

# **International Energy Agency- Hydrogen Implementing Agreement**

## **Task 39: Hydrogen in Maritime Transport**

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# Laboratories



Towing tank



Ocean Basin



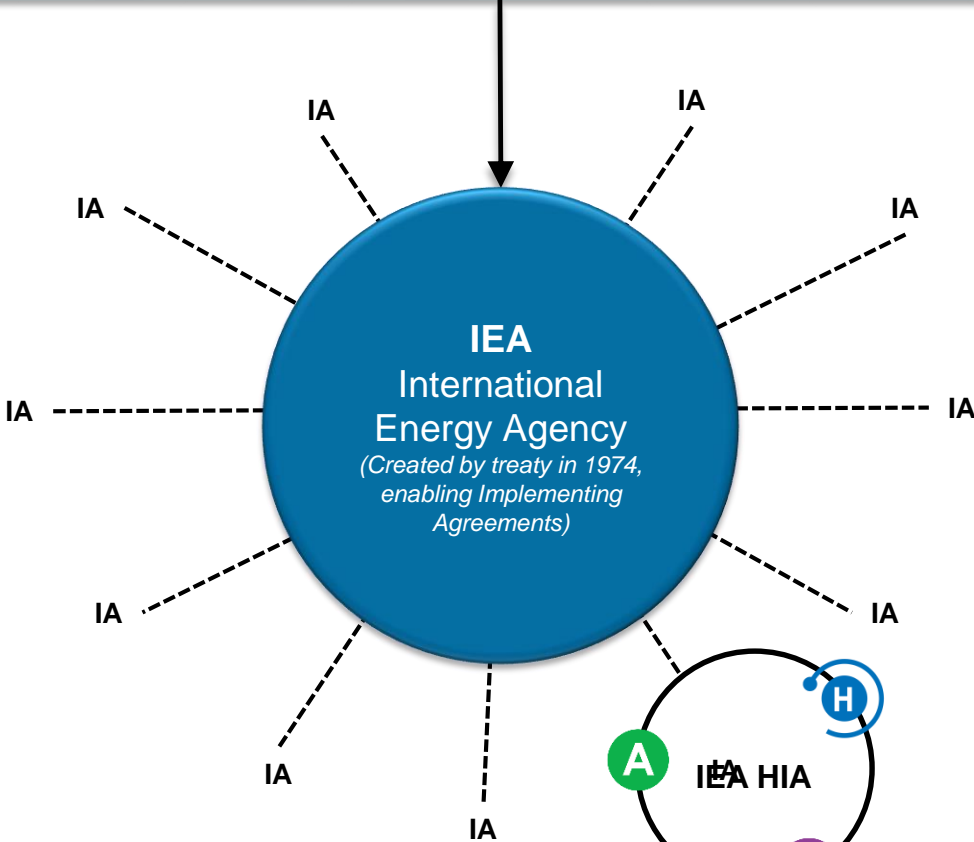
Marine Cybernetics Laboratory



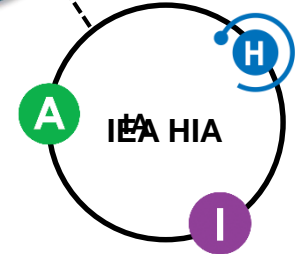
Research vessel 'Gunnerus'

Other specialized experimental facilities (e.g. for sloshing tests)

**OECD**  
Organisation for Economic Co-operation and Development  
*(Created by treaty post war)*



Implementing Agreements



International Energy Agency Hydrogen Implementing Agreement  
(Created by treaty in 1977)

## Strategic Framework 2009–2020

### **Vision:**

A hydrogen future based on a clean sustainable energy supply of global proportions that plays a key role in all sectors of the economy

### **Mission:**

To accelerate hydrogen implementation and widespread utilization to optimize environmental protection, improve energy security and promote economic development internationally while establishing the HIA as a premier global resource for expertise in hydrogen

### **Strategy:**

To facilitate, coordinate and maintain innovative research, development and demonstration activities through international cooperation and information exchange



# IEA HIA Members - Executive Committee (October 2016)

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**UNIDO (UN)**  
TBA



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**21 Countries + European Commission + UN + 4 Sponsors**

# Themes and Portfolios

## Collaborative RD&D that advances hydrogen science and technology

- Hydrogen production
- Hydrogen storage
- Integrated hydrogen systems
- Integration of hydrogen in existing infrastructure

## Analysis that positions hydrogen

- Technical progress and optimization
- Market preparation and deployment
- Support in political decision-making

## Understanding, Awareness and Acceptance that fosters technology diffusion and commercialization

- Information dissemination
- Safety
- Outreach

# IEA-HIA Task 39: Hydrogen in Maritime Transport

- **Overall Goal:**

To provide knowhow on the use of hydrogen and fuel cells in the maritime, evaluate concepts and initiate research and demonstration projects

