Industry efforts in Arctic spill response technology development

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Outline

- Background
- Global Collaboration
- Arctic OSR JIP Objectives
- Programme Key findings
- Conclusions

ART JIP Overview

2005–2009

- Renewed Arctic exploration interest

2010–2012 JIP Planning

- Build on decades of prior Arctic OSR Research
- Focus on continuous technology improvement
- $21.5M, nine member companies

2012–2017 Execution

- Collate existing data & conduct new research
- Connect broad range of research stakeholders
- Most extensive Arctic OSR JIP effort to date

2017 Completion

- Results and findings extensively communicated

Global Collaboration

1. Cedre Brest, France
2. IMARES, The Netherlands
3. COWI, Denmark
4. DTU Byg – Department of Civil Engineering, Technical University of Denmark, Denmark
5. DCE - Danish Centre for Environment and Energy, Aarhus University, Denmark
6. University Centre in Svalbard, Norway
7. SINTEF, Trondheim, Norway
8. Akvaplan-niva, Tromsø, Norway
9. The Nansen Environmental and Remote Sensing Centre (NERSC), Bergen, Norway
10. RPS-ASA, Rhode Island, USA
11. University of Alaska, Fairbanks, Fairbanks, USA
12. RAMBOLL/ENVIRON, Emeryville, California, USA
13. US Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL), New Hampshire, USA
14. Bigelow Laboratories, Maine, USA
15. C-CORE, St. Johns, Newfoundland, Canada
16. Alaska Clean Seas, Anchorage, US
17. Woods Hole Oceanographic Institute, Massachusetts, USA
18. The Prince William Sound - Oil Spill Recovery Institute (OSRI), Cordova, Alaska, USA
19. SL Ross Environmental Research Ltd., Ottawa, Canada
20. Hill and Knowlton Strategies, London, UK
21. Polar Ocean Service, Taynuit, UK
22. Aker Arctic, Helsinki, Finland
23. LAMOR, Porvoo, Finland
24. DESMI AFTI, Buffalo, New York
25. Alun Lewis Consultancy, Ottawa
26. University of Hamburg, Germany

28. The Glaciology and Environmental Geophysics Laboratory (LGGE), Grenoble, France
29. Jean Kuntzmann Laboratory, Saint-Martin-d'Hères, France
30. International Research Institute of Stavanger (IRIS), located in Stavanger Norway)
31. Arctic University of Norway-UiT' (Tromsø, Norway)
32. The 'University of Laval' (in Quebec city, Canada)
33. The 'Knipovich Polar Research Institute of Marine Fisheries and Oceanography' (Murmansk, Russia)
34. ING Robotic Aviation, Ottawa, ON
35. Plymouth University, Plymouth, UK
36. Ben Gurion University, Be-er Sheva, Israel
37. Waypoint Aeronautical, Everett, Washington
38. ASRC Energy Services, Anchorage, USA
39. Spiltec, Woodinville, USA
40. RPS-ASA, South Kingston, Rhode Island, USA
41. LGL Ecological Research Associates, Bryan Texas, USA

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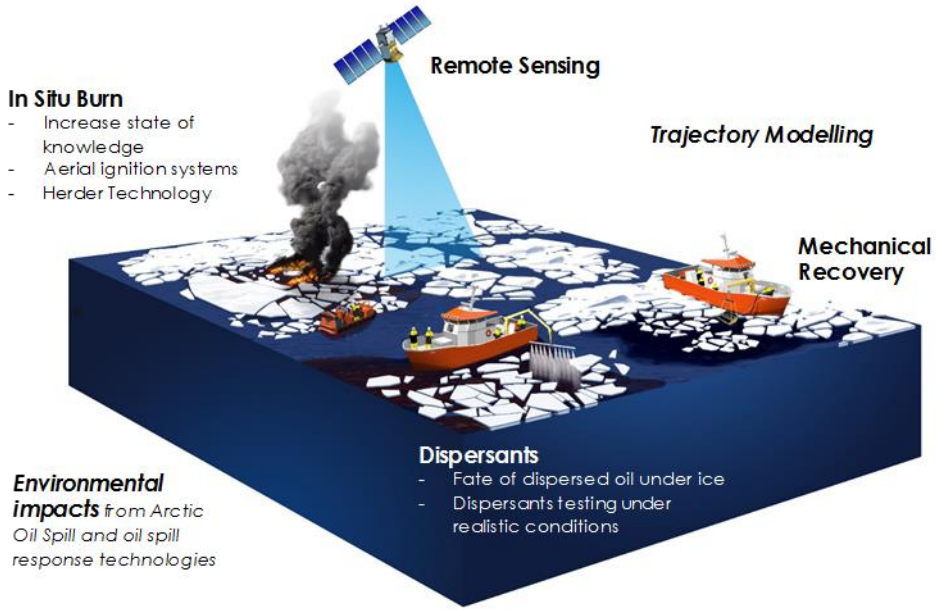
ART JIP Objectives

- Improve Arctic oil spill response capabilities in six key areas.
- Support Net Environmental Benefit Analysis (NEBA) of response options.
- Define response operating boundaries.
- Develop new OSR technologies for the Arctic.
- Disseminate information on best Arctic response practices.



