

Cluster  
**POWER  
AND ENERGY**



- **CPES**  
CENTRE  
POWER  
AND ENERGY  
SYSTEMS

Cluster  
**INDUSTRY  
AND INNOVATION**



- **CEGI**  
CENTRE  
INDUSTRIAL  
ENGINEERING  
AND MANAGEMENT
- **CESE**  
CENTRE  
ENTERPRISE  
SYSTEMS  
ENGINEERING
- **CITE**  
CENTRE  
INNOVATION,  
TECHNOLOGY AND  
ENTREPRENEURSHIP
- **CRIIS**  
CENTRE  
ROBOTICS  
IN INDUSTRY  
AND INTELLIGENT  
SYSTEMS

Cluster  
**NETWORKED  
INTELLIGENT  
SYSTEMS**



- **CAP**  
CENTRE  
APPLIED  
PHOTONICS
- **C-BER**  
CENTRE  
BIOMEDICAL  
ENGINEERING  
RESEARCH
- **CRAS**  
CENTRE  
ROBOTICS AND  
AUTONOMOUS  
SYSTEMS
- **CTM**  
CENTRE  
TELECOMMUNICATIONS  
AND MULTIMEDIA

Cluster  
**COMPUTER  
SCIENCE**

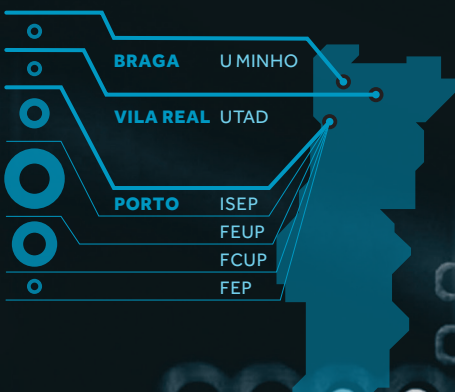


- **CRACS**  
CENTRE  
ADVANCED  
COMPUTING  
SYSTEMS
- **CSIG**  
CENTRE  
INFORMATION  
SYSTEMS  
AND COMPUTER  
GRAPHICS
- **HASLAB**  
LABORATORY  
HIGH-ASSURANCE  
SOFTWARE
- **LIAD**  
LABORATORY  
ARTIFICIAL  
INTELLIGENCE AND  
DECISION SUPPORT

**13 R&D CENTRES  
6 LOCATIONS IN 3 CITIES**

**725 RESEARCHERS**

350 PhDs



**MORE THAN**

**190 PROJECTS /YEAR**

NATIONAL AND EUROPEAN  
PROJECTS  
R&D AND CONSULTING SERVICES

**MORE THAN**

**300 PAPERS /YEAR**

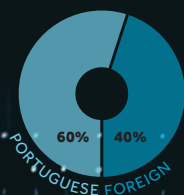
INTERNATIONAL  
SCIENTIFIC  
JOURNALS

**MORE THAN**

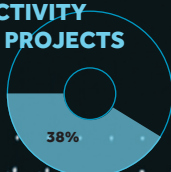
**350 GRANT HOLDERS /YEAR**

ENHANCING PERSONAL  
POTENTIAL THROUGH  
SCIENCE AND TECHNOLOGY

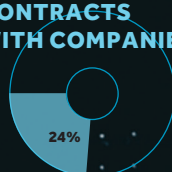
**PHD STUDENTS**



**INTERNATIONAL  
ACTIVITY  
IN PROJECTS**



**DIRECT  
CONTRACTS  
WITH COMPANIES**



- › research and technological development
- › technology transfer and valorisation
- › advanced training
- › R&D contracts with industry
- › technology-based business pre-incubation
- › advanced training

The Institute for Systems and Computer Engineering, Technology and Science — INESC TEC has over 30 years of experience in R&D and technology transfer. Present in sites in the cities of Porto, Braga and Vila Real, INESC TEC incorporates 13 R&D Centres with complementary competences, always looking to the international market.

At INESC TEC, the knowledge and results generated as part of fundamental research are typically applied in technology transfer projects, always guaranteeing added and immediate social relevance.

With the launching of INESC P&D BRASIL (in São Paulo, Brazil), INESC TEC has strengthened its presence worldwide, always associating Portugal to international scientific excellence. In Portugal, INESC TEC's capacity for technological innovation has made it possible to modernise national sectors and to launch new exporting companies.

#### ASSOCIATES



FEUP FACULDADE DE ENGENHARIA  
UNIVERSIDADE DO PORTO



FEP FACULDADE DE ECONOMIA  
UNIVERSIDADE DO PORTO



isep Instituto Superior de  
Engenharia do Porto

#### PRIVILEGED PARTNERS



Universidade do Minho  
Escola de Engenharia



#### SPECIAL PARTNERSHIPS



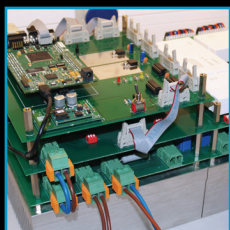
CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



FCT Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR





# EV SBC

EV SMART BATTERY  
CHARGER



# EV SBC

## EV SMART BATTERY CHARGER

---

The battery charger prototype developed by INESC TEC is a high value device with integrated grid support functions. Based on highly accurate local measurements, voltage and frequency droop control is implemented to reduce the charging rate when there are excessive voltage drops or large frequency changes, and even to reverse the power flow in very critical conditions. Furthermore, if the node where the EV is connected has a light load and an excessive local renewable energy production, the charging rate is slightly increased to maintain the voltage under its upper limit. A battery monitoring system ensures the adequate SOC management during grid support mode of operation.

### MAIN FEATURES

- Full-scale bidirectional power flow with low harmonic content
- Wide battery pack voltage range
- BMS Status, SoC, SoH, Highest and lowest cell monitoring
- Galvanic isolation
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition, including V2G
- Grid support during disturbances

### SPECIFICATIONS

- Maximum power:  $\pm 3680\text{W}$  // Max. Charging Current: 10A
- Battery pack voltage range: 350...480V
- Grid voltage:  $230\text{V} \pm 20\%$  // Grid frequency: 48...52Hz
- Connectivity: RS232, CAN and USB (firmware upload only)
- Switching frequency:  $\geq 20\text{kHz}$  // P.F. (full load)  $> 0.95$  // THD (full load)  $< 5\%$
- Droop control range: 200...260V, 48...52Hz,  $-3680...+3680\text{W}$

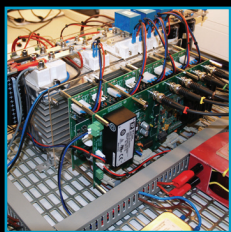


**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)



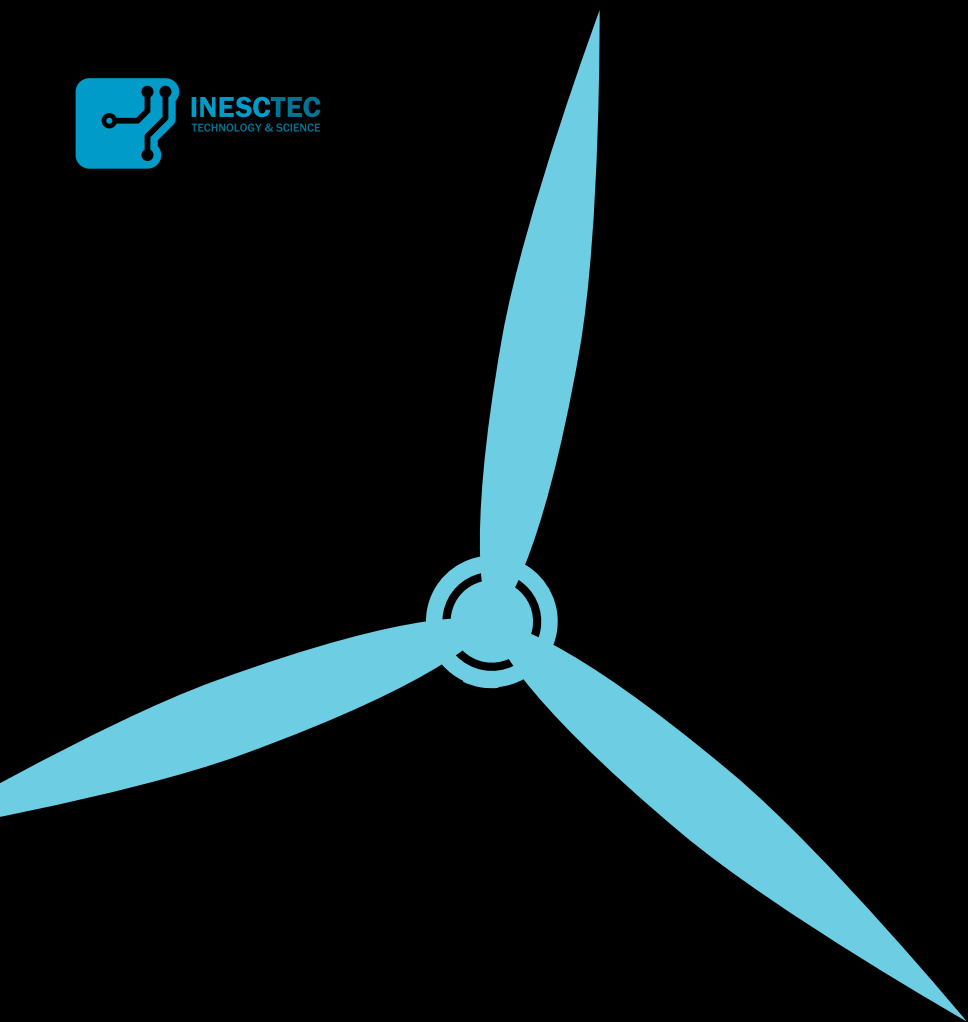


# WISE

## WIND INTEGRATION IN SMART ENVIRONMENTS



**INESCTEC**  
TECHNOLOGY & SCIENCE





# WISE

## WIND INTEGRATION IN SMART ENVIRONMENTS

---

The micro wind turbine inverter developed by INESC TEC is a high value device with integrated grid support functions. The inverter combines a fast and efficient power vs. speed tracking with an advanced Droop control based on grid voltage and real-time frequency measurements. These characteristics prepare the device for the next step in the expansion of micro producers. Additional features such as fast response to voltage and frequency changes allow the distribution network to easily recover when failures occur.

### MAIN FEATURES

- Full-scale controllable power flow with low harmonic content
- Integrated 3kW dump load control
- Real-time grid voltage and frequency monitoring
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition
- Grid support during disturbances

### SPECIFICATIONS

- Maximum power:  $\pm 3680W$  // Max. Generator current: 20A
- Generator voltage (line-to-line): 210...260V // Generator frequency: 10...100Hz
- Grid voltage:  $230V \pm 20\%$  // Grid frequency: 48...52Hz
- Connectivity: RS232 and USB (firmware upload only)
- Switching frequency:  $\geq 20kHz$  // P.F. (full load)  $> 0.95$  // THD (full load)  $< 5\%$
- Droop control range: 200...260V, 48...52Hz, -3680...+3680W

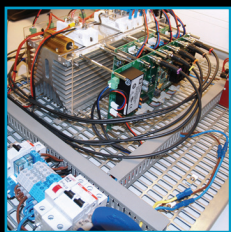


**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)





# SISE

## SOLAR INTEGRATION IN SMART ENVIRONMENTS



**INESC TEC**  
TECHNOLOGY & SCIENCE



# SISE

## SOLAR INTEGRATION IN SMART ENVIRONMENTS

---

The solar power inverter developed by INESC TEC is a high value device with integrated grid support functions. The inverter includes a fast and efficient MPP search, combined with advanced Droop control based on real-time grid voltage and frequency measurements. These characteristics prepare the device for the next step in the expansion of micro producers. Additional features such as fast response to voltage and frequency changes allow the distribution network to easily recover when failures occur.

### MAIN FEATURES

- Full-scale controllable power flow with low harmonic content
- Wide PV array voltage range
- Real-time grid voltage and frequency monitoring
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition
- Grid support during disturbances

### SPECIFICATIONS

- Maximum power:  $\pm 3680\text{W}$  // Max. PV array current: 10A
- PV array voltage range: 150...450V
- Grid voltage:  $230\text{V} \pm 20\%$  // Grid frequency: 48...52Hz
- Connectivity: RS232 and USB (firmware upload only)
- Switching frequency:  $\geq 20\text{kHz}$  // P.F. (full load)  $> 0.95$  // THD (full load)  $< 5\%$
- Droop control range: 200...260V, 48...52Hz, -3680...+3680W



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)







# ROBVIGIL

## SURVEILLANCE ROBOT



# ROBVIGIL

## SURVEILLANCE ROBOT

---

ROBVIGIL is an indoor surveillance robot equipped with sensors and video cameras that is capable of collecting and sending information in real time. The robot can be remotely operated or instructed to go on rounds autonomously. It operates independently of light conditions and can cooperate with other robots or humans.

### FUNCTIONALITIES

- Robust robot localisation
- Intelligent battery charging system
- Transparent management of different communication technologies
- Multiple cameras and sensors
- People detection and tracking
- Visual programming languages for intuitive robot mission configuration and route planning

### MAIN FEATURES

- Sensors: floor, water, fire, smoke, temperature, humidity, movement, gas (CH, GPL and CO)
- Supports videoconferencing
- Transparently selects the best wireless technology:  
WiFi and 3G (more in the future)
- No need for markers for indoor auto-localisation
- Video: 360° Camera, directional HD, Thermal, IR
- Remote Database

### SPECIFICATIONS

Dimensions: 120cm height, 60cm diameter

Autonomy: unlimited with 10 to 15-minute charging every 45 minutes (the robot remains fully functional even while charging);

8 to 12 hours without charging

Max speed: 1.4 m/s

### PARTNERS

**INESCTEC** INSTITUTE FOR SYSTEMS AND COMPUTER ENGINEERING, TECHNOLOGY AND SCIENCE

**FEUP** FACULTY OF ENGINEERING OF THE UNIVERSITY OF PORTO

**CLEVER HOUSE** SISTEMAS INTELIGENTES, LDA

**STRONG** SEGURANÇA, SA

**SINEPOWER** CONSULTORIA, PROJECTOS DE ENGENHARIA ELECTRÓNICA, LDA



CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt

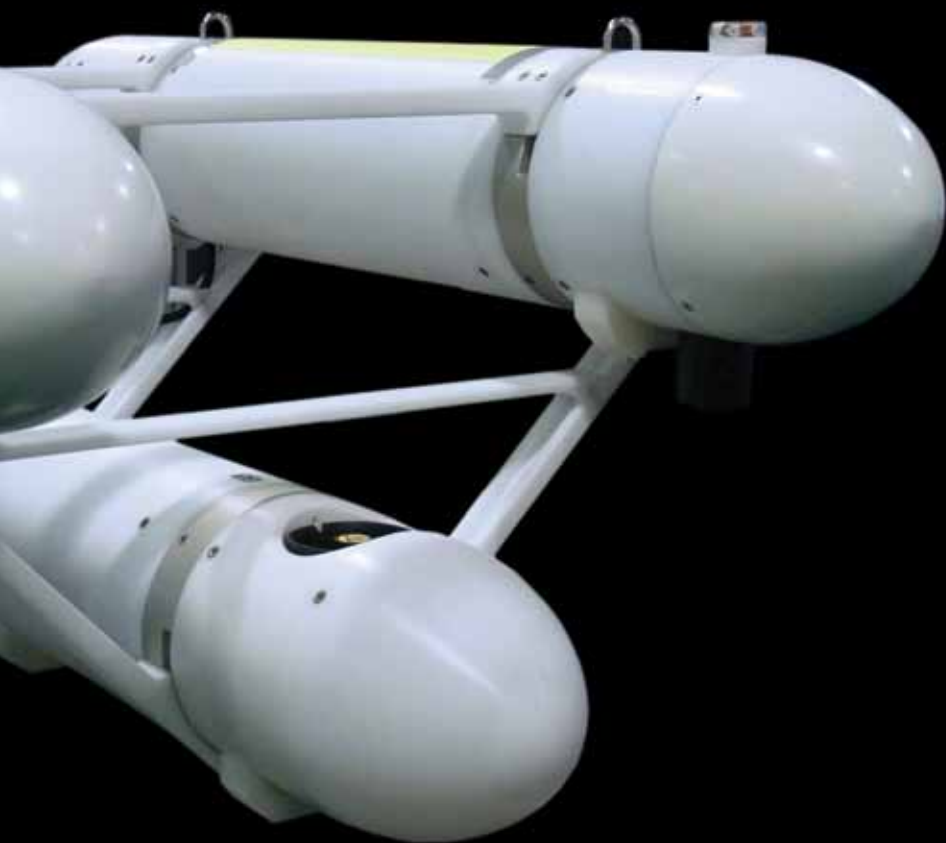


# **TriMARES**

## AUTONOMOUS UNDERWATER VEHICLE



**INESCTEC**  
TECHNOLOGY & SCIENCE





# TriMARES

## AUTONOMOUS UNDERWATER VEHICLE

---

TriMARES is an underwater vehicle designed for autonomous inspection, bathymetry, mapping and data collection. TriMARES' modular structure is based on the underwater vehicle MARES (OceanSys) and allows different sensor package configurations. Its increased capacity to transport sensors allows it to carry an on-board high resolution video camera, as well as different types of sonar equipment. It can move smoothly in the water, increasing the quality and georeferencing of the collected data. TriMARES was developed in 6 months by INESC TEC and commissioned by a consortium of Brazilian hydroelectric power companies (CEB Lajeado, EDP). The first unit was exported to Brazil in 2011.