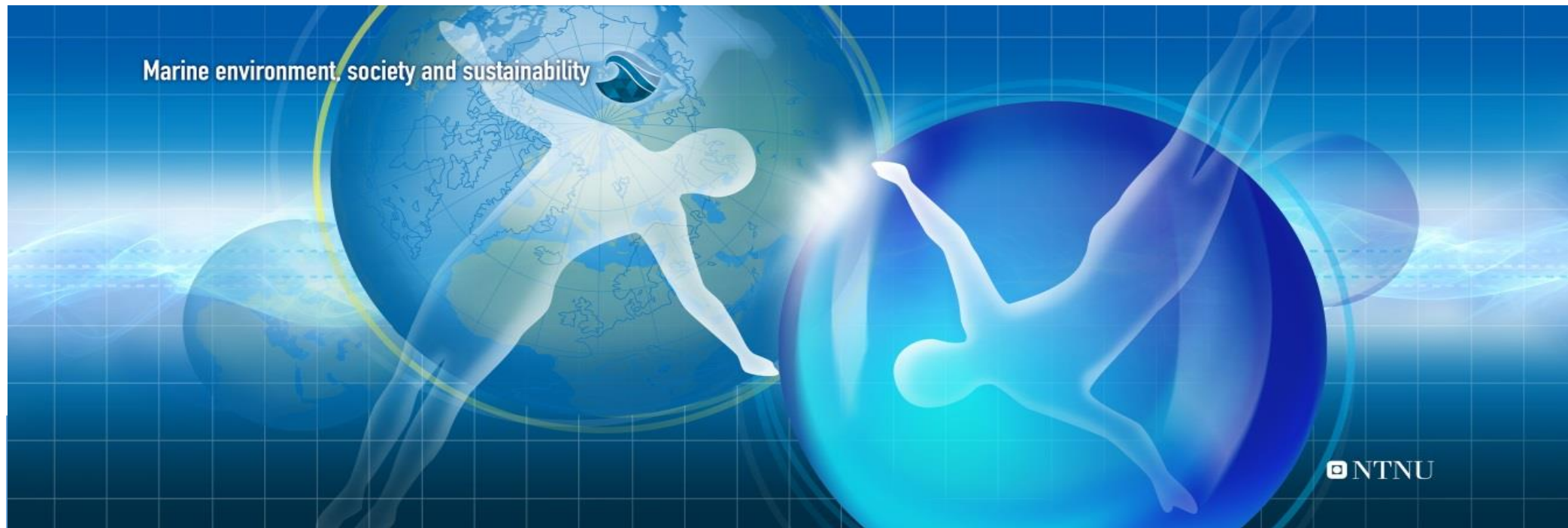
- Research within the area
- Technology monitor for ongoing activities
- Contributing to a global regulatory framework

