

UNIVERSITY OF  
Southampton

**MENSUS Showcase.**  
Monitoring of Engineered  
and Natural Systems  
Using Sensors

Tuesday 11 October 2016

# MENSUS Themes



## System Characterisation

focuses on modelling and experimental methods for establishing the behaviour of time varying systems to controlled or naturally occurring stimuli. Observed changes to their responses can then be attributed to the existence and severity of any evolving abnormalities.



## Sensors and Devices

encompass a wide range of physical and chemical detection methods using both optical and electronic platforms. The theme promotes novel sensors that utilise nano and micro fabrication, smart materials and photonics to monitor harsh environments, provide energy efficient solutions and integrate into smart networks.



## Energy Harvesting

is the process of using ambient forms of energy (solar, thermal, vibration, wind etc.) and converting this into electrical energy, which can be used to power autonomous devices, sensor nodes and measurement systems. A key enabler is wireless sensor networks, which can be coupled with energy harvesting systems to provide low-power, wire-free solutions.



**Big Data and Analytics** deals with structuring and analysing high volume data, enabling extraction of insightful and actionable information. Examples include high resolution data, such as imaging or acoustic data, or data collected from multiple or numerous entities and a variety of sources, as encountered with industrial machines.



**System Integration** enables the identification of the system measurable characteristics and appropriate sensor selection, sensor excitation and powering, signal processing and data transfer to be treated holistically. The theme focuses on the performance of the integrated system in its operational environment. An overarching consideration is the business models for application of the integrated system, managing risk, and societal and environmental impact in a highly sensed world.

# Welcome to the Monitoring of Engineered and Natural Systems Using Sensors (MENSUS) Industry Showcase.

MENSUS is a new interdisciplinary initiative centred at the University of Southampton that focuses on system monitoring technology and applications, and exploits expertise to tackle the challenges encountered by many industrial sectors.

The day has been designed to give an overview of research being conducted across the UK and in particular at the University of Southampton, providing valuable insight on the latest ideas and technologies and potential areas of new funding.

There is plenty of opportunity for networking and fostering new collaborations, with a full spectrum of industry, government and academia in attendance.

## **In this brochure:**

Programme	p4
Laboratory Tours	p6
Speakers	p8
Parallel Sessions	p11
Exhibitors	p14
Demonstrators	p16
Meet the MENSUS Co-Chairs	p20

# Programme

09:00 – 09:55	<b>Arrive and Refreshments</b> <b>Exhibition and Poster Viewing</b>
09:55 – 10:00	<b>Neil White – housekeeping notes and handover to headline</b>
10:00 – 11:00	<b>Session 1</b>
10:00 – 10:15	<b>Mark Spearing, Vice President of Research and Enterprise</b> Welcome and Showcase Opening
10:15 – 10:30	<b>Nigel Rix, Head of Enabling Technologies, KTN</b> The state of the current sensors community and technology in an increasingly sensed world, strategy and funding opportunities
10:30 – 10:45	<b>Matt Mowlem, Head of Sensors Development Group, University of Southampton</b> Innovative sensors for harsh aqueous environments: from invention to operation and commercialisation
10:45 – 11:00	<b>Richard Clegg, Managing Director, Lloyds Register Foundation</b> Emerging technologies from the perspective of Lloyd's Register Foundation
11:00 – 11:30	<b>Refreshment Break</b> <b>Exhibition and Poster Viewing</b>
11:30 – 12:30	<b>Session 2</b>
11:30 – 11:45	<b>Jane Burrige, Professor of Restorative Neuroscience, Faculty of Health Sciences, University of Southampton</b> Sensors embedded in a garment for stroke rehabilitation
11:45 – 12:00	<b>Philip Tyler, RESIST Project Coordinator</b> An SME's experience in collaborative research using real time sensors
12:00 – 12:15	<b>Jakob Sprickerhof, Portfolio Manager, EPSRC</b> Strategic Update from EPSRC
12:15 – 12:30	<b>Ling Wang, Chair of MENSUS, University of Southampton</b> MENSUS – An introduction
12:30 – 13:15	<b>Optional Laboratory Tours: (Tours A &amp; B)</b> Tour A: Clean Room and Optoelectronics Research Centre (led by Chris Holmes) (Max 40*) Tour B: Engineering: Human Factors Laboratory, Testing and Structures Research Laboratory, $\mu$ -VIS X-Ray CT Centre (led by Janice Barton). (Max 40*)
12:30 – 14:00	<b>Lunch, Exhibition and Poster Viewing</b>