### MAIN FEATURES

- Modular construction with reconfigurable sections
- Spare ports to accommodate additional payload sensors
- Robust and safe, with fully shrouded moving parts
- Operates in confined spaces - able to ascend/descend on the vertical
- Hovering in the water column - station keeping and close inspection
- 5 degrees of freedom (surge, sway, heave, yaw, pitch)
- Autonomous operation with simple mission definition
- Rechargeable Li-Ion batteries
- Low maintenance
- Optional fibre-optic umbilical for real-time video/data transmission (ROV mode)

### SPECIFICATIONS

- Length: 1.3 m // Total width: 80 cm // Overall height: 50 cm // Weight: 75 kg
- Maximum depth: 100 m
- Horizontal speed: 0-2 m/s, variable // Vertical speed: 0-0.3 m/s, variable
- Autonomy / Range: 10 hrs / 40 km
- Typical sensors: video camera, high sensitivity still camera, multibeam sonar, sidescan sonar, CTD, turbidity, fluorescence



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



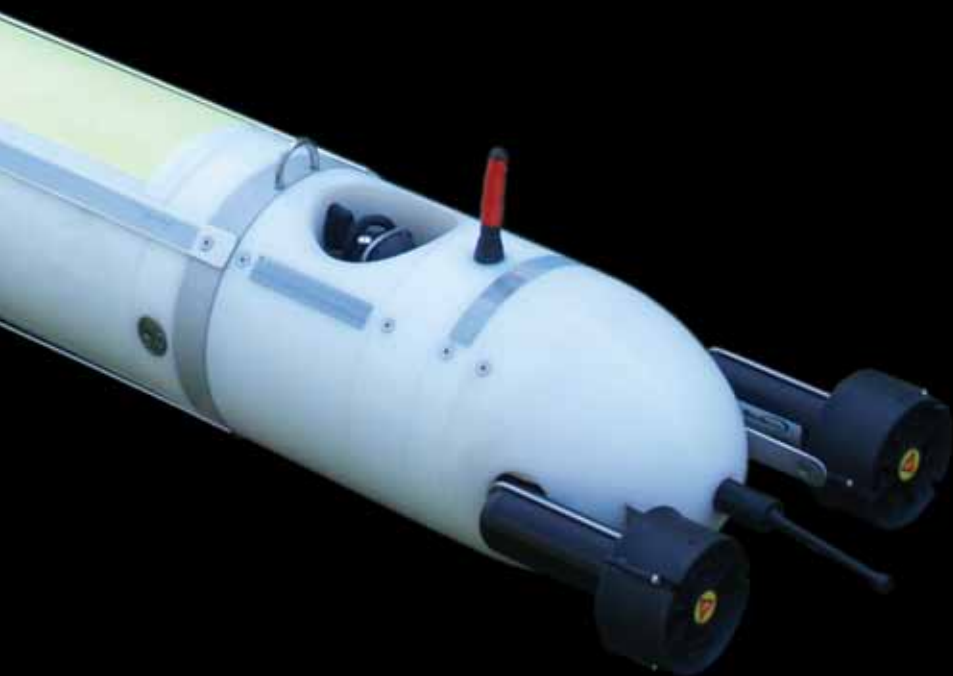


# MARES

## AUTONOMOUS UNDERWATER VEHICLE



**INESCTEC**  
TECHNOLOGY & SCIENCE



# MARES

## AUTONOMOUS UNDERWATER VEHICLE

Developed by OceanSys (INESC TEC and FEUP), MARES - Modular Autonomous Robot for Environment Sampling is an autonomous vehicle used in underwater operations. This robot can be easily configured and its modular structure allows it to carry a large variety of sensor packages. MARES can be used for different applications such as environment monitoring, underwater inspection and mapping, and surveillance. An acoustic positioning system makes it possible to georeference collected data. This device has been used regularly since 2007 in environmental monitoring operations.

### MAIN FEATURES

- Modular construction with reconfigurable sections
- Spare ports to accommodate additional payload sensors
- Robust and safe, with fully shrouded moving parts
- Operates in confined spaces - able to ascend/descend on the vertical
- Hovering in the water column - station keeping and close inspection
- 4 degrees of freedom (surge, heave, yaw, pitch)
- Autonomous operation with simple mission definition
- Rechargeable Li-Ion batteries
- Low maintenance
- Compact and lightweight - easy transportation and deployment

### SPECIFICATIONS

- Length: 1.6 m
- Diameter: 20 cm
- Weight: 32 kg
- Maximum depth: 100 m
- Horizontal speed: 0-2 m/s, variable
- Vertical speed: 0-0.5 m/s, variable
- Autonomy/range: 10 hrs / 40 km
- Typical sensors: CTD, sonar, turbidity, fluorescence, video camera



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)







# ROAZ II

## AUTONOMOUS SURFACE VEHICLE



**INESCTEC**  
TECHNOLOGY & SCIENCE



# ROAZ II

## AUTONOMOUS SURFACE VEHICLE

ROAZ II is an autonomous surface vehicle designed for aquatic environment monitoring, bathymetry, data collection and oceanography, security and search and rescue missions. With on-board sensor processing and high precision navigation it is capable of operating autonomously in the ocean environment. The robot has a wide range of sensors and advanced on-board controls allowing its use in efficient precision environmental modelling (oceanographic, 3D sea floor modelling), automated intrusion detection, target tracking, identification, area patrol, communications relay in multi-vehicle scenarios and surface support to underwater assets.

On-board ROV in coordinated missions makes it a suitable surface platform for underwater inspection and data collection tasks.

This vehicle has already taken part in various operational missions.

### MAIN FEATURES

Autonomous operation

GPS with RTK and INS for precise positioning

RADAR for obstacle detection

Infra-red and visible light cameras

On-board image processing

Wireless communication (data/video)

CTD

Multi-beam sonar and side-scan sonar

LiFePO4 Batteries

On-board inspection ROV (remotely operated Vehicle)

### SPECIFICATIONS

Length: 4.25 m // Width: 2 m // Weight: 250 kg

Maximum speed: 10 knots

Autonomy: 11 hours

Electric propulsion: 10 HP

Load capacity: 500 kg



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# GRIFO

AUTONOMOUS  
AERIAL  
VEHICLE



**INESCTEC**  
TECHNOLOGY & SCIENCE



# GRIFO

## AUTONOMOUS AERIAL VEHICLE

GRIFO is a small scale, fixed wing autonomous flight vehicle (unmanned aircraft) designed for environmental monitoring, security, forest fire prevention, communications relay and search and rescue missions. Developed by a team with more than 10 years of experience in aerial robots, this vehicle with on-board image processing and autonomous flight control can operate without direct communication with the land station. A custom developed inertial navigation system and autopilot allows the tight integration of additional sensors, a high degree of navigation positioning and sensor in the loop custom manoeuvres for particular applications. Advanced on-board image processing is used not only in application tasks (event detection, target tracking etc.) but also in automatic visual detection of obstacles (land and in flight) in order to endow the UAV with the capability of operating in accordance with VFR (Visual Flight Rules) aerial regulations.

### MAIN FEATURES

- Electric propulsion
- Custom developed autopilot
- Custom developed small scale inertial navigation system
- Low consumption on-board ARM (Cortex A8) CPU
- WiFi communication
- Autonomous flight control in gliding mode
- On-board imaging processing
- Image based sense and avoid
- LiPo batteries (Lithium-ion polymer)

### SPECIFICATIONS

- Wingspan: 4 m
- Maximum take-off weight: 10 kg
- Cruising speed: 50 km/h
- Autonomy: 4 to 6 hours
- Fibreglass glider airframe



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# SmartAGV

SMART AUTOMATED  
GUIDED VEHICLE



**INESCTEC**  
TECHNOLOGY & SCIENCE



# SmartAGV

## SMART AUTOMATED GUIDED VEHICLE

---

The SmartAGV is an Automated Guided Vehicle designed for applications facing challenges which call for a flexible and intelligent flow of materials with an effective cost/benefit ratio. This mobile robot is capable of using different types of localisation systems such as a contour based system, without the need for environment preparation, beacons or magnetic tape. The main objective is to achieve a system that is easily adapted, installed and used.

### MAIN FEATURES

- Several Localisation techniques:
  - contours (no environment preparation required)
  - beacons
  - magnetic tape
- Autonomous management of battery charging



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

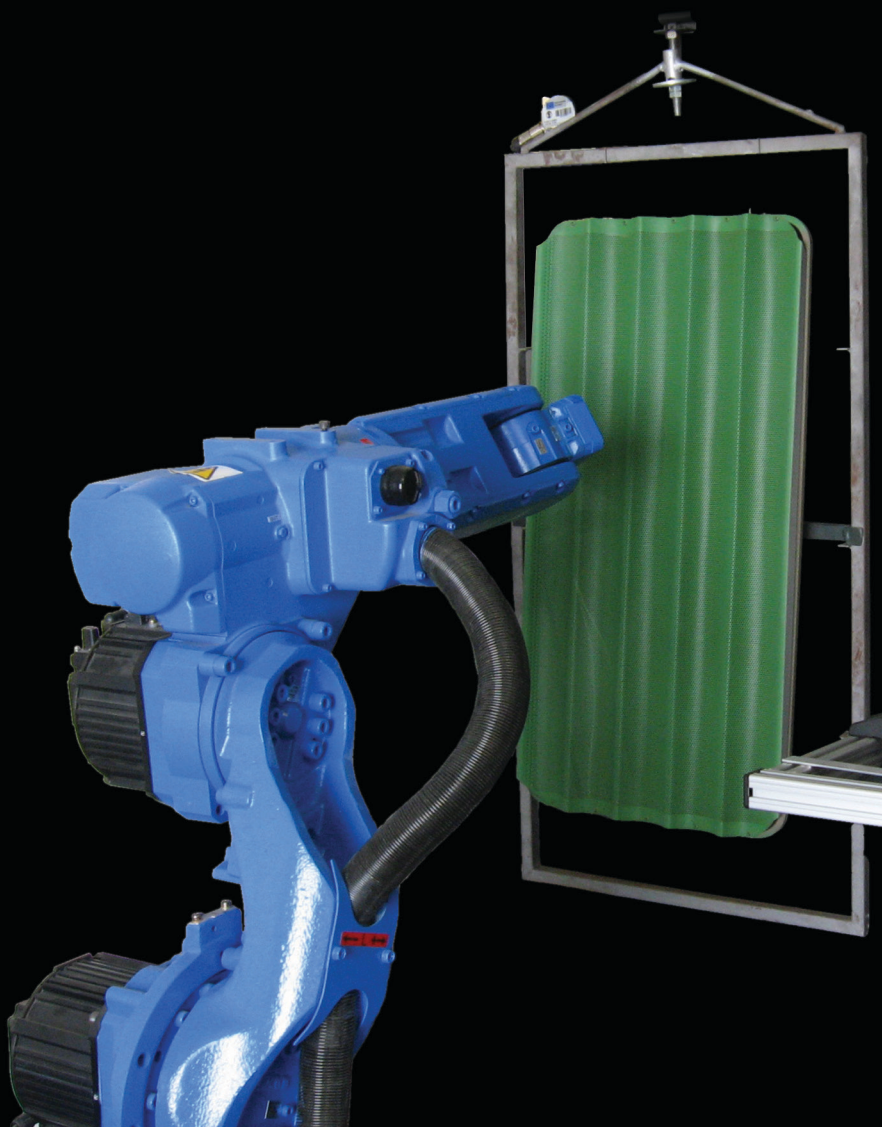
T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# SmartPAINT

SMART ROBOTISED  
PAINTING CELL



# SmartPAINT

## SMART ROBOTISED PAINTING CELL

---

The SmartPaint is a system that may lead to an increase in competitiveness in small series robotised painting. Some of the system's key factors include accumulated know-how which can be recorded and the capacity to increase production at a lower manufacturing cost, as well as the flexibility to rapidly adapt to new products and processes. This system aims at responding to these challenges by developing an intelligent robotised painting cell capable of acquiring, in a fast and intuitive way, the know-how accumulated by specialised technicians and optimised during several years of experience. The acquired trajectories are recorded and automatically translated to the language of the manipulator, which is taught by means of demonstration.

### MAIN FEATURES

- Programming of manipulators through demonstration
- Modular and flexible system for automatic recognition of object geometry
- Capable of translating the independent commands of the programming language to the commands supported by the concrete robot installed for production
- Advanced interface for management and control, supporting both local and remote interaction



CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



**FCT** Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR





# CARLoS

COOPERATIVE ROBOT  
FOR LARGE SPACES  
MANUFACTURING



**INESCTEC**  
TECHNOLOGY & SCIENCE



# CARLoS

## COOPERATIVE ROBOT FOR LARGE SPACES MANUFACTURING

---

CARLoS project applied recent advances in cooperative mobile robotics to a representative industrial scenario in shipyards. The final prototype was demonstrated as a robot co-worker for outfitting operations (stud welding and marking) inside blocks of ship superstructures. Currently, there is no automated solution for these tasks.

### FUNCTIONALITIES

- Autonomous stud welding
- Cooperative behaviour under uncertainties
- Semi-autonomous decision-making on the work to be done
- Highly usable and easy controlled by a shipyard worker

### MAIN FEATURES

- High mobility inside ship blocks
- Projection mapping augmented reality based interface
- 3DOF and 6 DOF localisation with natural features
- Close to walls path planning for the mobile platform
- Skills-based programming

### TECHNICAL SPECIFICATIONS

- Platform absolute localisation accuracy:  $< 6\text{cm}$
- Stud placement accuracy:  $< 1\text{cm}$
- Platform maximum speed:  $1.5\text{m/s}$
- Force application on the wall:  $> 160\text{N}$   
(depending on the arm configuration)
- Payload of the platform:  $100\text{Kg}$



THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S  
SEVENTH FRAMEWORK PROGRAMME FOR RESEARCH, TECHNOLOGICAL DEVELOPMENT  
AND DEMONSTRATION UNDER GRANT AGREEMENT No 606363



**INESCTEC**  
TECHNOLOGY & SCIENCE  
| ASSOCIATE LABORATORY  
PORTUGAL

INESC TEC  
R DR ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)



# STAMINA

SUSTAINABLE AND RELIABLE  
ROBOTICS FOR PART HANDLING  
IN MANUFACTURING AUTOMATION



**INESCTEC**  
TECHNOLOGY & SCIENCE



# STAMINA

## SUSTAINABLE AND RELIABLE ROBOTICS FOR PART HANDLING IN MANUFACTURING AUTOMATION

---

The STAMINA Project is focused on building the Factory of the Future with the help of new robotics technologies.

By increasing the flexibility of production facilities, handling an ever increasing customisation of products and production volumes variation, the STAMINA Project aims to find profitable solutions to increase the competitiveness of EU factories. The end result of the STAMINA project is a fleet of mobile manipulators capable of navigating and performing kitting operations on a complex logistic supermarket.

A Vertical Integration solution, aimed at bridging the fleet of mobile manipulators with the production systems is being developed by INESC TEC. A 3D spatial representation of the working environment, allowing a continuous assessment of inconsistencies between reality and the modelled information, is also in development.

### PROJECT BENEFITS

- Robotic fleet capable of operating on environments designed for human use.
- Set of sustainable robotic technologies, software and hardware, capable of being transferred to industrial use.
- Robust object recognition and grasping for a large variety of parts.

### TECHNOLOGICAL INNOVATION

- 3D Vision for part picking and inconsistency detection.
- Skill / Task based robot programming.
- Navigation without infrastructure.
- Web based Vertical Integration with the factory production system.

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S  
SEVENTH FRAMEWORK PROGRAMME FOR RESEARCH, TECHNOLOGICAL DEVELOPMENT  
AND DEMONSTRATION UNDER GRANT AGREEMENT NO 610917.

---



**INESC TEC**  
TECHNOLOGY & SCIENCE  
| ASSOCIATE LABORATORY  
PORTUGAL

**INESC TEC**  
R DR ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



# UNMANNED CAPSULE

## AUTONOMOUS ROBOT FOR SEARCH AND RESCUE OPERATIONS



**INESCTEC**  
TECHNOLOGY & SCIENCE



# UNMANNED CAPSULE

## AUTONOMOUS ROBOT FOR SEARCH AND RESCUE OPERATIONS

---

The Unmanned capsule is a small size autonomous surface vehicle designed for search and rescue operations at sea. This robot carries an uninflated life raft and is capable of inflating it close to survivors in large-scale maritime disasters. It can be remotely controlled or operated autonomously, and can be deployed from shore or from a mother ship.

The capsule was designed to operate in adverse environmental conditions, and is also equipped with a video camera and other sensors to provide information about victims and the disaster to operators on shore. This system was developed as part of project ICARUS (FP7 – Security).

### MAIN FEATURES

- Automatic inflation of life raft
- Autonomous navigation
- Live video stream to shore



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

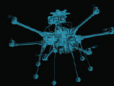
INESC TEC  
R DR ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)





STRONG  
**MAR**



STRENGTHENING MARITIME  
TECHNOLOGY  
RESEARCH CENTER



# STRONGMAR

## STRENGTHENING MARITIME TECHNOLOGY RESEARCH CENTER

**AIM** INESC TEC is strongly committed to become a center of excellence in maritime technology and, in particular, deep sea technology. The STRONGMAR project aims at creating solid and productive links in the global field of marine science and technology between INESC TEC and established leading research European institutions, capable of enhancing the scientific and technological capacity of INESC TEC and linked institutions (as well as the capacity of partnering institutions involved in the twinning action), helping raising its staff's research profile and its recognition as a European maritime research center of excellence.

