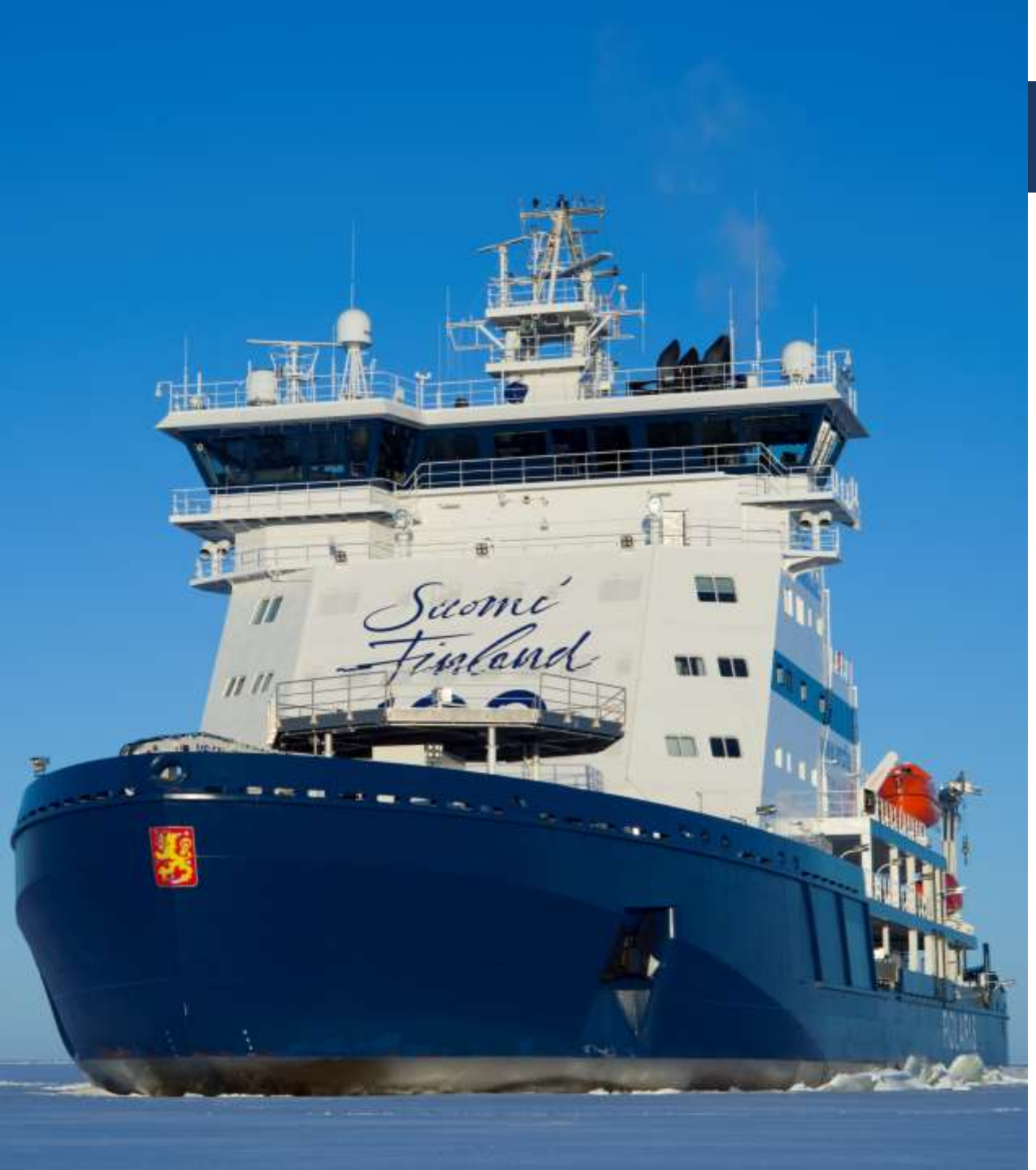


AKER ARCTIC TECHNOLOGY

News from Aker Arctic

17th Arctic Passion Seminar

2024-02-15

Mika Hovilainen

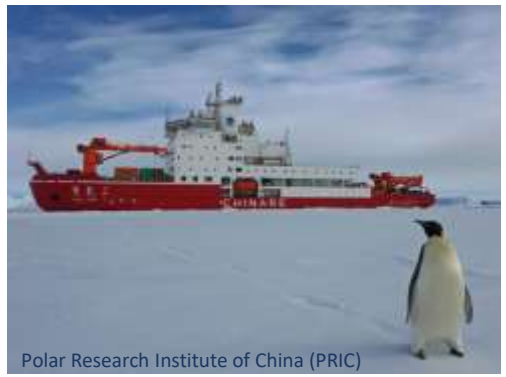
Managing Director, CEO (interim)