14:00 – 15:00	<b>Parallel Sessions</b>
	<b>Parallel Session 1: Challenges for Sensors and Devices</b> Chaired by Tim Waters and Matt Mowlem
14:00 – 14:15	<b>Speaker 1: Martin Willett, City Technology</b> Gas Sensors for Portable Applications – Challenges and Opportunities
14:15 – 14:30	<b>Speaker 2: Kirk Martinez, University of Southampton</b> Sensor Networks for the environment
14:30 – 14:45	<b>Speaker 3: Andy Morris, Chief Mechanical Engineer, EDF Energy – Coal, Gas and Renewables</b> Pressure systems installation, presenting significant technical challenges in a difficult commercial climate
14:45 – 15:00	<b>Speaker 4: Walter Holweger, Senior Key Expert at Schaeffler Technologies</b> Attempts for Real Time Sensing in Tribo-Contacts - Ways to Digital Tribology
	<b>Parallel Session 2: Challenges for Big Data and Analytics</b> Chaired by Honor Powrie and Joerg Fliege
14:00 – 14:15	<b>Speaker 1: Joerg Fliege - Head of Operational Research within Mathematical Sciences at the University of Southampton</b> The mathematics of big data
14:15 – 14:30	<b>Speaker 2: Mandy Chessel – Chief Architect, IBM Agency</b> Managing big data and analytics in multi-system environments
14:30 – 14:45	<b>Speaker 3: Zoheir Sabeur – Science Director, at IT Innovation Centre, UoS</b> Crowd physical motion and behaviour detection during evacuation from confined spaces
14:45 – 15:00	<b>Speaker 4: Jo Holbrook – University Hospital, Southampton NHS Foundation Trust</b> Tailoring bespoke medicine using big genetics and genomics data in the NHS
15:00 – 15:30	<b>Panel Discussion:</b> Chaired by parallel session chairs with Parallel Session Speakers
15:30 – 15:35	<b>Closing Remarks – Mark Spearing</b>
15:35 – 16:00	<b>Refreshment Break and Exhibition</b>
16:00	<b>Depart</b>

# Laboratory Tours

12:30 – 13:15

## **Tour 1 – Clean Rooms**

---

On this tour you will be shown Southampton's £120M Cleanroom Complex, which sits within the University's Zepler Institute (ZI).

The ZI is a unique multidisciplinary research centre that brings together world-leading expertise in photonics, quantum technologies and nanoscience. It is the largest photonics and electronics institute in the UK, with over 350 staff and PhD students led by Director Professor Sir David Payne.

The ZI offers a unique mix of expertise in established and cutting-edge technologies, combined with a wide range of equipment for micro and nanofabrication and electronic and optical characterisation across a range of facilities. The tour will include nanofabrication facilities, thick film development areas, optical fibre fabrication suites and toolsets used for metamaterial and integrated optics development.

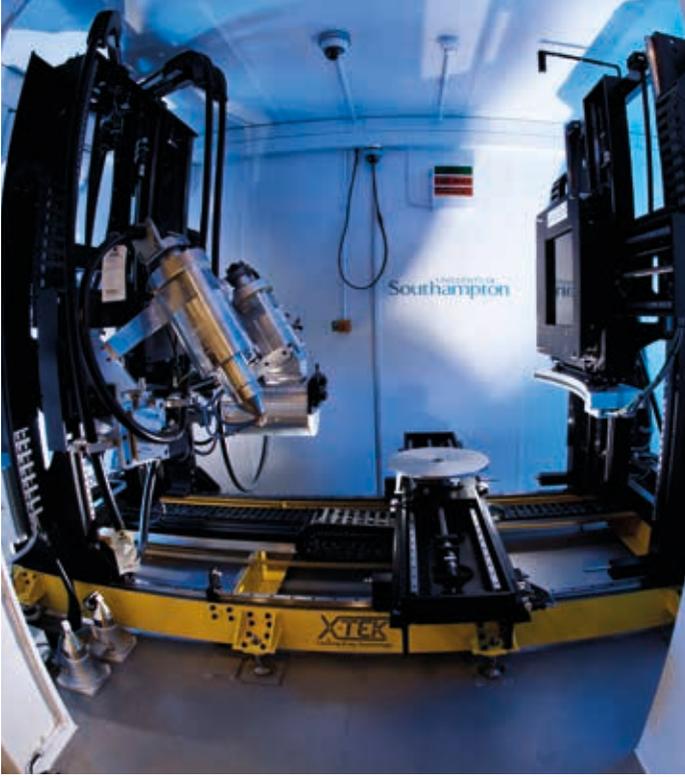
## **Tour 2 – Engineering**

---

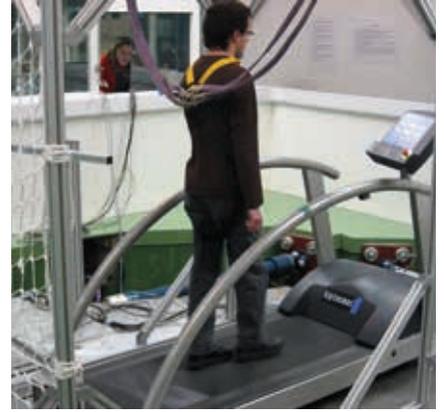
On this tour you will be shown the Human Factors Laboratory, Testing and Structures Research Laboratory (TSRL), followed by our unique Computed Tomography (CT) imaging centre - $\mu$ -VIS.

