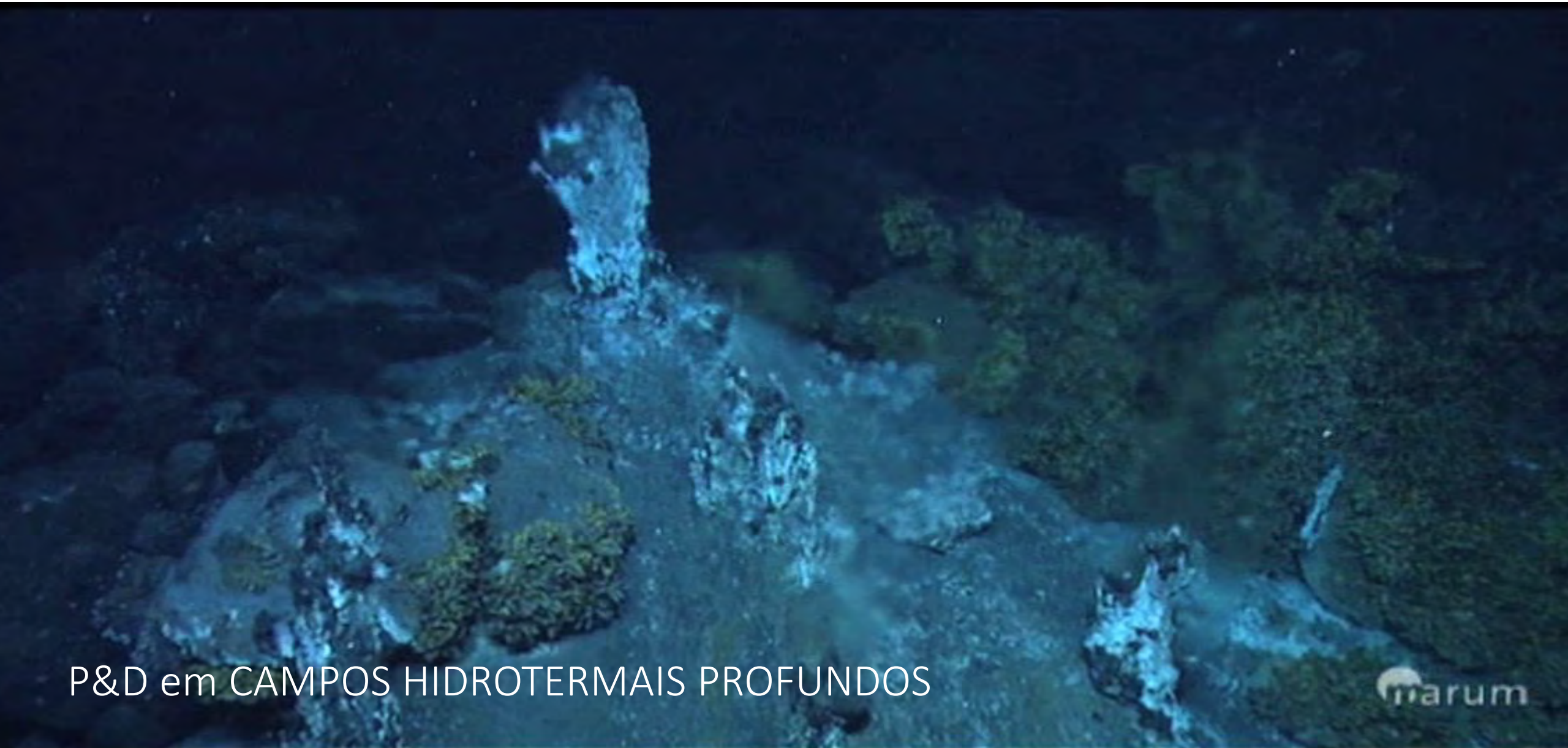
“Yo no vengo a decir un discurso. …”

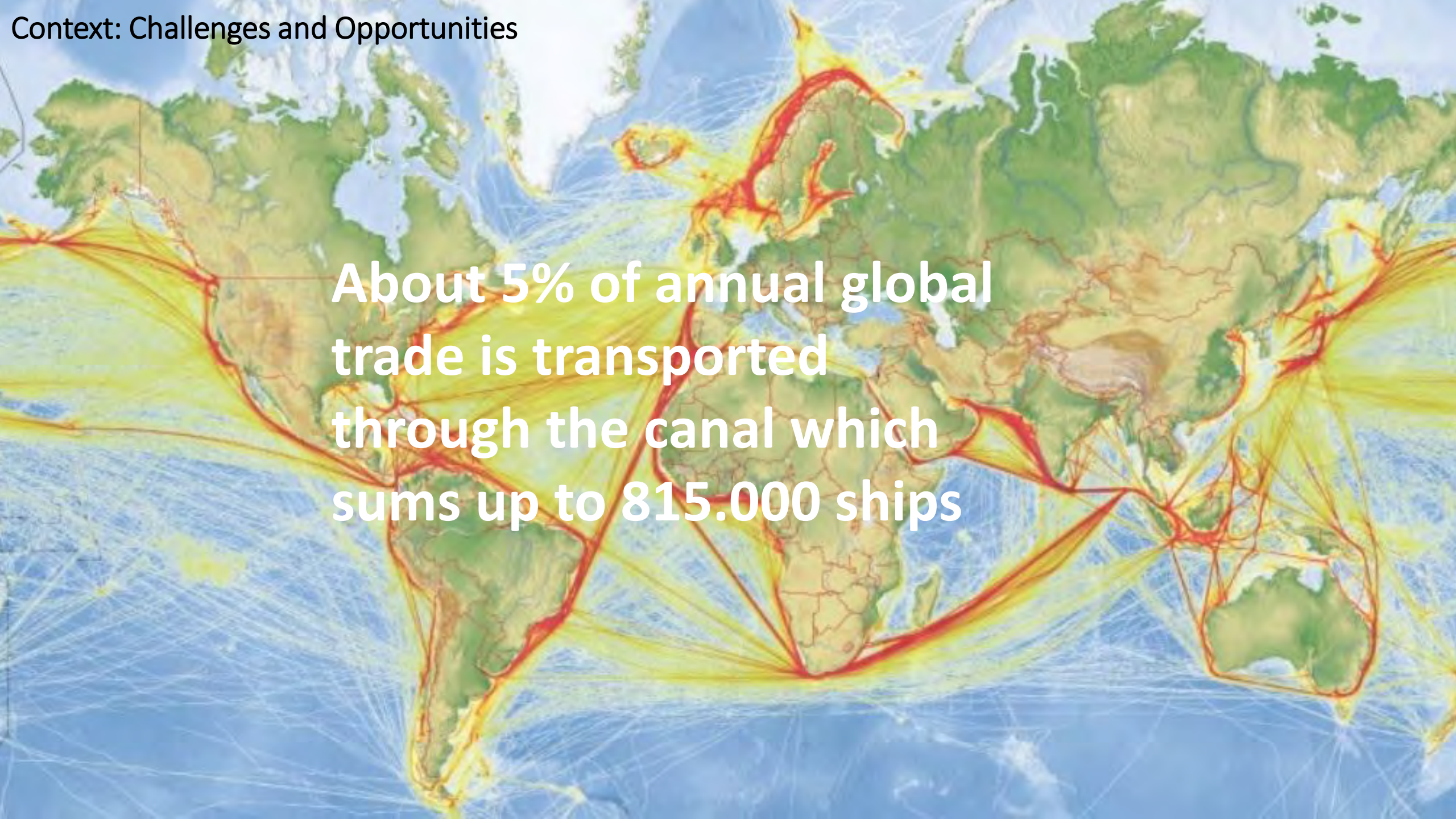
Gabriel Garcia Marquez, Zipaquirá, 1944

[...] **o mar** uma língua de água que nos uniu...

Agustina Bessa-Luís
Em “Portugal – Brasil”



Context: Challenges and Opportunities



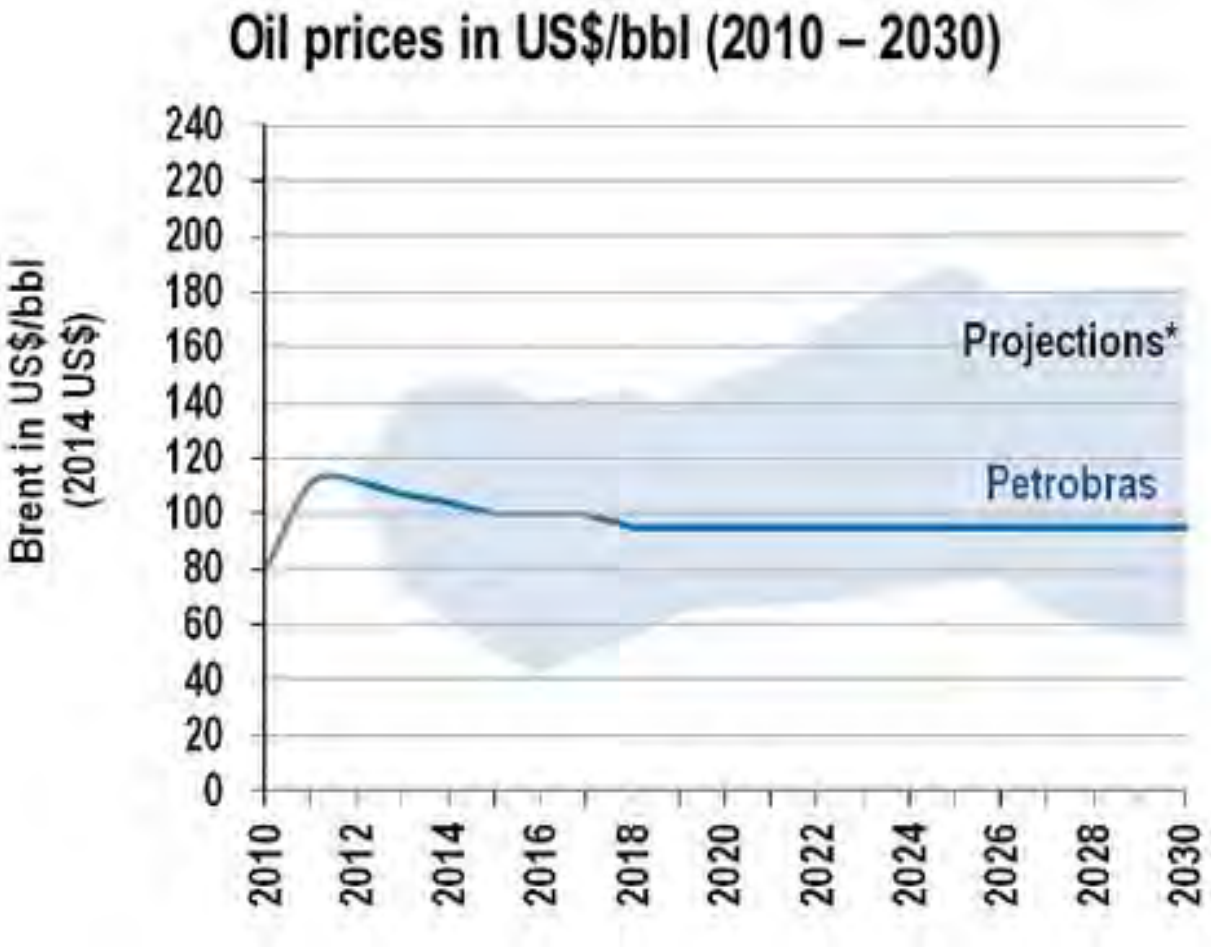
Context: Challenges and Opportunities

Ocean risk governance

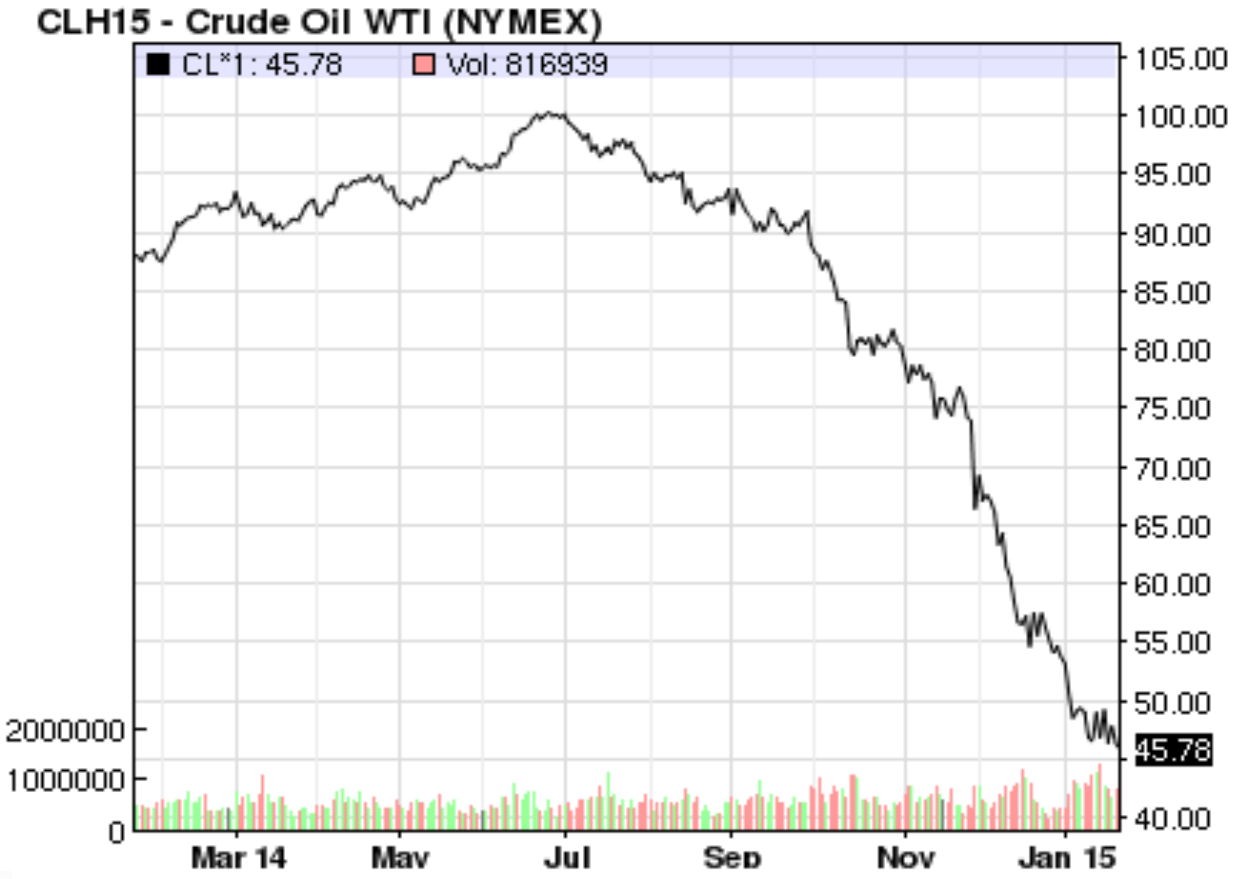
April 2010: Deepwater Horizon, Golf of Mexico

Uncertainty in the oil price

Petrobras' forecasts for oil price
early 2014

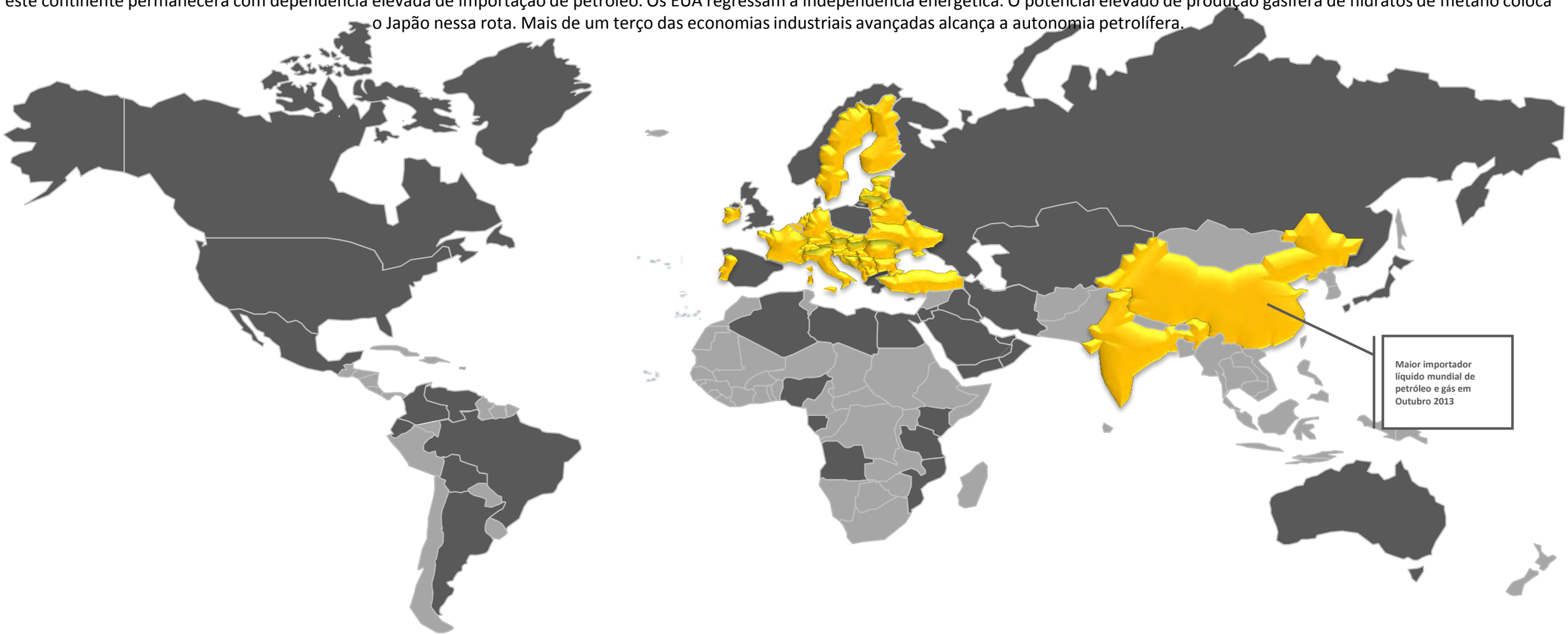


Crude oil price variation over last year
january 2015



...sobre as dinâmicas e geografias do Petróleo e Gás: Um novo mapa da auto-suficiência em formação 2000-2030?

