](http://www.microbridge.cf.ac.uk)

**metaFAB is a one-stop-shop that provides innovative engineering solutions for lab-on-a-chip microfluidic products together with chemical and industrial instrumentation applications.**

This Cardiff University-based centre offers the following technology: PTFE, Fused Silica, Silicon & Sapphire micromachining using world-unique 157nm+femtosecond laser; quality-control microscopy, pick-and-place, interferometry & HPLC-MS; product conceptualisation and brainstorming, chemicals microseparations, digital microfluidics, microfluidics design & modelling, microwave sensing, microreactor synthesis and micronanotechnology training.  
[www.metaFAB.net](http://www.metaFAB.net)

# Introduction

by **Dr Steve Davies**

**Technium Director Welsh Assembly Government (WAG)**

➤ The Welsh Assembly has a vision for a vibrant Welsh economy delivering strong and sustainable economic growth. In order to realise this vision it is essential to build upon the country's core strengths, including an increasingly skilled, innovative and entrepreneurial workforce together with an advanced technology and knowledge base.

Both the Welsh Assembly Government and UK Government have recognised Wales has a depth of expertise in micro &

nanotechnology (MNT). MNT is recognised as a strategic enabling technology for modern industry and has the potential to greatly improve productivity manufacturing there by making companies more competitive.

With the help of WAG, Wales-based open-access MNT facilities are being marketed collectively under the XGEN brand in order to promote their shared expertise and resources and exploit their commercial potential. In its short history XGEN

**DR STEVE DAVIES**



has succeeded in establishing an international profile and the aim is to support further inward investment in Wales for related specialised technology-based businesses.

## NORTH WALES COMPANY ON MISSION TO MARS

➤ Denbighshire-based high-tech company Laser Micromachining Limited (LML) is set to play a crucial role in a European Space Agency (ESA) mission to Mars after developing a vital component for next generation space technology.

From its world-class laboratories at St Asaph's Technium OpTIC, LML is using its laser micromachining expertise to produce a critical element which will help to measure the wind speed and direction on the dusty red planet. The anemometer, as the instrument is better known, is to be housed on the robotic rover vehicle on the ExoMars mission set to launch in 2016.

"LML has been chosen to assist in the ExoMars mission because we have world-leading laser-based capabilities for producing the highly precise components needed to measure the direction and strength of the wind on

Mars", said General Manager of LML, Dr Nadeem Rizvi. "Other techniques have been tried but have not been able to produce the very fine features required for the mission. This is a major technical development for the mission but also for future science investigations."

ExoMars is a European-led space exploration mission, currently under development by the European Space Agency (ESA), which will send a robotic rover

**"This is a major technical development for the mission but also for future science investigations."**

vehicle to the surface of Mars. The mission will search for signs of life on Mars, survey the Martian terrain and study the interior make-up of the red planet. Data from the mission should provide valuable input for broader studies of exobiology (the study of organisms

originating from outside of Earth) as well as the search for life on other planets.

The anemometer, one of the scientific instruments used to gather data on the robotic rover, requires a small rod of glass coated with a very thin layer of platinum (about a one thousandth of the thickness of a human hair). By using its laser micromachining technology, LML has developed a way of producing the very fine patterns on the platinum-coated

rod which can essentially create a miniature electrical circuit. By connecting sensitive electronics to this platinum circuit and measuring the response of this device it is then possible to detect the strength and direction of the wind.

