



MANAGING THE RISK OF ARCTIC OIL SPILLS: MINIMIZE LIKELIHOOD, UNDERSTAND AND MITIGATE CONSEQUENCES

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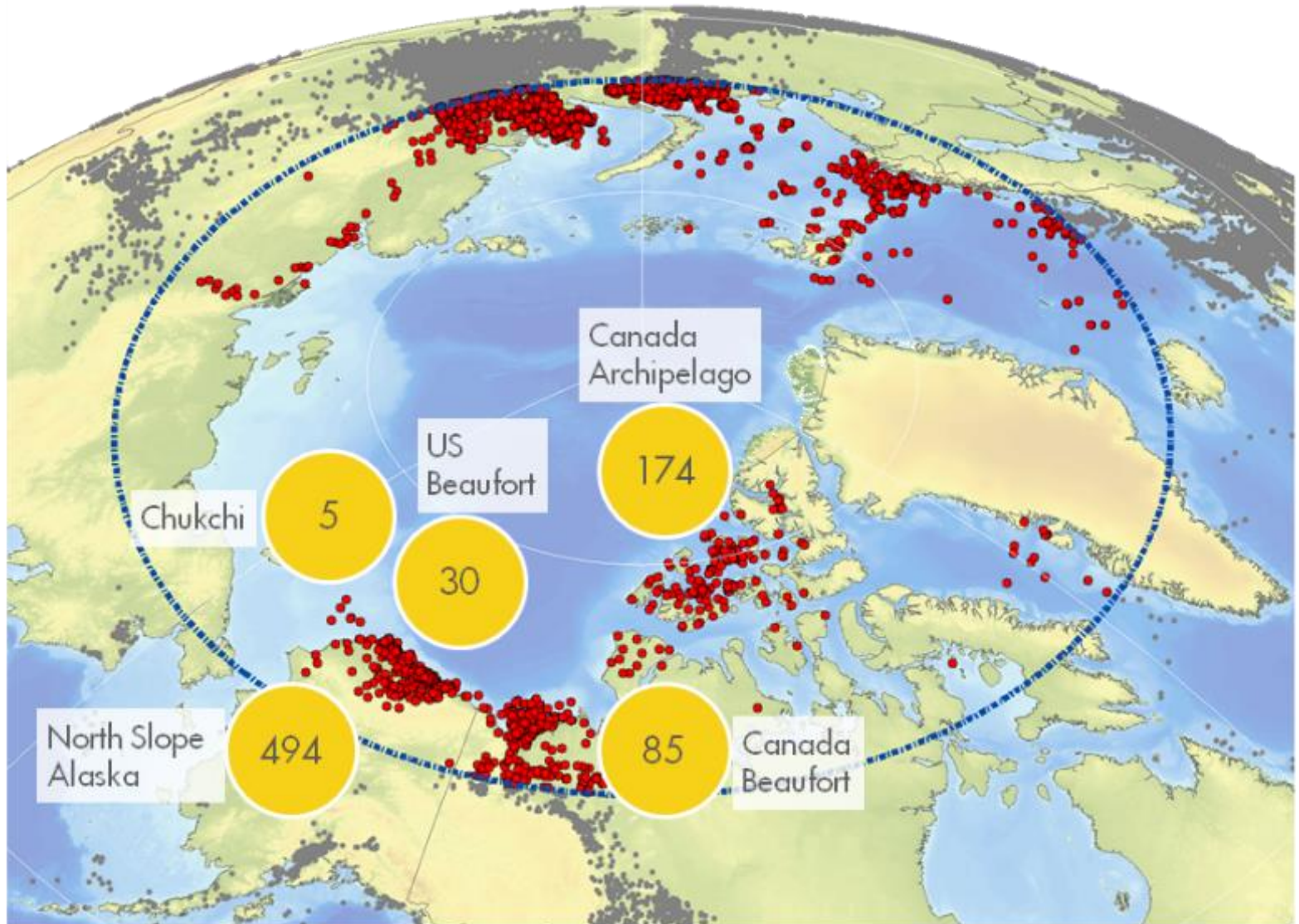
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MANAGING THE RISK OF ARCTIC OIL SPILLS: MINIMIZE LIKELIHOOD

