

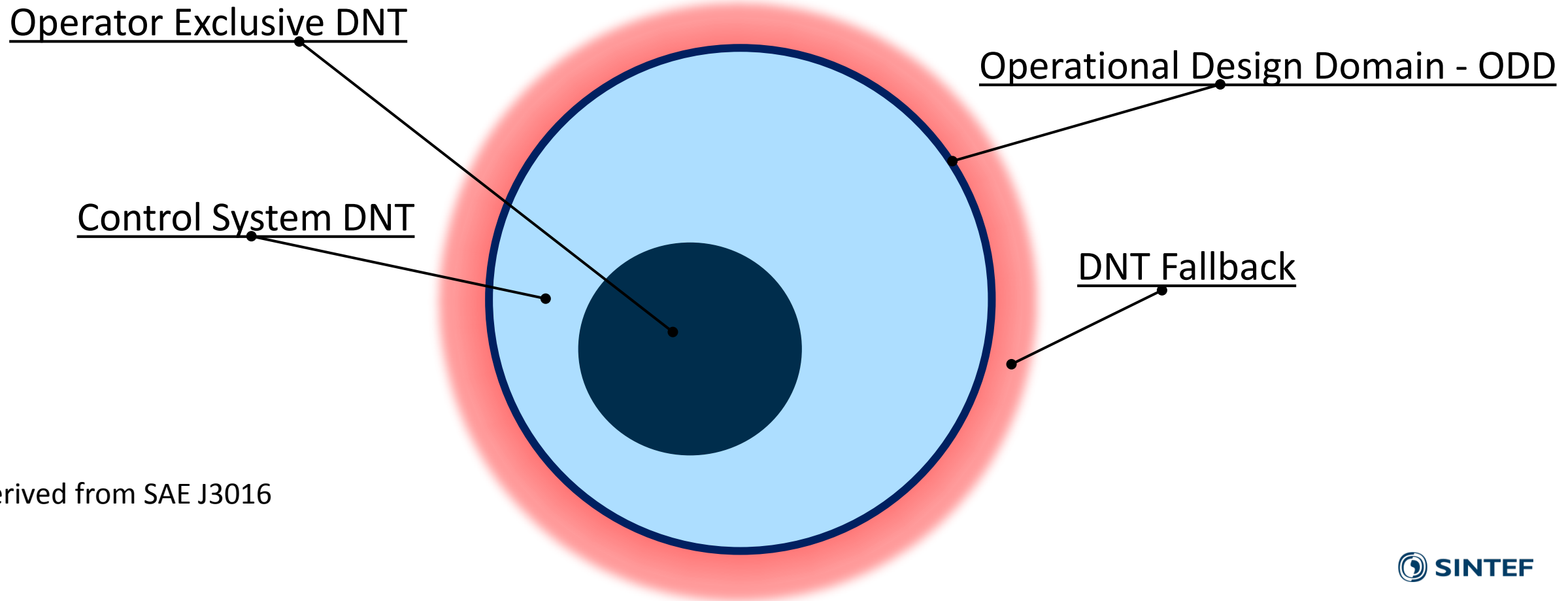


AUTONOMOUS SHIPPING PROJECTS IN NORWAY UNECE, FEBRUARY 12TH 2018

Ørniulf Jan Rødseth, Senior Scientist

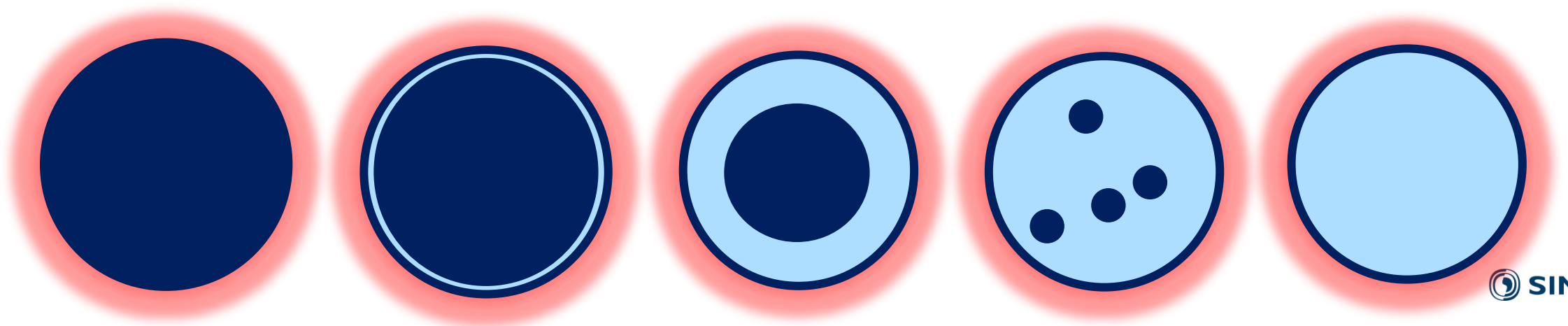
What is an autonomous and unmanned ship?