Aker Arctic
The Ice Technology Partner

Company Profile

Aker Arctic specializes in development, design, engineering, consulting and testing services for ice-going vessels, icebreakers, offshore marine structures and marine transport solutions

Terres australes et antarctiques françaises (TAAF)



Polar Research Institute of China (PRIC)

Compagnie du Ponant

Aker Arctic
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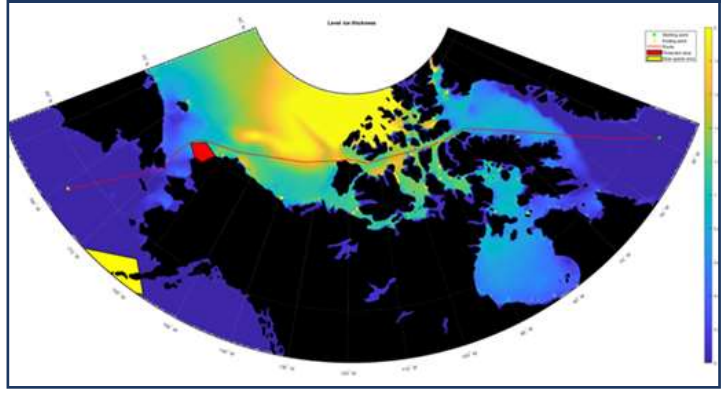
Aker Arctic's services and products

