

Highlights Newsletter

July/August 2015

The AFRC hosted the 13th International Cold Forming Congress from 2nd-4th September. Around 120 delegates, mainly from industry, attended this event from around the world.

The ICFC, held every five years, is aimed at bringing together leaders of the cold forming industry to help define future direction. This year's conference focused on the issue of achieving cost reduction in the face of increasing product complexity and customisation. The discussion topics explored throughout the conference sessions increased awareness and provoked discussions of the current state of the art and future potential for improvement.

The level of interaction during the three days exceeded all expectations. Delegates were clearly excited about the AFRC facility, the knowledge, enthusiasm and diversity of staff, and the professionalism of the conference organisation. Most significantly, many new business relationships and opportunities were identified through the three days of the conference.

Glasgow certainly lived up to its well-deserved reputation as a welcoming and lively city and many of the delegates used this opportunity to find out more about what the city and its surrounding area has to offer. The city also demonstrated its proud tradition of science, engineering and manufacturing and a genuine desire to play a key role in the future of industrial development, which is reflected in the AFRC's interest and involvement in turning the art of metalforming into a science. As such, the conference also acted as a launch platform for our High Value Manufacturing Scotland programme which featured speakers from the Scottish Funding Council, Siemens, Spirit Aerospace, Glasgow School of Art Digital Design Studio, The Scottish Institute for Remanufacturing and Scottish Enterprise.

Delegates also enjoyed the cocktail reception held in the [City Chambers](#). The Scottish themed conference dinner held in the [Barony Hall](#) on the Thursday evening was also very well received by the delegates.



Technical News

AFRC Gas Furnace



With the support of Catapult funding, the AFRC has become the owner of a new industrial gas furnace, a type widely used in industry. Within the forging industry, it can be used for preheating material and also for heat treatment purposes.

This new gas furnace is in accordance with aeronautic norm AMS2750E (Aerospace Materials Specification) and its configuration will allow an in-depth understanding of the behaviour of industrial gas furnaces. This piece of equipment can also act as a validation means for CFD simulation.

Instrumentation and configuration of the gas furnace will give access to gas flow and thermal variables inside the furnace

in order to optimise factors such as burner position, part position, part stacking, shadowing effects & surface oxide development.

This furnace will be operational from October 2015 with its main characteristics being:

- Maximum temperature of 1200°C
- Maximum power of 500kW
- Size of the useful zone : 700 mm in height per 1 m²
- Possibility of different burner configurations: from 1 to 4 cold air burners or up to 2 regenerative burners
- Possibility to test different fumes' exhaust locations

Core Projects

Final voting of the Core Research 15/16 proposals took place at the recent Technical Board meeting. Twelve projects which will run during 15/16 have been identified and are listed below. For further detail, please contact Pauline Murray at p.murray@strath.ac.uk

- Residual stress characterisation
- Investigation of microstructure evolution in hot forging conditions for titanium and nickel superalloys
- Gas furnace characterisation
- Measurements of materials micro-mechanical properties at different temperatures
- Continuation of 14/15 activity—development of microstructure model of high temperature alloys
- Measurement and monitoring the residual stress evolution in a sheet product (cold or hot)
- Hydroforming state of the art and key process variables review
- Development of lab based method to characterise localised deformation mechanisms
- Development and FE analysis of metals formability at room temperature using deep drawing
- Next generation warm closed die forging
- Hot forming coatings
- Low cost die material for hot forming

What's happening in our Cold Workshop?

The Cold Workshop carries out a range of engineering activities and we can design and manufacture components, fixtures, fittings and custom parts. We have the ability to turn, mill, Electric Discharge Machine, section, cut and prepare samples from a range of machines. We carry out work for all departments within the centre from designing and machining dies, wire cutting EDM samples and parts to turning and manufacturing tensile samples for mechanical test. With the addition of new turning/milling machines in the near future, our machining capabilities will increase across the centre.



AFRC Internal Research Seminars

As the centre continues to grow, these monthly research presentations provide a good opportunity for staff to understand the full range of research subjects that colleagues are involved in.