**A 1MM DIAMETER ROD WHICH HAS BEEN LASER MACHINED WITH THE TYPE OF VERY FINE PATTERNS USED FOR THE MARS WIND DETECTOR.**

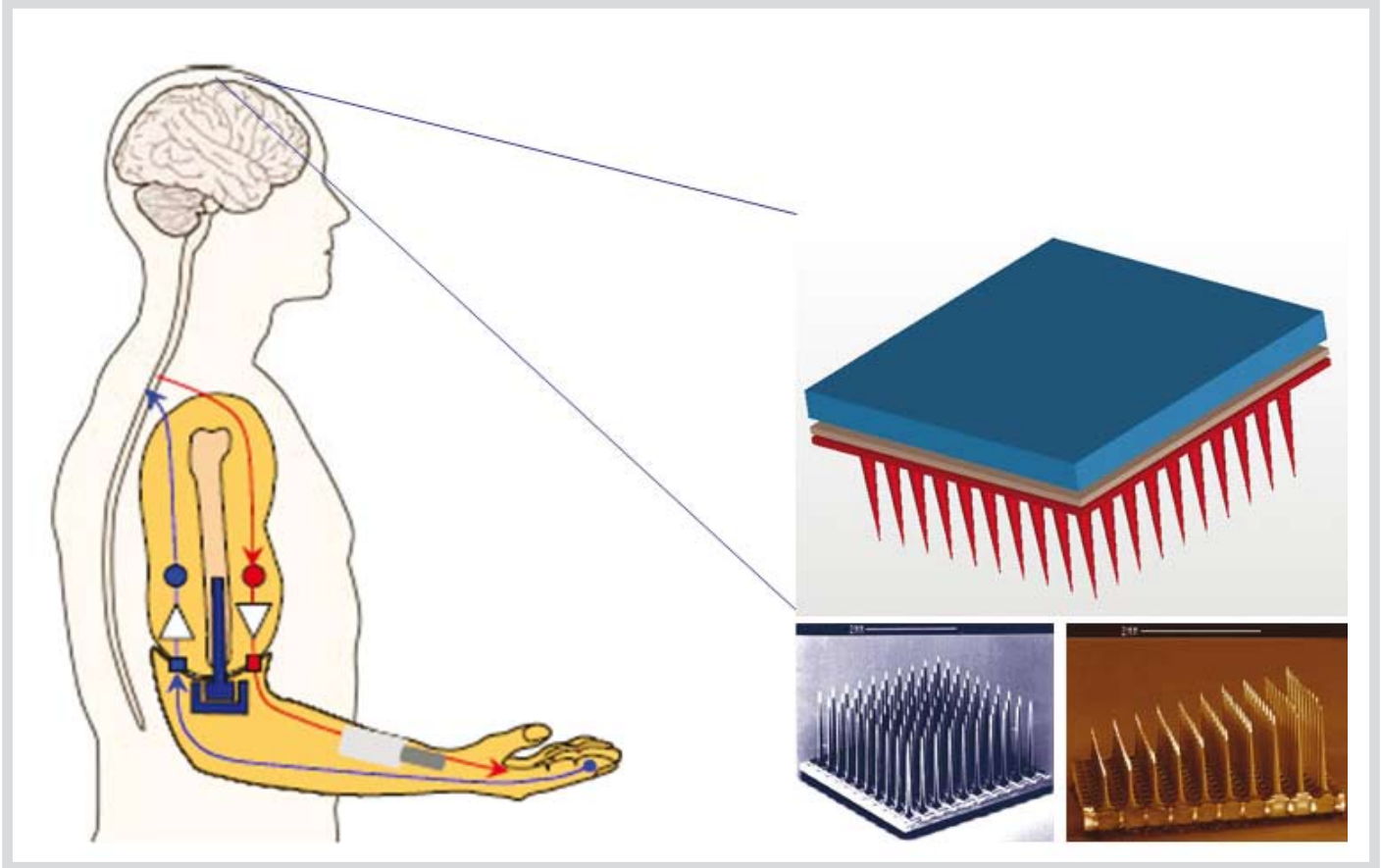


“The major challenge was to produce extremely fine and accurate patterns, as small as two hundredths of a millimetre, over the surface of a circular rod. We are proud to say that through the expertise and world-class facilities here at LML we have delivered what many thought was impossible and the detectors are being tested as we speak,” said Dr Nadeem Rizvi. “Not only has our technology produced the strongest accuracies demanded in space projects but we have proven that laser micromachining is here, it can work and has the potential to be the number one technology of the future.”

