Aker Arctic
New Innovations in Ice Navigation

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Background
Aker Arctic
Services
Technology
Vessel development
Model testing possibilities
Ice management
Offshore

Background

In 1950s Finland started building new icebreakers, for domestic use, for export to Sweden and opening new markets in Russia.

The first polar icebreaker series was underway in the late 1960s.

Oil in Alaska was discovered

This was our beginning...

Building the domestic icebreaker fleet created a knowledge to achieve a 60% market share in icebreakers globally

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From Wärtsilä to Masa-Yards and further to independent company in 2005

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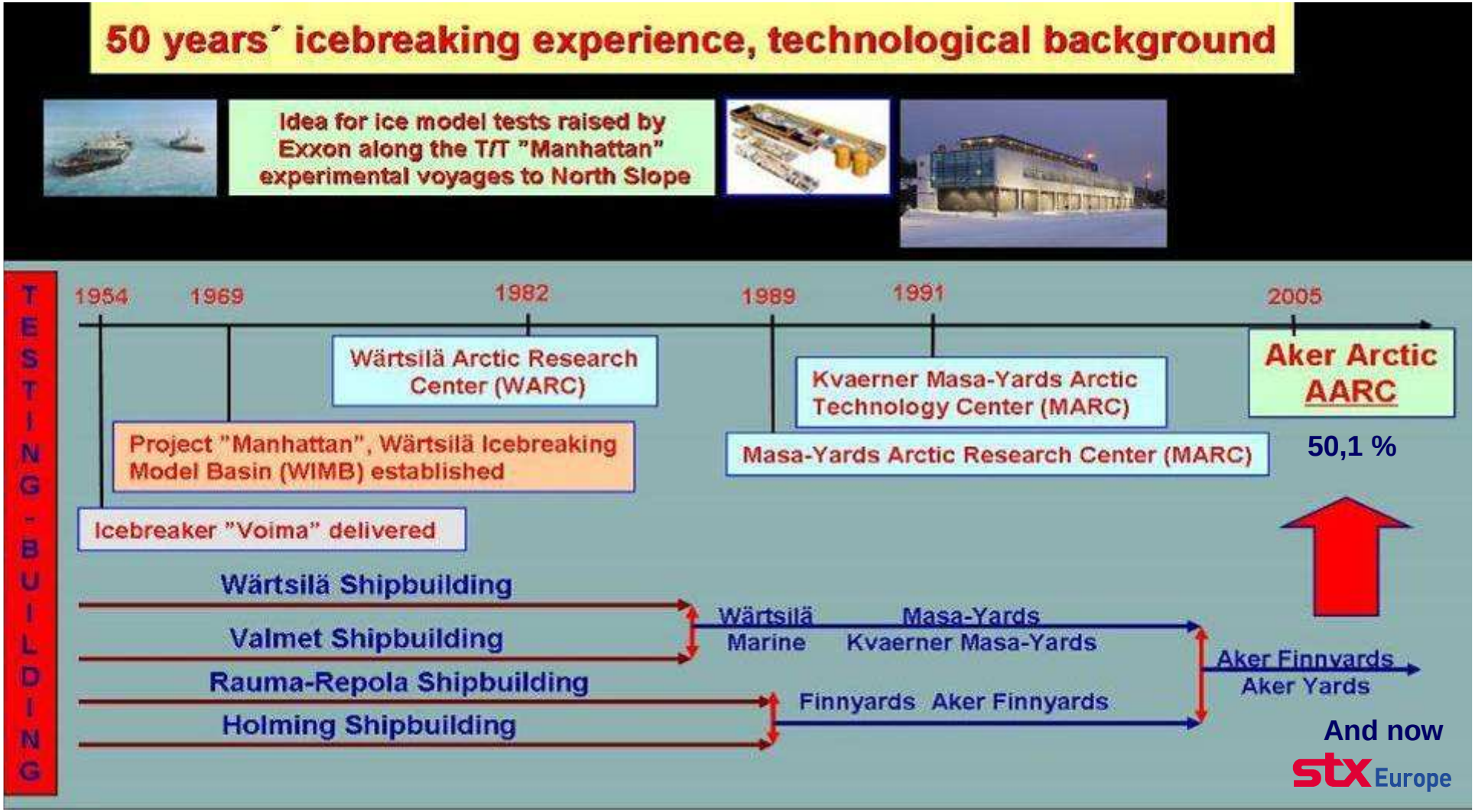


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Aker Arctic – The Ice Technology Partner

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- Established in 2005; growth from 1,5 Mill. EUR to 7 Mill. EUR in turnover
- Today 30 experienced naval architects, further growth expected
- We are a solid company with an equity of 8 Mill. EUR
- AARC shareholders are today:

STX Europe, Finland (ex Aker Yards)	50,1%
FLC West, Russia	21,3 %
ABB Oy, Finland	14,3 %
Aker Engineering & Technology AS, Norway	14,3 %

In 2005 we started independent life with global business objectives in Arctic technology, made a 10 Mill. EUR investment to create an unique combination of design resources with an ice model test basin

Services

Aker Arctic – center of excellence specialising in tailored solutions for winter and Arctic operations

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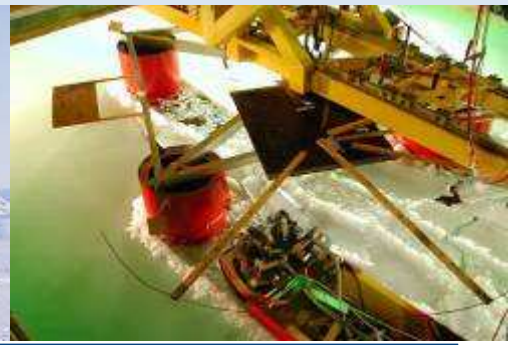
Field research
- Ice conditions
- Ice properties
- Route selection
- Design basis development

Concept development
- Basic design
- Feasibility studies
- Performance predictions
- Simulations

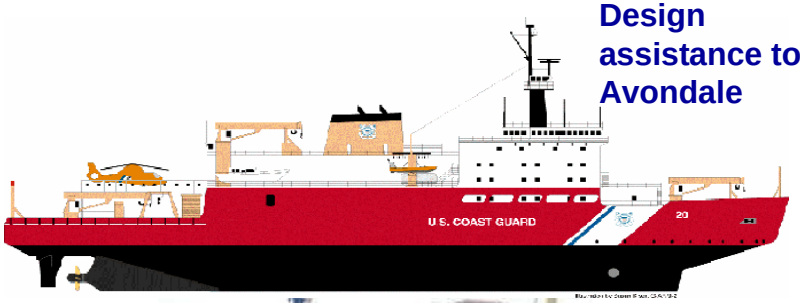
Testing in model and full scale
- Ships and structures
- Offloading operations
- Floaters
- Rescue and evacuation



Aker Arctic –
The Arctic Technology Partner

Project sales and project execution
- Tender packages
- Basic designs, License agreements
- Project executions, supervision
- Class advisory
- Experienced naval architects

Ice navigation training



Design assistance to Avondale

Basic design package to Admiralty Shipyards

Licence arrangements with other yards like Sumitomo or Samsung


Technology

We are enablers of competitive new operations in the Arctic by creating and implementing new technologies

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Examples:

- forerunner in diesel-electric icebreakers
- first four-screw icebreakers
- first polar icebreakers
- first shallow-draught river icebreakers
- first AC-AC drives in icebreaker application
- first air bubbling systems
- first stainless steel icebelts installed
- first Azipod developed
- first multipurpose icebreaker concept developed
- first double-acting ship developed
- first oblique vessel developed
- first Arctic shuttle tanker and oil export system developed

Vessel development

- Double Acting Ship DAS

If vessel sizes increase, two icebreakers will be needed for each vessel

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M/T ”Tempera” 7th year in her regular work, never used any icebreaker