Autonomy: Operational Design Domain – ODD, Dynamic Navigation Task – DNT

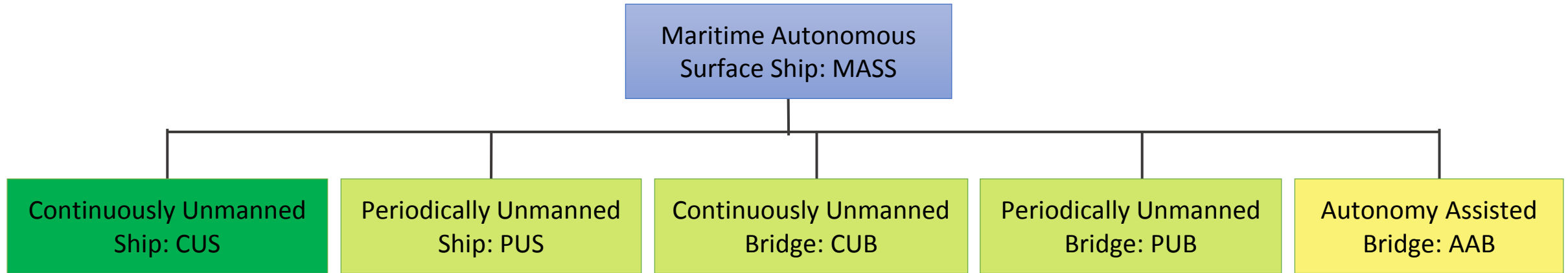


Main autonomy levels

- 1. Operator controlled:** Decision support and advice to operator. Operator decides.
- 2. Automatic:** Automated operation – stop at deviation, continuous supervision.
- 3. Partly autonomous:** Autonomous for certain operations, supervision.
- 4. Constrained autonomous:** Autonomous, but limit on response, continuous supervision.
- 4. Fully autonomous:** Autonomous and without supervision.

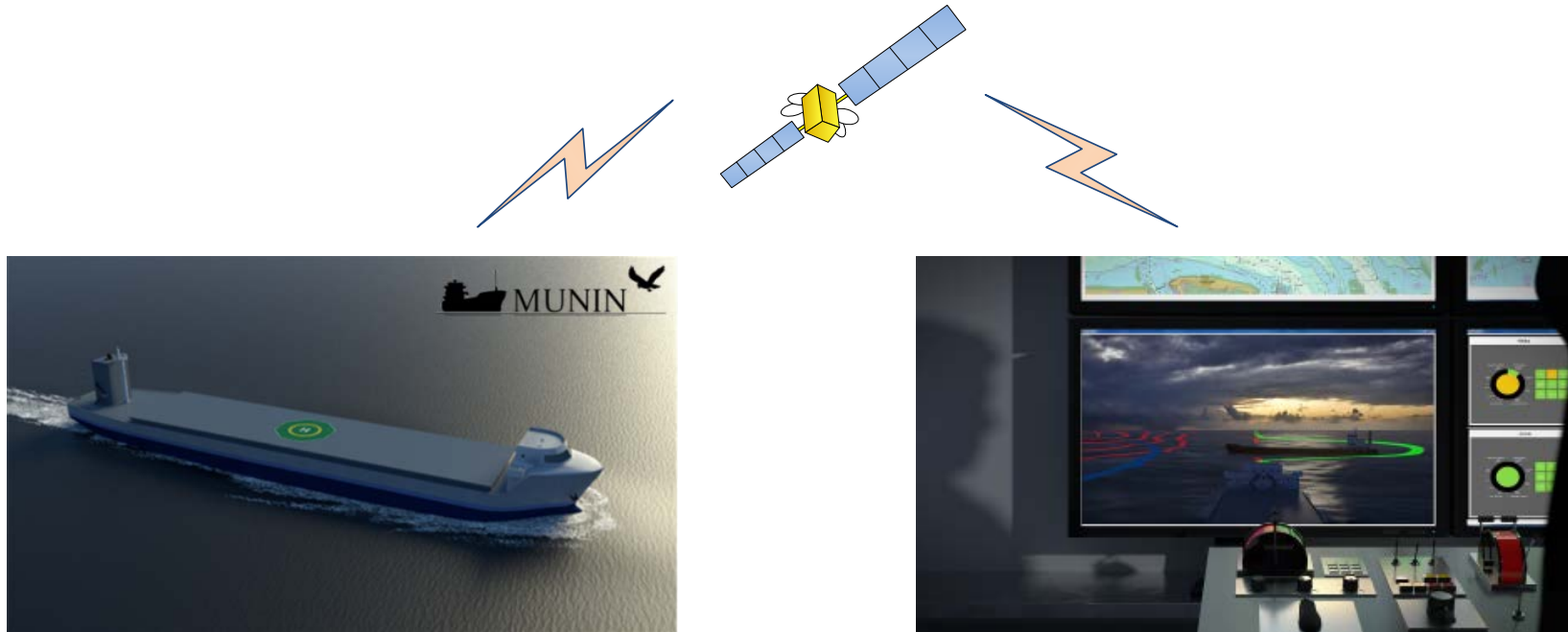


Unmanned ships



Ship type / Crew	Always on Bridge	Available on Ship	Never on Bridge
AAB	x		
PUB		x	
PUS			x
CUB			x
CUS			x

Shore Control Centre (SCC) is normally used



There is normally a human in the loop!