**Dr Steve Davies,**  
Welsh Assembly Government Technology Manager said:

“Solving complex application problems has been a strength within each of XGEN’s three member organisations and pulling these skills, experiences, know-how and technology together under one umbrella has made XGEN a force to be reckoned with on the international stage. The combination of these skills means that the wealth of expertise on offer can be applied to unique customer requirements enabling the development of practical, successful and cost-effective solutions for large and small businesses alike.”

## PROSTHETIC ARM



# THE BIONIC MAN: SCIENCE FICTION OR REALITY?

## Bionic Man moves step closer to reality as Welsh engineers develop ground-breaking technology

> The XGEN consortium is on course to tackle one of the major challenges facing the medical industry today - control over artificial limbs in severely disabled spinal injury patients or loss-of-limb patients via direct readings of the brain.

When George Lucas conceived of his hero, Luke Skywalker, with a bionic limb controlled by the central nervous system after his arm was severed during lightsaber combat, it was considered to be pure science fiction. However, with significant medical advancements

in amputation coming to fruition in recent years, the ability to manufacture artificial limbs that have the functionality and even the feel of a natural limb is becoming very real.

For decades, scientists have been interested in developing a technique for interpreting brain activity to motor output and according to Dr. Robert Hoyle of MicroBridge Services, part of the XGEN consortium, the technology for helping patients improve their ability to take signals from the human brain and translate those

signals into motion in the artificial limb is getting ever closer:

“We have been collaborating with researchers and medical practitioners who are testing our micro-needle array sensors in the field which we believe one day will have a massive impact on the future functionality of severely disabled or loss-of-limb patients.”

“The majority of motor functions in our body are driven by electrical currents originating in the brain, so when people lose a limb through illness or accident, it

“The technology for helping patients improve their ability to take signals from the human brain and translate those signals into motion in the artificial limb is getting ever closer”

is important that their artificial limb replacement can repair or restore any physical and mental constraints that the body is experiencing.

“In the majority of amputations nowadays, nerves that normally control the arm muscles are surgically relocated to the chest muscles and the electrodes are then able to pick up nerve impulses being sent out to the no-longer-existing arm muscles. The problem with this solution is that it doesn't work with patients without nerve endings, such as patients with cervical injuries, so the greatest challenge the industry currently faces is finding a way to control a prosthetic limb using readings from the brain. And this is where our technology comes to the fore.”

One of the critical components of the medical procedures for brain/machine interface is the sensor electrode array which sits as an implant in the surface of the brain. The component has been created using XGEN's electro discharge machining (micro EDM). Because of the complex and delicate nature of the brain, there is no room for error but with years of dedicated research in the field, XGEN is confident that its machinery can stand up to the test and be used in medical device research and development for years to come.

## MicroBridge LASER



### Dr Steve Davies,

Welsh Assembly Government Technology Manager said:

“Here at XGEN we now have the structure and combined expertise to create new and radically enhanced products that can far exceed what individual UK-based companies can offer.”



# PAY-AS-YOU-GO

## metaFAB & CEMMNT Nanocentres Metrology Agreement

➤ The metaFAB microfluidics laser-engineering centre has opened its metrology suite to industry via The Centre for Metrology in Micro and Nano Technologies (CEMMNT) in a new partnership agreement. metaFAB provides industry with pay-as-you-go access to a range of NIKON microscopies including, non-contact vision imaging, high-resolution x-y-z measurement, high power stereo zoom, and spinning disk confocal measurement. Also, a VEECO optical interferometer enables micro- and nano-scale measurement mapping over both small and large areas. An agreement between the two centres, made in January 2009, means that the metrology facilities at metaFAB will be promoted alongside that of Taylor Hobson, Qinetiq, the National Physical Laboratory, BAE Systems and Coventor through CEMMNT.

metaFAB director, Professor David Barrow, said of the agreement: "this

initiative will widen the geographic capture of industrial clients for the facilities that we have invested in at metaFAB and increases the cohesion between the 23 micronanotechnology centres we have established across the UK with both Welsh Assembly and Technology Strategy Board support".

