



Aalto University
School of Engineering

Marine and Arctic Technology

Overview of Aalto's current Arctic research

Arctic Passion, Feb 15, 2024

Assistant Prof. Mikko Suominen

Marine and Arctic Technology research group

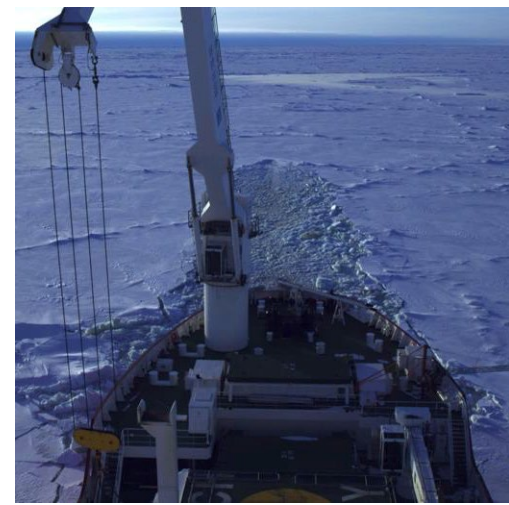
Content

Marine and Arctic Technology Group

Arctic Marine Engineering and Ice Mechanics

- Full-scale measurements, ice loads
- Smart winter navigation
- Offshore wind

Aalto Ice and Wave Tank Education



Marine and Arctic Technology group

Aalto University

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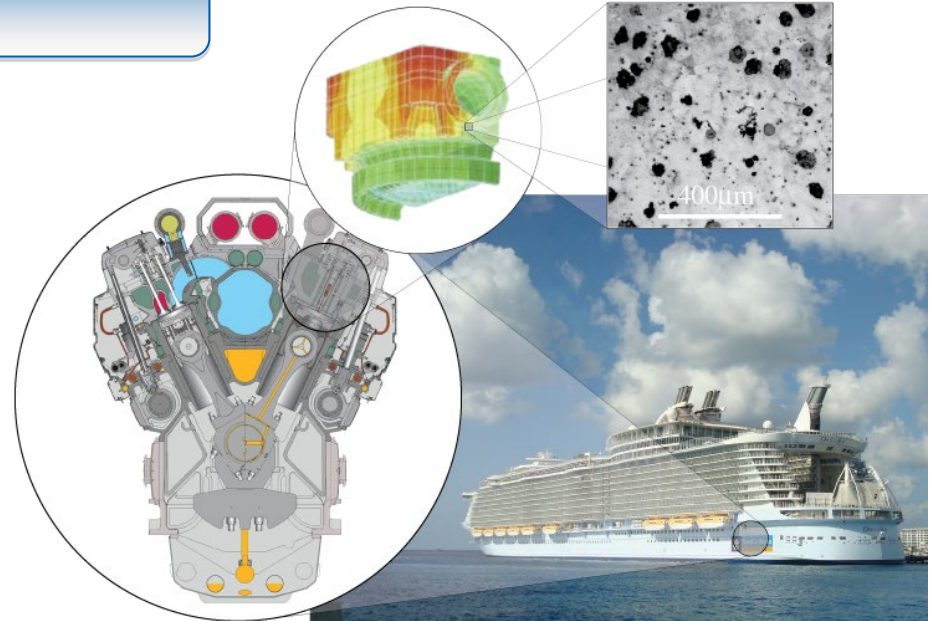
Department of Mechanical Engineering