- Simplifies technology, increases safety and security
- Simplifies transitions from today's legislation to unmanned operation

Autonomy vs. unmanned

	Operator controlled	Automatic	Partly autonomous	Constrained autonomy	Fully autonomous
Crew at bridge at all times	X	X	X	X	
Unmanned bridge, crew on ship, shore control	X	X	X	X	
Unmanned bridge, crew on ship, no shore control			X		
Unmanned, shore control	X	X	X	X	
Fully unmanned, no shore control					?

Why autonomous ships in Norway

Technical benefits

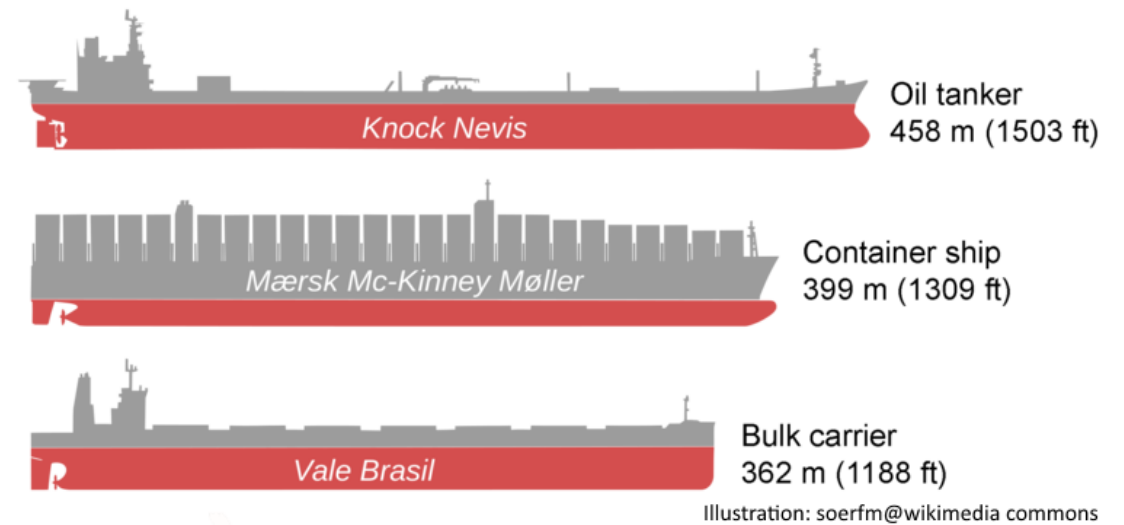
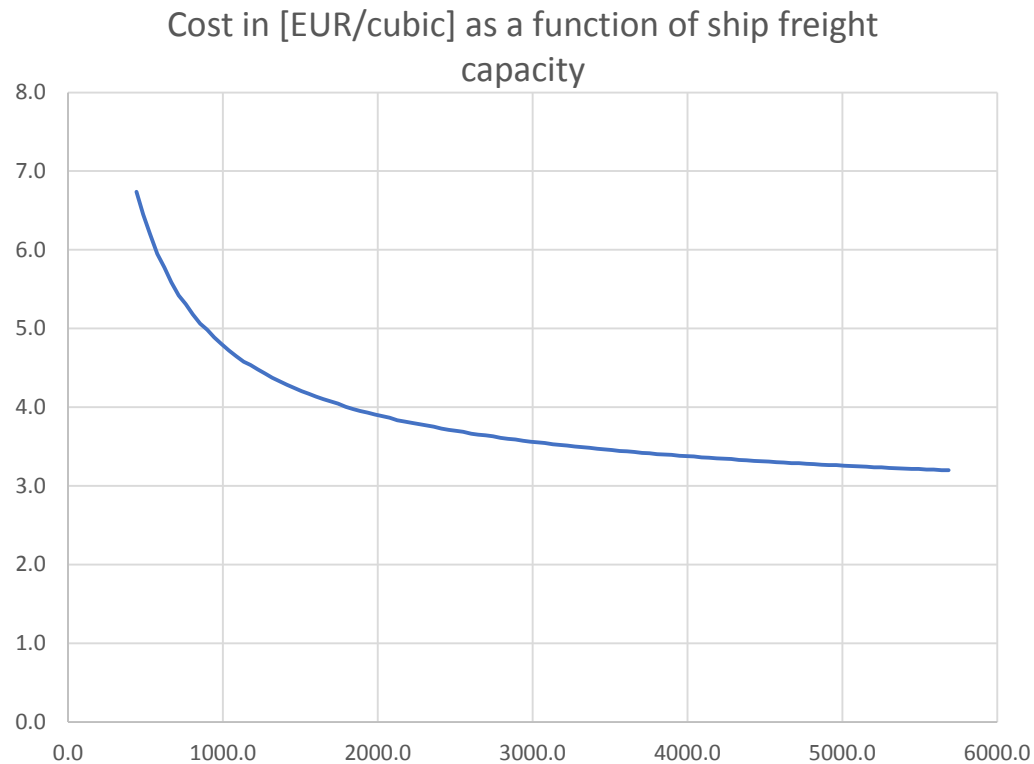