ARCTIC DRILLING ACTIVITY 1960S TO PRESENT



RISK OF ARCTIC OIL SPILL IS A MAIN CONCERN



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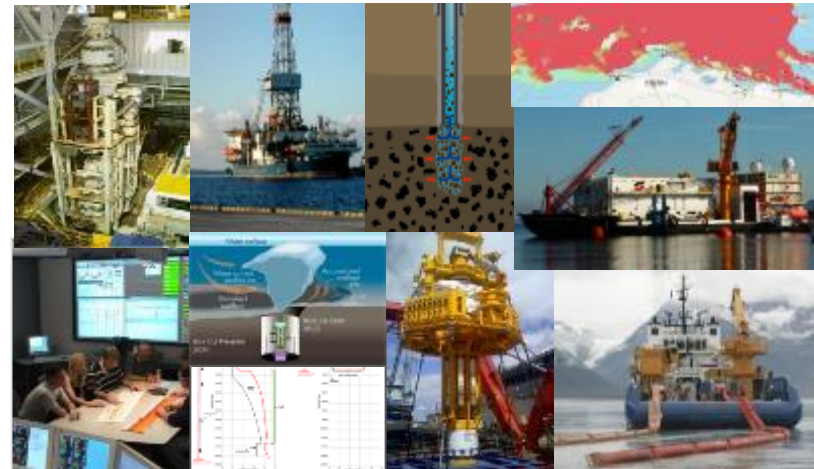
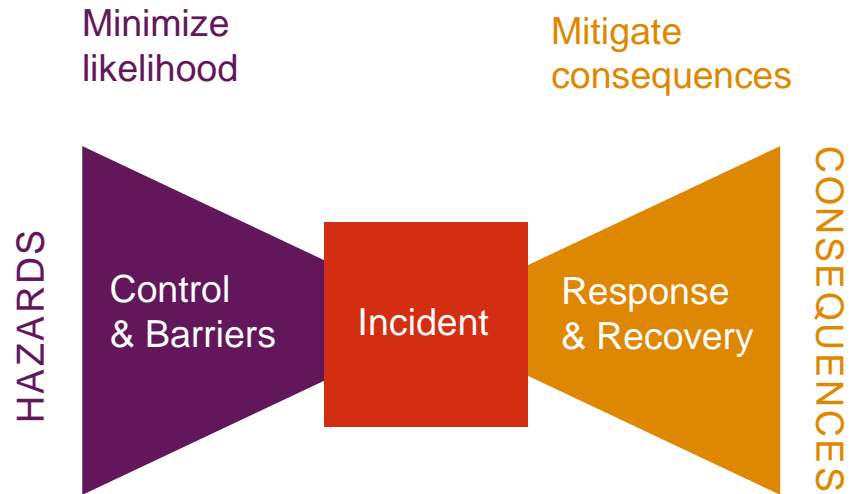
ARCTIC OIL SPILL PREVENTION AND RESPONSE

CONTROLS & BARRIERS

- Drill rig selection
- Subsurface knowledge
- Primary barriers (mud and casing)
- Training & preparation
- Real Time Operating Center
- Dual shear rams on BOP
- Mud line cellar
- Ice management plan

RESPONSE & RECOVERY

- Capping stack
- Arctic containment system
- Training & preparation
- Three tier oil spill response
- Second rig for relief well
- Search and rescue
- Medivac