The Human Factors Lab comprises a unique range of human-rated test facilities for experimental studies of human responses to whole-body vibration, hand-transmitted vibration, and low frequency oscillation.

The TSRL is a state of the art materials and structures testing facility that enables developments in measurement methodologies with a focus on utilising imaging systems to provide information on structural performance. There are a number of testing machines covering a range of loads both statically and dynamically. We also have facilities for testing over a range of temperatures from cryogenic to in excess of 500°C. The imaging systems include high speed and high resolution devices for optical measurements as well as infra-red systems and ultrasound.



01



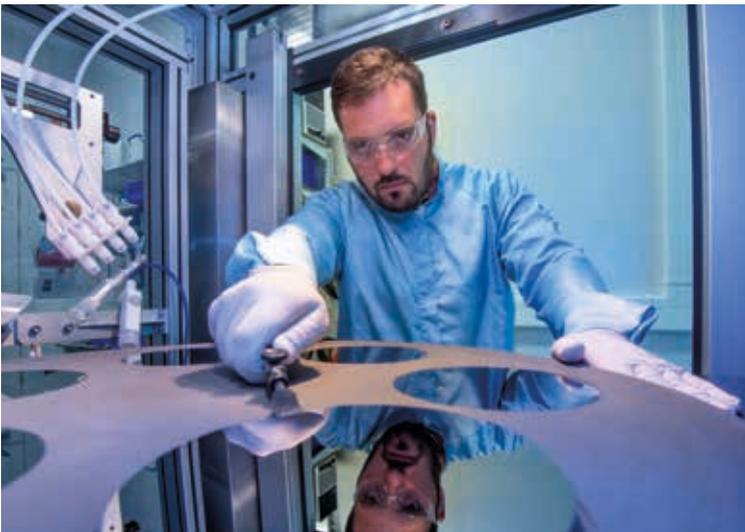
02



03



04



05

- 01 Our unique Computed Tomography (CT) imaging centre -  $\mu$ -VIS
- 02 Investigating balance when walking during exposure to low frequency motions.
- 03 6-axis simulation of recordings of vibration in a car.
- 04 Testing and structures research laboratory
- 05 The Cleanroom Complex is home to the best set of nanoelectronics and photonics fabrication capabilities in the UK.

# Speakers



## Professor Mark Spearing

---

Vice President for  
Research and Enterprise,  
University of Southampton

---

Prof. Spearing received his PhD from Cambridge University Engineering Department in 1990, worked as a research engineer at UC Santa Barbara from 1990-92 where he developed models for the failure of high temperature ceramic materials. From 1992-94 he was an engineering specialist at BP Research and subsequently a research engineer for Carborundum Microelectronics, where he was a member of the electronic packaging technology development team. He joined the Massachusetts Institute of Technology in 1994 and was appointed Full Professor in 2004. Professor Spearing's research focuses on developing mechanism-based models and design approaches for the failure of advanced engineered materials. His research activities involve advanced composites, layered materials and materials, structures and processes for microelectromechanical systems (MEMS) and other Microsystems.



## Nigel Rix

---

Head of Enabling Technologies, KTN

---

Mr. Rix is Head of Enabling Technologies at The Knowledge Transfer Network (KTN), which is a not-for-profit organisation focused on driving R&D and Innovation within UK industry, across all technologies and all sectors. It is funded by Innovate UK, the UK Government Innovation Department, and acts as their link to Industry. KTN's innovation network brings together industry, academia and government. Nigel's main focus within the KTN is managing the Enabling Technologies portfolio. Enabling technologies, in particular electronics, sensors, photonics and ICT, are those which have the potential to be used in multiple applications across many industrial sectors. Prior to joining KTN Nigel had over 30 years in industry developing products and companies, start-ups to multi-nationals, where companies were bringing new solutions to market – involving new technologies or new market sectors.



## Professor Matt Mowlem

---

Head of Sensors Development Group,  
University of Southampton

---

Matt is the head of the Sensors Development Group at the National Oceanography Centre, Southampton, UK. His research focuses on the development of novel biogeochemical sensors, with an emphasis on in situ systems. He is the leader of the Oceans 2025 theme 8.1 “4D biogeochemical sensors” project, is developing the submersible technology the Lake Ellsworth consortium, and is the project coordinator for RMST project. He heads the development of lab-on-a-chip environmental genomic and proteomic sensor technology for the FP7 project “lab-on-foil” project and is a partner in SENSENET (an FP7 ITN project).



## Professor Richard Clegg

Managing Director,  
Lloyds Register Foundation

Prof. Clegg joined Lloyd's Register in 2010 as Global Nuclear Director for the Energy business. He brings a wealth of experience from the nuclear sector and has worked in industry, academia and government in both the civil and defence sectors. Before joining the Group, Prof. Clegg was the Managing Director of the UK's National Nuclear Centre of Excellence. His other posts include Chief Scientist and Board Director at the Atomic Weapons Establishment (AWE) and he was the founding Director of the Dalton Nuclear Institute at The University of Manchester. He worked for nearly 20 years for British Nuclear Fuels (BNFL) where he left as the Corporate Director of Science. His technical background is in radioactive waste disposal and environmental modelling. He sits on a number of UK government advisory committees, is a trustee of the Science Museum and is a Fellow of the Royal Academy of Engineering.