Automate operations that
computers do better: 3D

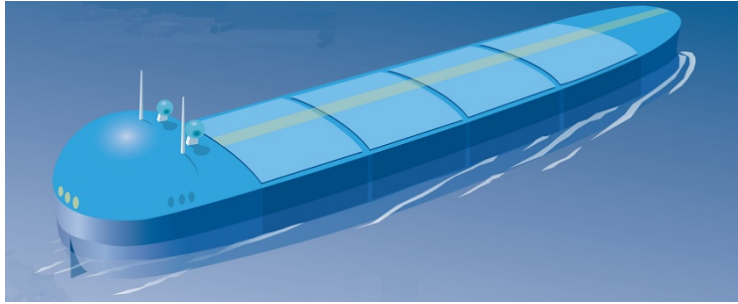


Lower emissions

Defeat economy of scale



Completely unmanned gives largest benefits!



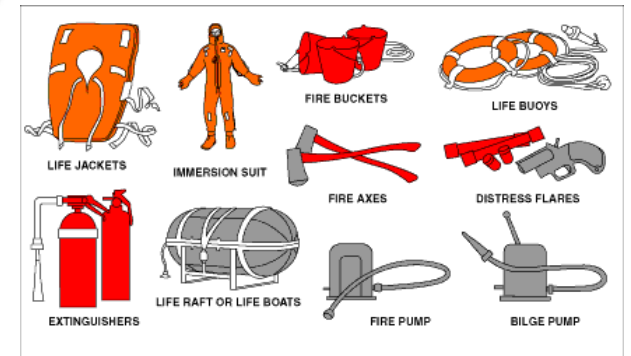
No accommodation
Less power
More cargo



No crew
No crew related costs



No safety equipment
New constructions



Enables completely new
transport system concepts



Why Norway?

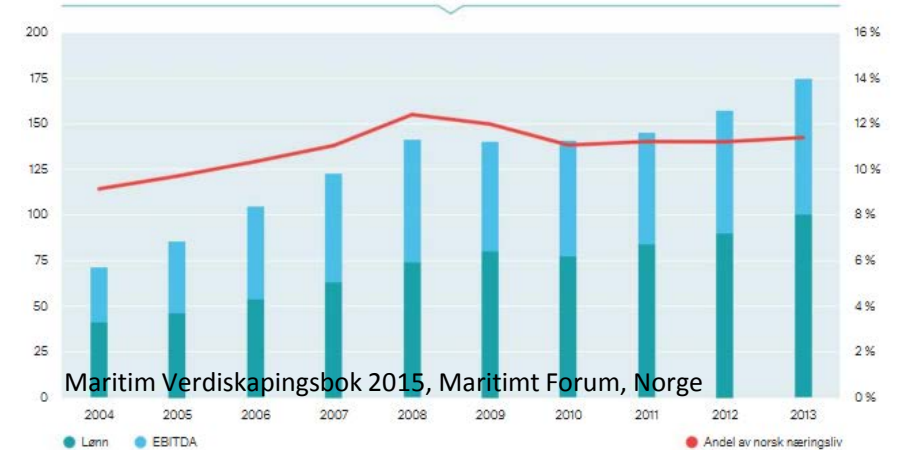


Coast: 100 000 km
Mainland: 85 000 km
Sea border: 2650 km

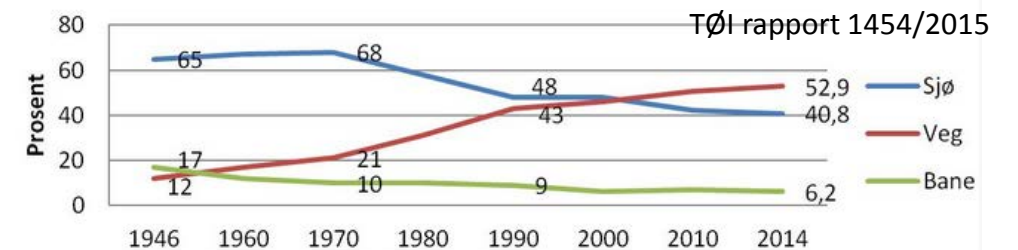


A complete maritime cluster.

Figur 2-1: Maritim verdiskaping og næringsandel av norsk næringsliv 2004-2013. Kilde: Menon/Bisnode



14% of value creation from businesses
38 % of export (ex HC)

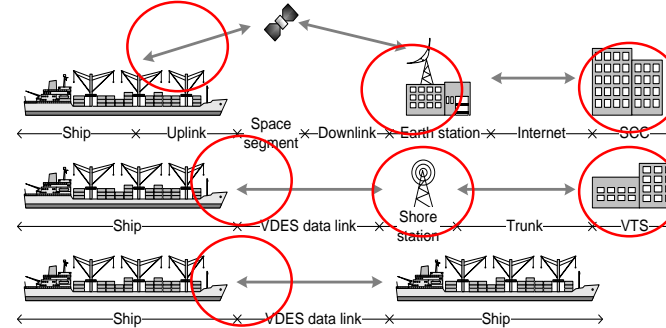


Still a big role in inland cargo transport –
that needs to be increased

Obstacles?



