



The
University
Of
Sheffield.

Advanced Manufacturing Research Centre



Portfolio

Last update: September 16, 2009



**THE QUEEN'S
ANNIVERSARY PRIZES**

2007

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Table of Contents

Numerical Overview.....	Page 3
Company Milestones.....	Page 4
AMRC Partners.....	Page 5
AMRC Leadership.....	Page 6
AMRC Board of Directors.....	Page 7
AMRC General Information.....	Page 8
AMRC Research.....	Page 9
The Factory of the Future.....	Page 10-11
Community Involvement.....	Page 12

A Numerical Overview of the AMRC

Total Partners

- Over 50

Staff

- More than 80
- Over 75% have a masters level qualification
- 30% of staff have a PhD level qualification

Apprentices

- 12

Research Projects

- 145 projects with 45 completed
- 15 generic

EU Research Projects

- PANACEA £3.6 million
- RAPOLAC £4.5 million
- AFFIX £12 million

Board Members

- 18

Regional Impact

- Over 200 instances of AMRC helping regional businesses (SME and LE)
- 200 Jobs created/safeguarded in Y&H companies
- £45 million in additional sales generated in Y&H companies

Regional Impact 2010 Commitment

- Further 600 jobs safeguarded/created
- Further £30 million additional sales generated

Individual Centre Value

- Assembly-£4.8 million
- Additive-£2.3 million
- Composites-£4.5 million

AMRC Total Value

- £60 million

Company Milestones



Advanced Manufacturing Research Centre



- **1999** - AMRC founded with £5.93m of dti funding.
- **2004** - AMRC building opened by HRH Prince Andrew, the Duke of York.
- **February 2005** - Rolls-Royce signs as a Tier 1 partner.
- **January 2006** - AMRC awarded £2.3 million to open the Innovative Metal Processing Centre.
- **February 2006** - Lord Sainsbury visits the AMRC.
- **May 2006** - AMRC awarded Composite Materials Centre.
- **July 2006** - AMRC begins apprenticeship program.
- **July 2006** - AMRC awarded £3.6 million to lead PANACEA research project.
- **August 2006** - AMRC awarded £4.5 million to lead RAPOLAC research project.
- **August 2006** - AMRC awarded £6.5 million from Yorkshire Forward to open the Factory of the Future.
- **August 2006** - AMRC awarded £3.75 million from the ERDF to open the Factory of the Future.
- **February 2006** - AMRC awarded £12 million from the European Commission to create AFFIX research project.
- **November 2006** - AMRC awarded £4.5 million to open the AMRC Composite Centre
- **March 2007** - Factory of the Future dedicated.
- **November 2007** - AMRC wins £500,000 EPSRC Knowledge Transfer Challenge to create MANTRA.
- **November 2007** - AMRC awarded the Queen's Anniversary Prize for Higher and Further Education.
- **June 2008** - Factory of the Future wind turbines activated.
- **October 2008** - Factory of the Future opened by HRH Prince Andrew, the Duke of York
- **November 2008** - AMRC Composite Centre launched.
- **November 2008** - AMRC Assembly launched.



AMRC Partners

Who are the AMRC's Tier 1 partners?

- Applied (Dassault Systemes)
- Alcoa
- BAE Systems
- The Boeing Company
- Carpenters
- MAG Cincinnati
- Delcam
- Lola Composite
- Messier-Dowty
- Metris
- Mori Seiki
- PTC
- Renishaw
- Rolls-Royce
- RTI Metals International
- Sandvik Coromant
- Siemens
- Wardjet
- Starragheckert
- Technicut
- WardJet

Who are the AMRC's Tier 2 partners?

- Aero Engine Controls
- ABB
- AMRC Manufacturing Limited
- Arcam
- ATS
- CG Tech
- Houghtons
- DIAD
- Dormer Tools
- Footprint Tools
- Machineworks
- Maher Ltd.
- Manufacturing Labs Inc.
- Materialise
- Mettis Aerospace
- Mitsubishi Electric
- Mitutoyo
- Nikken Kosakusho
- Optima
- Reliance Gears
- Rotary Engineering
- Third Wave Systems
- Timet
- Vibrant NDT
- Virtualis
- Westons

AMRC Leadership



Adrian Allen – AMRC Commercial Director

Adrian Allen was born in South Yorkshire, and has dedicated over a decade of his life to regenerating his home region which was devastated by the collapse of the mining and manufacturing industries in 1970's and 80's. After working in the aerospace industry for more than 20 years, which included owning and managing a Sheffield-based engineering consultancy firm, Allen developed a unique knowledge and understanding of the aerospace industry's key-drivers.