Consultancy & Technology Development



Ship Design & Engineering

Offshore Wind

Ice Model Tests

Full Scale Tests

Equipment and products

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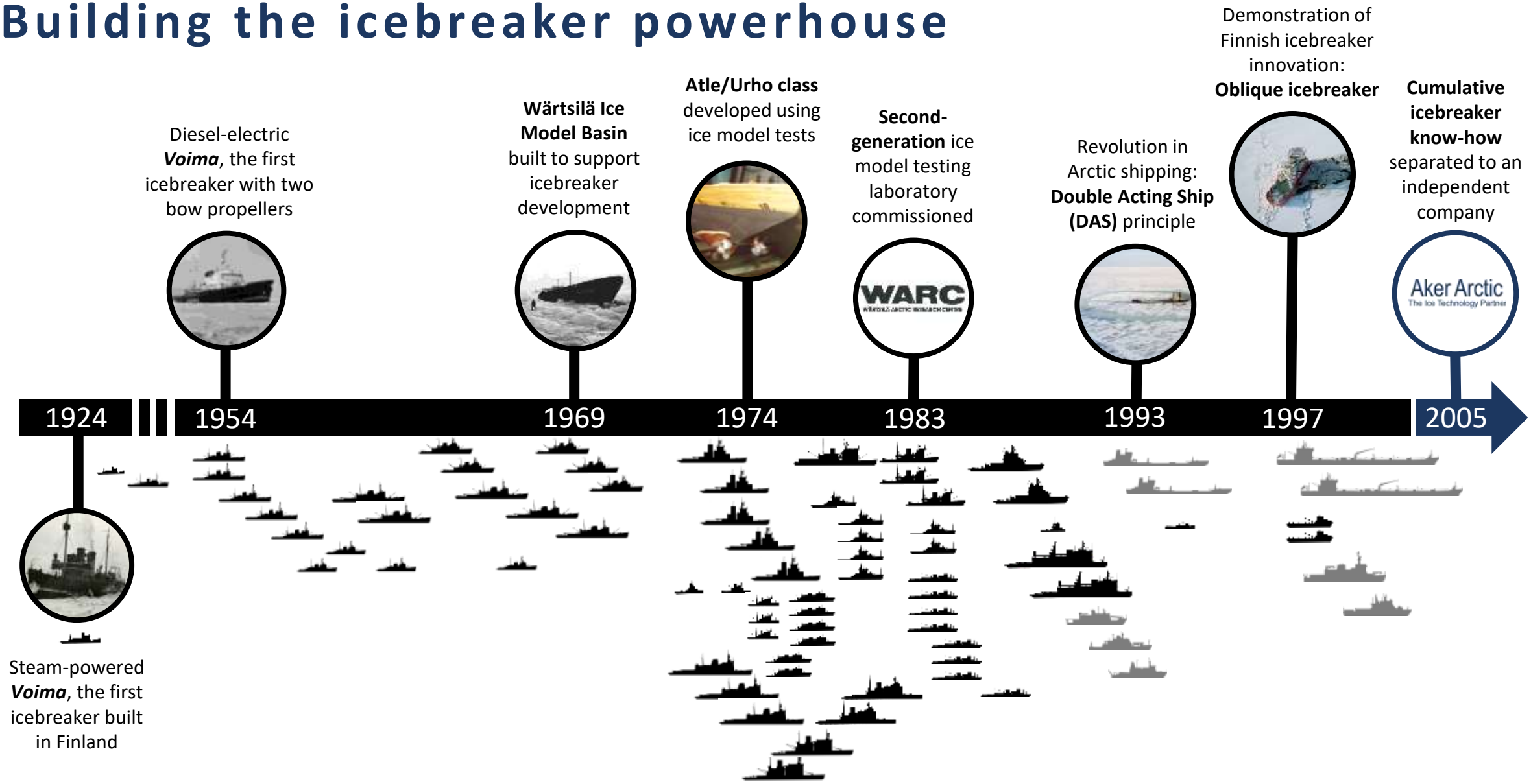
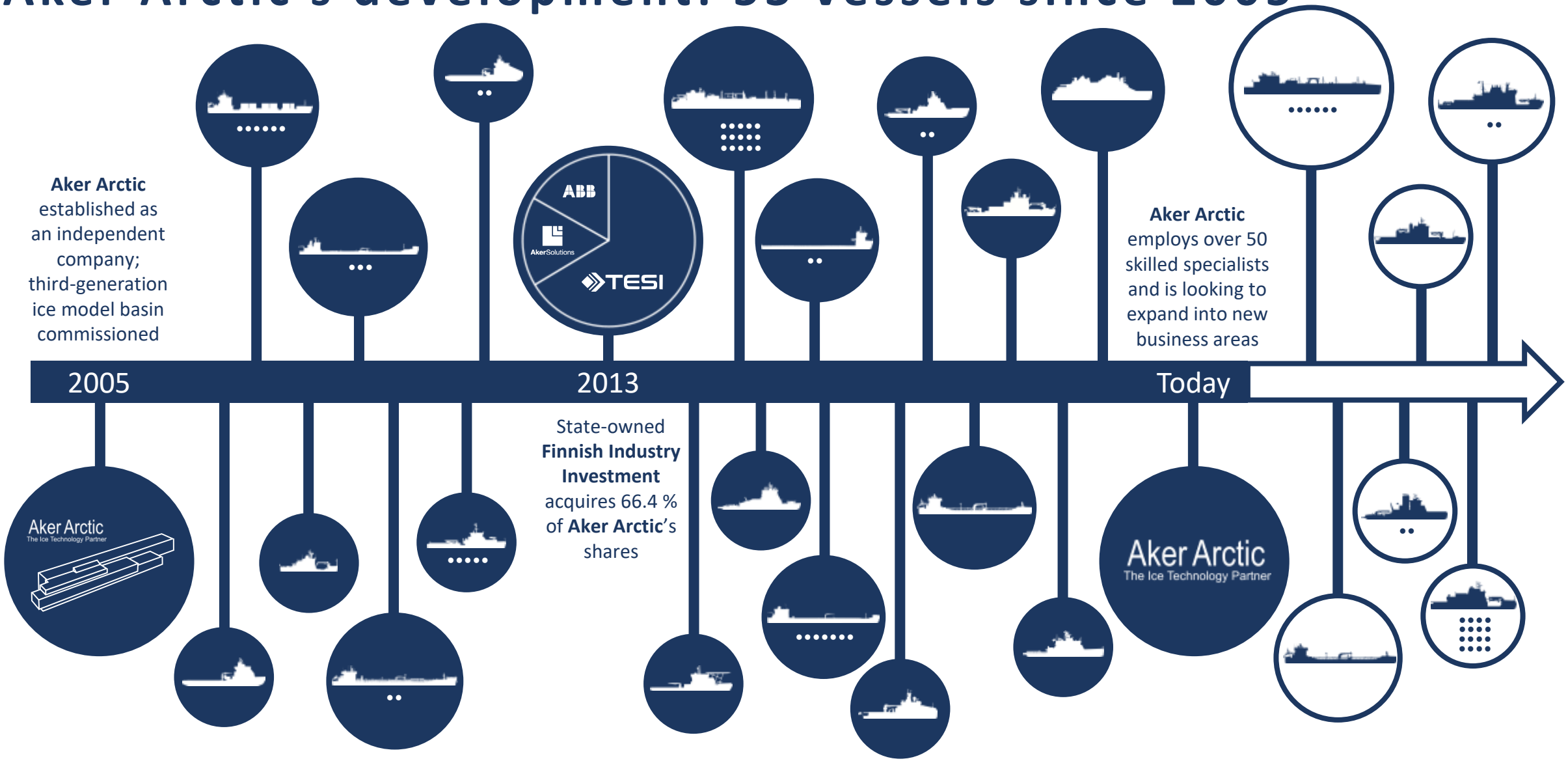
Building the icebreaker powerhouse