More expensive sensor and ICT



Extensive cyber security



Legal and liability



Stricter safety

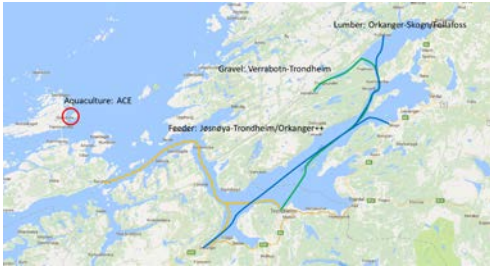


No intervention onboard

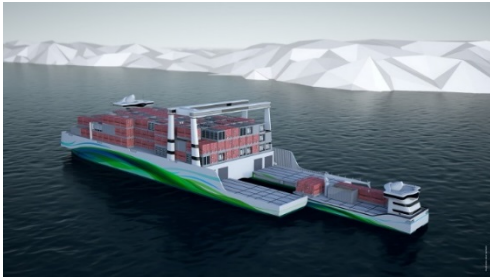


Shore infrastructure

We need a sound business case!



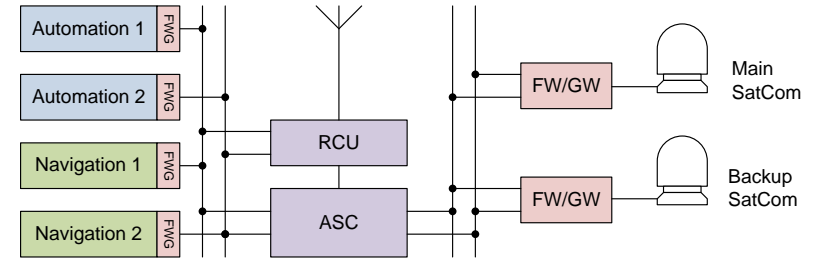
New logistics



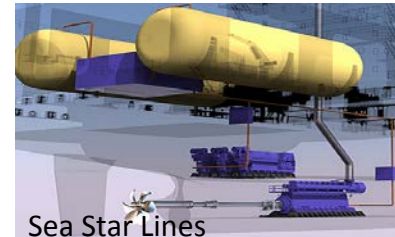
Improved operations



