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1

Maritime Transport Research Unit

University of Strathclyde Glasgow

Europe-Korea Conference on Science and Technology 2021

EKC 2021
Europe-Korea Conference on Science and Technology



By Prof. Evangelos Boulougouris

24 Oct 2021

X THE PLACE OF USEFUL LEARNING

Faculties

01
Engineering



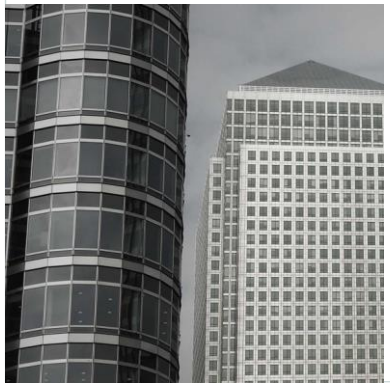
02
Humanities and Social Sciences



03
Science



04
Strathclyde Business School





Naval Architecture, Ocean and Marine Engineering

The department of ***Naval Architecture, Ocean and Marine Engineering (NAOME)*** was formed in 2001 through the merger of the department of *Ship and Marine Technology* at the ***University of Strathclyde*** and the department of Naval Architecture and Ocean Engineering at the ***University of Glasgow***, which have been involved in teaching and research in naval architecture since 1881.

https://www.strath.ac.uk/engineering/navalarchitectureoceanmarineengineering/

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Ranking > 2021 Global Ranking of Academic Subjects

2021 Global Ranking of Academic Subjects

2021

ShanghaiRanking began to publish world university ranking by academic subjects in 2009. By introducing improved methodology, the Global Ranking of Academic Subjects (GRAS) was first published in 2017. The 2021 GRAS contains rankings of universities in 54 subjects

Read More

Search a university

Marine/Ocean Engineering

50 Institutions

World Rank	Institution	Country/Region	Total Score	Q1
1	Shanghai Jiao Tong University		285.0	100
2	Norwegian University of Science and Technology - NTNU		258.5	79.2
3	Harbin Engineering University		251.8	81.7
4	University of Strathclyde		247.7	73.6
5	Dalian University of Technology		244.6	82.3
6	University of Lisbon		243.2	68.9
7	Wuhan University of Technology		210.3	61.1
8	Delft University of Technology		210.0	66.1

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NAOME – Research Team & Collaboration

- We have the **Europe's largest Marine Technology Research Students / Staff team** (**Approx. 140**) to sustain the production of useful and innovative ideas
- Our academic staff (**29**) are **internationally recognised** for their expertise including **international leaders** with significant achievements
- Our **close links with the industry** (**over 300 companies**) and other research institutes further strengthen our research team by the contribution of leading visiting researchers



Department of Naval Architecture, Ocean and Marine Engineering (NAOME) - Location

THE UNIVERSITY OF STRATHCLYDE

DEPARTMENT OF NAVAL ARCHITECTURE, OCEAN AND MARINE ENGINEERING

University of Strathclyde

Henry Dyer Building,

100 Montrose Street,

Glasgow G4 0LZ, UK

www.strath.ac.uk/naome/



HENRY DYER Building



STRATHCLYDE UNIVERSITY - A campus in the heart of Glasgow City

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NAOME - Experimental facilities



University of Strathclyde Engineering



Full Mission Bridge Simulator



Kelvin Hydrodynamics Laboratory



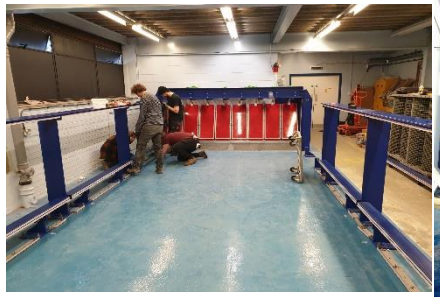
Fully turbulent flow channel



Marine Engineering Laboratory



Yacht *“Catalina”*



Small ocean basin



Field measurement equipment

NAOME's strategic direction and vision :

Sustainable Ocean Energy & Transport

- *The climate emergency is a University of Strathclyde and global priority. NAOME has the track record and kudos to* ***lead major research thinking in the key areas of Ocean Energy and Marine Transport****;*
- *By creating a clear and distinctive focus, we will* ***concentrate academic efforts, raising international visibility and impact in research and student attractability.***

Therefore, NAOME's research is organized in two ***Research Units:***

- ***The Ocean Energy Research Unit***
- ***The Maritime Transport Research Unit***

Ocean Energy Research Unit

- Professor Athanasios Kolios
- Professor Feargal Brennan
- Professor Maurizio Collu
- Dr Andrea Coraddu
- Professor Sandy Day
- Dr Laibing Jia
- Dr Liang Li
- Professor Ali Mehmanparast
- Professor Erkan Oterkus
- Dr Selda Oterkus
- Dr Julia Race
- Dr Weichao Shi
- Professor Longbin Tao
- Dr Qing Xiao
- Dr Zhiming Yuan