## Professor Jane Burridge

Professor of Restorative  
Neuroscience, Faculty of Health  
Sciences, University of Southampton

Prof. Burridge leads the Neurorehabilitation Research Group. Her research aims to understand the mechanisms of sensory-motor recovery following stroke. She and her Group use this better understanding to design and evaluate rehabilitation technologies that will improve recovery following central nervous system lesions such as stroke and spinal cord injury. In collaboration with electronics, control, design and signal processing engineers, psychologists and industrial partners, her group develops technologies for measurement and therapy, including rehabilitation robots; Functional Electrical Stimulation (FES); and non-invasive cortical stimulation. They also conduct research into the use and clinical effectiveness of technology in rehabilitation. In collaboration with Health Psychologists, they research into motivation adherence in neurological rehabilitation and barriers to adoption of new technologies.



## Philip Tyler

RESIST Project Coordinator

Philip's career started in academia working, including roles at universities in Germany and Japan, finishing at UC Berkeley. Initial spending 2 years working on engineering design software at KTI, he became a director of Enabling Process Technologies Ltd 15 years ago, working mainly in the aerospace sector (Airbus), and energy (EDF). Philip's main responsibilities alongside consultancy work, are finances, quality systems and R&D. Following successful European and UK funded projects he is now working on 4 Innovate UK projects. He is also a director of an engineering software and training company and chief technical officer at Infrastructure Capital Group.



## Dr Jakob Sprickerhof

---

Portfolio Manager, EPSRC

Dr Jakob Sprickerhof is the portfolio manager for Built Environment and Infrastructure and Urban Systems within the Engineering Theme of the Engineering and Physical Sciences Research Council. His responsibilities include the peer-review process as well as the development of strategy for these research areas. He is also the Equality & Diversity representative of Engineering for the EPSRC



## Dr Ling Wang

---

Associate Professor in Condition Monitoring for Tribological Systems, Faculty of Engineering and the Environment, University of Southampton

Dr. Wang is Associate Professor in Condition Monitoring of Tribological Systems at the national Centre for Advanced Tribology at Southampton (nCATS), University of Southampton. She is Chair of MENSUS USRG and Deputy Head of nCATS. She joined University of Southampton in 2001 after she completed her PhD in developing condition monitoring techniques for wastewater pumps. Her research focuses on the development of novel sensing techniques and advanced signal processing methods for fault detection and prediction, especially for tribological systems such as bearings and lubricants. Her research also focuses on wear, lubrication, surface engineering and bearing failure investigations.

# Parallel Sessions



## Dr Martin Willett

---

UCP Engineering Fellow,  
City Technology

---

After completing a BSc in Physics at Birmingham University in 1978, Martin joined the UK National Coal Board research establishment to work on sensors for challenging underground coal mine environments. He was awarded a PhD from Nottingham University in 1987 for studies of the surface chemistry and electrical behaviour of tin oxide semiconductor gas sensors. In 1994, he moved to City Technology in Portsmouth, focusing on the development of successful optical, catalytic and electrochemical sensor products for toxic and flammable gases. He has managed numerous external R&D programmes with Corporate Laboratories and Universities, investigating topics such as novel long life oxygen sensing technology, micromachined pellistors using mesoporous catalysts, and models for electrochemical sensor water management. In recent years he has led work on low power devices for mid-infra-red optical gas detection. His technical expertise was recognised by appointment as a Honeywell Technology Fellow in 2015.



## Professor Kirk Martinez

---

Professor of Electronics and  
Computer Science, Faculty of Physical  
Science and Engineering, University of  
Southampton

---

Prof. Martinez's main research area is in sensor networks for the environment, particularly the Glacsweb project (since 2003 with 6 grants), and Internet of Things sensing research (funded by ARM & NERC) with deployments in Iceland and Scotland. He has collaborated with a wide range of companies on real-world solutions. He also works on imaging projects, particularly of Cultural Heritage together with major museums.



## Professor Andy Morris

---

Chief Mechanical Engineer, Central  
Technical Organisation, EDF Energy

---

Prof. Morris currently works for EDF Energy as Chief Mechanical Engineer in the Coal, Gas and Renewables business and he has responsibility for the structural integrity of a wide range of power generation assets within the EDF generation fleet. Over the past 30 years he has specialised in the integrity assessment of a variety of power generation structures/systems, including electrical generators, naval nuclear PWR's, high temperature and pressure systems, steam turbines, gas turbines, civil structures and onshore/offshore wind turbines. Andy is a Fellow of the Institution of Mechanical Engineers and a Visiting Professor at Imperial College London. Andy is actively involved in research on life assessment methods (in particular with respect to ageing materials and condition monitoring under service loading) with Universities in the UK and with groups abroad.



