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Overview of interoperability between Eurofleets+ RVs and the offered marine equipment

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WP Leader	Dr. Anneli Strobel	AWI	24/06/2019

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1. Introduction

In Eurofleets+ the **Call Management & Proposal Evaluation** programme will be managed through WP4 and offers three different access programmes for users covering a broad span of European and International seas and oceans and offering a significant range of infrastructure.

The Eurofleets+ Research Vessels and Marine Equipment are of various sizes and capacities and will provide access to the Mediterranean and Black Sea; Baltic Sea and North Sea: North Atlantic (incl. Greenland and Norwegian seas) and Pacific Southern Ocean and Ross Sea. Through Eurofleets+, this advanced community will provide wider open-access to a unique, innovative and modern fleet and associated infrastructure. The Call Programmes will enable access to complementary highly capable robotic and autonomous deep-sea equipment and state of the art telepresence equipment to allow a much wider real-time access to the deep ocean for researchers and the public.

This report provides details of interoperability between Eurofleets+ Research Vessels and the offered marine equipment available for use across the **S**hip-time and Marine **E**quipment **A**pplication (SEA programme) both Oceans and Regional calls. It specifically seeks to identify the technical considerations and mobilisation requirements for the Enhanced Interoperability of Large Exchangeable Instrumentation, and the vessels on which these instruments can be mobilised to maximise utilisation of all available infrastructures across all calls.

The Eurofleets+ fleet of Research Vessels is comprised of twenty-seven research vessels (RV) (thirteen Global/Ocean and fourteen Regional), seven Remote Operating Vehicles (ROV), five Autonomous Underwater Vehicles (AUV) and a telepresence unit.

2. Interoperability

Eurofleets + has built on the legacy of previous projects, which allowed researchers to access high quality marine research infrastructure on a Pan-European basis for the first time to conduct high quality research. The interoperability of equipment is a key component of the call management procedure to allow applicants to choose which equipment and which vessels to select in their application to meet their cruise objectives and for vessel managers to coordinate Research Vessels and marine equipment for effective cruise planning. The capability of each research vessel has been assessed against its capacity to mobilise and deploy each of the of seven ROV's, five AUV's and the Telepresence unit. Factors considered included:

- Vessel deck space required
- Deployment and recovery systems
- Power requirement
- Deck loading
- Positioning systems
- Accommodation for technical personnel

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2.1. Methodology

Each Research Vessel operator conducted a self-assessment exercise appraising the technical capability, considerations and support required to deploy each item of available Eurofleets+ Large Marine Equipment.

For each piece of equipment, the owner/operator was asked to consider whether they had:

- Proven or routine deployment of the specified equipment
- Possible deployment of ROV/AUV with minor modifications
- Cannot deploy ROV/AUV e.g. RV not available or no D.P.

A matrix diagram was developed (Figure 1) with with Eurofleets+ RVs listed in the rows, the columns list all available ROVs… for deployment.

A colour coding was used to identify three categories or designations for each piece of equipment and each of the 27 RVs.

LEGEND	Categories/Designations
	Proven/Routine deployment on RV
	Possible deployment of ROV with minor modifications
	Cannot deploy ROV, e.g. RV not available or no D.P.

The bright green colour denotes RVs with a recorded deployment of a particular piece of equipment, or which has vessel technical specifications that make it very likely to have the capacity to deploy a piece of equipment with little difficulty. This would include providing power and data to equipment, securing items to deck etc.

For the lighter green designation, it is assumed that “minor modifications” will be required on either the vessel or the instrument/equipment to make it capable of deploying a particular piece of equipment. This could involve welding Launch and Recovery Systems (LARS) onto a deck, installing sheaves or parts of LARS onto vessels A Frame, providing additional electrical supply, arranging or re configuring a lab or suitable space for installation of temporary equipment.

The final category is in red, where it is considered that an RV could not deploy particular equipment for any number of reasons – the Research Vessel may not have Dynamic Positioning (DP) required for large ROV deployments, available aft deck space may be simply too small for container storage and operations, or there may be an insufficiently large or absent A-frame for equipment without its own Launch and Recovery System

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2.2. Interoperability Table

No.	RVs	Country	Length	Holland	Genesis ROV	Ocean Modules V8 offshore	Marum Squid	Ariane	Ægir 6000	ROV LUSO	VLIZ AUV	HUGIN	GLIDER Teresa	HUGIN (IMR)	ASTERx	Telepresence Unit
				3000m	1400m	3000m	2000m	2450m	6000m	6000m	1000m	3000m	1000m	3000m	2850m	
1	Celtic Explorer	Ireland	65.5													
2	New Magnus Heinason	Faroes	54													
	Magnus Heinason		44.5													
3	Aranda	Finland	66.3													
4	Simon Stevin	Belgium	36.3													
5	Skagerak	Sweden	38.1													
6	Aegaeo	Greece	61.5													
7	RV Belgica II	Belgium	71.4													
	RV Belgica	Belgium	50.9													
8	Mar Portugal	Portugal	72.55													
9	Laura Bassi	Italy	80													
10	TUBITAK MARMARA	Turkey	40													
11	MARE NIGRUM	Romania	82													
12	Ramon Margalef	Spain	47.3													
13	Angeles Alvarino	Spain	46.7													
14	Sanna	Greenland	32.35													
15	Arni Freidrickson	Iceland	69.9													
16	Dana	Denmark	78.43													
17	Thalassa	France	74.5													
18	L'Europe	France	29.6													
19	G.O .SARS	Norway	77.5													
20	Sarmiento de Gamboa	Spain	70.5													
21	Pelagia	Netherlands	66.07													
22	Alliance	Nato/Italy	93													
23	Alkor	Germany	55.2													
24	Tangaroa	New Zealand	70													
25	SOCIB	Spain	23.62													
26	Coriolis	Canada	49.95													
27	Atlantic Explorer	BERMUDA	51.8													

Figure 1Interoperability Table

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2 Results of Technical Considerations

There is an understandable correlation between the ability of larger vessels to deploy deep-water ROVs and AUV's s, although there are some exceptions.

The survey shows that three of the RV's have confirmed the capacity to deploy all seven ROV's, five AUV's. These are the RV Celtic Explorer, RV Belgica II and RV Alliance, with a further two vessels; the RV Sarmiento de Gamboa and the RV Tangaroa with the capacity for deployment with minor modifications.