**OBJECTIVES** The main objectives are: provide services and open access to the European academic and industrial communities; become a recognized maritime research asset; build a well-designed and coherent plan for knowledge transfer and exchange of best practices; and enhance the scientific and technological capacity of INESC TEC and linked institutions. These objectives will be fulfilled through a set of measures: summer schools, winter schools, short-term scientific meetings, long-term staff visits, networking meetings, workshops, conferences, technology transfer workshops with stakeholders, and other dissemination activities.

**PARTNERS** INESC TEC (PORTUGAL) / CINTAL (PORTUGAL) / HERIOT-WATT UNIVERSITY (UNITED KINGDOM) / NATO SCIENCE & TECHNOLOGY ORGANIZATION (BELGIUM) / UNIVERSITAT DE GIRONA (SPAIN) / UNIVERSITY OF ABERDEEN (UNITED KINGDOM)

**START** JANUARY 2016 **END** DECEMBER 2018 **BUDGET** ~1 M€



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

**CRAS**  
CENTRE FOR ROBOTICS  
AND AUTONOMOUS SYSTEMS

CAMPUS DO ISEP  
R DR. ANTÓNIO BERNARDINO  
DE ALMEIDA, 431  
4200-072 PORTO  
PORTUGAL

T +351 228 340 554  
F +351 222 094 050

[strongmar@inesctec.pt](mailto:strongmar@inesctec.pt)  
[www.strongmar.eu](http://www.strongmar.eu)

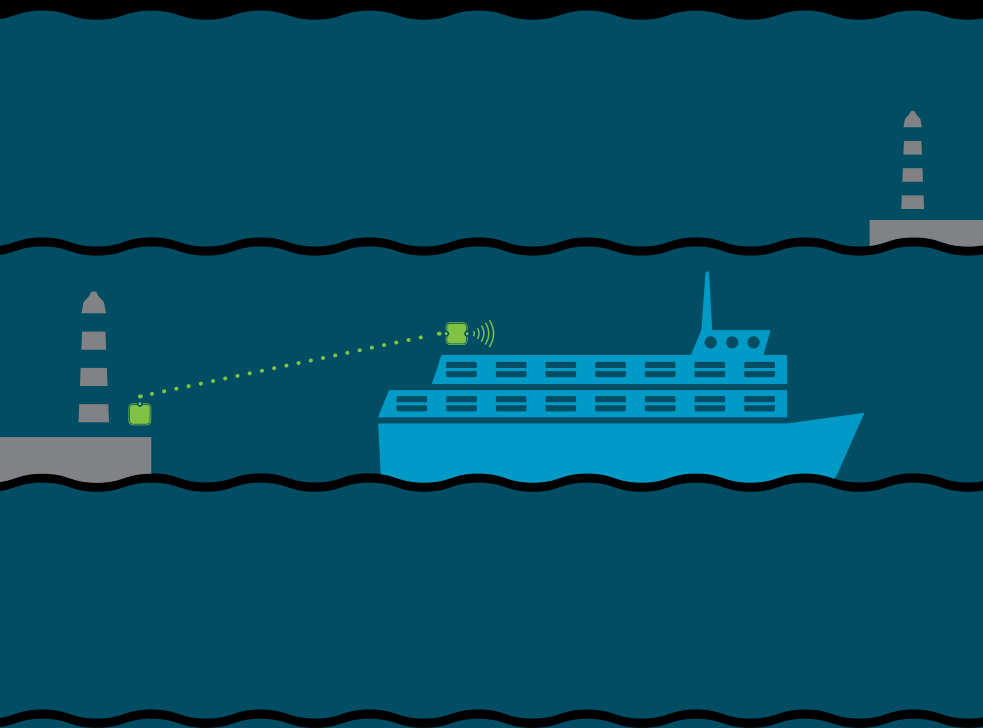






# JANUS-NC

MULTI-TECHNOLOGY  
MESH ACCESS POINT  
FOR NEAR-COAST COVERAGE



# JANUS - NC

## MULTI-TECHNOLOGY MESH ACCESS POINT FOR NEAR-COAST COVERAGE

---

Network equipment capable of offering Wi-Fi coverage, while connecting to the Internet via multiple heterogeneous links such as 3G, WiMax, and even other Wi-Fi connections. The devices connect to JANUS via a single stable Wi-Fi connection and the box transparently selects the best connection to the infrastructure, depending on temporal conditions. JANUS can form a transparent mesh network that is used to extend a network infrastructure or Internet link to remote locations, via multi-hop wireless links. JANUS can offer Internet connectivity and services (e.g., VoIP) to passengers on boats near the coast or at the dock. Improved Internet connectivity can be achieved using fiber or ADSL as backhaul instead of 3G/WiMax. It can also be used to provide a dedicated network for nodes of the same entity.

### FUNCTIONALITIES

- Near coast Internet extension
- Self configured network
- Support for prioritised traffic and QoS
- Support for data storage
- Remote management
- JANUS GPS location - estimated position of network clients

### MAIN FEATURES

- Support for multi-hop and mobile mesh network mode (Wi-Fi)
- Scales to large mesh networks (up to 7000 JANUS boxes)
- Multiple link layer technologies: 3G, Wi-Fi, WiMax, etc.
- Stable Wi-Fi connection regardless of the Internet link used
- Unnecessary network planning: dynamic auto-configuration

### TECHNICAL SPECIFICATIONS

- Dimensions: 26cm length, 23cm width, 8.8 cm height
- Power: DC jack or passive POE, 7-20 V, 5-6 W
- Supports renewable energy sources (e.g., solar panels)
- Internal Batteries: 12 V, 7.2 Ah
- Autonomy: ~10 hours
- WRAP-BOX is rated NEMA-67 / IP67



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

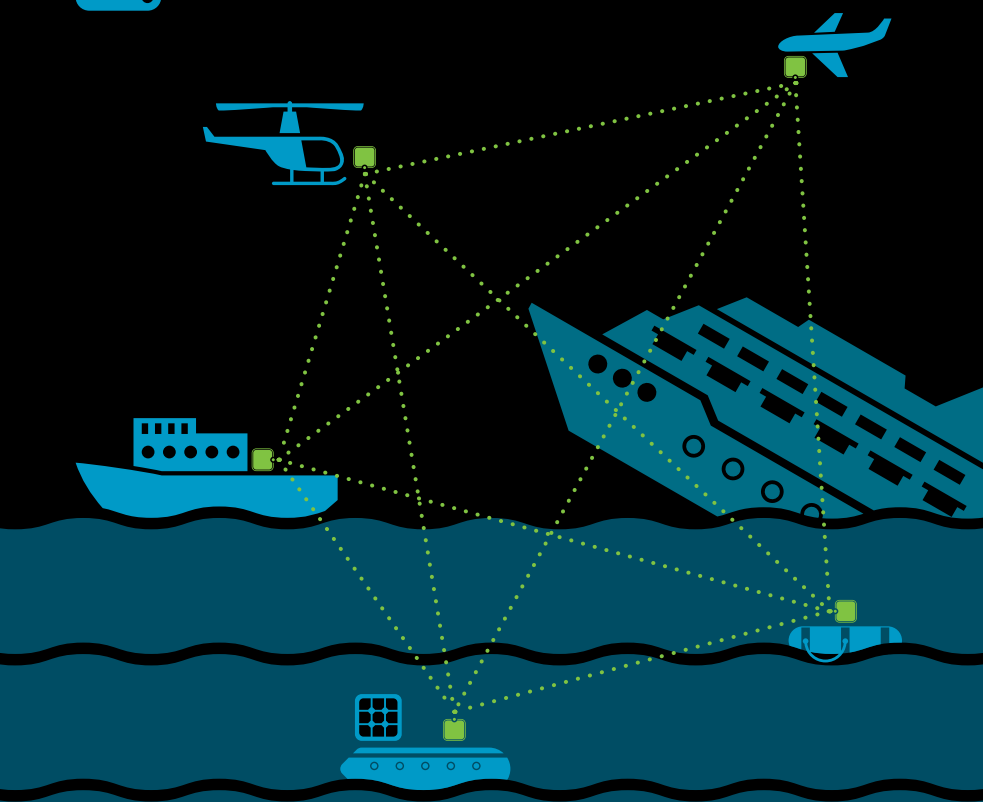
T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# JANUS-SR

MULTI-TECHNOLOGY  
MESH ACCESS POINT  
FOR SEARCH-AND-RESCUE  
OPERATIONS



# JANUS - SR

## MULTI-TECHNOLOGY MESH ACCESS POINT FOR SAR OPERATIONS

Network equipment capable of automatically interconnecting with other boxes to form a single broadband mesh network covering a large area for Search-and-Rescue (SAR). JANUS automatically discovers and reconfigures the network topology, providing broadband Wi-Fi connectivity to legacy terminals for local Command and Control. Each terminal, mobile or not, can communicate with any other terminal as if they all belonged to the same LAN, even if they are kilometres apart. Connections to the Internet can also be established if at least one JANUS box has Internet access, through Wi-Fi, 3G, WiMAX or other technology. Integration of drones is supported using the 802.11p wireless technology.

### FUNCTIONALITIES

- Broadband wireless coverage - JANUS in boats or buoys
- Data exchange among equipment of different technologies
- VoIP, video, and convey alarm information from sensors
- Self configured network
- Support for prioritised traffic and QoS
- Remote management
- Integration of drones - using the 802.11p wireless technology
- JANUS GPS location - estimated position of network clients

### MAIN FEATURES

- Support for multi-hop and mobile mesh network mode (Wi-Fi)
- Scales to large mesh networks (up to 7000 JANUS boxes)
- Multiple link layer technologies: Wi-Fi, WiMAX, ZigBee, etc.
- Stable Wi-Fi connection regardless of the Internet link used
- Unnecessary network planning: dynamic auto-configuration
- Fast deployment of broadband telecommunications networks

### TECHNICAL SPECIFICATIONS

- Dimensions: 26cm length, 23cm width, 8.8 cm height
- Power: DC jack or passive POE, 7-20 V, 5-6 W
- Supports renewable energy sources (e.g., solar panels)
- Internal Batteries: 12 V, 7.2 Ah // Autonomy: ~10 hours
- WRAP-BOX is rated NEMA-67 / IP67

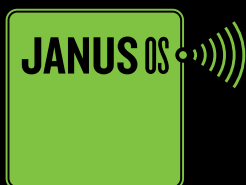


**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

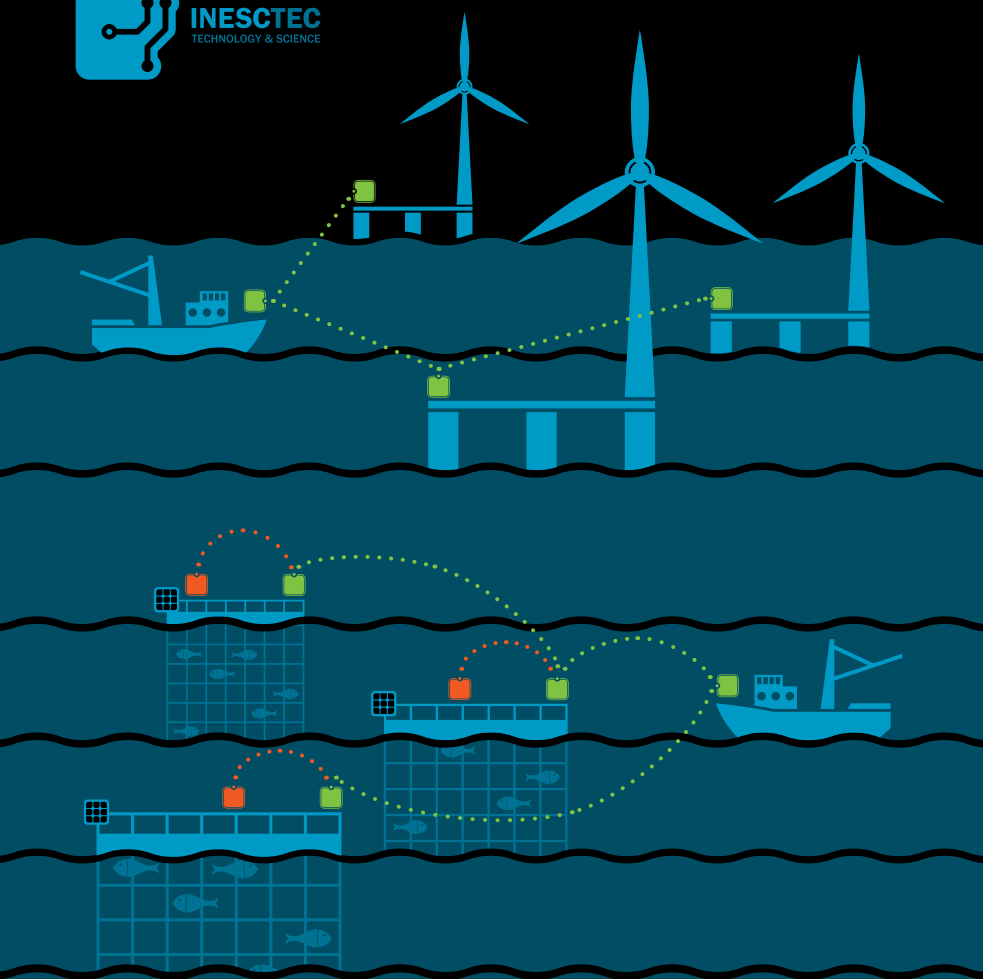
T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# JANUS - OS

MULTI-TECHNOLOGY  
MESH ACCESS POINT  
FOR OFFSHORE FACILITIES



# JANUS - OS

## MULTI-TECHNOLOGY MESH ACCESS POINT FOR OFFSHORE FACILITIES

---

Network equipment capable of automatically interconnecting with other boxes to form a single large area mesh network. At the same time, it offers Wi-Fi connectivity to normal terminals. The terminals connected to a JANUS box may communicate with any other terminals, even if they are kilometres apart, as long as they are connected to this broadband network. Each JANUS box provides a set of interfaces to support the integration of different devices and technologies (e.g., GPS, sensors, BT, ZigBee, etc.) and it is capable of providing QoS.

### FUNCTIONALITIES

Broadband network connecting off-shore infrastructures and mobile terminals (e.g., user terminals on boats)

Self configured network

Video, VoIP and data exchange among different equipments

Prioritised traffic and QoS – namely events/alarms

Support for data storage

Remote management

JANUS GPS location – estimated position of network clients

### MAIN FEATURES

Support for multi-hop and mobile mesh network mode (Wi-Fi)

Scales to large mesh networks (up to 7000 JANUS boxes)

Multiple link layer technologies: Wi-Fi, WiMAX, ZigBee, etc.

