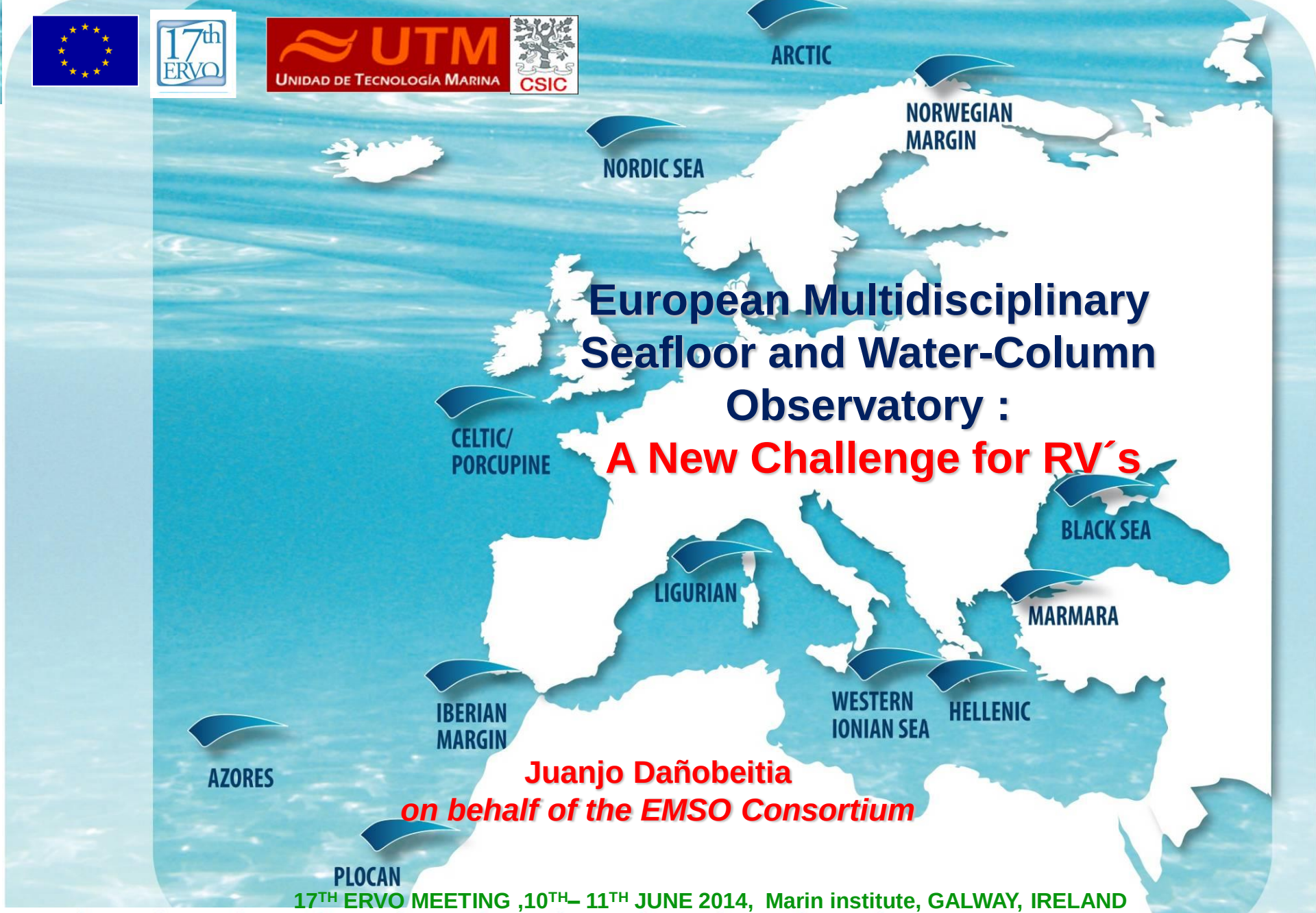


European Multidisciplinary Seafloor and Water-Column Observatory : A New Challenge for RV´s