Aker Arctic's development: 53 vessels since 2005



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Brash Ice Channel Resistance Research

- Model scale tests in an old brash ice channel can be utilized to verify ship's performance for Finnish-Swedish Ice Class
- The new environmental standards have generated changes is merchant fleet

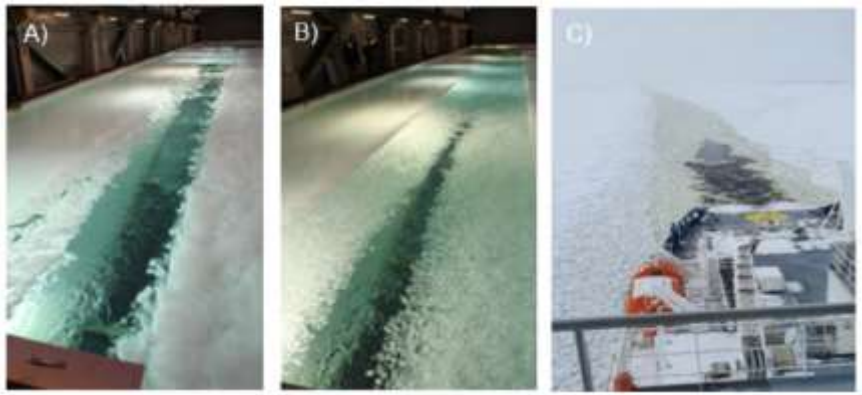
➔ Is the established model scale testing methodology suitable for realistically predicting the channel resistance of the new bow shapes?

Analysis of processes forming the ship's ice resistance in an old unconsolidated brash ice channel using experiments in full scale and in model scale

Determination of the ice properties contributing to the ship's resistance

Assessing whether the current model test methodology can simulate all substantial factors sufficiently

Introduction of a novel methodology for model scale simulations that improves the modelling of interaction between the brash ice blocks



IMPORTANCE

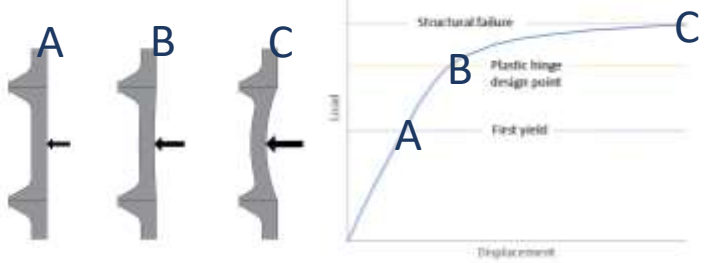
Winter navigation in the Baltic Sea is crucial for the society