- **Timeline:** 2017–2020

- **Director:** Prof. Ingrid Schjølberg, NTNU Oceans



# Oceans at NTNU



Maritime

Underwater  
science/  
technology

Polar  
research

Marine  
bio-resources

Marine  
minerals and  
energy

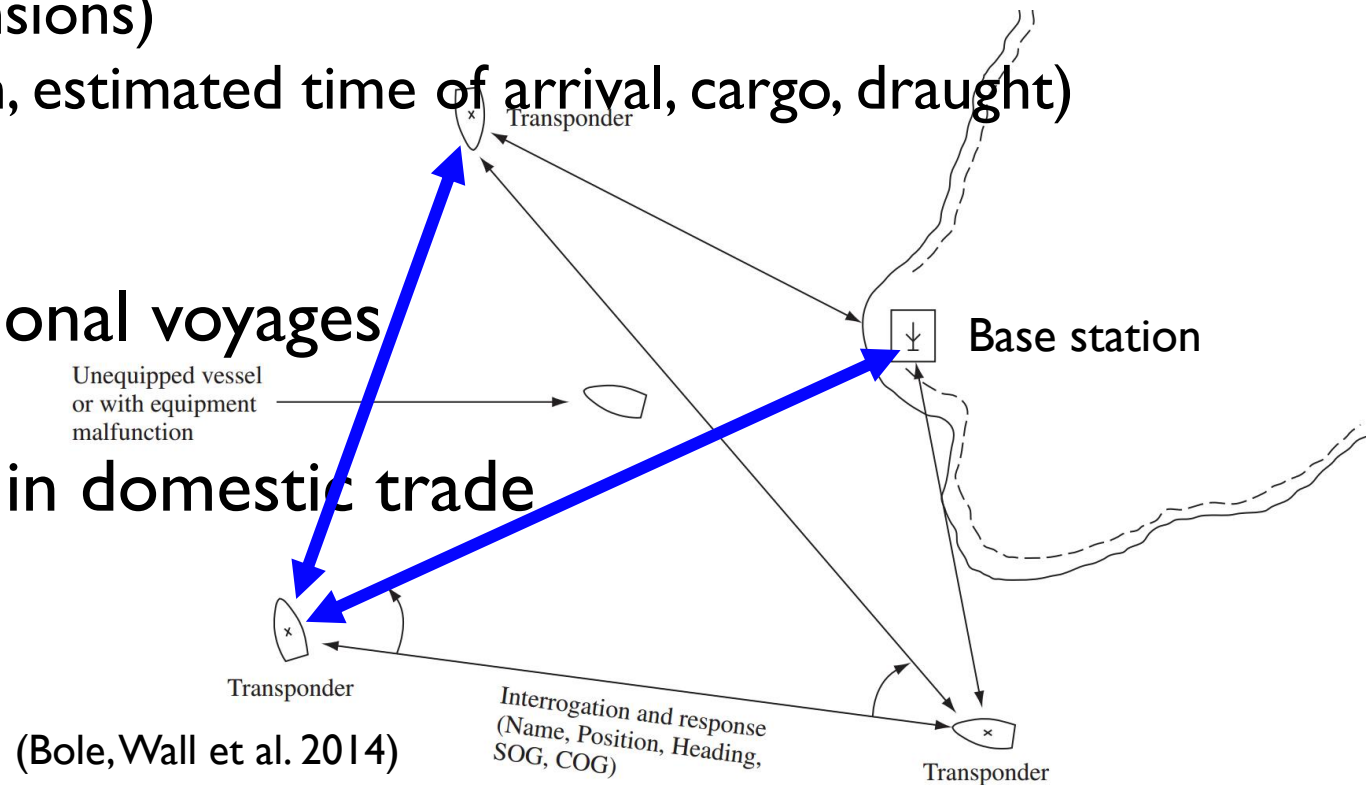
Enabling  
technology

Marine  
infrastructure

Marine  
environment,  
society and  
coastal  
development

# Current research on hydrogen in maritime transport at NTNU OCEANS

- Automatic Identification System (AIS)
  - Traffic monitoring
  - Dynamic (position, course, speed)
  - Static (identity, vessel type, dimensions)
  - Details on the sailing (destination, estimated time of arrival, cargo, draught)
- Ships above 300 GT in international voyages
- All passenger ships
- High-speed boats over 150 GT in domestic trade
- ...



AIS data



Changes in speed



Estimating load factor



Estimating fuel  
consumption



Estimating emissions

Hydrogen and fuel cells  
together with batteries  
for part load?



Hydrogen and fuel cells  
together with batteries  
for peak power shaving?



