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### **Portuguese representatives**

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President of the National Cartographic Council

**National deputy:** João Cordeiro Fernandes, Geographic Engineer  
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## **FOREWORD**

In the last four years Portugal has undergone a deep change of the legal and institutional frame in the area of Geographic Information (GI).

A new governmental approach to the Portuguese reality in the mapping and GIS and territorial planning and urban development areas has conducted to the the fusion of the former institutions like the National Mapping and Cadastral Agency (ex-Instituto Geográfico Português – IGP) and the National Agency for Spatial Planning and Urban Development (Direção-Geral de Ordenamento do Território e Desenvolvimento Urbano – DGOT-DU).

This new institution is the Directorate General of Territory assuming the Portuguese representative role on the International Cartographic Association (ICA) as did the former IGP.

On a national level, the Directorate General of Territory (DGT) will continue to be the national mapping and cadastral agency, as the national authority in areas such as Geodesy, Cartography and Cadastre, reaffirming its role in the regulation of the exercise of these activities in what concerns the rules and technical specifications of data production and reproduction, licensing and supervision of the referred activities, as well as the homologation of the respective products.

The Portuguese community of mapping and GIS has maintained its very important participation in different areas related with these technical and scientific domains through the continuous production and upgrade of different scale maps, the use of new satellite data and the development of national, regional and local geospatial infrastructures.

The realization of international events such as the Geospatial World Forum and the Iberian Days of Geospatial Infrastructures, and other national events covering different issues in GI has motivated the producers and the users of this kind of data.

Since 1995, Portugal remains on the front of the scientific and technological events of Geographic Information Systems. Under the responsibility of DGT, the national infrastructure for GI (SNIG) should coordinate and ensure the implementation rules of INSPIRE with special emphasis on the interoperability, visualization and delivering of GI data, which is a very important task involving institutions of different levels in the Administration.

Resulting from recent governmental initiative to promote the use of GI, the Portuguese community has a new internet portal with free access to different GI products available from national entities of Central Government, working as complement for the SNIG infrastructure.

As far as the new legal frame, a new Decree-Law has been published regulating the production and use of cartographic products by all public entities. The new cartography to support the presentation of proposals to implement new plans in the area of land planning and urban development must be produced according to national technical specifications, delivered by the DGT on their web site. For the first time in Portuguese cartographic history a geodetic reference frame has been established by law for the continental region and for the autonomous regions of Madeira and Azores, according to the INSPIRE directive.

This report will evidence the involvement of the many entities which constitute the Cartography Coordinator Council of Portugal, one of the organisms which were reinforced through the qualification of the national authority given to DGT.

Some of the most significant projects requiring the involvement of scientific research and technical means have been initiated by the Portuguese Task Group for the Extension of the Continental Shelf (EMEPC), which is a governmental institution with the purpose of preparing and following up the Portuguese Continental Shelf Extension Project, and by the Geographic Military Institute (Instituto Geográfico do Exército) with the creation and development of a GIS 3D and their participation in a Multinational Geospatial Co-Production Program (MGCP).

In spite of the recent economic crisis, many projects have been developed by Portuguese entities in collaboration with other international universities and private enterprises.

The DGT, as the Portuguese representative on ICA, must vigorously support and dynamize all the relevant initiatives that can promote in the most efficient way the acquisition, management, visualization and delivery of geographic information, to guarantee a better technical and political decision making over our country.

Lisbon, August 2015

Rui Manuel Amaro Alves, General-Director of the Directorate General of Territory  
President of the National Cartographic Council

## **DIREÇÃO-GERAL DO TERRITÓRIO (DGT)**

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### **1 – INTRODUCTION**

Heir to an institutional tradition that can be traced back to 1788, when the first systematic geodetic works began in Portugal with the purpose of “creating the general triangulation of the Kingdom, aiming both to establish new bases for the theory on the shape of the earth and to be a sound and undisputed basis for the construction of the geographic map of the Kingdom at scale 1:100 000”, IGP is Portugal’s national geodetic, mapping, cadastre and geographic information agency.

