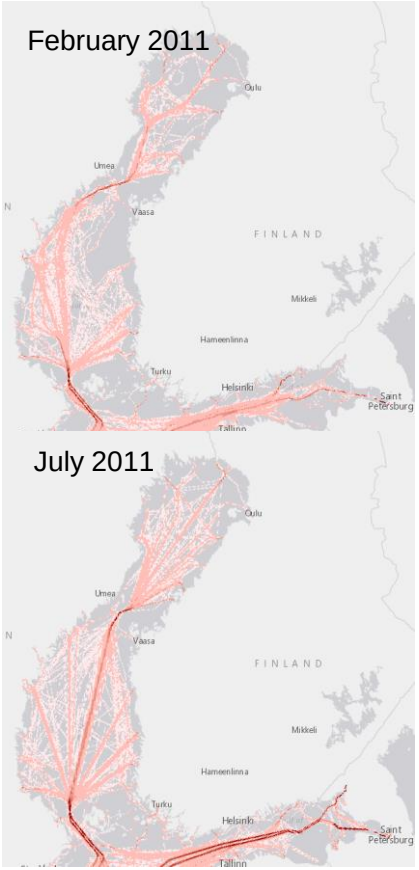
Securing winter navigation in the northern Baltic sea

Aker Arctic Technology

Arctic Passion Seminar 2018

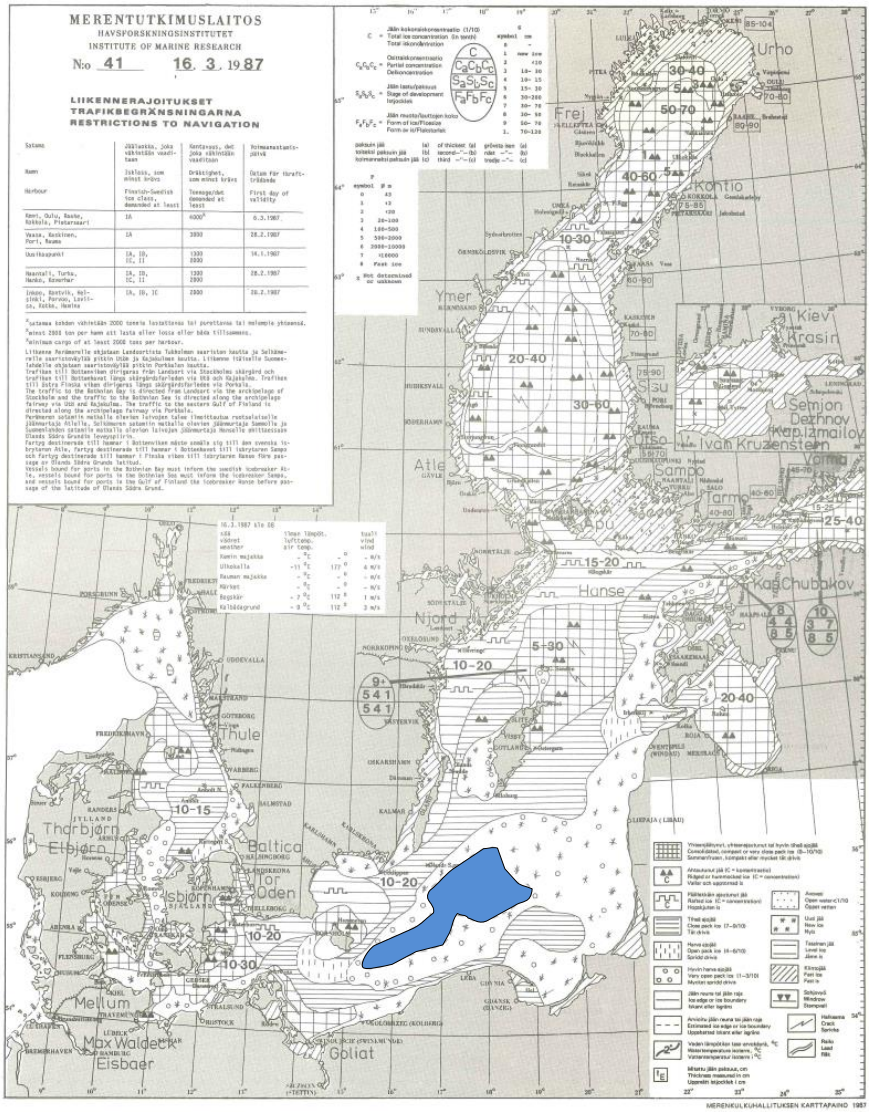
Background

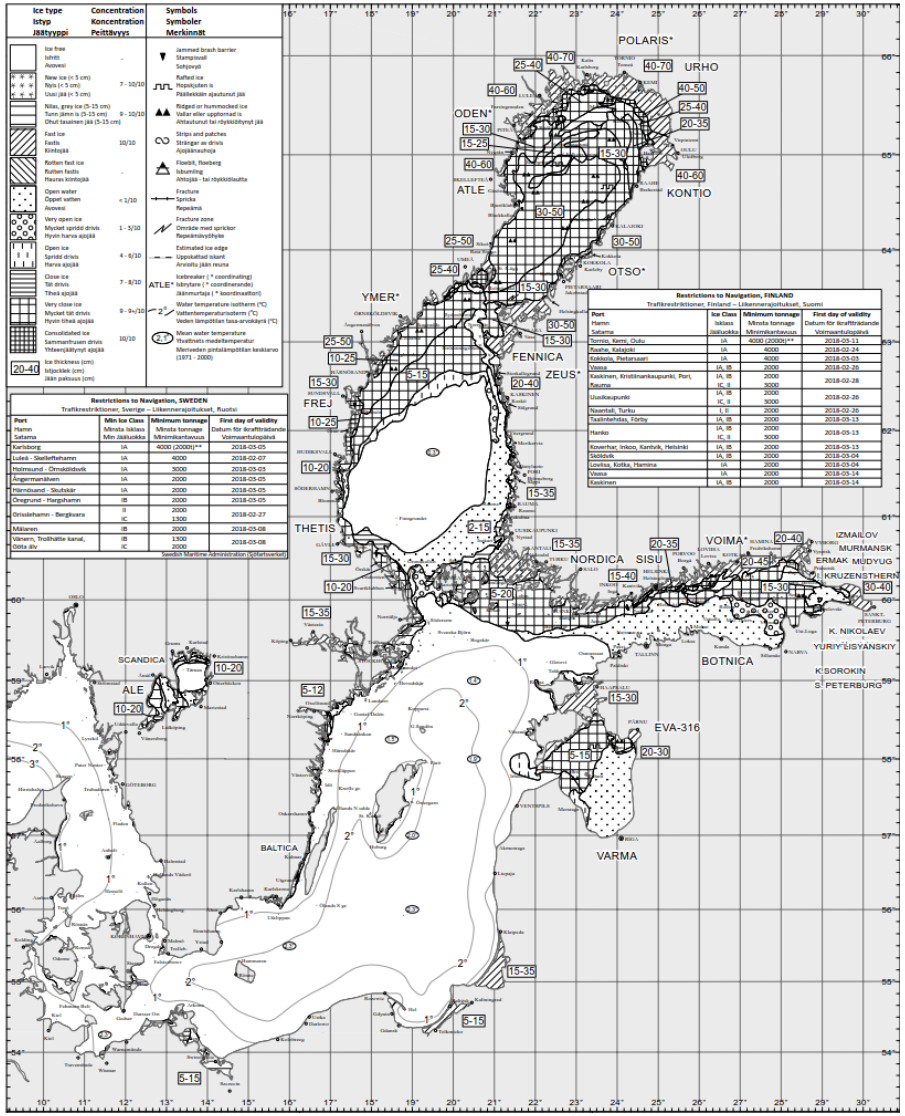
- Wintertime traffic in the Baltic Sea is a transportation system (BSTS)
  1. Environment
  2. Transportation needs
  3. Cargo vessel fleet
  4. Icebreaker fleet
  5. Icebreaker operation
  6. Rules
  7. Fairway dues
- Targets for the system
  1. Safe and efficient traffic
  2. Minimize waiting time / On-time transportation
  3. Minimize costs
     - whose cost?