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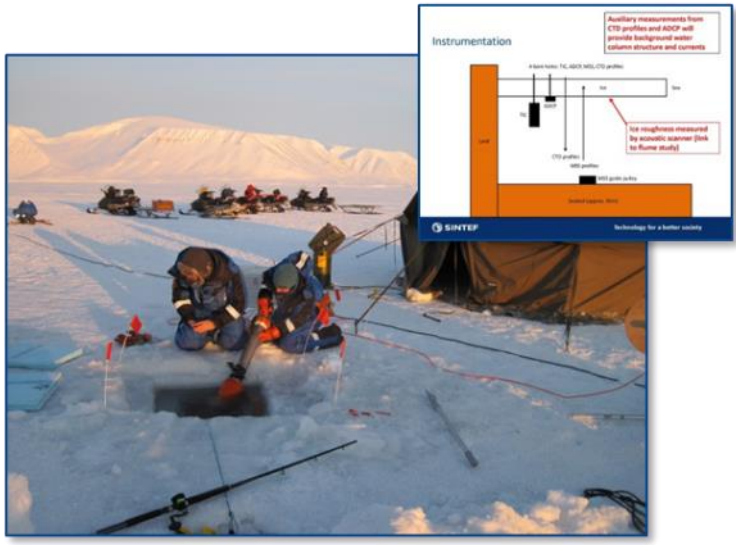
Dispersants

Key Outcome

- ART JIP reinforces previous research that dispersants can work in the Arctic and under certain conditions will be enhanced by presence of ice.

Selected Results and Findings

- New understanding of expected dispersant effectiveness vs key variables.
- Treated and untreated oil remain dispersible after release from melted ice.
- Model results showing insignificant impacts to Alaska Arctic cod population from dispersant scenarios.



Under ice measurements, SINTEF, Mar. 2015

Dispersant testing, SINTEF, Apr. 2015

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Environmental Effects

Key Outcome

- ART JIP reviewed and extended the available science base on oil spill impacts in an Arctic environment to support Net Environmental Benefit Analysis (NEBA).
- Prioritized gaps were addressed though laboratory, modelling and field tests.

Selected Results and Findings

- Searchable database created referencing over 1000 papers; accessed via a web-based literature access tool.
- Improved understanding of impact on ecological systems from oil frozen into ice

Mesocosm installation, Feb. 2015

Microcosms *in-situ*, Feb. - Jul. 2015

Oil Spill in Ice Modelling

Key Outcome

- ART JIP improved the predictive capability of existing trajectory models that will provide more accurate predictions of oiled ice movements in a range of ice conditions.

Selected Results and Findings

- Higher-resolution ice drift model is now available that outperforms existing models.
- Standardization of outputs to facilitate data exchange.
- Improved existing oil spill models OilMap and OSCAR.