Juanjo Dañobeitia
on behalf of the EMSO Consortium

17TH ERVO MEETING ,10TH– 11TH JUNE 2014, Marin institute, GALWAY, IRELAND

EMSO is a Distributed European Research Infrastructure of fixed seafloor and water column observatories constituting a Large Scale infrastructure for **long-term** monitoring of marine environmental processes

european multidisciplinary seafloor & water column observatory

emso

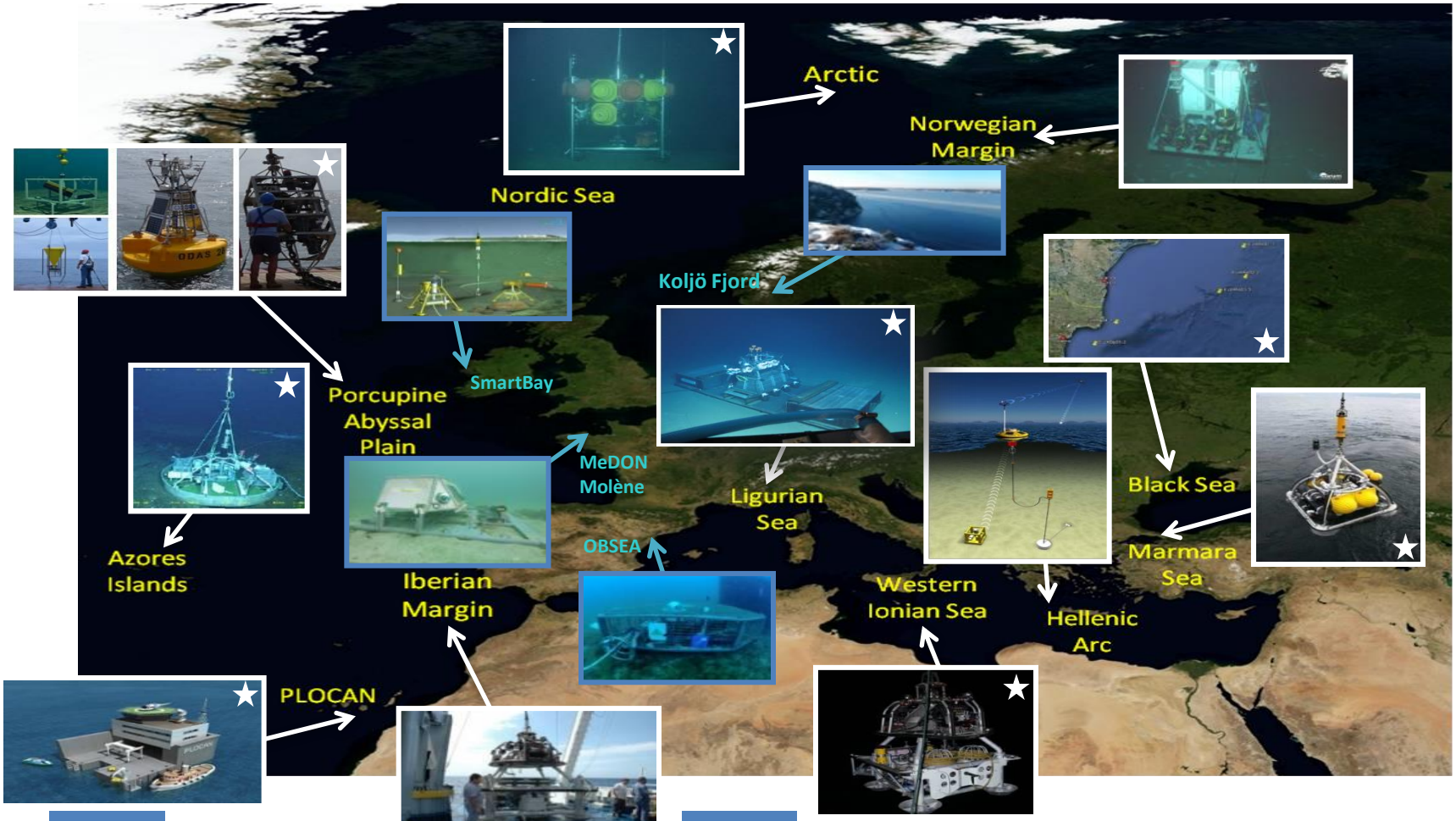
Challenging Topics

- Health of the Oceans; Ocean Circulation, warming and acidification
- Marine resources exploitation impact and sustainability
- Natural Hazards; Early warning of tsunami & earthquakes