http://maps.helcom.fi/website/AISexplorer/index.html

Years are not brothers: 1987 March vs 2018 March





Finnish Meteorological Institute

Introduction of the EEDI changed the balance

- Changes to vessel designs
- Power limitation effect on ice performance - especially
  - Tankers
  - Bulk carriers
  - General cargo vessels
- Traffic patterns will change
- So far only a few EEDI compliant ice strengthened vessels have been ordered
  - approximately 2—3 % of all ordered vessels

Keels laid after 2013	Tankers	Bulkers	General cargo	Total
1A Super	0	0	0	0
1A	37	5	2	44

EEDI upgrade makes things more challenging

- IMO has started to check possible updates the EEDI factors based on the experience from open water vessels.
- This will have a direct effect on ice strengthened vessels as EEDI for ice strengthened vessels is directly connected to EEDI in open water vessels
  - Additional propulsion power, f_j
  - Additional light weight and reduced dwt, f_i

$$\frac{\left(\prod_{j=1}^{n} f_j\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right) + \left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}*\right) + \left(\left(\prod_{j=1}^{n} f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right) - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}**\right)}{f_i \cdot f_c \cdot f_l \cdot Capacity \cdot f_w \cdot V_{ref}}$$

Slow Train Coming

- Difficult ice winters are few and far between
- Ice capable tonnage is replaced very slowly with EEDI compliant fleet

  => The effect of EEDI on the Baltic Sea winter navigation system can be seen only after a long time

  => It is important to follow signs of the EEDI effect so that it is possible to react in case it is needed

- It can take several years before there is another hard winter, which really tests the transportation system

Slow changes means that active follow-up has to be done on suitable parameters

- Aker Arctic is actively working on several fields to see, how the EEDI effects winter navigation in the Baltic
- Projects with Winter Navigation Research Board:
  1. PREEDICT
     Powering Requirements of Energy Efficient Design of Ice Classed Tonnage
  2. BowForm study
  3. EEDI and the need for icebreaker assistance
  4. Channel resistance measurements
  5. Ice rule model channel development work
  6. Notch-towing operations: full-scale measurements and observations
  7. Fast operation

Fast methods for measuring ice ridges in full-scale

Target	To investigate fast methods for profiling ice ridges in full-scale
Scope of Work	Profiling ice ridges by scanning sonar & laser scanner and by drilling. Joint-project with MeriTaito Oy
Schedule	Winter 2014 / finished

Notch Towing Operations:
Full-scale measurements and Observations

Target	Gather full-scale data of the forces acting on the towing line and find contributing factors for high/low loads and investigate how different merchant vessels apply for notch towing.
Scope of Work	Towing line force measurements in full-scale
Schedule	Winter 2016 / finished

EEDI and the need for icebreaker assistance

Target	To find out how much icebreaker assistance the EEDI compliant vessels need compared to non-EEDI compliant vessels and how the assistance speeds are affected due to EEDI regulations
Scope of Work	Statistical comparison of the icebreaker assistance between the EEDI compliant and non-EEDI compliant vessels
Schedule	2018 / On-going

