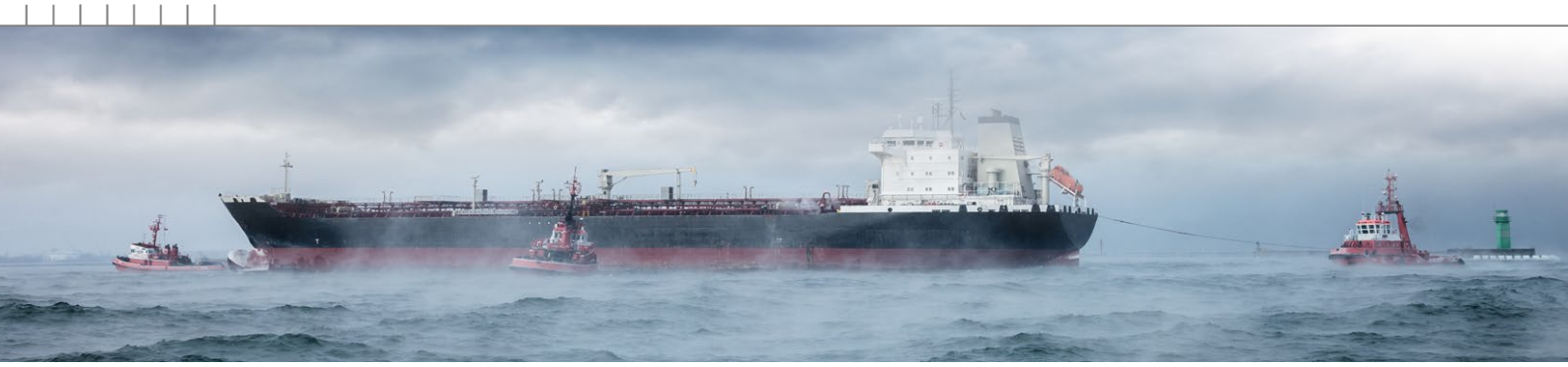


# AI support for the maritime future

## InnovationLab for smart, clean and safe shipping

**The economic and environmental sustainability of ship and offshore operations is becoming increasingly more complex. This is due to a combination of new regulations and ambitions for environmental-friendly and safe operations. New ship design with increased tonnages, innovative propulsion and more complex tasks add further complexities. Proper onboard and onshore advice on operation and design is needed to find optimal performance. Although physics based modelling sets a baseline, data driven algorithms can often bring the deciding advantage.**

**Activities covered in the InnovationLab:**

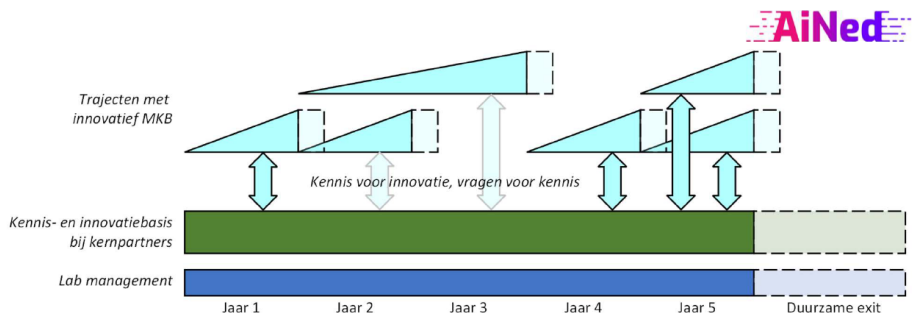
- Control in highly dynamic setups
- Image recognition in offshore environments
- Surrogate modelling for complex physics

### AiNed InnovationLab

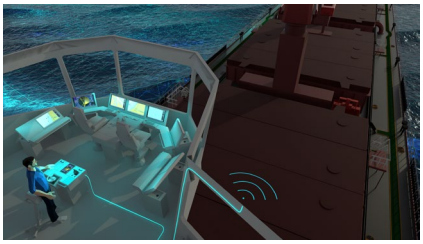
AiNed aims to develop a strong AI ecosystem in the Netherlands (https://ained.nl/). MARIN would like to contribute to this ecosystem by initiating an InnovationLab for the maritime industry to provide decision support for operational personnel.

