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Emerging technology snapshot

Emerging trends in Arctic research

Research in the Arctic is dominated by climate science but new research is emerging on topics related to increased shipping and digitalization in the Arctic. Warming temperatures and melting sea ice are opening new Arctic routes for shipping. Research shows that Russia is heavily investing in developing its Arctic communities and supporting infrastructure along the Northern Sea Route. China is also developing an icebreaker fleet with intentions to ship through the "Polar Silk Road". Safety and security concerns are growing.

Enabling Science and Technology

Traffic

Increased shipping in the Arctic has led many researchers to measure the conditions of the routes and quantify the impacts of ships in the Arctic. Tracking shipping traffic can support decision makers, regulatory managers and local communities and signal potential security risks when ships do not identify themselves.

Logistics

The Northern Sea Route (NSR) is the most important maritime logistics project for transportation of extracted resources, transit between European and Asian ports, and supplying Arctic cities. Challenges include an absence of transshipment points, inadequate ports, and route sections that can be too shallow to navigate.

Fleets

Russia's research is focused on modernizing its icebreaker fleet with nuclear or diesel-electric icebreakers, and investigating various algorithms for icebreaker fleet management simulation models. Canada and the US need to improve their icebreaker fleet capabilities in order to meet growing needs in the Arctic.

Smart systems

Variable weather in the Arctic is a critical factor for safe and reliable transportation of goods and people over land and water. Advantages of a maritime intelligent transportation system include the integration of existing autonomous shipping, autonomous unmanned vehicles, and maritime unmanned navigation. Intelligent transportation systems also connect satellite data with on-board systems to keep pilots informed about weather conditions and potential hazards.

"Digital connectivity is the cornerstone of Russia's plans for infrastructure build-ups and energy exploration along the Northern Sea Route… Better digital connectivity can enhance Russia's defense capabilities, maritime navigation and energy exploration….[and] Arctic digital infrastructure projects are emerging as an increasingly attractive sector for China."

Maria Shagina and Elizabeth Buchanan. China Enters the Arctic Digitization Race, January 17, 2021.

Signals

Academic
Development of knowledge-based decision-making systems and machine learning approaches for maritime logistics in the Arctic are promising areas for further research.

Government
The Russian Academy of Sciences (RAS) is the top affiliation, particularly on topics related to climate science, fossil fuels, developing the NSR and infrastructure in the Arctic.

Collaboration
Canada and USA have large international collaboration networks, frequently working with the UK, Germany and Norway. Russia's collaboration network is predominantly through RAS or Moscow State University.

Defence
Russia's Arctic military posture, particularly the formation of a single Arctic military command and the physical expansion of their military footprint, is concerning many. Moreover, ship traffic in the Arctic might lead to increased demand for search and rescue and disaster relief.

Corporate
Russian officials with Rosatom (state nuclear energy company) and Novatek (gas company) announced that year-round export of liquified natural gas from the Arctic to Asia would begin in the NSR early 2024.

"Canada's Arctic is under threat — from climate change and the belligerence of Russia and China, both of which share an interest in the region's energy resources, rare and highly prized minerals and seafood."

Tony Dean (Chair), Standing Committee National Security, Defence and Veteran Affairs, Defence upgrades in Canada's Arctic should have collateral social and economic benefits: Senator Dean, December 8, 2022

Impact

Social
Socio-economic barriers, as well as a lack of digital infrastructure and information and communications technologies (ICT) related skills are challenges for digitization in the Arctic.

Policy
Russian policies to increase economic and military development in the Arctic and China's Arctic policies, which include the Polar Silk Road, will significantly contribute to shaping the geopolitical landscape in the region.

Economic
While shipping routes are shorter through the Arctic, factors such as ice besetting events, uncertain weather and ocean conditions, carbon tax rates, fuel prices, and the impact of hubs need to be considered when assessing shipping costs.

Environmental
Emissions and other environmental impacts need to be considered with regards to increased Arctic shipping in order to protect the marine environment and local populations.

Defence
Russia's growing presence in the Norwegian and Arctic seas poses complications to Western security calculations and shifts in North American Treaty Organization's (NATO) maritime strategy.

"Canada and like-minded Arctic states continue to promote a low-tension vision for the region, but this vision is increasingly complicated by current geopolitical frictions, strategic competition and an evergrowing number of states, both friendly and adversarial, seeking access and influence. "

Jody Thomas (National Security and Intelligence Adviser, Privy Council Office). Standing Senate Committee on National Defence: Evidence December 8, 2022

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Produced in partnership by the National Research Council and Defence Research and Development Canada.

Derived from: Wiseman, E. Scientometric Study on Trends in Arctic Research. July, 2023..

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PDF: catalogue number NR16-427/2023E-PDF, ISBN 978-0-660-68341-6

October 2023 • Également disponible en français