european multidisciplinary seafloor & water column observatory

emso

EMSO Nodes (11 nodes & 4 test sites)



nodes

operating nodes (8/11)

test sites

european multidisciplinary seafloor & water column observatory emso

Participating Countries to EMSO RI*

10 Countries confirmed:

- Italy (coordinator) (JRU in progress)
- France (IFREMER, CNRS, IPGP)
- United Kingdom (NERC-NOCS)
- Germany (KDM)
- Spain (CSIC, PLOCAN)
- Portugal (IPMA)
- Greece (HCMR)
- Romania (GeoEcoMar)
- Ireland (MI)
- The Netherlands (NIOZ)

Planned participation:

- Norway (NRC)
- Turkey (TUBITAK)
- Sweden (UGOT)

- Total implementation costs: 300 M€
- Running costs: 20 M€/y

* Indipendent Legal Entity in progress

european multidisciplinary seafloor & water column observatory emso

Steps towards EMSO-ERIC

Italian Ministry Letter sent to the Funding Agencies	**DONE**
MoU Signature process	**DONE**
Interim Office establishment	**DONE**
ERIC Official Application submission (step1)	**DONE** **by Permanent Representation of Italy to EU**
ERIC Application review process	**NEXT**
ERIC APPROVAL ◆ **M1**	**NEXT**

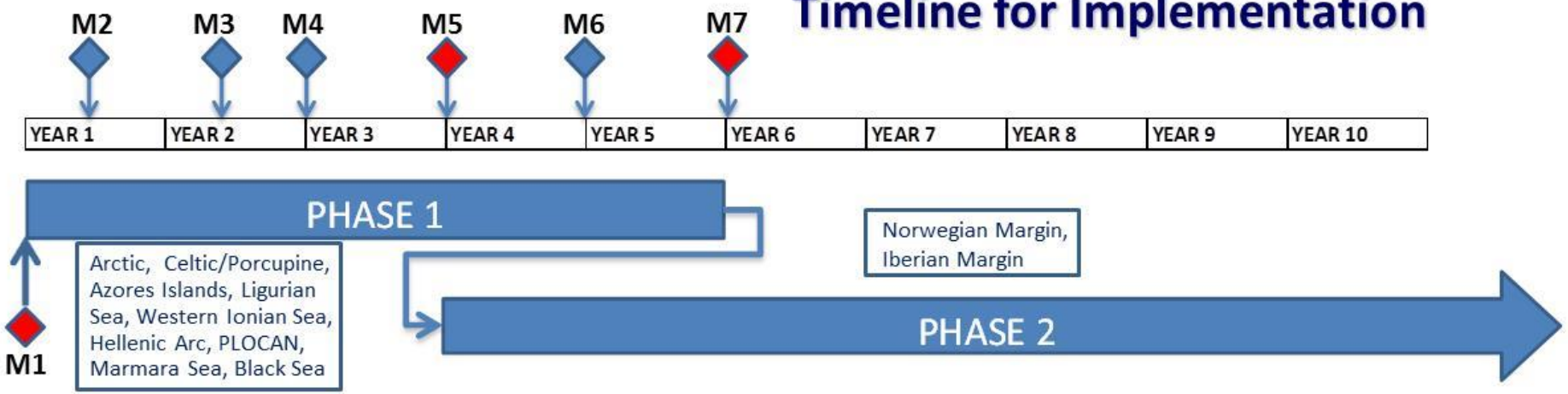
10 Signatory Countries:

Italy, UK, Portugal, Romania, Greece, The Netherlands, Ireland, Germany, France, Spain

Foreseen:

Norway, Turkey, Sweden (postponed)

Timeline for Implementation



european multidisciplinary seafloor & water column observatory emso

Fixed-point observatories

In order to explore the time changing properties of the oceanic environment, sustained observations are essential at a sufficiently high frequency

These provide the means to examine complex interrelations between processes and properties:

- **Short-time scales (minutes, hours to days)**
- **Longer-time scales (up to decades)**