Nodes/Clients connect to a normal Wi-Fi connection

Unnecessary network planning: dynamic auto-configuration

### TECHNICAL SPECIFICATIONS

Dimensions: 26cm length, 23cm width, 8.8 cm height

Power: DC jack or passive POE, 7-20 V, 5-6 W

Supports renewable energy sources (e.g., solar panels)

Internal Batteries: 12 V, 7.2 Ah

Autonomy: ~10 hours

WRAP-BOX is rated NEMA-67 / IP67



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



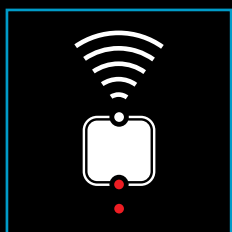
QUADRO  
DE REFERÊNCIA  
ESTRATÉGICO  
NACIONAL  
PORTUGAL 2007-2013



UNIAO EUROPEIA  
Fundo Europeu  
de Desenvolvimento Regional



Fundação para a Ciência e a Tecnologia  
Ministério da Educação e Ciência

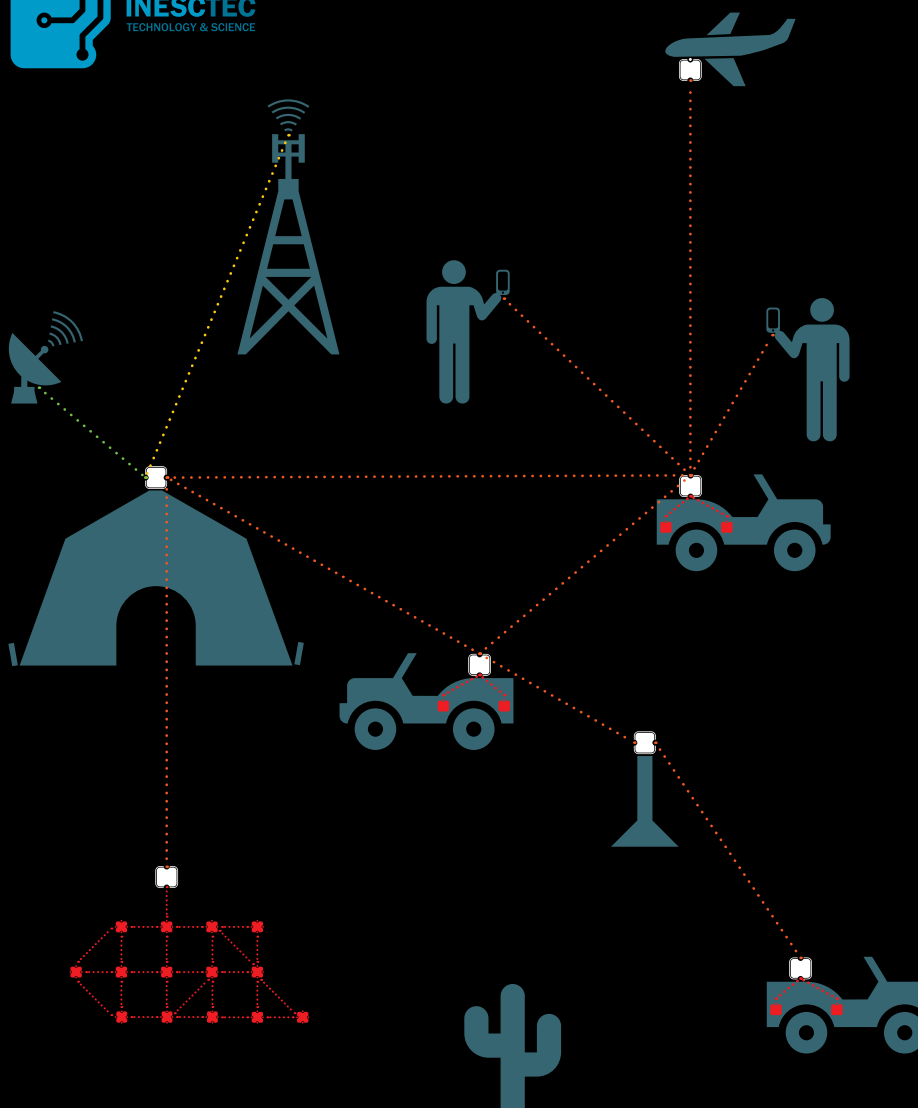


# COTTOS-D

MULTI-TECHNOLOGY EQUIPMENT  
FOR SECURE BROADBAND SELF-  
CONFIGURED MESH NETWORK



**INESCTEC**  
TECHNOLOGY & SCIENCE



# COTTOS-D

## MULTI-TECHNOLOGY EQUIPMENT FOR SECURE BROADBAND SELF-CONFIGURED MESH NETWORK

COTTOS-D is a versatile network equipment capable of automatically and dynamically interconnecting with other boxes to form a single, private and secure broadband mesh network covering a large area and supporting legacy terminals (Command and Control operations). Connections to outside the private network can also be established if at least one box acts as a Gateway, using Satellite, 3G/4G or other technology. Integration of Sensors and Wireless Sensor Networks is possible. Drones may be supported by IEEE 802.11p.

### FUNCTIONALITIES

- Broadband wireless coverage in ad-hoc scenarios
- Support for data exchange using different communications technologies
- Secure, mobile and private communications
- Support for VoIP, video and alarm information from sensors
- Support for data storage
- Self-configured network
- Support for prioritised traffic and QoS
- Remote management
- Prepared for integration with renewable energy sources
- Integration of drones supported by IEEE 802.11p
- Data exchange among fast moving nodes using IEEE 802.11p
- GPS positioning and estimation of the location of other terminals

### MAIN FEATURES

- Works in a multi-hop mesh network mode
- Scales to large mesh networks (up to 7000 boxes)
- Supports multiple link layer technologies, such as Wi-Fi, WiMax, Ethernet, ZigBee
- Discovers and reconfigures the topology dynamically
- Supports moving boxes and terminals
- Works without a telecommunications infrastructure (such as in desert scenarios)

### TECHNICAL SPECIFICATIONS

500 MHz AMD Geode, 256 MB RAM // Dimensions: 26cm length, 23cm width, 8.8cm height // Power: DC jack or passive POE, 7-20 V, 5-6 W // Supports renewable energy sources (solar panels, for instance) // Internal Batteries: 12 // V, 7.2 Ah // Estimated autonomy: 10 hours // WRAP-BOX is rated NEMA-67 / IP67



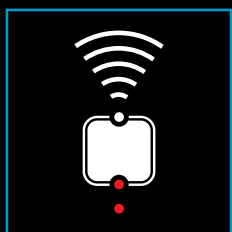
**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)

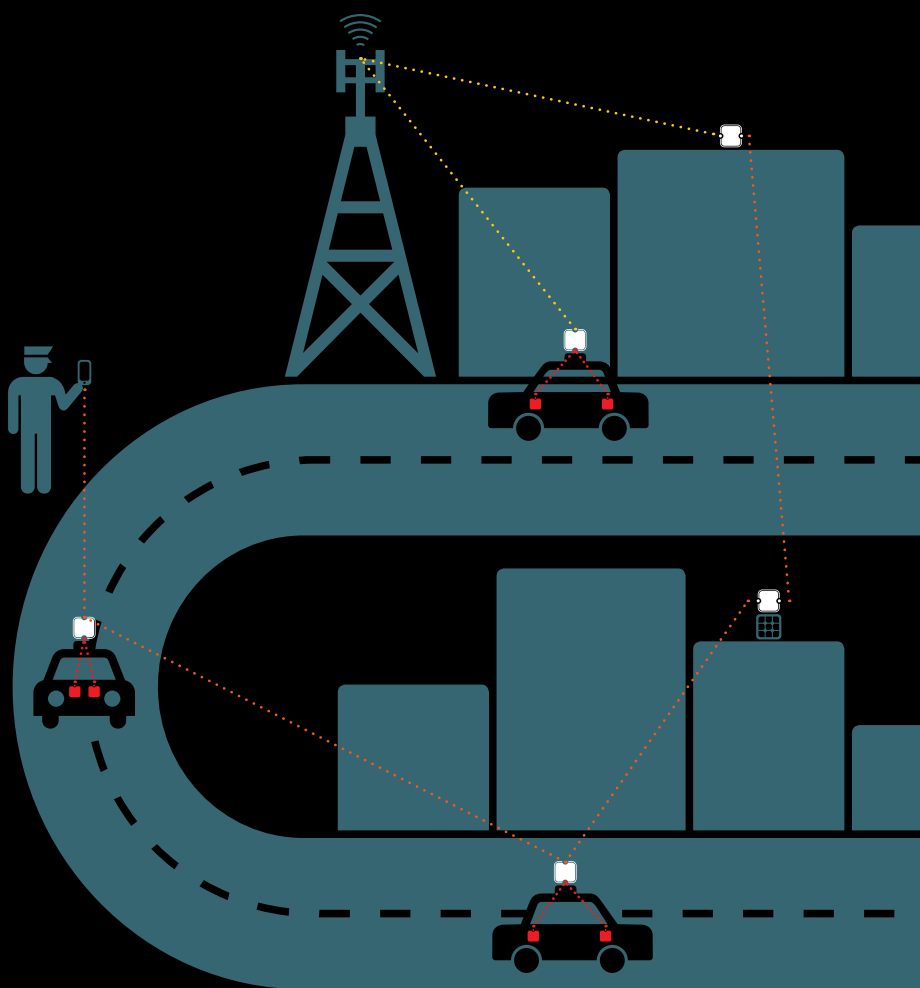






# COTTOS-C

MULTI-TECHNOLOGY NETWORK  
EQUIPMENT FOR SECURE, MOBILE  
AND PRIVATE COMMUNICATIONS



# COTTOS-C

## MULTI-TECHNOLOGY NETWORK EQUIPMENT FOR SECURE, MOBILE AND PRIVATE COMMUNICATIONS

---

COTTOS-C is a versatile network equipment capable of offering broadband wireless coverage, acting as a Gateway to an external network / Internet via multiple heterogeneous links, such as 3G/4G, WiMax and Wi-Fi connections. The box dynamically and transparently selects the best connection to the external network. COTTOS-C provides private and secure network connectivity for nodes belonging to the same entity (the police or the army, for example).

### FUNCTIONALITIES

- Broadband wireless coverage in infrastructured scenarios
- Support for data exchange using different communication technologies
- Secure, mobile and private communications
- Support for VoIP, video and alarm information from sensors
- Support for data storage
- Self-configured network
- Support for prioritised traffic and QoS
- Remote management
- Integration of drones supported by IEEE 802.11p
- Data exchange among fast moving nodes using IEEE 802.11p
- GPS positioning and estimation of the location of other terminals

### MAIN FEATURES

- Works in a multi-hop mesh network mode
- Scales to large networks (up to 7000 boxes)
- Supports multiple link layer technologies, such as Wi-Fi, WiMax, Ethernet, ZigBee
- Nodes/Clients benefit from a stable Wi-Fi connection, regardless of the chosen mesh connection link
- Discovers and reconfigures the topology dynamically
- Supports moving boxes and terminals (for instance, in cars)

### TECHNICAL SPECIFICATIONS

- 500 MHz AMD Geode, 256 MB RAM
- Dimensions: 26cm length, 23cm width, 8.8cm height
- Power: DC jack or passive POE, 7-20 V, 5-6 W
- Supports renewable energy sources (for instance, solar panels)
- Internal Batteries: 12 V, 7.2 Ah; Estimated autonomy: 10 hours



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



QUADRO  
DE REFERÊNCIA  
ESTRATÉGICO  
NACIONAL  
PORTUGAL 2007-2013



Fundo Europeu  
de Desenvolvimento Regional



Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

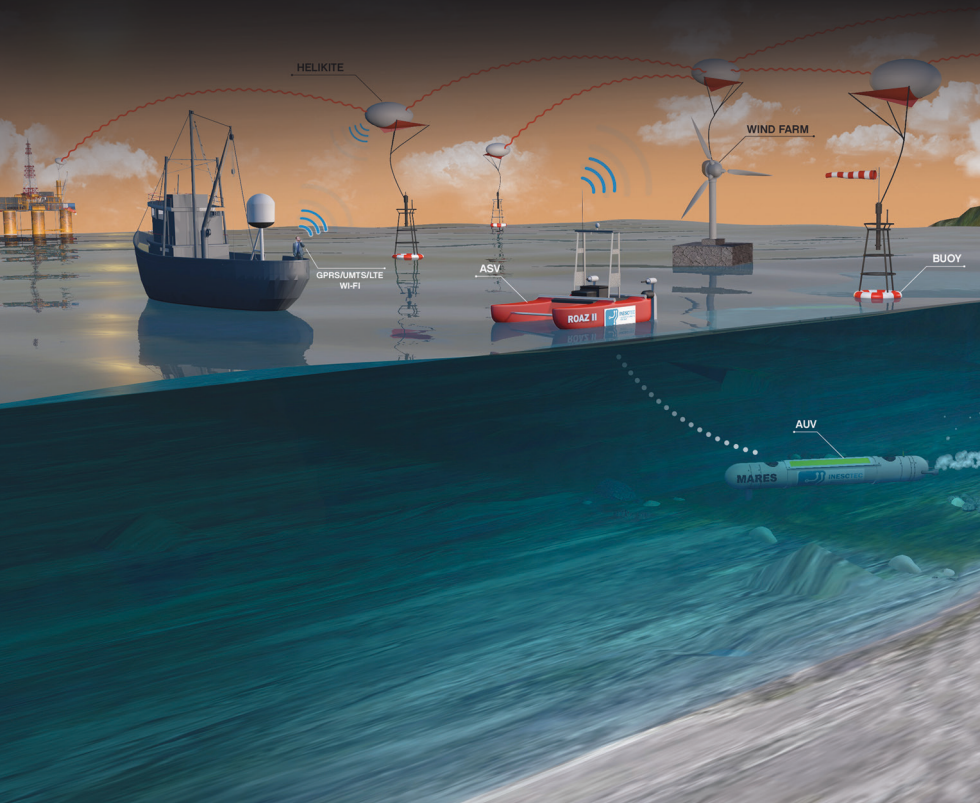


# BLUECOM+

BROADBAND  
COST-EFFECTIVE  
INTERNET ACCESS  
AT REMOTE  
OCEAN AREAS



**INESCTEC**  
TECHNOLOGY & SCIENCE



# BLUECOM+

## AN INNOVATIVE COMMUNICATIONS SOLUTION FOR INTERNET ACCESS AT REMOTE OCEAN AREAS

---

### MOTIVATION

There is no communications solution enabling broadband, cost-effective Internet access at remote ocean areas in alternative to satellite communications.

### GOAL

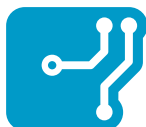
The goal is to develop an innovative communications solution that will enable broadband, affordable Internet access at remote ocean areas for regular devices using standard wireless access technologies, such as Wi-Fi and 4G. The project includes the specification, implementation and laboratory testing of the communication solution, to ultimately create a prototype that will enable broadband Internet access in remote ocean areas, beyond 100km from shore, in alternative to satellite communications.

### TARGET GROUPS

THE TARGET GROUPS INCLUDE: MARITIME TRANSPORTATION; FISHERIES, AQUACULTURE AND FISHING INDUSTRY; SCIENTISTS AND RESEARCHERS; COASTAL AND MARINE WATER MANAGEMENT SYSTEM; MARINE BIOTECHNOLOGY, MARINE MINERAL AND ENERGY RESOURCES.

### FUNDING

THIS PROJECT IS FUNDED BY NORWAY, ICELAND AND LIECHTENSTEIN THROUGH EEA GRANTS



**INESCTEC**  
TECHNOLOGY & SCIENCE  
| ASSOCIATE LABORATORY  
PORTUGAL

**INESCTEC**  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



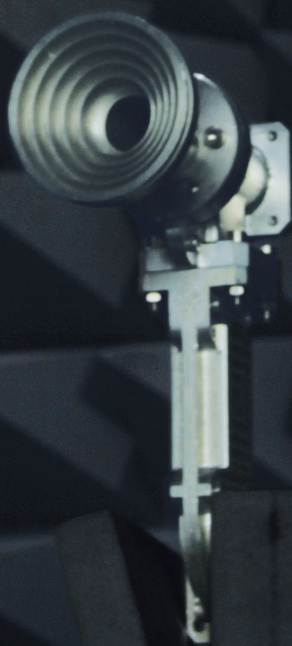
T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt





## **VSAT**

VERY SMALL APERTURE  
TERMINAL FOR SATELLITE  
COMMUNICATIONS





# VSAT

## VERY SMALL APERTURE TERMINAL FOR SATELLITE COMMUNICATIONS

A Very Small Aperture Terminal (VSAT) is a two-way satellite dish antenna, typically around 1 metre in diameter. VSAT can be used in both terrestrial ground stations and stabilised maritime antennas, providing data rates up to 4 Mbit/s from satellites in geosynchronous orbit.

This technology allows for simultaneous voice and data communication, including Internet connectivity. Therefore, this is a more practical alternative to terrestrial connectivity, especially when terrestrial networks are not available or reliable such as in remote areas.

INESC TEC specialises in designing and characterising waveguide devices for satellite applications, particularly for VSAT communications. The developed VSAT microwave configuration includes a feed, which illuminates the antenna dish, an orthomode transducer (OMT), necessary to isolate the transmitted and received signals, and a Transmit/Receive (TR) filter, which provides further isolation between the signals.

### MAIN FEATURES

Ku band

Simple and affordable fabrication

Lightweight

### SPECIFICATIONS

Receive Frequency: 10.7-12.75 GHz

Receive Return Loss: <-25 dB

Transmit Frequency: 13.75-14.5 GHz

Transmit Return Loss: <-26 dB

Transmit/Receive Isolation: >50 dB

Dimensions: 62mm x 172mm x 120mm

Feed radiation pattern: 40° (FWHM)

Total Weight: 400 g



CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



# **OPTOFLUIDIC DEVICES FOR MICROANALYSIS**

HYBRID MICROFLUIDIC CHIP  
FOR SINGLE CELL DIAGNOSIS



**INESCTEC**  
TECHNOLOGY & SCIENCE

# OPTOFLUIDIC DEVICES FOR MICROANALYSIS

## HYBRID MICROFLUIDIC CHIP FOR SINGLE CELL DIAGNOSIS

Miniaturisation and portability, increased automation, minimum reagent consumption, high throughput and reduced manufacturing costs are some of the strong motivations to develop microfluidic sensing platforms.

In this project, partners with complementary expertise (INESCTEC – Optoelectronics, CENIMAT – Material Science, ITQB – Biomolecular diagnosis) joined to develop a new optofluidic chip capable of performing optical and electrical characterisation of biological fluids and single cells.

The technology currently being developed makes it possible to perform multiple simultaneous measurements with extremely reduced sample volumes. As a result, this project guarantees an improved analytical diagnostic tool. In this particular project, the goal is to analyse red blood cells (RBC) simultaneously using impedance spectroscopy and refractive index measurements. The aim is to provide a way to differentiate infected and healthy cells more accurately. Nevertheless, the technology is versatile and will allow a diversity of analytical applications.

### POTENTIAL APPLICATIONS

- **Security and defence:** high sensitivity detection of multiple chemical and biological threats using minimal sample amounts.
- **Biomolecular diagnosis:** single cell manipulation and diagnosis (infectious states, cancer).
- **Point of care analysis:** fast and sensitive multiparameter analysis of biological fluids (blood, urine).
- **Quality control:** spectroscopic and refractive index analysis of dye solutions and other fluids (chemical industry, food industry).