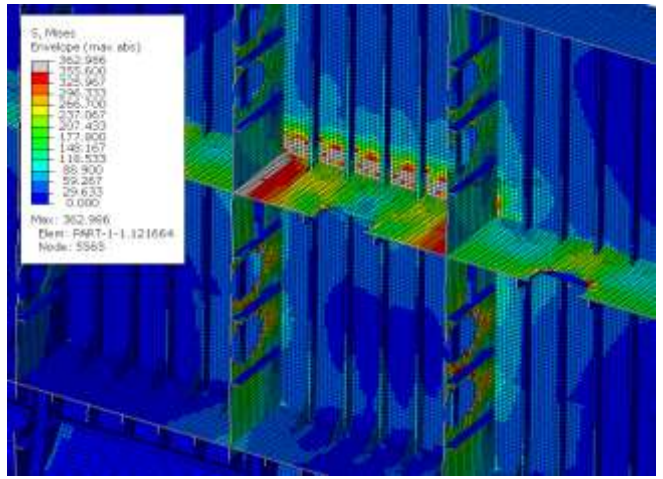
All stakeholders benefit for economically and environmentally optimized winter navigation system

Finding the optimal system necessitates good understanding on merchant ship's ice performance

FSICR ice class development

- Current FSICR hull rules are simple to use and have good service experience, but structural arrangement is very strict
  - Industry wish for direct calculation alternative to allow more design freedom
- Aker Arctic has been developing these guidelines for Winter Navigation Research Board for two years
- Goal to provide alternative method that allows novel designs and ensures sufficient strength and safety
  - Not to replace current rules, but to offer alternative method
- Methodology development was done in co-operation with VTT in 2022
- 13 different vessels analyzed by Aker Arctic in 2023 with the proposed method
  - Ensure applicability to whole Baltic fleet
  - Ensure equivalent strength level to current Rules
- Next steps in 2024
  - Some additional analysis
  - Rule draft publication and review with industry, in co-operation with Traficom





Aker ARC 149 design for Baffinland Iron Mines

Aker Arctic has supported Baffinland Iron Mines in the development of Steensby Inlet iron ore transportation system

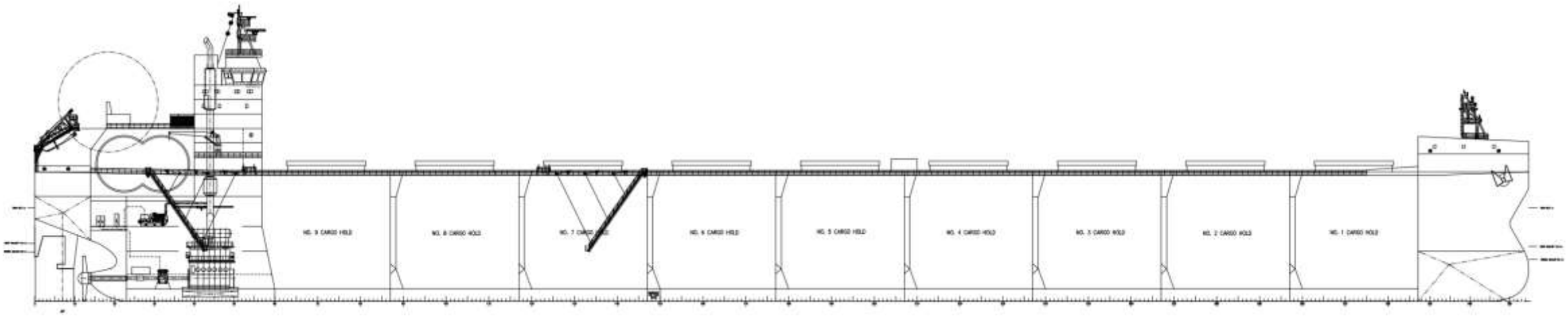
- Aker ARC 149 icebreaker design developed to support bulk carrier operations
- Bespoke ice strengthening exceeds Polar Class 3 to enable safe year-round Arctic operation
- Continuous operation without refueling through the most severe 30-day period during the seasonal shipping window
- Considerations for secondary missions and off-season deployment incorporated in the vessel design

Main parameters	
Length	123.4 m
Breadth	24.8 m
Draught, design	9.0 m
Propulsion power	2 × 10.2 MW
Icebreaking capability (80% MCR)	over 5 knots in 1.5 m level ice
Maximum icebreaking capability	about 2.3 m level ice

Aker ARC 230 Capesize Bulk Carrier design developed

- Lower ice class application up to PC6 available
- Combining low fuel consumption and efficient operation in icy water design driver
  - EEDI Phase 3 compliant
- Capable to follow icebreaker in narrow channel
- Single screw, LNG driven slow speed engine configuration
- Hull form tested in ice
- Concept design available for future development

