

The ATKINS partnership - Expertise & Track Record

Lead Partner: Loughborough University – Rapid Manufacturing Research Group

The Rapid Manufacturing Research Group (RMRG) led by Professor Richard Hague is located within the Wolfson School of Mechanical and Manufacturing Engineering at Loughborough University. The RMRG has been recognised as the World's leading research group in the field of Rapid Manufacturing, by both the US World Technology Evaluation Centre and by the International Review Panel of the Loughborough University IMCRC. The group, founded in 1992, is a recognised international leader in additive manufacturing technology with over 40 dedicated academic, research and support staff within the Loughborough facility. This facility contains state-of-the-art RM technologies and support equipment valued at over £4-million. The RMRG has a track record of running and managing research projects with DTI, EPSRC and EU FP6 funding. Additionally, through the RM Consortium (sited at Loughborough) the RMRG has an excellent and well established route for dissemination and exploitation to industrialists outside research projects.

The RMRG is the only research group, world-wide, to be investigating the primary areas of research within the ATKINS project, these being:

Rapid Manufacturing process and materials development – Although a number of Rapid Manufacturing production facilities have been set up using existing RP technologies, they are far from ideal, as the processes have not been developed or optimised for production manufacture. The RMRG is involved in a number of national and European government funded research projects to develop dedicated Rapid Manufacturing technologies using a range of new and emerging materials.

Design for Rapid Manufacture – Research within the RMRG is underway to develop new design protocols and working methodologies to gain the maximum benefit of part production using RM. Research is focused on multi-disciplinary design optimisation to enable parts and components fully optimised for functionality. The RMRG is also investigating part consolidation and re-design on functionality, cost and quality.

Management of Rapid Manufacturing – RM will have profound changes on existing supply chains. Manufacture will no longer be constrained by the availability and location of tooling, but by the transfer and manipulation of electronic data. The RMRG are currently investigating future supply chain scenarios and cost modelling for a range of applications in both high-value low-volume manufacture and in higher-volume lower-value manufacturing.

The RMRG have both the capacity in terms of scale and capability in terms of experience to lead the ATKINS project. This capacity and capability is demonstrated by the financial commitment of the industrial project partners and the successful track record of prior research activity.

Partner 1: Boeing Defence (UK) Ltd

Boeing is the world's leading aerospace company, and the largest manufacturer of commercial jetliners and military aircraft combined anywhere in the world. Boeing directly employs more than 600 people within the UK at 21-sites, including ATKINS partner Boeing Defence UK situated in Basingstoke. The company's long-standing relationship with British industry, the armed forces and the air transport industry dates back almost 70 years. Today the UK remains a critically important market, supplier base and a source for some of the world's most inventive technology partners. Boeing's annual spend in the aerospace industry supports thousands of jobs around the UK, in the process generating intellectual property, enhancing skills and facilitating exports.

As a major contributor to greenhouse gas emissions, Boeing also acknowledges its responsibility to move towards both more sustainable aircraft and a more sustainable supply chain, changes that Boeing believes can be stimulated through the development of more robust and repeatable RM technologies. The inclusion of Boeing within ATKINS is therefore seen as key to stimulating wider industry acceptance of RM within the aerospace sector across the UK, EU and globally.

Through Boeing Defence UK the ATKINS project has access to the Accelerated Digital Design and Manufacturing (ADDM) division located at the Phantom Works site in Illinois, USA. This facility represents one of the world most developed and advanced users of RM globally. Hence, the inclusion of Boeing in the ATKINS partnership provides a significant level of added value to the other project partners. Boeing uses disciplined engineering approaches to mature innovative technologies that enable the development of future aerospace solutions while improving the cycle time, environmental impact, cost, quality and performance of current aerospace products and services. The ADDM facility has ownership of many existing RM technology platforms and has an applied focus on the equipment, material and process characterization, resulting in the use of sustainable RM processes within Boeing's present and future product lines.

Through Boeing Defence UK, ATKINS will have access to dedicated UK based engineering and RM staff seconded directly to the project, existing RM technology platforms, advanced testing facilities and full process and materials qualification for RM within the global aerospace supply chain.

