First year of operation of RV Tom Crean & future fuel plans

34th Annual IRSO Meeting
Bruges - Oct 2023

Aodhan Fitzgerald
Research Vessel Manager Marine Institute
Project Manager RV Tom Crean Build

International Research Ship Operators

Foras na Mara Marine Institute

RV Tom Crean Project Timeline

FUNDING

Funding secured from Government to procure a modern repla cement vessel in 2018

DESIGN

Design tender awarded to ST design in January 2019

CONSTRUCTION TENDER

Tender issued for construction of vessel in July 2019

CONSTRUCTION CONTRACT

Contract for vessel construction awarded to ASTILLEROS ARMON in Dec ember 2019

EQUIPMENT PROCUREMENT

Equipment procurement and further detailed design work comme nced January 2020

STEEL CUTTING

Steel cutting commenced August 2020,

KEEL LAID

Keel laid November 2020

VESSEL LAUNCHED

Vessel delivered in Vigo on 8th July 2022

VESSEL DELIVERED

Vessel arrives in Galway on 18th July

HOME PORT

Vessel arrives in Galway on 18th July

VESSEL IN SERVICE

Vessel in service 25th July

VESSEL COMMISSIONED

Vessel commissioned 7th October 2022!

Skipsteknisk

ARMON

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Vessel Overview

RV TOM CREAN

MODERN VESSEL DELIVERING MODERN SCIENCE

FISHERIES SURVEYS
OCEANOGRAPHIC SURVEYS
ENVIRONMENTAL MONITORING
SEABED MAPPING
DEPLOYMENT OF OBSERVATIONAL INFRASTRUCTURES AND ROVs

Silent Research Vessel (ICES 209 noise standard for fisheries research)
Class Notations: Lloyd´s +100A1, UMS, Ice Class 1C FS, DP(AM)

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Rialtas na hÉireann
Government of Ireland

Tionscadal Éireann
Project Ireland 2040

EXEED
EXCELLENCE IN ENERGY EFFICIENT DESIGN

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RV TOM CREAN

The RV Tom Crean is used by the Marine Institute and other State agencies, universities and international users to undertake fisheries research, oceanographic and environmental research, seabed mapping surveys; as well as maintaining and deploying weather buoys, observational infrastructure and Remotely Operated Vehicles.

The vessel is a silent research vessel, designed to meet the stringent criteria of the ICES 209 noise standard for fisheries research.

The vessel is designed to operate in the harsh conditions encountered in the NE Atlantic and the vessel can spend 21 days at sea.

The Tom Crean has the capacity to support Remotely Operated Vehicle (ROV) and Autonomous Underwater Vehicle operations, which enable the exploration of our deep ocean down to 3,000m. Equipped with state-of-the-art scientific equipment, it provides increased accommodation for scientists and for researchers.

VESSEL OVERVIEW

Vessel Specifications	Power
Length Overall: 52.8m	Power Generation: 2 x 1350kw 1 x 400kw
Length PP: 48m	Main Propulsion Motor: 2000kw INDAR
Beam: 14m	Bow Thruster: 780kw Schottle SPJ 132 RD
Draft: 5.2m	Stern Tunnel thruster: 400kw Schottle
Endurance	Imo Tier III compliant
21 Days	DP1 Dynamic Positioning
8000 nautical miles	3 x 20ft Containers

ARMON © 3MI Grupo


ARMON © 3MI Grupo

Vessel Overview

OCEANOGRAPHIC CAPABILITIES

- Heave Compensated CTD system with 4500m wire. 24 bottle Carousel
- Underway T+S, Fluoresence, PC02 in dedicated sea water laboratory
- CTD Hangar, CTD Laboratory , 45 khz ADCP
- Controlled temperature Chemical Lab
- Bow Mast for Meteorological sensors
- Oceanographic winch for Towed samplers/Side scan sonar
- Hydrographic winch for Plankton Sampling
- -20 and +4 degree refrigeration

FISHERIES SURVEYS

Fisheries Acoustics

- EK80 Fisheries Echosounder on Drop keel - 5 frequencies
- SU92 Omnidirectional Sonar
- FS 70 Headline system

Egg/Larval Surveying

- Oceanographic winch with 2500m wire

Trawling Capability

- Marport net mensuration system
- Trawling capability: 2500m 22mm trawl wire, 25 Ton Pull
- 2 x 7m^3 split net drums (Demersal)
- 1 x 9m^3 Net Drum (Pelagic)
- 1 x Headline winch with 2500m Headline wire

UWTV Survey

- UWTV survey with Q5/Oceanographic winch
- Sonardyne Ranger 2 USBL system on retraction unit
- Dedicated Video Playback Lab

Catch Handling

- Net Hauler, Gilson Winch, Hopper system

Fish Lab

- 36.7m^2 with 6m Long conveyor system, 4 Measuring stations, -20 Freezer, separate 6m^2 freezer store

