Fremtidsrettede prosjekter ved SMS

Arctic Emergency Operations

Arctic Marine Operations

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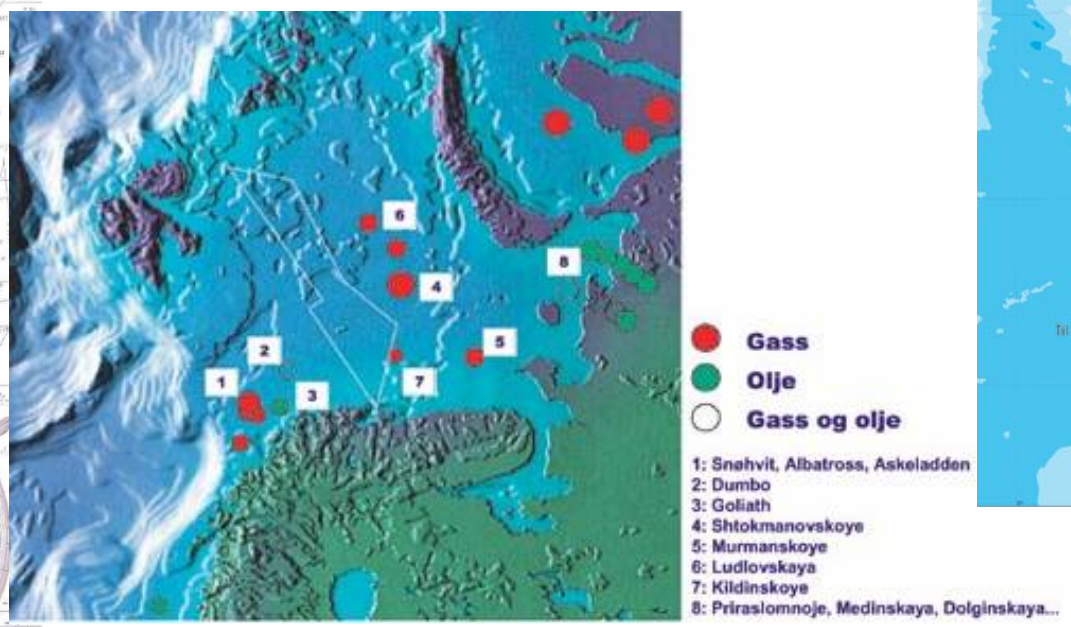
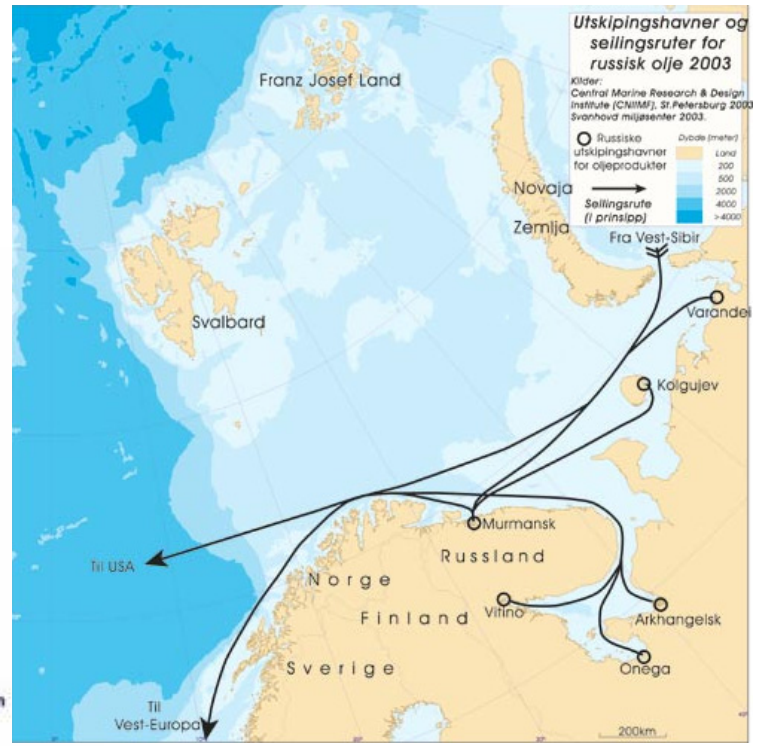
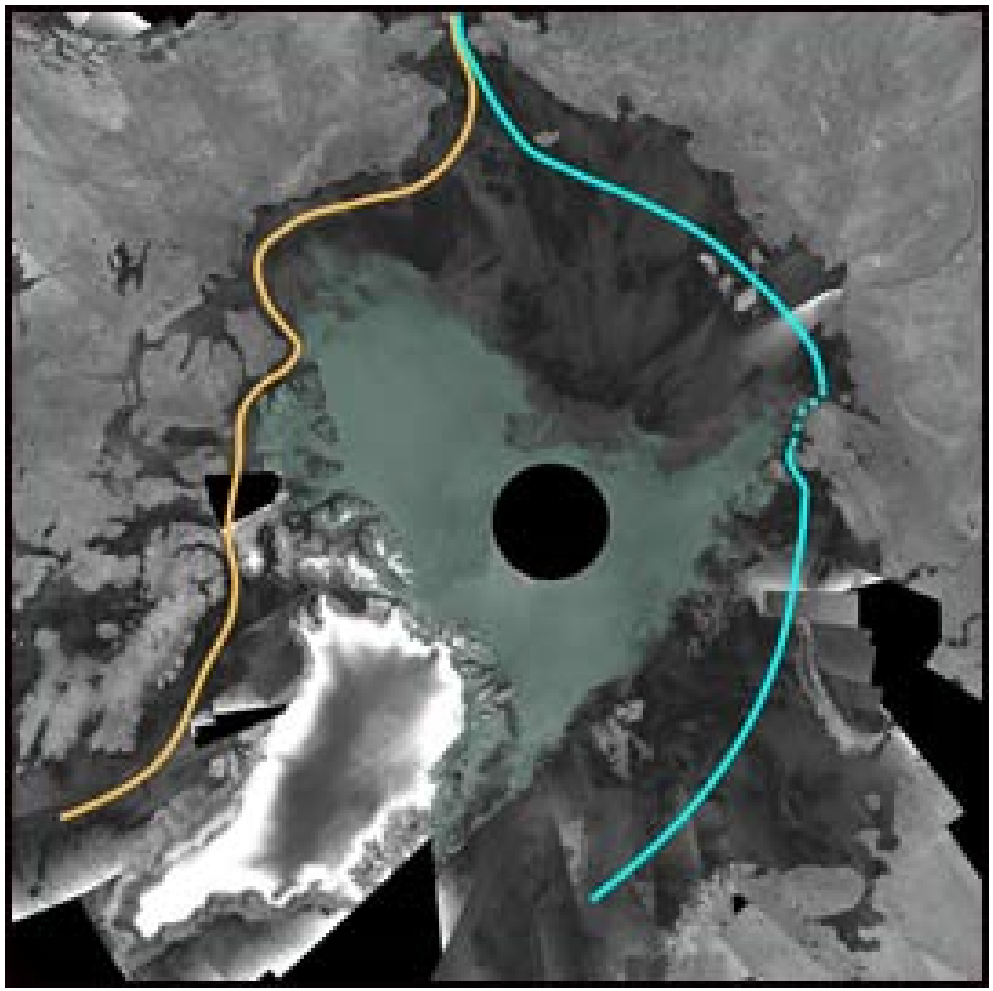
Bakgrunn for nordområdeprosjektene

