



DLR and AWI test satellite-based methods for improving maritime navigation

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Navigating through ice-covered waters on board the research vessel 'Polarstern'

The German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) is working on a satellite-based system for substantially improving ship navigation in ice-affected waters. The Earth observation satellites TerraSAR-X and TanDEM-X provide the high-resolution images needed to make this possible. Scientists from the Alfred Wegener Institute (AWI) – the Helmholtz Centre for Polar and Marine Research based in Bremerhaven – are currently on their way to Antarctica on board the research vessel 'Polarstern' to test the practicality of this technique.

Challenges of a polar ocean – freezing temperatures, storms and icebergs

The decline of arctic sea ice during the summer period will open new routes for the shipping sector, permitting the development of fossil fuel resources and also cutting the travel time for navigation by commercial vessels. But the risks presented by these new maritime routes are high; freezing temperatures, storms and icebergs pose a challenge for both crews and ships. In the event of an emergency situation, search and rescue missions would be significantly set back by the lack of marine infrastructure in these regions. In addition, there is insufficient real-time data that ships could use for navigating through polar oceans.

New satellite-based systems will ensure greater security in real time

DLR is developing satellite-based systems geared towards enhancing safety along maritime routes. They are based on high-resolution images provided by the radar satellites TerraSAR-X and TanDEM-X. The satellites transmit the images directly to the DLR ground station in Neustrelitz, where they are processed in near real time. "We are developing a suitable processing chain," says Egbert Schwarz from the Real-Time Data Center at the DLR site in Neustrelitz. An algorithm developed at the DLR research centre in Bremen automatically analyses the data for the presence of ships. "The integrated solution includes a fully-automated delivery system that sends the data products directly to the ship after processing. It also classifies icebergs and marks them as potential hazards," Schwarz adds.

Travelling the Weddell Sea

DLR and AWI are currently testing the extent to which this method is applicable on board the research vessel 'Polarstern' in the Weddell Sea off the coast of Antarctica. The primary purpose of the 'Polarstern' expedition is to study the relationship between winter ice cover and changes in the population of Antarctic krill. "The satellite images not only help us find the best routes through the ice, they also identify suitable ice floes on which to conduct scientific experiments over several days," says Thomas Krumpfen, a sea ice physicist at AWI. In addition, he and his team on board 'Polarstern' use a helicopter-based device named 'EM-Bird' that AWI developed specifically to measure the ice thickness. Until now, satellite-based methods have proved unable to measure ice thickness with the required precision. In future, the DLR Research Centre for Maritime Safety in Bremen and the DLR Microwaves and Radar Institute in Oberpfaffenhofen will use a combination of the ice information acquired by the helicopter measuring device and the satellites to improve the system. The cooperation between DLR and AWI in this field will include additional research expeditions in the Arctic.

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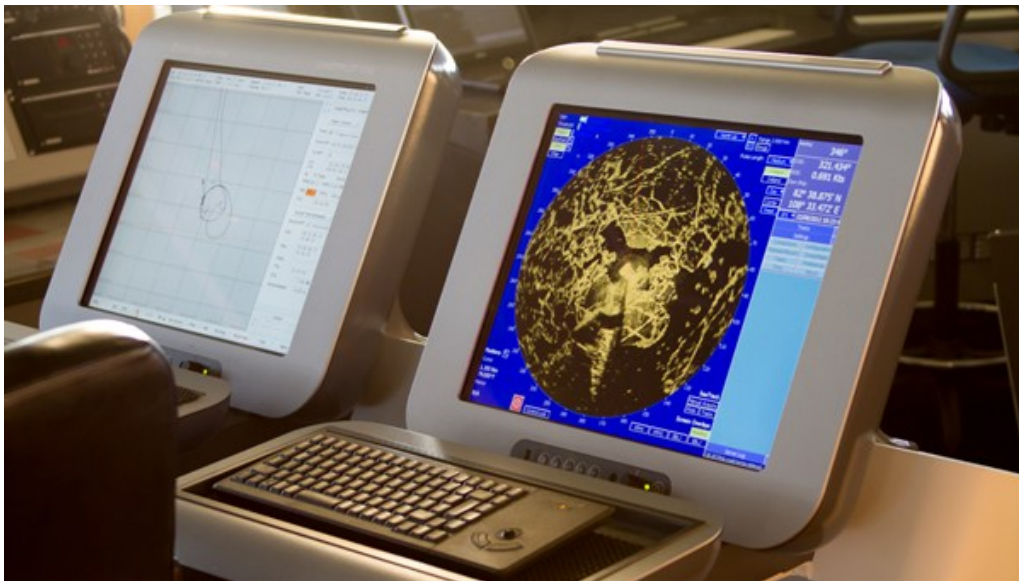
Freezing temperatures



Freezing temperatures, storms and icebergs present a challenge for both crews and ships.