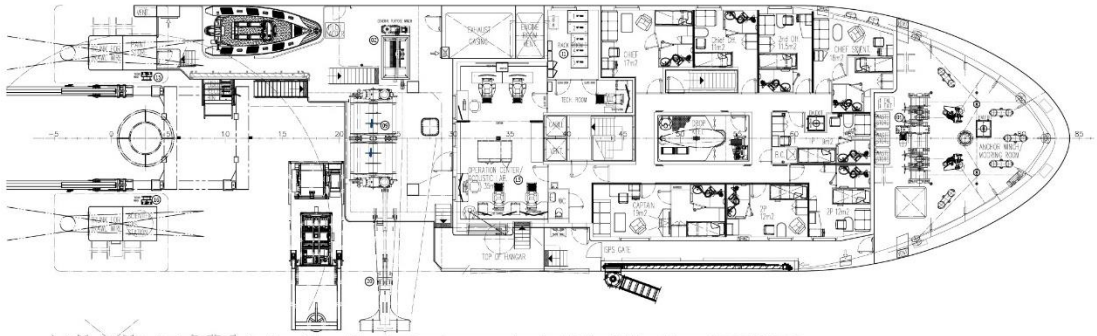
HYDROGRAPHIC/ GEOLOGICAL CAPABILITY

- Multibeam No.1: EM2040 Dual Head
- Multibeam No.2: EM2040 Single head (Drop keel)
- Capable of accommodating a EM712 1 x 1 degree Multibeam
- Sub Bottom profiler: Knudsen 3260, 9 x 3.5Khz, 1 x 12Khz
- Moving vessel profiler: AML MVP 30-350, Edgetech Side Scan
- MRU: Seapath 380 RGC 3 /RGC 2 Haps System
- GNSS: Cnav 5000 High Precision GPS
- Usbl: Sonardyne Ranger 2 USBL on retraction unit
- Can accommodate 12m Piston /Gravity Core, 6m Vibrocorer, CPT
- Can accommodate ROV Etain (UL) and ROV Holland
- Optimised for AUV Deployment /Control

FACILITIES/CAPABILITIES

- 11 – 13 Crew including permanent technician, 13 scientists. Total 26
- Gymnasium (12m^2)
- TV lounge
- Additional Lounge area in messroom
- Equipped with shore generator for fuel efficiency
- Electrical drive winches throughout (Ibercisa)
- Multipurpose design with removable net drum to increase deck space
- DP 1 (Praxis Mega Guard)
- Hoppe Anti Roll system
- 170 Degree 10 T A Frame /8 T Side T frame
- AUV/Glider “Step” in hull to allow easy access to water surface
- Can accommodate 3 x 20’ Laboratory containers
- Shore power connection to allow shutdown of all genesets when in suitable port
- Drop keel (c.2.5m below keel)
- Ability to utilise low carbon HVO as a replacement for MGO

First Deck



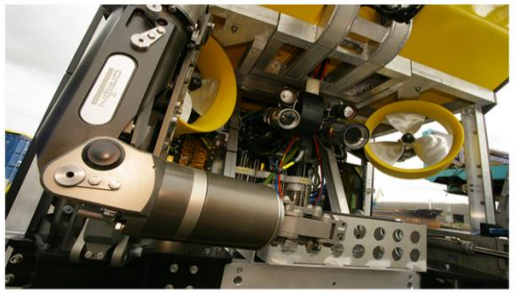
Main Deck

N.B. These specifications are subject to change without prior notice. The details are believed to be correct at time of printing but cannot be guaranteed.

Research Vessel Operations
Marine Institute, Rinville, Oranmore, Co. Galway. H91 R673
Tel: **+353 387200** Email: **rv@marine.ie** Web: **www.marine.ie**



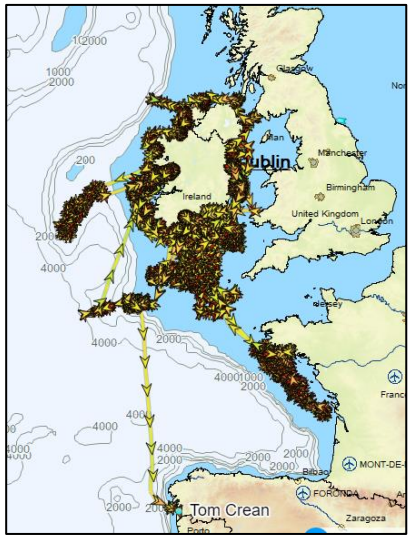


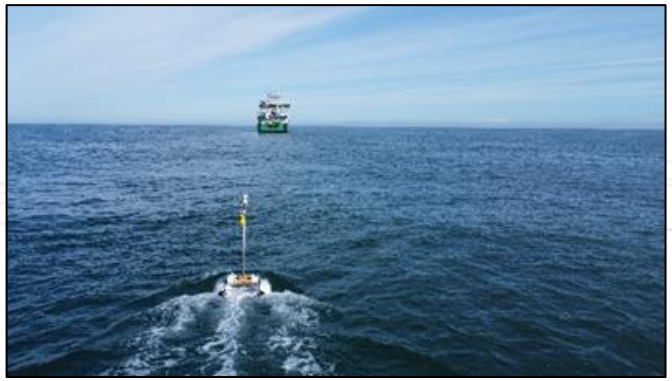


First year of successful operations

Summary:

- 31545 nm travelled July 16th 2022 to 8th July 2023.
- 33 surveys completed.
- 304 survey days.
- 1017588 Litres of fuel used.
- Activities in Irish , UK , French and Spanish waters.
- 415 UWTV stations completed in Irish, UK and French waters.
- 6317 km^2 of Seabed Surveyed during 2023.
- 1677 km of Ultra high resolution seismic acquired.