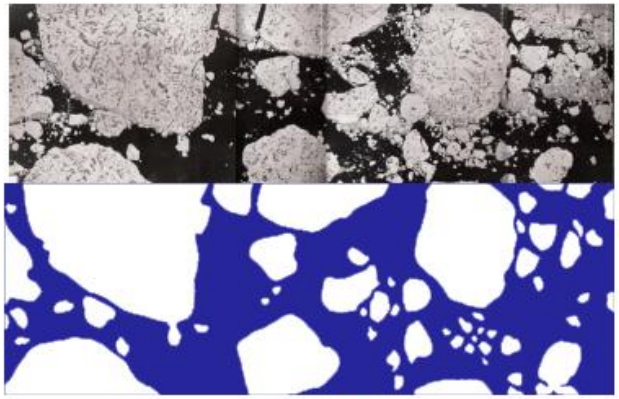

Photo: NERSC

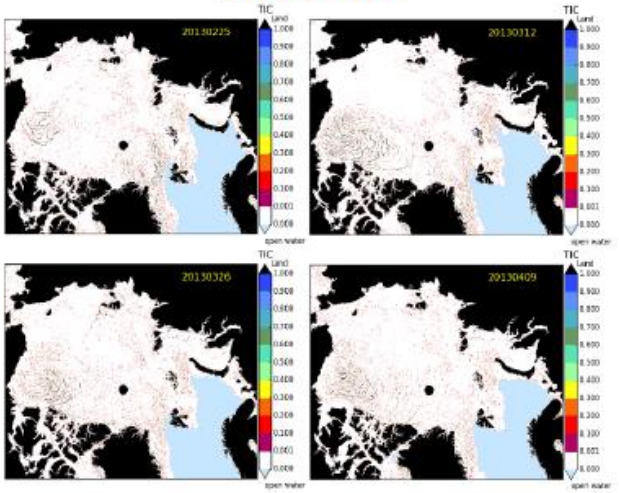

Photo: NERSC

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Remote Sensing

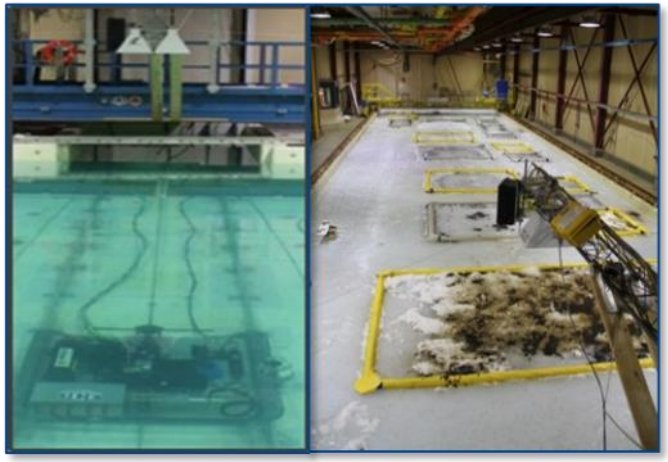
Key Outcome

- ART JIP has led to a better understanding of relative sensor capabilities, under a range of oil and ice conditions using range sensors above and below the ice.

Mounting sub sea sensors

Selected Results and Findings

- Most promising sensors evaluated and qualified under different conditions. All of the sensors tested were capable of detecting oil in ice under certain conditions.
- Operationally-oriented guide responders can use to select the most effective sensors for a given set of conditions.



Subsea and surface sensors

In-situ Burning

Key Outcome

- ART JIP provides support that ISB can be conducted in a wide variety of ice conditions and confirms that ISB is the technique with highest potential for oil removal in presence of ice.

Selected Results and Findings

- State of knowledge of ISB in ice-affected waters has been consolidated.
- Rapid response capability demonstrated using herders in combination with burning and new delivery system prototyped.
- Evidence low volumes of herders should pose no significant environmental risk.

Large-scale basin tests of herders and burning in Alaska

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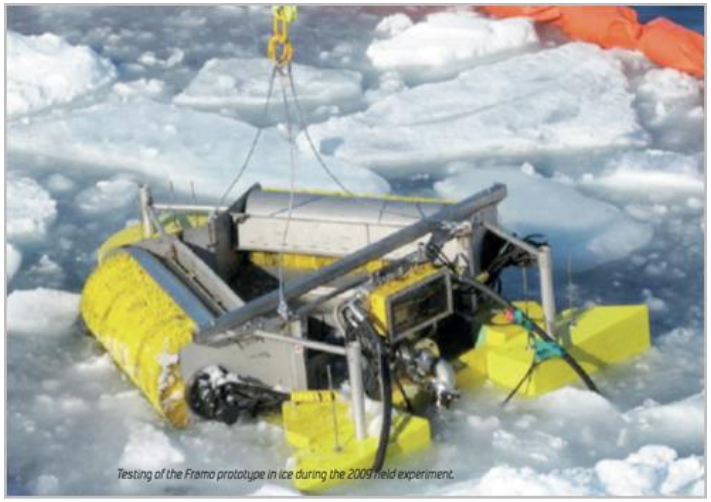
Mechanical Recovery

Key Outcome

- Integrating field operations with support tools like real-time remote sensing will lead to greater improvements by enhancing the performance of existing recovery systems.
- All tools in the tool kit needed.

Selected Results and Findings

- Physics of oil spreading and ability of equipment to contact recoverable oil limit efficiency
- Game changing mechanical recovery equipment concept is not realistic.



Mechanical Equipment Test - Photo: SINTEF

Testing at Ohmsett – Photo: J. .Mullin

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ART JIP Legacy

Timeline:
40 years
Arctic OSR Research

Summary and
Synthesis reports

>30 Technical reports and Searchable environmental effects database

>20 Peer Reviewed papers

All products except Peer Reviewed papers can be found on ART JIP's website: http://arcticresponse.wpengine.com/

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Concluding Remarks

- There is a large body of work (>40 years) underpinning Arctic OSR
- ART JIP has consolidated this experience, advanced the scientific basis underpinning response options, and developed new capability.
- All tools in the toolbox are needed. Advanced tools, ISB and dispersants, must be available in addition to mechanical recovery.
- Increased future collaboration is strongly encouraged between the oil and natural gas industry, regulators, and informed stakeholders.
- IOGP continues to promote the ART JIP and is working with IPIECA to improve the strategic framework Arctic OSR plan preparation and response.

Project ‘Coat hanger’ (2019)

- Ongoing stakeholder uncertainty about Arctic OSR capabilities
- Wealth of information on methods and tools, but these can be fairly contrasting and hard for non-experts to understand
- Industry needs to build confidence in its ability to manage Arctic oil spills
- Opportunity to share information to other industries and to avoid duplication of efforts

- IOGP is developing a webtool to give perspective and resources for Arctic oil spill preparedness and response
  - Prevent – Control – Respond
  - Risk management & links to resources, standards, guidelines, JIP findings etc.

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Acknowledgements
Thank You
Questions

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