Many of the larger ROV systems e.g. AEgir 6000, LUSO and ROV Holland have simply too large a deck requirement (75 Tonnes +) and power requirement in their normal deep-water configuration for the smaller vessels, however some of the ROV's (AEgir) have a more portable medium depth configuration which makes them suited to smaller vessels when operated with their medium depth Winches (see equipment profile Annex 1). The LUSO however comes with a small deck space requirement and can be deployed from over one-third of the fleet.

The ROV Modules V8 Offshore is mobile and containerized, thus a wide area of operation is possible including Arctic and Antarctic depending on sea-ice conditions, however with a weight of 7500KG's only eight of the larger vessels are suitable for its deployment with a further eleven with minor modifications.

Some of the ROV's such as the Marum Squid and Ariane HROV are designed to be as portable and possible for use worldwide on vessels of opportunity and this is reflected in their availability for use with the vast majority of vessels in the fleet. The Marum Squid can be operated with the use of just one 20ft control container which results in a very small footprint of <10m² for winch and ROV on deck, making the system well suited for operations from small platforms resulting in it being compatible with all but six Eurofleets+ vessels and can operate without DP. The Ariane HROV system is designed for use for smaller non DP vessels without dynamic positioning, and consequently can be used with six vessels without any modifications and a further nineteen with minor adjustments. The Ariane has a total weight of 1.5 tonnes and can be launched from most 25m ships. It is a hybrid ROV powered by 14 to 20kWh Li-on on-board battery which reduces weight and volume of on deck equipment and can be operated in teleported mode (ROV) or autonomous mode.

In terms of AUV'S it's clear that the smaller systems VLIZ AUV and the Glider 'Teresa' are less than 1000kgs and 1.7M in length and can be deployed from all nearly all vessels in the fleet. Glider 'Teresa' is modular, allowing for rapid sensor reconfiguration and can be deployed from all but one of the Eurofleet+ vessels and can be supported by only one engineer. The VLIZ AUV is similarly compatible with twenty-six vessels, requiring minimal deck space but requires access to a deckcrane for lifting.

The larger systems such as the HUGIN systems require the use of their own (Launch and Recovery System) LARS systems which are contained in 20' containers which restricts the range of vessels from which they can operate. These systems also require room for their command and control equipment on board which includes a LARS. Taking this into account both systems can be deployed from two-thirds of the available fleet.

The ASTERx AUV is suitable for coastal and deep water surveys and can be deployed from the majority of the Eurofleets+ vessels with some modifications. It is suitable for the study of sea bottoms and

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water column for multiple scientific objectives thanks to its payload modularity and requires and A frame for launch and recovery.

Full specifications are not currently available for the RV Laura Bassi which is replacing the OGS Explora later in 2019. Once confirmed the table will be updated. However, given this vessels former role as a ROV support vessel it is likely that all Eurofleets+ equipment can be accommodated.

Following the assessment 20 of the 27 vessels available have the capacity to deploy the Telepresence unit with a further four capable with minor modifications. The Telepresence Unit needs to have a 20-foot ISO high-cube container installed on the ship in a location that provides deck space with a reasonably clear, unobstructed view of the sky as this is the mounting system for the VSAT antenna. The system can also be deployed with just the VSAT antenna mounted in a suitable location and the balance of the equipment mounted in a suitable location within the vessel. This requires the running of cables to the antenna which increases the complexity of the installation. It is anticipated however that the Telepresence system will be employed in any case on a larger vessel which will be hosting a Deepwater ROV for maximum impact of the telepresence capability

As mentioned previously, this assessment has been made based on the information given to the task leader and in most cases has been validated by the RV operators. As the Eurofleets+ project progresses, additional information will come available through experience gained in Transnational Access cruises, due to take place in 2019/20 resulting in the updating of the interoperability tables for future calls. Full profiles for each of the ROV's, AUV's and the Telepresence unit can be found in Annex I.

Technical Requirement's

The following tables summaries the technical requirements, support and power specifications as provided by each equipment operator.

Type	Name	Depth Rating	Technical Support Required
ROV	Holland I	3000M	Dynamic positioning, Deck capacity for 2 x 20' containers, 9m x 4.5m A-frame and winch, 380-480vac power supply 200kva for control Van (with high startup load), 70kva for umbilical winch and A Frame, USBL system, Total system weight; 75Tonnes. Technician Support: 5 to 6 technicians if 24 hour operations.
	Genesis ROV	1400M	Deck Capacity for 2 x 20 ft-containers on deck. LARS: A-frame or crane. Power Supply: ROV system: 380-440 VAC, 32 Amps, Hydraulic main winch: 380-440 VAC, 64-70 Amps (full load) Control container: 380-440 VAC, 16 amps. Total system weight: 7500kg Technician Support: 3 x Engineer
	Ocean Modules V8 offshore	3000M	Deck capacity for 1 x 20 ft. containers on deck. Heave compensated MacArtney winch. Total system weight: 270kg (without equipment). Power Supply: Winch supply