---

## Professor Walter Holweger

---

Senior Key Expert, Schaeffler  
Technologies AG & CO. KG

---

Professor Holweger obtained his PhD from the Chemistry Department in University of Tuebingen on transient reactive intermediates in 1982 and is the Senior Key Expert in materials, chemistry, physics at Schaeffler Technologies Herzogenaurach since 2006. He is responsible for technology development in materials, physics, tribology, modelling and simulation at Schaeffler. He has been awarded the Royal Academy of Engineering Visiting Professorship in Material Science, Tribology and Lubrication Chemistry since 2015 in collaboration with University of Southampton. He leads the research and development of wind turbine bearing using multiple sensing technologies at Schaeffler.



---

## Professor Joerg Fliege

---

Head of Operational Research within  
Mathematical Sciences, University of  
Southampton

---

Prof. Fliege obtained his PhD in Mathematics from the University of Dortmund in 1997. After visiting positions at the universities of Berkeley, Brussels, and Erlangen-Nuremberg he was awarded an associate professorship at the University of Birmingham in 2004 and a full professorship at the University of Southampton in 2007. He is Head of the Operational Research Group at the University of Southampton and a Fellow of the Operational Research Society of the UK. Joerg is member of the steering group of STA, the Space Trajectory Analysis project of the European Space Agency, and associate editor of "Computational and Applied Mathematics".



---

## Professor Mandy Chessel

---

IBM

---

Prof. Chessel is an IBM Distinguished Engineer, Master Inventor and member of the IBM Academy of Technology. Her current role is the Chief Architect for Information Solutions in the IBM Information Analytics Group CTO office. She leads the design of common information management patterns for different industries and solutions. This includes the Data Reservoir, Next Best Action solution and the strategy for Information Governance. Outside of IBM, Mandy is a Fellow of the Royal Academy of Engineering and a visiting professor at the University of Sheffield, UK. In 2001 she was the first woman to be awarded a Silver Medal by the Royal Academy of Engineering and in 2000 she was one of the "TR100" young innovators identified by MIT's Technology Review magazine. Mandy also has been granted an honorary fellowship of the Institution for Engineering Designers (IED) and an honorary doctorate of science by the University of Plymouth.



## Dr Zoheir Sabeur

---

Science Director at IT Innovation Centre, ECS, University of Southampton

---

Dr Sabeur graduated with a PhD in theoretical particle physics from the University of Glasgow (1990). He had various academic appointments in Computational Science at Strathclyde University, the University of Leeds and also the University of Wuppertal (Germany). He also worked in industry for 14 years as Head of Research at BMT Group Limited where he led the development of advanced environmental information and decision-support systems for the UK Oil and Gas Industry and UK Government. Zoheir joined the University of Southampton, IT Innovation Centre, ECS, in 2009 and has been conducting research with his team on big data, machine learning and high level data fusion and reasoning for critical decision-support. Currently, he is investigating crowd behaviour detection in confined spaces using computer vision combined with concepts of fluid flow dynamics and statistical mechanics for human behaviour automated measurements.



## Professor Jo Holbrook

---

Professor of Bioinformatics, NIHR Biomedical Research Centre, University of Southampton

---

Prof. Holbrook wants to discover molecular biomarkers that can improve the individualised diagnosis and treatment of complex diseases. She analyses and interprets genetic and genomic datasets from observational and interventional cohorts and trials. She is currently a senior principal investigator within the Singapore Institute for Clinical Sciences (SICS, A\*STAR) and Professor of Bioinformatics at the NIHR Biomedical Research Centre, University of Southampton, UK. Previously, she worked within Glaxosmithkline R&D drug discovery (in the UK and USA) for ten years. She holds a PhD in Molecular Cell Biology from University College London (UCL) and a BSc (hons) in Genetics from the University of Newcastle Upon Tyne, UK.

# Exhibitors will include

## **Chris Mortimer and Tim Rycraft, RTLS Group**

Real Time Logistics Solutions - Real Time Asset Tracking and Machine Monitoring

Our service provision is to work closely with clients to support the increasing aspirations of Industry 4.0 and become an enabler for asset management (location and movement), stock security, and OEE development across a wide range of industrial applications.

We have developed end to end, turnkey systems with existing partners including specialist electronic wireless hardware design, firmware, software, integration into third party systems (SAP) and hosting with HTML remote reporting.

Our reusable core developments have enabled printing presses, packaging and film processing units to optimise operational performance by reducing ongoing core costs and minimising production delays due to core instability issues. The replacement of enhanced (specification) fibre cores by Aluminium has improved structural rigidity and specific modulus.

RTLS will bring example sensors and asset tags that are used in our end to end solutions along with example visuals of how our data capture can help the modern business.

## **Saritha Arunkumar and Sanaz Yeganefarde, IBM UK**

Delivering Industry Innovation

The IBM Emerging Technology team are based in Hursley and span a wide variety of research and technology areas with a team of highly qualified emerging technology specialists. We thrive on client relationships and are at our best when applying emerging technologies to real client problems to prove new ways of working, new business models and other first-of-a-kind ideas. We have relationships with a number of US and UK universities and a strong record of academic publications showcasing both the theory and application of some of our collaborative research work. So please come along to our stand to find out more about IBM Emerging Technology and how we might be able to work with you or your clients.

