US Army Corps of Engineers®
Engineer Research and Development Center

Oil Detection In and Under Ice

Problem

There is a critical need to develop a practical remote sensing program to detect and map oil in and under ice to facilitate leak detection and improve spill response capabilities for oil and gas operations in Arctic regions. Over the past 20 years, considerable effort has been spent on the research and development of various methods. To date, none of these technologies have resulted in an operational system.

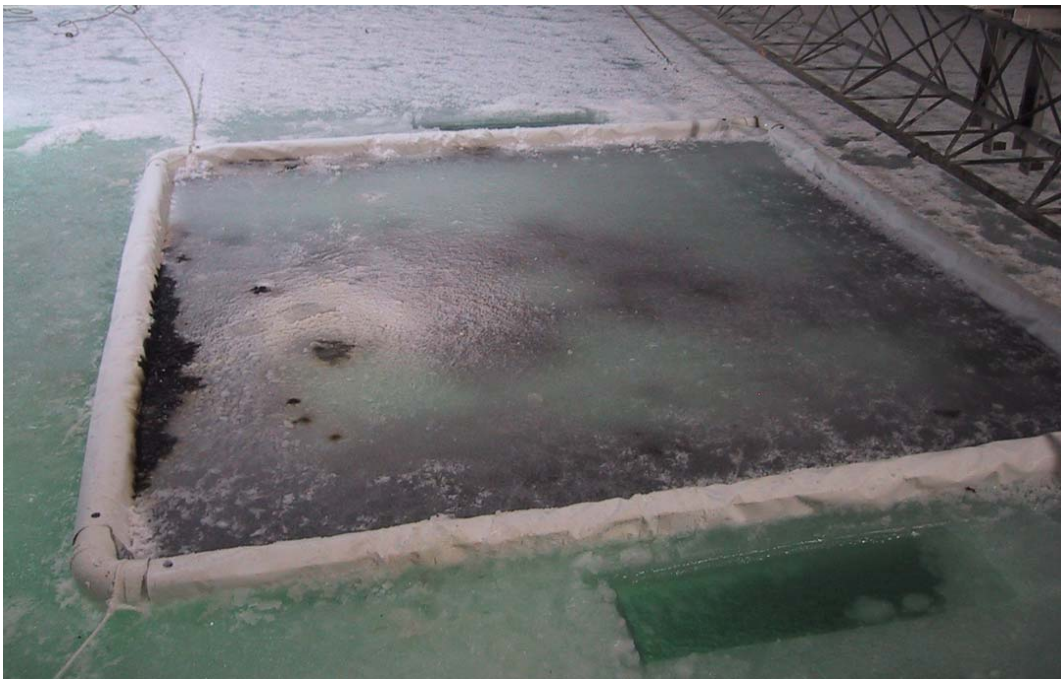
The only proven method of searching for and detecting the presence of oil from an accidental subsurface spill (e.g., slow leakage from an ice-covered marine pipeline) involves drilling holes at frequent intervals or in a closely spaced grid pattern to expose oil trapped in or under the ice. This process is extremely labor-intensive and is subject to considerable detection error. Ideally, systems could operate from surface and airborne platforms and determine whether oil is present and be able to map contamination boundaries over potentially large areas.

Oil spill tests are conducted in CRREL's Ice Engineering Facility.

Description

Scientists working in the Ice Engineering Facility at ERDC's Cold Regions Research and Engineering Laboratory have been conducting a study to determine whether off-the-shelf technologies and sensors can detect oil under ice in a controlled mesoscale environment as a prelude to further development and field testing of new and innovative equipment and technologies for the remote sensing and surveillance of oil in and under ice. Experiments have positively detected oil trapped in and under ice with two independent technologies, both of which have potential for further development and large-scale field testing.

Hardware evaluation and field testing over a variety of sea ice conditions, as well as software development and preliminary planning for a field test during the winter of 2005/2006, have been funded.



Skirts were set up in CRREL's Test Basin to measure oil containment.

Expected Products

The immediate objective of this program is to establish whether off-the-shelf technologies and sensors can detect oil under ice in a controlled mesoscale environment as a prelude to further development and field testing of new and innovative equipment and technologies for the remote sensing and surveillance of oil in and under ice. Results of this research will be published in a technical report.

The ultimate goal is to have complementary systems (or a single system) capable of providing both rapid initial determination of whether oil is present in a broad area, and detailed site mapping.

Potential Users

U.S. agencies and industry are environmentally and financially motivated to develop a reliable remote method of oil detection in and under ice that can be done economically and safely in the U.S. Arctic. Other nations also are pursuing development in areas with similar oil-in-ice problems, e.g., Sakhalin Island, the Soviet Barents Sea, the North Caspian Sea, and the Baltic Sea. These agencies and nations will benefit from this research.

Projected Benefits

Results obtained to date justify further research into systems and procedures to detect oil ice through both radar anomalies and ethane sensing. The means to achieve the immediate goal focus on two key areas: (1) increasing the level of confidence in reliability by using the system in an Arctic sea ice environment with variable sea ice thickness and roughness, and cold temperatures; and (2) developing the necessary software to automatically interpret the radar response, given known parameters (e.g., ice properties and temperatures) and oil-in-ice configurations associated with different Arctic spill scenarios.

Program Manager

Leonard J. Zabilansky
603-646-4319
E-mail: Leonard.J.Zabilansky@usace.army.mil

Participating ERDC Laboratories

Cold Regions Research and Engineering Laboratory
72 Lyme Road
Hanover, New Hampshire 03755-1290
603-646-4100
http://www.crrel.usace.army.mil/