Gass og olje i Barentshavet – Leting / Produksjon / Lasting / Transport





Og Nordvest- og Nordøstpassasjen



ÅPENT HAV: Dette bilde av Nordvestpassasjen er tatt av European Space Agency (ESA). Den oransje veien er helt åpen og den blå viser en vei som er så godt som åpen. Foto: AFP

Arctic Marine Operations

- Delfinansiert av Norges Forskningsråd

- **Deltagere i fase 1 (2006 – 2007):**

  SMS, NTNU (prof Løset)
  Statoil, Hydro,
  DNV,
  Kystvakta, Kystverket, Teekay,

  Makarov (Rus),
  J. Schwarz (Ger),
  RCN (Can)

- **Mål for prosjektets fase 2 (2008 – 2009):**

  - **Sanntids simulering av skip i bevegelse i is**
  - **Treningskurs for ulike scenarier og operasjoner i farvann med is**

Work packages phase 1

WP 1: Gathering and systemizing info.

(existing ice simulators in Russia, Canada etc)

WP 2: Internal competence build-up

(Russia, Tromsø etc)

WP 3: Field expedition on KV Svalbard

(together with DNV – Ice Load Monitoring project and UiB – BIAC/CARE-project)

WP 5: Developing KV Svalbard model

WP 4 – Developing Ice models

Prof Løset and Ph D stud Lubbad at NTNU, have developed new analythical algorithms making it possible to simulate real time ice behaviour.