### PARTNERS

**ITQB-UNL/IBET** BIOMOLECULAR DIAGNOSTIC LABORATORY (PT)

**CENIMAT** DEPARTAMENTO DE CIÊNCIA DOS MATERIAIS (PT)

**INESC TEC** INESC TECHNOLOGY AND SCIENCE (PT)

Financed by National Funds through the FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) as part of project «HYBRID - PTDC /SAU -BEB /102247/2008»

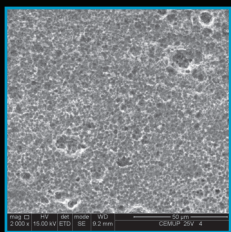


CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www.inescporto.pt](http://www.inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





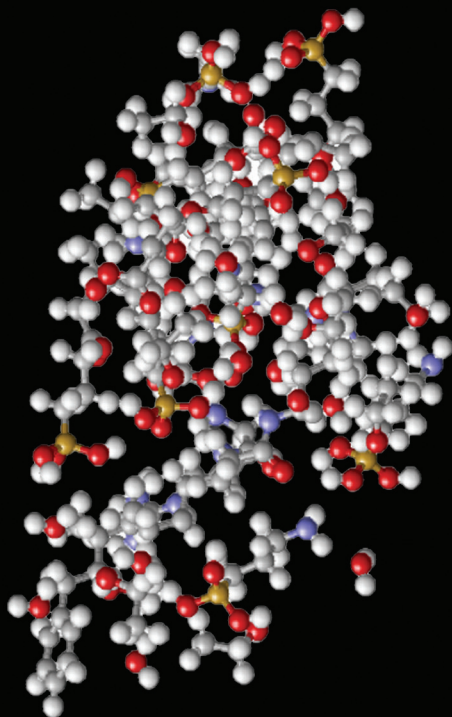


# SNIFFER

# NETWORK OF CHEMICAL AND PHYSICAL SENSORS FOR FOOD SUPPLY CHAIN SECURITY



**INESCTEC**  
TECHNOLOGY & SCIENCE



# SNIFFER

## NETWORK OF CHEMICAL AND PHYSICAL SENSORS FOR FOOD SUPPLY CHAIN SECURITY

---

The aim with project SNIFFER is to design and develop a network of distributed devices capable of rapidly detecting on-site multiple kinds of agents and CBR agents which are highly sensitive and specific throughout the most vulnerable stages of the food supply chain (such as farms, large collection centres, wholesalers).

INESC Porto will be responsible for developing sensors based on chemical or physical interactions. These sensors can be used to develop Molecular Imprinted Polymers (MIPs), which are highly selective materials, as well as on Resistive Pulse Experiments using functionalised and non-functionalised nanostructures. Electrical and optical sensors will be developed, extending the applicability of the sensors from single point low-cost sensors to wide area sensor networks.

SNIFFER IS AN FP7 APPROVED PROJECT

IN WHICH THE FOLLOWING INSTITUTIONS PARTICIPATE

**TEKEVER ASDS** PT

**Centro de Investigação da Academia Militar**

/ **Laboratório de Bromatologia e de Defesa Biológica** PT

**Umeå Universitet** SE

**Instituto de Engenharia de Sistemas e Computadores do Porto** PT

**Universidad de Burgos** ES

**Österreichischen Agentur für Gesundheit und Ernährungssicherheit GmbH** AT

**Centre Suisse d'Electronique et de Microtechnique** CH

**Forsvarets forskningsinstitut** NO

FP7-SE C-2012-1: Grant agreement 312411



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



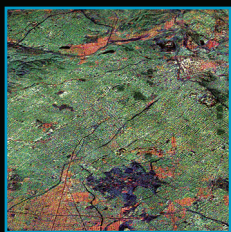
QUADRO  
DE REFERÊNCIA  
ESTRATÉGICO  
NACIONAL  
PORTUGAL 2007-2013



UNIAO EUROPEIA  
Fundo Europeu  
de Desenvolvimento Regional



Fundação para a Ciência e a Tecnologia  
Membro da ERCC e da CSRS



# SEE THE UNSEEN

## COMPRESSIVE SENSING BASED CAMERAS



**INESCTEC**  
TECHNOLOGY & SCIENCE



# SEE THE UNSEEN

## COMPRESSIVE SENSING BASED CAMERAS

Compressive sensing is an exciting and novel area of research and development that combines concepts from diverse fields, such as mathematics, signal processing, electronics, or optimization.

A camera with a single pixel is perhaps the most representative example of the breakthroughs provided by such technology. For certain scenarios, these cameras may constitute the most attractive solution or even the only available solution.

INESC TEC has recently developed a prototype of a hyperspectral single-pixel camera with a 10 pm spectral resolution, which represents an improvement of two orders of magnitude relatively to the best systems available on the market.

### APPLICATIONS

- **Security and defence:** detection of chemical species related with chemical and biological attacks, ability to see through foliage, night vision (InfraRed), Ultra-Violet imaging, Millimeter-Wave imaging, TeraHertz imaging.
- **Quality control:** spectroscopic imaging (detecting contaminations, lesions, defects in agro-food industries), determining the ripeness state and quality of fruits and vegetables.
- **LIDAR imaging:** aerial 3D imaging, unmanned navigation of vehicles.
- **Data encryption/security:** as the measurements depend on a random process, data will resemble noise for a receiver that does not know the originating seed.
- **Pharmaceutics:** detecting and quantifying compounds to uncover counterfeit medication, for example.
- **Remote sensing**
  - **Macro level:** classification of territorial areas (e.g. water, forest, sand);
  - **Local level:** mineralogical classification of the terrain (quarry, mining and oil industries).

### PARTNERS

**ESA** EUROPEAN SPACE AGENCY

**UM** UNIVERSITY OF MINHO (PT)

**UNCC** UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE (USA)

By now, we believe you are comfortable to say that INESC TEC can be your perfect partner when it comes to developing high-tech imaging systems.



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www.inescporto.pt](http://www.inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# AQUAMONITOR

SENSORS FOR WATER QUALITY  
MONITORING IN INTENSIVE  
AQUACULTURE



**INESCTEC**  
TECHNOLOGY & SCIENCE

CO<sub>2</sub>  
O<sub>2</sub>  
pH

# AQUAMONITOR

## SENSORS FOR WATER QUALITY MONITORING IN INTENSIVE AQUACULTURE

---

INESC TEC is leading a consortium – which includes CIMAR – Centro Interdisciplinar de Investigação Marinha e Ambiental –, the CIQ FCUP – Centro de Investigação em Química at the University of Porto, and the University of Pécs in Hungary – created to develop new sensors for real time water quality monitoring in hyper intensive aquaculture systems. In systems of stackable shallow raceway tanks with water recirculation there are more fish present in less water. Therefore, it is necessary to accurately and constantly monitor parameters, including dissolved CO<sub>2</sub> and O<sub>2</sub>, pH, nitrates and phosphates.

Currently used tools do not respond to the industry's needs. However, these types of tools are critical to reducing the investment risk and to increasing fish production and welfare. In order to make these tools capable of responding to these needs, they should be equipped with more effective optical sensors. New optical sensors are being developed by the consortium for this purpose.

In this project, optical fibre interferometric platforms are being combined with sensitive polymeric membranes to enable the detection of different analyte concentrations with the same instruments. The target analyte in the project is dissolved CO<sub>2</sub> but the technology will evolve towards the detection of multiple parameters to determine water quality.

Developed in 2 years (2011-2012)

### MAIN FEATURES

- Electromagnetic immunity
- Based on standard telecom optoelectronics
- Miniaturisation and versatility
- Multipoint multiparameter detection
- High sensitivity
- Real time remote operation
- Adaptable for different applications

FCT-PTDC/AAC-AMB/112424/2009; FCOMP-01-0124-FEDER-013911

---



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# PROTEU

ADVANCED OPTICAL SENSOR  
FOR MONITORING ESTUARINE  
AND COASTAL ENVIRONMENTS



**INESCTEC**  
TECHNOLOGY & SCIENCE



# PROTEU

## ADVANCED OPTICAL SENSOR FOR MONITORING ESTUARINE AND COASTAL ENVIRONMENTS

---

INESC Porto has developed technology to monitor temperature and salinity in coastal environments using an innovative fully integrated monitoring infrastructure based on optical fibre. As part of the research project PROTEU, an 11 km optical fibre cable, with Bragg sensors placed every 500 meters, was installed that runs from the mouth of the Ria de Aveiro and follows the Espinheiro channel bed to the Vouga river. This made it possible to measure the water temperature at each sensor location in real-time. The results of this project are currently being used in several studies concerning the Ria de Aveiro and the surrounding area and are crucial for continuous environmental assessment and management.

This technology is now being explored further and will be able to measure salinity and other chemical and biological parameters (dissolved CO<sub>2</sub>, cyanobacteria) making it an advanced analytical tool for the monitoring and study of marine conditions in estuarine environments.

Developed in 2004

### MAIN FEATURES

Electromagnetic immunity

Based on standard telecom optoelectronics

Multipoint detection

High sensitivity

Real-time remote operation

Quasi distributed sensing

Adaptable for the detection of other environmental parameters

### SPECIFICATIONS

11 km Optical fibre cable (TONGERE from CABELTE S.A.) with three SMF 28® optical fibres with 19 Fibre Bragg grating temperature sensors distributed every 500 m. Cable anchored to the river bed with concrete structures placed every 500 m in the vicinity of the sensors.



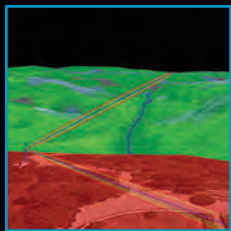
**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)





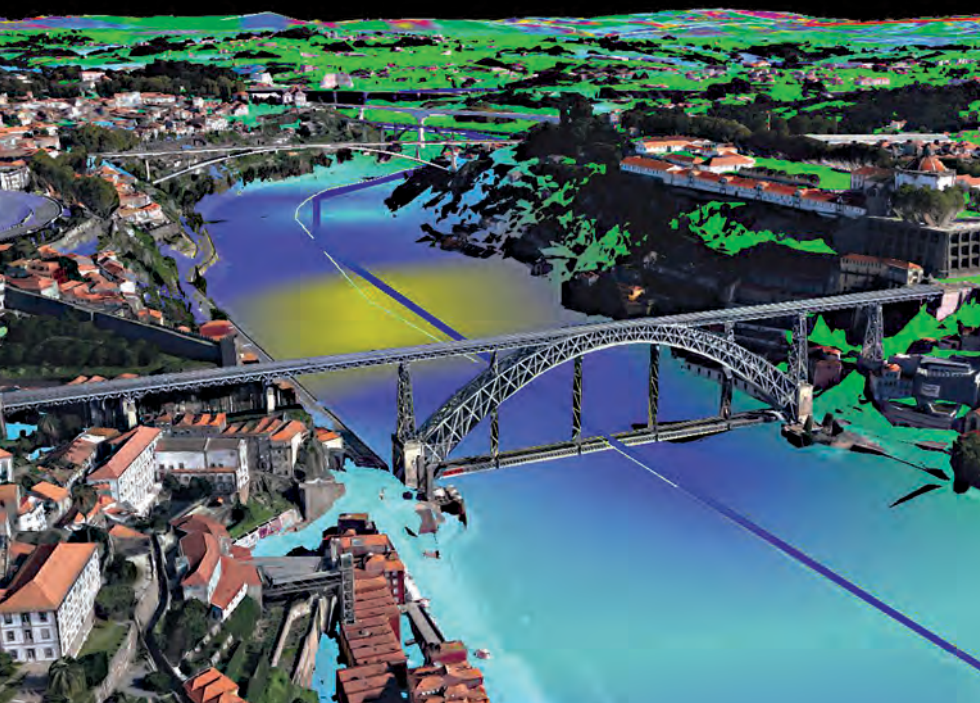


# **DRIW2020**

## DOURO RIVER INLAND WATERWAY



**INESCTEC**  
TECHNOLOGY & SCIENCE



# DRIW2020

## DOURO RIVER INLAND WATERWAY

---

### AIM

This project aims to upgrade Douro's waterway navigability, assuring an effective cross border link with the "Atlantic Core Network Corridor", through the implementation of River Information Services (RIS), according to Directive 2005/44/EC, such as fairway information, traffic information, traffic management, calamity abatement support, information for transport logistics, law enforcement information, statistics and waterway charges and harbor dues.

The resulting RIS are integrated and supported by APDL's information systems architecture, composed by applications such as JUP (Port Single Window), LSW (Logistics Single Window), 3PORT (GIS) and SAP (Corporate ERP).

### INESC TEC MAIN CONTRIBUTION

INESC TEC was contracted by APDL to act as prime contractor, technically coordinating a team of experts who studied RIS implementation, addressing issues like: marine VHF coverage, Automatic Identification System (AIS) provisioning, Differential Global Positioning System (DGPS) signal availability, wide area network data communications, Closed Circuit TV (CCTV), Aids to Navigation (AtoN), meteorology and hydrology sensors, Control Centers design and operation, remote site design, remote site location planning, systems integration, IT security and risk analysis and, finally, evaluation of waterway telecommunications coverage (digital terrestrial TV, mobile networks and emergency network).

Several results were obtained: preliminary studies addressing RIS in Douro's Inland Waterway, two funding submissions addressing its implementation (which were approved), technical specifications for procurement and for required permits and licenses.

**START DATE** SEPTEMBER 2014

**END DATE** SEPTEMBER 2015

### CLIENT

APDL - Administração dos Portos do Douro, Leixões e Viana do Castelo, S.A.

### PARTNERS

DUFINAV, SIGNALRAD, Eng. Gil Coutinho, PBS, SEGURTI, WAVECOM e DOURO AZUL.

### FUNDING

This project was co-funded by the European Union/ CEF - Connecting Europe Facility Programme.



**INESCTEC**  
TECHNOLOGY & SCIENCE  
| ASSOCIATE LABORATORY  
| PORTUGAL

**INESC TEC**  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



# WIDERMOS

WIDE INTEROPERABILITY  
AND NEW GOVERNANCE  
MODELS FOR FREIGHT  
EXCHANGE LINKING REGIONS  
THROUGH MULTIMODAL  
MARITIME BASED CORRIDORS



**INESCTEC**  
TECHNOLOGY & SCIENCE



# WIDERMOS

## WIDE INTEROPERABILITY AND NEW GOVERNANCE MODELS FOR FREIGHT EXCHANGE LINKING REGIONS THROUGH MULTIMODAL MARITIME BASED CORRIDORS

### AIM

The project aims at facilitating the homogeneous connection between Motorways of the Sea and the TEN-T core network corridors throughout several activities highlighting an IT Corridor Management Platform acting as a Logistic Single Window (LSW). The LSW acts as a network of interoperating platforms, for the integration of sea - based transport services in the logistic chain, considering all types of freight operations, in order to allow a seamless shipment management and communication between all the actors of the supply chain.

### INESC TEC MAIN CONTRIBUTION

INESC TEC was responsible for defining the conceptual model, as well as for identifying business scenarios and requirements. Moreover, INESC TEC developed the reference implementation of the interoperable platform for the Logistic Single Window.

**START DATE** DECEMBER 2014

**END DATE** DECEMBER 2015

### PARTNERS

LA SPEZIA PORT AUTHORITY // LA SPEZIA CONTAINER TERMINAL // INTERPORTADOVA CIRCLE // AGENZIA DELLE DOGANE // UNIVERSITÀ DEGLI STUDI DI GENOVA // REGIONE LIGURIA CIMNE // ISTITUTO TECNOLOGICO DE ARAGÓN // CORPORACIÓN MARÍTIMA // A.S.T.A. LOGISTIK PORT OF KIEL // PORT OF ROSTOK // KOMBIVERKEHR // APDL // SOGEMAR

### FUNDING

THE PROJECT WAS CO-FINANCED BY THE EUROPEAN UNION//TRANS-EUROPEAN



**INESCTEC**  
TECHNOLOGY & SCIENCE  
| ASSOCIATE LABORATORY  
| PORTUGAL

**INESC TEC**  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)



# 3PORT

GEOREFERENCED  
MANAGEMENT SYSTEM  
FOR PORT BUSINESS  
PROCESSES SOFTWARE  
LABORATORY



**INESCTEC**  
TECHNOLOGY & SCIENCE



# 3PORT

---

The goal with this project was to develop a state of the art tool for the technical services of Port Authorities that would help them manage and support Port Authority business processes in four major areas: Asset management, Monitoring and maintenance of maritime and land based infrastructures, Navigation safety procedures and Environmental regulation compliance.

**GOALS** The idea was to create a system that was fully aligned with the business process of the Port Authority so that the system adapts to the processes and not the other way around, a common problem in other solutions. The system was also developed to be an interoperability enabler, providing easy access to information in a georeferenced, integrated and consolidated way, interconnecting strategic areas.

**THE MODULES** The 3Port is based on eight modules, seven of which are used by the Port – Hydrography (dredging and navigable areas), Port traffic, Domain Management (licenses and concessions), Studies and Construction Work, Security, Environment, Assets Management –, and Live Map used by the general public.

**LEADING PARTNER** The leading partner was TRIEDE TTI, a company with more than 10 years of experience in the development of Environmental Management and Port Systems. TRIEDE TTI promoted the project and is now commercialising the solution focusing on the Community of Portuguese-Speaking Countries (CPLP) and Latin America.

**INESCTEC MAIN CONTRIBUTION** INESC TEC was the innovation partner and the booster of the technology transfer triangle. This technology transfer triangle was composed of INESC TEC (producer of the innovation), TRIEDE TTI (producer of the solution, integrating the innovation) and APDL (user of the solution and the one identifying the requirements).