Marine and Arctic Technology

Energy conversion and systems

Materials to products

Mechatronics

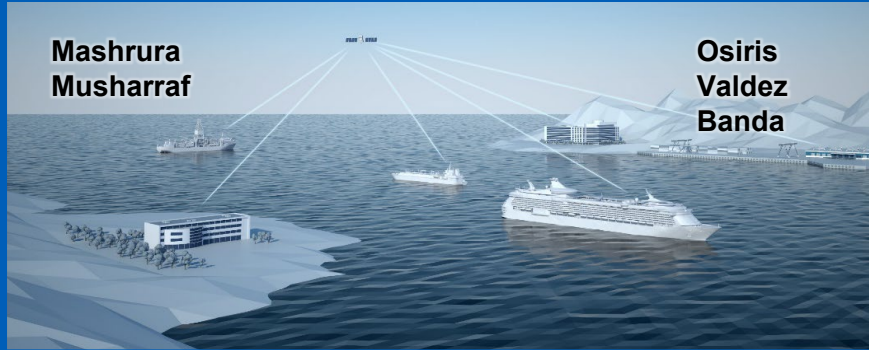


Research focus areas and persons

Risks and Intelligence in Marine System

Mashrura
Musharraf

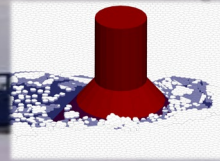
Osiris
Valdez
Banda



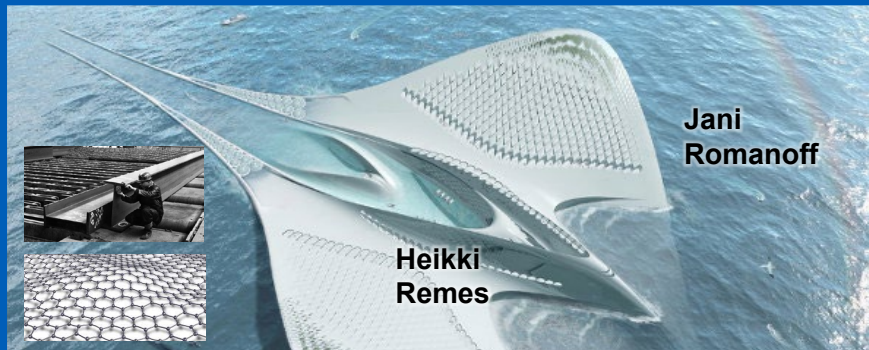
Arctic Marine Engineering and Ice Mechanics

Arttu
Polojärvi

Jukka
Tuhkuri



Mikko
Suominen



Jani
Romanoff

Heikki
Remes

Marine Structures and Solids Mechanics



Tommi
Mikkola

Pekka Ruponen
(PoP)

Marine Hydro Mechanics

Arctic Marine Engineering and Ice Mechanics

Research themes

- Future sea ice and its behavior
- Ice loads and ice fracture modeling
- Arctic shipping and smart winter navigation
- Offshore wind in cold sea areas



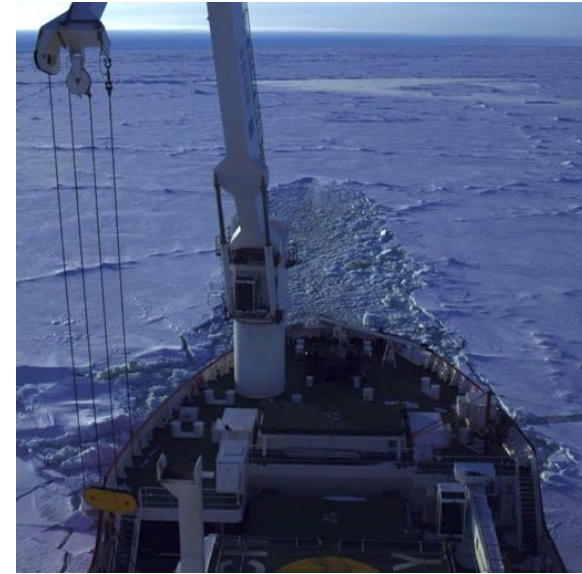
Ice Loads

Research on

- Ice load measurement methods
- Ice load statistics
- The link between ice loads and ice conditions
- Ice loads in ice floe fields with/without waves

S.A. Agulhas II

- Ice load measurements in Antarctic waters since 2012



Ice Loads & Interaction

ENDURANCE22 (2022)

ANTGRAD (2022-2026)

- Ship – ice floe – wave interaction
- Ice load measurements on SA Agulhas II
- Experiments in the Aalto Ice and Wave Tank



CEARCTIC & CEPOLAR (2013-2021)

- Risk management for Arctic operations
- Relating loads to conditions and safety
 - Probability of structural damage related to RIO

Smart Winter Navigation

JÄÄSIMU & DECIDE (2022-23)

- Simulating winter navigation system in the Baltic Sea
- Optimization & decarbonization

Towards human-centered intelligent ships for winter navigation (2022-26)

- Decision support tools for winter navigation

Offshore Wind

Research on structures in dynamic ice

- Ice-induced vibrations
- Sea ice effect on wind farms

SHIVER (2019-2024)

- An advanced ice model for design of offshore windmill susceptible to ice-induced vibrations.