He would later use this knowledge to persuade the world's leading aerospace company, Boeing, and the University of Sheffield to collaborate and create The Advanced Manufacturing Research Centre. Allen, is forty-seven, he lives in Sheffield, has four children and has been married over 20 years. In his free time he enjoys coaching rugby, and sampling real ales from around the world.



John Baragwanath – AMRC Projects Director

John's first career was in the Royal Air Force, where he specialised in radar and communications engineering. Following this he worked in the Middle East for International Air Radio where he was the chief engineer on a long range 3D radar site.

He joined the Department of Trade & Industry in 1990 and held a variety of posts mainly focused on assisting industry. He was awarded an OBE in 2004 for services to the Government Office. The AMRC with Boeing was one of many regionally significant projects for which John was responsible when headed the Regional Innovation Unit in the Government Office for Yorkshire & the Humber. On retiring from the DTI in October 2005 he joined the AMRC, as Projects Director, later that month.

John has been married to his wife, Carol, for 41 years and has three sons.



Professor Keith Ridgway – AMRC Research Director

After graduation in 1973 Professor Ridgway worked as a Special Apprentice at Mather and Platt Ltd., a Manchester based manufacturer of centrifugal pumps for the power generation and oil industries. In 1975 he joined Kennedy and Donkin, Consulting Engineers, where he worked on the design of thermal power plants, carrying out trouble shooting projects in Yemen, Venezuela and Northern Ireland.

In 1980 he joined the University of Manchester where he was supported by Shell International Marine to carry out research on the design of anchoring systems for large ships. In 1982 he joined Staffordshire University as a lecturer in Design and Manufacture and remained there until taking up a similar position at the University of Sheffield in 1988.

In 1997 he became Professor in Design and Manufacture at the University of Sheffield. In 2001 he worked with a local businessman (Adrian Allen) to establish the University of Sheffield Advanced Manufacturing Research Centre with Boeing.

Professor Ridgway was awarded an OBE in the Queens Birthday Honours in June 2006 and became a Fellow of the Royal Academy of Engineering in July 2006.

Board of Directors



- **Barton Moenster, Chairman**
Director of Advanced Manufacturing
Research and Development
The Boeing Company
- **Adrian Allen**
Commercial Director
The AMRC
- **John Baragwanath**
Project Director
The AMRC
- **Stephen Burgess**
Manufacturing Process & Technology Director
Rolls-Royce
- **Dr. Frank Brinken**
CEO
The Starragheckert Company
- **Shaun Clark**
Managing Director
Applied PLM Solutions
- **Dr. Sergio Durante**
Executive Vice President
DIAD
- **Paula Fisher**
Financial Controller
The AMRC
- **Derrick Fothergill**
Managing Director
Technicut
- **Stephen Johnston**
BAE Systems
- **Patrick Monclar**
Vice President
Messier-Dowty
- **Brian Moran**
Director of UK Industrial Participation
The Boeing Company
- **Roger Onions**
Sales Director
Delcam
- **Professor Keith Ridgway, OBE**
Research Director
The AMRC
- **Ralf Ridemann**
GM, European Engineering Department
The Mori Seiki Company
- **Marc Saunders**
Group Marketing Services Manager
Renishaw
- **Andy Smith**
Senior Manager
Marketing and Product Manager
Sandvik Coromant
- **Chip Storie**
Vice President
MAG Cincinnati
- **Professor Geof Tomlinson**
Pro-Vice Chancellor
The University of Sheffield
- **Jimmy Williams**
Vice President
Alcoa

General Information



What is the AMRC?

The Advanced Manufacturing Research Centre (AMRC) with Boeing is a £60million partnership that builds on the shared scientific excellence, expertise and technological innovation of the world's leading aerospace company and the world-class research within the University of Sheffield's faculty of engineering. The AMRC's vision is to become a world-class global research facility developing innovative and advanced technology solutions for advanced materials forming. The AMRC is tangible demonstration of what is possible when academia, government and industry collaborate to develop cutting-edge technologies enabling world-class scientists and engineers to deliver real economic and environmental solutions benefiting everyone.