Services provided by INESC TEC were crucial to ensure the integration of state of the art technologies and their alignment with Port Authority business processes. The final result was an innovative solution that will increase TRIEDE TTI's market competitiveness and already made Leixões and Viana do Castelo Ports some of the most innovative worldwide in terms of R&D.



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

INESC TEC  
R DR ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



PROGRAMA OPERACIONAL FACTORES DE COMPETITIVIDADE



QUADRO  
DE REFERÊNCIA  
ESTRATÉGICO  
NACIONAL  
PORTUGAL 2007-2013



UNIÃO EUROPEIA  
Fundo Europeu  
de Desenvolvimento Regional

FUNDING

APDL



# SCOPe

## ELECTRONIC PORT COMMUNITY SYSTEM



**INESCTEC**  
TECHNOLOGY & SCIENCE

ACSU 200329  
22G1

8

MAX.GR.  
TARE  
NET

30.480 KGS  
67.200 LBS  
2.185 KGS  
4.820 LBS  
28.295 KGS  
62.380 LBS

37

CU.CAP

33.2 CU.M.  
1.173 CU.FT

# SCOPE

## ELECTRONIC PORT COMMUNITY SYSTEM

---

### AIM

The project aim was to design and implement an integrated organisational model to manage the processes related to electronic data transfer regarding cargo passing through the Leixões Seaport for the two main business documents: Bill of Lading & Cargo Manifest.

### ACTORS

Globally, all Port Community Actors (Port Authority, Customs Administration, Forwarders, Shipping Agents, Customs Agents, Shipping Lines, Original Shippers, Consignors & Consignees and also Software Houses) were involved in this project.

### GOALS

The main goal was the conceptual development and validation of a system which needed to be open, critical, inter-operative with heterogeneous environments, flexible, scalable and compatible with UN /CEFACT standards.

The system was also developed to solve the limitations detected in existing solutions, namely intrinsic quality certification, intelligent process monitoring, actor performance measurement and added-value services, such as compensation and certification. This was the innovative domain of this project, with its focus on process innovation (associated to Bill of Lading and Cargo Manifest), enabling product innovation (through associated supporting software applications) and promoting sector modernisation.

**START DATE** OCTOBER 2002 **END DATE** JULY 2005 **BUDGET** ~3 M€

**PARTNERS** APDL // ALFÂNDEGA // INESC PORTO // AGEPOR (ASSOCIAÇÃO DOS AGENTES DE NAVEGAÇÃO) // APAT (ASSOCIAÇÃO DOS TRANSITÁRIOS DE PORTUGAL) // TCL // TCGL // BURMESTER // E A MOREIRA // EURONAVE // IBERO LINHAS // NAVEX // GARLAND // SOFRENA // PINTO BASTO // DAVID JOSÉ DE PINHO // PORTOCARGO // RANGEL // TREVOMAR // LAROZE // NASCIMAR // INTERMESUM // SOPORCEL // APIE // ATLANTA // MAEIL // FCR // IBS

**FUNDING** UNDER THE OPERATIONAL PROGRAMMES FOR SCIENCE, TECHNOLOGY AND INOVATION (POCTI) AND FOR THE SOCIETY OF INFORMATION (POSI) FINANCED BY THE ERDF AND BY NATIONAL FUNDS (MINISTRY OF SCIENCE AND TECHNOLOGY)



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)

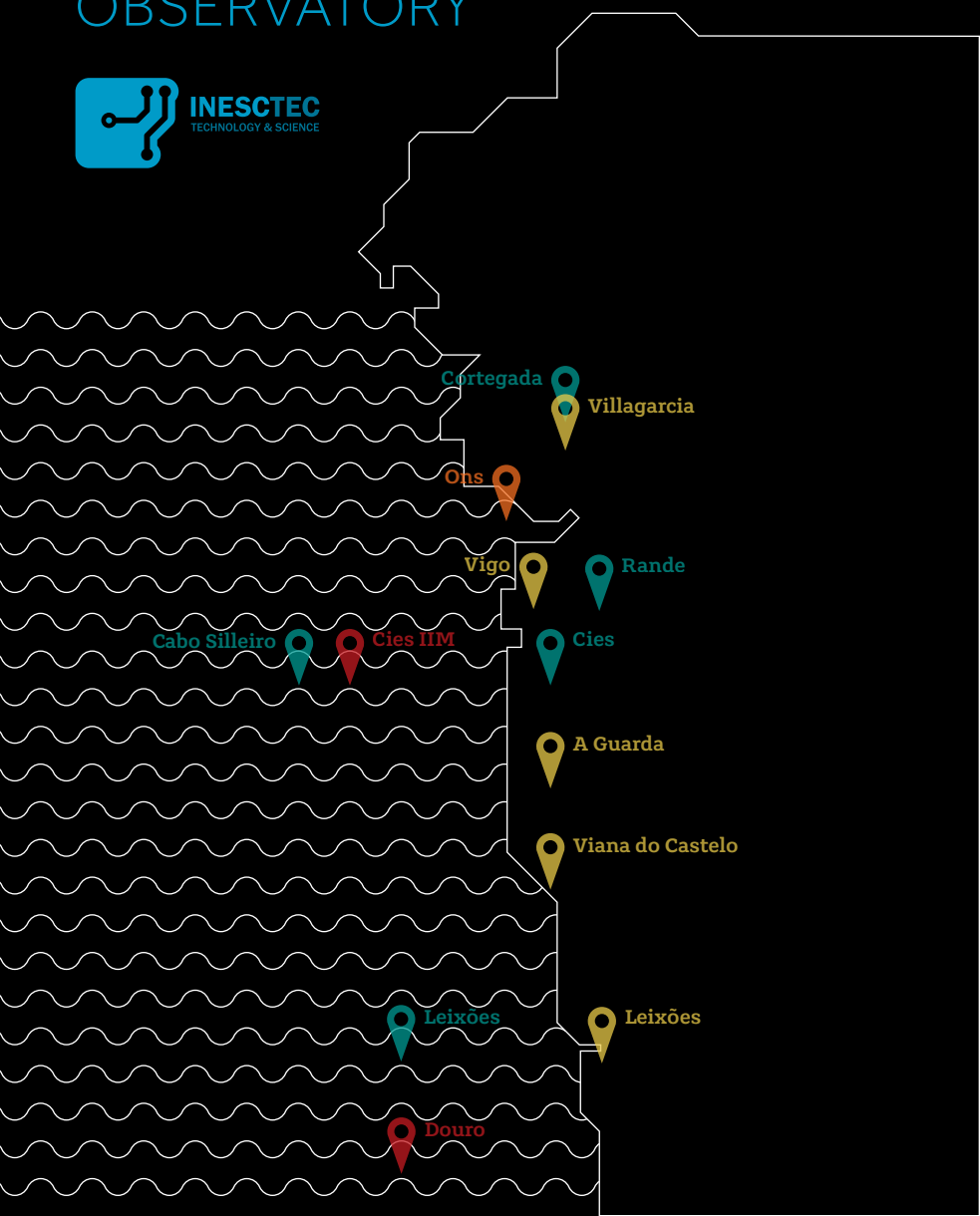






# RAIA

## IBERIAN COAST OCEANOGRAPHIC OBSERVATORY



# RAIA

## IBERIAN COAST OCEANOGRAPHIC OBSERVATORY

---

### AIM

Implementation of a cross-border oceanic observation network to consolidate operational oceanography in the Iberian coast and to create new scientific and technological opportunities that would foster the sea economy.

### INESC TEC MAIN CONTRIBUTION

Creation of a distributed data services infrastructure, enabling a sensor geographic network for planning and decision support. This data infrastructure uses international standards (ISO19100, OGC) and best practices, and complies with the INSPIRE EC Directive.

**START DATE** JANUARY 2009

**END DATE** DECEMBER 2011

**BUDGET** ~2.5 M€

### PARTNERS

METEOGALICIA // INTECMAR // IEO // CSIC-IIM

CETMAR // UNIV. VIGO // CIIMAR // INEGI

FEUP // IH // UNIV. AVEIRO // FCUP

### FUNDING

INTERREG IV-A

(NORTE DE PORTUGAL - GALICIA)



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)





# **BEACONING**

BREAKING EDUCATIONAL  
BARRIERS WITH  
CONTEXTUALISED,  
PERVASIVE AND  
GAMEFUL LEARNING



**INESCTEC**  
TECHNOLOGY & SCIENCE



# BEACONING

## OVERVIEW

BEACONING sets a forefront in multifaceted education technologies through large-scale piloting of a digital learning platform that blends physical and digital spaces. The BEACONING platform will be a ubiquitous solution that exploits advances in user experience design, mobile communication, location-based and context aware systems, procedural content generation, pedagogy-driven gamification, learning analytics, and cloud technology through innovative integration towards a blended learning space. The BEACONING demonstrator will facilitate, assess and author gamified learning activities, integrating existing educational tools and services of the participating organisations. Large-scale pilots will validate and inform the development of the BEACONING ecosystem that democratises learning across and among fully abled and those with mild to moderate physical and mental impairments (age 15 to 24), undergoing general and vocational training. BEACONING anticipates the benefits of making cross-subject matter more understandable, fostering the application of subject specialism to other domains.

## GOALS

1. To integrate technologies, pedagogical and social perspectives of using pervasive, context-aware, and gamified approaches.
2. To develop, implement, and validate the BEACONING platform.
3. To explore and measure the level of engagement, effectiveness, and impact that is enabled by BEACONING platform.

## TECHNOLOGY APPLICATION

The project will exploit pervasive, gamified, and context aware technologies to support "anytime anywhere" learning, extending the learning context and experience from the classroom settings to the outdoors and personal spaces. Partners are bringing in expertise and technologies, which will be integrated to provide an infrastructure for pervasive play-learn.

**START DATE** JANUARY 2016

**END DATE** DECEMBER 2018

## PARTNERS

Coventry University, United Kingdom (Coordinator); Herriot-Watt University, United Kingdom; BIBA Institute, Germany; INESC TEC, Portugal; UCM, Spain; ORT, France; SUCCUBUS, France; ATS, Romania; IMAGINARY, Italy; GEOMOTION, Spain; IFINITY, Poland; PLAYSOFT, France; SEBIT, Turkey; Hands-Free, United Kingdom; SIVECO, Romania.

## FUNDING

This project is co-funded by the Horizon 2020 Framework of the European Union BEACONING Grant Agreement 687676

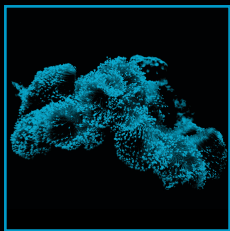


**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

**INESC TEC**  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt

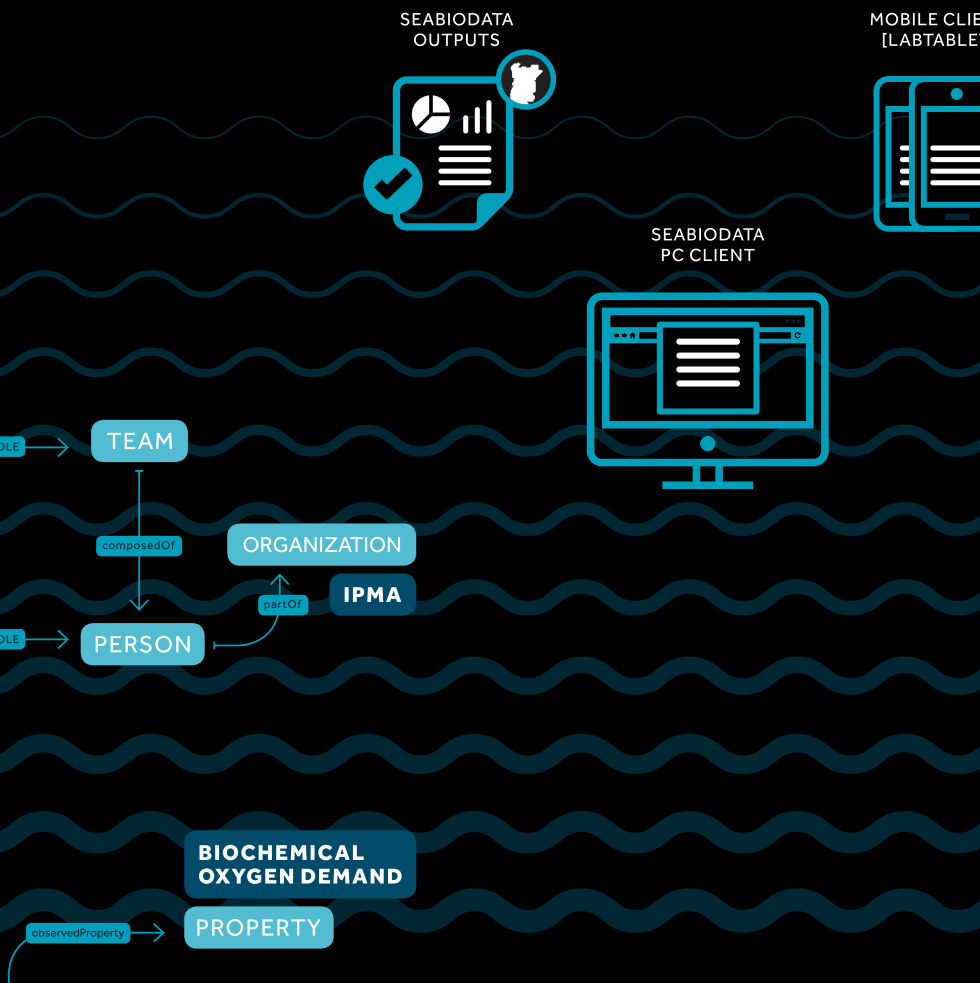


# SeaBioData

## PORTUGUESE SEAMOUNTS BIODIVERSITY DATA MANAGEMENT



**INESCTEC**  
TECHNOLOGY & SCIENCE



# SeaBioData

## PORTUGUESE SEAMOUNTS BIODIVERSITY DATA MANAGEMENT

---

### AIM

Development of an adequate technological framework for the effective and efficient monitoring of particular ecosystems such as seamounts, providing adequate and timely information to stakeholders. Thus contributing for the establishment of the Good Environmental Status (GES), the monitoring of resources and the promotion and preservation of Portuguese marine environment and their biodiversity.

### INESC TEC MAIN CONTRIBUTION

Conception and development of an adequate technological framework to ensure that the biological material and associated information, collected in the project BIOMETORE (EEAGrants, PT02\_Aviso2\_0001) about the biodiversity of seamounts and their ecosystems, namely in the Madeira-Tore and Great Meteor, is compiled and fully accessible. The system will ensure the integration, organization and long-term preservation of relevant data for marine information systems, enabling prompt and uniform data access to researchers at a local and national level.

Seabiodata (EEAGrants, PT02\_Aviso5\_0002) will provide new means to store and access original datasets and a set of interoperable services to disseminate observation data, thus providing baseline information for sustainable management of the Portuguese marine environment, as well as to the development of the marine strategies for the continuous assessment and maintenance of the good environmental status (GES).

**START DATE** JULY 2015

**END DATE** APRIL 2017

**BUDGET** 229K€

### PARTNERS

IPMA – INSTITUTO PORTUGUÊS DO MAR E DA ATMOSFERA (PORTUGAL)

IMR – INSTITUTE OF MARINE RESEARCH (NORWAY), AS CONSULTANT

### FUNDING

SEABIODATA WAS CO-FINANCED BY EEA GRANTS, EUROPEAN ECONOMIC AREA FINANCIAL MECHANISM, JOINTLY FINANCED BY ICELAND, LIECHTENSTEIN AND NORWAY

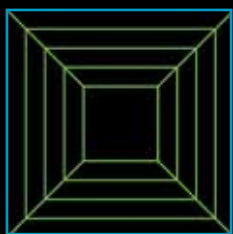


**INESCTEC**  
TECHNOLOGY & SCIENCE  
| ASSOCIATE LABORATORY  
| PORTUGAL

**INESC TEC**  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)

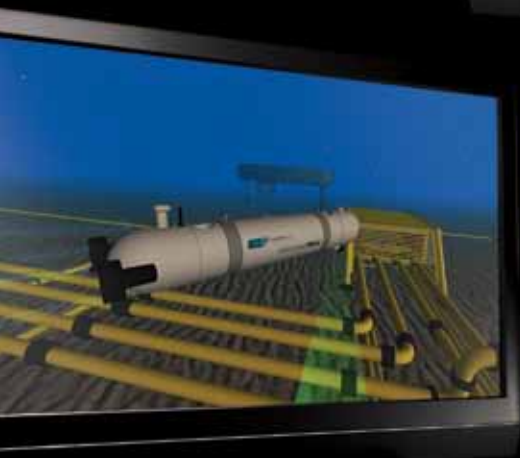


# SERIOUS GAMES AND VISUAL SIMULATORS

SPECIFICATION AND DEVELOPMENT  
OF SOLUTIONS FOR EDUCATION,  
TRAINING AND CERTIFICATION



**INESCTEC**  
TECHNOLOGY & SCIENCE



# SERIOUS GAMES AND VISUAL SIMULATORS

SPECIFICATION AND DEVELOPMENT OF SOLUTIONS  
FOR EDUCATION, TRAINING AND CERTIFICATION

---

## DESCRIPTION

Specification and development of Serious Games applications and Visual Simulators for Education, Training and Certification, based on 3D virtual environments controlled by rule engines and enabling multiplayer interaction.