Effect of cutting parameters on machining-induced residual stress, when turning nickel-based alloy Nimonic C-263 with tungsten carbide (WC) and polycrystalline cubic boron nitride (PCBN) cutting tools - Stephen Fitzpatrick—Senior Manufacturing Engineer

Tungsten carbide (WC) and polycrystalline cubic boron nitride (PCBN) cutting tools were utilised to conduct experimental turning cutting trials on Nimonic C-263, to determine the effect that semi-finishing and finishing cutting parameters had on residual stress in the machined layers. Nimonic C-263 is an age hardenable nickel-based alloy, developed by Rolls Royce for combustor gas turbine applications, typically rings, casings and sheet fabrications.

Before discussing the research activity, Stephen discussed the fundamentals of cutting tools, cutting tool geometry and cutting parameters used in turning, their importance in maintaining favourable cutting conditions and their subsequent effect on residual stress. The cutting trials were designed around full factorial design of experiments, for both WC and PCBN, and the effects of cutting speed, feed rate and depth of cut, on surface residual stress were analysed. Sub-surface measurements were also taken from selected samples for analysis.

The residual stresses were measured using the X-ray diffraction technique. All samples were measured in the hoop and radial directions on the surface, and two samples were selected for sub-surface measurements. All surface measurements, in both WC and PCBN, produced tensile residual stresses, and the results showed that feed rate was the strongest factor influencing the surface residual stress profiles in both tool materials. As feed rate increased, the tensile residual stress values increased. In addition, PCBN produced lower tensile stresses in almost all comparative experiments. The sub-surface results demonstrated that all experiments created compressive stresses within 30 μm depth and remained compressive throughout the depth range before becoming negligible after 150 μm depth.

Recruitment & New Starts

We are hiring!

The AFRC is experiencing a significant growth period and is currently recruiting new staff. You will find all current vacancies on our [website](#).

We are pleased to welcome the following new members of staff to the centre:

- ♦ Aurik Andreu—Senior Manufacturing Engineer
- ♦ Alison Ballantine—Business Development Manager
- ♦ Michael Canavan—Manufacturing Engineer
- ♦ Helen Emberson—Programme Manager
- ♦ Thomas Hicks—Workshop Technician
- ♦ Kornelia Kondziolka—Laboratory Technician
- ♦ Stephen Marshall—Partnership Development Leader
- ♦ Gladys Schnier - Research Associate
- ♦ Yu Shi—Research Associate
- ♦ Stephen Waugh—Workshop Technician

Staff Training

It is important to the AFRC to ensure staff are provided with training opportunities, valuable to their development, and to enable tasks to be carried out to the highest standard.

Project Management Training

Due to the number of new starts joining the centre recently, a two day course entitled, Project Management in the Real World, was held in August for 20 members of staff. Periodic training in this manner helps ensure a consistent approach to project management within the AFRC. The objective of this course was to provide a comprehensive introduction to the process of managing projects and the tools required to assist in planning and tracking progress. A third day of training is planned in September covering Risk Management. Participants are now trained to work and lead on commercial and research projects, with the support of the Programme Management Team.

Visits to the Centre

We are proud to advise that during July and August we had a total of 659 visitors pass through our doors.

Visitors to the AFRC in July and August included:

- ♦ Delegates of the Component Testing Workshop held on Wednesday 1 July
- ♦ Delegates of the Medical Devices Workshop held on Tuesday 14 July
- ♦ 150 Delegates of the ICNFT2015
- ♦ VIEWS Project Information Session attendees
- ♦ Dr Andrew McCormick, Permanent Secretary, Department of Enterprise, Trade and Investment, Northern Ireland and his Deputy, Chris Stewart
- ♦ John Mason, Scottish Government Director of Economic Development
- ♦ David Milliken, Senior Executive, Technology and Engineering, Scottish Enterprise

Engineering Technician Training

Two of our Cold Workshop Engineering Technicians, Fraser Mateer and James Stevenson, have completed 5 axis training and also an Alpha-cam CAD/CAM course at the AFRC. This will increase the AFRC's machining capabilities throughout the centre. The technicians are continually developing their knowledge base and will also become expert users when we take delivery of our new Mori Seiki milling/turning machine within the next month.

Apprentices

We would like to congratulate our two manufacturing engineering modern apprentices, Jayne Clark and Saad Ahmed, for completing their 1st year at college and both achieving A grades in their exams. Jayne was recently awarded apprentice of the year in the manufacturing engineering category and the full article can be read on P.8.