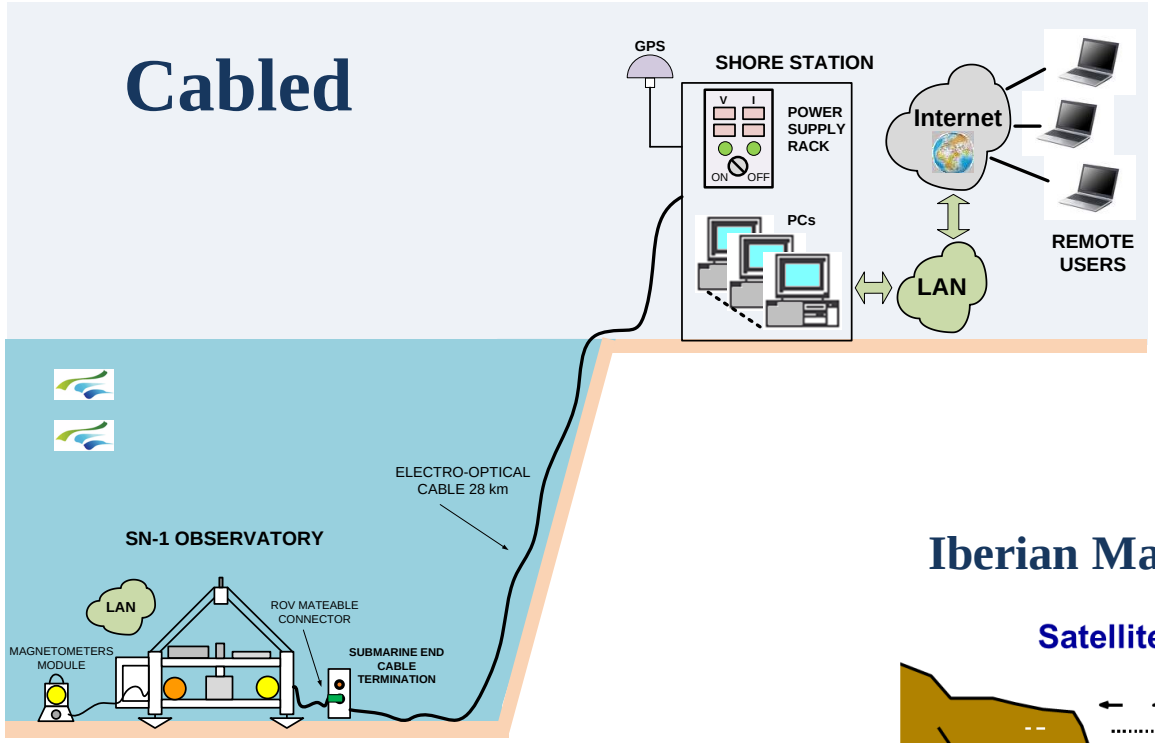
A key attribute of many current fixed observatories is that they are real-time multidisciplinary interactive and some cover several environments from the top of the ocean to the seabed