Aker Arctic 70.000 tdw shuttle tankers for Pechora Sea

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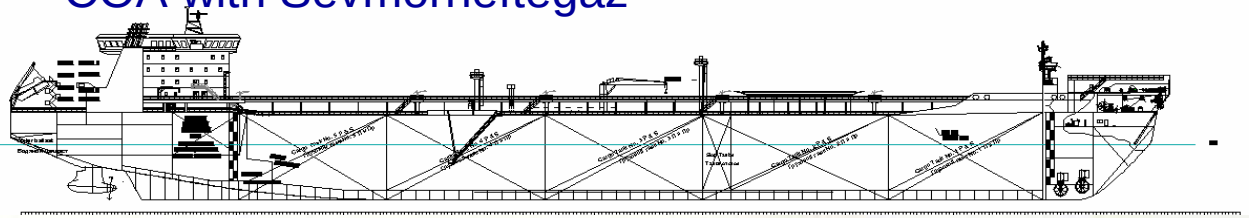
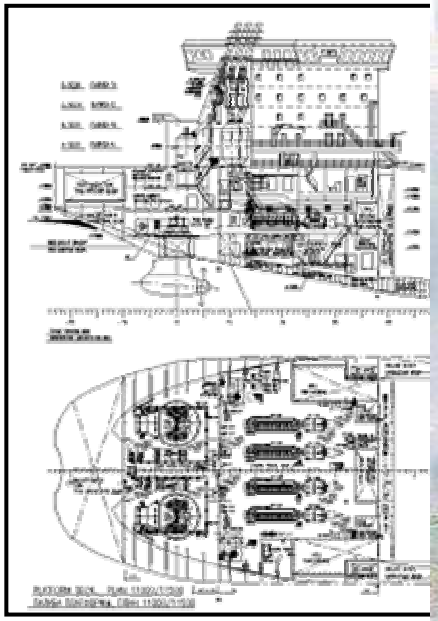
Prirazlomnoye; Admiralty yard, Owner Sovkomflot with a COA with Sevmorneftegaz





World´s first Arctic Oil Shuttle Export system now in full service with three 70.000 tdw Aker Actic DAS™ vessels, built by Samsung

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- Another new Aker Arctic DAS™ concept design
- Direct export for onshore oil
- Third vessel ”Timofei Guzhenko” enters service in these days
- 1,7 m icebreaking capability by 2 x 10 MW pods, ice class ARC6
- Vessel awarded Korean High Technology Award

Five DAS vessel series for OAO Norilsk Nickel, regular year-round logistics over the Kara Sea

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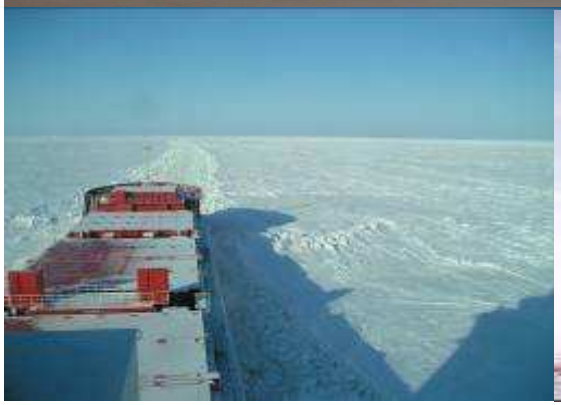
First vessel delivered after succesful ice trials on April 12th, 2006. Vessel in regular traffic between Dudinka and Murmansk in independent operation. Ice class ARC7. All five ships in service January 2009.



Vessel development

- ARC Series

Shallow Draught Caspian Icebreaker Aker ARC 104 to be built by STX Europe for the North Caspian - another Aker Arctic design

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Length oa	abt. 65.0 m
Length dwl	abt. 61.7 m
Width	abt. 16.4 m
Depth	abt. 4.4 m
Draught dwl	3.0 m
Minimum operating draught	2.5 m

Main propulsion to be by three azimuthing thrusters of abt. 1600 kW each
In 60 cm level ice the vessel shall be able to move at 4 knots speed and to proceed at
5 knots speed in prebroken ice channel when towing a barge

The new Aker Arctic ARC series

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ICEBREAKER FOR SUPPLY OPERATIONS AND ICE MANGEMENT

DNV ICEBREAKER ICE-10
LOA = 99.2 m
B =21.0 m
T = 8.0 m
DWT = 4 200 tonnes
GT ≈ 7000
MCR = 18 000 kW
2 * 7 000 kW Azimuthing Propulsors

The first of four standard Arctic ARC types were introduced in 2007, Ice class Icebreaker Ice 10 for DAS mode, DNV POLAR 15 for bow-ahead mode for Beaufort sea

Now Aker Arctic DAS™ is an industry adapted concept and multipurpose icebreakers are being planned for several clients in Europe and America

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MAIN DIMENSIONS	
Lenght, overall about	abt. 108.5 m
Length in waterline	abt. 99.6 m
Breadht at dwl, midships	abt. 23.8 m
Breadth at dwl, maximum	abt. 28.0 m
Draught, at dwl	8.4 m
Draught, scantling	8.5 m

DEADWEIGHT	
At the design draught	abt. 4700 t

MACHINERY	
4 x 12V32, 750 rpm,á 6000 kW	24 000 kW

PROPULSION	
Azimuth thrusters	16 800 kW

Multipurpose Icebreaker NB Voima 2

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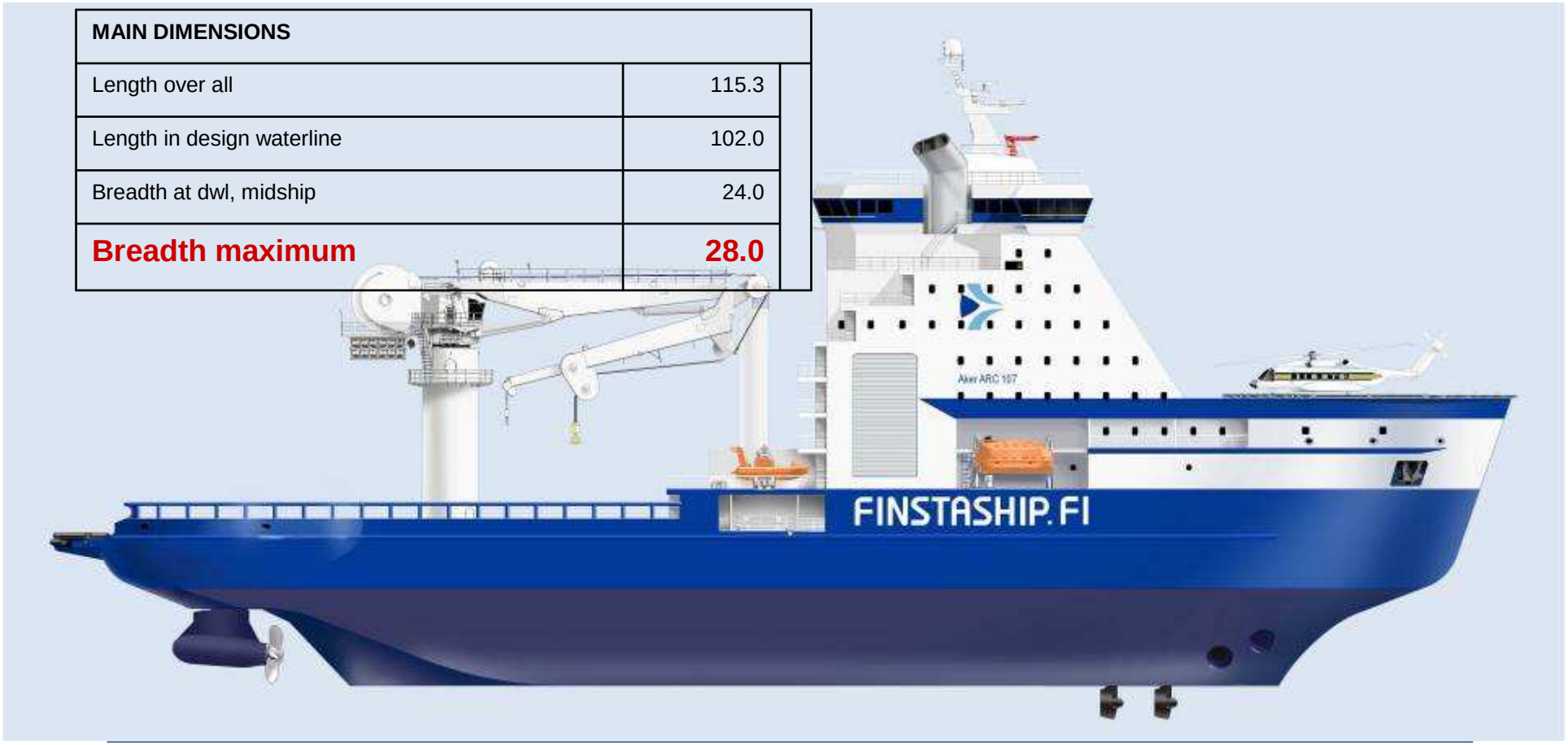
Finstaship is planning for the future and is well aware of the new needs, but Ministry of Transport considers investments in new icebreakers unnecessary due to climate change!

