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RAPOLAC researchers proving new manufacturing technology

Automated control a major step towards viability for the aerospace industry

A new manufacturing technique for the aerospace industry is moving towards commercial viability thanks to an international research project.

RAPOLAC (Rapid Production of Large Aerospace Components) is a three-year project to prove the commercial viability of the shaped metal deposition (SMD) process. The project is now at its halfway point, and on track to achieving its aims.

RAPOLAC involves eight academic and industrial partners from the UK, Belgium, Italy and Argentina. All participants met at the University of Catania, Sicily, in June 2008 to discuss progress.

Research project manager Rosemary Gault, of the University of Sheffield, says: *"The RAPOLAC project is progressing well, with universities and businesses working together to bring this promising new technology to the factory floor. We are demonstrating that SMD is a viable method of producing large components that meet the high standards of the aerospace industry, and which offers significant cost and environmental benefits.*

"In particular, the demonstration of automated control by our partners at the University of Catania is a major step towards making this technology a commercially viable one."

Automated control

SMD produces components by welding a continuous metal wire into the desired solid shape. This reduces the wastage involved in machining parts from a larger block, and removes the need for the expensive tooling used in forging.

The RAPOLAC project is using the prototype SMD cell at the University of Sheffield's Advanced Manufacturing Research Centre.

The movements of the robot welding arm within the SMD cell are automated, but the welding torch itself currently has to be manually controlled by a skilled technician.

For the technician, this is a tedious job - and for the firm, it is an expensive waste of staff resources. Developing an automated control system that will let the cell run itself without the need for continual supervision is vital for the commercial viability of the technology.

The Catania team have now demonstrated fully automated control on a simplified version of the SMD cell which they have constructed at their own laboratory.

Giacomo Spampinato, post-doctoral researcher at University of Catania, says:
"We have found stable working points for the welding process. By adjusting the effective voltage of the welding torch and the speed of the wire feed around these points, we can use the feedback to control the welding process. We now aim to implement the system we have developed on our machine on the full SMD cell in Sheffield."

The automated control will also be integrated with the process models being developed by Samtech, an engineering software company based in Liege, Belgium.

Continuing research

Other partners are testing and analysing the sample parts being produced by the Sheffield team.

The team at the Catholic University of Leuven are studying the microstructure and mechanical properties of the components, and are finding that they have similar strength to parts produced by established processes.

Researchers at Intec, part of the Universidad Nacional del Litoral in Santa Fe, Argentina, are meanwhile studying heat transfer and the behaviour of the metal weld during the SMD process.

Such refinement and analysis is essential if SMD is to move from the laboratory to the factory floor. Footprint Tools, 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 Tools, says:
"We want to move the company into new technologies, and access the aerospace market as a supplier. It's an excellent opportunity for us to regenerate the company. There's a tremendous amount of research being carried out by the different partners, and the results are very positive in terms of our being able to take it forwards as a viable business."

EDITOR'S NOTES:

ABOUT RAPOLAC

RAPOLAC (Rapid Production of Large Aerospace Components) is a three-year research and development project funded by Priority 4 (Aeronautics and Space) of the EC Sixth Framework Programme. The project aims to demonstrate that the shaped metal deposition (SMD) process is a technically and commercially valid technique for

producing large parts for aerospace and other industries.

The project is co-ordinated by the University of Sheffield Advanced Manufacturing Research Centre (AMRC). Partners include University of Catania, Sicily; Catholic University of Leuven, Belgium; Intec, of Argentina; Footprint Tools Ltd of Sheffield, UK; Samtech of Liege, Belgium; environmental consultancy Diad of Italy; and project management specialist Metec of Italy.

For more information, see http://www.rapolac.eu/

ABOUT SMD

Shaped metal deposition (SMD) is a manufacturing technology patented by Rolls-Royce plc and licensed to the University of Sheffield.

The system manufactures components by building them up from welded wire - typically titanium alloy or aerospace-grade steel. The system involves a robot arm carrying a TIG welding head, operating in a sealed cell filled with a neutral gas. The robot welder can follow a path derived from a computer-aided design (CAD) model of the component, but the current system requires continuous monitoring and control by a human operator.

Parts made by SMD are near-net shape and require minimal machining to finish. The technique can substantially reduce the cost and lead time of producing prototypes and short-run manufacturing. The technique can also be used to produce hybrid components by adding complex structures onto large cast or forged parts.