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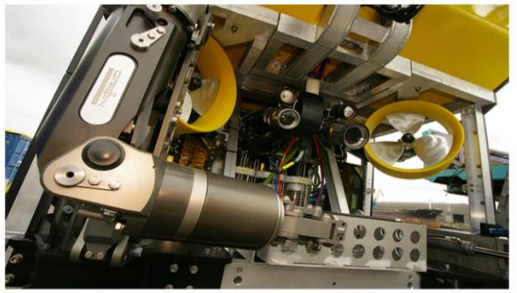

The Good…

- Vessel gives exceptional hydro acoustic performance, vessel surveying in force 7 to 8… no bubbles!
- Vessel is very stable and comfortable
- CTD Hangar, frame, winch are excellent proving sheltered conditions for CTD ops
- Mitsubishi v16 engines very reliable , reduced maintenance requirements agreed with local agent
- Silent engine room when in port (Harbour set in separate aft room)
- Dynamic positioning system (Praxis) is excellent in operation
- Schottle pump jet is very effective
- Aft deck layout working well , ROV system integrated easily, portable net drum likewise
- USBL system working well , effective retraction unit
- Galley/Messroom excellent layout
- PMS system working well (fuel minimisation)
- Drylab big screen layout is excellent
- Drop keel arrangement working very well including camera.

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The Bad…

- Science cabins a little on the small side especially when double occupancy
- Bridge windows : heating elements caused distortion … now replaced
- USBL pole noisy above 8kts… advice from Sonardyne is to retract when above survey speed
- Shared controls between different manufacturers e.g. winch /Crane causing some issues
- aft trawl pin arrangement had issues and required addressing in warranty rectification period
- Could do with more scientific equipment storage , main store tends to be used for ships equipment

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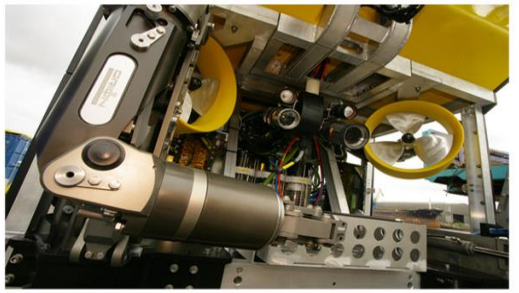
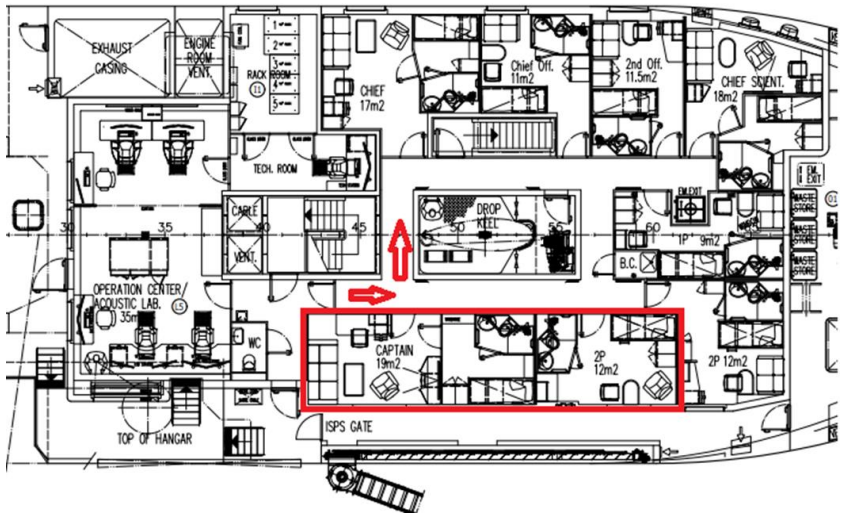


The Ugly...

- Layout of the cabins needs reconsiderations as the captains cabin is adjacent to a lot of activity, i.e., 24 hr dry lab operations. Noisy part of the ship, lots of foot traffic, banging doors etc.
- Experiencing some electrical interference on electrical winches on certain data from winch, e.g., Drop Camera, Side Scan Sonar Data. Potentially needs filtering to resolve.
- Exhaust bellow failing…incorrect component and orientation, now resolved.
- Pins seizing in A Frame, required different materials and modification in warranty period, now resolved.
- No shore power available anywhere!