MAIN DIMENSIONS	
Length over all	115.3
Length in design waterline	102.0
Breadth at dwl, midship	24.0
Breadth maximum	**28.0**



Model testing possibilities

- Harbours and structures

Model tests in ice

Model tests for designing of:

- ships
- offshore structures and
- harbour facilities

An inexpensive way to:

- compare different designs
- map operability
- study ice control
- avoid big mistakes

Operational tests

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- Harbour

Operational tests

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- **Assisting vessels**

Operational tests

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- **Ice management**

Offshore loading terminal operation in Varandei, 2008

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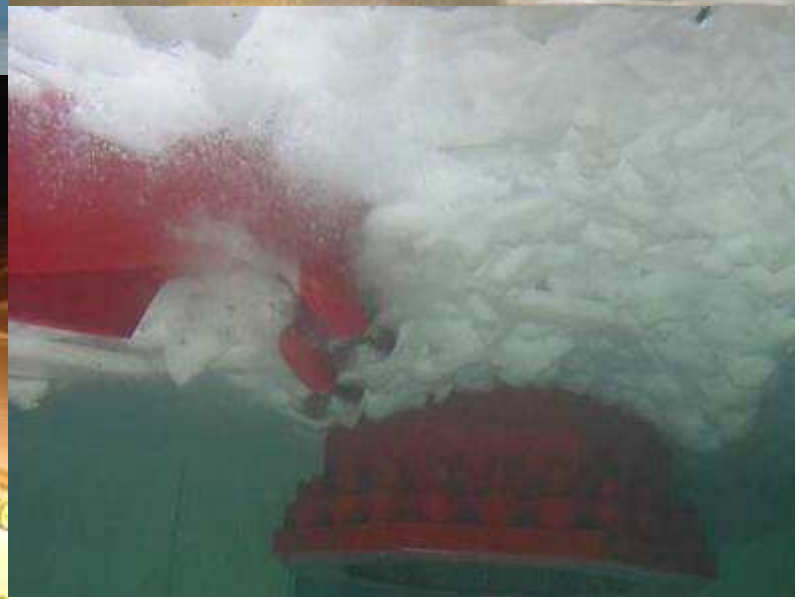

Tests with structures

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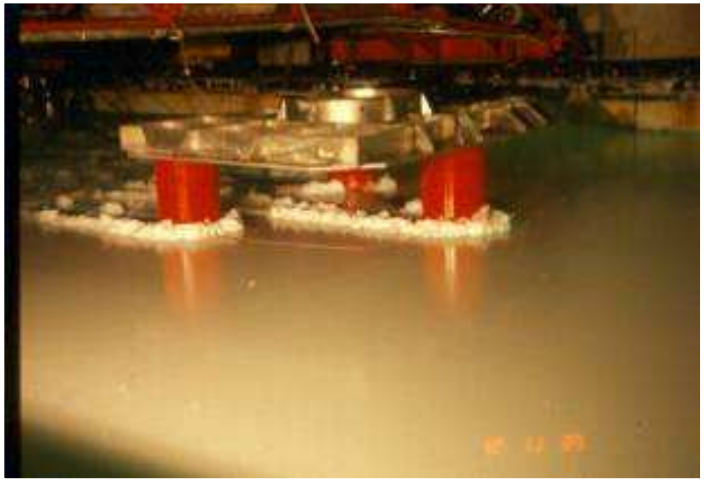