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			Electrical motor: 1 pc. 45 kW 3x400 V – 50 Hz ROV :3 x 400 VAC, 12 kW Technician Support: 3 x Engineer.
	Marum Squid	2000M	Deck capacity for 1 x 20ft container on deck. LARS: 1 x 2t crane to deploy/recover the ROV. DP not necessary. Power Supply: ROV: 120 amp 380- 440 vac 50hz Winch: 63 a 400vac Control van 16 a 4 x 220vac. Power to be supplied from the vessel (Input 380/440VAC, 125 A fuse). Technical Support: : 3 x Engineer
	Ariane	2500M	Deployments are possible from small vessels without dynamic positioning. Hybrid ROV with 14 to 20kWh Li-on battery. Length 2.2m Width 1.85m Height 2.13m Total weight Technical Support: 3 to 4 x Engineer
	Ægir	6000M	Has a portable "light" winch for the ROV (approx. 2000m cable) that makes it portable to be used on other vessels together with a Power Distribution Unit (PDU) and a 20' command and control container. Users can use a crane or a frame for the launch and recovery of the ROV. The light portable winch has 2000m umbilical for "free fly" operation of Ægir. Power supply 440 vAC 330 amp supply 50/60 hz. Technical Support: 2 x Engineer. To be used on G.O. Sars only in Eurofleets+.
	ROV LUSO	6000M	Deck space to accommodate 1 x 20" control container and 1x 10" workshop container. Power requirements: 440 VAC, 3-phase, 60kVA, 80A. Technical Support: 5 x Engineer.
AUV	VLIZ AUV	1000M	Minimal deckspace; 10m² (minimal 5m long). Storage room approx. 2m³. Dry lab/workshop to work with electronic equipment minimal workbenches for two technicians. Deckcrane for lifting AUV, workboat for recovery/launch. Length: 1.7 m to 3.55 m, Weight: 49 kg to 94.3 kg. Diameter: 0.2 m Endurance 4-7 hrs. Technician Support: 2 x Engineer.
	HUGIN UGOT	3000M	Deck Capacity: 1 x 20' container that also include the "stinger" (Launch and Recovery System - LARS) in a self-contained system that needs to be placed with the "back door" at the edge of the stern. In addition, space is required for the command and control equipment on board. Navigation data from the vessel, connection to HIPAP/USBL is an advantage. Principal dimensions Length: 6.3 m / Diameter: 875 mm / Volume: 2.4 m3 Weight in air: ca. 1.7 tons / Weight in water: neutrally buoyant – slightly positive / Minimum and maximum speed: 2 and 5.2 knots

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	GLIDER Teresa	1000M	Glider "Teresa", is modular, allowing for rapid sensor reconfiguration to respond to emergency conditions. Length 1.5m, Diameter 22cm, Weight 55-70kg. During the mission, and when the glider comes to the surface for positioning, part of the data will be transmitted via satellite to the data centre. Support: 1 x Engineer.
	HUGIN (IMR)	3000M	Deck Capacity: 1 x 20' container that also include the "stinger" (Launch and Recovery System - LARS) in a self-contained system that needs to be placed with the "back door" at the edge of the stern. In addition, space is required for the command and control equipment on board. Navigation data from the vessel, connection to HIPAP/USBL is an advantage. Principal dimensions Length: 6.3 m / Diameter: 875 mm / Volume: 2.4 m3 Weight in air: ca. 1.7 tons / Weight in water: neutrally buoyant – slightly positive / Minimum and maximum speed: 2 and 5.2 knots
	ASTERx	2850M	Deck space for AUV and recovery system (Caliste), USBL positioning system compatible with iXBLUE Posidonia (LF) or GAPS (MF) and acoustic modem transducer, or moon-pool or pole for installation of such. Crane or A-frame for deployment with clearance of at least 3m from the vessel stern. A detailed study of AUV - installation and –deployment is necessary.
Other	Telepresence Unit	-	Vessel must be large enough to accommodate a 20' (6m) ISO container in a location that has a significant visual access to the sky. There cannot be any significant obstacles obstructing that view. Vessel will need deck space ~ 21' x 9' (7m x 4m) with the ability to secure the 20' (6m) ISO container to the deck using baxter bolts (or equivalent) and chain binders. The vessel will need to provide crane capabilities for loading and unloading the system in port during mobilization and demobilization. The ship will need to provide clean power. Input voltage can be 240V, 450V or 480V single phase. 10KVA is sufficient. Support: 3 x engineer

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Annex I Equipment Profiles

ROV Holland I

LOCATION	*Galway, Ireland*
COORDINATES:	53.270962, -9.06269
ORGANISATION & ADDRESS:	MARINE INSTITUTE, RINVILLE, ORANMORE, CO GALWAY
INFRASTRUCTURE WEB SITE ADDRESS:	HTTPS://WWW.MARINE.IE/HOME/SITE-AREA/INFRASTRUCTURE-FACILITIES/INFRASTRUCTURE-FACILITIES
MAX NO OF EF+ DAYS:	10

Dimensions

Depth Rating	Length	Width	Height	Weight in Air	Total System Weight	Payload	Endurance (AUV)
3000m	3018mm	1810mm	1790mm	3240kgs	75T	312kgs	n/a

Technical Detail	
General Information	The Holland 1 Remotely Operated Vehicle (ROV) system is a scientific deep-water ROV system. The system is designed for deployment from the MI vessel RV Celtic Explorer as well as other vessels of opportunity. The system consists of a SMD Quasar work class Hydraulic ROV, , A- frame launch and recovery system and a deep-water (3000m) winch. The system is controlled from a 20' control container and comes with a fully equipped 20' workshop container. The system has been equipped with a survey skid to accommodate a wide range of scientific equipment including various biological and sediment sampling and multi-beam bathymetry systems. The vehicle is equipped with seven and five function manipulators to enable a wide variety of intervention and sampling procedures to be completed. The vehicle is equipped with conventional video and still cameras and a high definition camera system as well as

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	powerful lighting to ensure high quality observation and documentation of seafloor images. The ROV is designed to be used in live boating mode to ensure optimal operationsin deep or medium depth locations. A set of floats are attached tp the umbilical to create a LAZY S in the umbilical and crew support is required for this operation.
Vessel Requirements	Dynamic positioning , Deck capacity for 2 x 20' containers, 9m x 4.5m A-frame and winch, 380-480vac power supply 200kva for control Van (with high startup load), 70kva for umbilical winch and A Frame , USBL system, Total system weight; 75Tonnes
Thrusters	Horizontal & Vertical thrusters Forward, Vertical and lateral bollard pulls Auto Features: Depth, Altitude, Heading, Position
Cameras	Stills and video high definition camera system
Positioning (USBL etc)	1 x IXSEA GAPS USBL and 1 x Sonardyne Ranger 2 USBL 5 x MT8 2 x MT 9, 3 x WTM 8190 beacons
Instruments	Gyro, DVL, Altitude, Depth, Sonar
Optional Items	Multi-beam - configured to accommodate SeaBat 7125 with Octans subsea Gyro Spare Electrical/Electronic Ports - 8 x RS485/232 Ports, 10 x Analogue I/O Ports 12, 24 & 48 VDC, 110VAC PSU's available
Manipulators	2 x long reach 7F Schilling Orion (Normally fitted), 1x Rigmaster 2, 5F Grabber, 75mm slurp sampler with single chamber sample container, 2 x retractable Bio Boxes 535mm (w) x 400m (l) x 260mm (H) Additional sampling boxes can be fitted. Hydraulic cable cutters, Sediment corers
Modality of Access	The ROV Holland I is made available for deployment from the RV *Celtic Explorer* and other suitable vessels for a maximum of 10 days. Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	The ROV Holland I is available for all marine research disciplines. Support will be provided to all users on all technical and logistic support needed for the organisation, mobilisation and the execution of planned campaigns.