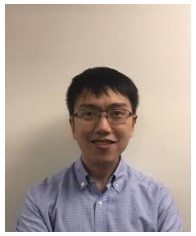










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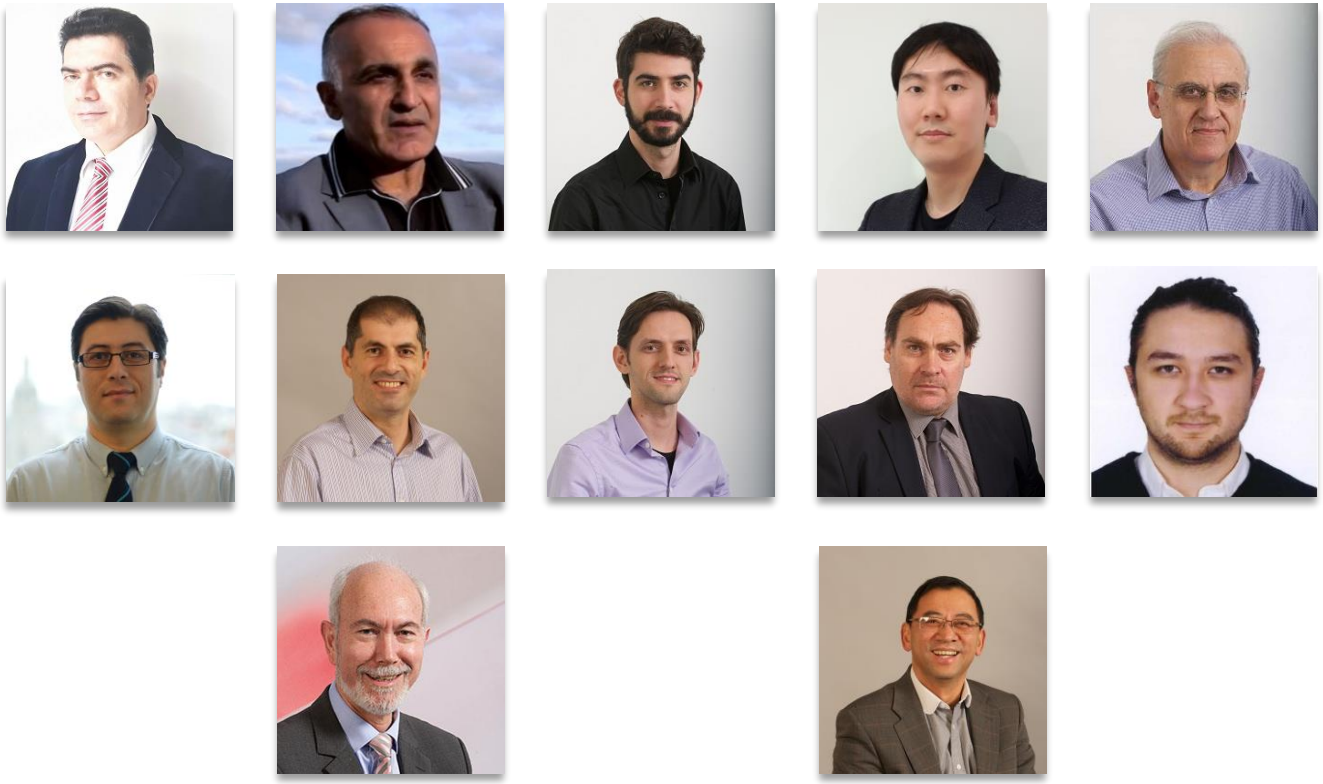
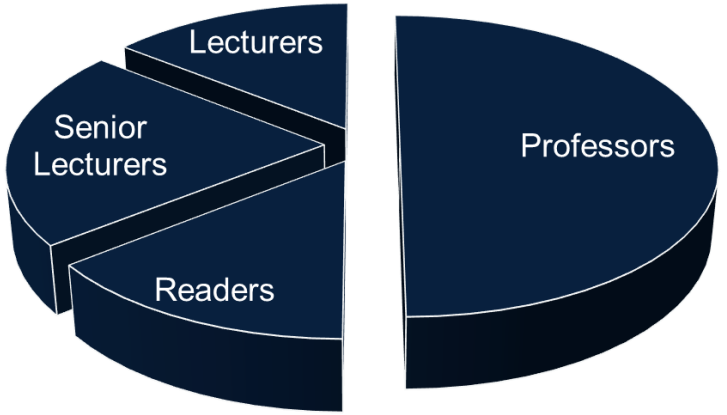
Marine Transport Research Unit - MTRU

Prof Evangelos Boulougouris

Prof Mehmet Atlar
Dr Yigit Kemal Demirel
Dr Byongug Jeong
Dr Panagiotis Kaklis
Prof Dimitrios Konovessis
Dr Rafet Kurt
Dr Iraklis Lazakis
Dr Tahsin Tezdogan
Prof Gerasimos Theotokatos
Dr Sefer Gunbeyaz
Prof Osman Turan
Prof Dracos Vassalos
Prof Peilin Zhou





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MTRU Research Interest Mapping

Research interests	MA	PK	TT	YKD	OT	IL	GT	EB	BJ	PLZ	SAG	EK
Fluid-structure interaction	■	■	■	■								
Experimental methods	■		■	■	■							
Energy efficiency of ships	■	■	■	■	■	■	■	■				
Computational (CFD) hydrodynamics,	■	■	■	■				■				
Conventional and unconventional hullform hydrodynamics, design and optimisation	■	■	■	■	■			■				
Ship performance at sea	■		■	■	■		■	■	■			
Experimental hydrodynamics	■			■								
Energy Saving Devices (ESDs)	■	■			■				■			
Seakeeping of ships & Offshore structures			■					■				
Collision and grounding of ship structures					■			■				■
Propulsor-hull interaction and optimisation	■			■	■							
Conventional and unconventional propulsor hydrodynamics, cavitation, vibration and underwater noise	■											
Antifouling coatings and fouling hydrodynamics	■			■	■							
Drag reduction	■			■								
Underwater vehicle hydrodynamics								■				
Fire damage in composite materials									■			
Energy efficient ship design and operation	■	■	■	■	■	■	■	■	■	■		■
Design and operational safety of ships					■			■	■			■
Intact & damage stability					■			■				
Maritime safety and safety culture assessment					■		■	■	■			■
Prevention of losses of lives & assets					■			■	■			■
Life cycle risk management					■	■	■	■	■	■		■
Maritime Human factors,					■							■
Experimental investigation of human performance					■							■
Maritime Resilience					■							■
Safety Culture and Just culture assessments					■							■
Ship manoeuvring in confined waterways	■		■									
Design and operability of underwater vehicles								■				
Maritime workarounds and efficient standard operational procedures,					■							■
Reliability assessment						■			■			
Operations and maintenance/asset management					■	■	■		■			
Safety, Risk assessment & management					■		■	■	■			■
Predictive reliability & criticality assessment						■	■	■	■			
Database development and data management					■	■		■				
Inspection, condition monitoring (remote sensors), repair strategies)						■	■					
Logistics support, cost benefit analysis and GUI tools								■				
Decision Support Systems, & control of uncertainty						■	■	■	■			
Optimal ship/weather routing and fuel consumption					■	■		■				
Real-time monitoring and predictive analytics						■		■				
Maritime policy making					■	■		■	■			■
Ship building and repair facilities planning						■		■				
Marine accident investigation					■	■	■	■				■
Ship recycling					■						■	■
Development and optimization of ship recycling yards and processes,					■						■	■
Inventory of hazardous materials,											■	■
Environmental impacts of ship recycling,					■						■	■
Risk assessment, application of circular economy to shipping,							■	■	■		■	■
Remanufacturing of marine assets,											■	■
Assessment of health and safety conditions in ship recycling yards,					■						■	■
Training needs assessment, development of vocational education and training,					■			■			■	■
Life cycle analysis										■		■
Shipyard green technology									■			■
Ship ballast water management												■
Surface modelling, fairing & reconstruction		■										■
IGA for free surface hydrodynamics		■										
Parametric modellers		■										■
VR environments									■			■
Ship power plant and systems											■	■
Marine Engines											■	■
Alternative propulsion systems	■											■
Waste Heat Recovery Systems												■
After Treatment Units												■
Alternative Fuels											■	■
Fuel Cells												■
New Technologies											■	■
Energy Management										■	■	■
Ship systems maintenance										■	■	■
Dynamic response to waves (including steep/breaking waves)												■
Dynamics of offshore structures												■
Structural design												■
Offshore decommissioning												■
Course keeping and course changing control												■
Human-System Design and Integration										■		
Occupational Accidents										■		
Bridge Resource Management										■		
Optimisation and simulation of Operations & Maintenance activities										■	■	
Life cycle assessment											■	
Reliability analysis											■	
Risk assessment/management of offshore assets										■	■	
Condition monitoring											■	
CTV Design and Operation	■		■							■		
Energy economics and policy										■		
Shipyard design and optimisation											■	
Process optimisation												■
Human in the loop simulations										■		
Human Reliability Assessment										■		
Human Performance in Offshore Wind Farm Operation and Maintenance										■		
Occupational Accidents in Offshore Wind Farms										■		
ML (Machine Learning) methods for NAOME applications		■										
Shallow water hydrodynamics	■		■									
Cyber-Physical Systems and Autonomous Ships											■	
Marine and Ship Systems Safety, Energy Efficiency & Sustainability											■	
Digital twins											■	
Multihull vessels design, optimisation												
Crashworthiness												
Naval Ship Design (incl. signatures)												
Fire modelling on ships												
Evacuation & abandonment												
Virus spread onboard ships												