## ADVANTAGES

- Reduces training and certification costs
- Avoids interaction with costly equipment in early training/certification phases
- Allows the simulation of complex or hazardous situations
- Enables flexible and remote training/certification
- Allows more training hours per trainee
- Increases the interest, the engagement and, therefore, the success of participants

## MAIN FEATURES

- 3D virtual environments
- Rule-based engine
- Multiplayer
- Web technologies, enabling remote use

## EXAMPLES

- F-16 aircraft engine maintenance simulator for teams
- Sea search and rescue AUV (Autonomous Underwater Vehicle) simulator
- Car driving simulator

## POTENTIAL USERS

- Armed Forces
- Civil Protection
- Flight Schools
- Aircraft Maintenance Companies
- Aircraft Industry



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)







# SOFTWARE VERIFICATION AND VALIDATION

SOFTWARE VERIFICATION  
AND VALIDATION  
FOR THE SOFTWARE INDUSTRY



**INESCTEC**  
TECHNOLOGY & SCIENCE



# SOFTWARE VERIFICATION AND VALIDATION

## SOFTWARE VERIFICATION AND VALIDATION FOR THE SOFTWARE INDUSTRY

---

### ACTIVITIES

Model-based testing (automatic test generation from formal models and UML models for API and GUI testing)

Verification & validation process improvement

Software model checking

Static analysis and contract-based verification

### SERVICES

V&V consulting

Test automation



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



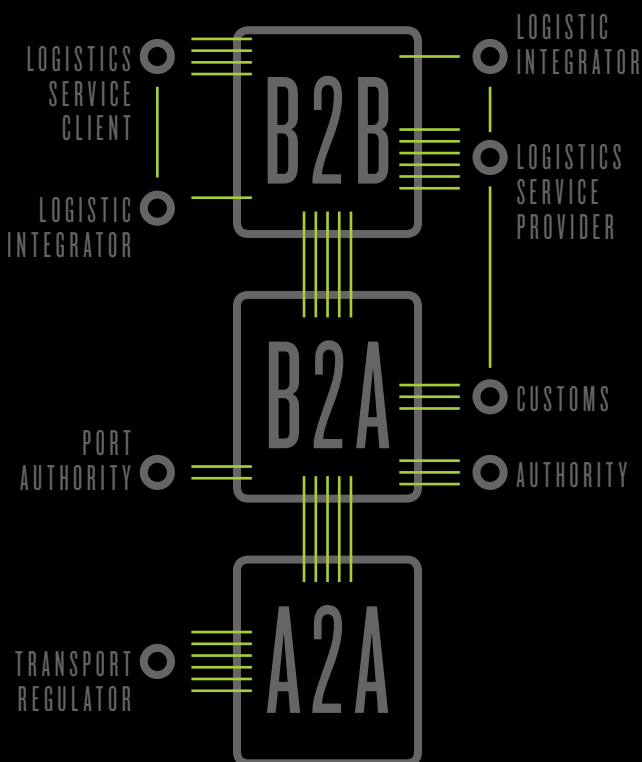


# MIELE

MULTIMODAL INTEROPERABILITY  
E-SERVICES FOR LOGISTICS AND  
ENVIRONMENT SUSTAINABILITY



**INESCTEC**  
TECHNOLOGY & SCIENCE



# MIELE

## MULTIMODAL INTEROPERABILITY E-SERVICES FOR LOGISTICS AND ENVIRONMENT SUSTAINABILITY

---

### AIM

The goal was to implement a Logistic Single Window as a network of inter-operating platforms, built by different organisations and commercial realities, capable of providing clients with integrated Door-to-Door logistic services with Business-to-Business and Business-to-Administration integrations.

### INESC TEC MAIN CONTRIBUTION

INESC TEC was responsible for defining the conceptual model, as well as for identifying business scenarios and requirements. Moreover, INESC TEC created an interoperable platform for the Logistic Single Window and a Mobile Application for transport operators to manage Bookings and Status reports. The systems are supported by the ECoNet – Enterprise Collaborative Network concept and by the GS1 Access Points in order to comply with the new GS1 messages.

**START DATE** SEPTEMBER 2010

**END DATE** DECEMBER 2013

**BUDGET** ~16 M€

### PARTNERS

RINA // ITALIAN MINISTRY OF TRANSPORT // GRIMALDI // TSG // IB // CAP  
CYPRUS PORT AUTHORITY // JACOBS UNIVERSITY // SIGNALIS // DBH LOG  
PORT AUTHORITY OF GIJÓN // CIMNE // COMPASS // PLAZA  
IPTM // APL // APDL

### FUNDING

THE PROJECT WAS CO-FINANCED BY  
THE EUROPEAN UNION // TRANS-EUROPEAN TRANSPORT NETWORK (TEN-T)



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

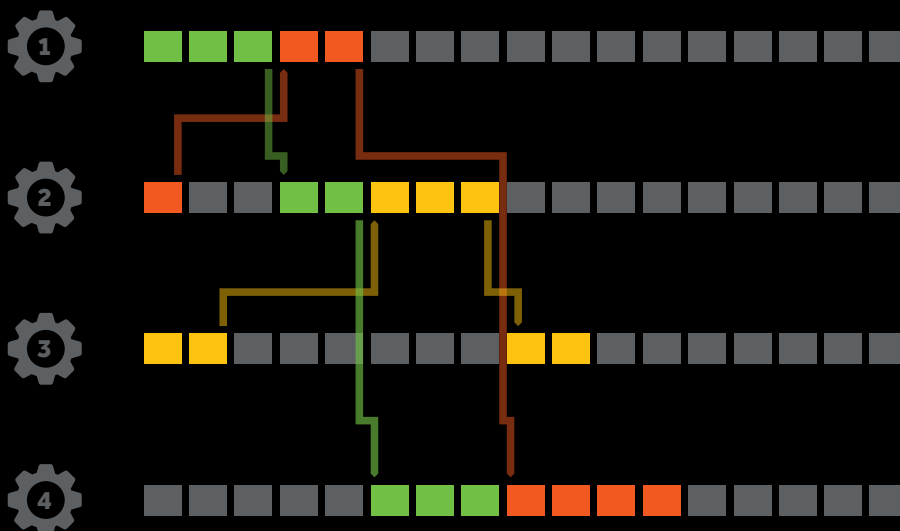
CAMPUS DA FEUP  
R DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)





# ADVANCED PLANNING AND SCHEDULING SYSTEMS





# ADVANCED PLANNING AND SCHEDULING SYSTEMS

---

In a globalised world manufacturing organisations seek to improve their competitive position by increasing operational performance. Production planning and operations scheduling are crucial to this end, representing today one of the most challenging tasks to managers. Furthermore, planners are struggling with the increasing complexity of production processes and with the lack of support planning tools that consider constraints and specific features of real world problems.

INESC TEC has a large experience in designing and developing innovative tools to optimise production planning and operations scheduling, thus contributing to reduce the gap between the practical needs of real production planning and commercially available solutions which are in general very strict and hard to use.

INESC TEC has designed and developed an optimisation engine that can be integrated with standard ERP or scheduling systems to enhance the global quality of schedules. This engine uses state-of-the-art, multi-criteria optimisation procedures and leads to considerable gains in productivity. Criteria such as reduction of delays or increase in resource utilisation can be considered at the same time, by using these procedures.

The benefits of this approach are even more evident in scenarios with a large number of production orders, different types of resources, complex product structures, or bottlenecks. Moreover, in a context where multiple criteria are taken into account, planners are involved in the process and they interact with the system to choose one of the multiple generated scheduling solutions (which correspond to different trade-offs between objectives).

Each solution is shown in a Gantt chart, allowing the planner to assess the quality of the schedule under analysis, in a multiple perspective way.



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



QUADRO  
DE REFERÊNCIA  
ESTRATÉGICO  
NACIONAL  
PORTUGAL 2007-2013



UNIÃO EUROPEIA  
Fundo Europeu  
de Desenvolvimento Regional



Fundação para a Ciência e a Tecnologia  
Membro da União Europeia



# CUTTING AND PACKING OPTIMISATION



**INESCTEC**  
TECHNOLOGY & SCIENCE



# CUTTING AND PACKING OPTIMISATION

---

Cutting and packing problems are at the core of many manufacturing networks and logistic systems. These are complex combinatorial optimisation problems, with a strong economic and environmental impact.

These problems arise in the context of several real-world applications, both in industry and services, whenever one or more large objects or container spaces have to be divided into smaller items in order to minimise waste. Examples include cutting paper rolls into narrower rolls in the paper industry, cutting large boards of wood into smaller rectangular panels in the furniture industry, cutting irregularly shaped components of garments from fabric rolls, and also packing boxes into containers or loading items on pallets in logistics applications.

INESC TEC has a large experience in designing and developing innovative solutions to optimise the cutting of 1D, 2D and 3D figures. This includes, for example, optimising the use of raw materials or truck loading. Industrial solutions have been developed for the textile, paper, wood and metalworking industries.

For the container-loading problem, a set of boxes must be packed inside a container, maximising the use of space. In some cases, some arrangements of boxes will not be loadable as there may not be a sequence to load them in the right positions. Moreover, other arrangements can be unstable during the loading process or during the transportation process. Constraints for each cargo unit (such as this side up or maximum bearing weight) must also be taken into account.

INESC TEC has created new algorithms that generate balanced solutions, considering objectives such as space utilisation, and cargo and worker safety.

The practical impact of these results in the performance of certain industrial sectors can be significant as the use of raw materials and product packing will be optimised, and waste will be reduced.



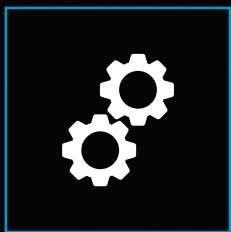
**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





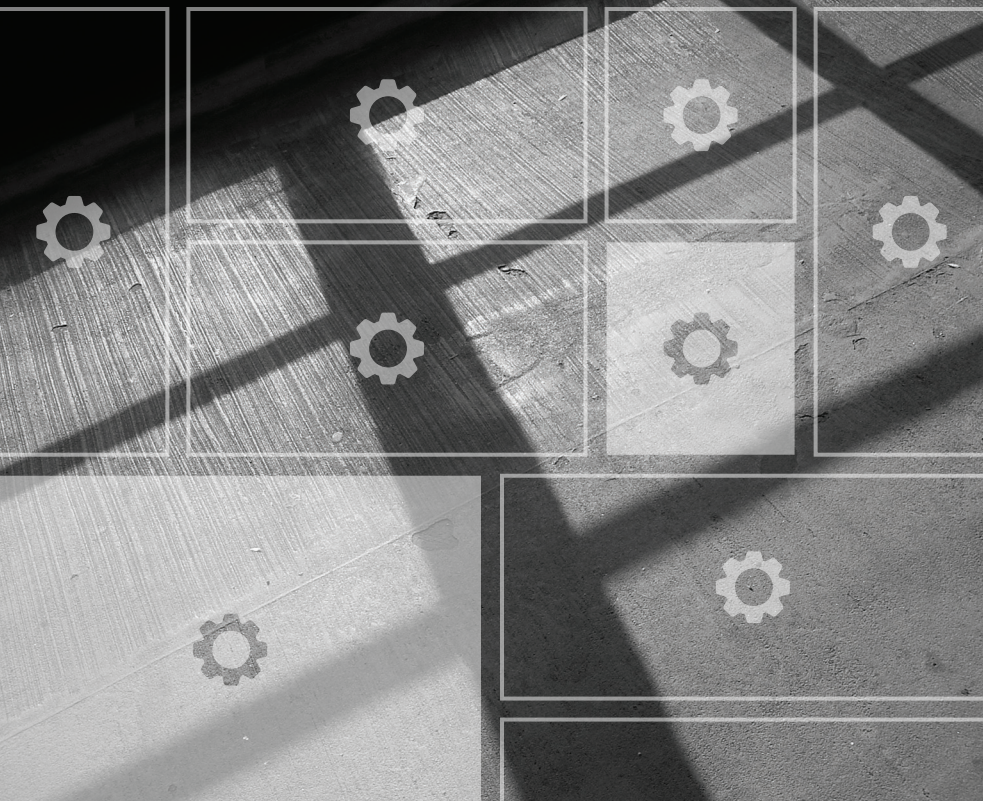


# PRODUCTION SYSTEMS ENGINEERING

CONSULTING SERVICES  
TO SUPPORT PRODUCTION  
SYSTEMS DESIGN, ANALYSIS  
AND IMPLEMENTATION



**INESCTEC**  
TECHNOLOGY & SCIENCE



# PRODUCTION SYSTEMS ENGINEERING

## CONSULTING SERVICES TO SUPPORT PRODUCTION SYSTEMS DESIGN, ANALYSIS AND IMPLEMENTATION

INESC TEC offers a consulting service dedicated to designing the best production system for each manufacturing company, from business model definition to implementation roadmapping. The service is based on a well-proved and extended methodology and supported by a complete toolbox covering the entire lifecycle of the project.

This service can be applied either to greenfield projects or to improve facilities already in operation. The methodology is based on lean concepts and focuses on added value creation throughout the entire process. It can be used in Make-to-Stock, Make-to-Order or Engineering-to-Order environments.

### MAIN BENEFITS

- A holistic and integrated approach where Operations and Production Resources Management, Internal Logistics, Quality Management and Information Management are considered simultaneously.
- Easy-to-use concepts supported by self-learning materials and pre-defined templates.
- Multi-scenario business demand analysis and system performance using Key Performance Indicators.
- Possible integration with process simulation software tools.



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)





# INTELLIGENT AUTOMATION AND INTERNAL LOGISTICS



INESCTEC

TECHNOLOGY & SCIENCE



# INTELLIGENT AUTOMATION AND INTERNAL LOGISTICS

---

In partnership with logistic systems manufacturers and software houses, INESC TEC designs and develops innovative solutions for transportation, distribution and intermediate warehousing in different industries, such as footwear, furniture and metal working.

These innovative logistic systems are supported by advanced software tools for managing, automating, monitoring, maintaining, balancing and scheduling production. Simulation is used to support the design and operations of these systems.

## MAIN RESULTS

- production capacity and throughput is increased
- operations that do not add value to the product are eliminated
- flexibility of production systems is increased
- different products can be produced simultaneously
- work in progress is reduced
- lead time is reduced

The One-Step Production System, Logicstore and LogicTrans are examples of products that were designed and developed in this context.

INESC Porto (the coordinating entity of INESC TEC) holds two patents in this field, the Modular Multi-ring System for Flexible Supply of Workstations, and the Distribution and Provisional Storage System for Transport Units.



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



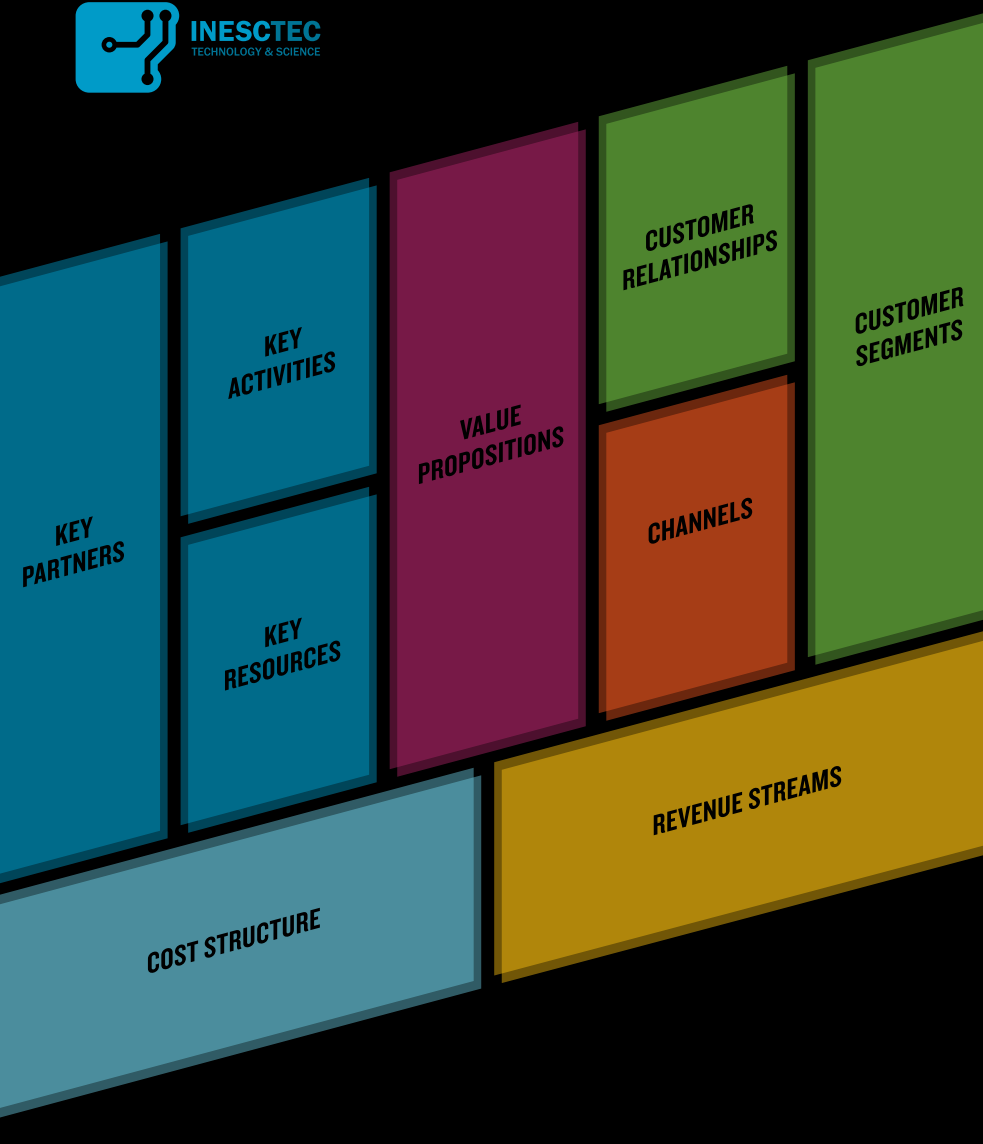


# OPTIMAL-IT

CONSULTING SERVICE:  
FROM BUSINESS MODEL  
TO IT IMPLEMENTATION



**INESCTEC**  
TECHNOLOGY & SCIENCE



# OPTIMAL-IT

## CONSULTING SERVICE: FROM BUSINESS MODEL TO IT IMPLEMENTATION

---

OPTIMAL-IT is a consulting service offered by INESC TEC to help organisations improve Business Processes and implement Information Systems in an effective and efficient way. The service starts with a Business Model Assessment and supports Business Processes analysis and improvement, and the implementation of Enterprise Information Systems.