<https://www.ibm.com/blogs/emerging-technology/>

## **Nicola Symonds and Ilaria Corni, nC<sup>2</sup>**

nC<sup>2</sup> is a University of Southampton engineering Business Unit working directly for industry providing consultancy services including: material testing, characterisation, failure investigation and applied research.

We offer solutions to industry in the fields of tribology, surface science and materials engineering. The state of the art equipment we utilise can produce abrasive, corrosive or erosive simulated environments providing material testing for our industrial customers from sports, oil & gas, manufacturing, transport and medical sectors. The nC<sup>2</sup> staff, working with resident academics use forensic materials examination and characterisation techniques to investigate and diagnose component failures, providing documented evidence where needed.

<http://www.southampton.ac.uk/nc2>

## **William Taylor, Business Development Specialist, National Physical Laboratory**

The National Physical Laboratory is a world-leading centre in the development and application of highly accurate measurement techniques. As the UK's national standards laboratory, NPL underpins the national measurements system, ensuring consistency and traceability of measurements throughout the UK. We offer a unique range of measurement services, contract research and training.

NPL's sensor work cuts across industry; from oil and gas to biotechnology, local air quality to aerospace. Capabilities include validation and verification of sensor devices using instrumentation traceable to national standards, development of novel sensor technologies, and consultancy services. NPL's goal is to deliver substantial benefits to the UK's prosperity and quality of life from its main laboratory in Teddington, and through its regional hubs in collaboration with partner universities at Cambridge, Huddersfield, Strathclyde and Surrey.



# Demonstrators

## Remote Access Laboratory – Ling Wang

Remote access laboratory (RAL) for vibration monitoring rig, supported by Boeing, has been designed and developed as a teaching tool incorporating the following:

- Mechanical system operation: a three bearing on a shaft configuration;
- Sensing system: three accelerometers are installed to monitor the condition of the three bearings;
- Remote access ability: students/learners can access this lab remotely;
- A range of experiments and data analysis methods can be taught and learnt:
- Types of test: changing of bearing/shaft rotating speeds; applying a bending force to the shaft hence changing the conditions on the three bearings (in different ways)
- Data analysis: students can record the sensor data and apply a range of signal processing techniques (time and frequency domains and advanced methods) to extract bearing condition information.



This tool can be used in teaching modules related to a wide range of industries essentially demonstrating sensing and bearing monitoring techniques.

## Residual Stress and Structural Integrity Studies using Thermography (RESIST), Janice Barton, University of Southampton

There is a clear case for an on-site inspection that can provide rapid inspections and prognostic information. Thermoelastic Stress Analysis (TSA) is a full-field thermographic technique which relates the thermal response of a component subjected to cyclic loading to the stresses. TSA data can be captured in as little as 10 seconds. More importantly, TSA provides visual information as a stress map which shows directly the redistribution of the stresses resulting from any defect enabling it to be used as both a diagnostic and a prognostic tool. A new means of excitation has been devised to provide the necessary cyclic loading that does not require electrical power so it can be deployed on-site during a scheduled outage at EDF Energy's coal fired power stations at West Burton and Cottam. The system was used to inspect a number of steam line welds and its viability is demonstrated for use in on site applications as an NDE system in the challenging environment of a coal-fired power station.

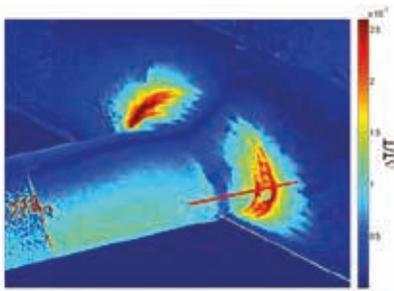
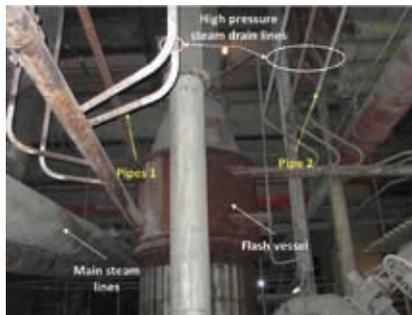


Image of stresses in the inspected pipe



Overview of inspection area at EDF West Burton.

## Lab on chip chemical and biology sensors, Matt Mowlem, University of Southampton

The University of Southampton and the National Oceanography Centre through the collaborative "Centre for Marine Microsystems" have produced a new breed of sensor technologies for environmental and industrial water. Examples will be shown and demonstrated at the showcase event and include state of the art microfluidic analysers that use reagent based assays to make precision measurements of a host of water quality parameters. This technology is mature, having been demonstrated in the deep sea (to 4800 m to date), and having returned accurate data for over a year in the Hampshire Avon and Christchurch Harbour and from a deep sea observatory in the Arctic. The team is actively seeking industry partners for licensing and commercialisation of the technology. Mature assays include nutrients, the carbonate system, trace metals. Assays in development include phytoplankton (biomass and taxonomic group), E.coli and pathogens, harmful algal blooms, organics and hydrocarbons.