How Boeing is involved with the AMRC?

Boeing invests directly into the AMRC and has a ten year commitment of involvement to invest in research and development in science and manufacturing.

How the University of Sheffield is involved with the AMRC.

The AMRC is part of the University of Sheffield (UoS) and employs most onsite staff. The university has a vested interest in regenerating a deprived region. This can be done by helping to introduce research and development into industry and up-skilling within the UK aerospace supply chain. Additionally, the university carries out its own research using the AMRC facilities.

How does membership work?

Any company who works in a complementary area or who wishes to participate in the support of our research programmes is invited to join the AMRC. Currently there are two types of membership.

- **Tier 1**-Tier 1 membership costs £200,000 per year. Tier 1 partners get an individual seat on the board and an opportunity to influence the direction of future research. Tier 1 members participate in, and obtain the results of all generic projects. Additionally, Tier 1 members have the opportunity to specify any number of specific projects which are presented to the board for ranking and approval as funds become available.
- **Tier 2**-Tier 2 membership costs £30,000 per year. Tier 2 members participate in, and obtain the results of all generic projects. All Tier 2 partners are represented by one single board member.

AMRC Research

What does the AMRC Research?

Very generally speaking, the AMRC identifies, researches and solves advanced manufacturing problems. This is done through several interconnected research areas.

- **Process Technology**
High-performance machining is a large part of what the AMRC does. It involves producing parts within a system in the shortest time possible without compromising the structural or surface integrity of the component. By using dynamic analysis, we are able to maximise a machine's efficiency typically by around 40 percent. Our fundamental understanding of materials allows us to apply the best parameters to the materials our partners work with.
- **Composite materials**
The AMRC composites centre is dedicated to developing manufacturing technology for fibre reinforced plastics. The centre's focus areas are; design and manufacture of hybrid structures (in particular titanium / composite); development of out of autoclave processing technology and Automated Fibre Placement. The composites centre has access to the latest in composite manufacturing technology as well as industrial sized processing equipment capable of producing large scale aerospace components.
- **Assembly**
Although there are many researchers involved in mass assembly and automation, very few have expertise with low-volume, high-value assembly problems. CECA brings together the latest precision manufacturing technologies in micro-moulding, laser processing, micro-machining and metrology.
- **Measurement and Testing**
Even slightly changing process can significantly impact a structural component's final performance. Because many of the projects that the AMRC works on are safety critical components of aircraft, there is an absolute requirement for us to characterise the performance of structures and materials to measure strength, durability environmental performance and other critical properties. It is vital for us to understand if any of our new manufacturing techniques are detrimentally altering a components material properties before they can be accepted into wider practice. Recognising this critical need, the AMRC has set up a Structural Integrity Centre that is dedicated to providing this service both internally, and externally to the customer base of the AMRC.
- **Additive Manufacturing**
Working directly with and for the AMRC, IMPC is exploring the possibility of creating high-value components by adding material on, rather than by removing it. Currently, our engineers are conducting the technical and managerial feasibility studies that will enable us to develop the most cost effective means for creating low to mid-volume components for the medical, dental and aerospace industries.

The Rolls-Royce Factory of the Future

What is the Rolls-Royce Factory of the Future?

- The University of Sheffield with Boeing, Rolls-Royce Factory of the Future, is the second phase of development of the Advanced Manufacturing Research Centre. It is a collaborative partnership that applies scientific theory, environmentally sustainable solutions and manufacturing principles to solve advanced manufacturing problems. The Rolls-Royce Factory of the Future is continuously evolving to push the boundaries of current manufacturing knowledge.

Size

- The Factory of the Future is 4,564 meters squared.

Opened

- October 9, 2008 by HRH Prince Andrew, the Duke of York.

Cost

- £10.25 million.

What does the Rolls-Royce Factory of the Future do?

- Bring together pure and applied research, educational and industrial resources to be a world-class incubator for creativity and excellence.
- Create an integrated knowledge sharing community.
- Adopt and demonstrate new business models; organisational concepts and business methods.
- Overcome the theoretical limitations to manufacturing performance by researching and demonstrating the potential of new technology.
- Demonstrate the implementation and use of step-change manufacturing technologies in commercial scale environment.
- Showcase leading-edge manufacturing processes, equipment and tooling systems.
- Have a fully integrated environment - PLM/CAPP/Manufacturing Intelligence.
- Include a pre-production "demonstrator" environment for manufacturing complex components in aerospace materials to "lean" principles.
- Target step change MOM improvements to strategic "high-added-value" component families. For example, Rolls-Royce casings, discs, shafts; structural parts for Boeing; Landing gear for Messier-Dowty; and other large prismatic parts.
- Provide guaranteed product conformance via embedded quality systems and advanced measurement technologies.
- Act as a "Sand-Box" environment for concept evaluation and training.