A dependência elevada irá localizar-se sobretudo nas economias industrializadas e sociedades em urbanização emergente na região da Ásia-Pacífico (China e Índia). Com algumas excepções na Europa, este continente permanecerá com dependência elevada de importação de petróleo. Os EUA regressam à independência energética. O potencial elevado de produção gasífera de hidratos de metano coloca o Japão nessa rota. Mais de um terço das economias industriais avançadas alcança a autonomia petrolífera.



Autosuficiência em petróleo e/ou gás (comprovada e potencial)

Dependência elevada da importação de petróleo e gás

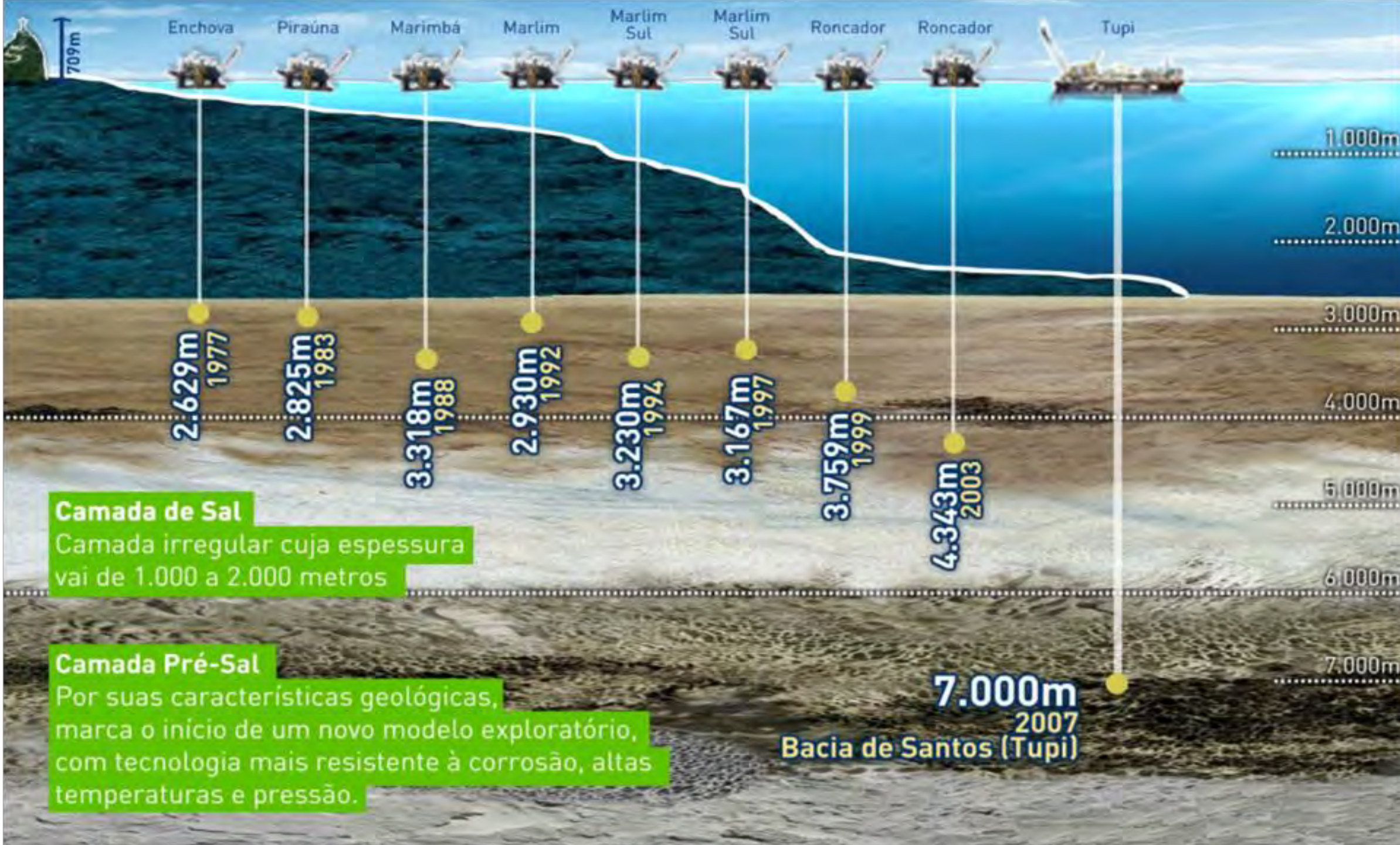
Fontes: Energy Information Administration, 2012
International Energy Agency, 2012

“Oil & Gas” – new challenges...

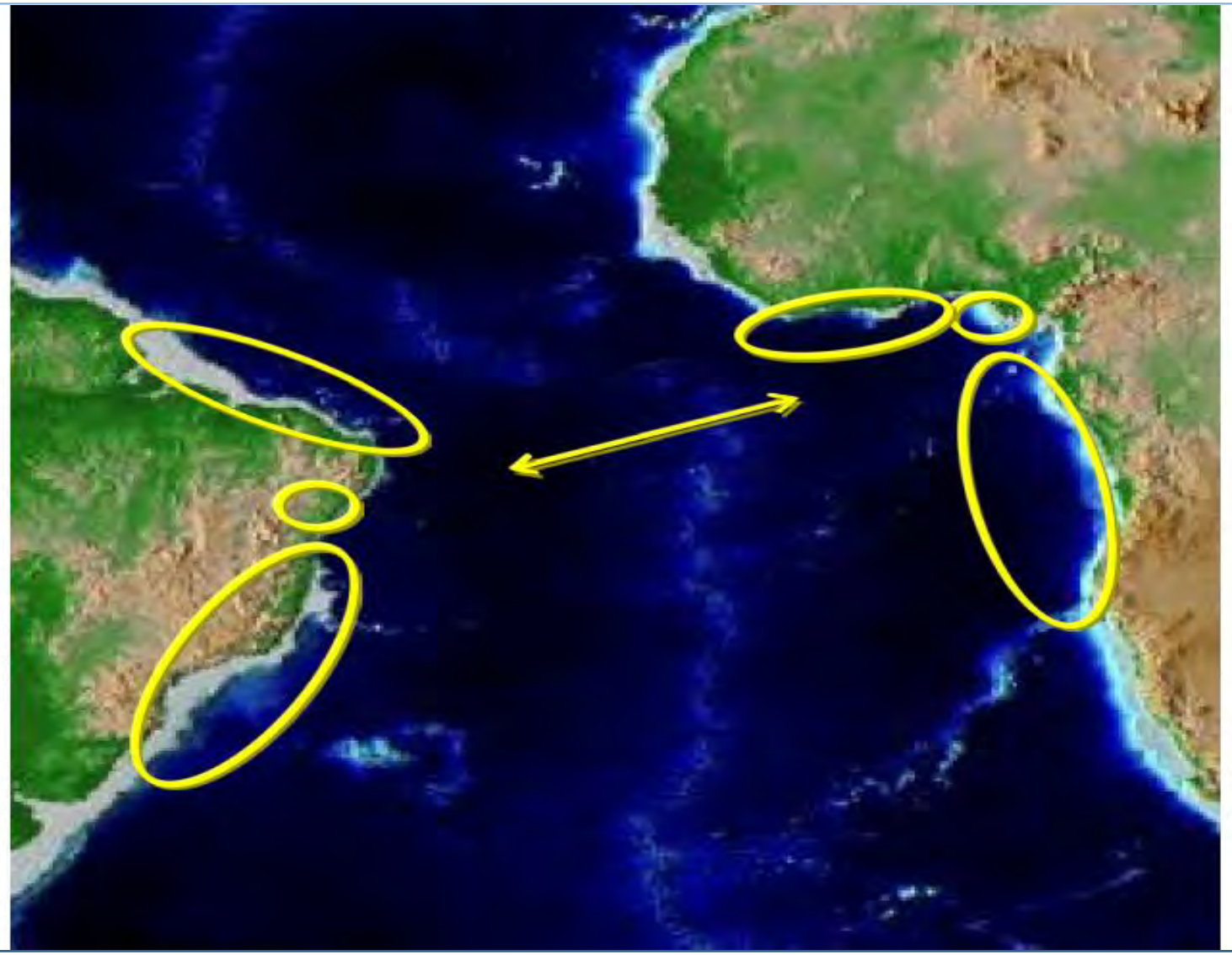
Conventional reservoirs
small volumes easy to develop

Increased pricing and
Improved technology

Unconventional reservoirs
large volumes difficult to develop


709m
Enchova
Piraúna
Marimbá
Marlim
Marlim Sul
Marlim Sul
Roncador
Roncador
Tupi
1.000m
2.000m
3.000m
4.000m
5.000m
6.000m
7.000m
2.629m 1977
2.825m 1983
3.318m 1988
2.930m 1992
3.230m 1994
3.167m 1997
3.759m 1999
4.343m 2003
Camada de Sal
Camada irregular cuja espessura vai de 1.000 a 2.000 metros
Camada Pré-Sal
Por suas características geológicas, marca o início de um novo modelo exploratório, com tecnologia mais resistente à corrosão, altas temperaturas e pressão.
7.000m
2007
Bacia de Santos (Tupi)

Context: Challenges and Opportunities



Context: Challenges and Opportunities

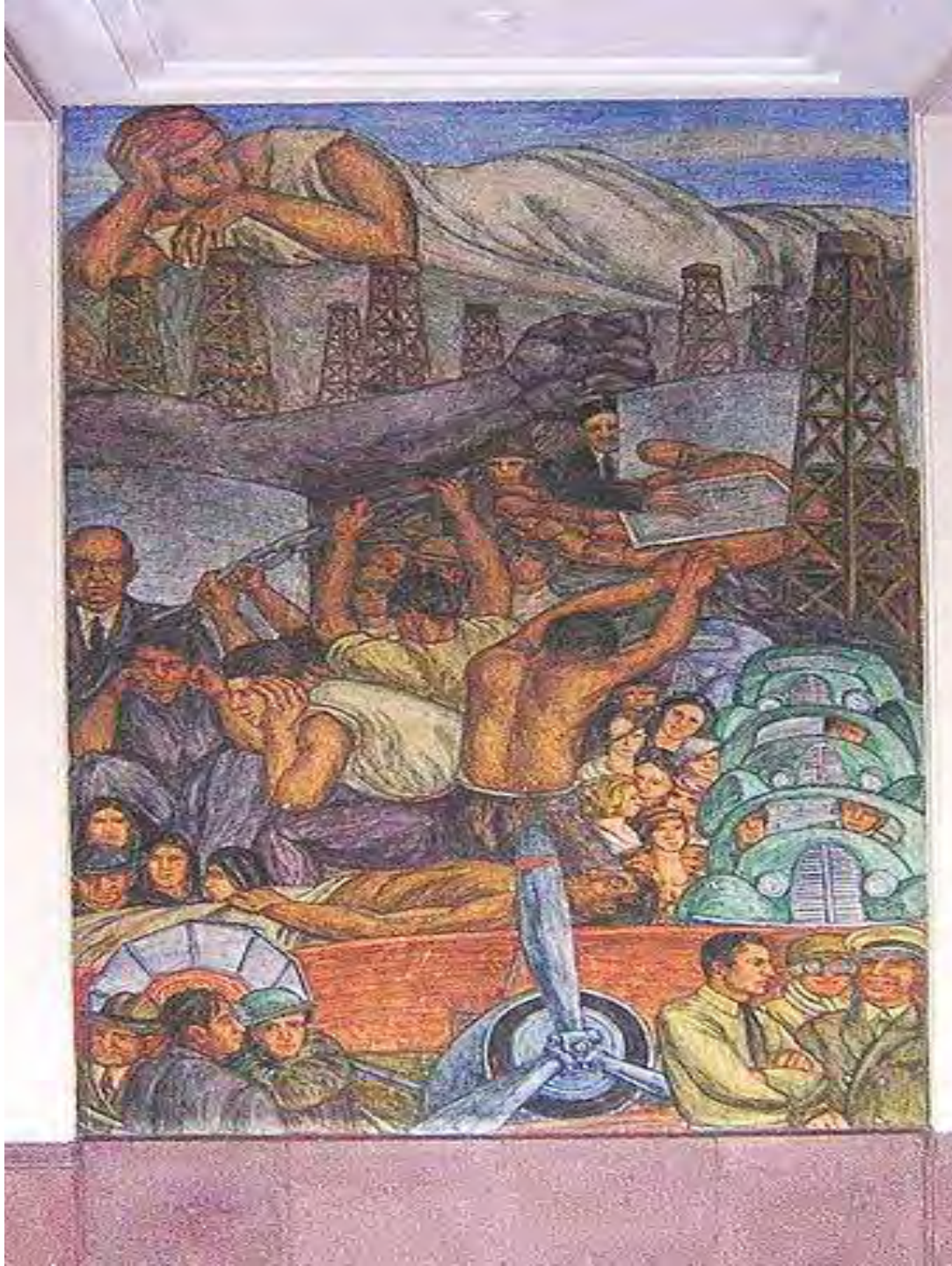
Pirate Attack Saudi Super-Tank seized off Kenian Cost

16th November 2008

“El Problema del Petróleo y la Energía”