## **Energy Harvester, Mohamed Torbati, University of Southampton**

An important issue related to mechanical energy harvesting devices is their power density and the efficient conversion of the available kinetic energy to electrical energy. An approach to increase the power density of a mechanical harvester is to design hybrid systems that are inertial based and are driven by the same energy source. This design is different than the existing hybrid systems in which energy is harvested from two different sources, such as sunlight and sound or heat and light. We have developed a hybrid system in which the linear motion of the proof mass (that is driving a generator through a leadscrew) is used simultaneously to energise a flux-switching mechanism). Flux-switching permanent magnet (FSPM) machines are used in numerous applications and mainly find their use as motors in a rotary configuration and hence the focus of this work is relatively novel, i.e., the design of a linear FSPM generator. In this design, the proof mass of the mechanical harvester is employed as the rotor that is surrounded by a number of stators (two in this design) and windings to form an additional linear generator. This kind of approach opens up a whole host of important research issues that arise from the interaction between different electromechanical parameters that can subsequently be taken advantage of to improve the power density of the device.

## **Lloyd's Register Foundation International Consortium of Nanotechnologies, ICON**

The International Consortium of Nanotechnologies (ICON), led by the University of Southampton, aims to “build capacity and knowledge in the application of nanotechnologies to support safety of life and property”.

Societies and communities around the world face major challenges linked to climate change, population growth, energy security and the availability of food and water. In response, innovative technology, in areas such as smart materials, energy storage and generation and big data, is being developed to ensure the critical infrastructure on which modern society relies is able to satisfy growing demands.

ICON will develop more than 50 new international nanotechnology experts who will have spent their training considering safety issues and advancing knowledge within a specific field related to the themes, such as smart materials, identified in the Foundation's Foresight Review of Nanotechnology (2014).

### **Industrial Engagement**

ICON sees working together and engaging with industry as part of its wider mission of building a safer world with Nanotechnology.

ICON would like to hear from those interested in attending or exhibiting at an ICON event, hosting an ICON student via a secondment or having an interesting, relevant problem that fits within its remit.

## **Research Institute for Industry (RIFI), Simon Quinn and Duncan Crump, University of Southampton**

The Research Institute for Industry (RIFI) is one of the University of Southampton's professional consultancy units, within the Faculty of Engineering and the Environment. Its technical expertise is focused on materials and structures, specifically:

- Cryogenics (low temperature engineering)
- Experimental mechanics (materials and structural testing)
- Structural analysis using finite element analysis (FEA)

We utilise our knowledge to solve complex problems for all industries, for example experimental testing in a variety of environmental conditions and temperatures. This includes static and fatigue loading and impact and dynamic conditions. State-of-the-art imaging techniques can be utilised to produce full-field data for stress/strain and damage assessment.

Experimental data can be used to support and validate FEA and FEA in turn can be used to optimise test campaigns through parametric studies to provide cost efficient solutions.

# Meet the MENSUS Co-Chairs



## Dr Ling Wang

---

### Chair

---

Ling is Associate Professor in Condition Monitoring of Tribological Systems at the national Centre for Advanced Tribology at Southampton (nCATS), University of Southampton. She is Chair of MENSUS USRG and Deputy Head of nCATS. She joined University of Southampton in 2001 and her research focuses on the development of novel sensing techniques and advanced signal processing methods for fault detection and prediction, especially for tribological systems such as bearings and lubricants. Her research also focuses on wear, lubrication, surface engineering and bearing failure investigations.



## Professor Neil White

---

### Co-Chair and Theme Leader for Energy Harvesting

---

Prof. White was Head of Electronics and Computer Science from 2011 to 2015. He obtained a PhD from the University of Southampton in 1988 for a thesis describing the piezoresistive effect in thick-film resistors. He was awarded a personal Chair in 2002. His research interests include thick-film sensors, intelligent instrumentation, MEMS, self-powered microsensors and sensor networks. He is a Chartered Engineer, Fellow of the IET, Senior Member of the IEEE, Fellow of the IoP and a Chartered Physicist. He has published over 200 scientific papers in the area of sensors and instrumentation systems and holds 10 patents. He is a former Director and co-founder of the University spin-out company Perpetuum Ltd., which specialises in vibration energy harvesting. He was the recipient of the 2009 Callendar silver Medal, awarded by the Institute of Measurement and Control for his 'outstanding contribution to the art of instruments or measurement'.