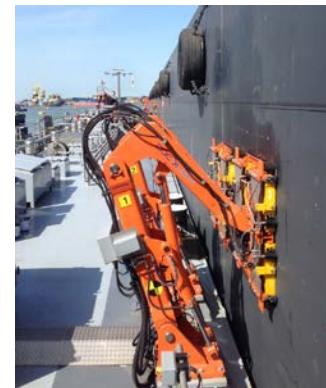
Some reduced costs



More complex ship systems



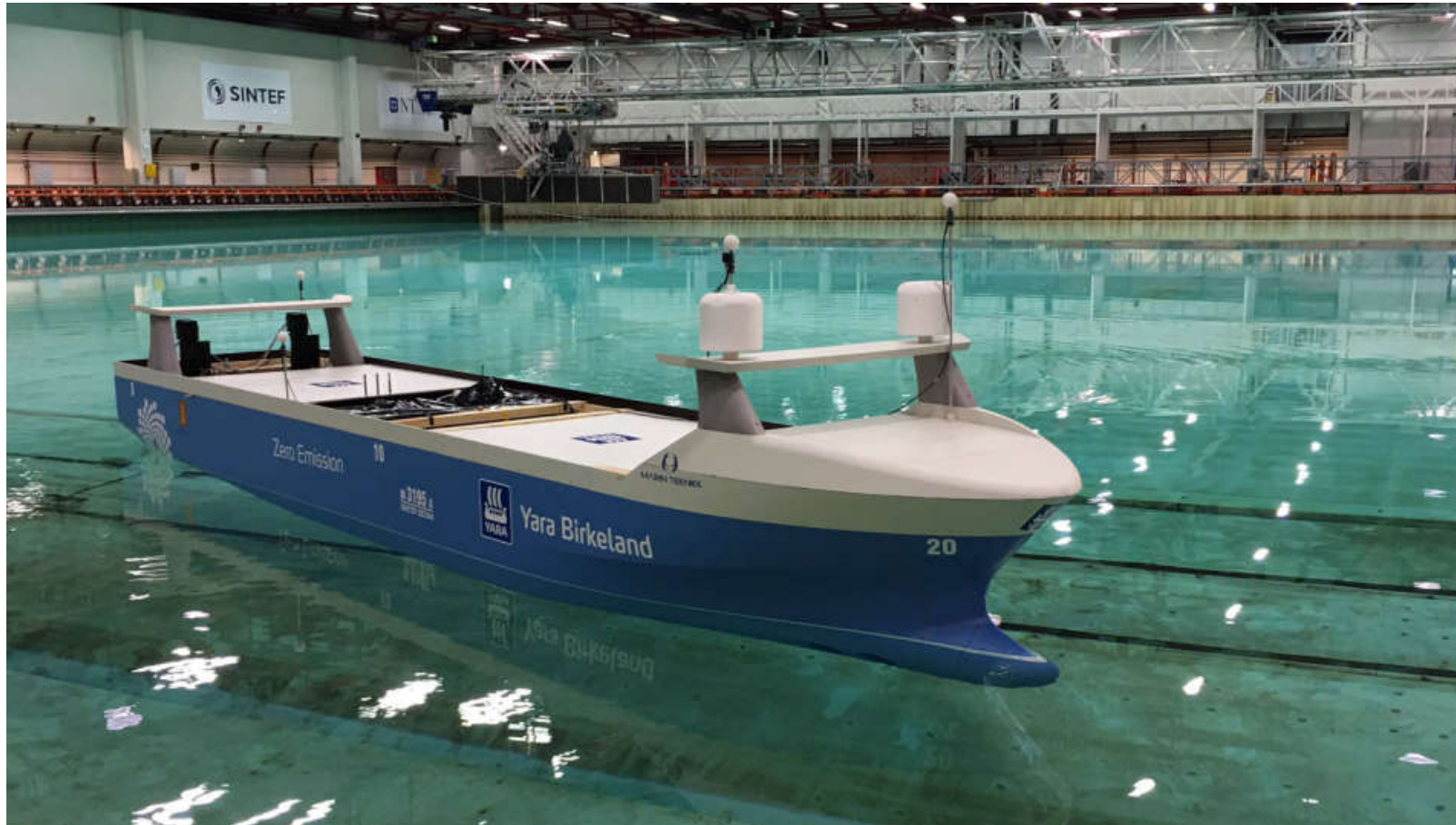
Reliability: No maintenance on board



Shore Infrastructure

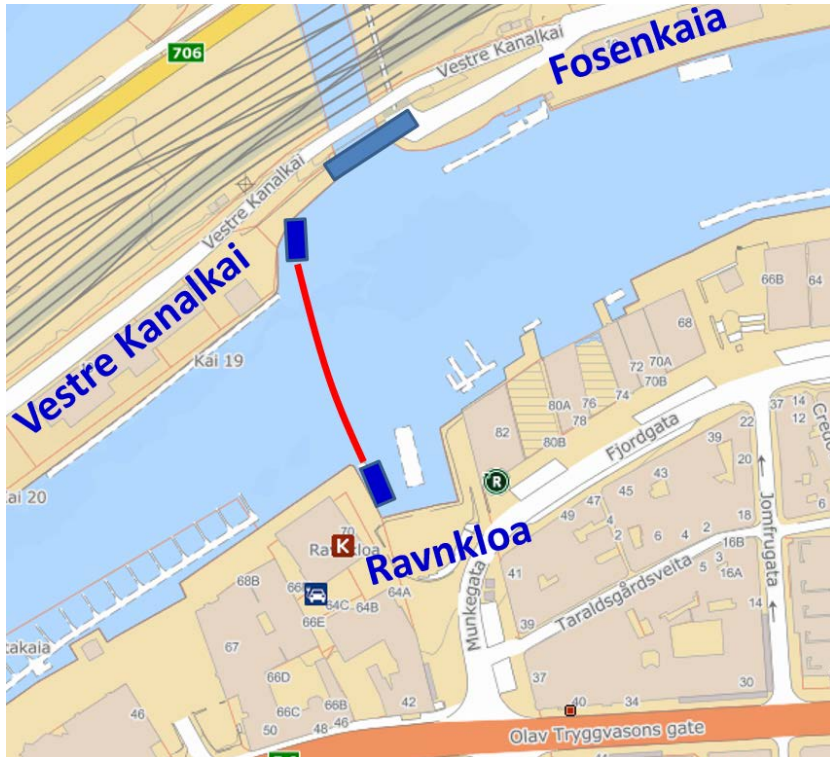
Main application areas

Yara Birkeland



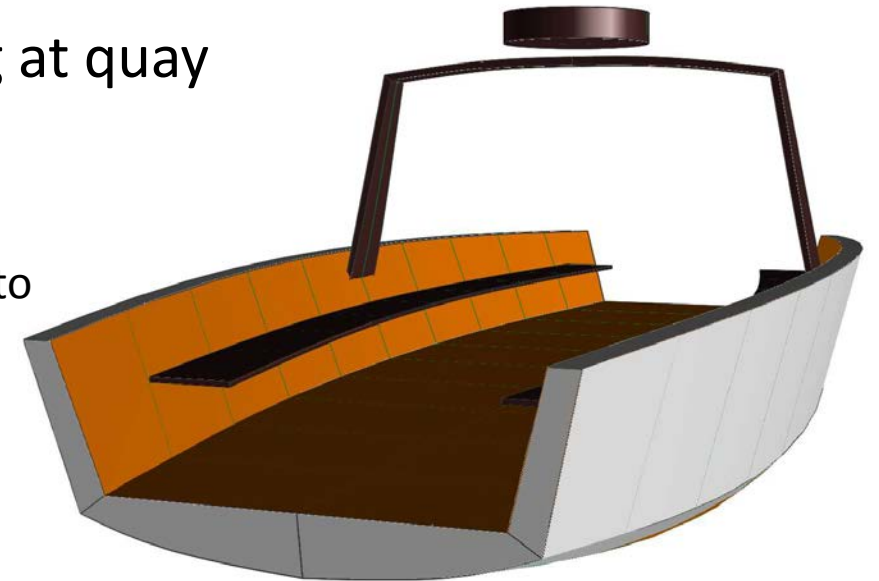
- Yara fertilizer
- Kongsberg partner
- Replaces 40 000 truck trips a year