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Lessons/points for a future new build

- Single cabins throughout for ships crew and more scientists
- Special purpose ship…
- Bigger is better, construction and installation of equipment
- Crew to input more on layout particularly around accommodation arrangements
- More flexible winch arrangements e.g. orientation, cable /wire routing
- More redundancy in terms of winches/ more winches
- Alternate liquid fuels will be a large consideration
- Hull/ superstructure optimisation for fuel consumption…
- Separate harbour generator room….
- General layout evolving with Celtic Explorer as a starting point

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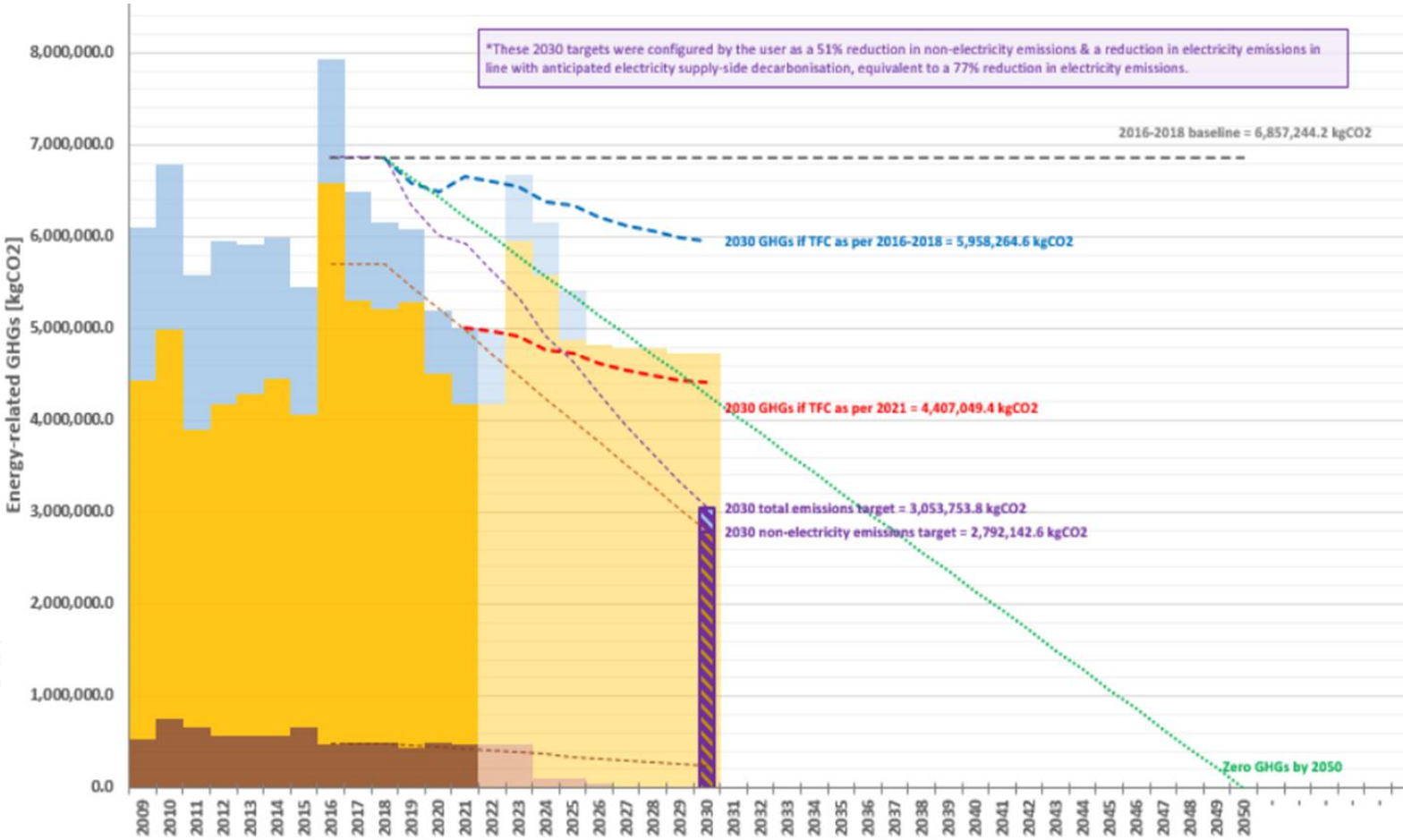
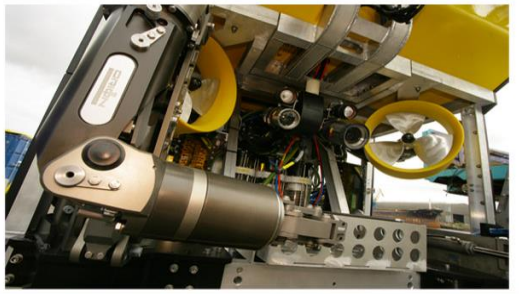
GHG reduction commitments - Marine Institute

- The Climate Action Plan 2021 has set a target to reduce Ireland's Greenhouse Gas emissions by 51% by 2030.
- The Public Sector Climate Action Mandate will support public sector bodies leading by example on climate action. It aims to inspire the necessary climate action in wider society to reduce Ireland's greenhouse gas (GHG) emissions by 51% by 2030.