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Shipping's Decarbonisation

Operational Measures	• Weather Routing	• New Charter Arrangements	
	• Speed Optimisation	• Just In Time Shipping	
	• Vessel Performance Reporting	• Smart Vessel/ Improved Reliability	• Fleet Interactive Performance Optimisation
Technology Improvement	• Air Lubrication	• Improved Hull & ESD Options	• Wind/Solar
	• Hybrid	• Fuel Cells	• Electric Propulsion
	• Cold Ironing	• Carbon Capture (Shore/ship)	
Alternative Fuels and Energy Sources	• LNG		• Hydrogen
	• LPG/Ethane	• Ammonia	
	• Methanol (Regional)		
	• Biofuels (Regional)	• Biofuels (Global)	

2050

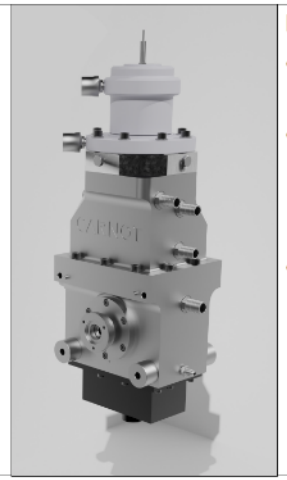
Shipping's Route to 2050

DfT Clean Maritime Demonstration Competition – MTRU

Carnot Marine Vessel APUs - Feasibility Study

Project Deliverables

- Project Plan for ultra-efficient, net zero Carnot ceramic engine APU demonstrator on Carisbrooke cargo vessel
- Life-Cycle Assessment
- Market Assessment
- Regulations/Safety Case Assessment



Long-Term Ambitions

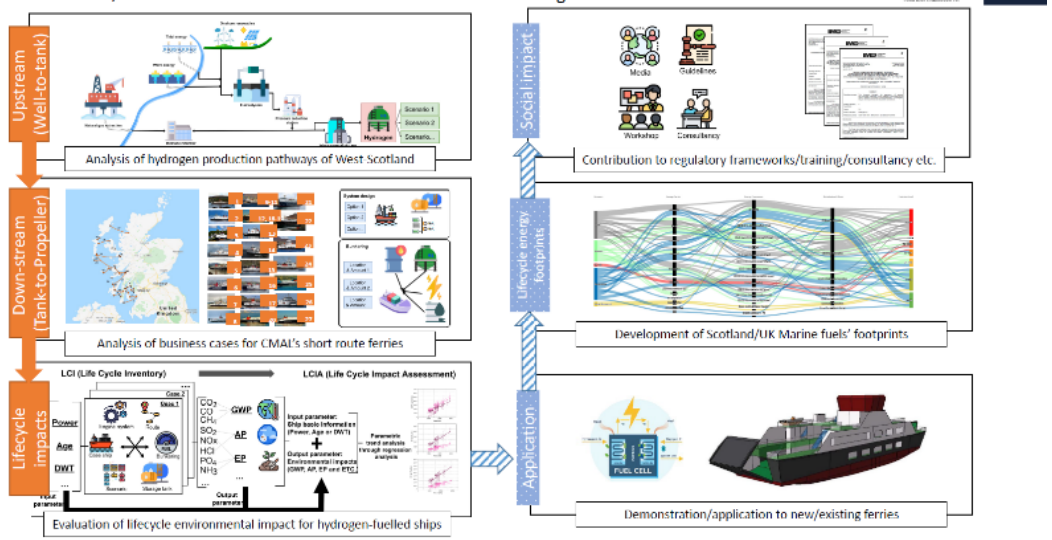
- Demonstrate reliability in operational environment
- Form manufacturing partnership with industrial player and license technology
- Develop < 10MW propulsion systems for marine vessels