Pedro Nel Gomez, 1936

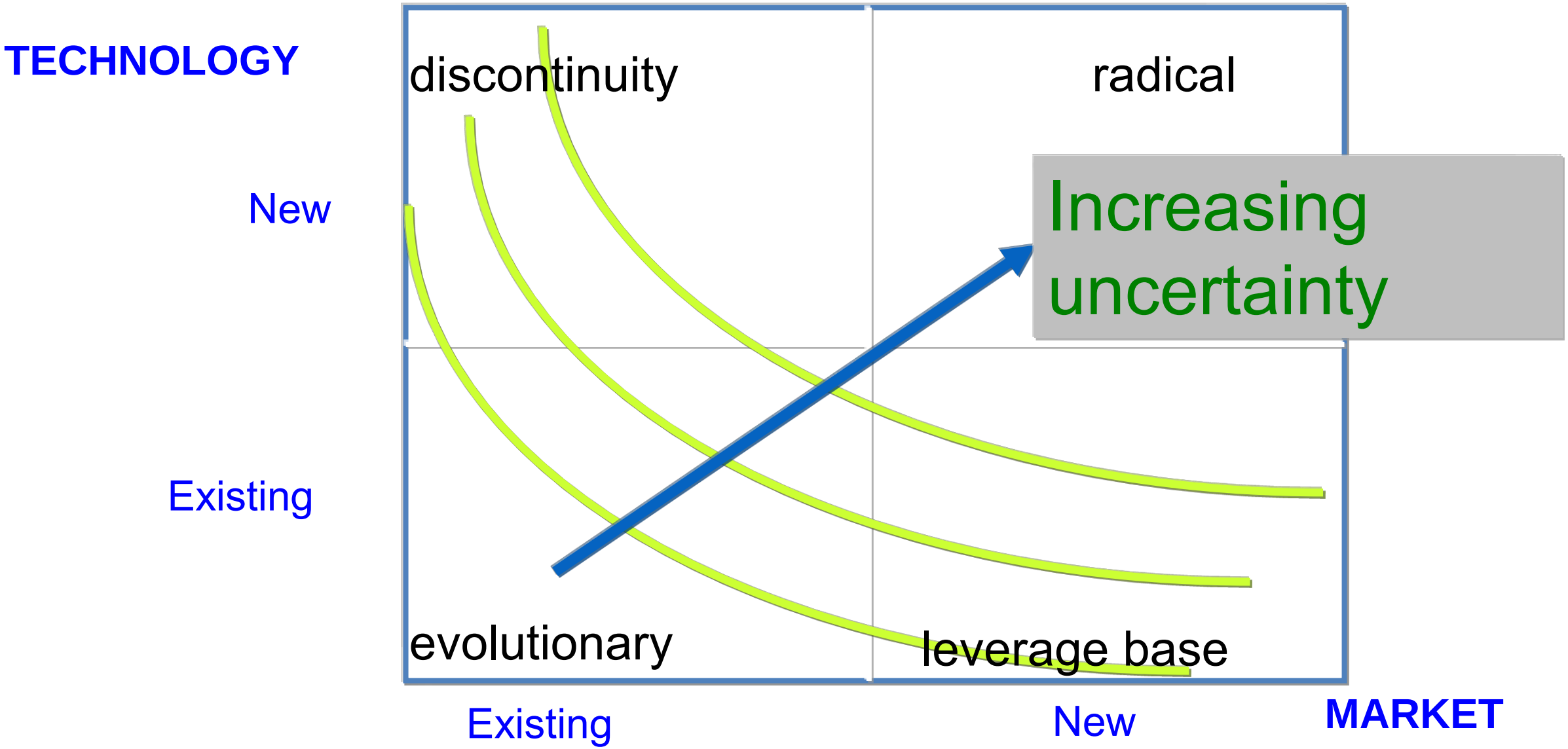
Museo de Antioquia, Medellin



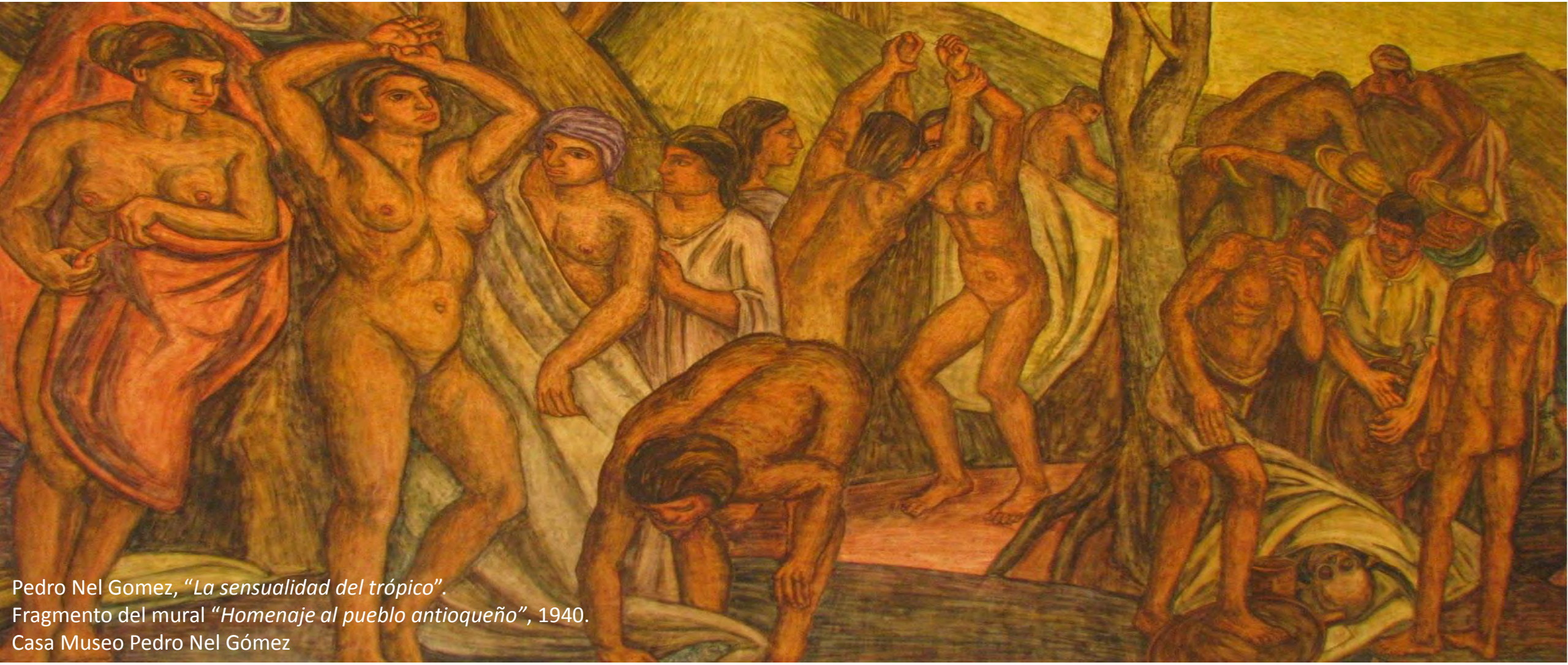

INL
INTERNATIONAL IBERIAN
NANOTECHNOLOGY
LABORATORY

Patterns of technical change

Source: Branscomb,Morse & Roberts (2001): www.atp.nist.gov/eao/gcr_787.pdf



Why Science and Innovation? **…valuing human resources!**



Pedro Nel Gomez, "*La sensualidad del trópico*".
Fragmento del mural "*Homenaje al pueblo antioqueño*", 1940.
Casa Museo Pedro Nel Gómez

It is people who matter ultimately!

Objectives:

- Build and promote an **INTERNATIONAL AGENDA of technology development** towards the sustainable exploration of the Atlantic, promoting endogenous growth:

  +atlantic – to identify ***challenges and opportunities***

- Promote an **INTERNATIONAL OBSERVATORY** to monitor, assess and foster the international agenda:

  www.oipg.org

  - Founding partners: Brazil; Colombia, Portugal, Germany
  - Other: US, Norway, Angola

Contents

PART I: Characterization and Analysis

Context: Challenges and Opportunities
Technological trends: uncertainty and complexity
Comparative assessment of National Technology Strategies: Norway, Brazil, …

PART II: A contribution for a potential intl. AGENDA (to be discussed…)

Rational: four technological platforms

1. **Ocean Monitoring, Control and Surveillance Systems (MCS) for Risk Governance**
2. **Ocean Subsea**
3. **Ocean Surface**
4. **Ports Technology and Systems**

Horizontal programs: capacity building, internationalization, specialization
Funding…

Portuguese current economic exclusive zone and continental platform shelve extension

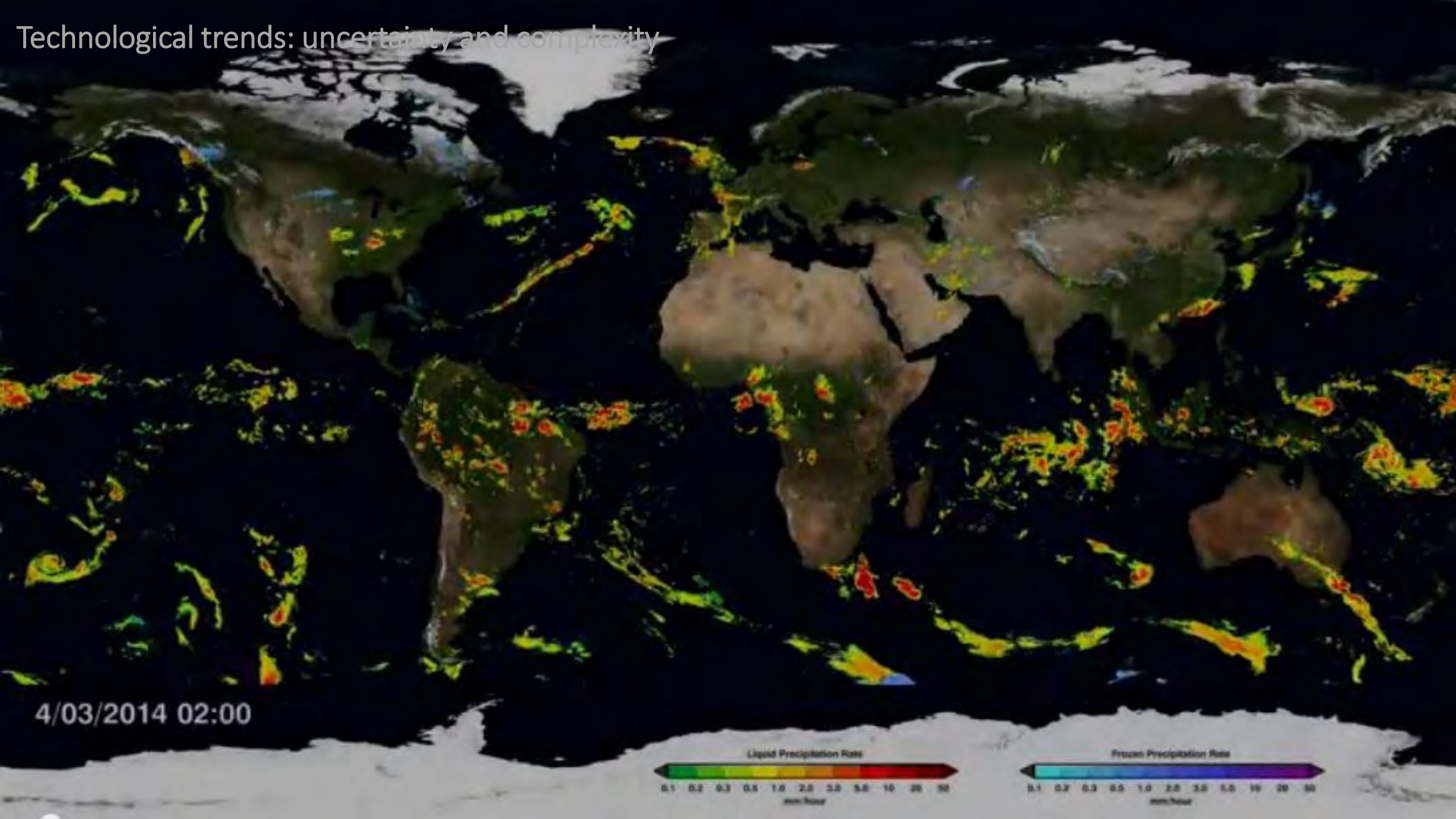
Actual continental shelf:

- Continental Portugal - 327,667 km²
- Azores Islands - 953,633 km²
- Madeira Islands - 446,108 km²
- Total - 1,727,408 km²

Proposal of extension:

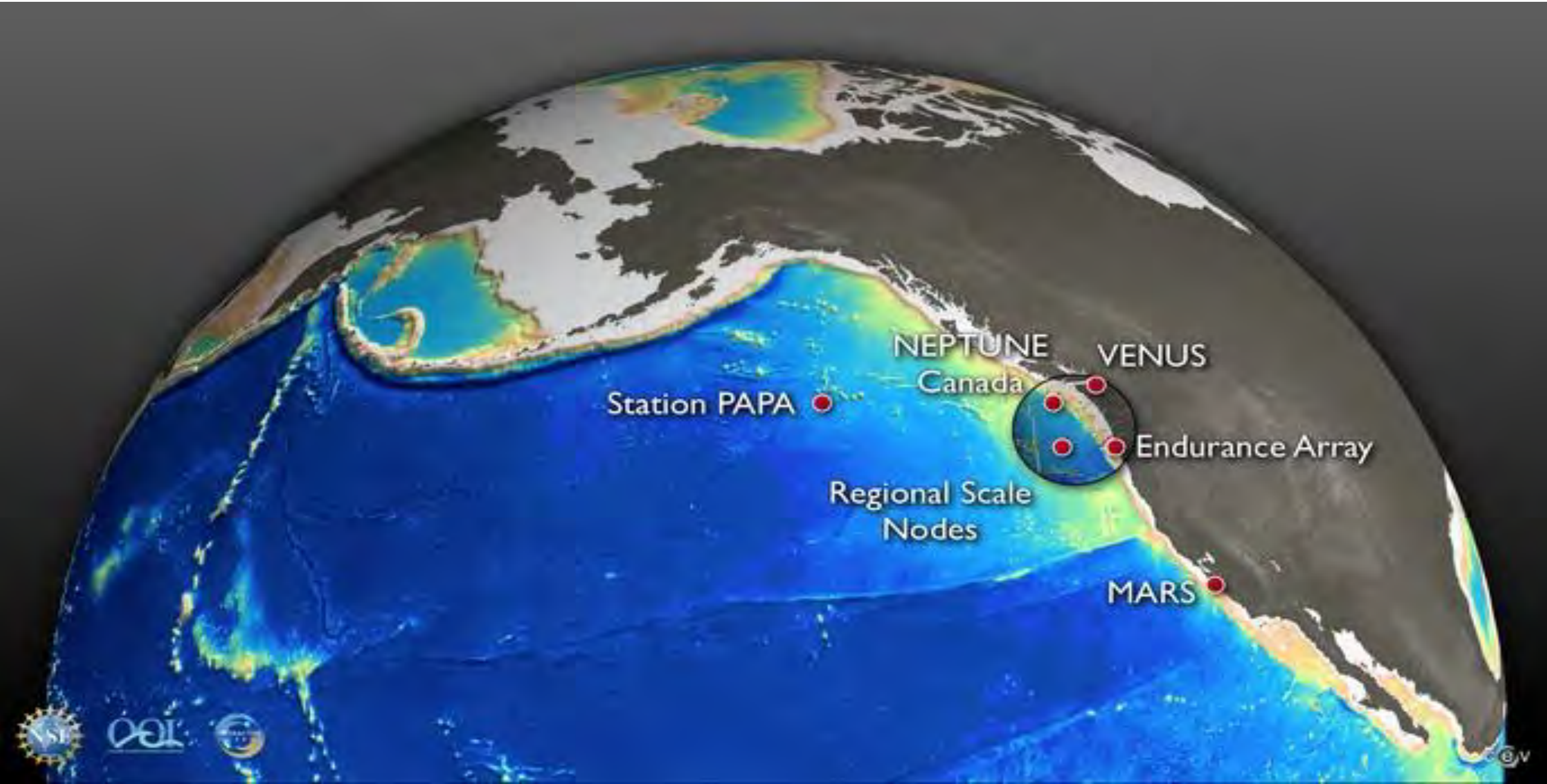
- Additional 2.15 million square kilometers
- Resulting in an EEZ with an area of more than 3,877,408 km²