Transition to HVO - Tom Crean

- Vessel is capable of utilising 100% HVO (Hydrotreated Vegetable oil) in its Mitsubishi main engines and its Scania Harbour set.
- HVO gives a 90% reduction in C02 emissions over ULSFO.
- To date vessel has utilised 100% ULSFO gas oil, largely due to cost and due to vessel in its first year commissioning/warranty phase.
- Plan is to commence trials in October/November 2023 and move to 50% HVO over the course of 2024. It is planned to move to 30% HVO on Celtic Explorer over the course of 2024.
- HVO is now available in bulk commercial deliveries in Ireland following opening of 54 million litre capacity bulk storage facility in Cork Harbour.

Product Details

Product:	Hydrotreated Vegetable Oil (HVO)
Applicable standards:	BS EN 15940:2016
Use:	In diesel engines
Notes:	Appearance is clear and bright

Purchasing Specification for GBF's Gd Fuels

based on BS EN 15940 Class A (BS EN 15940:2016+A1:2018 Incorporating corrigenda December 2018 and March 2019)

	Unit	Min	Max	Test method
Cetane No.		70.0	-	EN 15195 / prEN16906 / EN 5165
Density at 15°C	kg/m^3	765.0	800.0	EN 12185 / EN 3675
Flash point[1]	°C	65	-	EN 2719
Viscosity at 40°C	mm^2/s	2.000	4.500	EN 3104
Initial bp	°C	180	-	
recovery at 250°C	%(v/v)	-	<65	EN 3405 / EN 3924
recovery at 350°C	%(v/v)	85.0	-	
95% recovery	°C	-	360.0	
Lubricity / HFRR (wsd at 60°C)[2]	µm	-	400.0	EN 12156-1
FAME content[3]	% v/v	-	0.05	EN 14078
Manganese content[3]	mg/dm^3	-	0.50	EN 16576
Total Aromatics content	%m/m	-	1.1	EN12916
Sulphur	mg/kg	-	5.0	EN 20846 EN 20884
C residue on 10% distillation	%(m/m)	-	0.3	EN 10370
Ash content	%(m/m)	-	0.01	EN 6245
Water content	% m/m	-	0.020	EN 12937
Total contamination	mg/kg	-	24.0	EN12662
Cu strip corrosion 3h/50°C	Rating	-	Class 1	EN2160
Oxidation Stablity	g/m^3	-	25.0	EN 12205
	h	20.0	-	EN 15751
Cloud point	°C	-	-15	EN 23015
CFPP[4]	°C	-	-15	EN 166 / EN16329





Carbon Reduction with introduction of HVO

Business as usual

		Tom Crean	Celtic Explorer	Total	
	Unit	2022/2023	2022		
Gasoil	litres	1017588	1500503	2518091	Litres
C02	kg CO_2	2772083	4087625	6859708	kg CO_2
	Tonnes	2772	4088	**6860**	Tonnes C02

50% HVO Tom Crean /30% Celtic Explorer

			Tom Crean	Celtic Explorer	Total	
	Unit		2024	2024		
Gasoil	litres	50%/30%	508794	1050352	1559146	Litres
C02	kg CO_2	2.72417	1386041	2861338	4247379	kg CO_2
HVO		0.03558	508794	450151	958945	Litres
	kg CO_2		18103	16016	34119	kg CO_2
	Tonnes		1404	2877	**4281**	Tonnes C02
	REDUCTION c02				**2578**	Tonnes C03
	% reduction				**38%**	

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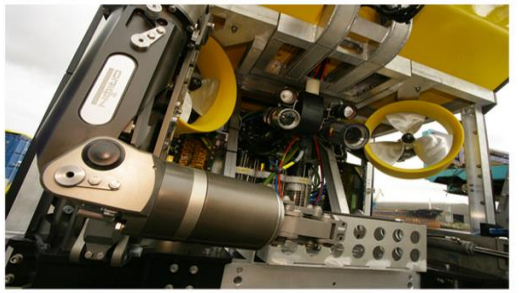
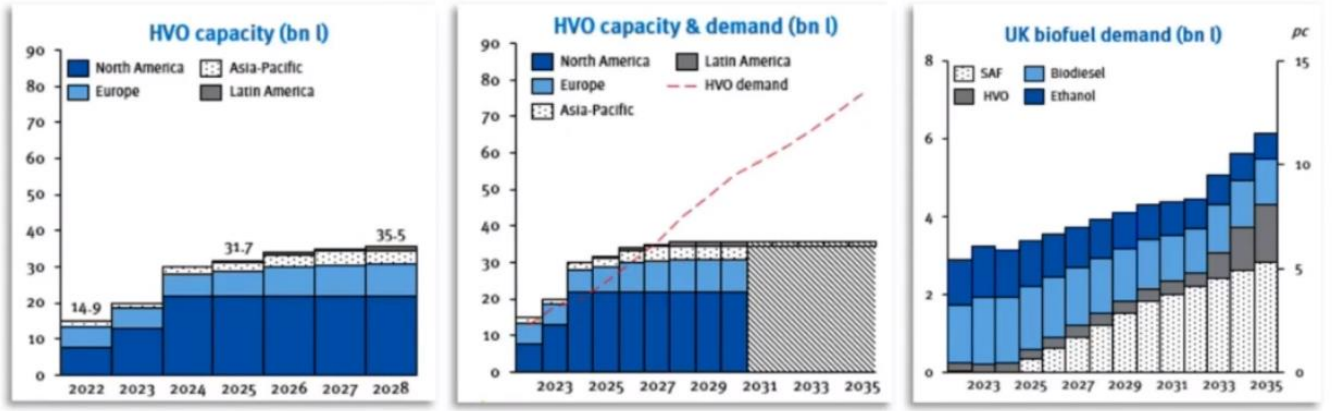