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ROV GENESIS

LOCATION	OOSTENDE, BELGIUM
LOCATION COORDINATES	51.2303 LAT 2.92 LONG
ORGANISATION & ADDRESS	VLAAMS INSTITUUT VOOR DE ZEE, WANDELAARKAAI 7 8400 OOSTENDE
INFRASTRUCTURE WEB SITE ADDRESS	HTTP://WWW.VLIZ.BE/EN/ROV-GENESIS
MAX NO OF EF+ DAYS	10

Dimensions

Depth Rating	Length	Width	Height	Weight in Air	Total System Weight	Payload	Endurance (AUV)
2000/1400	1400mm	870mm	1100mm	1700kg	7500kg	N/A	N/A

1. Technical Detail

General Information	The Remotely Operating Vehicle (ROV) "Genesis" with Tether Management System (TMS) is a medium sized observation/light work ROV (Cherokee-type built by Sub-Atlantic). It can be operated from any vessel capable of accommodating a winch and a control/workshop 20ft-container. An A-frame is used for launch and recovery of the ROV-system. The ROV can be used for observation work and a 5-function manipulator allows handling smaller equipment. The ROV Genesis is part of the associated equipment of the RV Simon Stevin and can be operated from this 36m coastal/regional research platform. The ROV Genesis has also been deployed around the globe from a total of 7 different research vessels in international campaigns. The ROV is operated yearly during minimum 4 campaigns: two on-board the Simon Stevin in Belgian coastal waters and two during international campaigns. The ROV has a depth rating of 2000m but operations are limited to 1400m due to umbilical-length.

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Vessel Requirements	Ability to accommodate two 20 ft-containers on deck and lifting capacity preferably A-frame or crane.
Thrusters	6 vectorised thrusters, powered by 440 VAC
Cameras	Luxus High Definition Cameras, colour, black/white, stills.
Positioning (USBL etc.)	A GAPS USBL-system is standard installed during ROV operations to achieve sub-meter scale positioning and navigation.
Instruments	Hydraulic HLK-EH5 5f arm; medium work, lift cap.: 25 kg Drawer in skid for e.g. sample stowage Obstacle avoidance: Tritech Super SeaKing 325/673 kHz CTD: Sea & Sun CTD 48m Small coring system Sediment temperature: THP temp probe from micrel Niskin bottles Gassampler system (from NIOZ) Installation of client sensors on request
Optional Items	N/A
Manipulators	5-function manipulator
Special features	The ROV Genesis is a very versatile vehicle that requires little mobilisation time and can easily be installed on-board ships having space for two 20 ft. containers on deck and lifting capacity by (preferable) A-frame or crane.
Modality of Access	The ROV will be available for a maximum of 10 days, either on-board the Simon Stevin or on-board any other capable research vessel. Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	VLIZ support all users with all technical and logistic support needed for the organisation, the local mobilisation and the execution of planned campaigns. VLIZ provides full technical and operational support for the entire campaign. Extra technical support can be sought with both NIOZ (NL) and ODNature (B) due to cooperation agreements regarding the use of the ROV and marine other research equipment.

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Ocean Modules V8 Offshore ROV

LOCATION	GOTHENBURG, SWEDEN
LOCATION COORDINATES	LATITUDE: 57.70 LONGITUDE 11.96
ORGANISATION & ADDRESS	UNIVERSITY OF GOTHENBURG, SWEDEN
INFRASTRUCTURE WEB SITE ADDRESS	HTTPS://WWW.LOVEN.GU.SE/
MAX NO OF EF+ DAYS	20

Dimensions

Depth Rating	Length	Width	Height	Weight in Air	Total System Weight	Payload	Endurance (AUV)
2000m	1100mm	800mm	900mm		270kg (without equipment)	40kg	n/a

1. Technical Detail

General Information	The Remotely Operated Vehicle (ROV) "Ocean Modules V8 Offshore" is in service since 2010/2011 and has been used primarily in Swedish territorial waters but also on-board the German research icebreaker "Polarstern" in southern summer season 2015/2016 in the south-eastern Weddell Sea, Antarctica. In 2015 the ROV system was upgraded with a 20 foot HC Control and Transport container together with a mobile winch (MacArtney type MERMAC R10 / 2125/16, 2-23.5 AHC) The ROV was primarily used for marine biological research projects (monitoring, visual inspection of cold water coral reefs, Antarctic benthos communities, in situ experimentation). But the system may also be used for projects in physical/chemical oceanography and marine geology.
Vessel Requirements	The ROV system is mobile and containerized, thus operations are possible world-wide including the Arctic and Antarctic depending on sea-ice conditions.
Thrusters	N/A

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Cameras	HD Video camera Osprey Tritech cameras (2) Still camera Imenco Digital SDS1210
Positioning (USBL, etc)	N/A
Instruments	Tritech altimeter CTD with optode (oxygen) type SAIV Scientific payload tool skid Deep Sea LED lamps (Oceanlight Wide Flood) 4 green laser scaler
Optional Items	N/A
Manipulators	Advanced manipulator ECA 5 – function electric
TMS/Deployment Method	N/A
Modality of Access	All potential users of the ROV are obliged to submit applications for ship-time via a web-portal (http://skagerak.gu.customer.i8t.com/). The ROV system is mobile and containerized, thus operations are possible world-wide including the Arctic and Antarctic depending on sea-ice conditions. The ROV will be available year-round according to an annual cruise plan. Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	Technical support and preparation for mobilization and demobilization will be provided. Our warehouse facilities and the Robotics Lab workshop in Gothenburg harbour can be utilised for storage of user equipment pre and post survey.