Events and Workshop News

ICNFT2015 Delegates took part in the AFRC Facility Tour

On Friday 7th August 2015, AFRC hosted 150 delegates from 21 countries who were attending the 4th International Conference on New Forming Technology.

The ICNFT2015, which was organised by the Department of Design, Manufacture and Engineering Management, University of Strathclyde, was held in Glasgow from 6th to 9th August 2015.

AFRC's Technical Director, Dr Michael Ward, gave a warm welcome to the delegates and a short overview of the AFRC. The delegates were then divided into groups and, guided by AFRC members of staff, were given a tour of the centre's workshops, laboratories and facilities. Feedback to the conference organisers was that the delegates were very impressed by what they saw and expressed their appreciation for the well organised tour.

The visit was held on a beautiful, sunny day as you can see in the photo below.



ICNFT2015 Delegates outside the AFRC

VIEWS AFRC Information Session

The Centre for Ultrasonic Engineering (CUE) and Advanced Forming Research Centre (AFRC) in collaboration with Spirit AeroSystems (Prestwick) has recently secured funding through the VIEWS programme—(*Validation and Integration of Manufacturing Enablers for Future Wing Structures*) of £1.5M to commission a new robotic inspection cell at the AFRC. This forms just a small part of the thirteen partner, £30M VIEWS programme which is part-funded through the UK Aerospace Technology Institute (ATI).

The VIEWS programme is aimed at innovative aircraft wing design, manufacture and assembly technologies and will advance technologies that have been developed under the recently completed STeM research programme to a higher TRL.

The multi-robot flexible inspection cell recently commissioned at the AFRC provides a direct conduit to take fundamental research conducted in the EEE Department to higher TRL levels (4 to 6) ready for future industrial exploitation. The flexible nature of the cell will also allow new fundamental research to be supported and investigated.

A very successful AFRC information session was recently held, showcasing the project, equipment and its relevance, impact and future opportunities for advanced high value manufacturing. The VIEWS team would like to thank all those who attended and assisted with this event. If anyone has any questions or requires any more information, please contact:

Gareth Pierce:
s.g.pierce@strath.ac.uk

Charles MacLeod:
Charles.macleod@strath.ac.uk

Medical Devices Manufacturing Workshop

AFRC hosted a Medical Devices Manufacturing Workshop on the 14 July as a Satellite Event to the 25th Congress of the International Society of Biomechanics in held in Glasgow in the same week. There were 37 attendees at the event including 9 companies involved in various aspects of device manufacture. The morning session concentrated on technical presentations that included new manufacturing processes and new possibilities for materials developments.

The afternoon session concentrated on market needs and NHS processes for appraisal and approval that are necessary precursor steps in the development of new products for this important market. Andrew Marsden of the Scottish Health Technologies Group presented on the appraisal and adoption process for the NHS. The contribution of the sector to the UK economy is highlighted by the turnover of £17B per year for UK companies active in the marketplace. Robin Wilson of Innovate UK presented on the funding opportunities available to companies. Vincent Nelis gave a presentation showing how Vascutek develop and provide lifesaving products for up to 150,000 people per year. The expectation for the future is that more improvements in healthcare will come from the rapid uptake of new methods and processes in this important area.

Component Analysis Workshop

In July 2015, the AFRC jointly hosted with the [Offshore Renewable Energy \(ORE\) Catapult](#) and the [European Marine Energy Centre \(EMEC\)](#), a Component Analysis Workshop for the wave and tidal industry. This was attended by representatives of some of the leading companies within wave and tidal energy.

The workshop was run as part of a project looking to foster industry knowledge sharing around components that have failed in real-sea conditions and the reasons why. From this, a database of component information will be built to be used by the offshore renewables supply chain, technology and project developers. In the first workshop session, AFRC provided an overview of why components fail, followed by facilitated discussions with delegates sharing their experiences of component failures and lessons learnt.

The next stage in this pilot project is to carry out analysis on a variety of components that have undergone real-sea testing, and feed the results into a database to enable knowledge sharing across the industry. The testing phase is due to be completed in early 2016, and a report will be published shortly after with details of the findings, as well as the launch of the database for joint use across the industry.