HVO Availability & Sustainability Issues

- **Don't be fooled**, HVO is not sustainable | Einride
- **Global HVO production to quadruple by 2025**: Greenea
- **The future of HVO is bright** | Biofuels International Magazine
- Is HVO the Holy **Grail of the world biodiesel market**? - Greenea

Growing capacity outpaced by rise in demand: HVO



Source:
Argus Biofuels Analytics

- Rapid growth global HVO capacity, EU mandates increasing, interest in HVO100
- Higher renewable fuels targets in the transport sector require use of products that can surpass 7pc technical blend wall that applies to conventional biodiesel
- More HVO available if Sweden cuts mandate to 6pc in 2024
- Newer plants could decide to produce more HEFA SPK SAF than HVO – UK & EU mandate starts 2025

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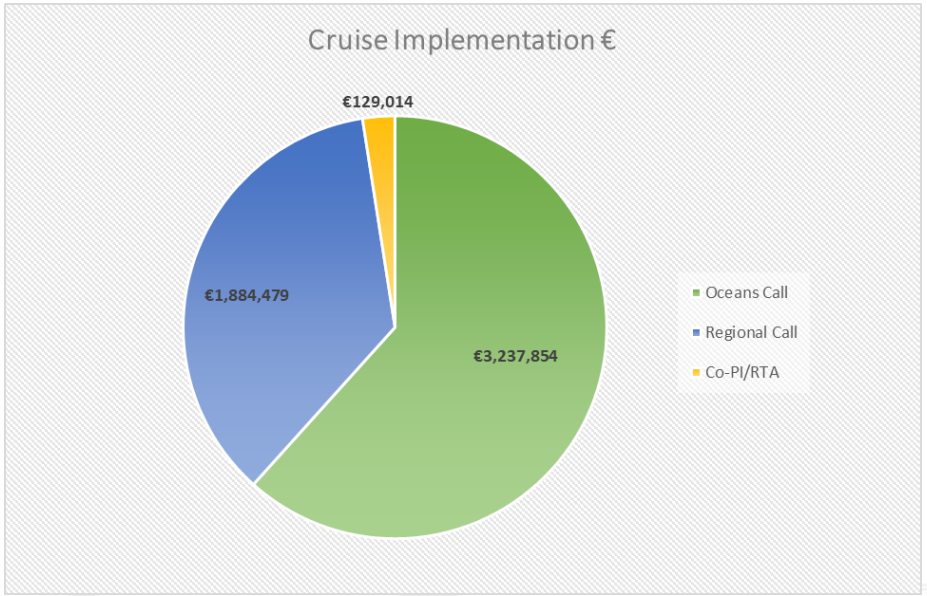
Eurofleets update



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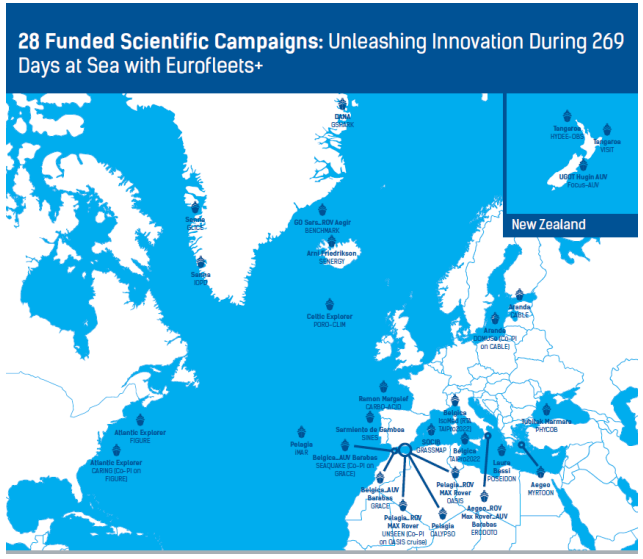
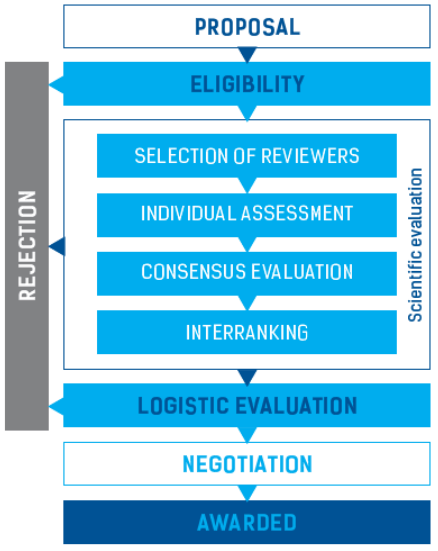
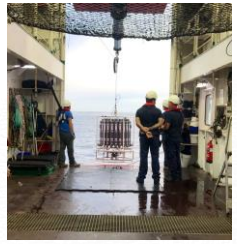
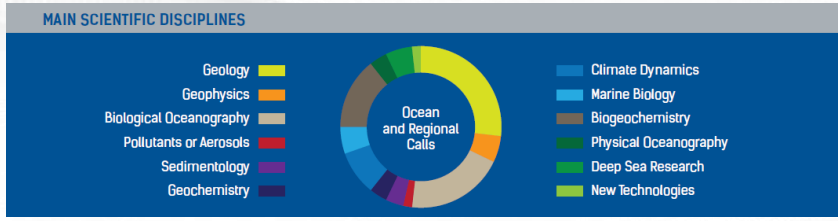
EUROFLEETS TRANSNATIONAL ACCESS