Milli-Ampere – urban waterway



- On-demand passenger ferry
- Max 12 persons + bicycles
- Electrical propulsion, battery
- Inductive charging at quay

Linking center of Trondheim to
seaside and rail station

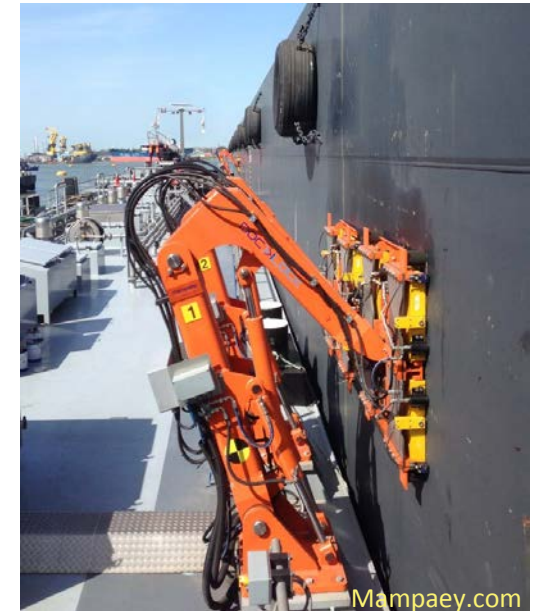


Hrönn: Unmanned offshore service vessel



- Light-duty, offshore utility ship
- Commissioned in 2017, in operation 2018
- Initially for man in the loop applications
- Will be tested in Trondjemsfjorden test area

Automated highway ferries




High interest in Norway

Norwegian authorities are very supportive

Autonomous Vessels

Feb 2016: Technology towards 2030 – autonomous Vessels ?



© Rolls-Royce

KYSTVERKET
NORWEGIAN COASTAL ADMINISTRATION

Sjøfartsdirektoratet
Norwegian Maritime Authority

Sjøfartsdirektoratet ønsker å være verdensledende innenfor ny teknologi



NIS/NOR 16.05.2017

Seminar autonome skip
Grimstad 2017-05-15

Den foretrukne maritime administrasjonen



Supported by research council



APPLY FOR FUNDING

Find calls for proposals

Application information

Application status

> Complaints

> Impartiality

> Application processing

MAROFF-2: 19 new projects

NOK 152,8 million has been allocated as a result of the call for proposals with deadline 11.10.2017.

Title of call for proposals: [Inntil 120 millioner til Innovasjonsprosjekter i næringslivet for maritim sektor](#)

MAROFF-2: 3 new projects

NOK 29,7 million has been allocated as a result of the call for proposals with deadline 6.9.2017.

Title of call for proposals: [Inntil 50 millioner til Forskerprosjekter for utvikling av autonome og fjernstyrte fartøy](#)

MAROFF-2: 3 new projects

NOK 42,9 million has been allocated as a result of the call for proposals with deadline 6.9.2017.

Title of call for proposals: [Inntil 70 millioner til forskning i maritim sektor - Kompetanseprosjekter for næringslivet](#)