The Rolls-Royce Factory of the Future

Environmentally sustainable features

Electricity

- Designing the building form to enable good daylight levels (i.e. average daylight factor between 2%-5%).
- Making use of wind energy to provide electricity for heating and lighting the building and for powering equipment.

Heating and Cooling

- Orientating the building to reduce summer heat gains.
- Position external solar shading on the South facade to reduce solar radiation causing the overheating of the building's inside.
- Avoiding the position of windows on the East and West facade where heat gains are difficult to control.
- Selecting external solar shading that enables passive solar radiation to heat the internal office accommodation during winter.
- Designing the building form to enable the majority of areas to be naturally ventilated.
- Introducing mass into the building to help reduce heating and cooling loads.
- Improving and testing the air-tightness of the building to reduce uncontrolled heat losses from infiltration.
- Introducing systems that enable surplus energy generated by the wind turbine to be exported back to the national grid.
- Using ground source heat pumps to provide heating and cooling.

Water

- Energy meter all primary building services, energy consuming systems.
- Avoiding the use of "power hungry" air humidification plant.
- Collecting rainwater from the roof and use this for toilet flushing and irrigation on the site.
- Using low-flow sanitary ware and installing flow regulating devices on all general water outlets.
- Introducing mains water leak detection systems on the incoming water mains.
- Introducing interceptors into the car park drainage system.
- Employing sustainable drainage strategies for surface water run-off from the site.

Ecological

- Using sustainable timber within the building and during the building process.
- Enhancing the ecological value of the site through thoughtful landscaping.
- Ensured that the contractor minimised construction site impact by the use of the Considerate Constructors Scheme and that they achieved a minimum score of 32.
- Constructing a building that achieved a "BREEAM Excellent" score.
- Using zero ozone depleting insulation materials and refrigerants.

Usability

- Developing a building users guide to enable non-technical people to fully understand the operation of the building.
- Carrying out post occupancy seasonal commissioning of the building to ensure that all systems are operating correctly and as the design intended.

Our sense of community responsibility stems from our dedication to earning the trust of our partners, customers, employees and our community. The AMRC participates in outreach programmes for education and regularly hosts learning opportunities for students of all ages. We believe the AMRC should be a centre of education, and not just for our partner companies.

Encouraging engineering

We assist schools in our community by:

- Increasing pupils' and teachers' awareness and understanding of engineering.
- By giving an insight into the role of the modern manufacture engineering.
- We hope that the AMRC might encourage talented young men and women to consider an engineering degree or a career in advanced manufacturing.

Classroom presentations

We enjoy going into classrooms to show students the different opportunities available for people who want to be involved in engineering. We can cover a variety of topics because not all the jobs in engineering are about operating machines.

The AMRC's school based activities include:

- Brinsworth Comprehensive School's M.A.D. for Physics Day.
- Fir Vale Primary School's Personal Air Vehicle Design Competition.
- Guest lecturing at Sheffield College.
- Hosting the Young Institution of Mechanical Engineering.
- Partnering with the LEA to develop a program for the new engineering diploma.

MANTRA

We have won £500,000 from the Engineering and Physical Sciences Research Council to take our advanced manufacturing techniques on the road. MANTRA is a specially equipped HGV, fitted with the latest manufacturing equipment. It will introduce aspiring engineers to the latest production engineering techniques that have enabled AMRC partner companies to make significant improvements in productivity.

Higher and Further Education

We can support courses in science and engineering by:

- Giving an insight into the role of the modern manufacture engineering.
- Encouraging students into taking an engineering degree and thereafter a career in advanced manufacturing.
- Demonstrations Lectures and presentations.

Apprenticeships

We are proud to partner with Sheffield College to offer apprenticeship opportunities which offer the chance to work on some of the biggest projects in aerospace. The programme is open to young people with four A-C grades in math, English and science based subjects. Successful apprentices will have the opportunity to continue to a higher or further education qualifications.



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