Technological trends: uncertainty and complexity

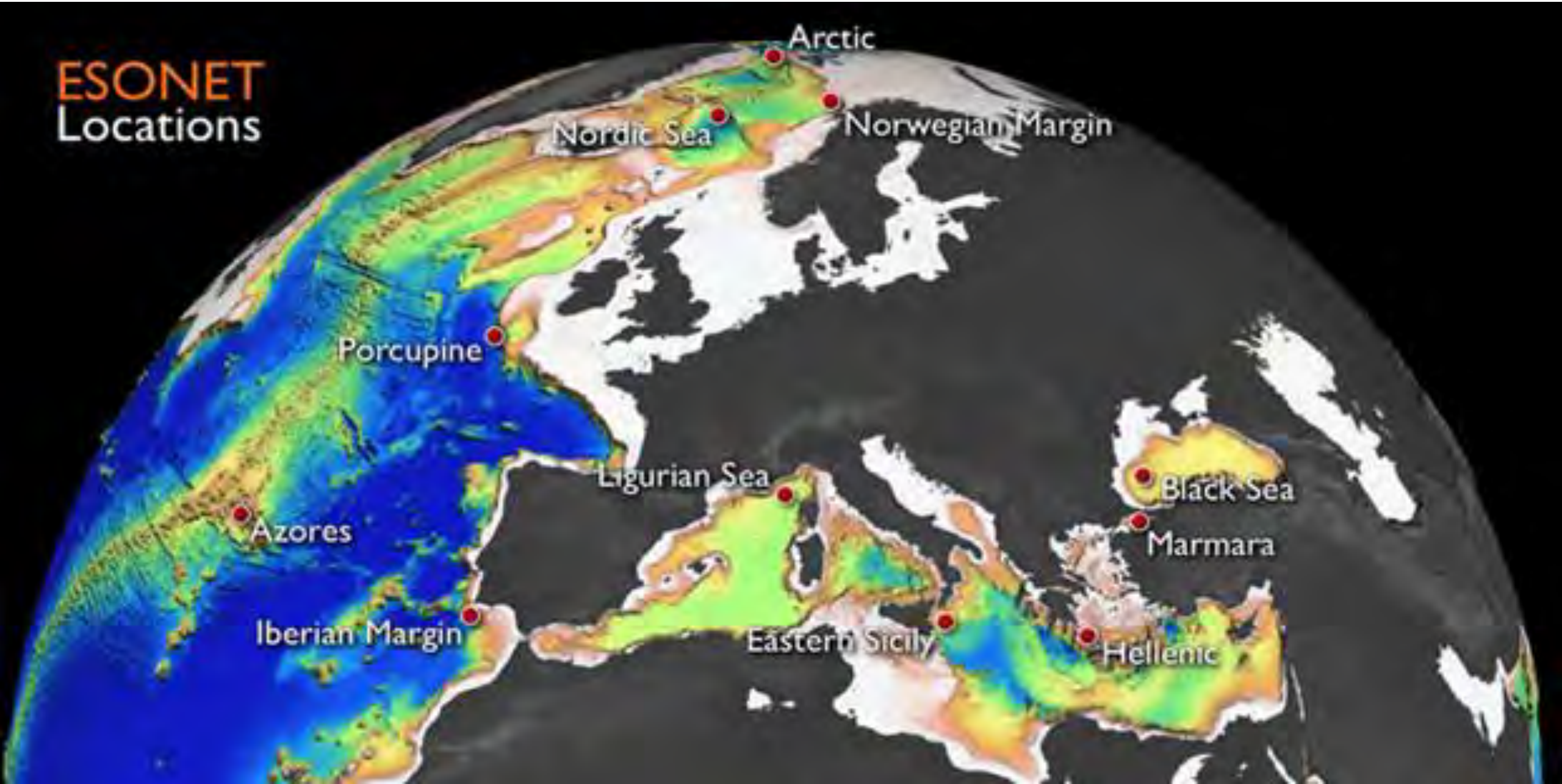


ocean observatories - new way of looking at oceans

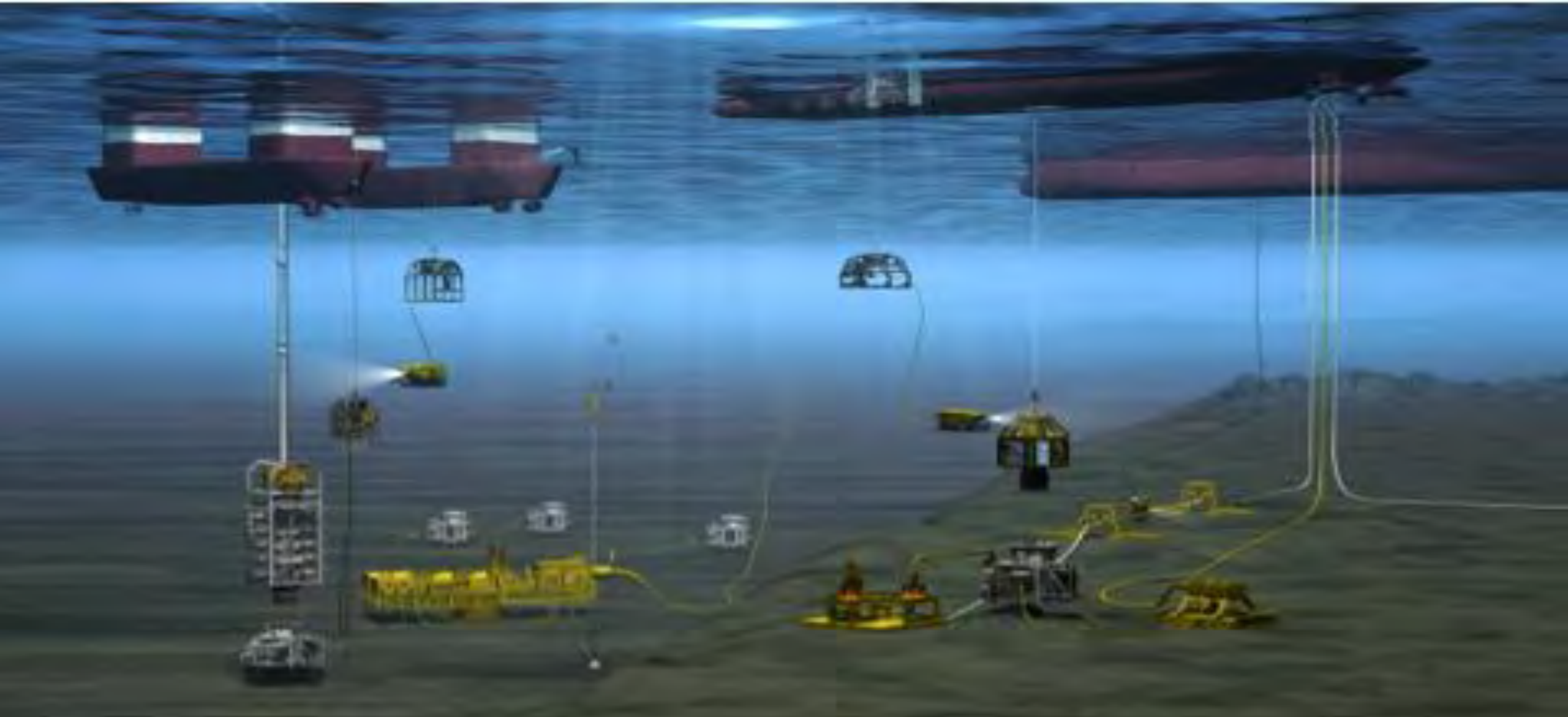
Technological trends: uncertainty and complexity



Technological trends: uncertainty and complexity



... Pre-salt and deep-sea challenges

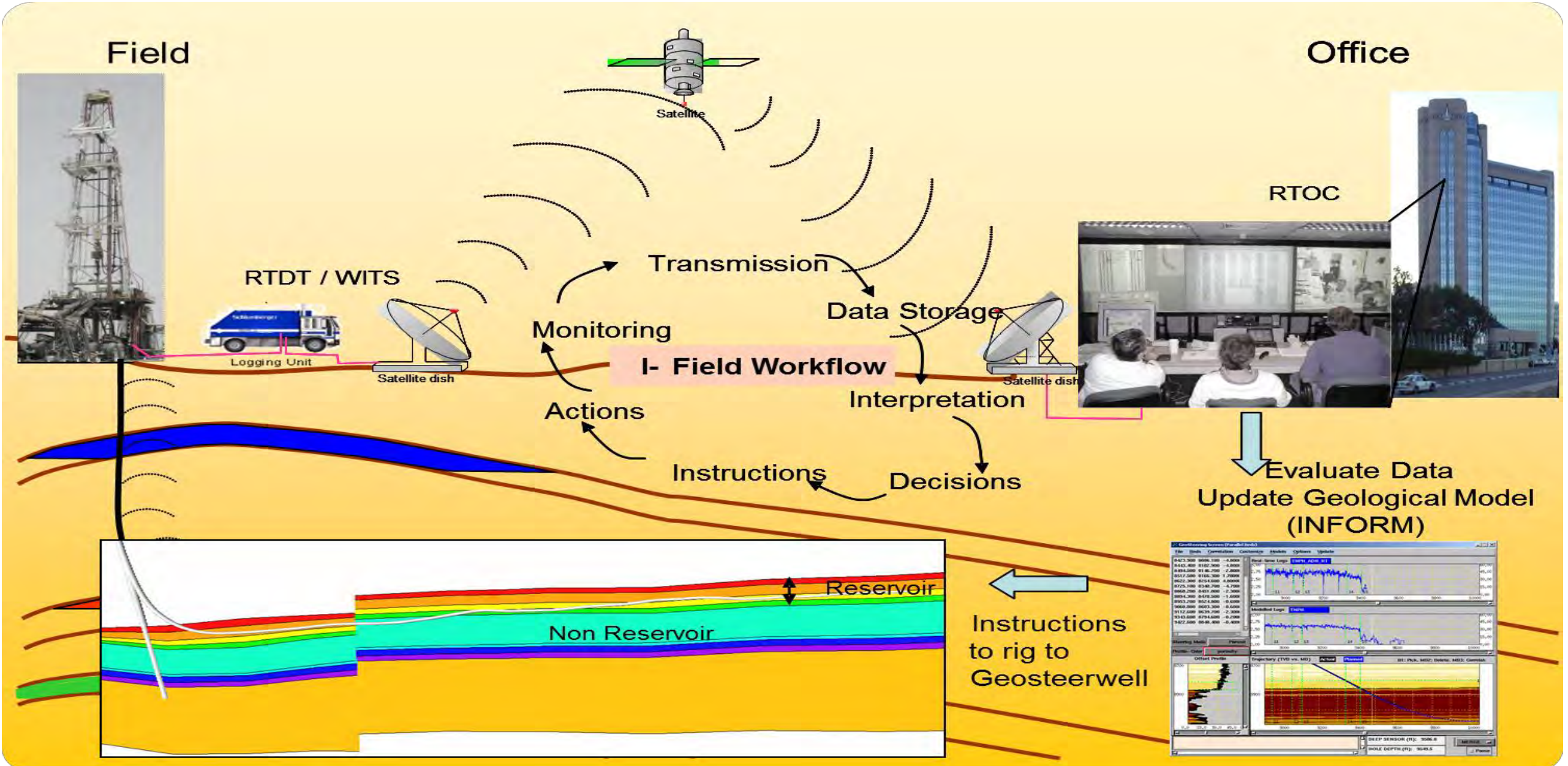


subsea versus **surface** technology changing paradigms for oil and gas exploration

DISRUPTIVE

CONTINUITY

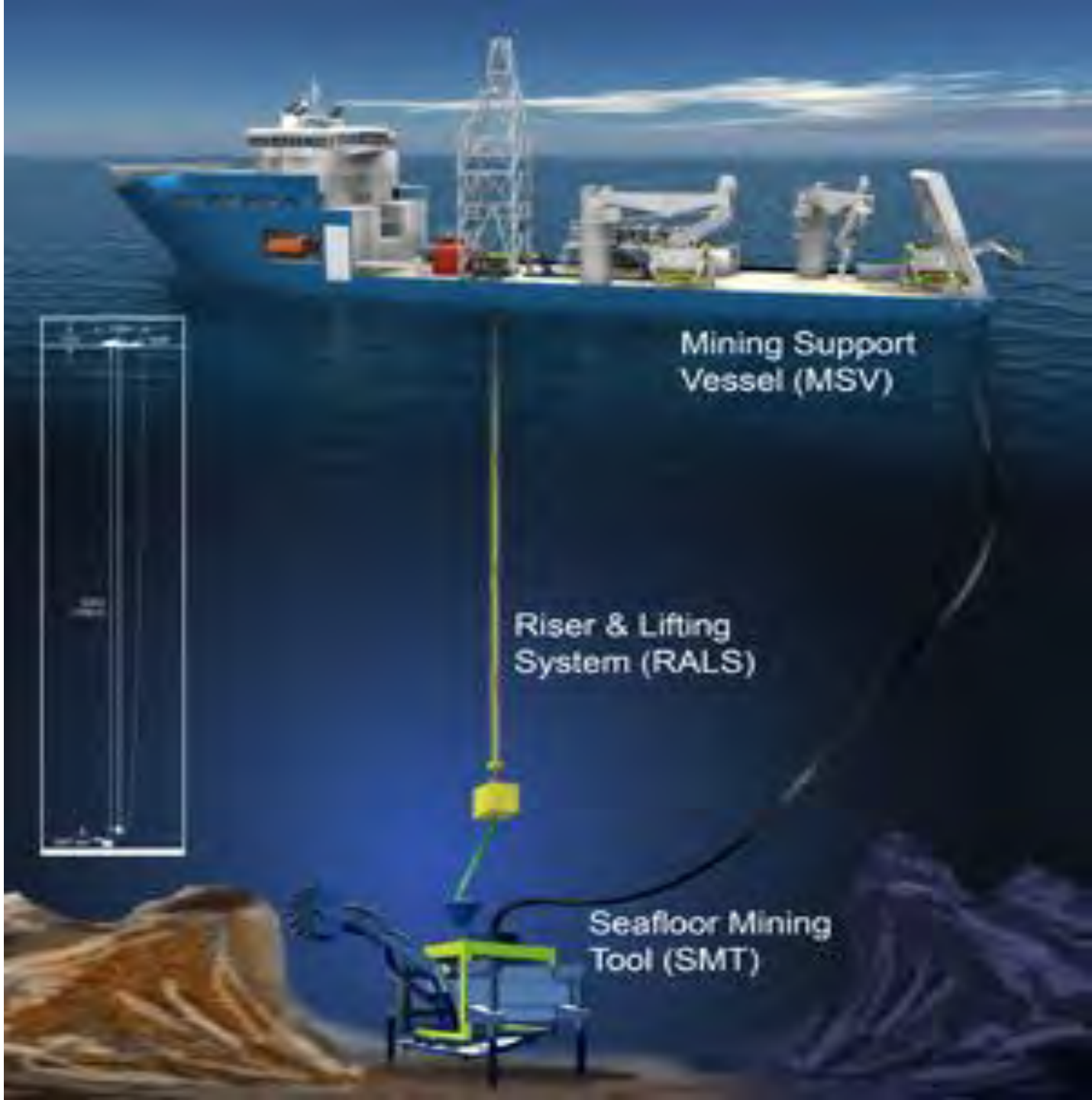
From Automation to "i-Fields"



Technological trends:
uncertainty and complexity

deep sea mining:

a new possibility?



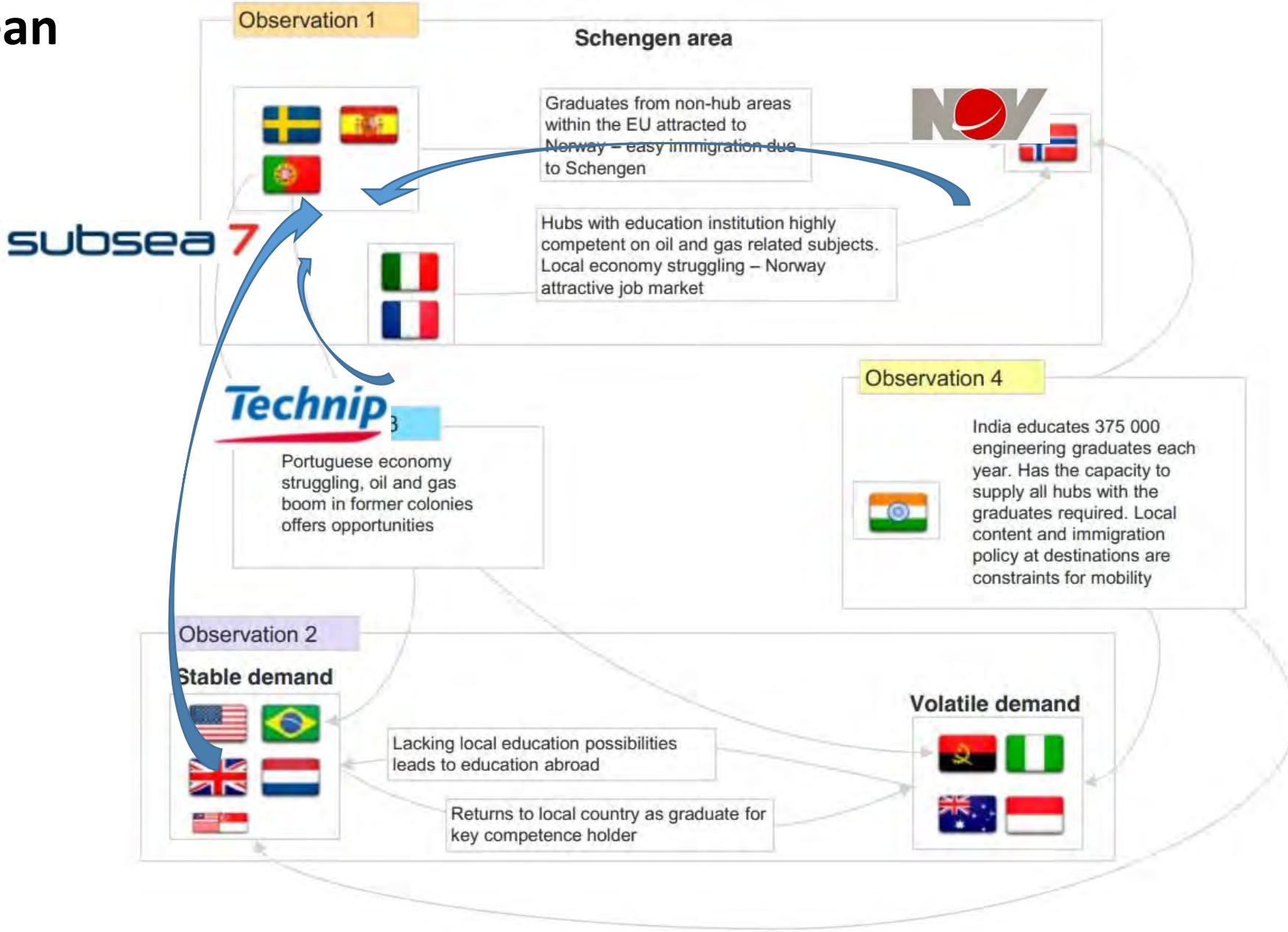
Migratory fluxes and the increasing North European Portuguese Diaspora

