Autonomous Ships – Current Status and Future Outlook
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Who we are

ARTIFICIAL INTELLIGENCE / MACHINE LEARNING SENSOR FUSION FOR AUTONOMOUS VESSEL NAVIGATION (MARITIME AI-NAV)

NLS FINNISH GEOSPATIAL RESEARCH INSTITUTE FGI

Aalto University

Fleetrange
Topics

Notable research projects around the world

Notable achievements

Key elements and challenges

The look ahead

Rolls-Royce tests remote controlled ferry in Finland
WHERE ARE WE TODAY

General status of autonomous ship projects, achievements and activities
Research and players are currently quite concentrated to **North Europe and US**

Korea, Japan, China and Singapore also show activity

Remote control is already well demonstrated

A lot of work has been done in smaller **ASVs** (Autonomous Surface Vehicles) for military use
MUNIN was essentially a feasibility study and test-bed development for an **Unmanned Cargo vessel**.

The project looked at technical, economical and legal feasibility.

http://www.unmanned-ship.org
The AAWA initiative looked at technology, safety, incentives (economics) and legal of autonomous vessels in general.
**One Sea**

*Autonomous Maritime Ecosystem*

One Sea is a Finnish Ecosystem (project), which aims at providing a solid ground for research, testing and collaboration reg. autonomous ships.

One Sea features an open test area “Jaakonmeri”

Similar test areas are found also in Norway and China

https://www.oneseaecosystem.net/
Yara Birkeland
First ever electric and autonomous
The SIMAROS project is one of several Norwegian undertakings. SIMAROS looked mainly at safety aspects.

Other notable Norwegian projects are:
AUTOSEA (Sensor fusion and collision avoidance for autonomous surface vehicles)
ROMAS (Remote Operation of Machinery and Automation Systems)

The Norwegian research is quite focused around NTNU AMOS (Centre for autonomous marine operations and systems), Kongsberg and DNVGL

https://www.ntnu.edu/web/amos/research
NYK, together with its research-arm MTI (and other Japanese companies) has announced plans to demonstrate remote operations of a container ship in Pacific trade.
This Chinese project is lead by the Chinese Classification Society CCS.

Rolls-Royce, Wärtsilä and ABS (American Bureau of Shipping) have been mentioned as external project partners.
Successful tests

Rolls-Royce has done two interesting remote operation tests

First one was a remote controlled Svitzer tug (project Sisu) and the second was a Finnish coastal ferry (project Svan)
L3 ASV and Sea Machines

In smaller work-boats and ASVs we have seen much more development and products are already in the market.

ASVs have been around for military use already a long time.

Smaller boats in restricted waters benefit from easier local rules, controlled traffic area and easier connectivity. And smaller boats cause less damage if they hit something 😊
Key elements and challenges in autonomous ships

Autonomous vessels need to **act** and **react** much in the same way as a **typical human of average abilities** would normally do.
Autonomous vessel operations and systems face a number of specific challenges related to technology, societal and legal aspects and naturally also the business case needs to be attractive.
Technology

Tech is a lot about safety and (cyber) security

Technological aspects include:

- Programmatic situational awareness (i.e., machine readable data on the surroundings)
- Reliability and integrity
- Sensor fusion
- Artificial intelligence and ML
- Production and life-cycle costs
- Maintenance of equipment
- Connectivity (there’s no 5G on the High seas – yet)
The legal framework and regulatory landscape is challenging also in shipping. This is mainly due to the fact that shipping is a hyper-global business with several hundred year old rules, regulations and practices. Not to mention flags-of-convenience and international politics.

However, local waters and areas are a different story! This gives local autonomous projects a potential to succeed more quickly.
“An Autonomous vessel will need to **assess** and **cope** with same types of events as conventional vessels”
Main categorisation of requirements

Compliance (Rules)
- COLREGs
- SOLAS (Ch 5)
- MARPOL
- Load Line, SAR, Local rules

No “Rights of way”
Good seamanship needs to be applied

Safety (reactive)
- Identify risk situations
- React according to Good seamanship
- Cross-reference data sources + data fusion

Safety is mainly tactical and reactive

Navigation
- Safely from point A to point B
- Effectively
- Safety corridor
- Keep out of potential problems

Strategic voyage planning
Tactical tasks here and now

Weather
- Interpret weather data
- Understand how this impacts the vessel
- Reference multiple sources
- Avoid dangerous weather

For autonomous vessels mainly tactical

Image source: Tallink Group
Business

Shipping is already the most efficient means of global transport

The business case for autonomous systems, autonomous ships and autonomous operations is a combination of many factors, as always.

Manned ships need life-support systems and many types of HMIIs. And they also usually carry a vast amount of spares and tools.

The effect of this is increased weight and reduced cargo capacity.

Note! Passenger vessels are special, since they will need all the life-support systems etc for the passengers. But these types of ships benefit from autonomous tech which can increase safety of the vessel itself and ALSO the surrounding traffic.
What happens next in this arena?

<<< FUTURE
Next steps...

Rolls-Royce envisages a remotely operated local vessel being the first stage and in operation by 2020.
THE ONE SEA VISION
The vessel will be delivered from Vard Brevik in first quarter 2020, and will gradually move from manned operation to **fully autonomous operation by 2022**.

**YARA BIRKELAND**
After collecting data and developing a system using domestic coastal ships and tugboats, a demonstration test will be carried out on a tugboat in the latter half of 2019.

By 2025, Japan is seeking to begin demonstrations for the practical implementation of autonomous ships.
Autonomous ship research and projects will most likely start in various parts of the world and the race is definitely ON!

Currently Norway has a very strong lead in the game with Kongsberg (strong in tech and very close ties to the government and Class) and Rolls-Royce (thought leader).

ESA has decided to fund PUBLIC research in this area and the Maritime AI-NAV project is one good example of this.

IMO has agreed on a definition of Maritime Autonomous Surface Ships (MASS) and on a framework for analysing the applicable IMO regulations.

Connectivity is getting better all the time, but the fact remains that it will be a challenging task.
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https://maritimeai.org/