COLLABORATION AMONG NINE COMPANIES

• International research programme
• Builds upon decades of R&D in arctic oil spill response
• Brings together experts across industry, academia and independent research centres
• Research integrity through technical review and public dissemination of results

Six areas of research:
• Dispersants
• Environmental Effects
• In Situ Burning (ISB)
• Mechanical Recovery
• Trajectory Modelling
• Remote Sensing
ACHIEVEMENTS TO DATE

In Situ Burning (ISB)
• State of Knowledge
• Technology Summary and Lessons from Key Experiments
• Status of Regulation in Arctic and Sub-arctic Countries

Dispersants
• Fate of Dispersed Oil Under Ice
• State of Knowledge of Dispersant Testing Under Realistic Conditions
• Status of Regulations and Outreach Opportunities
• Inter-Basin Calibration

Remote Sensing
• Surface Remote Sensing
• Subsea Remote Sensing

The 9 completed reports are available on the JIP website: www.arcticresponsetechnology.org
PROJECT HIGHLIGHTS

Dispersants

AIM: Define the operational limits of chemical dispersants and mineral fines in arctic marine waters

- Available project reports: State of Knowledge, Summary of Existing Regulations, and Inter Basin Calibration
- Dispersant effectiveness experiments initiated at research facilities in Canada, France, and Norway
  - 75 dispersant and 45 oil mineral aggregate experiments
  - 5 crude and fuel oils, including weathered states
  - 4 dispersants, including 2 dispersant-to-oil ratios
  - 3 sea water salinities and 2 ice concentration levels
  - 3 energy levels: low, high and propeller wash
Positioning of Propeller
Dispersant Application
Removing Barrier After 18-Hours of Weathering
Initial Testing at Low Energy

SINTEF Flume Tank
Dispersant Application
Removing Barrier After 18-Hours of Weathering
Initial Testing at Low Energy
PROJECT HIGHLIGHTS

Environmental impacts

AIM: Improve the knowledge base for conducting arctic Net Environmental Benefit Analysis (NEBA)

• Comprehensive Phase 1 review and NEBA tool is complete, coming soon to the JIP website

• Phase 2 research underway, including four research projects

• Akvaplan-niva received permit from Governor of Svalbard to install 20 mesocosm at Svea, Norway and conduct the experiments

• Initial 8 mesocosms installed in sea ice in January 2015 and will remain until June 2015

• Remaining 12 mesocosms to be installed after sea ice melt
Mesocosm Buoyancy Testing at Cedre

Four Conical Shape Floats Held Together by a Protective Metal Famework Keep the Mesocosm at the Surface as the Ice Forms

Mesocosms to be Employed in the Svea, Norway Field Campaign. Length: 3 m, Diameter: 1.6 m, Weight: 325Kg
Remote sensing

AIM: Advance oil spill remote sensing and mapping capabilities to locate oil on, in and under ice

• Phase 1 complete; State of Knowledge reports for surface/subsea technologies available on the JIP website

• Phase 2 experiments nearing completion at the U.S. Army Corps of Engineers-Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, NH
  • Ice grown in large, climate-controlled test basin (37m X 9m X 2.4m)
  • Testing with oil in and under new ice (frazil), columnar ice up to 80 cm thick, and melting ice
  • Oil thickness ranges from few mm to 5 cm
Subsea and Surface Sensors Being Evaluated in the CRREL Test Tank
Ice and Sensor Sampling

Ice cores outside hoop 3a
Oil migrated from leak in hoop 2

View of Test Hoops from CRREL Cam

Hoop 2B After Warm Oil Injection
Hoop 2B Warm Oil with ECI Laser
Ice Coring and Sampling
In situ burning - Chemical Herders

AIM: Advance knowledge of chemical herder fate, effects, performance and ability to expand operational utility of in situ burning as an arctic response tool

• Laboratory, small and large scale basin experiments are being conducted in Canada, Denmark, and USA
  • Physical fate of the herder during burning as well as combustion products emitted
  • Acute and chronic toxicity and bioaccumulation of chemical herders on arctic copepods
  • Biodegradation of herders in arctic conditions
  • Windows-of-Opportunity for Herders
  • Impacts of Herder Monolayer on Birds

ISB with 90% efficiency after herding
PROJECT HIGHLIGHTS

Field research: Chemical herders to advance in situ burning

AIM: Validate the operational feasibility of an aerial herder/burn response strategy using both manned and remote controlled helicopters

- Constructed large, above ground, fully lined, test basin 90m x 90m in Fairbanks, Alaska
- Field experiments
  - Field release: ANS crude oil (200 liters per test)
  - Apply herder and ignite oil using a variety of delivery platforms
  - Conduct helicopter testing to confirm the suitability of aerial herder delivery system and spray pattern
  - Evaluate the feasibility of robotic helicopter technology (UAVs) to apply herders and igniters

Photo: J. Mullin
Completed Test Basin
View from East Corner to North Corner
Ice Formation Experiments in Test Tank
WHAT’S NEXT?

• Field studies using in situ mesocosm to measure the exposure potential, sensitivity and resiliency of sea ice and the sea surface micro layer will be conducted January-June 2015 at Svea, Norway

• Field experiments will be conducted in April 2015 in Fairbanks, Alaska to validate the operational feasibility of an aerial herder/burn response strategy using both manned and remote controlled helicopters

• Flume tank studies in the UK and field research at Svea, Norway to collect turbulence data for dispersant modelling project

• Research has been initiated to develop a new sea ice model that will be tested, evaluated and validated. Results will be integrated into established oil spill trajectory models

• Initiation of a new project to improve aerial ignition systems for using in situ burning as an arctic oil spill response tool.
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Visit the programme website at: www.arcticresponsetechnology.org
Tank Experiments at High Energy with Polyethylene Blocks

Polyethylene Blocks

Tank Experiments at High Energy with Ice

Ice Blocks
Planned layout of small, medium and large ice forms in test basin. Release frame shown in centre.