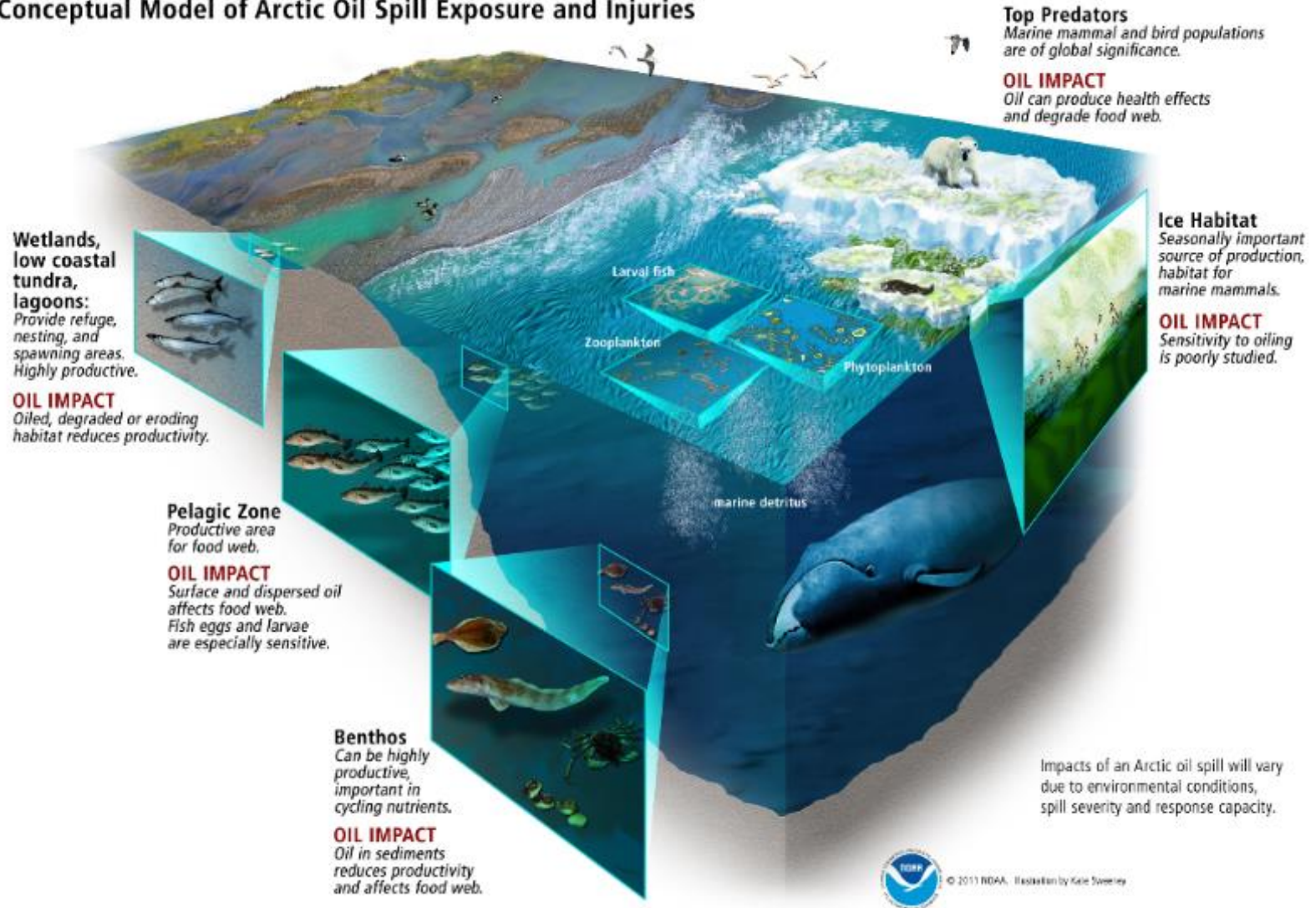


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MANAGING THE RISK OF ARCTIC OIL SPILLS: UNDERSTAND CONSEQUENCES

UNDERSTANDING THE ARCTIC ECOSYSTEM TO UNDERSTAND OIL SPILL CONSEQUENCES

Conceptual Model of Arctic Oil Spill Exposure and Injuries



ADVANCING SCIENCE ON ARCTIC SPILL RESPONSE

ARCTIC RESPONSE TECHNOLOGIES

The technologies that currently form the basis of Arctic oil spill response include mechanical recovery, dispersants, remote sensing and in situ burning. The research of the Arctic Oil Spill Response Technology Joint Industry Programme (JIP) is intended to build on existing knowledge of these and other emerging technologies, and their role in an integrated response.

RESEARCH PROJECTS

Over the course of four years, the Arctic Oil Spill Response Technology JIP research programme will be focused on expanding industry knowledge through nine research projects:

- Fate of dispersed oil under ice
- Dispersant testing under realistic conditions
- Environmental impacts from Arctic oil spill and oil spill response technologies
- Oil spill trajectory modelling in ice
- Oil spill detection and mapping in low visibility and ice
- Mechanical recovery of oil in ice
- In situ burning of oil in ice-affected waters:
 - Increase state of knowledge
 - Aerial ignition systems
 - Chemical herders



2012	Programme Launch
2013	Research Projects & Interim Findings
2014	Research Projects & Interim Findings
2015	Research Projects & Final Reports

ABOUT THE JIP

Ten oil and gas companies have established the Arctic Oil Spill Response Technology Joint Industry Programme (JIP) to further build on more than 40 years of existing research into technologies and methodologies for Arctic oil spill response. The goal of the JIP is to advance response strategies and equipment and to increase understanding of potential impacts of oil on the Arctic marine environment.