Main parameters	
Length	300 m
Breadth	45 m
Draught, design	18.7 m
Propulsion power	19 MW
Deadweight	180 000 tons
Independent icebreaking capability	about 50 cm



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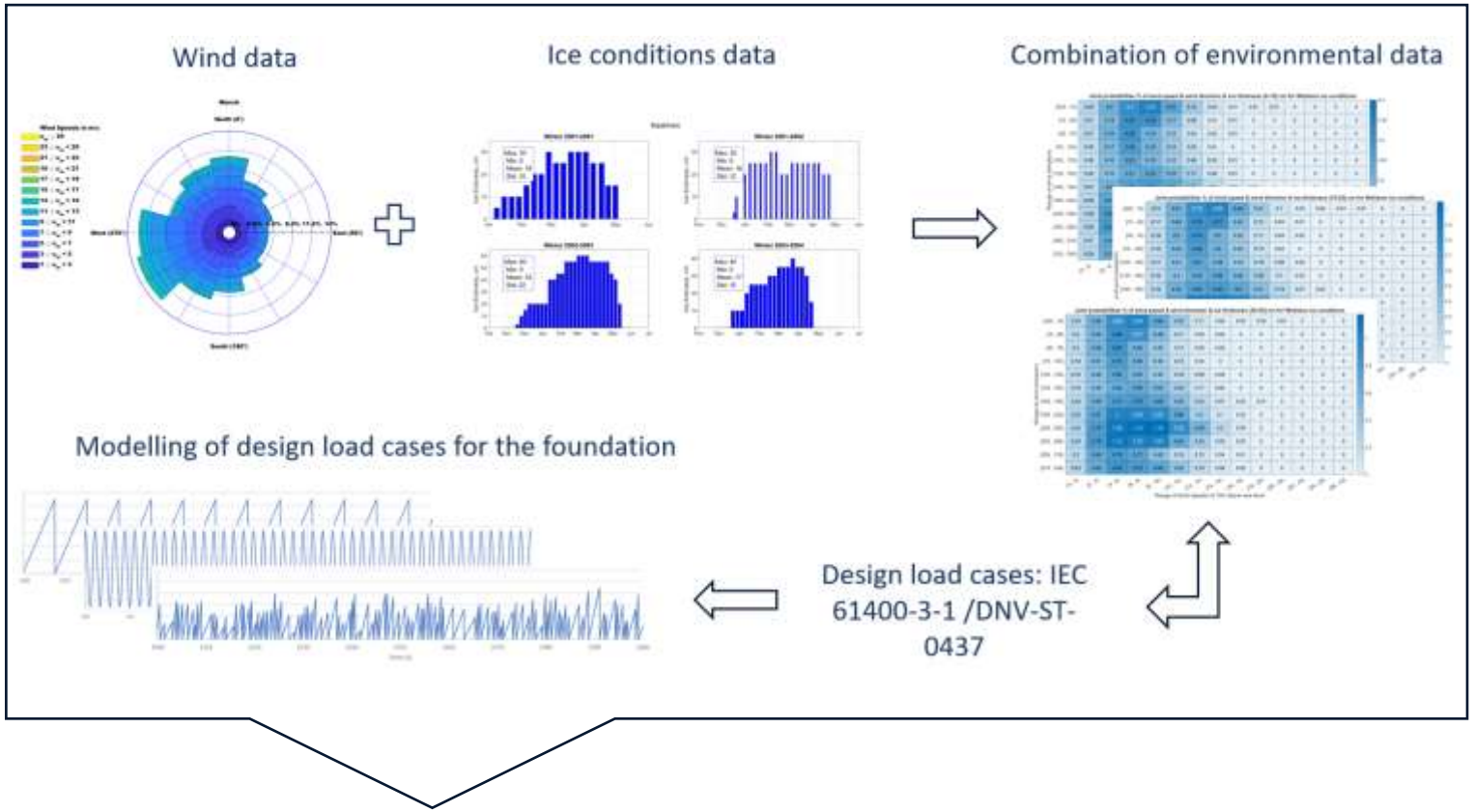
Support for Seaspan in CCG icebreaker programs

