TECHNOLOGY & INNOVATION

# Accelerating new technologies into commercialisation

**Utilising a collaborative R&D environment, a new applied research centre in Virginia is fostering breakthroughs in surface engineering and manufacturing systems — and speeding developments into manufacturing. *James Whitton*, Chromalloy program manager for the Commonwealth Center for Advanced Manufacturing and director of operations there, reports on the success of the shared approach as well as new and future developments.**

In a global business environment in which speed to market, reduced cost and improved quality translate to competitive advantages, a new applied research centre in Virginia is fostering breakthroughs in surface engineering and manufacturing systems — and speeding developments into manufacturing.

From human factor improvements for the production floor to digital manufacturing techniques and advanced surface and coating applications, developments are under way at the Commonwealth Center for Advanced Manufacturing (CCAM) near Richmond, on the Crosspointe campus of the Rolls-Royce component manufacturing plant.

CCAM, a public/private applied research centre, is sponsoring R&D with industry partners and the state's leading research universities. The developments are resulting in production-ready manufacturing techniques to be used by Rolls-Royce, Siemens, Aerojet, Chromalloy and other CCAM member companies.

The applied research centre is unique in its collaboration between industry and the state's research universities. The CCAM mission is to accelerate new technologies into commercialisa-

*Rolls-Royce completed a new advanced manufacturing plant in Virginia. The new Commonwealth Center for Advanced Manufacturing is located nearby, on the same campus.*

## How Rolls-Royce and industry partners meet industry demand through applied research centres

To meet industry demand for new production processes and developments while training future workers, the Commonwealth Center for Advanced Manufacturing (CCAM) is one of seven collaborative research facilities worldwide in a network in which power system manufacturer Rolls-Royce participates.

A leader in the manufacture of civil and military aero engines, marine propulsion systems and power generation systems, Rolls-Royce partners with industry, governments and universities to accelerate technology development through a global network of applied research centres in the UK, one in the US and one in Singapore.

CCAM, the newest applied research centre in which Rolls-Royce participates, was completed in 2012 and officially opened in 2013. As a hub for advanced manufacturing in the US and a site for R&D, CCAM operates independently with a board of directors appointed by the seven organising industry member companies and Virginia's leading universities. All of the modern technology centres in which the engine manufacturer participates serve Rolls-Royce, the other participating member companies, partner universities and the communities.

CCAM is located at the 1,000 acre Rolls-Royce campus at Crosspointe, Virginia, where aircraft engine components are manufactured, assembled and tested. Rolls-Royce donated the land for CCAM.

As a CCAM founding member, Rolls-Royce contributed to the centre's $30m development and construction costs and with the other industry members, is a beneficiary of the centre's research breakthroughs. Each industry member will transfer the breakthrough technologies developed in the CCAM labs directly to their manufacturing operations.

CCAM student interns from the partner universities, who gain hands-on experience while working at the research centre, are able to evolve their roles and expertise into permanent engineering and technical positions at the member companies.

The success behind applied research centres — in addition to the collaboration across industries, government and universities – is the focus on highly technical manufacturing areas where new developments are required by industry.

CCAM is dedicated to new surface technologies, which are among the field of additive manufacturing, and new manufacturing systems for factories.

Other applied research centres in which Rolls-Royce participates focus on key manufacturing areas:

- Composites (National Composites Research Centre, South Wales, UK)
- Surface conditioning processes (Process Technology Research Centre, Singapore)
- Forging and forming (Advanced Forming Research Centre, Glasgow, UK)
- Automation, fixturing, joining manufacturing (Technology Centre, Ansty, UK)
- Machining and measurement (Advanced Manufacturing Research Centre, Sheffield, UK)
- Manufacturing technology, training and accreditation (Nuclear Advanced Manufacturing Research Centre, Sheffield and Manchester, UK)

True to the charter of state-of-the-art applied research facilities for cross-industry, community and academic collaboration, the centres are dedicated to the rapid commercial application of R&D.

tion and reduce costs associated with manufacturing through shared facilities and personnel, and share pre-competitive research among members and its university partners.

In the process, the centre also provides for the training of the next generation of engineers and technical workers in advanced manufacturing principles.

## Collaboration and partnership

CCAM was conceived in conjunction with the development of the Crosspointe site, based on a model that has been successful in the UK for the last decade, by power system manufacturer Rolls-Royce. The company, which had just completed a new component factory (see sidebar), donated the land for the centre after the applied research facility's charter was established and gained financial support from the state's Economic Development Authority and the Virginia Tobacco Commission, which viewed it as a boon to the region's economic growth. Additional support came from the federal government and Virginia's three research universities — the University of Virginia, Virginia Tech and Virginia State University — each of which signed on early with funding, intellectual rigour and the innovation provided by academic researchers.