Attracted by:

- Highly qualified engineers
- Complete domain of Portuguese and English languages

Engineering multinationals companies moving to Portugal:

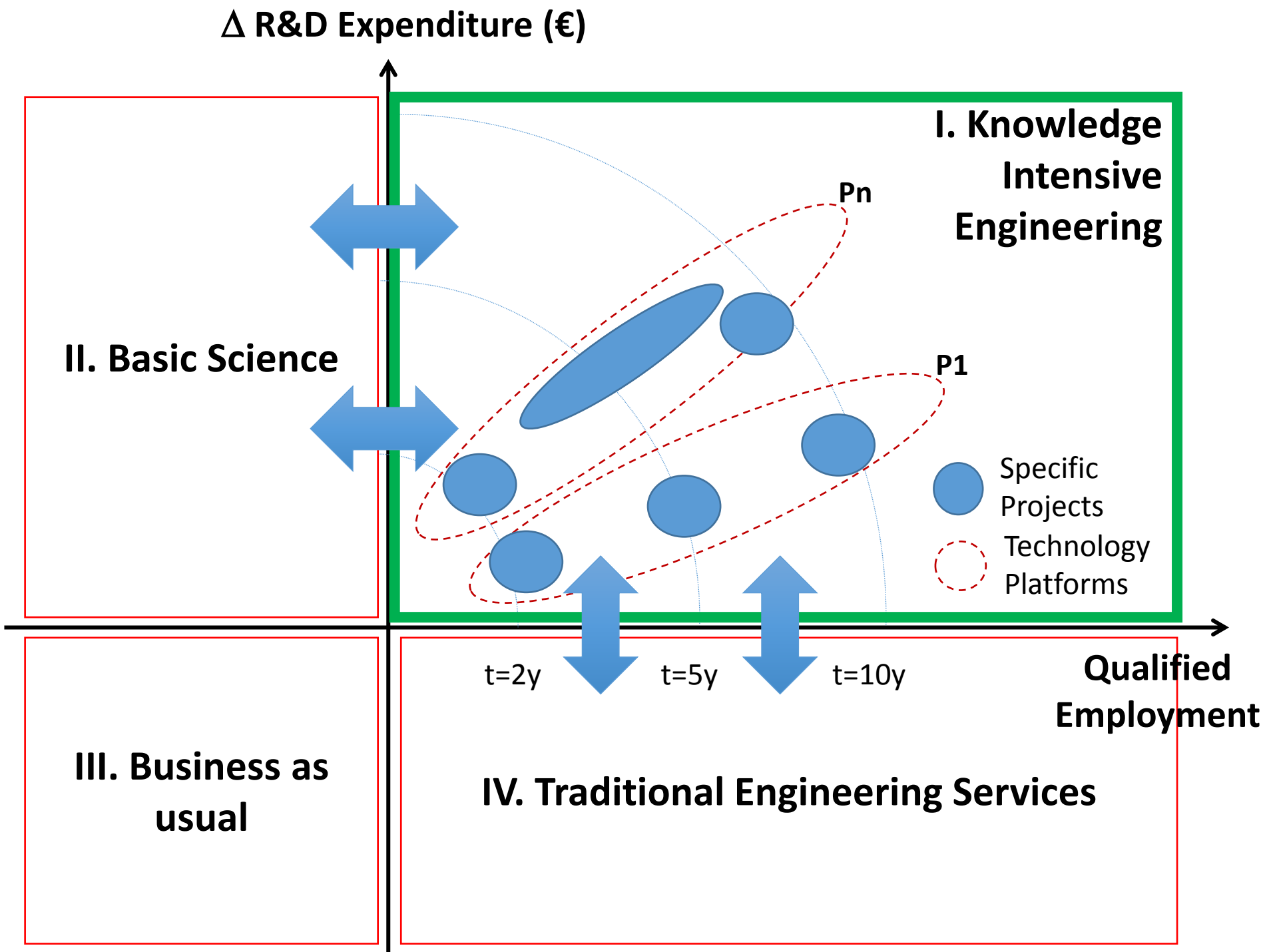
- Technip
- NOV - National Oil Well Varco
- Subsea 7



Source: RYSTAD 2013

Contents

Approach:


Δ R&D Expenditure (€)
I. Knowledge Intensive Engineering
Pn
P1
II. Basic Science
Specific Projects
Technology Platforms
t=2y
t=5y
t=10y
Qualified Employment
III. Business as usual
IV. Traditional Engineering Services

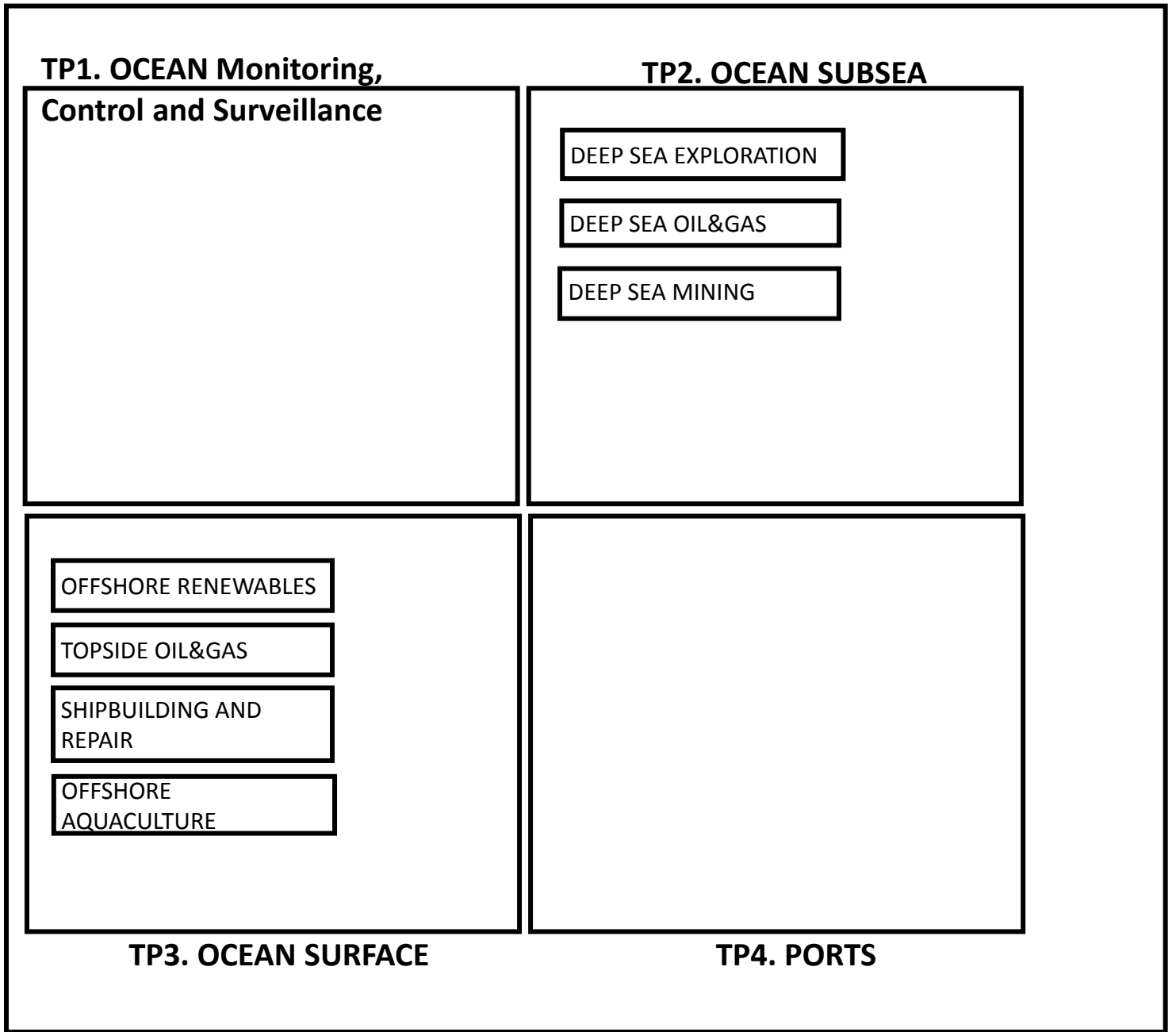
A contribution (from Portugal):

OCEAN Monitoring, Control and Surveillance

OCEAN SUBSEA technologies and Systems

OCEAN SURFACE technologies and Systems

PORTS technologies and Systems



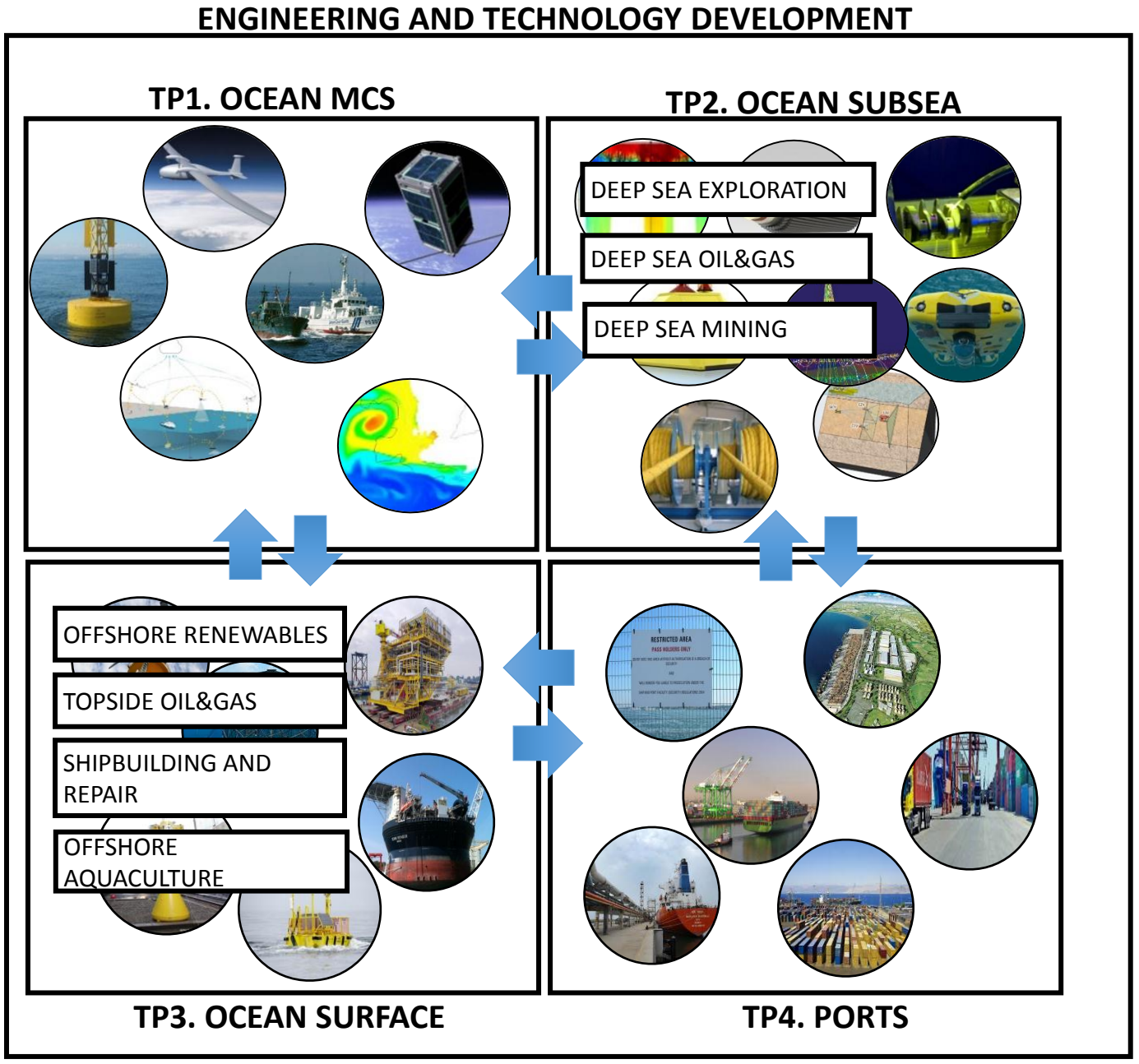
A contribution (from Portugal):

OCEAN Monitoring, Control and Surveillance

OCEAN SUBSEA technologies and Systems

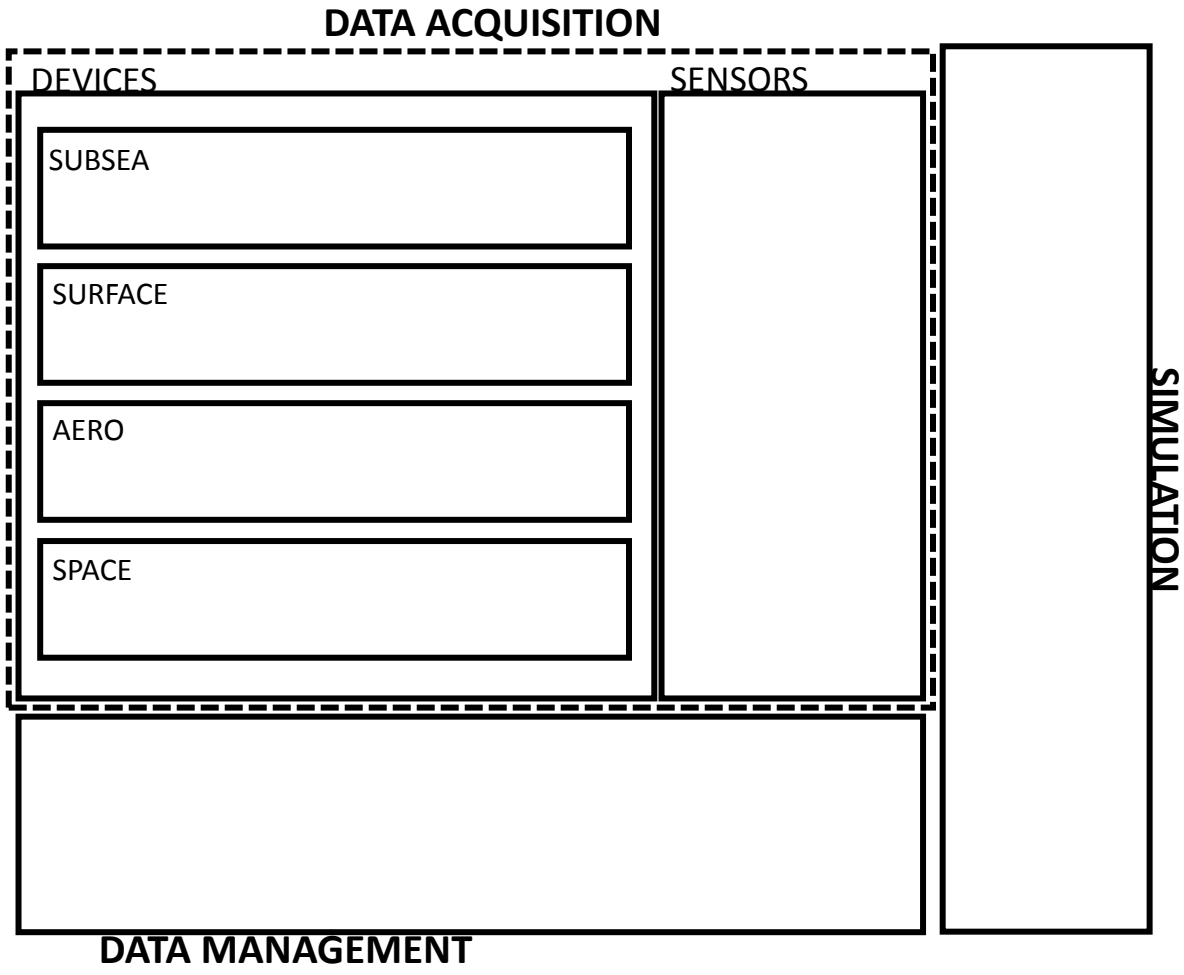
OCEAN SURFACE technologies and Systems

PORTS technologies and Systems



A contribution (from Portugal):