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MARUM SQUID ROV

LOCATION	BREMEN, GERMANY
LOCATION COORDINATES	LAT 53.074982 LONG 8.807080
ORGANISATION & ADDRESS	UNIVERSITY OF BREMEN, MARUM - CENTER FOR MARINE ENVIRONMENTAL SCIENCES
INFRASTRUCTURE WEB SITE ADDRESS	HTTPS://WWW.MARUM.DE/EN/INFRASTRUCTURE/ROV-MARUM-SQUID.HTML
MAX NO OF EF+ DAYS	10

Dimensions

Depth Rating	Length	Width	Height	Weight in Air	Total System Weight	Payload	Endurance (AUV)
2000	2.1	1.2	1.8	1.3t	<10T	20kg	n/a

1. Technical Detail

General Information	ROV MARUM-Squid is a SAAB-Seaeye *Leopard* type compact, small work-class ROV system for operations down to 2000 m water depth, designed to operate from small research vessels with limited deck space. The vehicle has the possibility to maintain position in the water column (midwater station-keeping) without acoustic link to the seafloor via DVL or similar. The advanced sensor package also allows accurate track following necessary to perform e.g. photo-mosaicking tasks.
Vessel Requirements	Suitable for smaller vessels with limited deck space. The waiving of an additional 20" control container results in a very small footprint of <10m² for winch and ROV on deck, making the system well suited for operations from small platforms.
Thrusters	The above-average thruster power (>3 knots forward speed) allows operations in high current areas, denied to systems with comparably lower thruster-power.
Cameras	HD video camera, 14 megapixel stills, PAL overview camera 1 pair of green line lasers, Video recording on hard-disk.
Positioning (USBL, etc)	For positioning, ROV-Squid uses the Posidonia or GAPS USBL systems from IXBLUE. Due to the advanced navigational sensor package of the ROV, positioning and displacement within 10cm

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	is possible. The system can fly along given patterns within this accuracy to create photo-mosaics on small scale structures such as bacterial mats. Station-keeping in the water column is also possible which can be of interest to scientists studying midwater biota. The vehicle can maintain its position, acting as a stable, non-drifting platform anywhere between the surface and the seafloor.
Instruments	Attitude heading and reference unit (laser gyro, 3-axis accelerometers, DVL), Dual frequency sonar; 325/675kHz, Depth sensor, Altimeter, Magnetic compass, CTD Probe.
Optional Items	Free interfaces for additional scientific sensors: 2 x serial links (RS232), 1 x Gigabit Ethernet port, 1 x PAL cam
Manipulators	Seven function manipulator, Sample drawer-box for sample storage and payload installation.
TMS	The vehicle is a free-flyer without TMS or LARS to be deployed over the side of the vessel via the ship´s crane.
Modality of Access	A successful TNA proposal will be integrated into the cruise planning process of the system. Within this process, the cruise is scheduled and allocated to a suitable time slot. Part of the planning process is to evaluate whether the system can operate from the proposed vessel, taking into account e.g. lifting gear, positioning possibilities or lab space. Hence, a visit to the ship within the scope of the cruise preparation is eligible in order to prepare mobilization and operation. A pre-cruise meeting with the responsible scientists will be organized to discuss details of the cruise, operation and payload. A detailed description of the desired payload to be integrated to the system needs to be provided by the user. The payload is to be sent to MARUM early enough for integration and testing. Mob/Demob in port requires 2 days by the ROV team which consists of 4 Pilots/Technicians. Shipping and logistics of the system will be organized by the MARUM logistics department and costs covered by Eurofleets+ up to a maximum amount. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	MARUM-Squid will be operated by a trained crew with a long-term experience in ROV operation. The team will assist and support the scientific party in any ROV related matters like technical or operational issues. The team will take care of the mobilization/demobilization on the vessel with support from the ship´s crew, operation and repairs. Dives are possible on a

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	daily basis but are limited to 8 hours' operation time, however exceptions can be made depending on the current situation. With support from the ROV team, the scientists are asked to prepare a scientific dive plan for each dive to use the system as efficiently as possible.

HROV ARIANE

Location	Toulon, France
Location Coordinates	Lat 43.125191 Long 5.931040
Organisation & Address	Ifremer, Centre de Bretagne, Zone Industrielle de la Pointe du Diable, CS10070, 29280 Plouzané, France
Infrastructure Web site address	wwz.Ifremer.fr
Max No of EF+ Days	7 Days

Dimensions

Depth Rating	Length	Width	Height	Weight in Air	Total System Weight	Payload	Endurance
2500m	2.2m	1.85m	2.13m	1800kg	1.5T	220kg	6 -10 hour

1. Technical Detail	
General Information	The hybrid ROV Ariane is a new generation of remote underwater system operated through an optical fibre link, where energy is supplied by on-board lithium-ion batteries. Two payload configurations are possible: - "exploration and sampling" integrating two 5 and 7-function manipulator arms, one basket, one directional camera, sampling tools - "cartography" including an EM2040 multi-beam echo sounder and a directional camera. The system design is especially attractive in the following aspects: - propulsion architecture and navigation system especially designed for work on strong cliffs and canyons;

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	- high-end payload devices for manipulation, mapping and sampling; - all major scientific ROV functions in a compact package operated at optimized cost and fast access from 25m+ coastal ships.
Vessel Requirements	Deployments are possible from small vessels without dynamic positioning.
Thrusters	Its propulsive architecture and navigation sensors offer to work on any type of seabed, including very rugged operational areas such as canyons.
Cameras	HD video, a tilted 24Mp still photo camera with synchronized flash lighting, image are stored in raw format with wide meta-data (view parameters, vehicle navigation data Etc.);
Positioning (USBL, etc)	GAPS – USBL box
Instruments	Vacuum fauna sampling, sediment coring, sampling basket; CTD, ADCP, interfaces for simple scientific sensors; Kongsberg 2040 multi-beam echo-sounder in vertical, 45° and horizontal orientations, water column recording; Full software GIS compatibility and data visualization tools.
Optional Items	Possibility of adding sensors or specialised tools.
Manipulators	2 electric manipulators with respectively 5 and 7 functions
TMS	ROV Ariane can be operated in tele-operated mode (ROV), via a light optic fibre cable deployed from a depressor or a cage. This tether management system allows the vehicle to operate from vessels without dynamic positioning. It can also be operated in autonomous mode (AUV), with an optional acoustic communication link.
Modality of Access	The HROV Ariane is based in Ifremer's Toulon facilities. Technical infrastructure, test tanks, and access to a controlled harbour basin (150m x 300m) gives strong potential for integration work and harbour trials preceding sea-trials. Access will be structured by 3 to 5-day integration & harbour trials, and sea-trials on Ifremer or opportunity ships. For the vehicle operation itself a team of 3 operators is provided, one engineer is provided for the specific technological aim. A primer training for operations with the deep-sea medium size HROV is included in the harbour trials. Office space close to the test facilities is made available.

