Freighter without crew

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On the bridge of a modern ship, a lot already runs automatically. But these unmanned ships of the future are not intended to operate completely unsupervised. Credit: Fraunhofer MUNIN

Ships of the future will soon be steered across the Seven Seas – unmanned. A new simulator is helping propel these plans forward. Partners from five different countries engineered the design of the autonomous freighter.

Hans-Christoph Burmeister scans over the onboard instrumentation: an electronic maritime chart; a display of water depths; the adjacent monitor that displays the radar image. Burmeister then reaches for the

wheel and steers his 220 m mass-goods freighter into a new direction. "We are now sailing on a course of 290 degrees, speed twelve knots." Even if this scenario is quite realistic, Burmeister is no captain on the bridge, but is standing instead in a room at the Fraunhofer Center for Maritime Logistics and Services CML in Hamburg. A ship navigation simulator has been installed at the facility of the Fraunhofer Institute for Material Flow and Logistics IML. The steering and display instruments resemble those of a freighter. The simulator is expected to help advance an ambitious undertaking: under the EU Project MUNIN, the Fraunhofer researchers, together with partners from five countries, are engineering the design for an autonomous ship – a bulk carrier that sails across the world's seas without a crew. The motive: "In Europe, making a career in shipping is no longer a popular choice," explains Project Coordinator Burmeister. "This industry has successor problems."

In the approach, there is already technology for an autonomous ship – on the modern bridge of a ship, quite a lot is already automated: The autopilot steers a pre-set course with the support of GPS, at tempo automation system maintains the pace of speed. Radar equipment and ship detection systems search the surroundings and sound the alarm automatically in the event of risk. In addition, an autonomous ship should be equipped with other sensors: Original and infrared cameras are to observe the ocean surface, in order to detect specifically smaller vehicles, flotsam, or shipwrecked.

In an emergency, operators can intervene via satellite

The core of the unmanned freighter is served by a centralized software application. It analyzes the data from all sensors and determines, for example, if and how the ship changes its course in order to avoid collisions with, for example, a loose container floating around that may have fallen from another freighter. Nonetheless, the unmanned ship will not be travelling. A human being is supposed to monitor all events and, if

necessary, intervene. "Certain situations are conceivable in which the autonomous on-board systems are overextended," Burmeister explains, "such as when multiple [ships](#) are simultaneously on collision course or technical breakdowns arise." For these cases, a station is at the ready on land which will intervene via satellite and can steer the ship remotely.

In order to demonstrate how this might appear in an actual setting Burmeister is putting his simulator into gear. On the screen, you can see a container ship approaching from port. Although Burmeister's freighter has right-of-way, the other ship just will not budge. In order to prevent collision, the researcher takes control through the autonomous ship. "I deactivate the autopilot, set a course change for starboard, reduce speed and wait until the other ship has been passed. "Even when docking and casting off, a human being should be at the helm. If the ship departs from the harbor, a crew is on board. Once the freighter reaches open sea, the team leaves the ship via pilot vessel or helicopter, and automated steering takes over. At the destination, the reverse is conducted: Right in time, just before entry into the harbor, a team goes on board in order to steer the freighter in.

The MUNIN project was launched in autumn of 2012. Since the demands for an autonomous ship are highly diverse, the experts work meticulously on the various detail issues. This way they can guarantee that the ship's propellers are also running reliably during those times when no mechanical technician is available. The engine rooms have to this date been configured so that you can leave them unattended for a 24-hour period. Were a fire to break out on board – due to a short circuit – an automatic sprinkler system would have to start up. As a precaution, critical areas are flooded with CO_2, so that no fire can catch here in the first place. For tough sea passages, the autopilot should turn the hull in such manner that the waves hit it as little as possible, and in general one would circumnavigate impending inclement weather at the outset.

Computer simulation ready by 2015

The EU project is slated for completion by the autumn of 2015. The goal is a computer simulation that allows experts to test and review their ideas on a virtual basis. After that, it would be conceivable to furnish a real ship with a completely automated system. "Yet even beforehand, manned navigation could benefit from our results," says Burmeister. Because individual components that the MUNIN technicians are assiduously working on would already be helpful on the bridge of any vessel today. Thus, an automated lookout system would ease the burden on the crew just as much as an improved collision warning system.

Provided by Fraunhofer-Gesellschaft