CLEANSHIP optimat CARNOT CARISBROOKE SHIPPING

Lifecycle Energy Solutions for Clean Scotland/UK Maritime Economy

CMAL

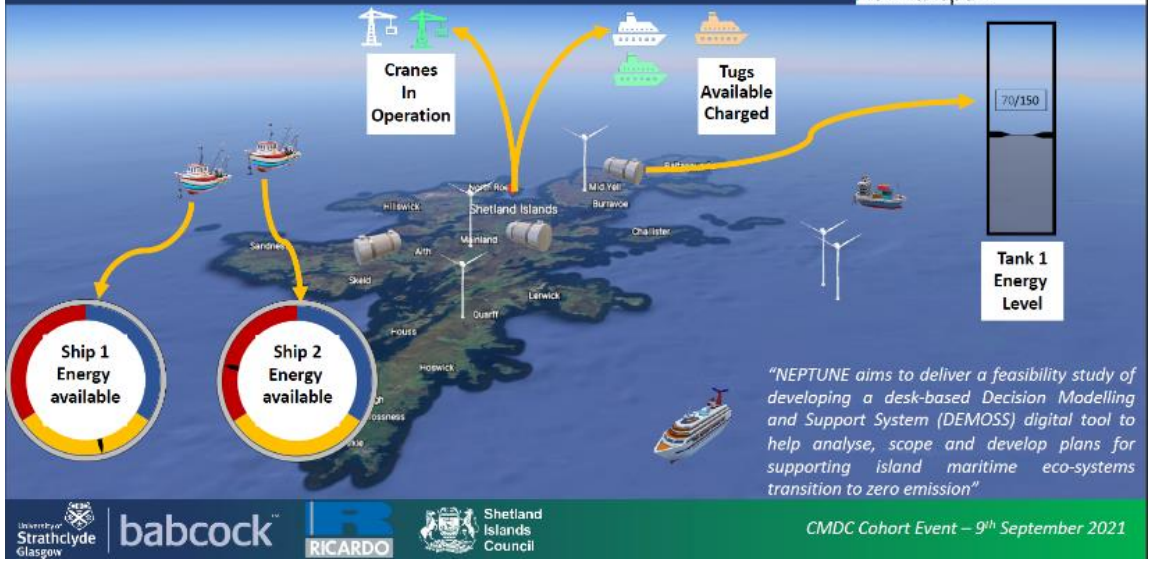
- Outlines/deliverables
- Long-term ambition



Project NEPTUNE

Project Neptune is part of the Clean Maritime Demonstration Competition, funded by the Department for Transport and delivered in partnership with Innovate UK.

Department for Transport | UKRI Innovate UK



"NEPTUNE aims to deliver a feasibility study of developing a desk-based Decision Modelling and Support System (DEMOSS) digital tool to help analyse, scope and develop plans for supporting island maritime eco-systems transition to zero emission"

University of Strathclyde Glasgow | babcock | RICARDO | Shetland Islands Council

CMDC Cohort Event – 9th September 2021

UKRI Innovate UK

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NAOME - Maritime Safety Research Centre

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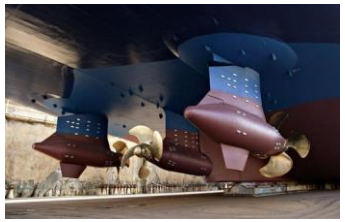
Research areas

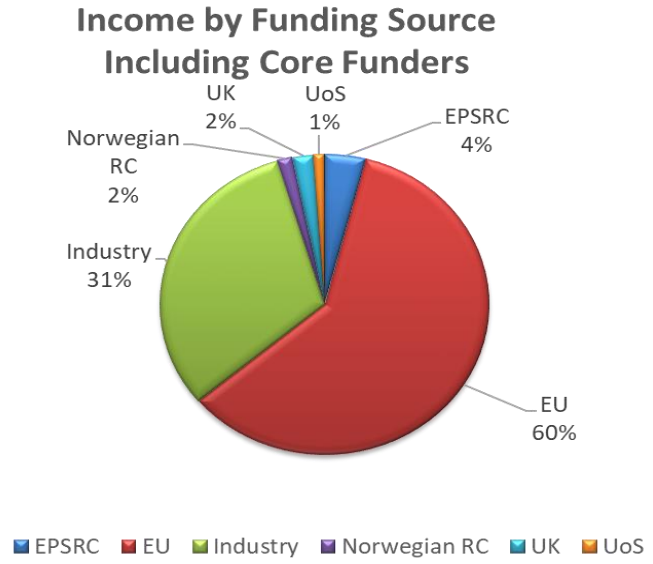
- Complex system safety & security
- Dynamic barrier management
- Intact & damage stability of cruise ships
- Safety culture
- Fire protection & prevention
- Blackout prevention
- LSA
- Evacuation
- Accidents
- Navigational practices



Funding

- MSRC succeeded to attract around **£10M** research funding from various sources, in 3 years after its establishment
- 4 H2020 Successful Applications in 2019!



Output

- 20 Journal Papers per year
- +30 Int. Conference Papers per year
- 2 PhD completions per year
- 10 UG Diploma thesis per year
- 12 Running Projects

DNV·GL
University of Strathclyde Engineering
RoyalCaribbean INTERNATIONAL



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MARITIME SAFETY RESEARCH CENTRE

SHIPFC
GREEN AMMONIA ENERGY SYSTEM

HyShip

TrAM

FLARE
FLOODING ACCIDENT RESPONSE

SafePASS

AUTOSHIP
Autonomous Shipping Initiative for European Waters

NEXUS

Interreg
Atlantic Area
European Regional Development Fund

EUROPEAN UNION

IN 4.0

HOLISHIP

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NAOME – Maritime Human Factors Centre(MHFC)

University of Strathclyde Engineering

Industry-Focused Maritime Human factors Centre is the international home for maritime human factors to enhance the maritime safety.

Performs world leading research in collaboration with other human factors groups around the world and industry.

Supports the maritime industry towards achieving safer and more efficient human operations by offering consultancy services, training, CPD courses

Attracts high quality researchers and students to train the next generation of researchers through provision of PhD degree

Generates top quality research outputs that will inform and motivate next generation of human factor researchers all over the world.

