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Robotic ‘vacuum’ offers shipping industry a clean solution

An automated robotic cleaning system that removes slime from the hull of a ship is being pioneered at Newcastle University.

Designed to stop marine plants and animals being transferred from one side of the world to the other on the bottom of ships, the robot also offers a solution to spiralling fuel costs and pollution, reducing the carbon footprint of the world’s shipping industry.

Operating in a similar way to the automatic carpet cleaner, the robot has been developed out of an EU-funded project called HISMAR (Hull Identification System for Marine Autonomous Robotics) and is able to navigate its own way across the ship’s hull.

First a map of the hull is automatically charted, recording the location of every weld, thickness change, rivet and indentation on the ship’s surface.

The robot is then attached to the ship’s side using strong magnets and sent off on its journey of the hull, following the planned route and cleaning as it goes.

Adjustable jets of pressurised sea water blast the marine growth off the surface of the ship and then it is sucked up into the main chamber.

Here, 150 litres of water a minute is filtered and the bio-fouling removed and rendered harmless to the local environment.

In this way, the ship’s robotic ‘vacuum’ can continuously roam the ship’s hull, preventing the build up of slime and allowing it to travel through the water efficiently by cutting down on drag. This significantly reduces fuel consumption and also pollution such as the greenhouse gas carbon dioxide.

It also solves the problem of harmful, non-indigenous species being transferred to local waters, such as the Asian clam and zebra mussels which are now colonising Europe and parts of the US and out-competing native species.

Newcastle University’s Professor Tony Roskilly, leading the project, said: “Marine growth on ships is a huge environmental and financial problem for the marine industry and HISMAR offers a unique solution to both of these – and more.

“What we have created is a system that works totally independently – in or out of the water – and not only keeps the ship clean but also feeds back vital information about the hull’s condition.

“Because the map it follows is so detailed, if there is a change to its path caused by corrosion or a crack in the steel then it feeds this information back. This means it can be used as an additional check on the seaworthiness of the ship’s hull or highlight potential future problems.

“And because the drive module and navigational system are separate to the cleaning tools we hope that ultimately we will be able to fit it with different tools to carry out different tasks – such as stripping and painting the hull.”

Led by Newcastle University, the international team of experts will present a prototype of the robot at the largest marine maintenance fair in the world - Shipbuilding, Machinery and Marine Technology in Hamburg - on September 23rd.

Until the beginning of this year, ships used antifouling paints to protect them from the corrosive environment, with Tributyltin (TBT) added as a biocide to also prevent marine growth.

However, it was found to contaminate the surrounding water – having a serious detrimental impact on other marine life - and this summer it became illegal worldwide to use TBT antifouling coatings.

Newcastle University's Jonathan Heslop, a researcher on the project, explains: "All other developed cleaning or inspection systems currently available are remotely controlled during their operation, requiring highly skilled and experienced operators to effectively clean the hull, while the ship is out of operation and usually out of the water.

"The advantage of the HISMAR robot is that it is an autonomous system so it can continue cleaning with the ship remaining in service – feeding back hull information as it does so – resulting in very little build up of slime, reduced fuel costs and much less pollution."

The HISMAR robot uses a novel optical dead-reckoning system in conjunction with a magnetic system to identify the location of surface and sub-surface features to build up a detailed map of the ship's hull. It is this navigation system which allows the robot to operate above and below the waterline whilst the ship is in port or at anchor.

Ends

FACTFILE

- A study in 2002 showed that of 186 vessels operating in the North Sea between 1992 and 1996, it was found that 96pc non-native species were found on the ships' hulls. Of the 110 species found in hull samples 75 were non-native and taking into account the climatic conditions of the North Sea it was concluded that 19 of the non-native species had a high chance of becoming established.
- A study undertaken for the New South Wales Coastal Council, compared the performance of thirty two vessels and showed that with light fouling, such as slime, a 5pc increase in the annual fuel consumption occurs. This increased to 27pc for moderate to heavy fouling.
- In 1989, a study estimated that costs of \$3billion were incurred by the global shipping fleet each year in dealing with fouling, where \$720million was incurred in increased fuel consumption and \$409million due to shipping delays. The study also showed that by burning less fuel, greenhouse gas emissions could be reduced by 20 million tonnes per annum, relating to 3.1-3.2 tonnes of Carbon Dioxide (CO₂) per tonne of fuel burnt and 7.36 million tonnes of other greenhouse gases annually.

Notes to Editors:

- Professor Tony Roskilly (project leader) and Mr Jonathan Heslop are available for interview/photographs on Tuesday, September 17. Phone 0191 222 4936/5869 or email: Jonathan.heslop@ncl.ac.uk
- Led by Newcastle University, the research team comprises experts from businesses and academic institutions across Europe. The three and a half year project has been funded by the European Union under Framework 6.

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