In particular, metaFAB provides open access to a unique Nikon, non-contact, vision-based, imaging microscope (iNEXIV) which is ideal for the automated quality control of small engineered parts. Professor Barrow added "customers for this tool come from diverse industries ranging from engineering to biotechnology. Parts tend to be about the size of a coin or smaller and have features that need to be measured with an accuracy measured in micrometres". Customers usually receive a quotation electronically and post the samples to metaFAB where the measurements are made.

Professor Barrow said, "The special relationship with Nikon means that we have very significant backup for our service, and that, added to our agreement with CEMMNT, effectively increases our marketing team in this special service sector. This further complements our open-access industry offering in terms of our Thermo Fisher, High-Performance-Liquid-Chromatography Mass-Spectrometry facility for chemical analysis."

CEMMNT Business Development Director, Paul Newbatt, commented: "this agreement further strengthens the role of CEMMNT as the UK hub for metrology in micro- and nano- technology. We look forward to a profitable and cost-effective, promotional relationship with metaFAB and its partners."

[www.metafab.net](http://www.metafab.net)  
[www.cemmnt.co.uk](http://www.cemmnt.co.uk)



# New Technologies in Healthcare

Wednesday 13th May 2009

## WHERE TO FIND US

Meet us at events during 2009

**XGEN will be attending many conferences and events in 2009.  
Recent planned events include:**

25 - 26th MARCH // 2009

medTECH UK 2009 Show NEC, Birmingham

13th MAY // 2009

The XGEN consortium will be featured at this year's 'New Technologies in Healthcare' conference held at Cardiff Millennium's Stadium on Wednesday May 13th, 2009. The conference will be profiling the practical application of specialist technologies in the healthcare industry.

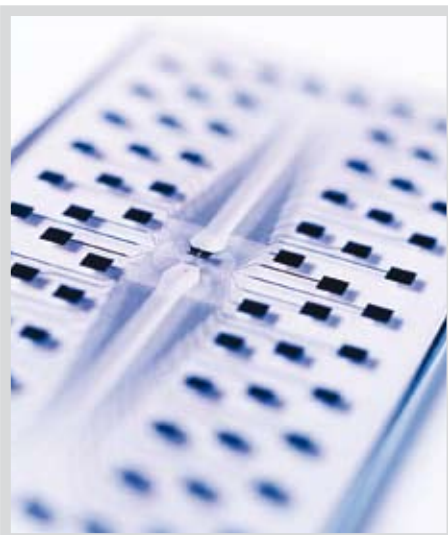
For more information on the conference please visit: [www.newtechnologyconference.co.uk](http://www.newtechnologyconference.co.uk)

JUNE // 2009

European Medical Device Technology Roadshow

Proposed visit schedule: Galway, York, Leeds Eindhoven, Bad Homburg, Tolochenaz, Buc.

**Please come and visit us, we look forward to meeting you!**



# The Team

WWW.XGEN.ORG.UK

DATE // SPRING.2009

PAGE // 08



## DR. NADEEM RIZVI



**Laser  
Micromachining  
Centre (LML)**

**LML** was established in 2005 as part of the UK Micro and Nanotechnology (MNT) network to provide world-class independent laser micromachining services to industry. Commercial product development and manufacture combines with cutting-edge research to ensure a high quality, flexible and cost-effective package for companies large or small and across all application sectors.

Using high intensity laser light it is possible to cut, drill, and shape an almost unlimited range of materials with extremely high precision. Unlike conventional manufacturing processes, laser micromachining doesn't involve any physical contact and so can be used to machine difficult-to-handle materials to offer one of the most diverse ranges of laser micromachining services available today.

**LML** recently became one of a small elite group of organisations to be awarded the prestigious Institute of Mechanical Engineers' MNT Quality Mark for its open-access laser facilities.

