



# ICEOP

*Exploring ice conditions of the Barents Sea to facilitate oil and gas developments*

<b>PROJECT TITLE</b>	<b>ICEOP – Ice Operations</b>
<b>IMPLEMENTATION PERIOD</b>	15.10.2018 – 31.10.2021
<b>ORGANISATIONS INVOLVED</b>	Northern Research Institute Narvik (NO); Northern (Arctic) Federal University named after M.V. Lomonosov (RU); Association of oil and gas suppliers “Sozvezdye” (RU); Luleå University of Technology (SE); Storvik & Co Oy (FI); Finnish Meteorological Institute (FI)
<b>PROGRAMME</b>	Kolarctic CBC 2014-2020
<b>TOTAL BUDGET</b>	1.215.002,00 €



The ICEOP project main objective is to offer more business development opportunities for oil and gas exploration and production in the Arctic. The aim is to improve maritime accessibility, to have better knowledge of the ice conditions in the Arctic and to develop more accurate models to ensure safe and environmentally friendly developments on the field. The project is performing field expeditions, measurements and data collection to increase the current knowledge of the Barents Sea ice conditions, to establish best practice models and to create recommendations for oil and gas field exploration.

**OPEN INNOVATION**



Project co-funded by the European Union

**ECONOMIC DEVELOPMENT**

*"In some ways, the ice is so transparent. It carries its history on the surface."*

Peter Høeg  
*Miss Smilla's Feeling for Snow*

It is not only Smilla from the Høeg's book who highly thinks of snow and ice, and lives in a world of numbers and science. The Ice Operations (ICEOP) project team is also fascinated by the challenging conditions of the Arctic Barents Sea, with level ice, ice rubbles and ridges, icebergs and ice drifts. They try to explain all this using mathematical modelling, and in extreme weather conditions (low temperatures, snow and strong winds) they make predictions of ice forces, to estimate the local and global loads affecting the offshore structures in the Arctic.

This information is essential for the oil and gas industry companies operating in Arctic waters, for the safety of people and equipment, as well as for ensuring sustainability of their operation. A thorough understanding of ice mechanics as well as an in-depth knowledge of interaction between ice features and industrial structures is necessary, and these competences are now all available in the ICEOP project supported by the Kolarctic CBC Programme.

The main objective of the project is to provide opportunities for oil and gas exploration and production in the Arctic: the partners from four countries are working to obtain better knowledge of ice conditions and to develop more accurate models that could improve maritime accessibility, ensuring safe and environmentally friendly field developments. To achieve this, they jointly perform trips in the Arctic Barents Sea region, with the purpose to gather data and do the measurements.

The collected samples are analysed in the cold climate laboratories, which investigate the structure and the strength of the ridged ice: this information is used for the numerical modelling of ice structure interaction. Field exploration is coupled with desk research, based on data from the Synthetic Aperture Radar (SAR) images, remote sensing, satellites images and meteorological data. Last but not least, there is information from previous projects and expeditions, which allows for the mathematical modelling of sea ice, ice ridges and icebergs, to be produced.

This is how Terje Nordvåg from SINTEF Narvik (project lead beneficiary) describes the data collection during the field expeditions: "We combine the visual impressions of the ice that we navigate through; we back it with the satellite images coming from the Finnish Meteorological Institute and the radar images from the ship; and finally, we measure the propulsion, i.e., how the engine of the ice breaker reacts when moving through level of ice and ice ridges."

Geometry of the ice ridges, concentration and thickness, temperature and porosity are measured, and this is topped up by the analysis of the compression and tensile strength properties of the ice, all important elements for the modelling work. This information allows to develop the risk maps of the ice conditions in the Barents Sea, a very precious tool for the industries operating there. "I think this type of project without the framework of the Kolarctic CBC Programme would not have been possible – continues Mr Nordvåg – The partnership is solid and strong, and putting all these forces together in a good consortium produces results."

Of course, when planning project activities, partners did not know that in the second half of the project they would not have had the possibility to cross the bor-



ders and meet their counterparts in the other countries. The COVID-19 pandemic did not allow for joint expeditions; trips had to be carried out as single-country activities. However, this has not prevented from sharing the results among the partners and arriving to joint conclusions for the common benefit.

When asked about the added value of the cross-border cooperation, Terje mentions that the project has allowed to put together a very good team, where each partner brings in its specific competences and perspectives. "One country alone would not have achieved what we have done together. Nowadays challenges are global, and they need a joint response."

Høeg's Smilla states that "Reading snow is like listening to music. To describe what you've read is like explaining music in writing." Of course, the power of nature, especially in the Arctic, is majestic and cannot be fully decoded. But Terje and his colleagues believe that it is possible to provide at least some explanations and make some predictions that will serve a greater purpose.