Eurofleets+

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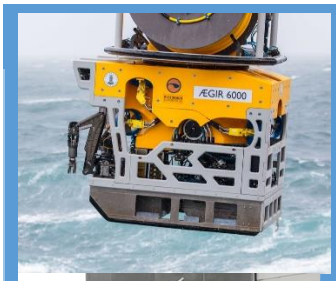
	Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	The integration of experimental third party or partner equipment in terms of mechanical, electrical or computer engineering can be conducted in cooperation with Ifremer's engineering teams.

ROV Ægir 6000



Location	**Bergen, Norway**
Location Coordinates	Lat 60.391262 Long 5.322054
Organisation & Address	University of Bergen, Postboks 7803, N-5020 Bergen, Norway
Infrastructure Web site address	http://www.uib.no/geo
Max No of EF+ Days	10

Dimensions

Depth Rating	Length	Width	Height	Weight in Air	Total System Weight	Payload	Endurance (AUV)
6000m	2,75m	1,7m	1,65m	3600 kg	N/A	N/A	N/A

1. Technical Detail	
General Information	Work-class ROV specially equipped for science with samplers and sensors. Sufficiently powered to operate seafloor drilling systems and to install and maintain seafloor observatories. Designed for operation from both RVs G.O. Sars and Kronprins Haakon (using the latter's moon-pool when operating in ice-covered water).

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Vessel Requirements	To be used on G.O. Sars only in Eurofletes+.
Thrusters	
Cameras	The ROV is equipped with a high-quality camera and navigation systems, and comes standard with a range of sensors and sampling equipment.
Positioning (USBL, etc)	N/A
Instruments	Gas sampler, Fluid, Sediment, Bio and Rock samplers, Microbiology, Macro biology, Methane sensor, CO2 sensor, Multi-beam echo sounder
Optional Items	N/A
Manipulators	Equipped with delicate pincers for taking targeted samples
TMS	1000m+
Modality of Access	The ROV will be available on board the RV G.O. Sars for a maximum of 10 days. Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	Users will be supported by University of Bremen and IMR staff.

ROV Luso

<table>
<tr><td colspan="2">Location</td><td colspan="6">Paço de Arcos, Portugal</td></tr>
<tr><td rowspan="4">  </td><td>Location Coordinates</td><td colspan="6">Latitude: 38.6938
Longitude: -9.2953</td></tr>
<tr><td>Organisation & Address</td><td colspan="6">EMEPC – Estrutura de Missão para a Extensão da Plataforma Continental</td></tr>
<tr><td>Infrastructure Web site address</td><td colspan="6">https://www.emepc.pt/rov-luso?lang=en</td></tr>
<tr><td>Max No of EF+ Days</td><td colspan="6">8</td></tr>
<tr><td></td><td colspan="7">Dimensions</td></tr>
<tr><td>Depth Rating</td><td>Length</td><td>Width</td><td>Height</td><td>Weight in Air</td><td>Total System Weight</td><td>Payload</td><td>Endurance (AUV)</td></tr>
<tr><td>6000m</td><td>2.0m</td><td>1.6m</td><td>2.2</td><td>2300kg</td><td>35T (including</td><td>100kg</td><td>n/a</td></tr>
</table>

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					control container)		

1. Technical Detail	
General Information	ROV Luso is capable of diving to depths of 6000m adapted for scientific purposes aimed at collecting various types of sample (geological and biological - with different requirements in samples packaging), and is equipped with an HD camera and several sensors that aim to collect and provide real time information concerning the physical and chemical characteristics of the water in which the ROV Luso is operating. ROV Luso incorporates a larger sample box, the incorporation of a suction sampler with 5 individual chambers and an area for storing a group of corers and several sensors targeting different parameters. Specific tools are also integrated in the ROV Luso, such as a rock saw for sampling in situ and new corers with internally designed restraint systems.
Vessel Requirements	Deck space to accommodate 1 x 20” control container and 1 x 10” workshop container.
Thrusters	7 x 5.5 kW, 20A, 4 Horizontal, 3 Vertical
Cameras	1 x Sony Argus RS, 1 FocusZoom HDTV camera, 1 Kongsberg Still camera 10 Mpx + flashgun, 1 DSPL lowlight Black & White camera and 5 DSPL other cameras.
Positioning (USBL, etc)	Linkquest USBL
Instruments	Mini-Drill unit, Push Corers, Suction sampler with 5 chambers, Biologic and geologic sample boxes, 2 x Imenco green scaling lasers.
Optional Items	Teledyne DVL, Contros CH4 Sensor, Contros CO2 Sensor SAIV CTD SD204 with additional sensors: Dissolved Oxygen, Fluorescence, Turbidity, Idronaut CTD with additional sensors: Dissolved oxygen, turbidity, pH, redox potential
Manipulators	1 x 5 function and 1 x 7 function
TMS	Deployment Method: Free Flying Latch Launch Method: LARS (Launch and Recovery System)
Modality of Access	The ROV Luso will be made available for deployment from the RV Mar Portugal. Mobilisation and demobilisation costs will be

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	covered as will transportation costs up to a maximum amount if required. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	Support will be available during survey preparation stage mobilisation and demobilisation.

CNR GLIDER 'TERESA' with MICRORIDER

Location	Lerici (La Spezia), ITALY
Location Coordinates	Lat 44.106700 Long 9.829260
Organisation on & Address	CNR ISMAR – Institute of Marine Science, Arsenale - Tesa 104, Castello 2737/F, 30122 Venezia, Italy,
Infrastructure Web site address	http://www.ismar.cnr.it/infrastructures/instrumentation-and-equipments/Slocum-Glider-Teresa
Max No of EF+ Days	10

Dimensions

Depth Rating	Length	Diameter	Total System Weight	Endurance (AUV)
1000m	1.5	22cm	55-70kg	15-40 days depending on the sampling frequency and communications.