This means developing new mathematical models and visual presentation of

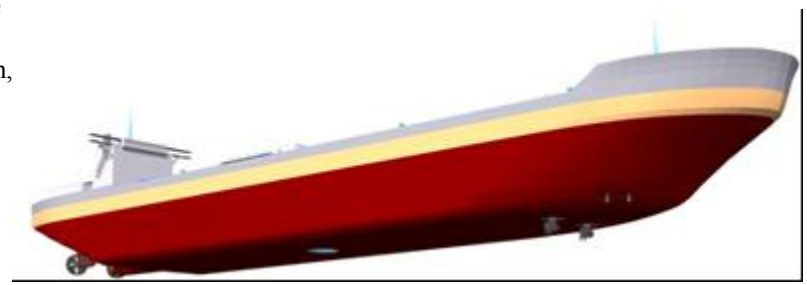
- **first year firm ice and broken ice**
- **multiple year ice**
- **drifting ice and pack ice**
- **bash ice / Slush**

The findings are validated against real data collected from the KV Svalbard field expedition

The resistance of a ship advancing in unbroken ice depends mainly on

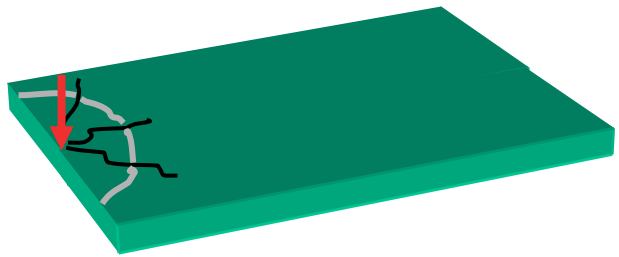
hull dimensions and geometric form,
ice thickness,
ice strength,
dynamic friction ice-hull,
speed of ship,

Other factors are snow cover on the ice, its temperature and wetness.



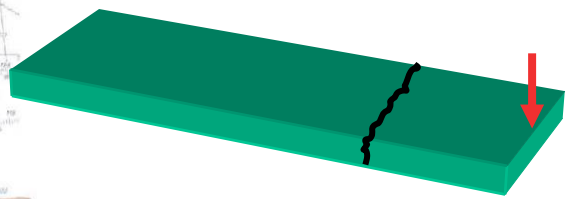
Examples of theoretical approach

Plate failure



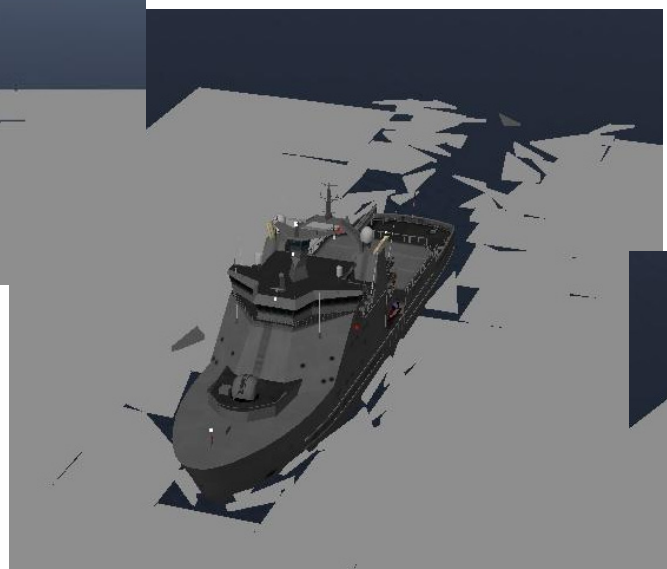
1. Radial cracks generating
2. Circumferential cracks