	EurofleetsPlus
Number of calls	3
Proposals submitted	69
No. of granted cruises	28
No. of days at sea (Vessel/Equipment)	268
No. of researchers and students	315









ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

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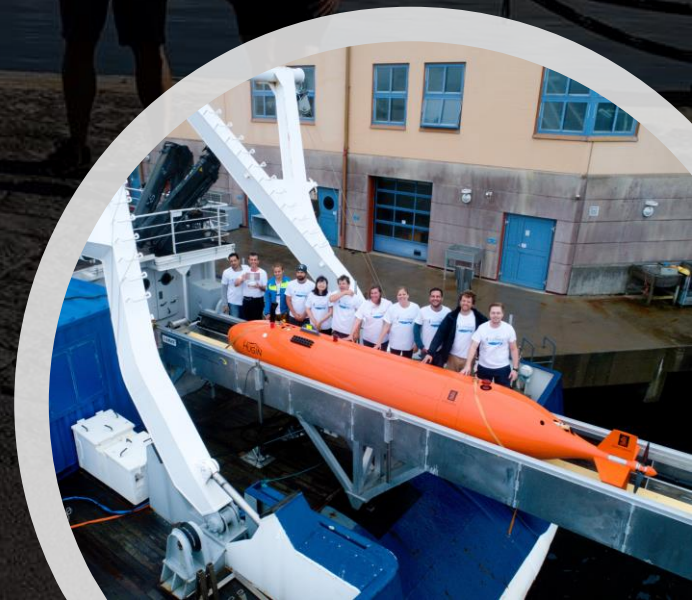
Eurofleets+ Core Goal

The ultimate goal of Eurofleets+ is to facilitate access to unique marine infrastructure, enable excellent research, increase ocean literacy, and provide a clear road map for the continued integration and advancement of the European research fleet.

Education Training

- 5 Floating Universities
- 8 Marine Internships
- 2 Autonomous Underwater Vehicle Labs
- 2 ROV Labs at University of Bremen
- 2 Seismic Labs at
- Ocean Classroom with over 83 resources
- Research Infrastructure Management Workshop
- Ship to Shore educational Broadcasts
- Partnerships with Partnership for Observation of the Global Ocean (POGO) and All-Atlantic Floating University Network



TOWARD A LEGAL FRAMEWORKEUROFLEETS RI

Consiglio Nazionale delle Ricerche

EUROFLEETS RI aims at uniting world-class RVs and associated equipment among European partners **to facilitate access to unique marine infrastructure for a wide user community**, **enabling excellent research**, **increased cooperation** in technical development and **sharing of knowledge in RV operations & management**.

EUROFLEETS RI will play a **central role in delivering the European Union Missions by the provision of access to our Seas and Oceans through facilitation of multidisciplinary science teams** tackling changing climate, supporting bio medical research, ocean monitoring, sustainable fisheries and advancing the European Green Deal.

Collaboration in **EUROFLEETS RI** will help **to optimise integration, develop a European approach to address common challenges** through the provision of **single point transnational access to our Seas and Oceans**.