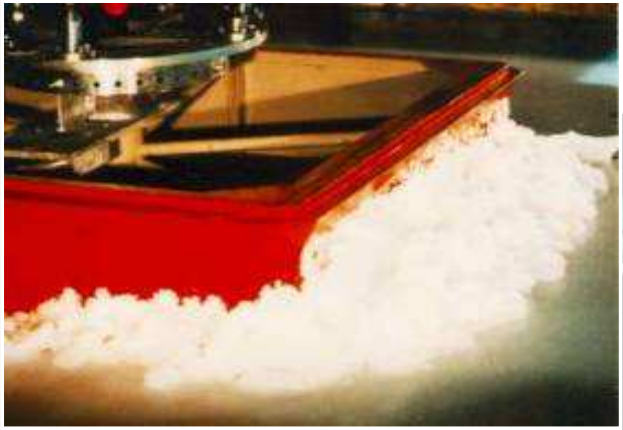

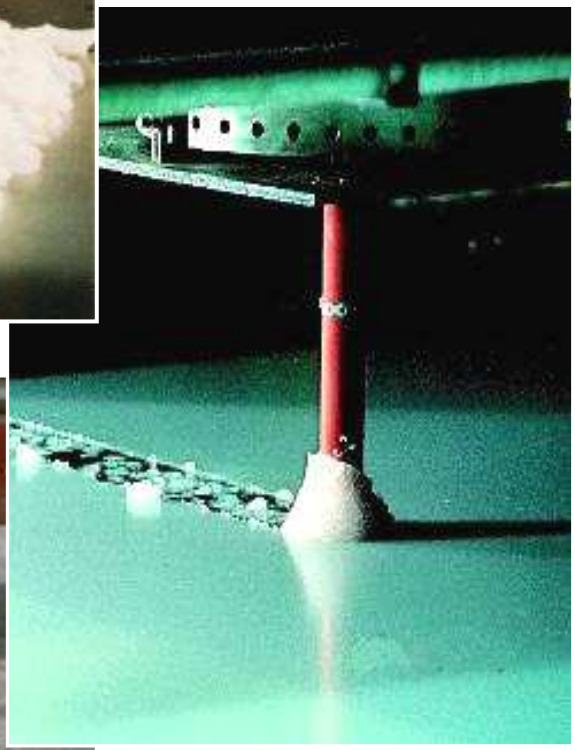

Shallow water testing

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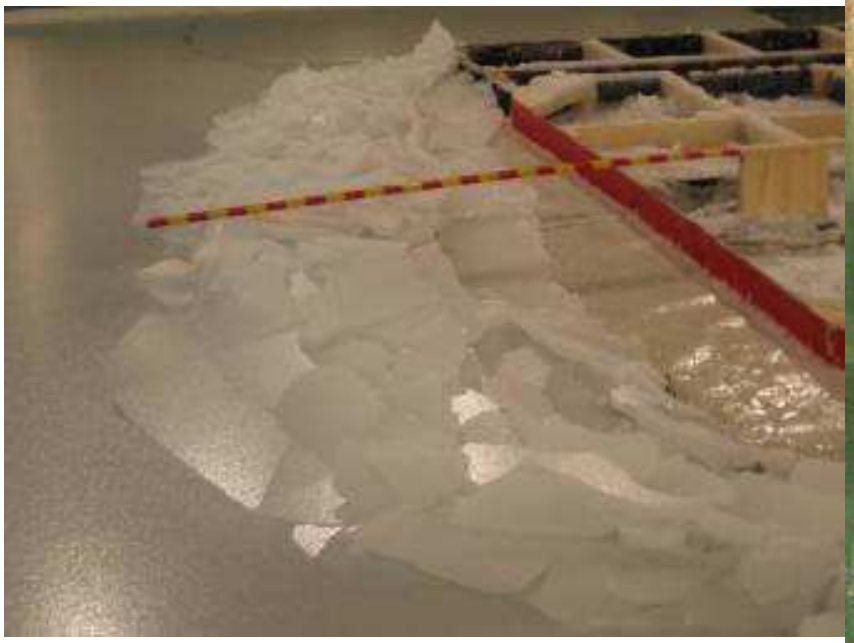
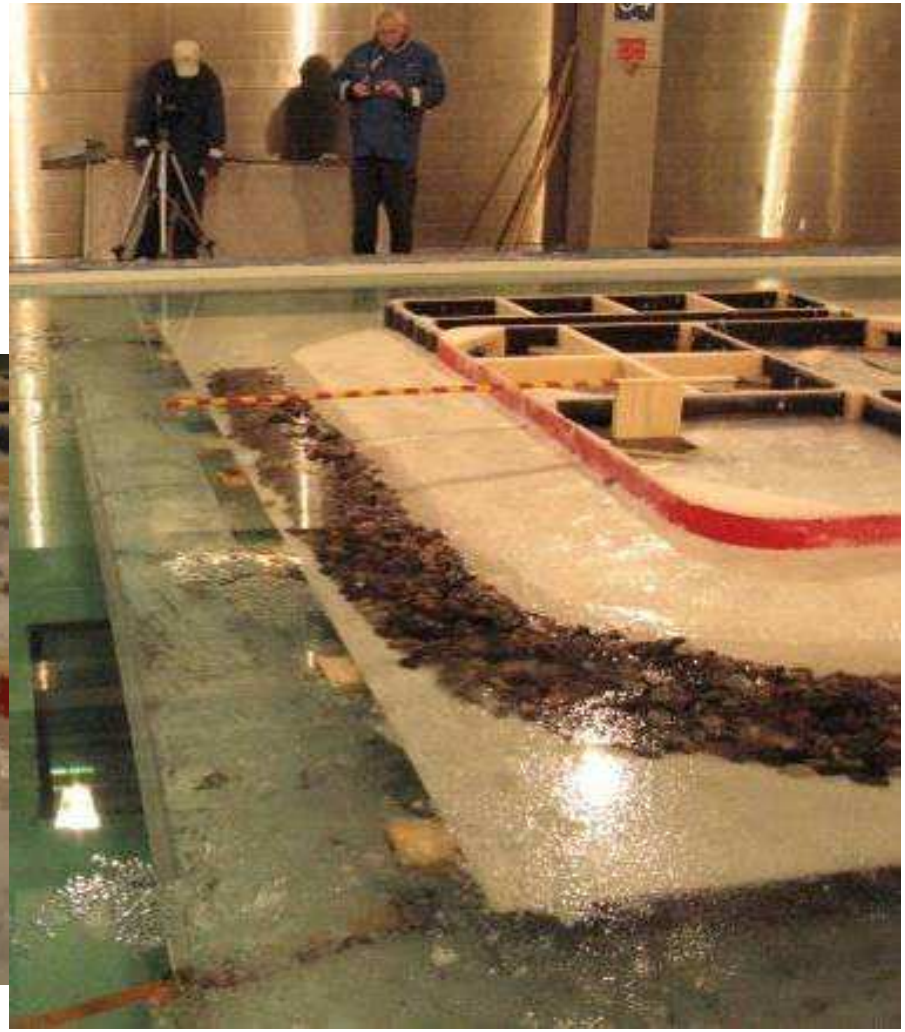
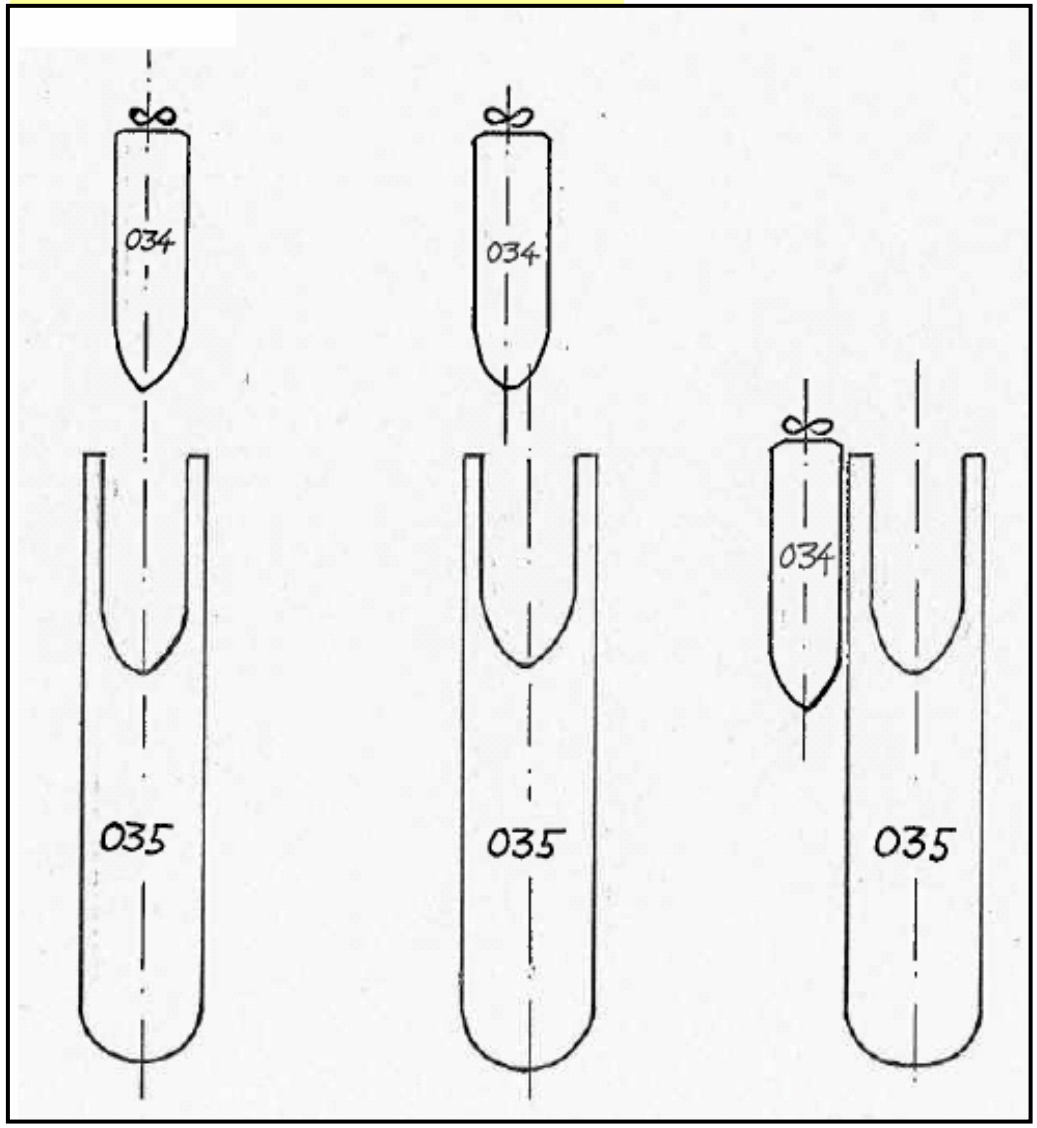


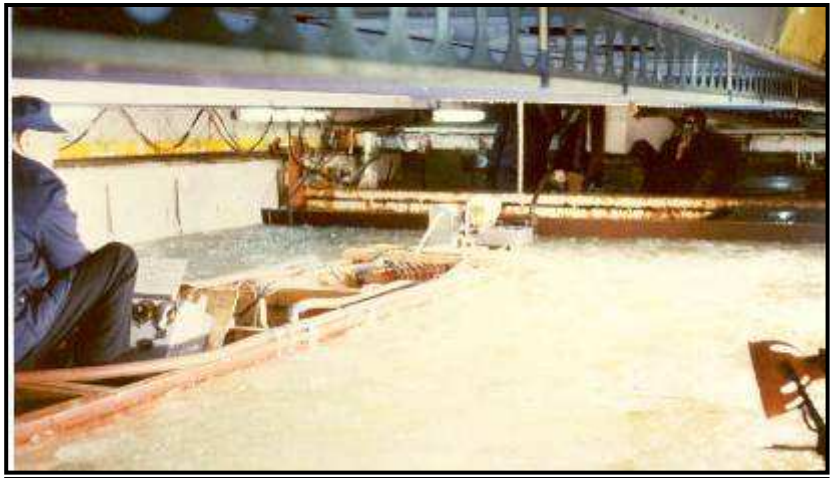


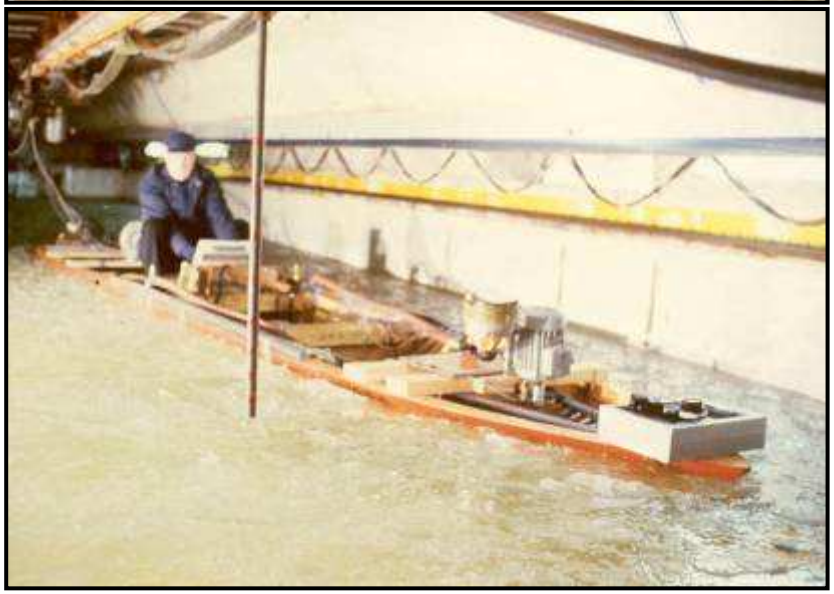
Harbour facilities



Harbour facilities

Offloading





Harbour facilities

Caspian Sea barges

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Pushing one barge
in floe ice,

Pulling one barge
in level ice,

Turning in floe ice,
towing two barges

Ice navigation studies for Ministry of Transport

Two Super 1 A ice class river-sea type ships were compared

Conventional

Length	**113 m**
Breadth	**16 m**
Draught	**4,5 m**
Shaft power	**3 200 kW**
(twin propellers)	

DAS vessel

Length	**115 m**
Breadth	**16 m**
Draught	**4,5 m**
Shaft power	**3 200 kW**
for 1 A ice class	
alternative	**2 280 kW**