Beam failure

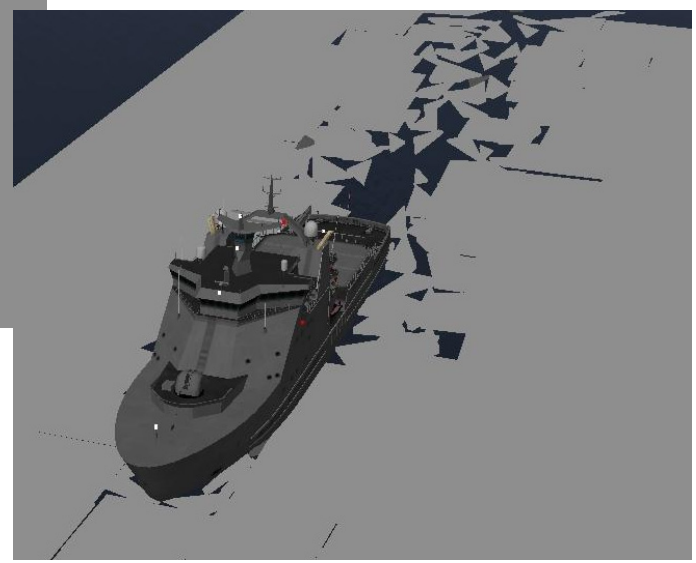


ARCMAROP – Phase 2

Foreløpige resultater av fartøy i is, gir til konklusjon at prosjektets fase 2 settes i gang



Bilder hentet fra første versjon
real time simulatorkjøring i level ice



Fase to inneholder følgende foreløpige arbeidspakker, pakkene blir fastsatt ved dannelsen av nytt consortium :

ARCMAROP – WP 6
Geographical Area Models

- 3D models of parts of Kara Sea / Novaja Semlja (2 hours sailing at 15 kts)
- Mapping of ice-movement due to tidal currents & wind

ARCMAROP – WP 7
Port Operations in Ice /Bash Ice/Slush

- 3D models of a port area
- Models of forces/resistance from layer of ”slush” when manoeuvring vessels in a port operation
- Effects from propellers, rudders, thrusters
- Harbour cleaning

ARCMAROP – WP 8

Mathematical and visual model of Vessel Operations at Loading Buoy/Tower in Drift Ice

- Models of forces from drift ice working on vessel
  - Firm ice & Ice floes in combination with current&wind
- Model forces acting on buoy/tower from vessel and –ice
- Model forces acting on mooring lines and cargo hose
- Model forces acting on buoys mooring system

ARCMAROP – WP 9

Mathematical and visual model of Drilling Vessel or FPSO in fixed position, variable heading in drift ice

- Calculate and develop models of forces from drift ice working on vessel
  - Firm ice & Ice floes in combination with current&wind
- Forces from ice working on moorings, risers, drill pipe etc
- Calibration of model against tank measurements
- Modelling of vessel/FPSO

ARCMAROP – WP 10

Mathematical and visual model of Vessels in Convoy lead by Ice Breaker

- Develop models of Ice Breaker, Tankers in various ice types
- Open channel w/ ice floes
- Opening / closing channel due to wind/current
- Calculate/develop models of forces acting on 1st, 2nd vessel in channel narrower than the tankers
- Resistance / Friction
- Manoeuvrability, change of heading
- Develop ”Automatic testing tool” for convoy ops+

ARCMAROP – WP 11, 12, 13

Developing theoretical documentation and exercises for WP 7, 8, 9 and 10

ARCMAROP – WP 14 *Project administration*

ARCMAROP – WP 15 *Dissemination activities*

ARCMAROP - Project plan phase 1 and 2

ID	Aktivitetsnavn
1	ARCMAROP Phase 1 og 2 Project
2	ARCMAROP Phase 1
3	WP 1: Gath and syst info
4	WP 2: Basic training in St.P.burg
5	WP 3: Field exped & photo doc
6	WP 4: Devel ice mod
7	Beam theory Implementing
8	Plate theory Implementing
9	Wedge theory Implementing
10	First year firm ice, multi year ice
11	Broken ice and drift ice
12	Pack Ice and Ridges
13	Slush
14	WP 5 Develop KV Svalbard
15	
16	Present results for steering commitee
17	Aplication to NRC
18	Invite new partners to phase 2
19	
20	ARMAROP Phase 2
21	**WP 6: Develop Geographical Area Models**
22	3D Models of parts of Kara Sea
23	Radar simulation of ice
24	Mapping of ice-movements due to tidal c&w
25	**WP 7: Math & vis mod of port ops in ice/slush**
26	3D Models of port area
27	Models of forces/ressistance from layer of "slush"
28	Harbour cleaning
29	**WP 8: Math & vis mod of vessel ops at loading buoy/tower ir**
30	Model forces
31	**WP 9: Math & vis mod of dr vessel/FPSO in f pos-var hdg in**
32	Model forces
33	**WP 10: Math & vis mod of vessel in conv lead by ice breake**
34	Models
35	Develop automatic test system
36	
37	WP 11: Devel theorl doc for WP7
38	WP 12: Devel theor doc for WP8 and 9
39	WP 13: Devel theor doc for WP10
40	WP 14: Proj adm
41	WP 15: Diss activities