## Professor Janice Barton

---

### Co-Chair and Theme Leader for System Integration

---

Janice is a Professor of Experimental Mechanics in the Faculty of Engineering and the Environment at the University of Southampton. She received her PhD from the University of Manchester in 1993 where she started her research on the topic now known as 'Thermoelastic stress analysis'. She has published around 300 papers with more than 100 in archival journals. Janice's expertise is in imaging for data rich materials characterisations and assessments of structural performance, with a focus on lightweight structural design particularly composite structures. She has developed novel approaches in experimental mechanics, with a focus on the development of infra-red imaging recently covering high speed data capture, new approaches to residual stress analysis and strain-based NDE. Janice is a Fellow of the Institute of Physics, the Society for Experimental Mechanics and the British Society for Strain Measurement. Recently Janice was chairman of the 16th International Conference on Experimental Mechanics in 2014, which attracted over 500 international delegates to Cambridge in the UK.



## Dr Chris Holmes

---

### Theme Leader for Sensors and Devices

Christopher is a Senior Enterprise Fellow at the University of Southampton. He is passionate about bringing laboratory concepts to commercial fruition. He sits on the board of directors for the Gas Analysis and Sensing Group Ltd (GASG) and has over 100 journal papers and patents in the area of optical sensor technology. His current research builds upon technology surrounding the University optical sensor spin-out company, Stratophase Ltd. Namely this includes developing components to monitor physical, (bio)chemical and gas species. His research continually engages with industry partners including Huawei, Honeywell and Parker Hannifin.



## Professor Honor Powrie

---

### Theme Leader for Big Data and Analytics

Professor Honor Powrie has over 25 years' experience in the Aviation industry, working for General Electric (GE) Aviation (including Smiths Aerospace) since 1994. Over 20 years' of this experience has been in Machinery Health Monitoring Systems, with more than 50 published papers in this area. Honor currently manages GE Aviation's only UK-based Data Science team, which delivers innovative solutions for monitoring and managing GE's extensive and world-renowned commercial engines fleet. Honor is a member of the IoP, CPhys and a member of the IMechE Tribology Group Committee.

Honor is also a visiting Professor at nCATS in the Faculty of Engineering and the Environment at the University of Southampton. In this role she delivers guest lectures, is a co-chair of the MENSUS strategic research group and MENSUS Theme Leader for Big Data and Analytics. Honor is closely involved with industrial liaison with the University, including joint research programmes and PhD supervision.



## Dr Tim Waters

---

### Theme Leader for System Characterisation

Tim joined the University's Institute of Sound and Vibration Research in 1998 as a consulting engineer and has been a member of academic staff since 2000. His research interests relate to vibration control, structural dynamics and structural health monitoring. Current collaborative projects with industry include crack detection using acoustic emissions and vibration based techniques for in-flight ice protection of aircraft. He has published about 80 papers in international journals and conferences, and a book chapter on vibration testing. He regularly runs short courses for companies in automotive and other sectors.

Prior to joining the university, he worked in structural dynamics and aerodynamics at Airbus in the UK, and completed a PhD in finite element model validation at the University of Bristol.



## Professor Matt Mowlem

---

### Co-Chair

---

Matt is the head of the Sensors Development Group at the National Oceanography Centre, Southampton, UK. His research focuses on the development of novel biogeochemical sensors, with an emphasis on in situ systems. He is the leader of the Oceans 2025 theme 8.1 “4D biogeochemical sensors” project, is developing the submersible technology the Lake Ellsworth consortium, and is the project coordinator for RMST project. He heads the development of lab-on-a-chip environmental genomic and proteomic sensor technology for the FP7 project “lab-on-foil” project and is a partner in SENSENET (an FP7 ITN project).



## Mr Roger Gardner

---

### Aerospace Sector Advisor, University of Southampton

---

Roger is an expert in promoting collaboration between the aerospace industry and academia to exploit the research base and draw through innovation. He conducts research, analysis and provides advice on aerospace and aviation environmental impacts and solutions. He also provides support to the university, industry and government to foster collaborations.



## Professor Joerg Fliege

---

### Co-Chair

---

Joerg obtained his PhD in Mathematics from the University of Dortmund in 1997. After visiting positions at the universities of Berkeley, Brussels, and Erlangen-Nuremberg he was awarded an associate professorship at the University of Birmingham in 2004 and a full professorship at the University of Southampton in 2007. He is Head of the Operational Research Group at the University of Southampton and a Fellow of the Operational Research Society of the UK. Joerg is member of the steering group of STA, the Space Trajectory Analysis project of the European Space Agency, and associate editor of “Computational and Applied Mathematics”.

Relevant web links are shown throughout this brochure. Please also consult **[www.southampton.ac.uk/mensus](http://www.southampton.ac.uk/mensus)** for further details and/or any changes which have appeared since first publication.

#### **Disclaimer**

This document is for information purposes only and is prepared well in advance of publication. While the University of Southampton uses all reasonable efforts to ensure that all statements, information and data contained in this document are accurate as at the date of publication, it reserves the right to make revisions or modifications to such statements, information or data at any time and accepts no responsibility for the consequences of any such revisions or modifications.

© University of Southampton 2014

This document can be made available, on request, in alternative formats such as electronic, large print, Braille or audio tape, and in some cases, other languages.

[www.southampton.ac.uk/mensus](http://www.southampton.ac.uk/mensus)