TEC4SEA: Technological platform for a comprehensive approach to the ocean challenges

Vladimiro Miranda
INESC TEC: an inter-institutional organisation

The Associates

- 1985 – INESC Norte (Porto)
- 1998 – INESC Porto
- 2002 – INESC Porto Associate Laboratory
- 2012 – INESC TEC – Technology & Science
- 2012 – INESC P&D Brazil
INESC TEC: a web of clusters - of R&D centres

800 researchers - 300 PhDs

POWER AND ENERGY
- Power Systems
- Critical Software
- Advanced computing
- Inform. Systems, Comp. Graphics
- Telecom. & Decision Aid
- Enterprise Systems
- Robotics
- Industrial Management
- Inovation & Tech. Transfer

COMUNICATIONS AND DEVICES
- Photonics
- Bioengineering
- Telecom. & Multimedia
- Mach. Learning, Decision Aid

INDUSTRY AND INNOVATION

COMPUTER SCIENCE
Entrepreneurial testbeds – Thematic Lines

Vision from outside
- Clear image for Businesses
- Easy to explain
- Easy to target entities/companies
- Closely adapted to strategic agendas (European, National...)

Advantages inside
- Cross R&D Centre intervention
- Active exploitation and valorisation of cross-centre competencies
- Common research objectives
- Cultural integration
TEC4SEA: the challenge as a magnetic force field

Power & Energy
- CPES

Industry & Innovation
- CITE

Networked Intelligent Systems
- CTM
- CROB
- CAP

Computer Science
- CSIG
- HASLAB
- LIAAD

CAPACITIES: common ground

CHALLENGES: complementary skills
TEC4SEA

Beyond the deep frontier

www.tec4sea.com

Research and Technological Development | Technology Transfer and Valorisation | Advanced Training | Consulting
Pre-incubation of Technology-based Companies
Intervention based on multidisciplinary approach
**TEC4SEA actors and stages**

Recognized by FCT as a top national technological infra-structure

Supporting research, development, and testing of new technologies along 4 major research lines:

- Marine robotics
- Technologies and systems for underwater monitoring
- Broadband wireless communications systems
- Acoustic systems

**TEC4SEA members**

- INESC TEC (coordinator)
- CINTAL from the Algarve University
- CINAV (R&D Portuguese Navy Center)
- INESC P&D Brazil

[Open to others institutions]

**Intervention fields**

- Deep Sea
- Fisheries
- Aquaculture
- Safety & Security
- Environment monitoring
- ...

www.tec4sea.com
Location, facilities
Location in Leixões sea Port
Resources

Robotics platforms

<table>
<thead>
<tr>
<th>ROAZ II autonomous surface vehicle</th>
<th>TRIMARES autonomous underwater vehicle</th>
<th>PELICAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARES autonomous underwater vehicle</td>
<td>SLOCUM underwater glider</td>
<td>GRIFO autonomous aerial vehicle</td>
</tr>
</tbody>
</table>
AUV Mares: Quality of Coastal Water
AUV Trimares: Inspection of Reservoirs
Resources

- **Laboratories of:**
  - **Robotics with test tanks** (1000 square meters and 2 tanks)
  - **Optical/radio communications** with access to an anechoic camera
  - **Acoustic submarine signal processing** and instrumentation development for submarine exploration
  - **Optical and image sensors**, with access to infrastructure for fabrication of fiber optic based devices, micro fabrication (clean room), and optoelectronics instrumentation
MARBED - MARitime wireless networks testBED

Two land stations and eight sea nodes deployed in fishing ships sailing within the coast line of the Porto Metropolitan area up to 10 nautical miles from shore

Wi-fi maritime communications

PROPEIXE cooperative (sardine fishing vessels)

No satellite.

Running since April 2013
MARBED - MARitime wireless networks testBED

Land station

Maritime comm. equipment

Vessel w/equipment (sea node)
Projects in several domains:

Environment monitoring

- **Modal**: Models for predicting algae blooms
- **Morwaq**: Monitoring and predicting water quality parameters
- **Proteu**: Advanced optical sensor for monitoring estuarine and coastal environments
- **Trimares**: AUV for reservoir/dam monitoring
- **RAIA**: Iberian Coast Oceanographic Observatory

Safety & Security

- **ICARUS**: Integrated Components for Assisted Rescue and Unmanned Search operations
- **SUNNY**: Smart UNmanned aerial vehicle sensor Network for detection of border crossing and illegal entrY
- **JANUS SR**: Multi-technology mesh access point for SAR operations
Projects in several domains:

Deep Sea
• **TURTLE**: collaborative project with national companies

Fisheries
• **MARBED test bed**: communication systems for the fishermen community
• **JANUS NC**: Multi-technology mesh access point for near-coast coverage