The Arctic Oil Spill Response Technology JIP is sponsored by ten oil and gas companies:



<http://www.arcticresponsetechnology.org>

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Environmental Impacts of Arctic Oil Spills and Arctic Spill Response Technologies

Literature Review and Recommendations

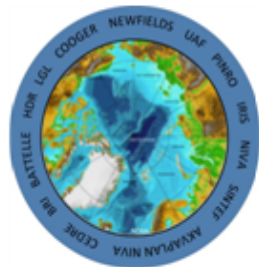
Principal Investigator: Jack Q Word

Contributing Authors

North America: Dr. Don Swickel, Battelle Memorial Institute; Dr. Charles Greer, Biotechnology Research Institute (ERI)/National Research Council of Canada; Drs. Gina Coeche and James Clark, Mr. James Stevens, Ms. Laura Essau, Ecosystem Management & Associates (EM&A); Dr. Benny Callaway, (LGL Ltd); Mr. William Cardiner, Dr. Will Hafner, Ms. Lucinda Word, NewFields; Drs. Robert Perkins and Phillip Loving, University of Alaska Fairbanks (UAF).

Europe: Dr. Lionel Camus, Akvaplan Niva; Dr. Jennie Friis-Rasmussen (ARTEK); Mr. Francois Merlin, Dr. Stephane Le Floch, Centre de Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE); Dr. Morten Rjorth, COVI; Dr. Scinar Sanni, Dr. Thierry Bausant, International Research Institute of Stavanger (IRIS); Dr. Torgeir Bakke, Norwegian Institute for Water Research (NIVA); Drs. CI Bogle-Kreuzer, Odd Brakstad, Per Daling, Liv-Guri Faknnes, Bjørn Henrik Hansen, Alf Molbye, Ida Broeche Øverjordet, Ivar Singaas (SINTEF).

Russia: Drs. Oleg Titov, Andrei Zhilin, the Polar Research Institute of Marine Fisheries and Oceanography (PINRO).



MAIN FINDINGS:

- Many baseline ecosystem and biodiversity assessments performed to better understand and protect the marine Arctic
- Extensive data from field and laboratory studies on fate of oil, OSR techniques and potential effects under the different seasonal conditions
- Assumptions that dispersant treated oils are more toxic than undispersed oil, dispersants are more toxic than oil, dispersants reduce the ability of microbes to degrade oil, and Arctic species are more sensitive to oil than non-arctic species are incorrect
- Effect studies of OSRT mainly focus on acute toxicity to individual (pelagic) species

Environmental Impacts of Arctic Oil Spills and Arctic Spill Response Technologies

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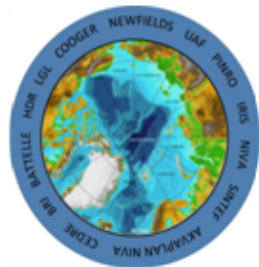
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MAIN RECOMMENDATIONS:

- Improve availability of the vast amount of data on the impacts of oil spill response techniques and on the resilience of VECs to NEBA practitioners and stakeholders
- Validate fate and effects of oil and response techniques on unique Arctic communities within interface habitats with focus on population responses and species interactions
- Identify relative importance of chronic effects to population response and resilience

First of it's kind long-term ice mesocosm studies (early winter until late spring):

1. Fate and biodegradation of oil and oil spill response residues
2. Exposure potential, sensitivity and resiliency of sea ice ecology and sea surface micro layer



In-situ mesocosms



Van Mijenfjorden,
Svea

Treatments:

1. Natural attenuation
2. Chemical dispersants
3. In-situ burning
4. Control



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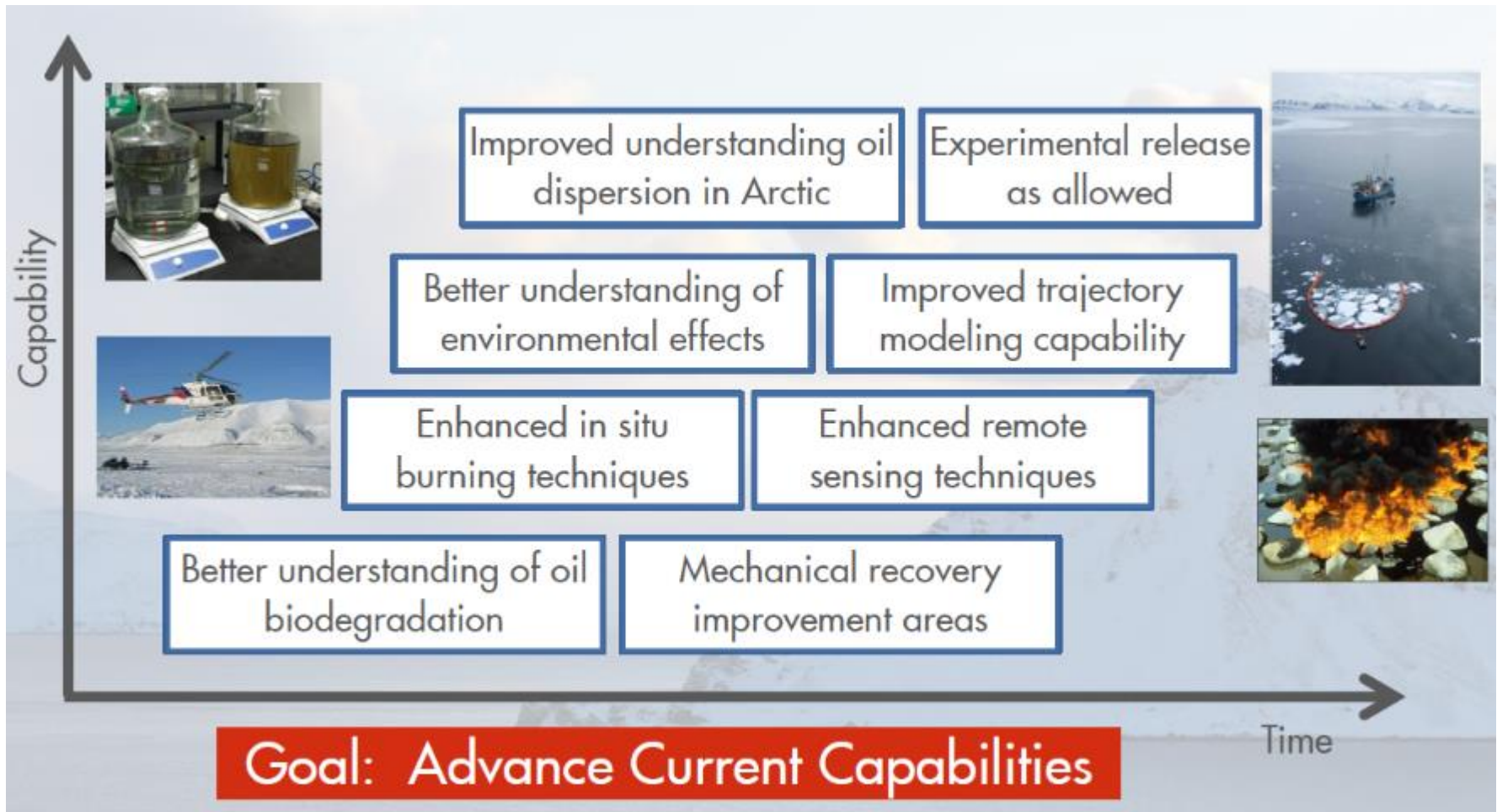
MANAGING THE RISK OF ARCTIC OIL SPILLS: MINIMIZE CONSEQUENCES

RESPONSE TECHNIQUES IN THE TOOLBOX

- Natural attenuation (monitoring)
- Mechanical recovery and Containment
- Dispersant application
- In-situ burning
- Combinations of those



ADVANCING OIL SPILL RESPONSE TECHNOLOGY



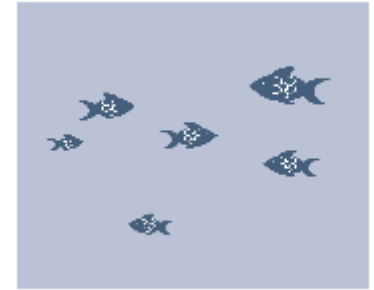
- Nine state-of knowledge and technology summaries have been published and provide a comprehensive assessment of current oil spill response in ice capability
- These summaries support in situ burning and dispersants as viable oil spill response tools in ice in addition to mechanical recovery
- Additional research is being executed to enhance the effectiveness of oil spill response in ice tools and better define operating envelopes



NEBA HELPS MINIMIZING IMPACTS ON SHARED VALUES



NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA) IS A PROCESS USED BY THE RESPONSE COMMUNITY FOR MAKING THE BEST CHOICES TO MINIMIZE IMPACTS OF OIL SPILLS ON PEOPLE AND THE ENVIRONMENT.



Through the use of NEBA, the oil and gas industry strives to uphold community values and protect community assets with every operational decision.

Q & A