Governor Tim Kaine had been instrumental in attracting Rolls-Royce to Virginia prior to 2009. In 2010, when Governor Bob McDonnell took office, he became an ardent supporter viewing CCAM as a catalyst for industrial development. McDonnell placed economic development and jobs high on his agenda and saw CCAM as a stimulus for accelerating technology development and commercialisation — and revitalising the region's business infrastructure.

For Rolls-Royce and the industry members, the collaborative nature of CCAM would offer highly specialised solutions and developments to address the challenges facing the industrial manufacturers.

CCAM incorporated in May 2010 with the support of the region's top manufacturing leaders, who became organising industry members. In doing so they committed generic research funding and in return would share in the results and intellectual property. Partner companies can also conduct their own directed research in the privacy of specially designated, proprietary labs and unique software data systems.

Members of the CCAM now number more than 15, including aerospace, defence, consumer electronics, automotive, shipbuilding transportation and industrial software companies. To the companies that participate, CCAM offers low R&D costs due to the collaborative environment, facilities and personnel. The companies share pre-competitive research findings. Research is conducted in 10 labs, which include a metrology centre, characterisation labs and a 3D visualisation room. The 62,000ft² centre also has a 16,000ft² open high bay with industry scale equipment.

The CCAM research team includes industry and academic experts and a chief technology officer, principal scientists and technologists, project team leaders in manufacturing systems — and a small army of undergraduate and graduate students. In 2013, when the CCAM facility opened its doors, more than 35 university in-

*Researchers staff the new Commonwealth Center for Advanced Manufacturing. The centre has a 16,000² open high bay with industry scale equipment.*

**"CCAM continues to add member companies that seek a collaborative R&D environment and facility, with diverse industry and academic partners at its core."**

terns and graduate research assistants were working on research projects alongside industry and academic experts on priority developments.

## Intellectual property

In contrast to typical consortium based agreements where it is common for the academic bodies to control dissemination of the resulting intellectual property, CCAM is decidedly different. At the higher levels of membership commitment, companies split their dues between generic and directed research. For projects engaged under generic research, IP is retained by CCAM and licensed to the eligible members at no cost. Directed research is defined and initiated by individual members and the IP resides with the members directing the research, not CCAM.

Given the IP structure, it is possible for multiple members within a common supply chain to join in a directed effort and all benefit, leveraging their research dollars. Similarly, a single member may choose to utilise the directed research option as an extension of their internal R&D, while gaining the benefits of the CCAM facilities, researchers and member universities. Benefits of generic research are shared amongst all eligible members across diverse industry backgrounds, further demonstrating the leverage of collaborative research.

## New developments

Active research at the CCAM facility was initiated in early 2013, including both generic and directed research projects. The centre's technology steering committee evaluates R&D topics for the generic research and ensures that the portfolio of active projects support all the member companies. R&D topics for directed research are determined by the member companies sponsoring the research.

Current projects address industrial manufacturing challenges in the area of adaptive machining, surface preparation, human factors, multi-modal part inspection and surface characterisation and identification. Examples include:

- **Machining of thermally sprayed abradable coatings** — This project will develop robust and repeatable machining processes which will save on machining time and material usage and improve coating properties for CCAM members. Benefits are expected to impact those members who produce the equipment and tooling as well as members who specialise in providing the products or services related to abradable coating application.
- **Characterisation of human performance utilising continuous motion data** — An extension of a previous project on human factors, this venture expands on the use of rapidly developing sensing technology common in devices such as gaming consoles (Microsoft Kinect) and applies it to common issues relevant to manufacturing. The goal is to learn from the interactions between humans and the products and processing steps within a manufacturing environment.

## Today and tomorrow

CCAM continues to add member companies that seek a collaborative R&D environment and facility, with diverse industry and academic partners at its core. In early 2013, CCAM received another infusion of state funding — a $100,000 grant from the Commonwealth Research Commercialization Fund's Center for Innovative Technology Matching Funds Program, for R&D in abrasive blasting processes.

In June, NASA Langley Research Center, a long-time pioneer in innovations in aeronautics and space exploration, announced it will become a CCAM member.

Given the green light by the Virginia universities, member companies and the state, CCAM is on its way to claiming a permanent identity as the region's industrial development showcase.