Project:
Channel resistance measurements in full scale

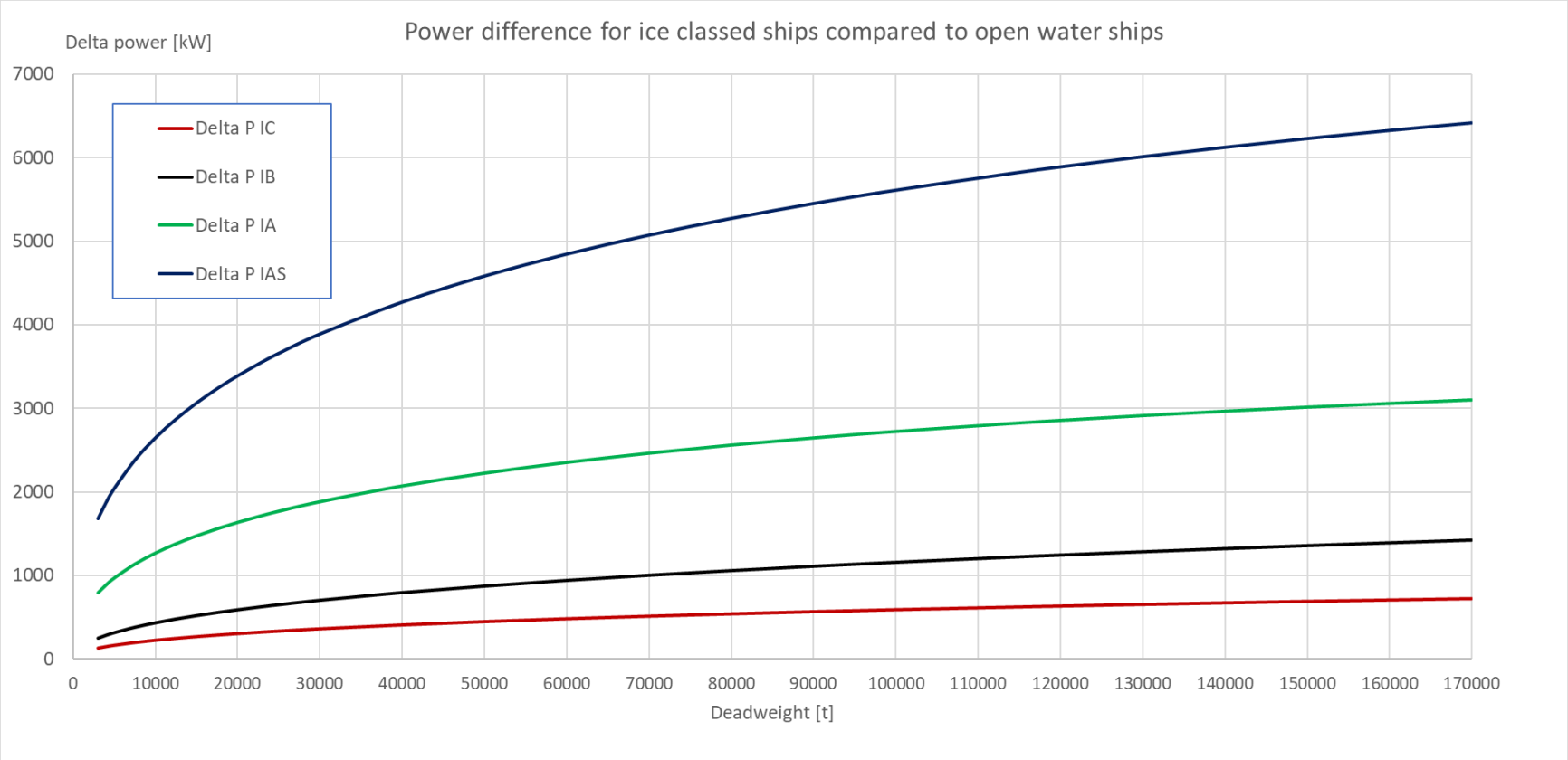
Target	Parameters other than those defined by the Finnish-Swedish ice class rules, affect the channel resistance in model scale. In order to define testing conditions more accurately, a reliable reference point in full scale is required.
Scope of Work	A channel test is conducted with an existing ship in full scale and with corresponding model in model scale in known and well documented ice conditions
Schedule	6 months / ongoing



Project PREEDICT

Target	To ensure Ice class ships EEDI compliance in comming EEDI phase.
Scope of Work	Develop new correction factors for capacity decreases and power increase.
Schedule	Year 2017- finished
Main result	Change of correction factors to dwt based increases correlation considerably.