Platform 1: *Ocean monitoring, control and surveillance (MCS)*



A contribution (from Portugal):

Platform 1: *Ocean monitoring, control and surveillance (MCS)*

CH1.1 Low-cost multi-use buoys

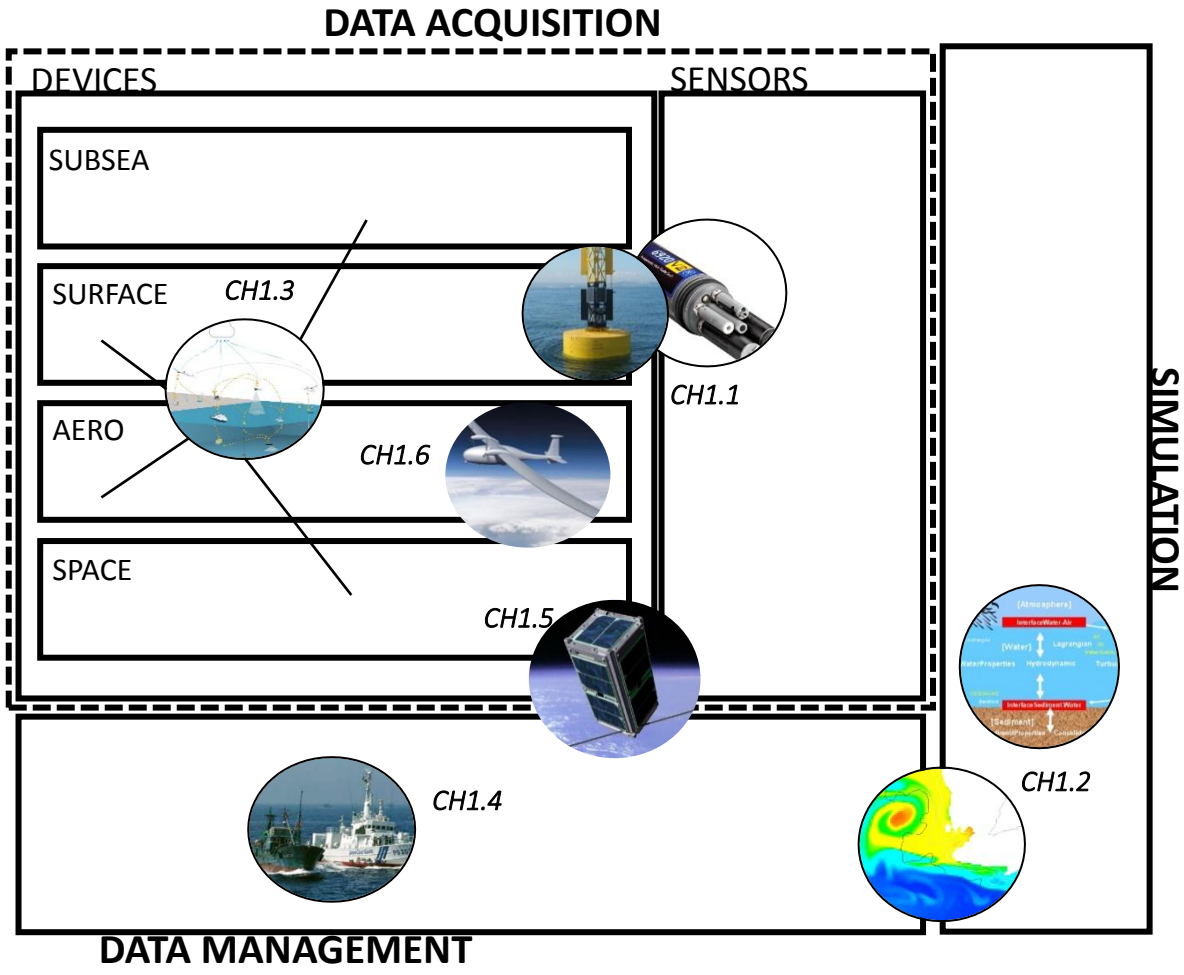
CH1.2 Integrated computational models for better oceanic behaviour prediction

CH1.3 Networked autonomous platforms, with monitoring devices, seamless integration and control architectures

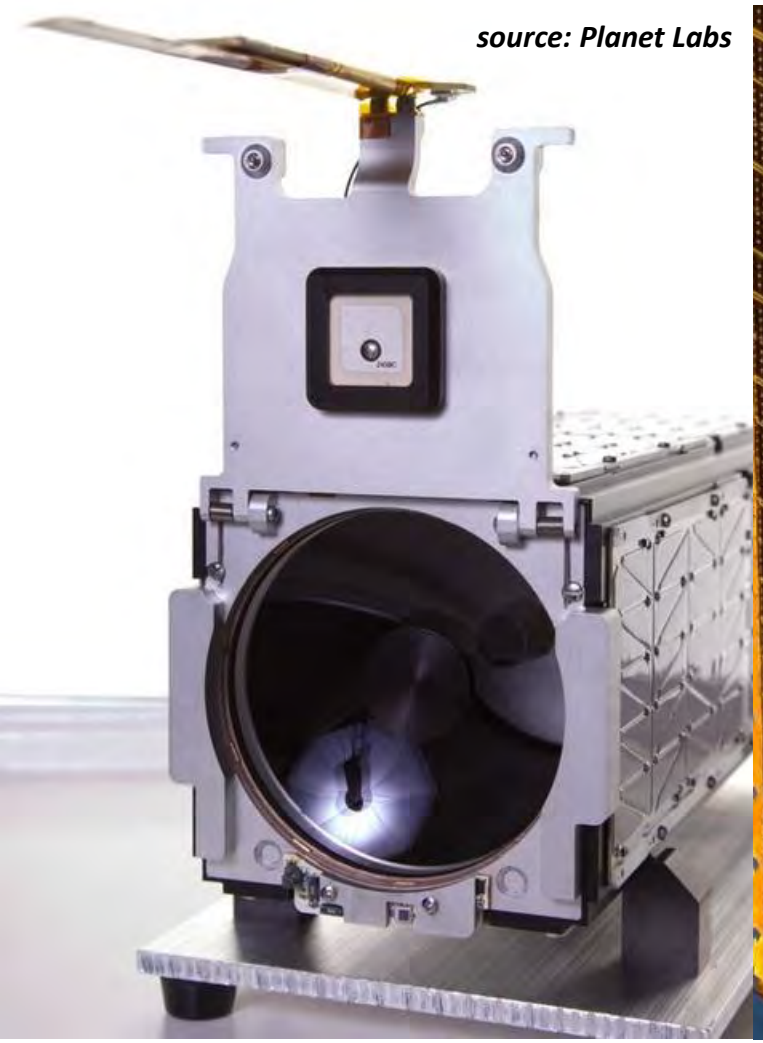
CH1.4 Image processing algorithms to control and improve fishing activities

CH1.5 Miniaturised satellites for advanced low cost monitoring capabilities

CH1.6 High Altitude Long Endurance (HALE) Unmanned Autonomous Vehicle (UAV) for long standing monitoring capability



CH1.5 Miniaturised satellites for advanced low cost monitoring capabilities



source: Planet Labs

source: NASA

Includes suggestions by: Tekever, CEIIA, Von Karman Institute, ESTEC

CH1.5 Miniaturised satellites for advanced low cost monitoring capabilities

source: Blackbridge

source: Blackbridge

Challenge: *To develop a nanosat constellation that can contribute to an economical and effective MCS system, allowing also technology-based companies to enter emerging markets*

Includes suggestions by: Tekever, CEIIA, Von Karman Institute, ESTEC

CH1.6 High Altitude Long Endurance (HALE) Unmanned Autonomous Vehicle (UAV) for long standing monitoring capability

source: Northrop Grumman (2015)

source: Israeli Air Force (2014)

Includes suggestions by: AFA, IDMEC, UAVISION, TEKEVER, Spinworks, CEIIA

CH1.6 High Altitude Long Endurance (HALE) Unmanned Autonomous Vehicle (UAV) for long standing monitoring capability

source: UAVision

source: TEKEVER

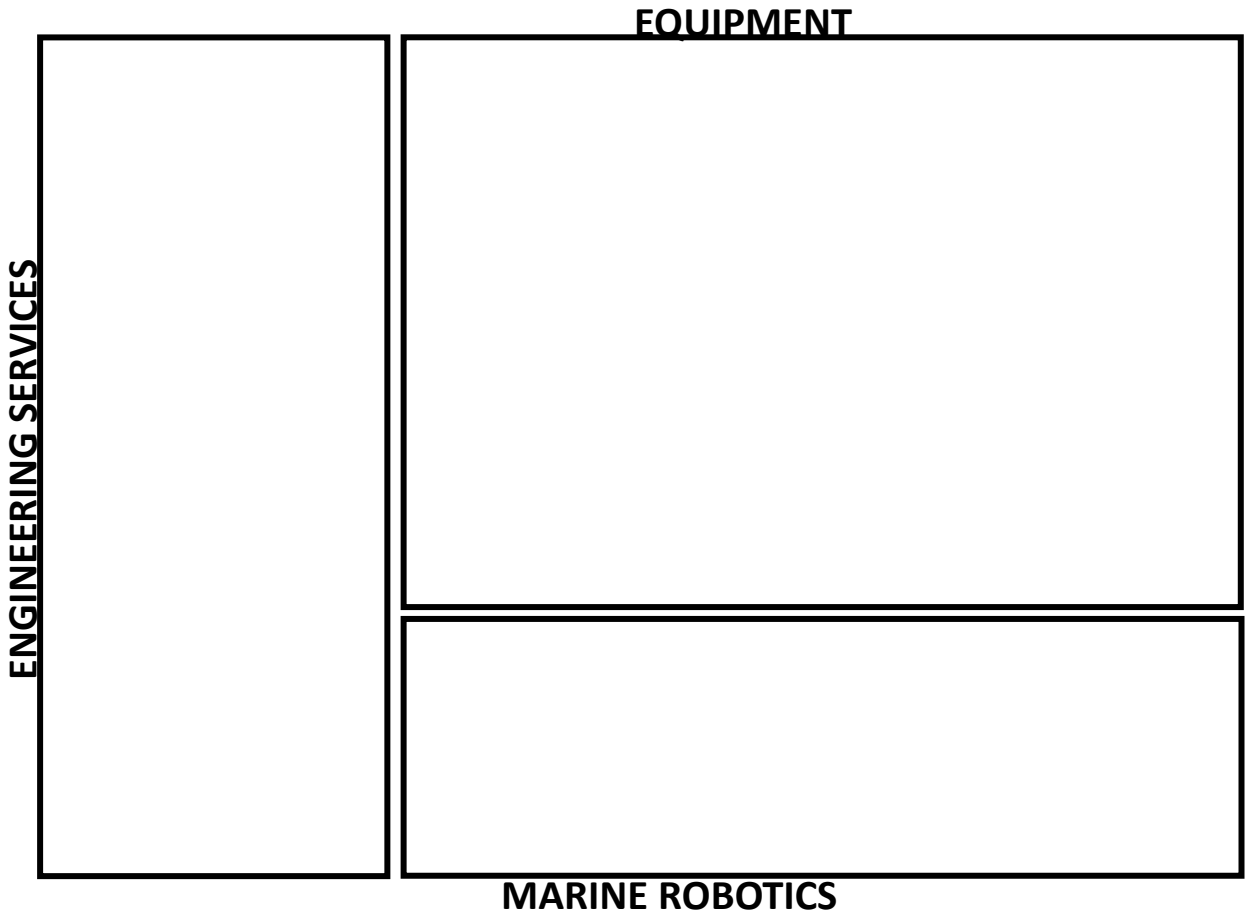
source: FAP/CEIIA

Challenge: *a breakthrough UAV HALE project towards high-end Class 2 and Class 3 MALE UAV*

Includes suggestions by: AFA, IDMEC, UAVISION, TEKEVER, Spinworks, CEIIA

A contribution (from Portugal):

Platform 2 - *Ocean subsea technology*



A contribution (from Portugal):

Platform 2 - *Ocean subsea technology*

CH2.1 Marine robotic systems for deep sea floor characterization

CH2.2 Lander for Deep Sea long term presence and operation

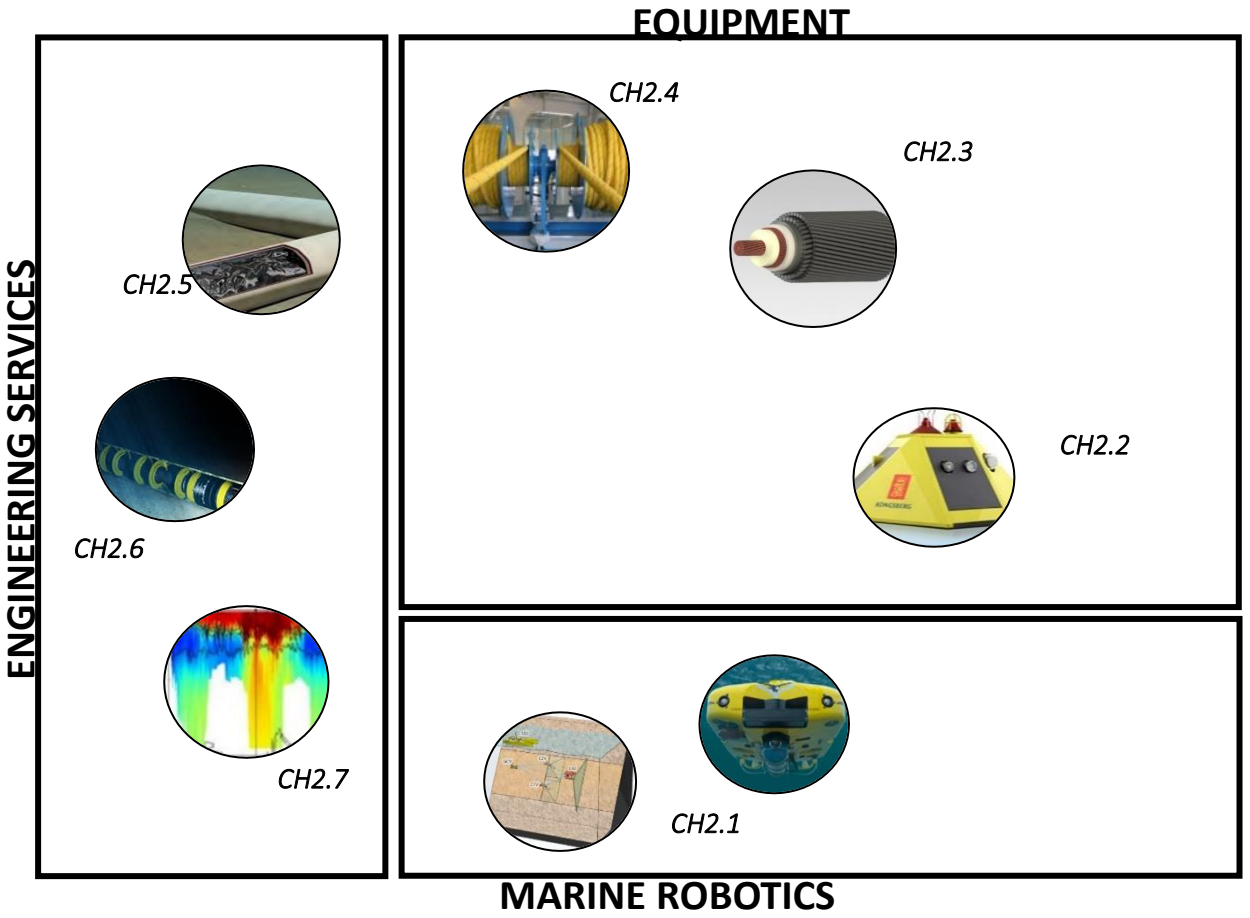
CH2.3 Advanced subsea mooring ropes for ocean exploitation new challenges