Norwegian Forum for Autonomous Ships

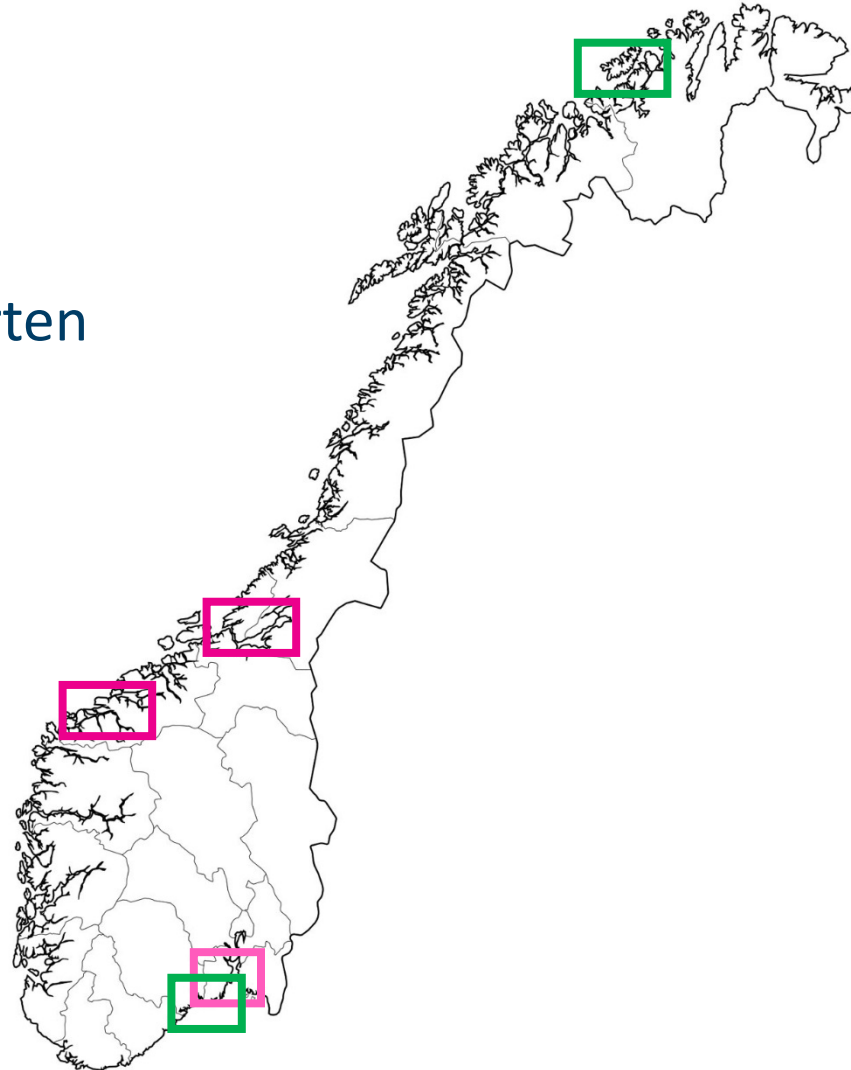
- Established October 4th 2016
- Operated as a joint industry project at SINTEF Ocean.
- General Manager is Mr. Ørnulf Jan Rødseth.
- A board of governors overseeing operations. General assembly approves budgets and strategies.
- 43 Institutional Members
 - Including Industry, authorities, class, insurance research, universities, ports ...
 - 2 other institutions as personal members



<http://nfas.autonomous-ship.org>

Test area developments

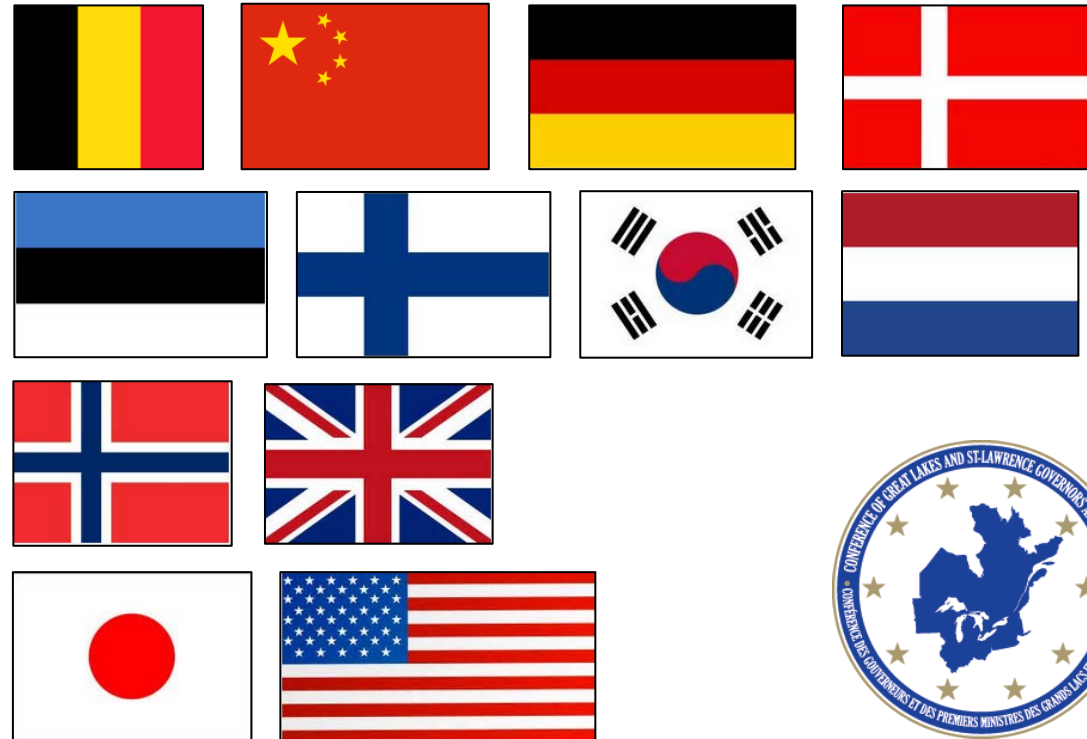
- Trondheimfjorden, Storfjorden and Horten are established
- Grenland to be announced 2018
- Tromsø possible next



International Network for Autonomous Ships



- Agreed on at meeting in Oslo Oct. 30th 2017
- Hosted by NFAS and SINTEF Ocean
- 22 participants at meeting
- 2 correspondent countries
- First inland meeting in Trondheim November 6-7



Conclusions



- Unmanned ships will mostly be “constrained autonomous”
- Autonomous ships is an important strategic area in Norway.
- Autonomous ships will be a game changer and create new business models.
- International cooperation is needed.



Technology for a better society