IceWind (2022-2024)

- Ice load and condition monitoring for an offshore structure in the Gulf of Bothnia

DEMFLO (2022-2026)

- Linking scales in ice modelling

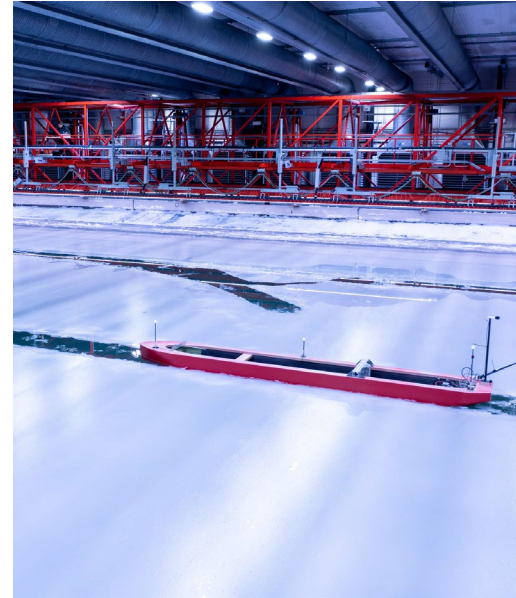
Aalto Ice and Wave Tank

- 40m x 40m x 2.8 m basin with cooling equipment
- Mainly scaled experiments, but also with real ice
- Aalto Significant Research Infrastructure



Aalto Ice and Wave Tank

- Ships in ice: resistance, maneuvering, loads, new hull forms
- Structures in ice: windmills, wide structures
- Ice mechanics: fracture, ridges, scale effects
- Waves + ice + ships / structures & new wave maker
- Open water tests
- Member of a Nordforsk funded COLDHUB network
- **SCALE-MODEL (2023-2027)**
 - New scaling method for ice in model scale testing for local ice loads
- **FRICCO (2023)**
 - friction coefficient correction for model scale testing in brash ice



Education

Master's Programme in Mechanical Engineering

Majors: Arctic technology, Marine technology

- Ship operations in ice
- Ice mechanics
- Ice loads on structures
- Model-scale testing in ice

Nordic Master in Maritime Engineering

- Joint program by Aalto, Chalmers, DTU, KTH and NTNU

Nordic Master in Cold Climate Engineering

- Joint program by Aalto, DTU and NTNU

Doctoral education

- Active, through our research projects
- 2020 (4), 2021 (7), 2022 (4), 2023 (5)

Marine Technology Research at Aalto University

Shanghai ranking¹ in subject fields 2022

ShanghaiRanking: Aalto University ranks in top 100 worldwide in nine academic subjects

Published: 22.7.2022

Marine/Ocean Engineering, Business Administration, Management and Library & Information Science were the best performers among Aalto's subjects

Ranking: **ShanghaiRankings by Subjects 2022**
Field: **Marine/Ocean Engineering**

21st
in the world

Top 50 research subject Fields in Finnish Universities in Shanghai Ranking 2022

Subject	University	Ranking
Marine/Ocean Engineering	Aalto	21
Business Administration	Aalto	24
Ecology	Helsinki	26
Dentistry & Oral Sciences	Helsinki	31
Geography	Helsinki	35
Athmospheric Science	Helsinki	35
Management	Aalto	38
Communication	Helsinki	41
Education	Jyväskylä	44
Public Health	Helsinki	44
Telecommunication Engineering	Tampere	45
Library & Information Science	Aalto	46
Agricultural Sciences	Helsinki	46
Remote Sensing	Helsinki	47



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**Thank you for your
kind attention!**