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German-Canadian research project

Safe navigation through the Northwest Passage

- **The Northwest Passage is becoming navigable for longer periods of the year. Ship traffic, however, still bears hazardous risks.**
- **A German-Canadian research team co-initiated by Fraunhofer wants to change that.**
- **In the project PASSAGES, it is conducting the preparatory work for a safe navigation through the icy waters.**

As the polar ice caps are melting, the Northwest Passage is becoming more navigable – its economic use is within reach. Even the federal government of Germany has the topic on the agenda. “For a country dependent on exports, such as Germany, shorter sea routes are of great importance,” says Dr. Wolfgang Koch, Head of Sensor Data and Information Fusion at the Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE. “Compared to the route between East Asia and Europe via the Suez Canal, the route via the Northwest Passage is about 5,000 nautical miles shorter, which means enormous savings for ship owners,” says Koch. This route has been too dangerous, though: There is no reliable information about it.

That is what Koch and a German-Canadian research team want to change. In the project PASSAGES (Protection and Advanced Surveillance System for the Arctic: Green, Efficient, Secure), they are conducting the preparatory work for safe navigation through the icy waters. This is not an easy task, because the route is challenging not only due to the presence of a number of bays, islands, uncharted shoals and narrows, but also because of drift ice and extreme weather conditions. In addition other vessels sometimes do not record their positions or (in cases like those of illegal fishing vessels) record false positions. The system has to provide reliable information about all of that.

Merging data sources sensibly

The problem: There is little data available, because there is no infrastructure in sensor and communication technology. The entire route is larger than Western Europe and is sparsely populated. Even if there were sufficient data these would have to be processed into information which would be useful for stakeholders such as ship crews. The researchers are addressing all of these difficulties by developing concepts about which technology can gather what information and where and how it can be fused. “The difficulty is to bring together very diverse and inaccurate data in order to provide for

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instance decision support for ship captains to decide on which route to take when," says Koch. Creating algorithms for the fusion of sensor data is the specialty of the FKIE researchers.

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The first thing to do, though, is to tap data sources in the harsh climate zone. For example, the Automatic Identification System (AIS) can be used, which reports among other information ships' current position. In addition, there are satellite images (which, however, have the drawback of being incomplete). Even old sonar systems from the Cold War era could be resurrected. However: A high-resolution view by means of which captains could safely pilot through the water does not yet exist. Koch is therefore still hoping for another data provider: the passive radar. This technology uses the electromagnetic pollution from mobile stations near the coast. Receiving stations will tap into this and gain information about ships and ice blocks – their size, position and speed. "In this way, large areas can be monitored," says Koch. Other possibilities are unmanned vehicles that gather information below and above water.

Support from government and industry

Based on the newly gained insights and ideas for such a system, Koch would like to establish an appropriate monitoring and information system: "We hope that our research project will be followed by a development project." The project is supported by the German Federal Ministry for Economic Affairs and Energy (BMWi) as well as the project partners Airbus, exact Earth, and Dalhousie University in Halifax, Canada. An operational system would be a great asset for shipping companies, the Coast Guard and maritime authorities. Even insurance companies are interested in the data. "On this basis, they could calculate premiums for the ships that are to be insured," explains Koch. After the tricky route is made manageable through safe navigation, ship owners would not have to spend so much on insurance coverage.

It will take at least a decade until the navigation system is ready to be launched. Over these years, the route will become progressively ice-free and economically navigable for shipping traffic. This will show that the scientific groundwork of today will have been worthwhile. Koch: "As dramatic as global warming is, we try to get at least something positive out of it."

The Northwest Passage

The Northwest Passage is an approximately 5,780 km-long sea route which connects the Atlantic to the Pacific Ocean to the north of the American continent. Between 1903 and 1906, Roald Amundsen was the first to successfully manage the complete maritime transit. The first oil tanker passed through the sea in 1969 – however, ship traffic through the Arctic Ocean is still considered today to be risky and not very economical.

Geographical importance

Instead of transporting goods via the Suez Canal, which is about 21,100 km between Europe and Asia, the shortcut through the Northwest Passage would only be 15,900 km long. Moreover, the risk due to piracy, such as around the Horn of Africa, would be minimized.

Consequences of climate change

After the melting of the ice sheet in the Arctic region, the Northwest Passage has become more and more navigable in recent years. Already in September 2007, the ESA satellite images showed the Canadian portion of the passage to be completely free of ice and, therefore, navigable for the first time since records began to be kept.



A German-Canadian research project aims to navigate ships safely through the Northwest Passage in the future. © Lee Carson, NORSTRAT Consulting, Canada | Picture in color and printing quality: www.fraunhofer.de/en/press

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