Model tests

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Ice model test results

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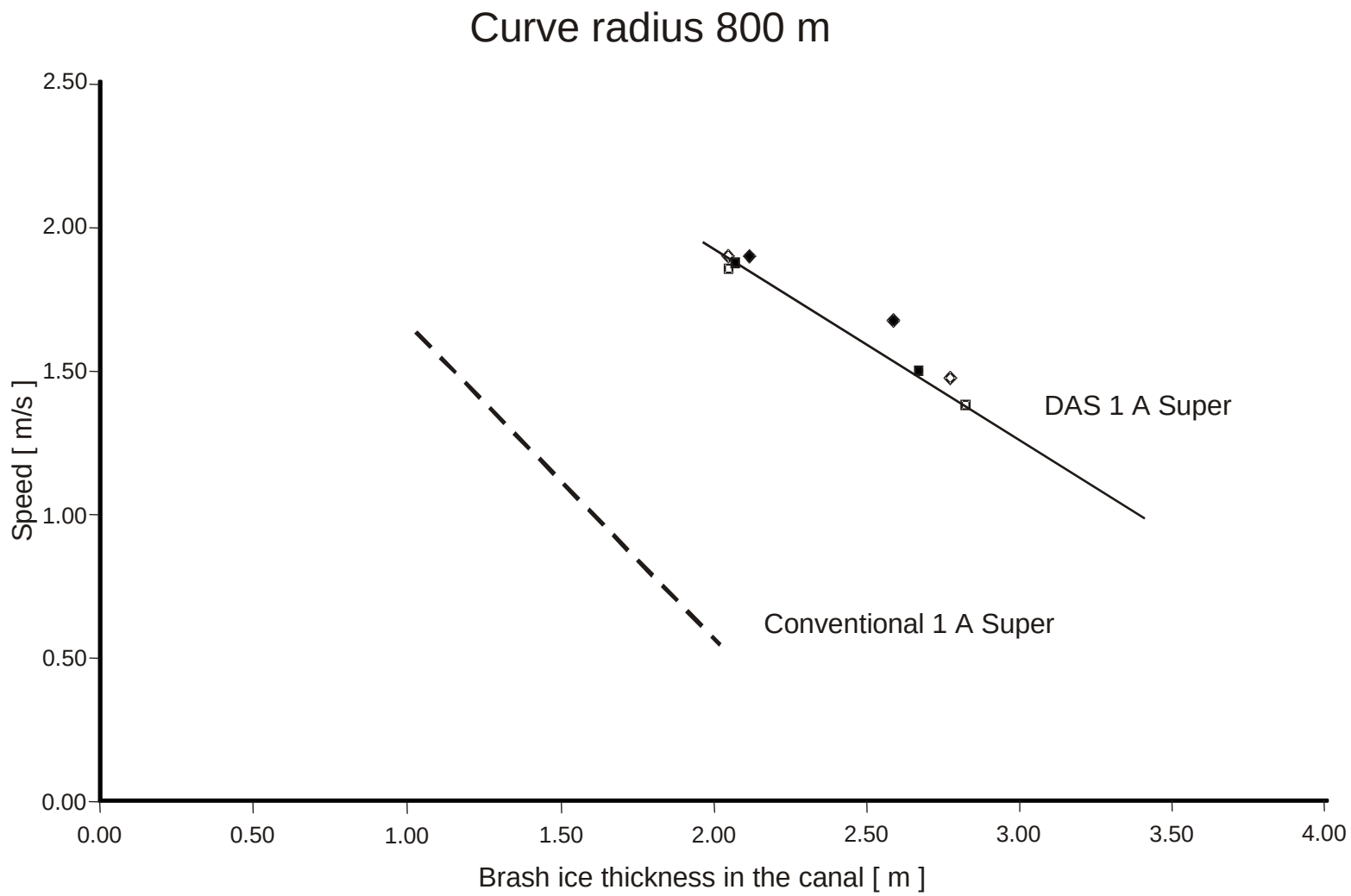

Main conclusions for DAS vessel

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- General operating performance is much better compared to conventional
- Model was able to turn in all conditions
- Turning radius affects only little to vessel speed
- Depth of the canal had no major influence
- Higher speed was achieved in narrow ice channel
- Propeller flow does not move ice from inside of canal edges
- Achieved speed in 2 m brash was almost 4 knots and in 3 m more than 2 knots
- Vessel can manage independently up to over 3 m brash ice
- DAS vessel achieved twice the speed than conventional

DAS vessel

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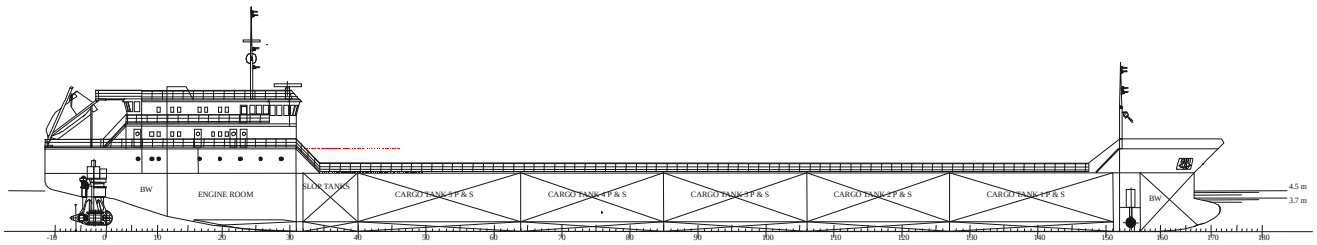
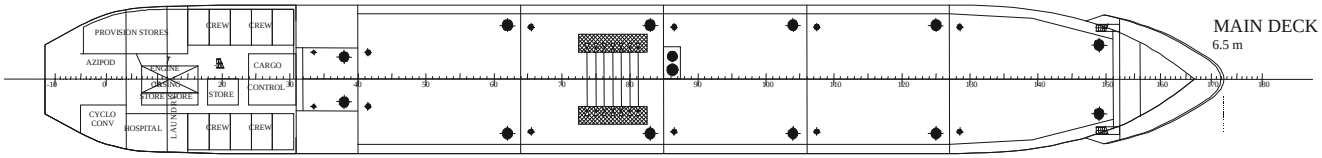
The VolgaMax oil tanker for year round operation

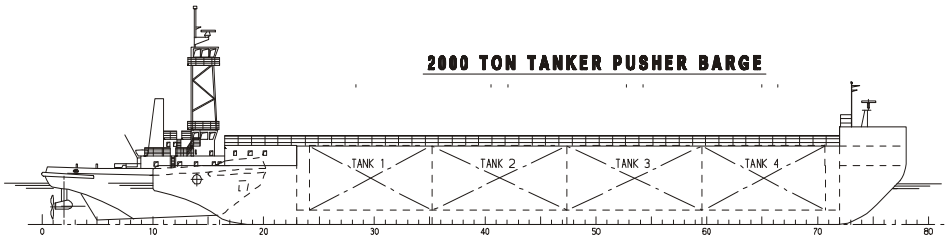


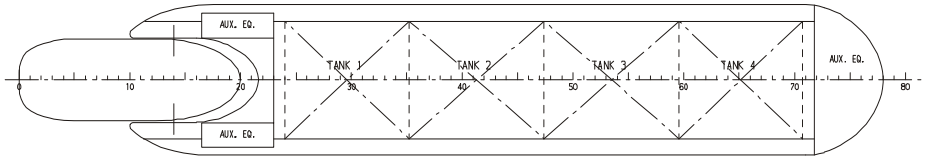
MAIN DIMENSIONS

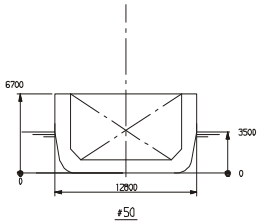
LENGTH over all	140.2 m
BREADTH	16.5 m
HEIGHT to main deck	6.5 m
DRAUGHT max.	4.5 m