MRFC is supported by the experimental facilities and human monitoring tools

Full Mission Ship Bridge Simulator



VRLab







Wireless EEG Tobii Eyetracking Glasses



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Research Projects
MTRU

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AUTOSHIP Project

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MARITIME SAFETY RESEARCH CENTRE

AUTOSHIP
Autonomus Shipping Initiative for European Waters

https://www.autoship-project.eu/

11 Partners
DURATION: 2019-2023
BUDGET: 27.7M EUR





CiaoTech PNO — KONGSBERG — SINTEF

ITALY
Ciaotech S.r.l. – PNO Group
www.pnoconsultants.com/it

NORWAY
Kongsberg Maritime CM AS
www.kongsberg.com/maritime

Kongsberg Maritime AS
www.kongsberg.com

Kongsberg Digital AS
www.kongsberg.com/digital

Kongsberg Norcontrol AS
www.kongsberg.com/en/kds/knc

NORWAY
Sintef Ocean AS
www.sintef.no/en/ocean

SCOTLAND
University of Strathclyde
www.strath.ac.uk

NORWAY
Eidsvaag AS
www.eidsvaag.no

BELGIUM
Blue Line Logistics NV
www.bluelinelogistics.eu

FRANCE
Bureau Veritas
group.bureauveritas.com

BELGIUM
DE VLAAMSE WATERWEG NV
www.vlaamsewaterweg.be

The project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement N°815012.

Scope

- **2 remote and autonomous vessels** and their shore control and operation infrastructure (over TRL7)
- Testing during two pilot demonstration campaigns
- Optimise efforts and investments to advance common standards and enabling operations in a shorter timeframe
- Allow commercial applications of the technology behind the next generation of autonomous ships by the end of 2023

Contact: Prof. Gerasimos Theotokatos

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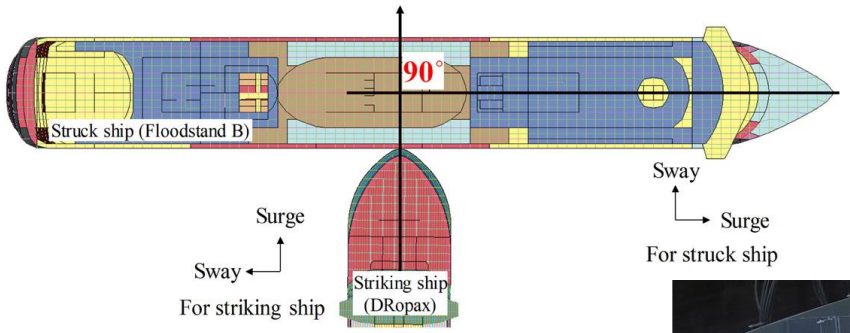
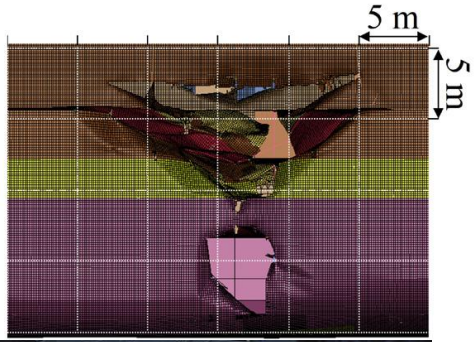
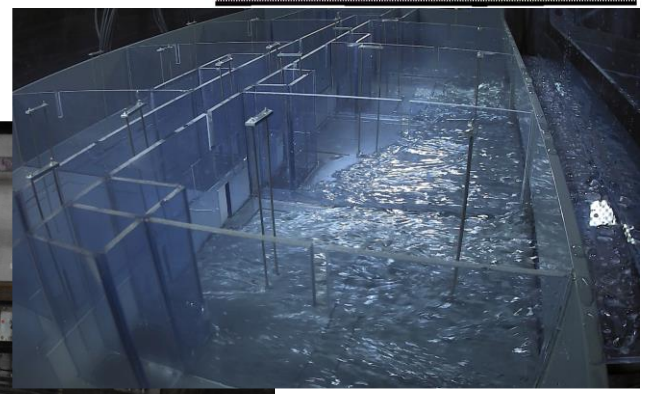
HORIZON 2020

FLARE
FLOODING ACCIDENT RESPONSE

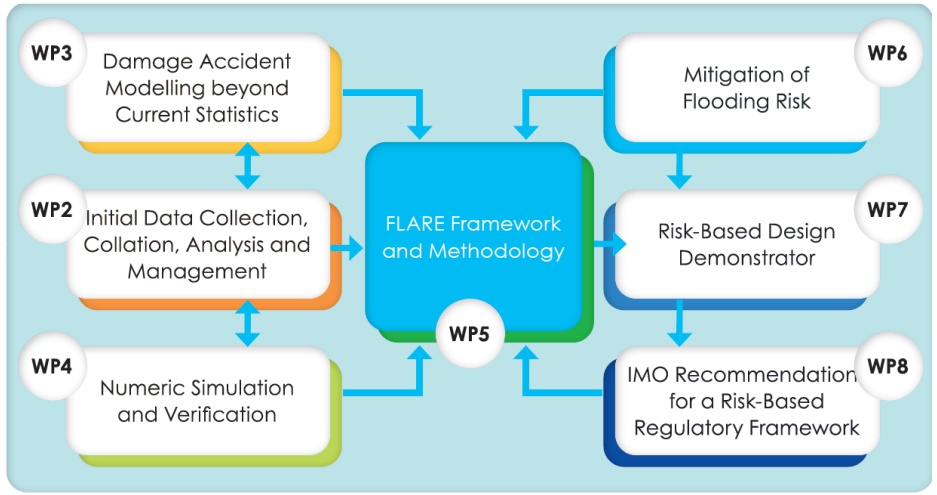
https://flare-project.eu/











21 Partners
DURATION: 2019-2022
BUDGET: 9.4M EUR

Aim

A risk-based methodology for "live" flooding risk assessment and control, by developing a generic and holistic risk model with potential application to newbuildings and existing ships.