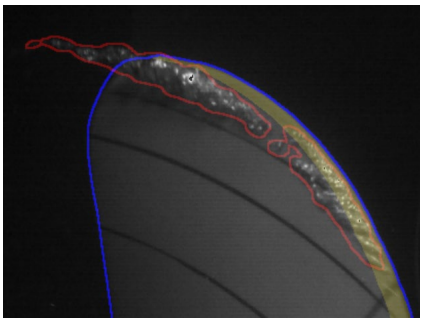
Within the InnovationLab, app developers, data consultants, companies and MARIN work together on developing AI techniques and tools to address challenges in an operational setting.

The InnovationLab has an open structure in which core partners ensure continuous development and provide support for a flexible ring of consortium members. These consortium members bring forward specific case studies which can be addressed using tools developed and supported in the InnovationLab. The lab management provides technical and strategic guidance to the InnovationLab.




*InnovationLab structure*



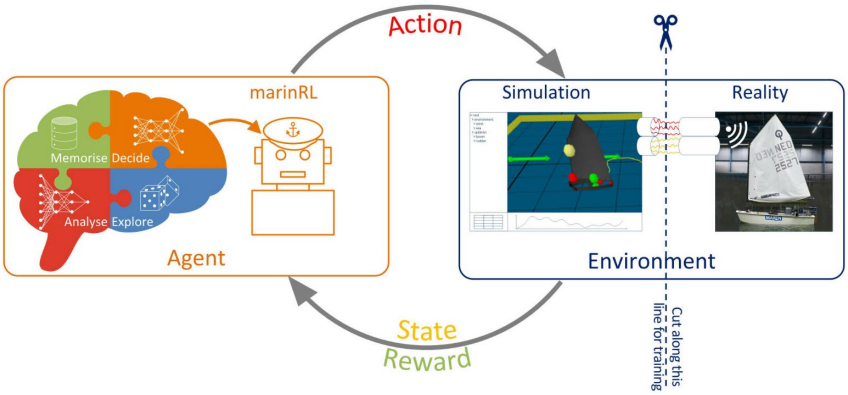


For more information contact MARIN:
Remco Hageman
T + 31 317 49 33 40
E r.hageman@marin.nl

## Scope of Work

Within the InnovationLab, a toolbox with AI techniques and tools will be developed. Together with physics based simulation tools, the toolbox will provide a powerful combination of techniques that can be used to solve practical challenges. The toolbox will initially focus on a set of applications:

- **Image processing for shipping and offshore applications**: Underwater inspection, relative positioning, object/ship detection and structural inspections may all use camera images. Even though image recognition was one of the earliest applications of machine learning, the additional challenges in a (subsea) offshore environment, with continuously moving platforms, distorted or polluted images and reduced visibility, provide some unique challenges that need to be addressed.
- **Data driven performance optimisation**: Modern computational methods are able to address complex physical phenomena that govern vessel behaviour. However, these models may be infeasible to provide decision support because of their complexity or computational requirements. Data driven models, based on actual operational data, provide quick and accurate insight in current and adapted operation. Herein lies the possibility to also collaborate through federated learning: training data driven models together, without sharing data.
- **Control for complex systems**: Optimising the operation is not just a matter of making better choices. Onboard systems can be controlled by algorithms trained in actual operations as well. This allows for specific, accurate, and low-latency solutions. Reinforcement Learning (RL) is one such algorithm, with the specific property of optimising for long-term gain, while keeping stable short-term performance. Insights in good procedures for conducting RL are developing at high pace. With a good base from the MARIN-RL toolbox, relevant use cases can be taken on right away, such as control for roll reduction or wind propulsion systems.




*https://magazine.marin.nl/marin-report-139/ai-sail*

## Work Package X

Developments in the world of AI are going fast. For example, Large Language Models have quickly proven their value in specific applications and are still evolving. In the next few years, more new technologies will surely arise. So, while the Scope of Work for the first few years will be defined within the project agreement, the InnovationLab will have the freedom to address new emerging technologies in its toolbox as well. This is work package X.