The Caspian Push / Barge Tanker System







TUG

LENGTH	20.00 M
BREADTH	7.00 M
DRAUGHT	3.50 M

BARGE

LENGTH	68.00 M
BREADTH	12.80 M
DRAUGHT	3.50 M

MAIN DIMENSIONS OF COMBINATION

LENGTH OVER ALL	abt	78.00 M
BREADTH		12.80 M
DRAUGHT		3.50 M

Ice management

Ice management

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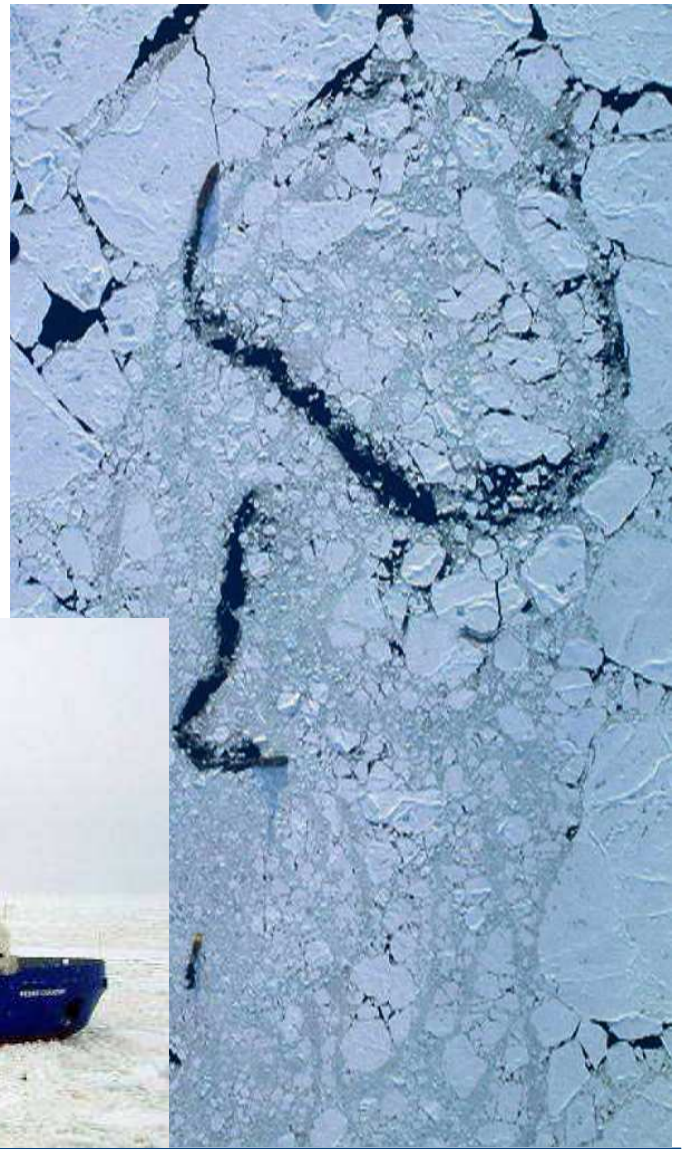
- Protecting offshore structures
- Ice clearing



Aker Arctic DAS™

The ice technology partner

Ice management

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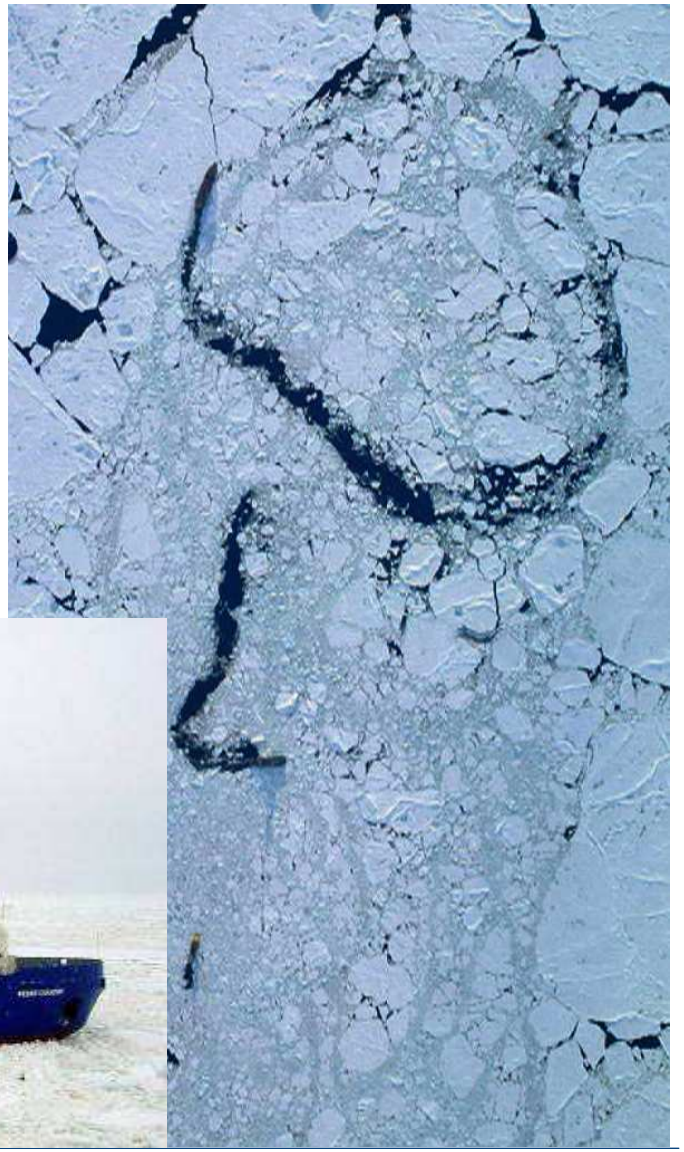
- Ships breaking ice
- Ships using propulsion for ice clearing
- Air bubbling



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Reduction of ice loads by Ice Management

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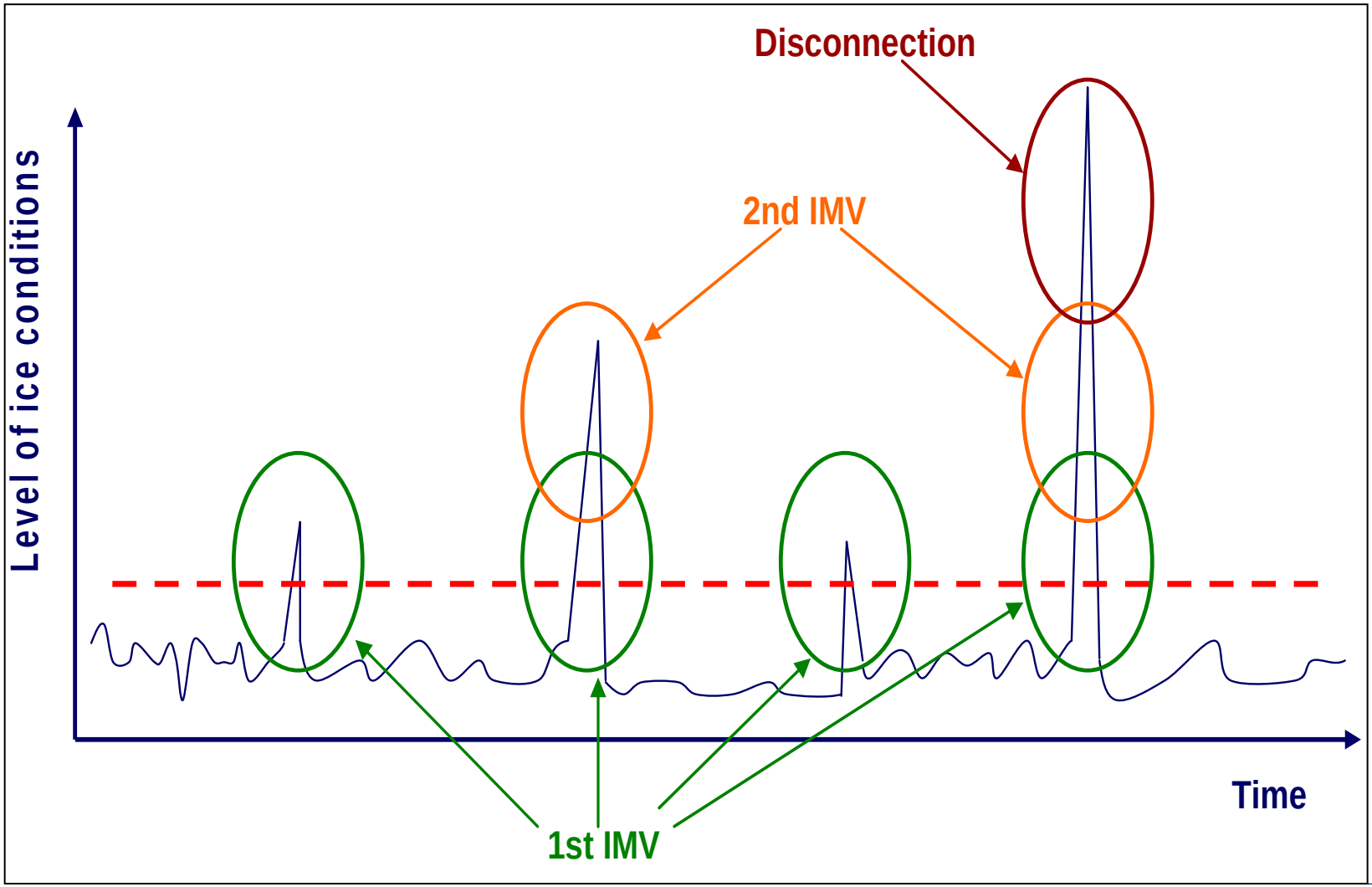

