

Shaped metal deposition

The AMRC led an international team to bring a new manufacturing technique to the brink of commercialisation.

Eight academic and industrial partners from four countries collaborated on the European-funded Rapolac (Rapid Production of Large Aerospace Components) project. The three-year project developed the shaped metal deposition (SMD) process from an experimental proof of concept, to an automated manufacturing technology ready for use by a range of companies.

Many metal components for aerospace and other high-value industries are made by cutting large castings down into the desired shape – an expensive process that requires specialist tooling and which generates significant waste.

SMD is an additive process which produces components by welding a continuous metal wire into the desired shape. This reduces the wastage involved in machining parts from a larger block, and removes the need for the expensive tooling used in forging. Using SMD, the time required to design and produce a large aerospace component such as an engine casing can be reduced from nine months to a few weeks.

The SMD technology was initially developed by Rolls-Royce plc, but was not widely adopted for commercial production for several reasons. The TIG welding process had to be manually controlled by a skilled technician, and there was little understanding of the material properties of the parts produced by such an innovative process.

Rolls-Royce licenced the technology to the University of Sheffield Advanced Manufacturing Research Centre with Boeing (AMRC), the lead research partner in Rapolac, to move SMD towards commercialisation.

The AMRC team worked with partners at the Università degli Studi di Catania, Sicily, to develop an automated control system. This was initially installed on a simplified version of the SMD cell in the Catania team's laboratory, then integrated into the primary SMD cell at the AMRC.

The AMRC team also focused on optimising the SMD process, ensuring that parts are produced with the best achievable material properties in the most efficient way.

Working with the Rapolac partners, the AMRC researchers have helped demonstrate the commercial benefits of SMD, including:



Up to 60% reduction in lead time for new parts, by reducing need for tooling and prototyping
40% reduction in the cost of manufacturing
90% reduction of inventory
Material waste reduced almost to zero
Significant savings in energy efficiency.

Dr Rosemary Gault, European project manager at the AMRC, says:

“SMD was a very promising technology when it came to us, but companies weren’t interested because it was very labour-intensive and we didn’t understand the material properties. We have now taken SMD to the point where companies can put it into their own production lines, with the confidence that the produced parts will be of the highest material quality.”



Dr Gault will be presenting results from the Rapolac project at the Aerodays 2011 in Madrid in March.

The SMD team at the AMRC has now produced test parts for six different aerospace companies, and has been approached by companies from other sectors including medical and motorsports.

Footprint Sheffield, the leading industrial partner in Rapolac, aims to adopt the technology in its own factory to help the company expand its markets and offer higher-value services.

Richard Jewitt, director of Footprint Sheffield, says:

“To survive and prosper we must move up the technology ladder in what we manufacture and enhance the skills level of our staff. Being part of the Rapolac project has enabled us to assess a new manufacturing method, while our staff have been working closely with experienced and highly capable partners.”