1. Technical Detail

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General Information	Glider "Teresa" is a Slocum Deep Glider G2, operating in the Mediterranean Sea along vertical sawtooth sections, monitoring the water column up to 1000m depth. As all gliders, it moves both horizontally and vertically thanks to density variations and centre of mass displacement. It is equipped with a CTD probe, dissolved oxygen optode and a set of fine-structure sensors; it measures vertical profiles of hydrological properties, dissolved oxygen and turbulence through continuous cycles of immersion-emersion. High precision turbulence measurements can be obtained due to the shear sensors and high-frequency thermistors. During the mission, and when the glider comes to the surface for positioning, part of the data will be transmitted via satellite to the data centre. Glider "Teresa", as most of the Glider vehicles, is modular, allowing for rapid sensor reconfiguration to respond to emergency conditions. The fast-response shear probes for fine structure measurements of hydrological properties is a very peculiar payload, deserving to be handled with care during glider deployment and recovery. The system has been acquired by CNR in 2014. **Payloads:** 1-CTD: Seabird Electronic SGP (Slocum Glider Payload) 2- Dissolved Oxygen Sensor: Optode mod.4330 from Aanderaa 3- Microstructure Sensor: MicroRider (MR) from Rockland Scientific
Vessel Requirements	None specified.
Modality of Access	CNR will carry out all glider preparation and maintenance; sensor calibration, integration and testing; batteries check and mission design. Deployment and Recovery, piloting, NRT data transmission and data retrieval, elaboration and visualization is also included. Transportation of glider will be organized and the cost will be covered by Eurofleets+ up to a maximum amount. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs to and from their location are covered.
Support Offered to Eurofleets+ Users	The user will work together with the field technician for the scheduling of the mission by defining all aspects required for the success of the experiment and the achievement of the expected results. The support will include deployment and recovery of the glider as well as remote action in case of emergency.

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	Near-real-time in-situ data analysis is done by the PI using SOCIB DAPP Interface as well as post processing elaboration for the final data.

HAVFO AUV HUGIN

Location	Horten, Norway,
Location Coordinates	Lat 59.412470 Long 10.485530
Organisation & Address	Norwegian Defence Research Establishment (NDRE), Forsvarets forskningsinstitutt (FFI), PB 25, 2027 Kjeller, Norway
Infrastructure Web site address	www.ffi.no
Max No of EF+ Days	10

Dimensions

Depth Rating	Length	Diameter	Total System Weight	Endurance (AUV)
3000m max	5.6m	75cm	1000kg	15-25hours

I. Technical Detail	
General Information	The Hugin AUV is designed for military and civilian scientific use, it is of a modular design, container based and can easily be equipped with temporary sensors. Safe launch and recovery up to seastate 5-6. Payloads: Synthetic Aperture Sonar, Multi-beam echo sounder, sub-bottom profiler, cameras, oceanographic sensors, Ch4 detector, Magnetometer, turbidity sensor, fishery sonar, acoustic towed array
Vessel Requirements	n/a
Modality of Access	Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact

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	EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	Support will be provided during planning, mobilisation and demobilisation and post survey. Operators will be available to operate the AUV.

AUV ASTERx

Location	Toulon, France
Location Coordinates	Lat 43.125191 Long 5.931040
Organisation & Address	Ifremer, Centre de Bretagne, Zone Industrielle de la Pointe du Diable, CS10070, 29280 Plouzané, France
Infrastructure Web site address	wwz.Ifremer.fr
Max No of EF+ Days	8

Dimensions

Depth Rating	**Length**	**Diameter**	**Total System Weight**	**Endurance (AUV)**
2850m	4.5m	0.7m	800kg	16h max

1. Technical Detail	
General Information	The AUV are autonomous underwater vehicles dedicated to scientific studies on the continental margins down to 2 850 m. These vehicles can operate payloads such as multi-beam echo sounders, sub bottom profilers and specific scientific sensor packages on up to 100 km length profile. They are able to study sea bottoms and water column for multiple scientific objectives thanks to their payload modularity. As open systems, Ifremer has complete knowledge and capability to modify/adapt/integrate sub-systems to answer new requests (ex. HO fuel cell integration, experimental payloads such as Raman spectrometer, gravi-meter etc.) Their operability on coastal vessels allows fast and efficient mobilisation at a reasonable cost. Standard Payloads : Multibeam echosounder: EM2040 (Konsberg)

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	Sub Bottom Profiler: ECHOES 5000 (Ixblue) Magnetometer: 3 axis Fluxgate Fisheries echosounder: EK60 - 70 kHz, 200 kHz (Kongsberg) Current profiler: ADCP WH 300/600/1200 KHz (RDI) Physical sensors: CTD SBE49 (Seabird) Spectrometer UV ISUS V3 (Satalantic) Modular electrical and mechanical interfaces for user scientific equipment, engineering capabilities for specific integration or functional adaptation.
Vessel Requirements	Deck space for AUV and recovery system (Caliste), USBL positioning system compatible with iXBLUE Posidonia (LF) or GAPS (MF) and acoustic modem transducer, or moon-pool or pole for installation of such. Crane or A-frame for deployment with clearance of at least 3m from the vessel stern. A detailed study of AUV -installation and –deployment is necessary.
Modality of Access	The AUVs are based in Ifremer's Toulon facilities. Technical infrastructure, test tanks, and access to a controlled harbour basin (150m x 300m) gives strong potential for integration work and harbour trials preceding sea-trials. Access will be structured by 3 to 5-day integration & harbour trials, and sea-trials on Ifremer or opportunity (partner?) ships. For the AUV operation itself a team of 3 operators is provided, one engineer is provided for the specific technological aim. A primer training for operations with the deep-sea medium size AUV class is included in the harbour trials. Office space close to the test facilities is made available.
Support Offered to Eurofleets+ Users	The AUVs have a modular control architecture which gives access for a high level "backseat" piloting computer allowing implementation of experimental strategies while guaranteeing full safety through the low level controller. The "open" mechanical architecture with a significant payload section (volume 0,7m x 0,7m diameter). The integration of experimental third party or partner equipment in terms of mechanical, electrical or computer engineering can be conducted in cooperation with Ifremer's engineering teams. Ahead work on a hardware-in-the-loop simulator for software integration can be made available.