CH2.4 Subsea cables tracking device

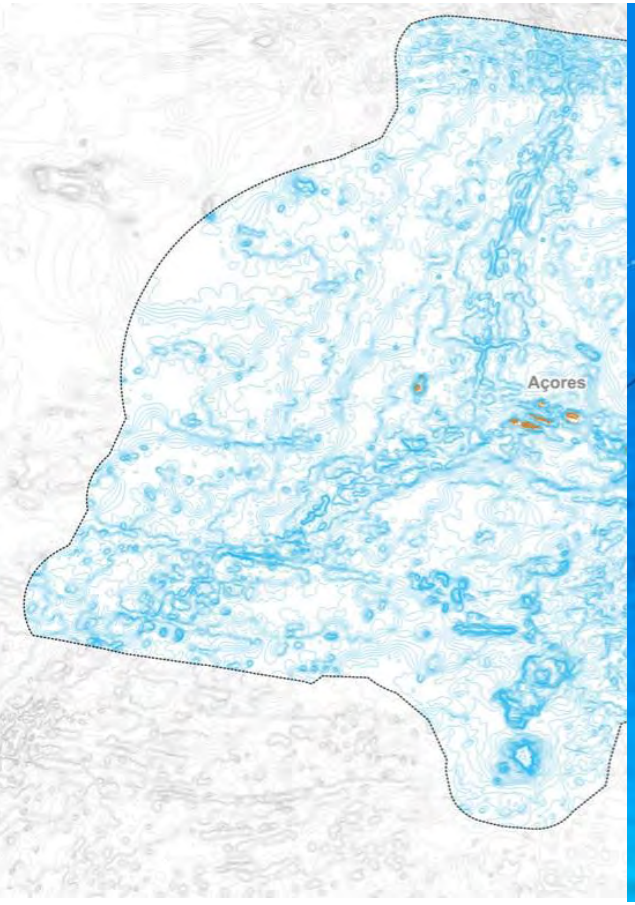
CH2.5 CFD novel numerical analysis applications to the subsea

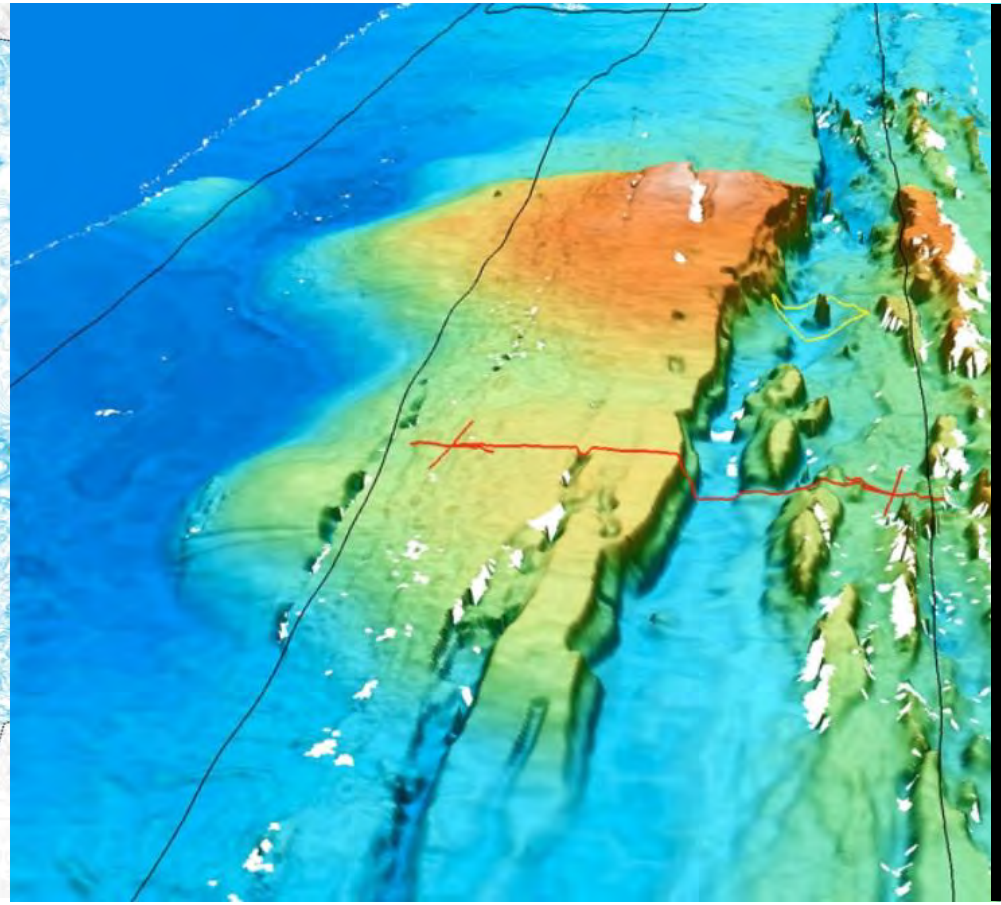
CH2.6 Big Data Analytics for Monitoring Data Integration and Statistical Handling

CH2.7 SURF in-situ inspection based on GMR technology

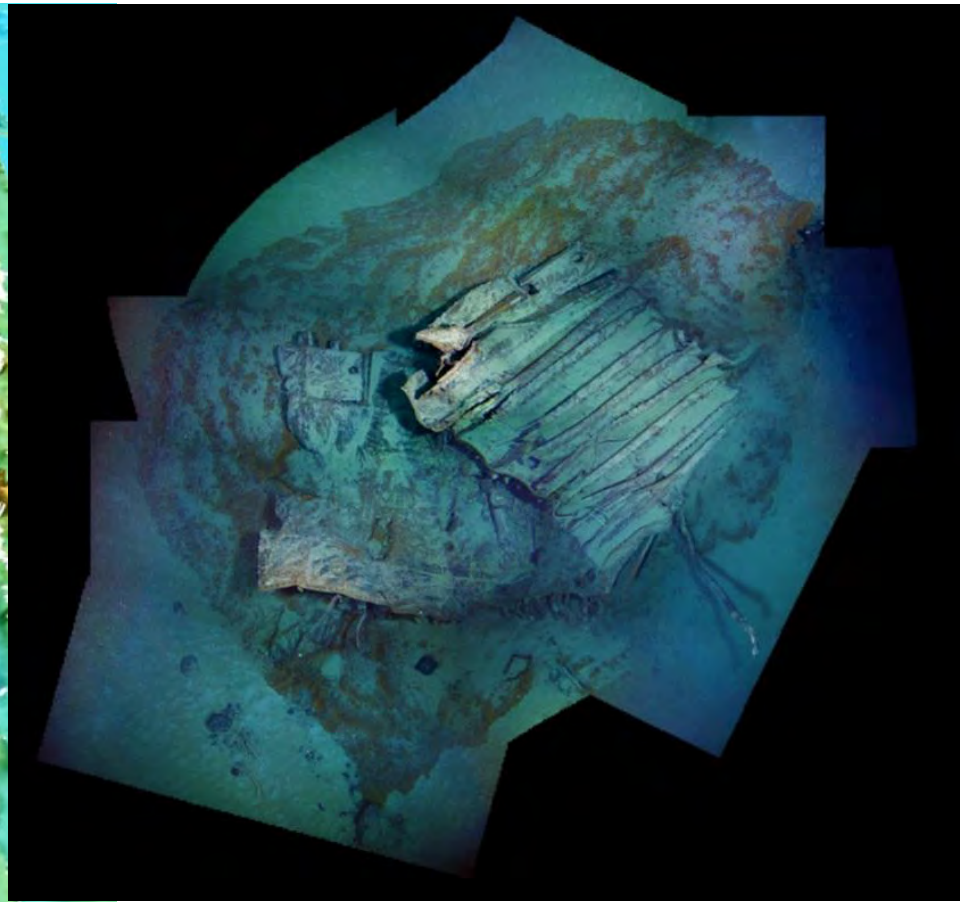


CH2.1 Marine robotic systems for deep sea floor characterization





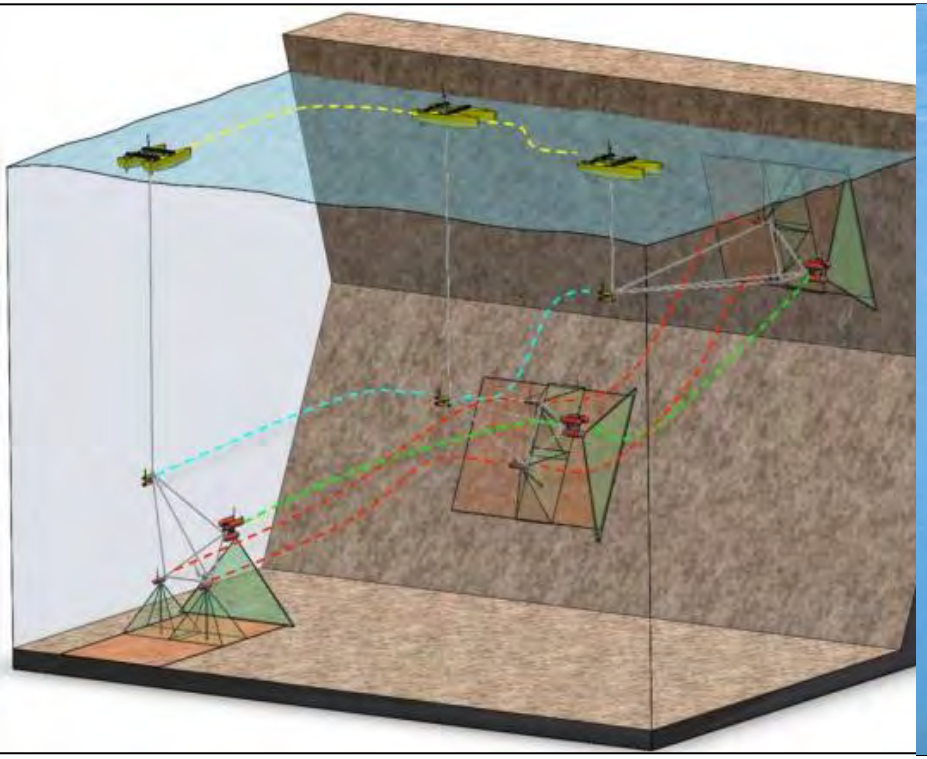
source: MBARI



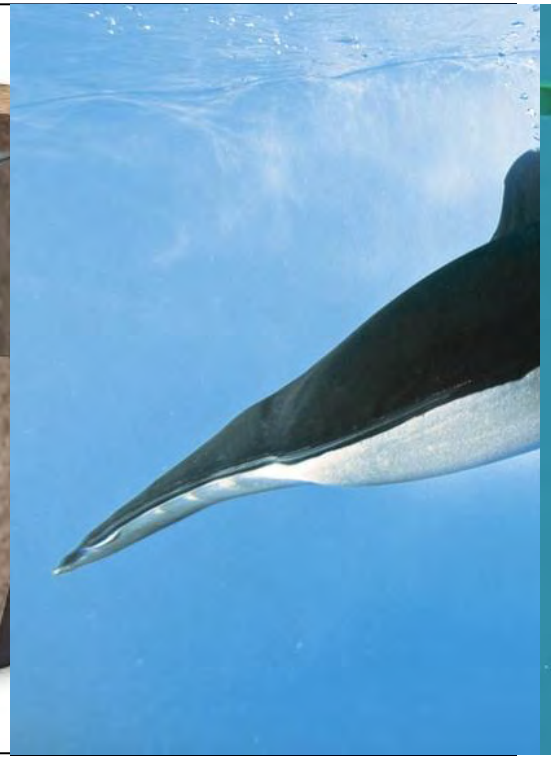
source: RMS Titanic (2012)

Includes suggestions by: EMEPC, IPMA, ISR-DSOR, , LSTS, DOP Azores, CEIIA, ARGUS, Oceanscan, TEKEVER, CREMINER

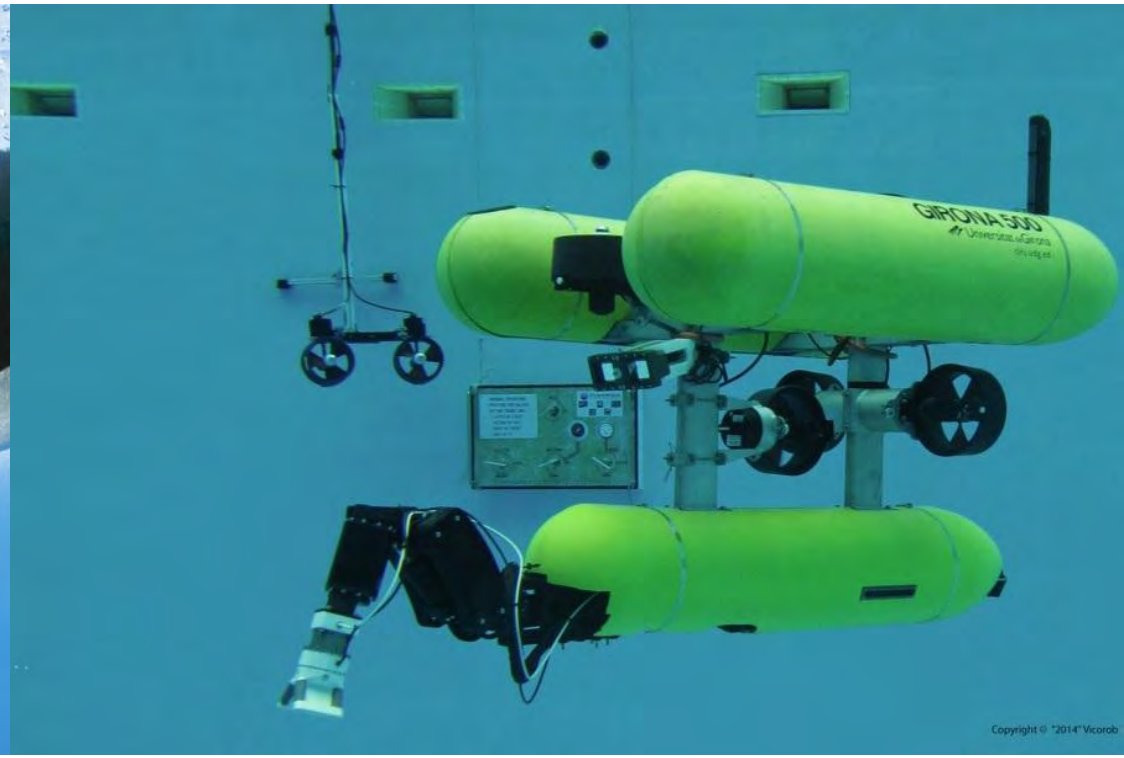
CH2.1 Marine robotic systems for deep sea floor characterization



source: MORPH



source: Fugro Oceanologics (2014)



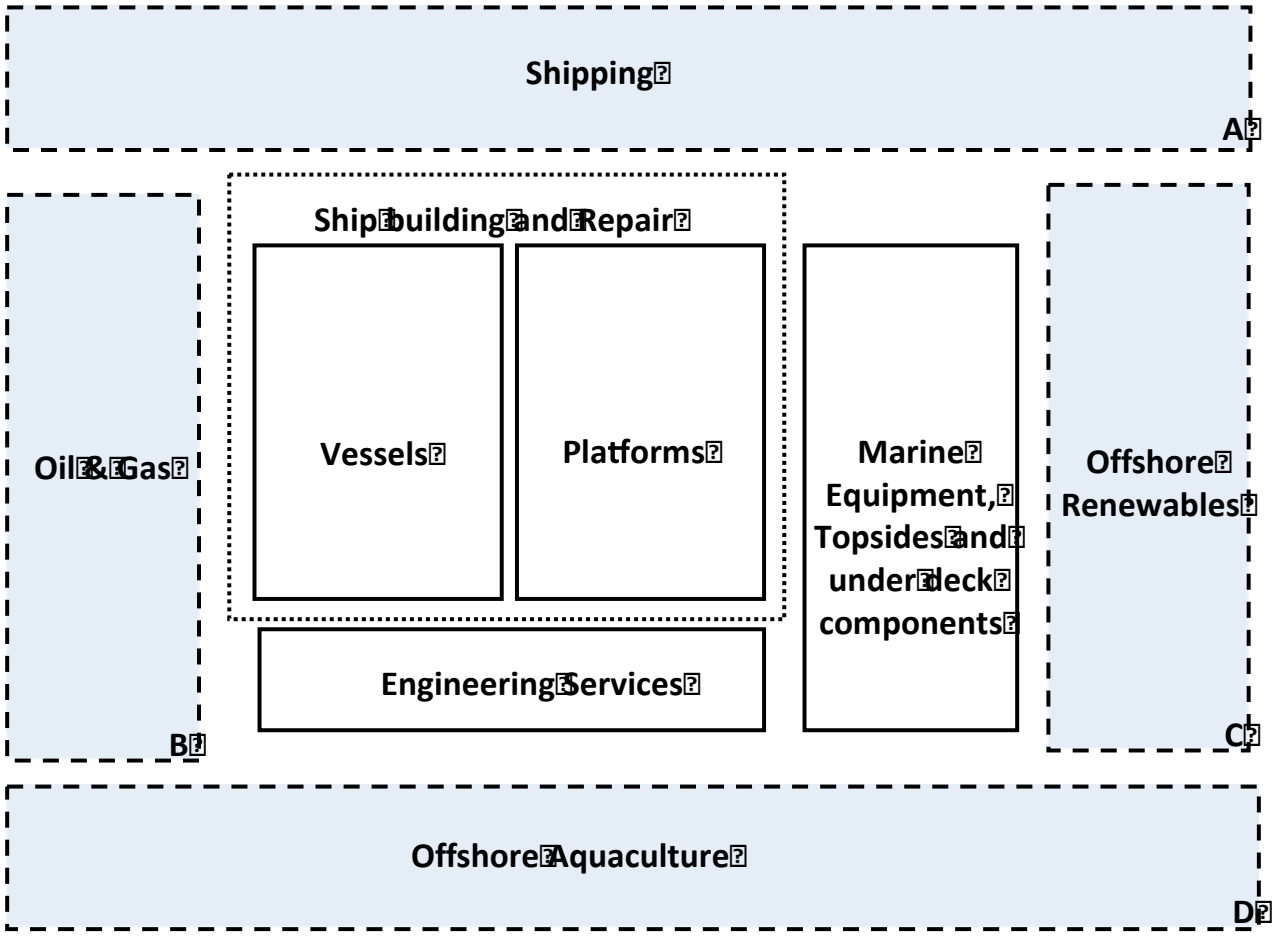
source: Vicorob (2014)