Contact: Prof. Dracos Vassalos

The project has received funding from the European's Horizon 2020 research and innovation programme (Contract No.: 814753)

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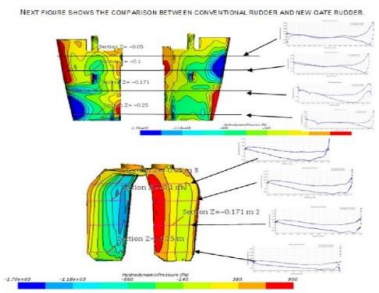
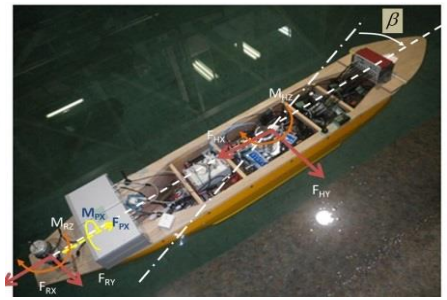
The EC - H2020 Project "GATERS": GATE Rudder System as a Retrofit for the Next Generation Propulsion and Steering of Ships.

(Project ID: 860337)











OBJECTIVE: To develop and demonstrate to TRL 6 and higher innovative, cost-effective retrofit solution for marine shipping to provide substantial improvements regarding environmental impacts and life cycle cost

DURATION: 2021-2024
BUDGET: 5.9M EUR

PARTNERS (18) : *UoS*(UK)*, *HSVA*(DE), *BV*(FR), *GME*(GR), *CNR*(I), *HYD*(TR), *ITU* (TR), *TWI* (UK), *NAS*(MT), *CAPA*(TR), *SINTEF(*NO), *DANAOS*(CYP), *SMP*(UK), *GURD*(TR), *UNEW*(UK), *STARB*(CYP), *LLI*(UK), *CETENA*(I)

(*) The NAOME Dept, University of Strathclyde (UoS) is the Project Coordinator (Prof Mehmet Atlar)



Contact: Prof. Mehmet Atlar

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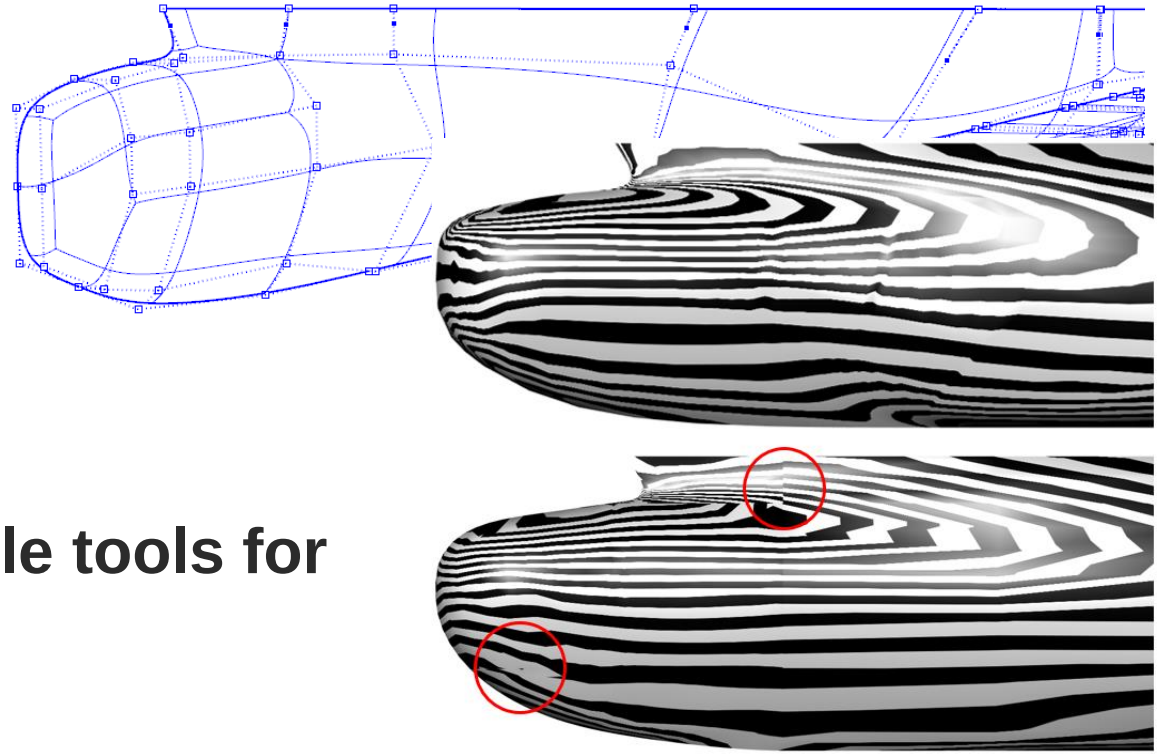
GRAPES : learninG, pRocessing, And oPtimising shapES

http://grapes-network.eu/

Marie Sklodowska-Curie Actions
Innovative Training Networks (ITN)

area: Mathematics
GA: 860843
duration: 1/12/2019 -31/11/2023

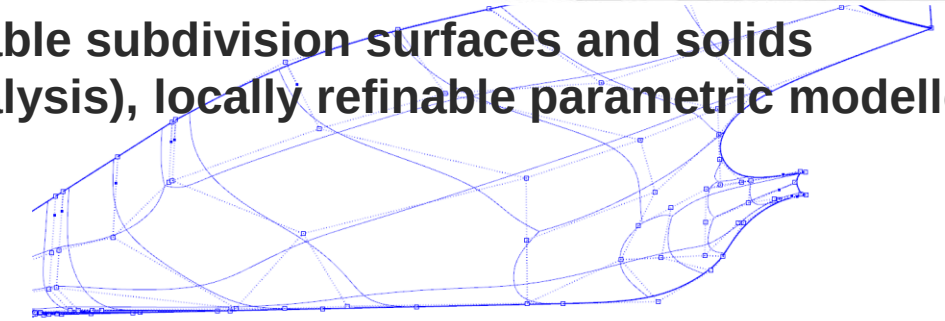


NAOME is leading WP2:

Algebraic and analysis-suitable tools for efficient shape optimisation

Tasks:

- **Modelling and simulation using analysis-suitable subdivision surfaces and solids**
- **Shape optimisation via IGA (Isogeometric Analysis), locally refinable parametric modellers and dimensionality reduction**
- **Multi-degree spline technologies for IGA**
- **Barycentric rational curves and surfaces methods in multiview geometry**