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UGOT Hugin AUV

Location	**Gothenburg, Sweden**
Location Coordinates	Latitude: 57.70 Longitude 11.96
Organisation & Address	University of Gothenburg, Sweden
Infrastructure Web site address	https://www.loven.gu.se/
Max No of EF+ Days	20

Dimensions

Depth Rating	Length	Diameter	Weight in Air	Total System Weight	Payload	Endurance (AUV)
3000m	6.3m	875mm	1.7T	N/A	N/A	61 hrs max

1. Technical Detail	
General Information	HUGIN's modular construction and versatile payload suite enable operators to conduct a wide variety of missions with a single AUV. The ability to carry a large array of sensors including a full suite of geophysical and environmental options provides the capability to collect a comprehensive data set in a single dive. One of the key strengths of this AUV is the tight integration of payload sensors with vehicle systems. This means HUGIN can operate all of the sensors on board concurrently. The AUV is equipped with four (4) (but offers space for up to six (6) Kongsberg Maritime K235 Series batteries with 8 KWh each)). With 4 batteries the AUV can operate at 3 knots speed simultaneously the Multi-beam Echo Sounder, the Side Scan Sonar System, the Sub-Bottom Profiler and a camera for 41 hours. At 4 knots cruising speed the total mission period can last for 26 hours. With a full set of batteries this may increase mission periods to 61 and 40 hours, respectively. The Navigation accuracy in autonomous mode of operation (no position updates, straight line) in real-time has an estimated navigation error of 0.08% of distance travelled, less than that after post-processing of data.
Vessel Requirements	N/A

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Modality of Access	All users of this AUV are obliged to submit applications for the use of this large mobile infrastructure by using our established web-portal originally developed for ship-time applications for the RV "Skagerak" (http://skagerak.gu.customer.i8t.com/). The AUV will be available year-round according to an annual cruise plan. The "HUGIN 3000" will be available for operations world-wide, even in the Arctic and Antarctic including missions under sea-ice or glaciers. Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	All necessary technical skills including support for mobilisation and demobilisation by a combination of technical and logistic personnel will be provided. Our warehouse and workshop facilities in Gothenburg harbour can be utilised for storage of user equipment pre and post survey.

VLIZ AUV

Location	Oostende, Belgium
Location Coordinates	51.2303 Lat 2.92 Long
Organisation & Address	Vlaams Instituut voor de Zee, Wandelaarkaai 7 8400 Oostende
Infrastructure Web site address	http://www.vliz.be/en/rov-genesis
Max No of EF+ Days	10

Dimensions

Depth Rating	Length	Diameter	Total System Weight	Endurance (AUV)
1000	1.7	0.2	49 – 94.3kg	4-7 hours

1. Technical Detail	
General Information	The USV allows controlled autonomous long-lasting measurements of both atmosphere and ocean characteristics in the Belgian part of the North Sea and beyond.

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	The AUV has a depth range up to 1000 meters and is equipped with a multitude of sensors including a multi-beam echo sounder, a sub-bottom profiler, a synthetic aperture sonar and an environmental module. This allows seawater, seabed and sub-seafloor measurements related to chemical, biological, physical, geological and historical research from shelves to continental slopes. The AUV has a maximum speed of 5.5knots, 480GB memory and comes with its own transport case, LARS (launch and recovery system) and portable cage. Communication & GPS: Ethernet: till 100 Mbit/s, Wi-Fi: till 54 Mbit/s, Acoustic modem (Benthos): till 2 kbaud, Iridium satellite communication, Gps with RTK-corrections, GAPS-transponder enables USBL-updates.
Vessel Requirements	Minimal deckspace; 10m² (minimal 5m long) Storage room approx. 2m³ Dry lab/workshop to work with electronic equipment minimal workbenches for two technicians Deckcrane for lifting AUV, workboat for recovery/launch
Modality of Access	Equipment transportation costs up to a maximum amount will be covered by Eurofleets+. Users should contact EurofleetsPlus@marine.ie prior to submitting an application to ensure shipment costs from their location are covered.
Support Offered to Eurofleets+ Users	Two support technicians will be provided.

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Telepresence Unit

Location	USA
Organisation & Address	The Global Foundation for Ocean Exploration, Inc. PO Box 417, Mystic, CT USA 06355
Infrastructure Web site address	http://www.engineeringfordiscovery.org/
Max No of EF+ Days	14

1. Technical Detail	
General Information	One Sea Tel 9711QOR VSAT 2.4-meter satellite system, housed on top of its 20-foot container, will be provided during an oceanographic mission. Its purpose is to offer "telepresence" capabilities. Telepresence allows data from the vessel and a ROV to be transmitted in real time via satellite to anyone with an internet connection. There are only a handful of organizations, mostly US-based, that currently have this capability. Other equipment provided includes a spectrum analyser, modems, Ethernet switch, router, cabling, laptops, racks, and other equipment as necessary. The VSAT's purpose is to offer "telepresence" capabilities to oceanographic missions. Telepresence allows data from a ROV to be transmitted in near real time via satellite to anyone with an internet connection. Thus, missions can be watched by other researchers, policymakers, and the general public by tuning into a specific website. This allows for unlimited shore-side participants to be involved in the mission and is more cost effective than sending people to sea.
Vessel Requirements	Vessel must be large enough to accommodate a 20' (6m) ISO container in a location that has a significant visual access to the sky. There cannot be any significant obstacles obstructing that view. Vessel will need deck space ~ 21' x 9' (7m x 4m) with the ability to secure the 20' (6m) ISO container to the deck using baxter bolts (or equivalent) and chain binders. The vessel will need to provide crane capabilities for loading and unloading the system in port during mobilization and demobilization. The ship will need to provide clean power. Input voltage can be 240V, 450V or 480V single phase. 10KVA is plenty.
Modality of Access	System should be utilized in conjunction with a medium to large size ROV system with HD cameras, capable of supporting a major science and/or exploration mission

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Support Offered to Eurofleets+ Users	Shipping to port, mobilization/demobilization, all necessary engineers for setup and operation.

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