- Aker Arctic has continued to support Seaspan Vancouver Shipyards in the Canadian Coast Guard Polar Icebreaker and Multi Purpose Vessel (MPV) programs
- CCG Polar Icebreaker Functional Design is progressing well and Aker Arctic's current tasks are the following:
  - Hull form, performance and model testing
  - Intact and damage stability
  - Winterization aspects
  - Ice strengthening including non-linear FE analysis
- Aker Arctic also continues support Seaspan in the CCG MPV project:
  - Hull form, performance and model testing
  - Various technical studies

Offshore wind turbine foundations in ice covered waters

OWT in ice covered waters

- Environmental / ice data analysis
- Ultimate and fatigue ice load assessment
- Modelling of selected design load cases
- Cost impact study
- Comparison of costs for different foundations



Offshore Wind Foundation Model Tests

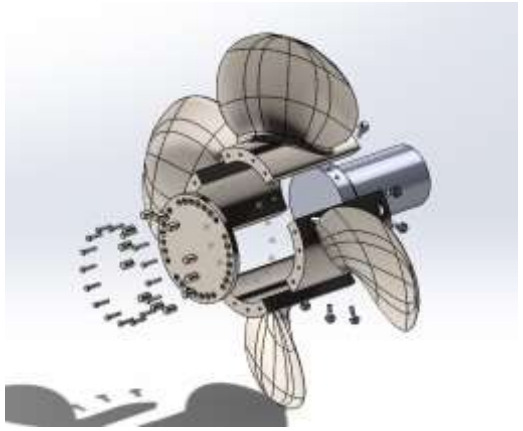
- As part of Aker Arctic's own research and development work, a series of ice model tests were conducted in November 2023 to investigate the ice loads affecting windmill monopiles.
- The aim was to measure comprehensive data on ice loads in scaled model ice when ice crushing is crucial. Four different model sizes were tested with scale ratios ranging from 1:89 to 1:16. All tests were extrapolated for a full-scale monopile with a 6.67-metre diameter in 80 cm thick ice.
- Final goal with the monopile tests is to develop correlation between model basin and full scale to support analytical and numerical methods.

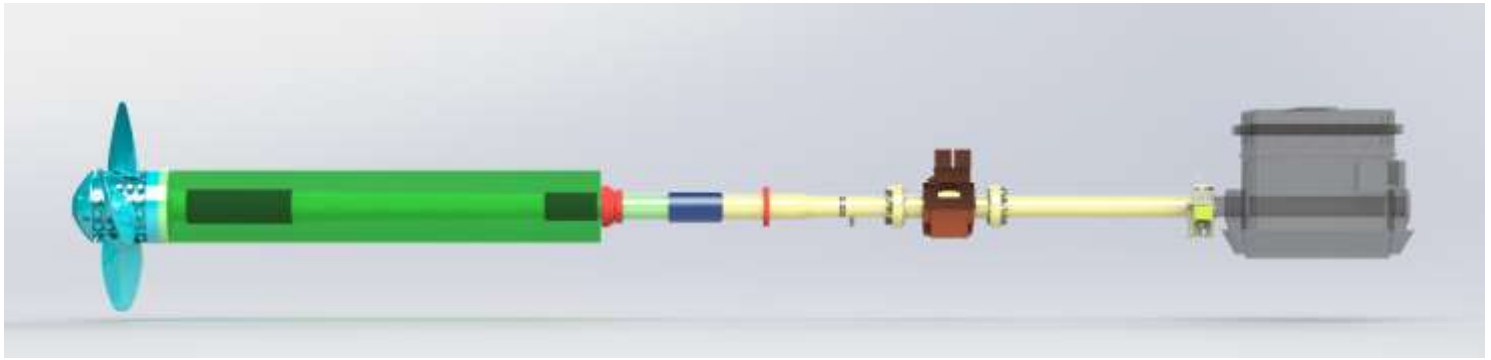
Example of scale 1:41.7	Model scale	Full scale
Structure width	160 mm	6.67 m
Ice drift speed	16 – 64 mm/s	0.2 – 0.8 kn
Ice thickness	19 mm	0.80 m
Ice compressive strength	60 kPa	2.5 MPa

Equipment and Systems

- **Products:**
- Propeller and shafting component deliveries
- Development of innovative Hubless propeller “Navaton”
- Ice load monitoring system ILMS

- **Ongoing Projects :**
  - SQ2020 propeller and shaftline on delivery phase
  - High ice class propeller for arctic operation on design phase





THANK YOU!

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