This service can be applied either to greenfield projects or to improve systems already in operation.

These services are based on a coaching consulting approach. Therefore, projects are developed by progressively introducing concepts and by working closely with the Client in order to achieve concrete results. This way it is possible to ensure that after the project is concluded the Client will have the necessary skills to monitor the implementation of the identified improvement opportunities.

### APPROACH

- Business Model Assessment
- Business Process Mapping
- Business Process Modelling
- Information System Specification
- Information System Procurement
- Advice during Business Processes and Information Technology Implementation

### MAIN BENEFITS

- Reduce implementation risk
- Reduce the total cost of ownership
- Reduce implementation duration
- Advice independent from technological solutions and suppliers
- Multidisciplinary and holistic approach
- Use of world class industry best practices



**INESCTEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)



# TEC4 INDUSTRY<sup>®</sup>

SMART INDUSTRY VALUE CHAINS

Gain competitiveness  
with INDUSTRY 4.0

## COLLABORATIVE AND SUPPLY NETWORKS AND CHAINS

- › New Business Models and Collaborative Networks
- › Management of Information, Knowledge and Collaboration
- › Flexible and Resilient Systems

## INTERACTION AND CO-CREATION WITH THE CLIENT

- › Omni-channel experience (Web, Social Networks, Stores)
- › Intelligent Stores
- › Product-service Systems

## LOGISTICS AND MOBILITY

- › Automation and Optimisation of Internal Logistics
- › Transport and Logistics Systems

## BUSINESS INFORMATION SYSTEMS

- › Architecture and Technology for Cyber-Physical Systems, IoT and Big Data
- › Analysis and Design of Business Information Systems

## OPERATIONS, RESOURCES AND PROCESS MANAGEMENT

- › Design and Simulation of Manufacturing Systems
- › Integrated Planning, Scheduling and Control Systems
- › Asset Management and Predictive Maintenance

## ROBOTICS AND INTELLIGENT SYSTEMS

- › Collaborative Manipulators and Programming by Demonstration
- › Mobile Manipulators
- › 2D/3D Artificial Vision and Intelligent Sensors
- › Technology Integration and IoT

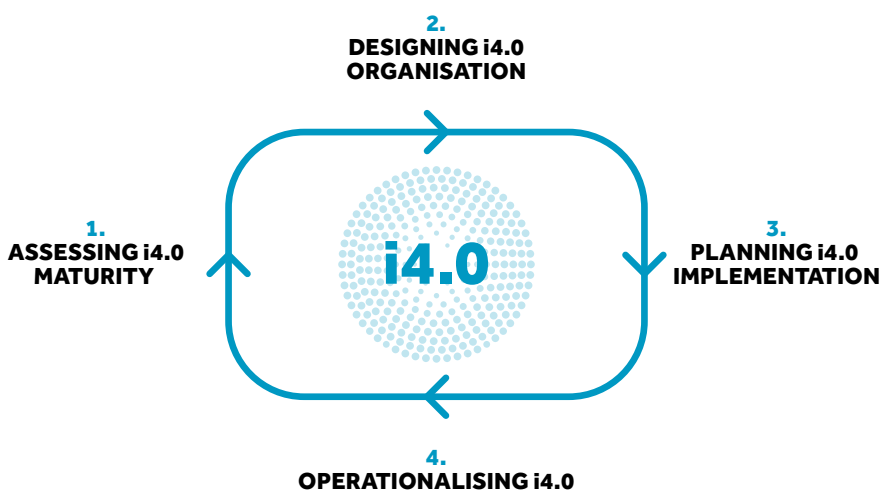
## BUSINESS ANALYSIS AND INTELLIGENCE

- › Intelligence in Manufacturing and Business
- › Performance Management Systems
- › Decision-support Systems and Intelligent Reporting



# MEET YOUR R&D PARTNER FOR i4.0 SUCCESS

Manufacturing enterprises are facing important challenges regarding the adoption and development of innovative concepts – technological, business, organisational, social – around Industry 4.0. To overcome uncertainty and to maximize success, it is crucial the definition of suitable strategies and action plans, scoping all complexity and dimensions of the adoption of i4.0 in industrial organisations.



INESC TEC's research track record, and extensive consultancy experience in developing and deploying solutions for industrial enterprises and value chain management, enabled the offering of high-value services to help companies assess, design, plan and operationalise i4.0 strategies.

INESC TEC i4.0 framework has been developed using a multi-methodological and multi-disciplinary approach including a conceptual modelling and qualitative and quantitative methods for field validation.

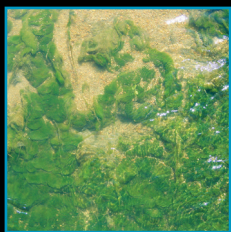


CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



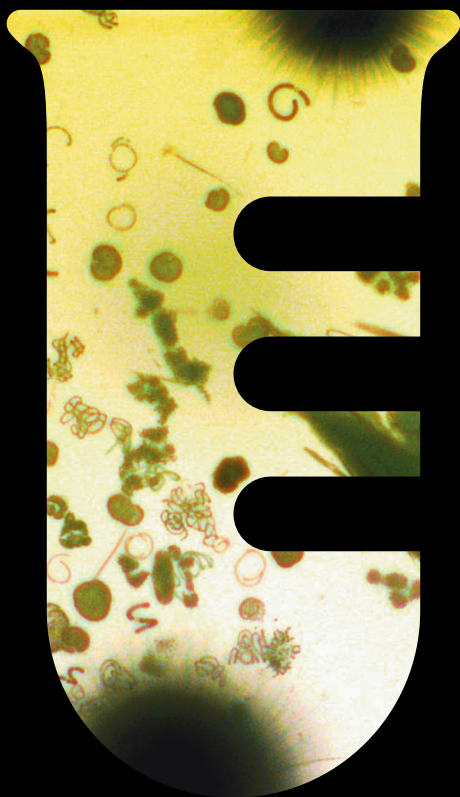
T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt





**MODAL**

MODELS FOR PREDICTING  
ALGAE BLOOMS



# MODAL

## MODELS FOR PREDICTING ALGAE BLOOMS

---

The occurrence of abnormal amounts of certain species of phytoplankton may be associated with eutrophication, which can lead to serious risks in terms of public health, particularly when these phenomena occur in places where drinking water is collected. Forecasting these phenomena in advance is essential for taking preventive actions and thus avoid undesirable consequences.

INESC TEC has applied, compared and adapted several modelling techniques to the problem of predicting harmful algae blooms in the hydrographical bay of river Douro, namely in the reservoir of the Crestuma-Lever dam.

This is a prediction problem with a strong social and economic impact on the metropolitan area of Porto because most of the drinking water in this region comes from this dam.

### RESULTS

- Several algorithms developed for forecasting algae blooms
- Software for monitoring and forecasting algae blooms



CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



**FCT** Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



**MORWAQ**

MONITORING  
AND PREDICTING WATER  
QUALITY PARAMETERS



# MORWAQ

## MONITORING AND PREDICTING WATER QUALITY PARAMETERS

---

INESC TEC has developed models that can be used for monitoring and predicting water quality parameters in the context of water distribution network. These models were developed and tested in the context of the distribution network managed by the company Águas do Douro e Paiva (AdDP), SA. The AdDP conducts regular sampling procedures in different points of the distribution network in order to monitor a set of parameters associated with water quality.

INESC TEC used the data resulting from these sampling procedures conducted for several years. Various models were developed using these data to address two main problems:

- Monitoring the large set of water quality parameters controlled by the AdDP in order to provide early warnings on eventual deviations from the expected “normal” values.
- Predicting the occurrence of extreme values on water quality parameters across the network, with the goal of allowing early preventive actions to be taken to avoid subsequent problems.

### MAIN FEATURES

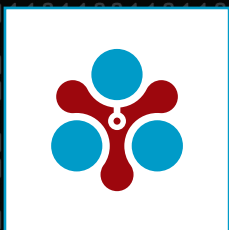
- Predictive models for forecasting water quality parameters supporting preventive actions that can avoid abnormal values.
- Predictive models to estimate the value of several water quality parameters in different points of the network using information obtained at other geographically correlated points, avoiding costly sampling analyses.
- Models for discovering correlations among water quality parameters.



CAMPUS DA FEUP  
RUA DR. ROBERTO FRIAS  
4200-465 PORTO  
PORTUGAL



T +351 222 094 000  
F +351 222 094 050  
info@inesctec.pt  
www.inesctec.pt



# HASLAB

## HIGH ASSURANCE SOFTWARE



**INESCTEC**  
TECHNOLOGY & SCIENCE

# HASLAB

## HIGH ASSURANCE SOFTWARE

---

**Dependability, Information Security and Formal Methods** are essential pillars supporting the development of **Trustworthy Software Systems**. A trustworthy system is inherently reliable, secure, and available. It must behave as people expect it to, despite environmental disruption, human errors, and attacks by hostile parties. Design and implementation errors must be avoided, eliminated or somehow tolerated. It is not sufficient to address only some of these dimensions, nor is it sufficient simply to assemble components that are themselves trustworthy. Trustworthiness can only be achieved through a global approach to system development.

INESC TEC's **High Assurance Software Laboratory** has been active in both theoretical and applied research, exploring the synergies between these areas for two decades. The highest practical impact of the activity stems from participations in R&D projects (GORDA, CACE, STORK, Cumulo Nimbo, SMART, Minha) aiming at exploring knowledge and technology transfer on the design, implementation and validation of trustworthy software systems with several industrial partners.

The expertise at INESC TEC makes it possible to jointly address several aspects that are central to trustworthy software for today's critical systems:

- Rigorous modelling, and formal specification and verification of software systems' correctness, availability and security
- Dependable and scalable data management protocols, with emphasis on Cloud Computing and infrastructures for big data
- Large scale information dissemination and aggregation protocols such as gossip for handling very large amounts of data
- Technology to implement and integrate the necessary software components to obtain highly-efficient solutions without compromising security

**High Assurance Software Laboratory (HASLab) is an R&D Unit of INESC TEC hosted by the University of Minho, Portugal**

### INDUSTRIAL PARTNERS

PT Inovação // Critical Software // Multicert // SAP // Google // Hewlett- Packard  
// Nokia // MySQL // Instituto de Aeronáutica e Espaço (Brasil)



INESC TEC  
R DR ROBERTO FRIAS  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[info@inesctec.pt](mailto:info@inesctec.pt)  
[www.inesctec.pt](http://www.inesctec.pt)

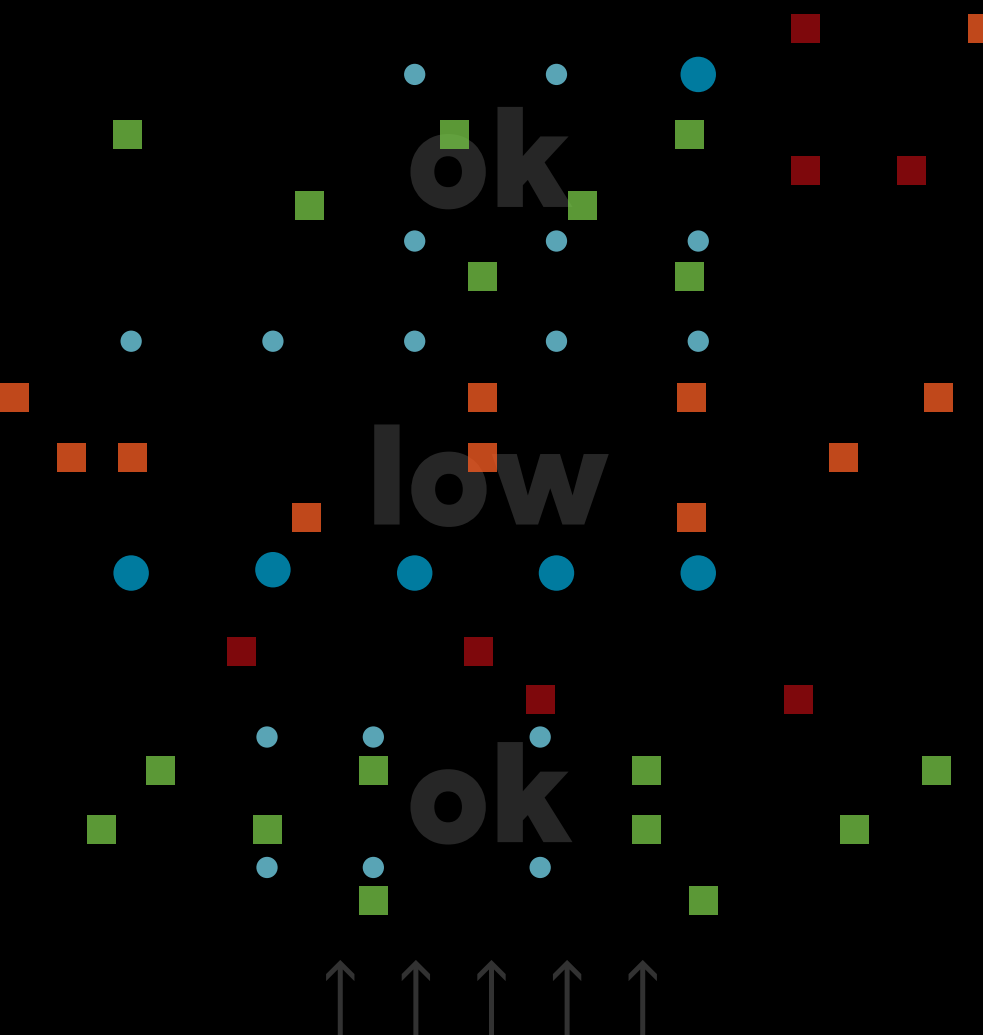


# CISTER

RESEARCH CENTRE  
IN REAL-TIME & EMBEDDED  
COMPUTING SYSTEMS



**INESCTEC**  
TECHNOLOGY & SCIENCE



# CISTER

## RESEARCH CENTRE IN REAL-TIME & EMBEDDED COMPUTING SYSTEMS

Real-time computing systems are those in which correctness depends not only on the logical result of computation, but also on the time at which the results are produced. This implies that, unlike more traditional information and communication systems, where there is a separation between correctness and performance, in real-time computing systems – like those deployed in the aerospace domain - these two aspects are closely related.

INESC TEC's Real-Time Embedded Computing Systems Research Centre has been active in both theoretical and applied research, exploring the synergies between these areas for more than 15 years. The highest practical impact of the activity stems from participations in national and international R&D projects and from the fact that the Centre is a member of the European Networks of Excellence in the area (ArtistDesign, CONET and HiPEAC). The ultimate goal is to explore knowledge and technology transfer on the design, implementation and validation of real-time and embedded computing systems with several industrial partners.

The expertise at INESC TEC makes it possible to jointly address competences that are providing advances and services in architectures for distributed embedded real-time systems, real-time wireless sensor networks, cyber-physical systems, operating systems and quality-of-service distributed computing:

- Wireless Sensor and Actuator Networks
- Embedded Middleware
- Real-time Operating Systems
- Multicore Platforms
- Mission Critical Software
- Adaptive Energy Control
- Avionics

**The Real-Time & Embedded Computing Systems Research Centre (CISTER) is an Associate Unit of INESC TEC hosted by the School of Engineering (ISEP) of the Polytechnic Institute of Porto (IPP), PT.**

**PARTNERS INCLUDE** Airbus (FR) // Critical Software (PT) // EADS (DE) // Embraer (BR) // Finmeccanica (IT) // Honeywell (US/CZ) // Space Systems Finland (FI) // SYSGO (DE) // Thales (FR)



**INESC TEC**  
TECHNOLOGY & SCIENCE  
ASSOCIATE LABORATORY  
PORTUGAL

CAMPUS DA FEUP  
R DR. ROBERTO FRIAS 378  
4200 - 465 PORTO  
PORTUGAL

T +351 222 094 000  
F +351 222 094 050  
[www@inescporto.pt](mailto:www@inescporto.pt)  
[www.inescporto.pt](http://www.inescporto.pt)