Partner 2: Delphi Diesel Systems Ltd

Delphi Diesel Systems designs and manufactures diesel Fuel Injection Equipment (FIE) for on and off highway use. Delphi are currently the second largest supplier of diesel FIE in the world with a global manufacturing footprint. The company has extensive CAD; Rapid Prototyping and multi axis machining experience utilising current additive manufacturing technologies on a daily basis to produce design verification models, castings patterns and functional experimental parts for both mechanical and electrical applications. RM is viewed by Delphi as being both commercially and sustainable advantageous. However, current technologies are left significantly lacking for the rigorous applications identified by Delphi.

Delphi is an experienced project research partner and was involved with Loughborough University on the Design for Rapid Manufacturing project supported through the vehicle Foresight program. Hence, the company is both experienced and committed to the furtherment of RM. Within the ATKINS project, Delphi will bring extensive metal component design and manufacturing process knowledge, which will allow the partnership to both benchmark existing production technologies with RM and to identify and develop the most suitable processing conditions for a production RM Platform. Globally, Delphi has a need to develop more flexible, cost effective manufacturing techniques to remain competitive, and to cope with variable production batch sizes and variety. Delphi sees Rapid Manufacturing as a potential means of addressing these needs, whilst addressing the critical issue of moving towards a more sustainable, low carbon supply chain.

Partner 3: Bentley Motors Ltd

Bentley Motors Ltd, a division of Volkswagen, is arguably one of the world most recognised and established automotive brands. Bentley employs approximately 4,000 people worldwide, with the majority located at the companies' production facility in Crew Cheshire, where some 10,000 vehicles including the Bentley Arnage and Continental GT were assembled in 2006. The Crew site also houses the Bentley Mulliner division where over a hundred specialists and craftspeople produce one-off, single production volume items. Over 90% of the Bentley Arnage product is fitted with bespoke features from Mulliner. This could be something as simple as a refrigerated bottle cooler, or an embroidered personal design on the leather hide. Or it could be as radical as an entirely new body-style, extended wheelbase or a fully-functional mobile office.

As well as the needs of the direct customer, Bentley also recognises the impact that its factory at Crewe and its cars can have on the local and global environment and that an effective technology strategy is essential to maximise Bentley's contribution to environmental protection. Bentley sees RM as a technology that has the double advantage of enabling economic low volume production for both Mulliner and standard vehicles, but also the ability to enable the manufacture of optimised geometries, hence reducing weight, fuel consumption and emissions, as well as production line and supply chain benefits.

Bentley is already an experienced user of polymeric RM, with a number of parts now integrated into vehicles. However, the application of metallic RM into structural vehicle applications requires significant development from a Bentley perspective as current technologies are left significantly wanting in terms of accuracy and repeatability. Within the ATKINS project, Bentley will deploy a multifunctional team of graduate engineers across the company to work on RM integration in areas including vehicle design, engineering, purchasing, supply chain management and logistics. These engineers will be supported and managed by an experienced technology manager, who will also manage the production of RM test samples, testing programs and detailed technical specifications on behalf of the company.

Partner 4: MCP Tooling Technologies Ltd

MCP Tooling Technologies Ltd is a global supplier of additive layer manufacturing equipment and a leading innovator in rapid-manufacturing machinery. MCP has subsidiary offices in the USA, Germany, Italy, France, Spain and Russia and sales agents in many other countries, hence providing a developed exploitation route for new technology and IPR resulting from the ATKINS project. MCP has pioneered the development of Selective Laser Melting (SLM) for the direct production of dense metal parts from 3D CAD data, in a wide range of commercially available powders of great interest to the other ATKINS partners, including titanium, aluminium, stainless steel and Inconel. To support SLM development the company has a growing team of dedicated research staff and strong links with leading UK Universities including ATKINS lead partner Loughborough.

One of the companies' key strengths lies in identifying the needs of industry and engaging with the partners such as ATKINS. MCP has recently completed a lengthy and involved development project with a large industrial organisation and the University of Liverpool, demonstrating both a commitment to structured RM research and the capability to engage in large scale R&D projects with both academic and industrial partners.

Within ATKINS, MCP will bring specific knowledge and know how to further develop and optimise the SLM process for producing weight saving matrix structures and blending dense material together with these structures to form a mechanically predictable design that can be implemented into mainstream production by the project partnership. The development of advanced software to model and then compile data in an efficient manner will be a key factor in achieving success. The use of this software is paramount in any light-weighting design for any additive process such as SLM. MCP Tooling Technologies will therefore provide both software development capabilities, coupled with process and materials science knowledge.