Credit: Martin Schiller, AWI.

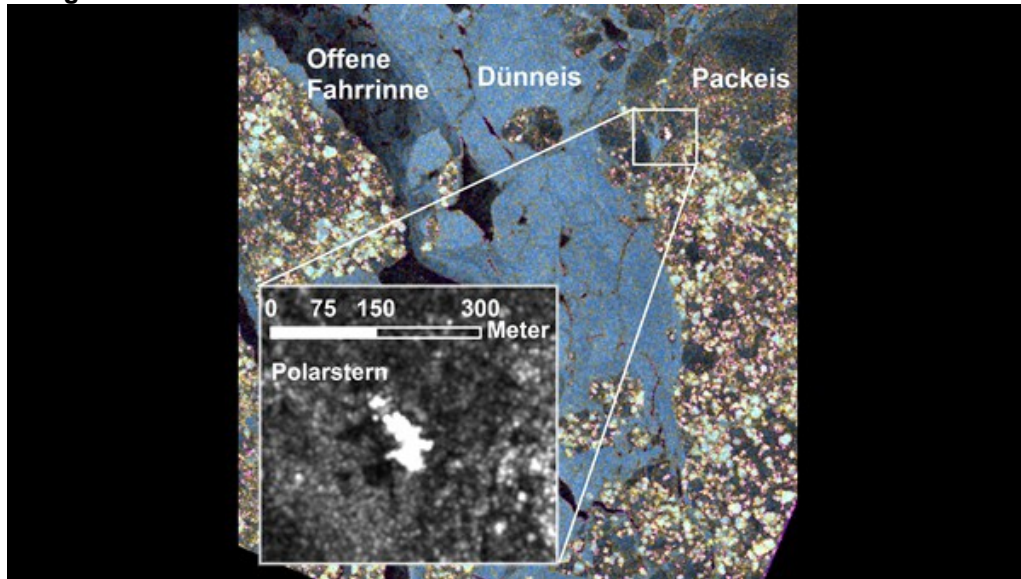
Ice radar



Among other things, the nautical specialists use the ice radar system installed on the bridge to navigate through the ice.

Credit: Martin Schiller, AWI.

Navigation of vessels in ice-affected waters



The German Aerospace Center (DLR) is developing satellite-based systems geared towards enhancing safety along maritime routes in ice-affected waters. The satellite image here, acquired on 3 September, shows the German research icebreaker 'Polarstern' on the edge of a large region of pack ice. In addition to aiding navigation, the satellite images help to draw conclusions about the age and composition of the ice.

Credit: DLR/Thomas Krumpen, AWI.

Navigation with real-time satellite images



DLR and AWI are currently testing to what extent this method is applicable on board the research vessel MS Polarstern; at the moment, the ship is located in the Weddell Sea to analyse the relationship between winter ice cover and changes in the population of Antarctic krill.

Credit: Martin Schiller, AWI.

Measuring the ice thickness



The ice thickness is measured using a helicopter-based system that the Alfred Wegener Institute (AWI) developed specifically for this purpose. In future, the DLR Research Centre for Maritime Safety in Bremen and the DLR Microwaves and Radar Institute in Oberpfaffenhofen will use the combination of ice information recorded by the helicopter-based measuring device and the satellites to improve the system.

Credit: Martin Schiller, AWI.

Measurement flight



The ice thickness is measured using a helicopter-based system that the Alfred Wegener Institute (AWI) developed specifically for this purpose. In future, the DLR Research Centre for Maritime Safety in Bremen and the DLR Microwaves and Radar Institute in Oberpfaffenhofen will use the combination of ice information recorded by the helicopter-based measuring device and the satellites to improve the system.

Credit: Martin Schiller, AWI.

Helicopter-based ice thickness measurement



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Credit: Martin Schiller, AWI.

Studying the thickness and porosity of deformed ice



While stationed on the ice, the researchers gather data on snow cover and conduct studies on the thickness and porosity of the deformed ice.

Credit: Martin Schiller, AWI.

Researchers collect data on snow cover



While stationed on the ice, the researchers gather data on snow cover and conduct studies on the thickness and porosity of the deformed ice.

Credit: Martin Schiller, AWI.

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