Working with EMEC and ORE Catapult, the AFRC hopes to help companies understand component failure and outline key steps to develop a 'right first time' approach to wave and tidal energy converter design. The AFRC is excited to be part of this opportunity and looks forward to working with EMEC, ORE Catapult and wave and tidal companies to better understand components and help unlock the potential in renewable products. If you'd like to learn more about this, please contact info@afrc.org.uk



Component Analysis Workshop Delegates at the AFRC
Image: © EMEC

Forthcoming Events and Exhibitions

We look forward to meeting you at the following:

Catapult Networking Event, TIC, Glasgow

Monday 26th October 2015

Advanced Engineering 15, NEC, Birmingham

Wednesday 4th and Thursday 5th November 2015

Innovate UK 2015, Old Billingsgate, London

Monday 9th and Tuesday 10th November 2015

Formed in the UK2, AFRC, Glasgow

Wednesday 2nd December 2015

AFRC Route to Impact Funding Competition

As part of an ongoing commitment from the AFRC to accelerate impact of earlier TRL stage research and technologies, the AFRC is pleased to announce a funding competition to enable University of Strathclyde academics, researchers, or KE staff funding support for projects where outcomes have the potential to drive manufacturing impact, innovation and ultimately lead to industrial advantages.

The competition, titled 'Route to Impact' is looking for projects between the value of £10,000 to £25,000 for feasibility studies where the end goal is to leverage larger sums of funding and/or demonstrate and de-risk an opportunity for industry.

A launch of the funding call will take place at the University of Strathclyde Technology and Innovation Centre on Thursday 17th September from 2.15-3pm. The deadline for applications is Friday 2nd October 2015 and application forms can be downloaded from the AFRC website shortly or on request. For more information or to register for the launch please contact Janine.de-fence@strath.ac.uk.

Can your small business benefit from the Catapult network?

Cross-Catapult SME event - Glasgow - Monday 26th October

Catapults are transforming the UK's capability for innovation in specific industry sectors. The Catapult network is a series of nine physical centres where the very best of the UK's businesses, scientists and engineers work side by side on late-stage research and development - transforming high potential ideas into new products and services to generate economic growth. SME's are strategically important to the innovation expected over the coming years. The Catapults are an invaluable resource to SME's in a wide range of markets and one of the ways in which we reach out to engage with SME's is through our series of cross-Catapult events across the UK. These events showcase our capabilities, expertise and successes, and allow us to promote the benefits of working with the Catapults:

- Access to facilities
- Access to a dynamic network environment
- Skilled resource
- Trusted environment

Our events provide SMEs with the opportunity to meet experts from each Catapult and to hear from entrepreneurs who have already watched their ideas transform into business reality. **Come along to the next event on Monday 26th October at the Technology & Innovation Centre in Glasgow, hosted by the ORE Catapult.** Through collaboration with Scottish Enterprise, this event will target Scottish-based SMEs, and will allow all Catapults to network with innovative businesses across a wide range of sectors, where future cross-cutting opportunities may exist. [Click here for more information and to register for the event.](#)

AFRC'S JAYNE CLARK WINS GLASGOW CLYDE COLLEGE'S APPRENTICE OF THE YEAR (MANUFACTURING ENGINEERING)

Jayne (pictured right) joined the AFRC in August 2014 as an Engineering Apprentice, working alongside the technicians in the Cold Workshop.

During this four year apprenticeship, Jayne spent the majority of her first year at Glasgow Clyde College's Anniesland Campus, studying for an HNC in Manufacturing Engineering. Having successfully gained her HNC, Jayne will now be based at the AFRC over the next few years learning practical skills and working towards SVQ Level 3.

On Friday 21st August, Clyde College held their award ceremony in The Trades Hall, Glasgow, where it was announced that Jayne had won Apprentice of the Year (Manufacturing Engineering).

Jayne says: "I was delighted to receive this award on Friday. I did not expect it and it was a great way to end the first year of my apprenticeship."

The AFRC is very proud of Jayne's achievement.



Congratulations!

Congratulations to our Quality Manager, Colin, and his wife on the birth of their beautiful daughter, Emily. Best wishes to all the family.

Best wishes to University EngD student, Andreas Reimer, on his recent marriage.

Contact us:

Advanced Forming Research Centre
85 Inchinnan Drive
Inchinnan
Renfrewshire
PA4 9LJ

E: info@afrc.org.uk
T: +44 (0)141 534 5200
W: www.afrc.org.uk