**LML** can help to exploit the benefits of laser micromachining equipment and expertise for companies and projects large or small. With over 30-years combined experience the team guarantees high-quality services for demanding applications, a rapid turnaround and ultra-reliability on deadlines.

**Our services:** **LML** offers access to the very latest laser micromachining equipment and expertise for:

- Evaluation / proof-of-concept trials
- Applications developments
- Prototyping of devices
- Single and small batch production
- Large quantity machining services
- Technical consultancy
- Collaboration with other MNT service providers to create a complete design & manufacture package

## CONTACT

**Dr. Nadeem Rizvi** - General Manager  
**Laser Micromachining Limited**  
OpTIC Technium, St. Asaph Business Park,  
Denbighshire LL17 0JD

Tel: +44 (0)1745 535165  
Fax: +44 (0)1745 535101  
Email: n.rizvi@lasermicromachining.com  
Web: www.lasermicromachining.com

## PROF. DAVID BARROW



**metaFAB – at the  
apex of micro and  
nanotechnology**

**metaFAB** provides access to unique engineering tools for precision control at the molecular, nano and micro scale. Its Xtreme Laser Facility is a pioneering new European resource that offers three industrial lasers for laser micromachining at 157nm, 193nm and femtosecond 795nm. With this unique capability both simple and complex forms can be created from any material ranging from fused silica, quartz, PEEK, Teflon, sapphire, silicon, metals.

Benefiting from world-class research and resources at Cardiff University the multidisciplinary technology transfer team has both the expertise and the hardware to provide services in: laser microfabrication, molecular imprinting, microfluidics, microreactor synthesis, cell encapsulation, microwave engineering, and automated quality control of small engineered parts.

### Our services:

- Fast turn-around laser micromachining in any material
- Hands-on access to metaFAB laboratory and metrology tools at hourly rates
- Surface micro- and nano-topography using VEECO Optical Interferometry
- Chemical analysis with ThermoFisher HPLC-Mass spectrometry
- Optical measurement and inspection using the Nikon Microscopy Suite
- Collaborative and contract research with proof of principle demonstrators

**metaFAB** originates novel, patent-protectable concepts and undertakes proof of principle demonstrations to industrial contract with our multidisciplinary team comprising:

- Barrow Applied Microfluidics Laboratory
- Porch Microwave Science Laboratory
- Allender Artificial Receptor Laboratory
- Wirth Organic Synthesis Laboratory

## CONTACT

**Professor David Barrow**  
metaFAB

Tel: +44 (0)78 0983 9979  
Email: Barrow@cf.ac.uk  
Web: www.metaFAB.net

## DR. ROBERT HOYLE



**MicroBridge:  
Between  
Engineering and  
the Future**

**MicroBridge Services Ltd** is a company exploiting the commercial potential of Cardiff University's micro and nano process research and development activities.

The services are available to anyone wishing to benefit from first-class facilities on a commercial open-access basis.

The company, backed by a team of commercial and technical specialists, offers a comprehensive range of micro engineering and fabrication services for virtually any material and supplements this with nano structuring and replication capability.

**MicroBridge** offers the possibility to create discrete micro components and 3D surface structures from 1mm down to 50 nanometres using a range of process technologies including picosecond laser micromachining, micro milling, micro electro-discharge machining EDM, micro injection moulding, focussed ion-beam milling and nano-imprinting processes.

With some of the best-equipped engineering facilities in the UK the **MicroBridge** resource base offers clients the opportunity to create levels of functionality, product performance and appearance previously unavailable to industry.

### The services on offer are:

- Prototyping services
- Process development
- Single component and small batch production
- Volume production using injection moulding
- Technical consultancy
- Product design and development
- Contract and collaborative research

## CONTACT

**To access this resource contact:**

**Dr Robert Hoyle** - MicroBridge

Tel: +44(0)29 2087 4641  
Email: HoyleRT@cf.ac.uk  
Web: www.microbridge.cf.ac.uk