3-D-printed propeller blade opens the way to eco-friendly shipping

10 April 2019

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To make the European maritime industry more competitive globally, innovative materials are needed to improve ships' performance and make them more environment friendly. In recent years, other industries have made a lot of progress in this area. However, the maritime sector is lagging behind in the adoption of advanced materials that have a smaller environmental footprint and are less costly and easier to maintain.

Doing its part to propel the maritime industry forward, the EU-funded project RAMSSES has taken advantage of new lightweight, high-performance materials to develop the first demonstrator of hollow propeller blades. This innovative outcome was achieved using additive manufacturing (AM) – a process in which 3-D objects are built by adding layer upon layer of material. In an online news item published in the journal 'Marine Propulsion & Auxiliary Machinery', propeller package manager Patrice Vinot of project partner Naval Group says: "Although additive manufacturing is increasingly present in industry, the programming and design of complex parts, such as propeller blades for ships, represents a considerable challenge." The project team's aim is to produce propellers that enhance the operational capabilities of ships.

3-D printing for better vessel propulsion

The AM process the researchers are using to improve ship propulsion is called wire arc additive manufacturing (WAAM). The process works by melting metal wire using an electric arc as the heat source. When melted, the wire is extruded into beads that stick together to create a layer of metal. This is then repeated layer by layer to build a 3-D metal part. WAAM is used to design large components – in this case, propellers of up to 6 m in diameter – which traditional manufacturing technologies are incapable of. This development will make the production of more complex propellers possible in the future.

Expected industrial gains

The team's first demonstrator is a one-third–scale hollow blade for a container ship propeller. It was printed in stainless steel in under 100 hours and weighs approximately 300 kg. While 300 kg for just one blade, and a scale model at that, may seem ridiculously heavy to the layman, it may put things in perspective to know that propeller blades can way up to 20 tonnes! When produced at full scale, the team expects that the blade will weigh over 40% less than conventional components. The blade's hydrodynamic properties will be assessed through numerical simulation. It will further be subjected to fatigue and corrosion tests.

The RAMSSES (Realisation and Demonstration of Advanced Material Solutions for Sustainable and Efficient Ships) project is currently in the process of developing a full-scale, hollow-bladed propeller for container ships. "The potential of the process revealed by this new case study means that we

now anticipate unparalleled performance for the propellers of tomorrow," says Mr Vinot. The project is about halfway through its 4-year term.

More information: RAMSSES project websitewww.ramsses-project.eu/

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