Aquaculture
• **Aquamonitor**: Sensors for water quality monitoring in intensive aquaculture (dissolved CO2)
• **JANUS OS**: Multi-technology mesh access point for offshore facilities
• **SCAN**: non mechanical fish classification (industrial contract, on-going)
TURTLE – Deep Sea platform

Autonomous platform (3 months) with sensors to remain vigilant in deep waters

- Silva Matos Metalomecânica S.A.
- Ply Industries UK
- Centre for Navy Research (CINAV, Portuguese Navy)
- INESC TEC

Approved by EDA – European Defense Agency

70 projects submitted to EDA
6 projects approved

TURTLE single EDA and NATIONAL phase granted

15 | June 5, 2014
# Entrepreneurial testbed – tec4sea

<table>
<thead>
<tr>
<th>Key Points</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal community identification</td>
<td>Yes (7 centres; 3 clusters)</td>
</tr>
<tr>
<td>References in the intervention fields</td>
<td>Yes (&gt;30 projects)</td>
</tr>
<tr>
<td>Alignment with national &amp; international strategies</td>
<td>Yes (H2020, Smart Specialization, Norte 2020, National Strategy for the Sea)</td>
</tr>
<tr>
<td>Partnerships with national R&amp;D communities</td>
<td>Yes (3 already accepted)</td>
</tr>
<tr>
<td>International R&amp;D communities</td>
<td>Yes (EIT – kic RawMatTERS proposal)</td>
</tr>
<tr>
<td>National Policy Makers</td>
<td>Yes (Ministry of Defense, State Secretary for the Sea)</td>
</tr>
<tr>
<td>National Stakeholders</td>
<td>Yes (2 Clusters + industrial partners invitation - ongoing)</td>
</tr>
<tr>
<td>International Stakeholders</td>
<td>On preparation</td>
</tr>
<tr>
<td>Advanced training plan</td>
<td>On preparation</td>
</tr>
<tr>
<td>Entrepreneurship support actions</td>
<td>Not yet started</td>
</tr>
<tr>
<td>Strategic Roadmap</td>
<td>On preparation</td>
</tr>
<tr>
<td>Thematic line exploration for new projects</td>
<td>Yes (approved: 1 H2020 + 1ESF project + 1 direct contract)</td>
</tr>
<tr>
<td>Funding</td>
<td>Internal funding</td>
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</table>
Funding structure and sources

Research Infrastructures
- EI I&T (exogenous demand - Raw Materials KIC, associated partner)
- EMSO (exogenous demand deep sea observatories, Portuguese branch, associated partner)
- TEC4SEA infra-structure (endogenous demand, sea robotics technologies led by INESCTEC)

Applied Research
- Social Challenges (Raw materials, Blue Growth and Safety)
- Industry oriented (ICT Robotics - INESCTEC is founder of EUrobotics, who contracted a PPP with EU commission)
- Industries demands (direct contracts – Europe and South America, EU SME initiatives)

Basic research
- FCT: Robotics Perception Science and Technologies, Sensor Fusion, Environment Modelling
  - Future and Emerging Technologies (Environment Semantic Perception)
TEC4SEA ambitions: in 6 years...

INESC TEC will have built a shareable offshore research structure technologically oriented, supporting sea and deep sea autonomous platforms in regular operation, via:

- Solutions for broadband communications within the water column
- Mastering the coordination of swarms of AUV and with ROV operation
- Original solutions for underwater sensing
- Original integrated solutions for the power and energy supply of underwater devices
- Added valuable contributions to underwater mining operations

INESC TEC will hopefully have contributed to a response to social challenges and ocean industries demands, via the development of:

- New tools for raw materials exploration
- New equipment for in situ earth and ocean observation.
- New tools for citizens safety
- New offshore O&G solutions and impact assessment, and problem mitigation
- Solutions enabling a environmental acceptable underwater mining
- Solutions enabling offshore aquaculture and injected IC technologies in the aquaculture industry
- Solutions for new sustainable fisheries techniques

INESC TEC will have transferred knowledge and technology for the industrial national and international environment, with impact also in the economy and employment in the region North of Portugal, by having:

- Established a strong alliance with South Hemisphere partners
- Established strong cooperation with world industrial players
- Created a dense pocket of know how in ocean challenges and scientific responses
- Generated highly qualified human resources for the industry and for R&D
- Become internationally recognized as a reference in an integrated technologic approach to the ocean challenges
Invitation

- INESC TEC invites all stakeholders/interested parties in responding to the ocean challenge to consider an alliance or partnership with the TEC4SEA initiative.

- TEC4SEA is classified by the FCT (Foundation for Science and Technology) as one of the top R&D national infrastructures