EMSO nodes types

european multidisciplinary seafloor & water column observatory

emso

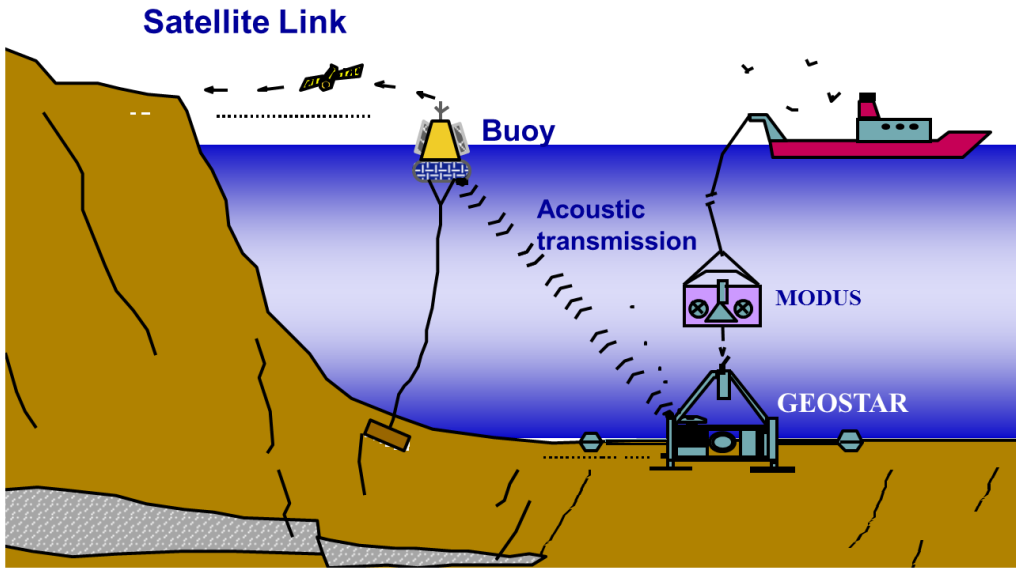
Cabled



Payload:
seismological, geomagnetic, gravimetric, oceanographic, hydro-acoustic, bio-acoustic

Standalone

Iberian Margin – NEAREST EC Project

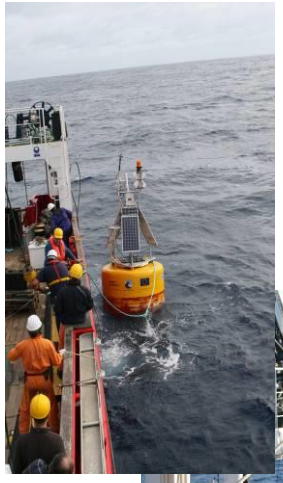


Rationale for the missions:
i) characterise ambient noise (marine mammal sounds, environmental/anthropogenic sources);
ii) study earthquake and tsunami generation in Iberian Margin & Western Ionian Sea
Detection algorithm runs in the Shore Station

EMSO nodes: present status

european multidisciplinary seafloor & water column observatory

emso



November 2009 deployment

Iberian margin

Geo-Hazard

Tsunami Early Warning system prototype
Seismometer, bottom pressure data;

Marine ecosystem & climate change: CTD, hydrophone, gravity meter, current meter, ADCP, turbidity meter, seismic, sea bottom pressure

First mission (2007-2008)

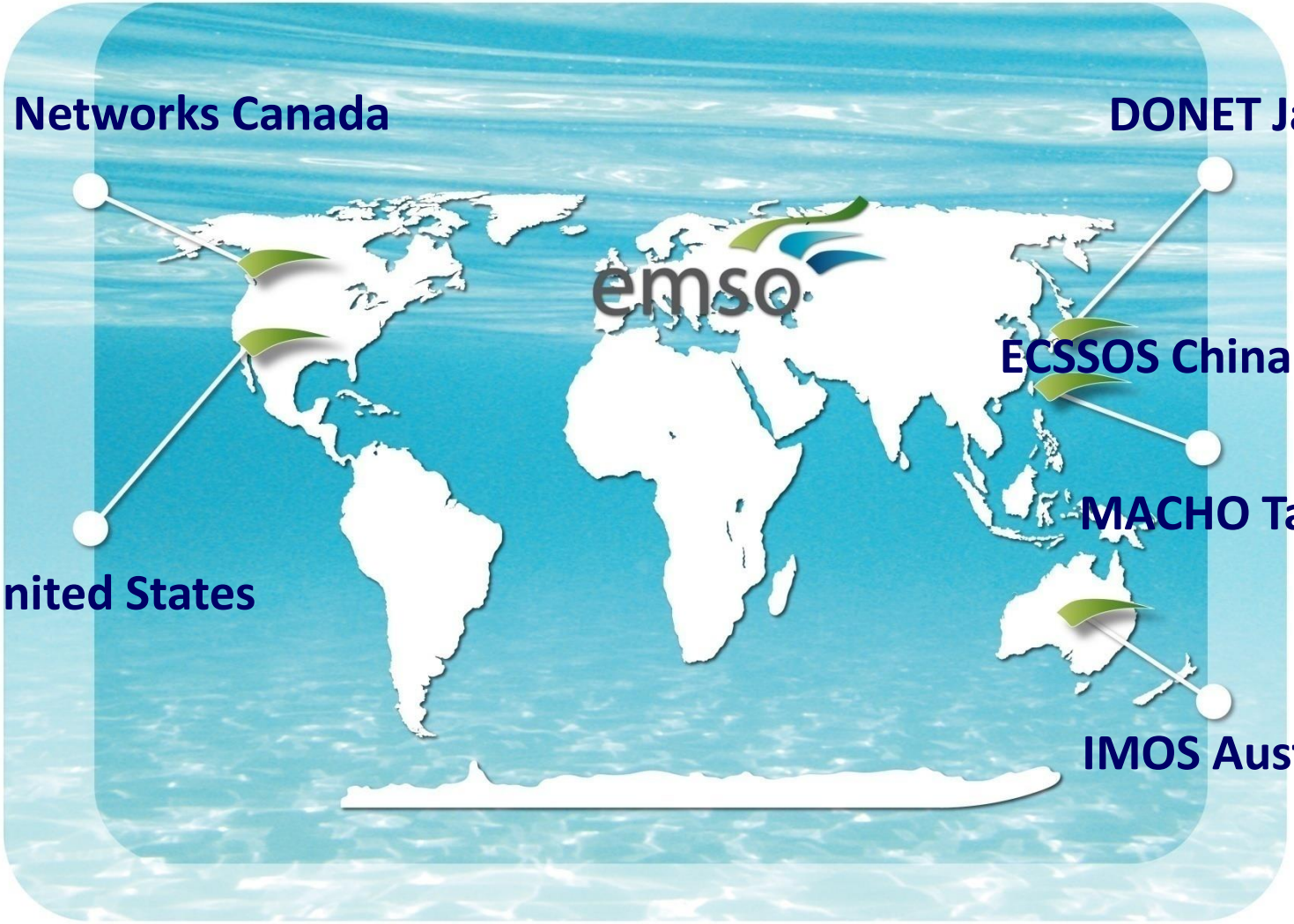
(NEAREST EC project)