Ice observation and forecasting

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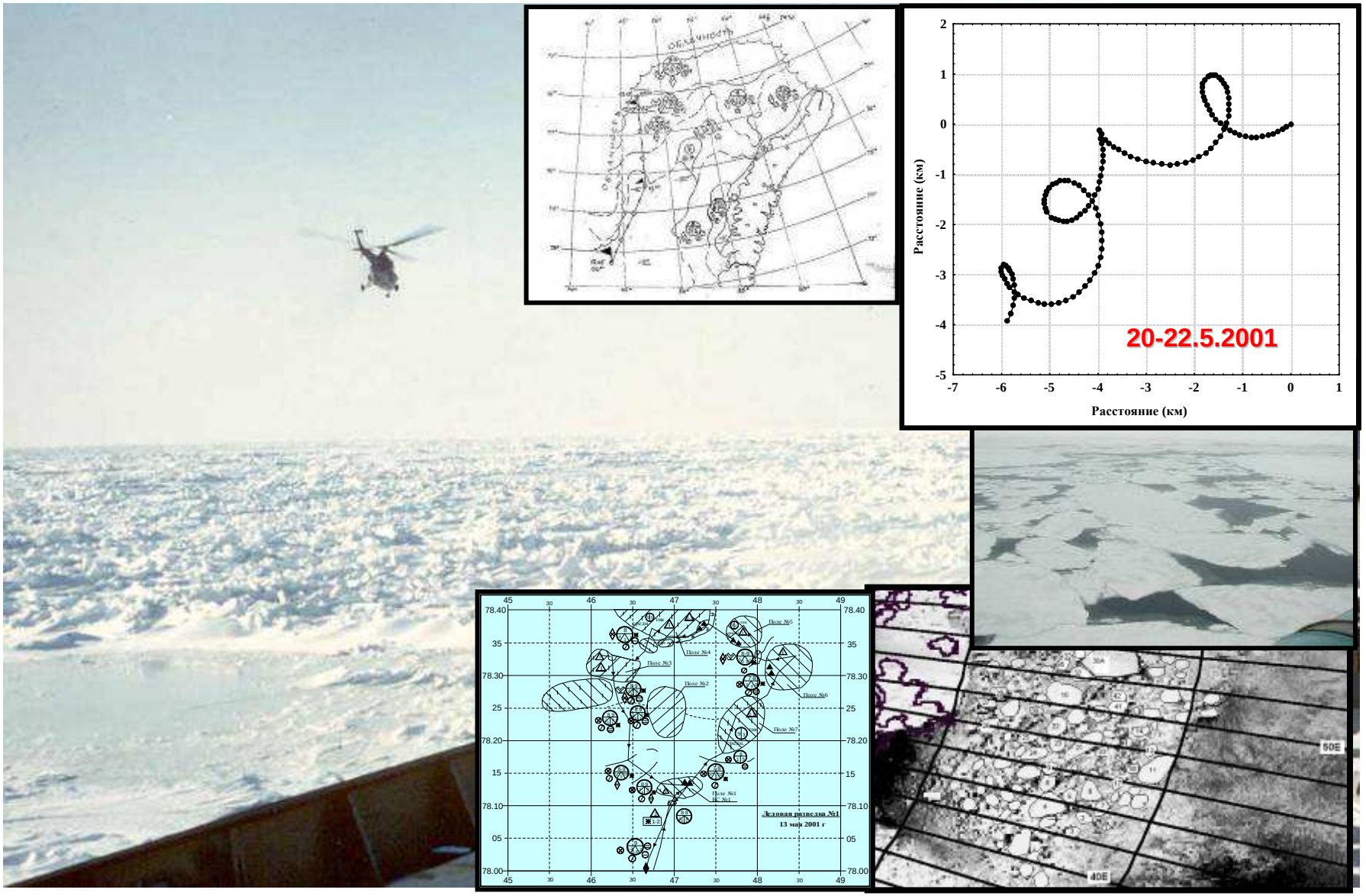

Ice Management Propulsor comparison is now available

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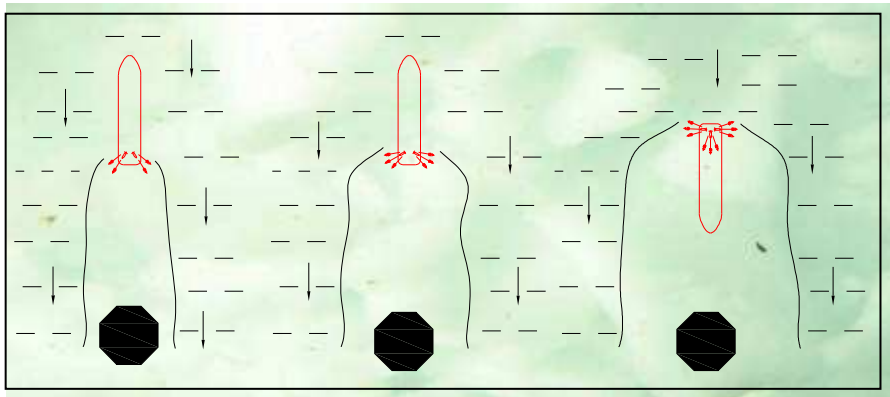
IN THE STUDY USED VESSEL
Lbp = 93.5 m
Bcwl = 20.95 m



And propulsor variants

Electrical Mechanical Thruster with Nozzle

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Offshore

Offshore structures

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- Hull/structure shape
- Ice forces
- Ice management
- Dynamic behaviour
- Anchoring
- Dynamic Positioning
- Winterization
- Air bubbling

Ice capabilitiy improvement for Shell/Frontier Drilling for the ”Bully 3” concept

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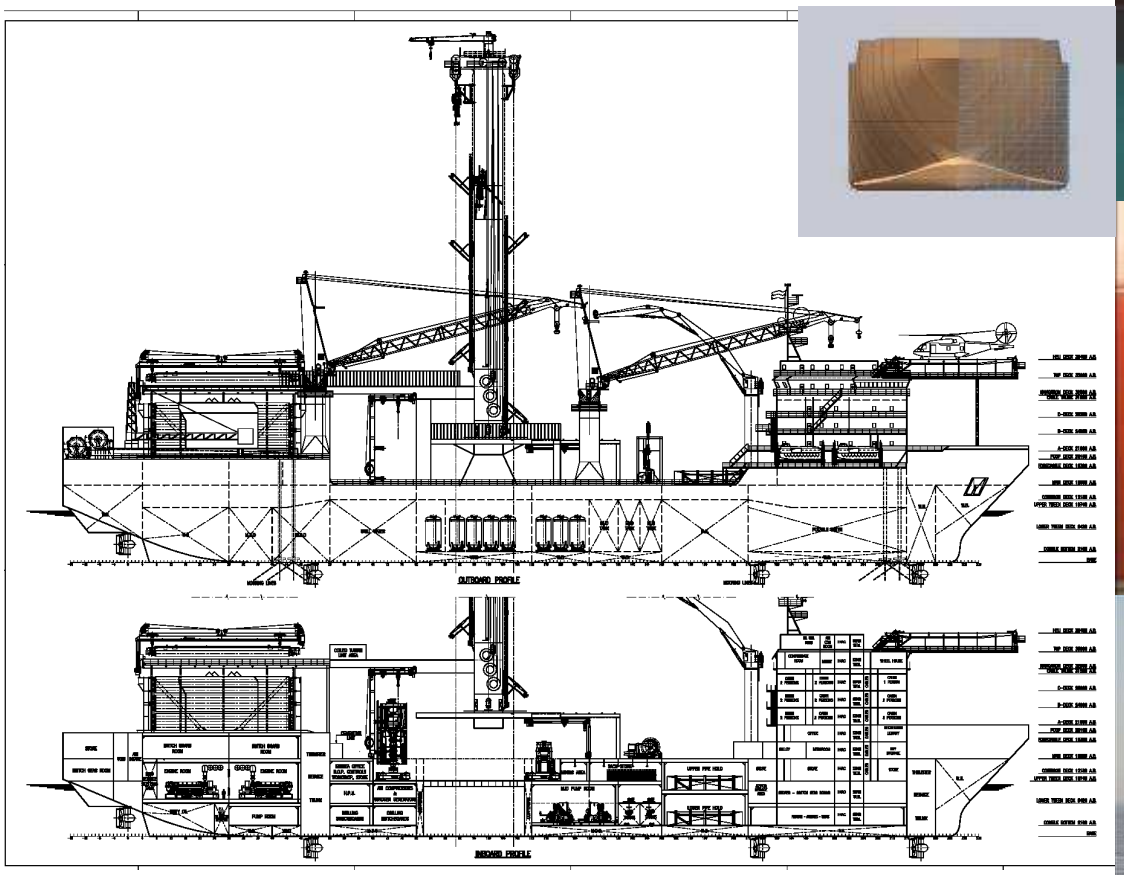