Contact: Dr. Panagiotis Kaklis

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HyShip

UNIVERSITY of STRATHCLYDE
MARITIME SAFETY RESEARCH CENTRE



14 Partners
DURATION: 2021-2025
BUDGET: 11M EUR

Wilhelmsen NorSea Norwegian Centres of Expertise NCE Maritime CleanTech equinor KONGSBERG LMG MARIN DNV·GL Air Liquide ETH zürich sus.lab DIANA SHIPPING INC. NORLED University of Strathclyde Persee Stolt-Nielsen

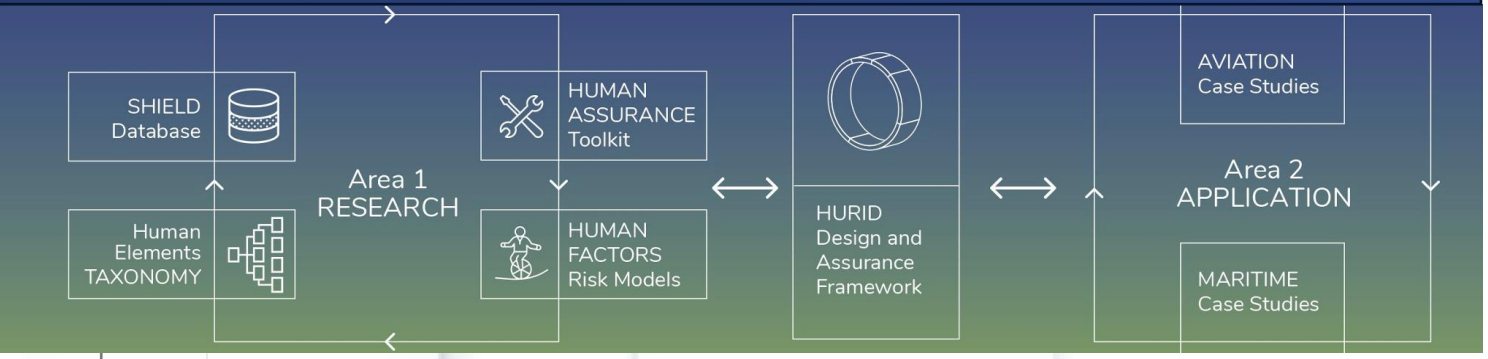
Contact:

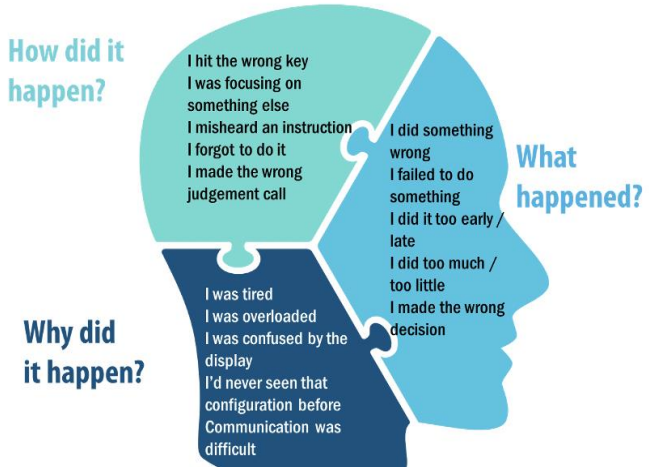
SAFEMODE

The EC – H2020 Project SAFEMODE - Strengthening synergies between Aviation and Maritime in the Area of Human Factors towards achieving more efficient and resilient MODE of transportation
(GA Number 814961)

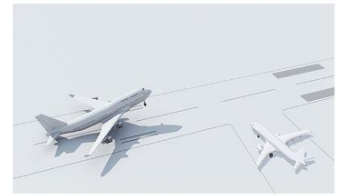
HORIZON 2020

The main aim of SAFEMODE project is to develop a novel HUman Risk Informed Design (HURID) Framework in order to identify, collect and assess Human Factors data to informed risk-based design of systems and operations.