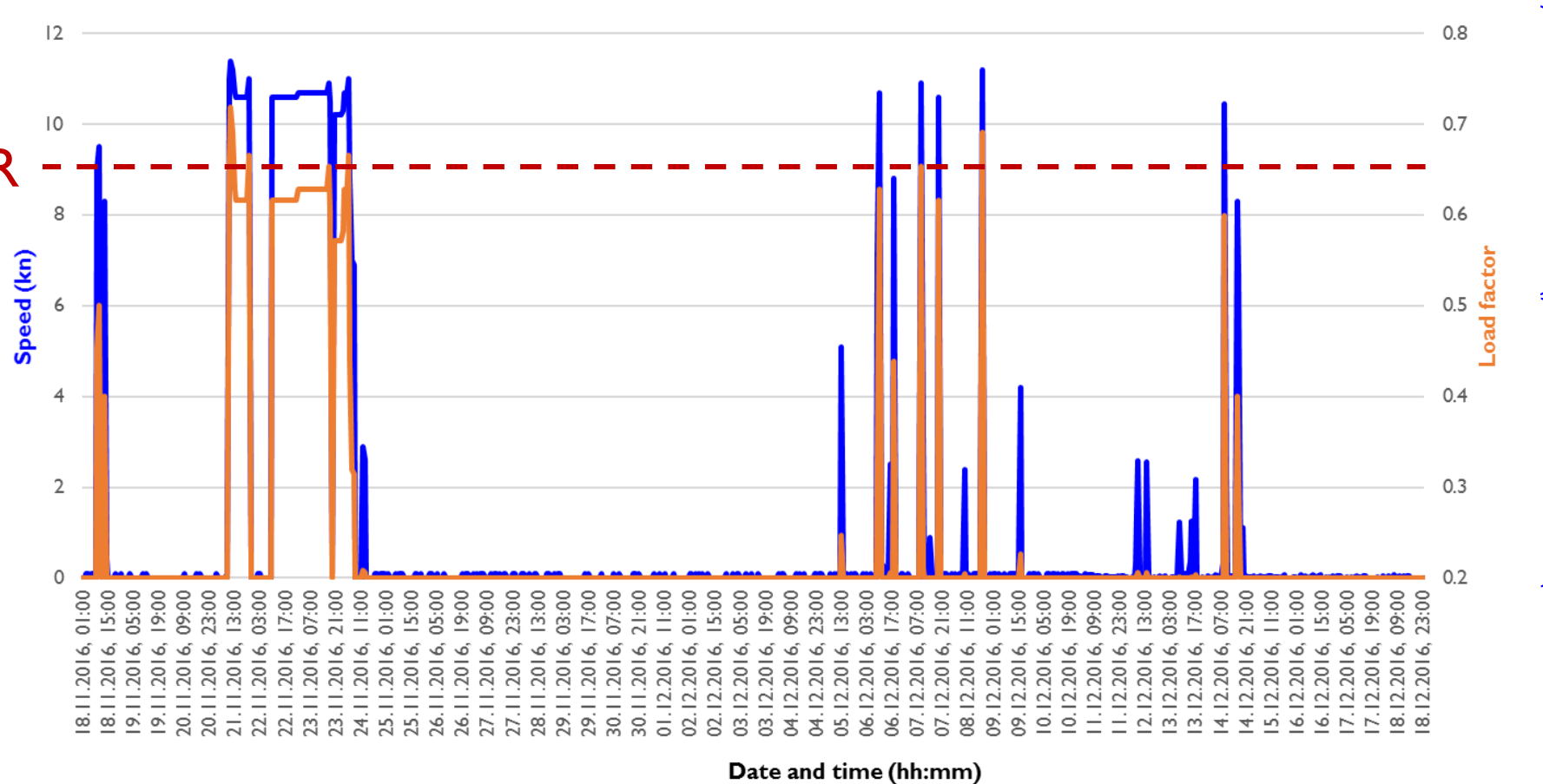
# R/V Gunnerus

- Length overall: 31.25 m
- Breadth extreme: 9.90 m
- Depth moulded at main deck: 4.20 m
- Main propulsion: 1000 kW
- Speed at 100% MCR: 12.60 kn
- Cruising speed: 9.40 kn

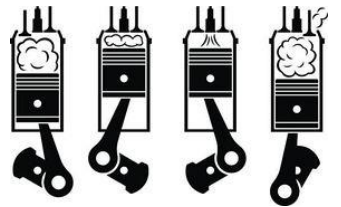


# Speed and load factor during a month

65% MCR



Hydrogen  
and fuel cells



# IEA-HIA Task 39: Hydrogen in Maritime Transport

## Subtasks:

- Technology Overview
- New Concepts
- Safety and Regulations
- Demonstration



# Subtask I: Technology Overview

- **Sub goal:** Investigate possibilities for use of hydrogen in maritime transport
- Define system segments under investigation (short/deep sea, offshore)
- Energy systems: fuel cells and battery
  - Impact on emissions
  - Peak power handling
- Economic and business case analysis
- Fuel supply logistics/infrastructure (harbor and onboard)

# Subtask II: New Concepts

- **Sub goal:** Contribute to concept evaluation and identification of challenges and opportunities
- New builds, design and impact
  - Autonomous vessels with fuel cell based propulsion
- Retrofitting existing vessels with fuel cells
- Fuel cell system solutions
  - Marine applications
  - Design and configuration
  - System integration

# Subtask III: Safety and regulations

- **Sub goal:** Contribute to safety and risk management
- Overview of regulations, codes and standards and upcoming regulations related to systems and emissions
- Safety methods and models
  - Safety analysis in the engine room/storage
- Risk management for design and operations

## Subtask IV: Demonstration

- Sub goal: Support, provide input to, evaluate and link international demonstration projects
- Generate an overview of existing projects
- Create an international database
- Link communities, experience and practice

# Expert meetings

- February 13–14, 2017, Oslo
- 40 Participants
- 15 countries
- 29 institutions



# Oslo meeting

- Hydrogen and fuel cells in maritime transport: an overview
- Marine applications of fuel cells
- Safety codes and standards
- Hydrogen infrastructure and storage
- Fuel cells suitable for marine applications
- Energy systems and management



# Next expert meeting

- September 26–27, 2017, Delft
- Learn the latest news on ongoing research projects and industrial advances
- For more information visit:  
<https://www.ntnu.edu/oceans/iea-hydrogen>

# How to become a member?

- Two expert meetings per year
- Writing a chapter for the final report
- Filling up a form
- Interested?  
Contact Sepideh Jafarzadeh  
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# Thank you!

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