Partner 5: Econolyst Ltd

Econolyst Ltd is a socioeconomic and technology consultancy dedicated to providing technology strategies, management tools, research and skills development solutions in Additive Layer Manufacturing (ALM) technologies, and Rapid Manufacturing (RM) applications. Econolyst have worked with a great number of companies on the development and application of additive manufacturing systems and the development of supply chain software solutions.

Econolyst have championed the concept of 'Grid-RM' as a solution for sustainable, distributed Rapid Manufacture. Through ATKINS, Econolyst will work across the project partnership to initially identify and then to codify the information, data and knowledge flow needed to facilitate a sustainable RM supply chain. Econolyst will then use in house software development skills to produce a working RM supply chain management solution focused on distributed manufacture as a way of reducing environmental impact. The concept of Grid-RM being to distribute and control the flow of digital data to multiple manufacturing sites using industry validated and accepted RM technology platforms.

Although a micro-business, Econolyst is highly experienced in collaborative project working and has existing working relationships with many of the ATKINS project partnership. Econolyst have been engaged in a number of EPSRC, DTI and EU framework projects in addition to the direct delivery of ERDF and ESF funded project focused on RM.

Econolyst will deploy a dedicated supply chain engineer into the ATKINS project, who will be supported by both administrative and RM professionals. The Company has committed to invest in the Information Communications (IT) infrastructure needed to develop and host the software elements of ATKINS to enable a digitally distributed supply chain.

Partner 6: Perkins Engines Ltd

Perkins, which is a wholly owned subsidiary and brand within Caterpillar, is recognised as a world leader in the design and manufacture of industrial diesel engines. The Peterborough facility of Perkins employees in excess of 3,100 people and is committed to both on-site and office site product driven environmental improvements.

Perkins already has a long-standing programme to recover and reclaim failed major components from the market place. The program called the "Perkins Power Exchange Programme" covers components such as complete engines, turbochargers, injectors, starter motors, and alternators. The programme is set for growth with new investment in salvage techniques, remanufacturing, core management and logistics. Through ATKINS it is hoped that a 'sister' program could be established at the front end of the supply chain, where component parts for assemblies such as engines, turbochargers, injectors etc, can be manufactured nearer to their point of assembly, distribution and ultimately use. Over time, the two programs may even be integrated, whereby RM parts will be manufactured at service facilities as replacements or up-grades for failed or outdates parts. Such a future business model will however require both fully validated RM technologies and capable supply chain methodologies and software tools.

Within the ATKINS project, the main focus of Perkins activity will be in the understanding and development of the distributed supply chain enabled by RM. Perkins will identify parts that could be manufactured using RM and then look at the current and future RM footprint of these parts through the supply chain. Perkins will achieve this through the part time secondment of two existing senior environmental managers and the support of a number of graduate engineers distributed throughout the supply chain.

Partner 7: Alcon

Alcon is one of the world's foremost manufacturers of performance and motorsport brake and clutch systems; supplying and winning in F1, WRC, NASCAR, Indy Car, Touring Cars and GT racing, as well as engineering extreme solutions for several leading performance road car manufacturers.

Alcon will be working within ATKINS to investigate the use of optimised product design to improve performance.

Partner 8: Virgin Atlantic Airways Ltd

Virgin Atlantic is committed to reducing its environmental impacts by becoming a more efficient business through both practical and technical solutions. Virgin Atlantic is continuing to evaluate more efficient ways of operating its existing fleet of aircraft, until manufacturers can develop technological solutions to reducing carbon emissions such as innovative aircraft design or viable alternative fuels.

Uniquely within the airline industry, Virgin Atlantic takes ownership of the design, supply and installation of its cabin interiors. Hence, the company is in a position to directly influence the use of innovative light weight engineering solutions. Virgin Atlantic has already instigated a program to remove any extraneous weight from its aircraft. Weight (and the fuel needed to fly it around) is now a key consideration in developing new onboard products and services, and finding lighter-weight alternatives to existing materials can add up to considerable emissions reductions over the course of a year. RM has been identified by Virgin as a nascent technology that has the potential to be applied into many cabin applications, such as passenger and crew seating, entertainment systems and safety equipment. However, at present no RM technologies are validated for such applications within aerospace. Through the ATKINS partnership, and in collaboration with key supplier Boeing, Virgin will work with its supply chain to identify suitable RM applications across its cabin products. Virgin will provide input into ATKINS through the development of new weight saving and optimised designs and through the specification of materials requirements, geometric tolerances and life cycle cost and carbon models.