Own R&D

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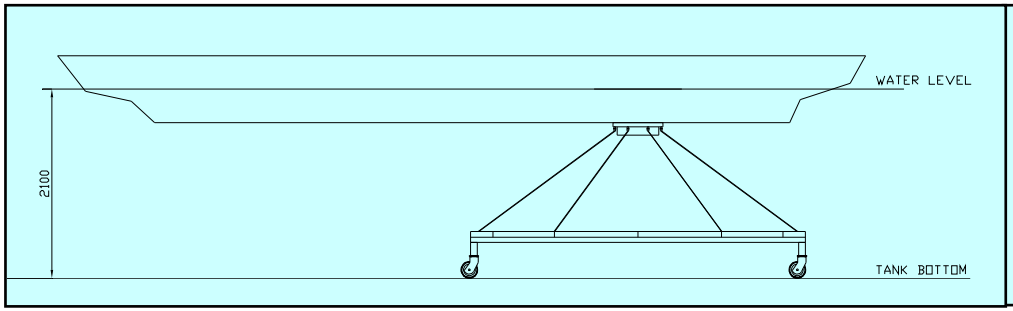
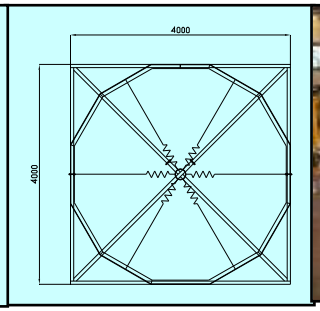
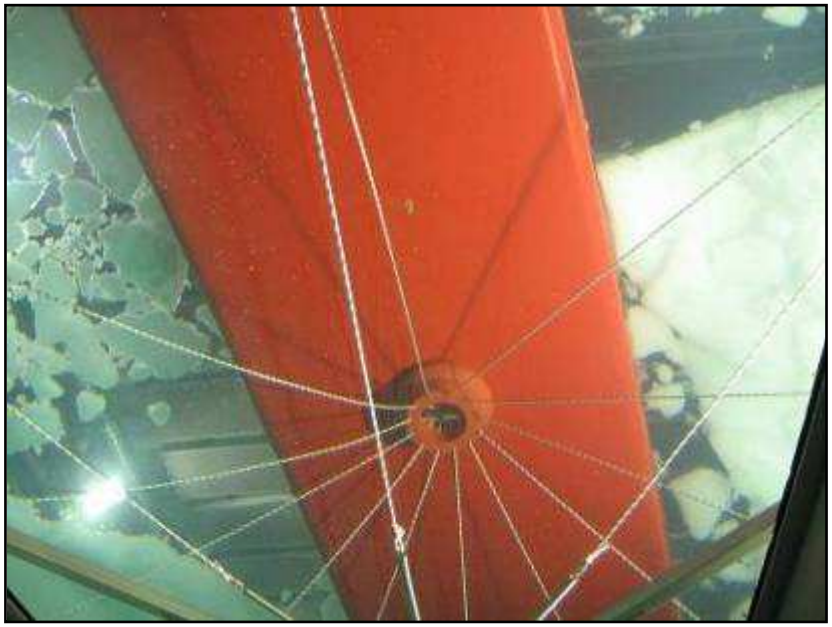
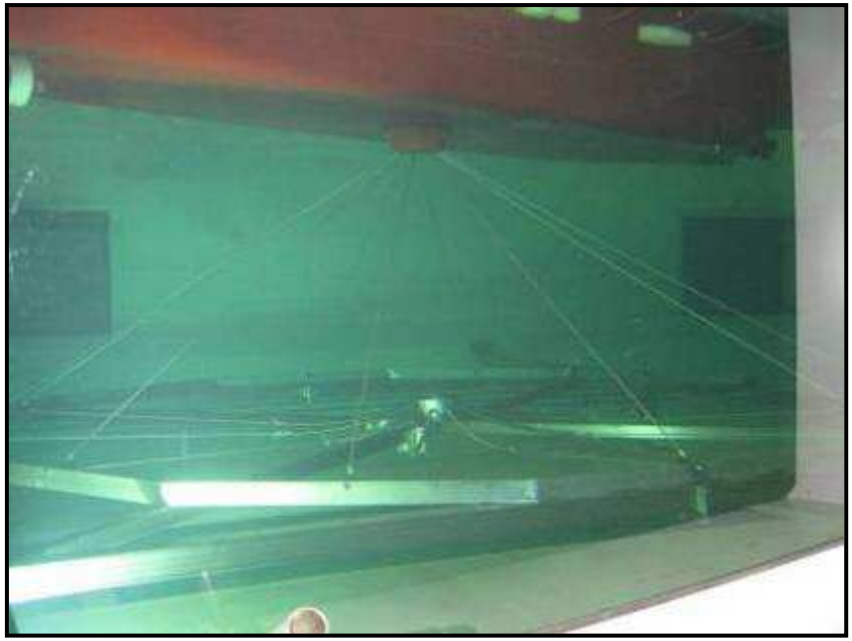
- **Mooring tests**









Own R&D

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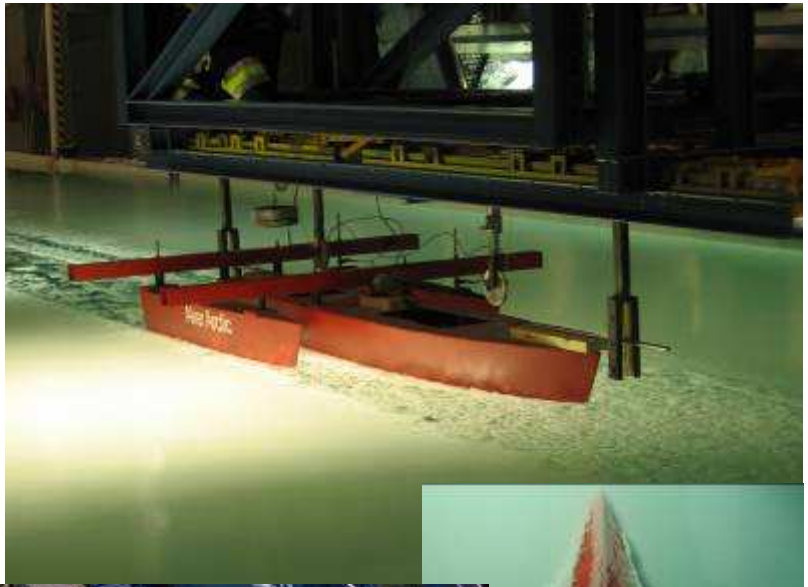

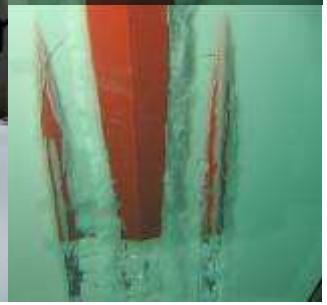

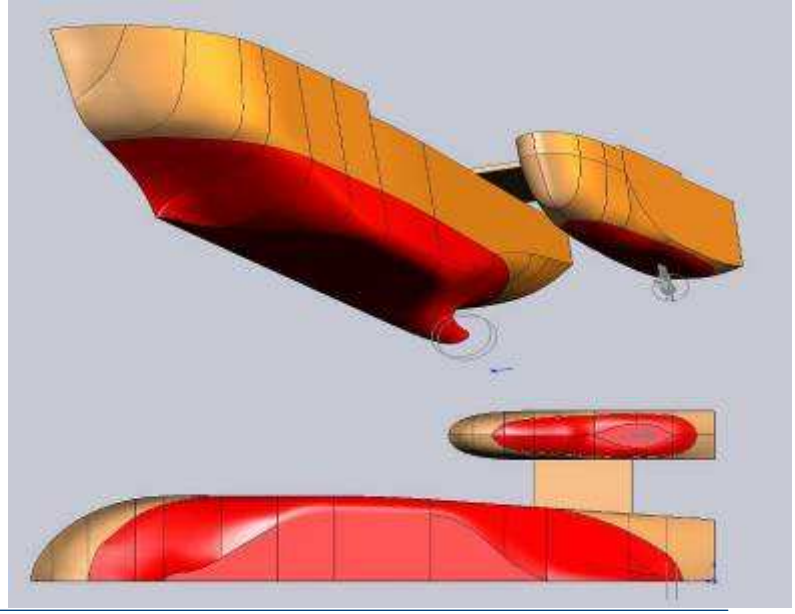

We make our own design basis expeditions, like here the Shtokman North-Barents Ice Expedition 2008

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Aker Arctic
Creativity is our business
Towards new challenges
Thank You!

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