Second mission (2009-2011)
NEAREST - ESONET LIDO DM
GEOSTAR recovered in June 2011

June 2011 recovery

european multidisciplinary seafloor & water column observatory

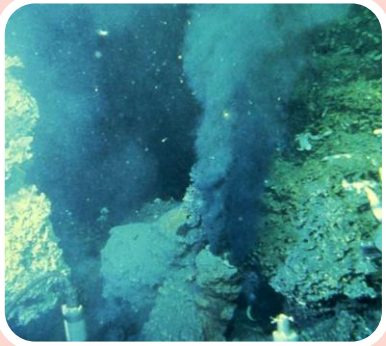
International Dimension

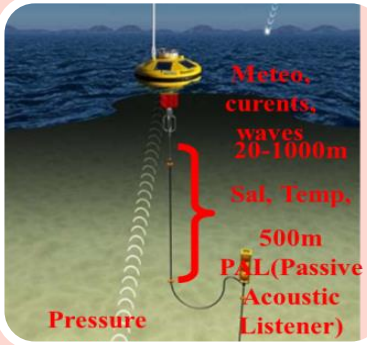


european multidisciplinary seafloor & water column observatory

emso

SCIENTIFIC RESEARCH OBJECTIVES





Geosciences

Seismicity

Gas hydrate stability

Seabed fluid flow

Submarine landslides

Submarine volcanism

Geo-hazard early warning

Physical Oceanography

Ocean warming

Deep-ocean circulation

Benthic and water column interactions

Marine forecasting

Biogeochemistry

Ocean acidification & Solubility pump

Biological pump

Hypoxia

Continental shelf pump

Deep-ocean biogeochemical fluxes

Marine Ecology

Climate forcing of ecosystems

Molecules to microbes

Fisheries

Marine noise

Deep biosphere

Chemosynthetic ecology

Opportunities exists through **EMSO- ERIC** consortium

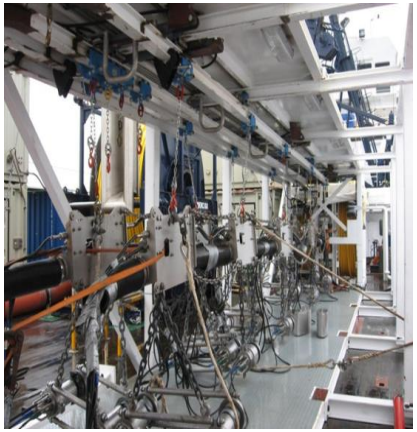
Key Socio-Economic Impacts (1/2)

EMSO addresses several Horizon 2020 challenges

Socio Economic Impact: incidence Sectors

european multidisciplinary seafloor & water column observatory emso

Natural resources; Oil, Gas, Deep Sea mining, etc.
Environment; Civil protection, Marine mammals protection, Biodiversity
Marine Technology; **Sensor, vehicles, Seafloor Observatories, seismic tools**
Energy; Submarine cabling, wind farming, wave energy, etc.
Shipping Cia; Shipyards, ship design, green ships
Management; Services, HSE Control, Training, etc.