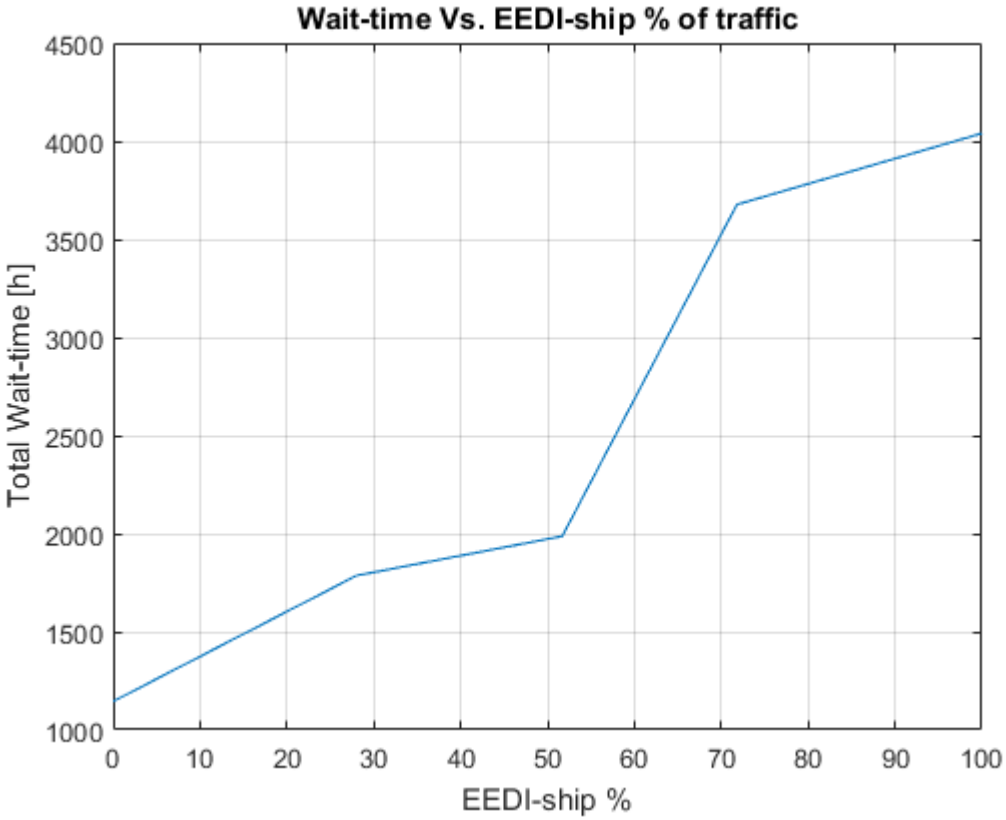
PREEDICT results:
DWT vs. additional propulsion power



To secure the winter navigation in the northern Baltic Sea we have to know…

- How the EEDI works from ship design and ship performance point of view
  - What kind of ships are possible?
  - How do the EEDI vessels perform in ice conditions?
  - How much icebreaker assistance do the EEDI vessels need?
  - How many icebreakers are needed?
  - What kind of icebreakers are needed?
- What kind of fairway dues to be applied?
- Possible needs for future rule development proposals

Effect of EEDI on vessel waiting time with current icebreaker fleet



Linderberg, M., Kujala, P., Karjalainen, M, Toivola J., 2018. Simulation model of the Finnish winter navigation system. IMDC conference, Otaniemi, 10-14.06.2018

For Finland it is not only about shipping

- Finnish economy is depending on winter navigation and Baltic Sea Transportation System (BSTS)
- Shipping and winter navigation is part of the whole logistic chain
  - Land transportation
  - Ports
  - Storage
- Shipping is serving the whole Finnish economy and industry
- Reduced reliability means higher costs for the Finnish industry
- Present service level in the EEDI world is in the end an economical question
- In case we use current icebreaker fleet and current EEDI definition there would be the following consequences:
  - Ship owners -> higher costs because of more passage time
  - Finnish industry -> competitiveness suffers / delays in deliveries
    - More ships, more storage
  - Finnish transport agency -> More icebreaker assistance needs

The main question that we have to solve

How to guarantee that ships will sail according to feasible schedules also in the future?

Copyright