Challenge: *To develop a deep sea AUV system that can efficiently characterize complex sea floor and be at the same time commercially viable in an extremely competitive international market*

Includes suggestions by: EMEPC, IPMA, ISR-DSOR, , LSTS, DOP Azores, CEIIA, ARGUS, Oceanscan, TEKEVER, CREMINER

A contribution (from Portugal):

Platform 3 – *Ocean surface technologies*



A contribution (from Portugal):

Platform 3 – *Ocean surface technologies*

CH3.1 Design and construction fixed deep-water foun for offshore wind integration Conditioning Maint Systems

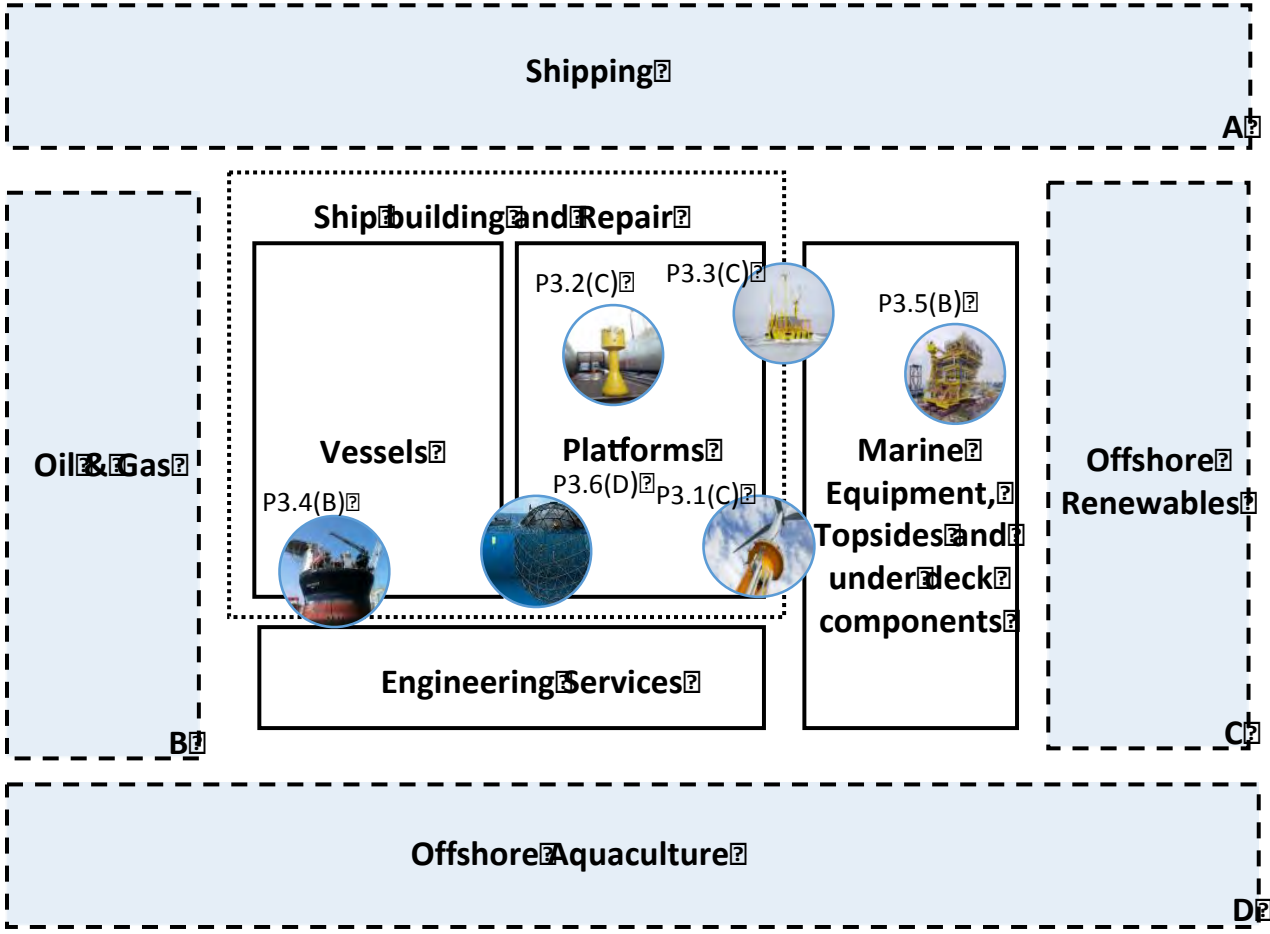
CH3.2 Design, construction and testing of innovativ energy converter

CH3.3 Offshore Platform to serve as a test bench f devices

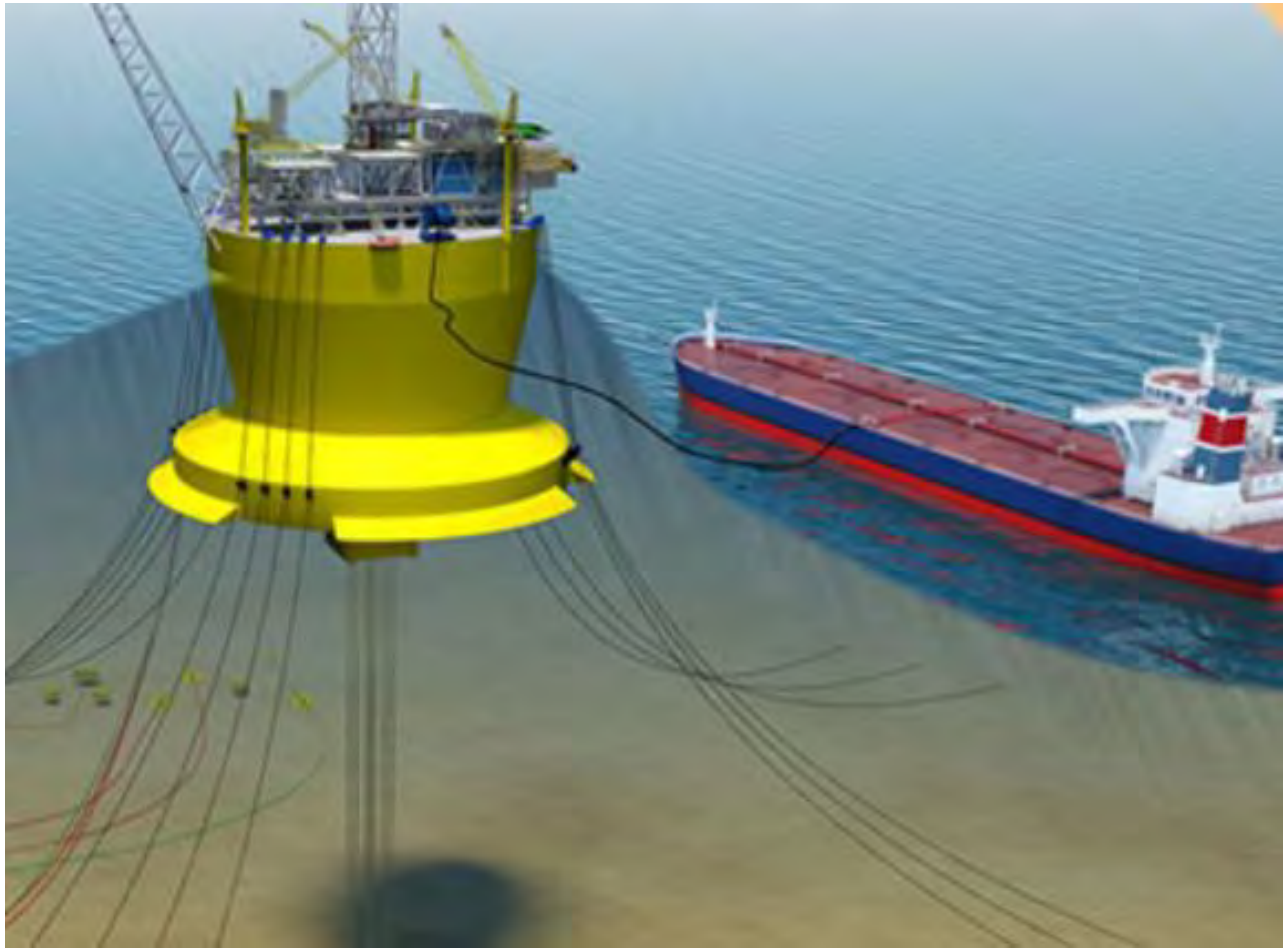
CH3.4 Engineering Design for a new generation FPS CO2 levels

CH3.5 Integration of CMS in existing Top-side supplie O&G industry

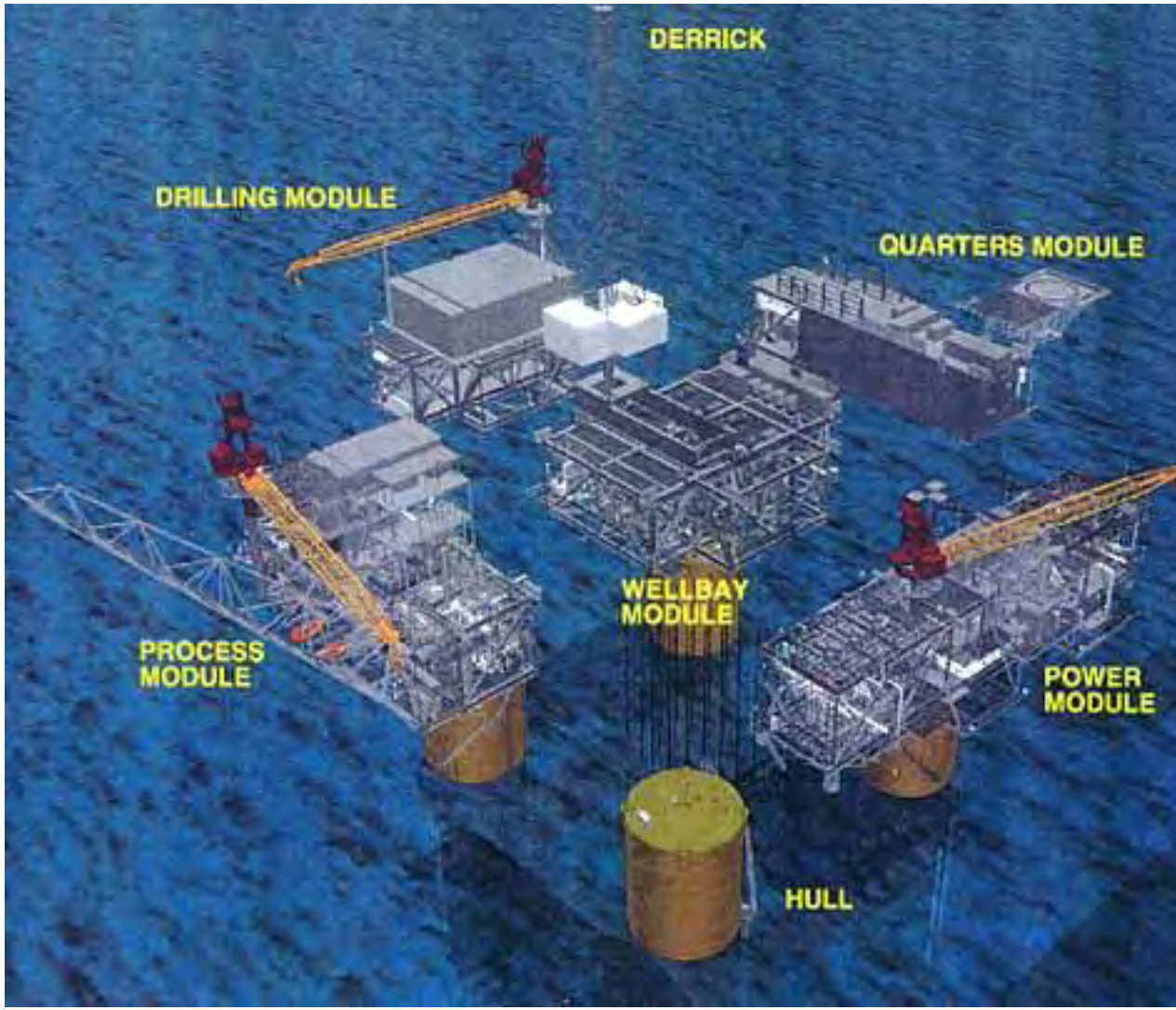
CH3.6 Design and construction of a deep-offshore aq system.



CH3.4 Engineering Design for a new generation FPSO for high CO2 levels



CH3.5 Integration of CMS in existing Top-side supplies for the O&G industry



A contribution (from Portugal):

Platform 4 – *Port technology and systems*

A contribution (from Portugal):

Platform 4 – *Port technology and systems*

CH4.1 Janela Única Logística (JUL);

CH4.2 Introduction of the Liquefied Natural Gas and Renewable Energy Devices in the Port structure;

CH4.3 Best practices development to use residual waters cleaning stations during the ships ballast liquid change;

CH4.4 Monitoring and safety systems for the maritime access, port infrastructure and superstructure;

CH4.5 Interface logistics and monitoring of the inland accessibilities;

CH4.6 Port flexible spatial planning integrated with the hinterland regarding the spatial planning, urban areas and interface with the inland accessibilities;

To be complemented with **Horizontal Measures:**

- ***HP1:*** *Integrated Ocean Observatory Initiative*
- ***HP2:*** *Promoting Public Policies, Innovation Dynamics and Risk Governance*
- ***HP3:*** *Capacitation, Training and Qualification of Human Resources*
- ***HP4:*** *Science Dissemination and Divulgation*
- ***HP5:*** *Promoting Internationalization and access to emerging Markets*
- ***HP6:*** *Promoting new technology-based companies and players and their integration in industrial value chains*
- ***HP7:*** *Identify Funding Sources and help raising the necessary resources*

Project Team in PORTUGAL:

LARSyS, ***Laboratório Associado em Robótica e Sistemas de Engenharia*** (www.larsys.pt),
Center for Innovation, Technology and Policy Research of IST, **IN+** (http://in3.dem.ist.utl.pt/)

Manuel Heitor, mheitor@ist.utl.pt
Rui Pimentel, ruipimentelsantos@tecnico.ulisboa.pt
Diogo Santiago
Guilherme Farinha
Leonardo Santos

WAVEC, http://www.wavec.org/en:
António Sarmento
Pedro Pires
Graça Jorge

CEiiA, http://www.ceiia.com
José Rui Felizardo
Artur Costa
Sónia Romão

In close collaboration with:

Instituto de Sistemas e Robótica, ISR
António Pascoal
Luís Sebastião

MARETEC
Ramiro Neves
Rodrigo Fernandes

Madeira Interactive Technologies Institute, **MITI**
Nuno Nunes

CEiiA
CENTER FOR INNOVATION, TECHNOLOGY AND POLICY RESEARCH
IN+
LARSyS Robotics and Systems in Engineering and Science
WavEC Offshore Renewables

Horizontes, Francisco Antonio Cano, 1913 (Museo de Antioquia)

+atlantic

…towards an INTERNATIONAL AGENDA of technology development and risk governance, promoting industrialization and endogenous growth

www.oipg.org

an **INTERNATIONAL OBSERVATORY**

to monitor, assess and foster the international agenda

“No esperen nada del siglo XXI, que es el siglo XXI el que lo espera todo de ustedes. …”

Gabriel Garcia Marquez, UNESCO/BID**,** Paris, 08/03/1999