Links to Other Major EU and Intl. Initiatives (1/2)

Europe

- Partnership Agreement with RI SIOS - Svalbard Integrated Arctic Earth Observing System (www.sios-svalbard.org)
- Cross collaborations with other RIs, such as: EURO-ARGO, EPOS, ICOS, EMBRC, LIFEWATCH and KM3NeT
- Participation in many EU projects (e.g., FixO3, ENVRI, MARsite, SCIDIP-ES)
- Links with other EU initiatives (e.g., EUROFLEETS-2, SeaDataNet, EMODnet)
- Future cooperation with European Centres of Excellence (e.g., CAGE-Centre for Arctic Gas Hydrate, Environment and Climate in Norway)
- Cooperation and co-investment with industry (e.g., oil and gas, renewable energy, deep-sea mining, fisheries)

Links to Other Major EU and Intl. Initiatives (2/2)

Global

- Contacts and exchanges with sister research infrastructure initiatives:
  - ONC - Ocean Networks Canada
  - OOI - Ocean Observatories Initiative (USA)
  - DONET - Dense Oceanfloor Network for Earthquakes & Tsunamis (Japan)
  - IMOS - Integrated Marine Observing System (Australia)
- Partnership Agreement with DONET
- Collaboration with OOI is on-going within the EU-US research cooperation project, CoopEUS
- Also, have teamed up with ONC, OOI, IMOS to propose an extended continuation of CoopEUS under Horizon 2020
- ONC is joining EMSO as an Observer
- The EMSO Coordinator nominated to the ONC International Science Advisory Board

Needs for sampling and monitoring deep seafloor : Some amazing numbers

european multidisciplinary seafloor & water column observatory

emso

- Three humans have managed to reach deepest point of the world's oceans—the Marianas Trench.
- By contrast, more than 500 people have journeyed into space and 12 people have actually set foot on the surface of the moon.
- Fiscal year 2013 NASA's annual exploration budget was roughly $3.8 billion. That same year, to NOAA's Office of Exploration and Research received just $23.7 million.
- There are some similarities between space and ocean travel: Both are dark, cold, and completely inhospitable to human life.
- Scientists estimate that we still have not discovered 91 percent of the species that live in our oceans.
- The deep seabed is a much more likely source of so-called rare-earth metals than distant asteroids. Recently the United Nations published its first plan for management of mineral resources beneath the high seas that are outside the jurisdiction of any individual country.

FREIRE SHIPYARD -Since 1895-

FREIRE

SIGNIFICANT VESSELS – Specialized Vessels

ROV/CONSTRUCTION VESSEL. POLAR KING AND POLAR QUEEN

Why Seafloor Observatories are a challenge opportunity for RV´s ?

european multidisciplinary seafloor & water column observatory emso

The **deep sea is the engine** that controls the overall climate—but we don't yet understand enough about how this engine works. Monitoring deep-sea changes could better predict future crises, such as rising sea-level, for heavily populated coastal areas.

Species that live closer to the surface are depleted, commercial fisheries are seeking other species at even greater depths. But we know little about the biology of these delicious deep-sea habitants.

Around the hydrothermal vents, there are very valuable mineral deposits, covering thousands of square km of the deep-sea floor are billions of tons of so-called "manganese nodules" that are rich in cobalt, nickel, and manganese. International consortia are pressing to get started! What effects will mining have on fragile deep-sea habitats?

There are almost four thousand offshore oil wells in the Gulf of Mexico. When will we have another gigantic oil spill like the Deepwater Horizon accident of 2010, and how much short-term and long-term damage will it do? Do we have enough information now, so we can accurately judge the extent of possible future damage and recovery times?