EUROFLEETS RI ROADMAP

Concept Development

- Secure members from the RV and LEXI communities
- Determine costs for establishing an EF RI support office.
- Establish commitment for funding for TA from the EC

Design

- Confirm Membership
- Signature of the AISBL's constitutive agreement
- Establishment of the AISBL and the first 4 missions

Preparation

- Confirm Infrastructures
- Recruit Staff
- Set Up Office
- Develop service contracts and Coop agreements
- Establish SAC & WG's

Implementation

- Select RV and LEXI for calls
- TA call development and publishing

Operational

- Select and allocate TA cruises for execution
- Execute TA
- Develop Training Programme
- …

2023 | 2024 | 2025–2027 | 2028 | 2029 - 2030

PHASE 1

implementation phase and running-in of the first #4 missions between 2024 and 2026

PHASE 2

covering the implementation of the 5th mission (Transnational Access) from 2027

Aqua Research Infrastructure Services for the health and protection of our unique, oceans, seas and freshwater ecosystems

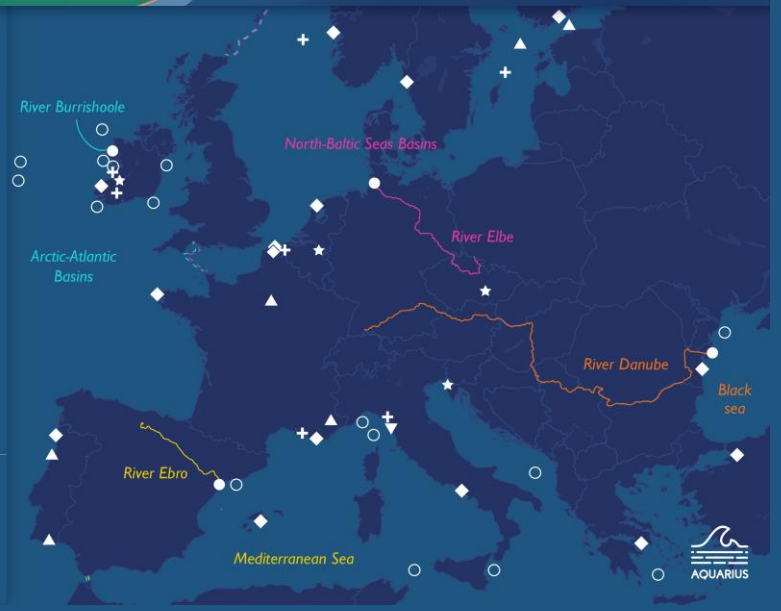
AQUARIUS

TRANSNATIONAL ACCESS TO INTEGRATED RESEARCH INFRASTRUCTURE

Coordinator: Marine Institute
Funding: 14.5M€
Duration: 48 Months
Start Date: 1st March 2024
Finish Date: 29th February 2028
Number of Partners: 41 (+ 4 affiliated partners)

Research Infrastructures:

- Research Vessels (18)
- Mobile Marine Observation Platforms (12)
- Aircraft, Drones and Satellite (6)
- Seafloor observatories and data buoys (11)
- Mobile and Fixed Freshwater Research Facilities (4)
- Experimental & Research Facilities (6)
- Data infrastructures (+10)



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AQUARIUS Research Vessels and Marine Equipment

(not all project RI's or equipment listed below)

-Gaia Blu (CNR, Italy)
-Sarmiento De Gamboa (CSIC, Spain)
-Jákup Sverri (FMRI, Faroe Islands)
-Mare Nigrum (GEOECOMAR, Romania)
-SANNA (GINR, Greenland)
-Aegaeo & ROV Max Rover (HCMR, Greece)
-THALASSA, L'EUROPE and HROV (IFREMER, France)
-GO SARS (IMR, Norway)
-Arni Freidrickson/Bjarni Sæmundsson (MFRI, Iceland)
-Celtic Explorer (MI, Ireland)
-Wim Wolff (NIOZ, Netherlands)
-Belgica (RBINS, Belgium)
-SVEA (SLU, Sweden)
-SOCIB (Socib, Spain)
-ARANDA (SYKE, Finland)
-Tubitak Marmara (Tubitak, Turkey)
-Simon Stevin, AUV Barabas, Glider Yoko & USV Adhemar (VLIZ, Belgium)

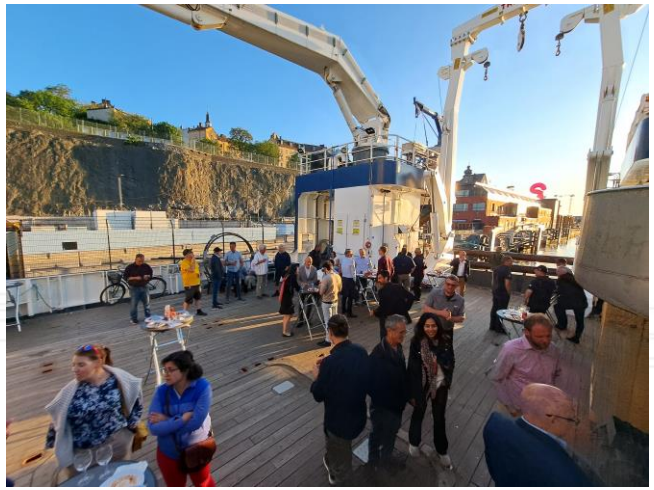




ERVO UPDATE

25th ERVO Meeting, 12-14 June 2023

- KTH Royal Institute of Technology, Stockholm, Sweden.
- Over 60 participants
- Tours of SVEA and ARANDA!



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