WP1: Project Management

WP2: Development of SHIELD Open Data Repository

WP3: Development of Methodologies for Assuring Human Performance

WP4: Development of Human Factors Based Risk Models

WP5: Definition and Consolidation of the HURID Framework

WP6: Forward Looking Scenarios and Doman Case Studies - Aviation

WP7: Forward Looking Scenarios and Doman Case Studies - Maritime

WP8: Dissemination and Communication Activities

WP9:Policy recommendations, Institutionalization and Exploitation Activities

Duration:2019-2022
Budget: ~ €10 Million

The consortium – Core team & Research Partners



Contact: Dr. Rafet Kurt

EKC 2021 Europe-Korea Conference on Science and Technology

SafePASS

UNIVERSITY of STRATHCLYDE
MARITIME SAFETY RESEARCH CENTRE

HORIZON 2020



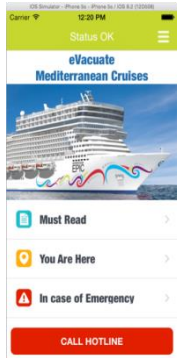




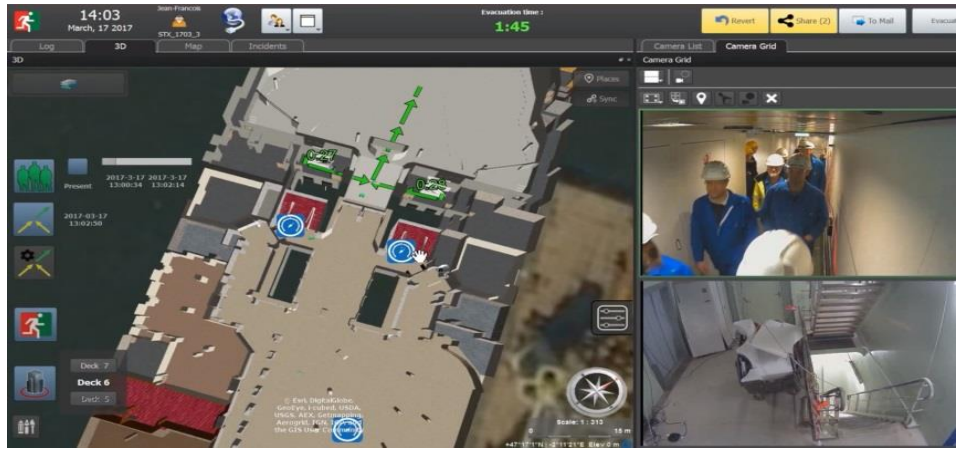






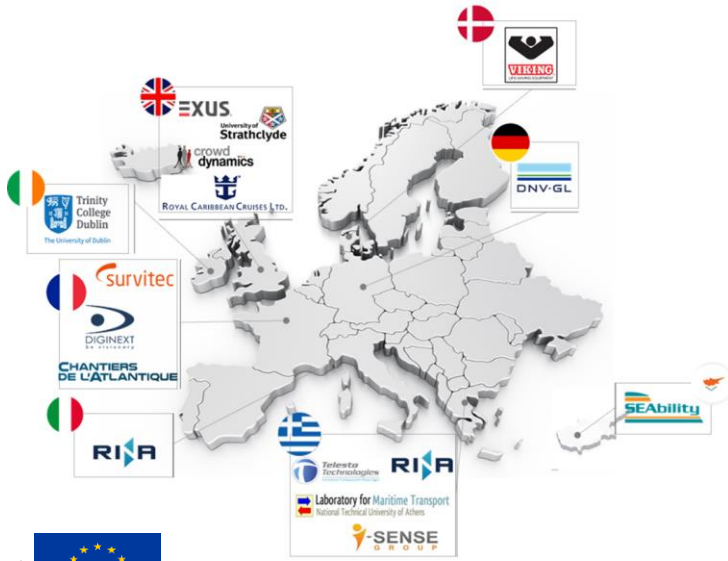












15 Partners
DURATION: 2019-2022
BUDGET: 8.2M EUR

Aim:

To radically redefine the evacuation processes, evacuation systems/equipment and international regulations for passenger ships

Contact:

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THE UNIVERSITY OF STRATHCLYDE

UNIVERSITY of STRATHCLYDE
MARITIME SAFETY RESEARCH CENTRE

SHIPFC

GREEN AMMONIA ENERGY SYSTEM

Eidesvik · equinor · WÄRTSILÄ · YARA

cmr Prototech · Fraunhofer IMM · STAR BULK · University of Strathclyde Glasgow

SUSTAINABLE ENERGY · NORWEGIAN CATAPULT CENTRE · Norwegian Centres of Expertise NCE Maritime CleanTech

CAPITAL EXECUTIVE Ship Management Corp. · NORTH SEA SHIPPING · Persee smarter energies

FCH FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

14 Partners
DURATION: 2020-2025
BUDGET: 13M EUR



Contact:

THE UNIVERSITY OF STRATHCLYDE

Ship Life Cycle Software Solutions – SHIPLYS

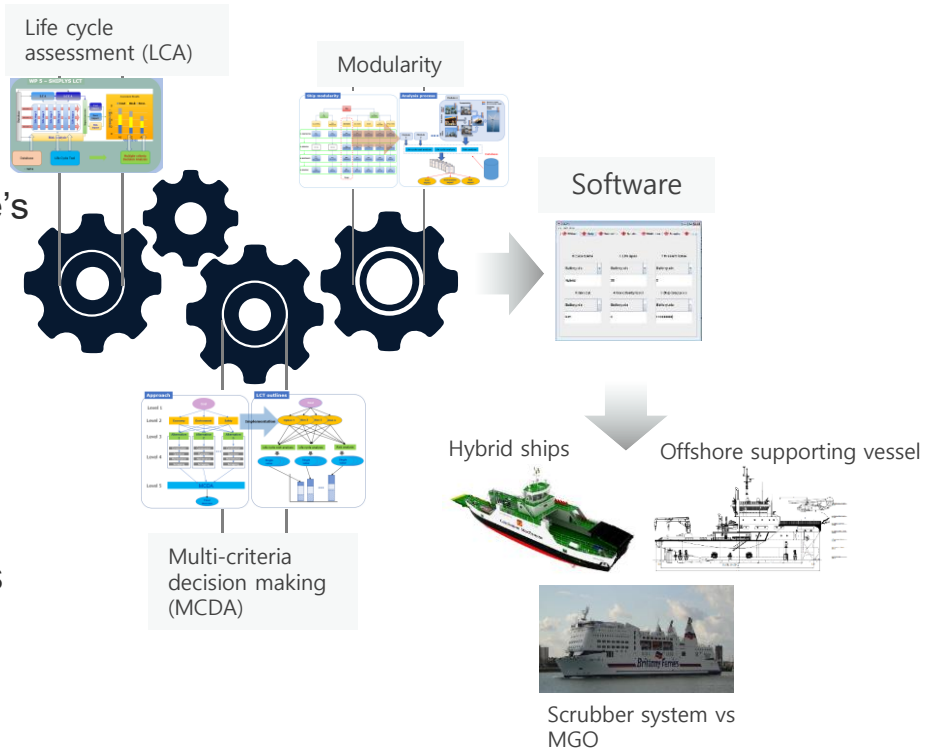
Horizon 2020 - Research and Innovation Framework Programme

SHIPLYS is a three-year project started in September 2016 with a budget of about 6.2 million Euros.

12 partners from 7 EU countries

Project Objective: to compete with the larger yards and low-cost countries, Europe's SME designers and production yards need new tools and paradigms to:

- improve their capability to reduce the time and costs of design and production
- develop the ability to reliably produce better ship concepts through virtual prototyping
- meet the increasing requirements for LCCA (Life Cycle Cost Analysis), environmental assessments, risk assessments and end-of-life considerations as differ initiators.



12 Partners
DURATION: 2016-2019
BUDGET: **6.2**M EUR

Contact: Prof. Peilin Zhou

TrAM

UNIVERSITY of STRATHCLYDE
MARITIME SAFETY
RESEARCH CENTRE

TrAM

Transport: Advanced & Modular

- Main mission:

  "…to develop and validate a concept for waterborne transport by implementing modular design and production methods, with a main focus on electrically powered vessels operating in protected waters."

14 Partners
DURATION: 2018-2022
BUDGET: 14M EUR





Contact:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 769303.

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QUESTIONS



University of Strathclyde Glasgow

https://www.strath.ac.uk/engineering/navalarchitectureoceanmarineengineering/