Credits: Charles Fisher

Why Seafloor Observatories are a challenge and an opportunity for RV´s ?

european multidisciplinary seafloor & water column observatory emso

The deep sea—that part of the ocean that is perpetually dark—is 280 million of km^2 in area. Canada extends for 9,9 million km^2 . However, despite a significant increase in exploration in recent decades, we still know very little about this "inner space." **We urgently need to know a lot more**

RECENT HISTORY

HERMIONE (Hotspot Ecosystem Research and Man's Impact On European Seas (2009-2012) EU funded project mobilized hundreds of scientist and marine technicians across Europe, more than 1000 days at sea, 50 RV´s, ROV´s, AUVs, etc.

HERMES AND HERMIONE mobilized a substantial amount a marine research infrastructures between 2006-2012 without any thoughtful preparation on the side of ship operators. Lesson learned

Currently there are few Submarine Labs operative (Canada Neptune, OOI-USA, etc.) RVs are part of the program by installing sensors, reparations, and some maintenance, etc.

ERVO has a unique opportunity to anticipate events and prepare our Rv´s in an efficient and collaborative way to address the challenge of early implementation of undersea laboratories.

CONCLUDING REMARKS
Scientific & Societal demand for Deep Sea and Water Column

european multidisciplinary seafloor & water column observatory

emso

- **Oceans are** essential to quality of life on Earth. **Largest most complex Biome on Earth- ORIGIN OF LIFE**
- **Oceans dynamics** drive most of the ecosystems on Earth, and control on the Planetary Climate

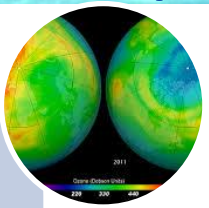
-70% of Volcanism on Earth Occurs Underwater. Source of Hazards- Often Unpredictable

- **Oceans** are the **last unexplored frontier on Earth**
-There is a **increasing exigency to understand de oceans**

EMSO AIMS: For long-term monitoring series of sub-seafloor, seafloor and water column

To study Ecosystems, Global changes, Earth Sciences and Geo-hazards and for Environment protection

Marine component of **GMES** and **GEOSS** Platform for **Data Access and management**



Earths interactions hydrosphere, biosphere, lithosphere, atmosphere

Geohazard and early warning capacity for earthquakes ,tsunamis, gas-hydrates release and submarine slope failure and sediments instability

Research and long term and continuous monitoring has the highest priorities?

Interactions between ecosystems , biodiversity, biogeochemistry physic and climate for e.g. understanding present and past climate changes in the poles?

Regular operations are needed and prioritized for research, monitoring purposes, and maintenance of permanently installed observatories, based on the previous items?

Impact of exploration and extraction of natural resources and living resources

Observation on how Natural and Anthropogenic changes Connecting scientific outcomes to stake holders and policy makers

http://www.emso-eu.org/
interim.office@emso-eu.org

EMSO PARTICIPANTS

european multidisciplinary seafloor & water column observatory

emso

- Paolo Favali, Laura Beranzoli, Pier Luigi Franceschini

Istituto Nazionale di Geofisica e Vulcanologia, Italy (Coordinator)

- Jean-Francois Rolin

Institut Français de Recherche pour l'exploitation de la mer, France (Deputy Coordinator)

- Christoph Waldmann

Konsortium Deutsche Meeresforschung e.V., Germany

- Michael Gillooly, Fiona Grant

Irish MarineInstitute, Ireland

- Juan Jose Danobeitia, Jaume Piera

Unidad de Tecnologia Marina-Consejo Superior de Investigaciones Cientificas, Spain

- Per Hall

Goteborgs Universitet, Sweden

- Vasilios Lykousis

Hellenic Centre for Marine Research, Greece

- Henry A Ruhl

National Oceanography Centre Southampton, UK

- Benedicte Ferré, Jürgen Mienert

University of Tromsø, Norway

- Jorge Miguel Alberto de Miranda, Livia Moreira

Fundação da Faculdade de Ciências da Universidade de Lisboa, Portugal

- NamikÇagatay

Istanbul Teknik Universitesi, Turkey

- Jens Greinert

Stichting Koninklijk Nederlands Instituut voor Zeeonderzoek, The Netherlands

Thanks for your attention