IGP’s mission is to act as the national authority in the four fields mentioned above, to produce official geographical information, to develop and coordinate the national geographical information system, to promote training and research in earth sciences and geographical information technologies and to contribute to the information society. It is responsible for the execution of geographical information policies.

In this capacity, IGP is responsible for licensing private companies for cadastral production and for the certification of mapping and cadastre produced by other organisations, with the exception of military and hydrographic cartography.

IGP has a staff of 241, with its head office in Lisboa and six regional offices on mainland Portugal. The former offices in the autonomous regions of Madeira and Azores are already under the regional government.

### **2 - SNIG**

SNIG is the National Spatial Data Infrastructure (NSDI) that allows the registry and search of the spatial data and services produced by public and private entities in Portugal. It was created 25 years ago being one of the pioneer NSDI in Europe and the first one launched on the Internet.

The Directorate-General for Territorial Development (DGT) is the public authority presently in charge of chairing the steering committee responsible for the NSDI strategic coordination, being also the National Contact Point for INSPIRE.

The NSDI geoportal allows searching, exploring and visualizing the geographic data through OGC webservice for the whole country.

In 2014, SNIG geoportal has been reformulated and new functionalities were added to make the platform more efficient and more user-friendly. Data producers can now register their metadata in an easier way and it is also simpler for the users to find the data using specific and restrictive parameters on their search. The viewer allows the visualization of open webservice and also geographic data from files in several common formats, for confrontation purposes.

SNIG also supports the application of the INSPIRE Directive in Portugal. Every year the INSPIRE Directive monitoring process relies on SNIG metadata to calculate the indicators through the metadata registered on the system. Part of the information relevant to follow the application of the Directive in Portugal, used in the three years report, is also obtained from the NSDI.

### **3 - iGEO**

In 2014 the Portuguese government promoted the creation of iGEO, an internet portal to boost the use of open spatial data and that is a complement to the national spatial data infrastructure (SNIG). iGEO began with the cooperation of the following public institutions: Directorate-General for the Territory, Institute for the Conservation of Nature and Forests, National Institute for Housing and Urban Rehabilitation and Portuguese

Environment Agency, which provided access to most of their geo-spatial data, through web services created under OGC (Open Geospatial Consortium) standards.

This geoportal is divided in two main sections: a list of spatial datasets, with the reference to their OGC services, and a collaborative area for open code of mobile apps developed using these data.

To promote the usage of the available geographic information and to reach new types of users, a contest of ideas for new mobile apps was open, with the support of the Portuguese-American Foundation.

The goal for the future is that new public entities will join this initiative as well as other spatial data producers, like NGOs, universities and private companies.

#### **4 - IPSentinel - Portuguese infrastructure for storage and delivery of images of the Sentinel satellites.**

DGT and the Portuguese Institute of Sea and Atmosphere (IPMA) initiated a project to build an infrastructure for the Portuguese Sentinel data - IPSentinel. This infrastructure will allow access to the data of the Sentinel satellites of the Portuguese territory, and also the search and rescue area in the Atlantic Ocean under the responsibility of Portugal. The project is promoted by the General Directorate of Marine Policy (DGPM) through the Financial Mechanism of the European Economic Area (EEA Grants). It is expected that the infrastructure will be operational in 2016.

#### **5 - Large scale mapping**

For the purpose of large scale topographic maps and orthophotos, DGT has been establishing partnerships with regional and local authorities for the production and updating of cartography at scales 1:10 000, 1:1:2 000 and 1:1 000.

##### **5.1 National Topographic Map Series 1:10 000**

This map series was designed mainly to use the data in a GIS environment. It's based on a multi-codes system. DGT coordinates and verifies all the activities related with the production of this map series. At the moment 75% of Portugal mainland is covered with this map.

##### **5.2 National Topographic Map Series 1:50 000**

This map series is being updated. Around 55% of the country is covered with vector data for all themes.

##### **5.3 National Topographic Map Series 1:100 000**

This map series is being produced using the data from the topographic map series at scale 1:50 000. Around 40% of the country is already covered with vector data for all themes.

##### **5.4 National Topographic Map Series 1:500 000**

This map covers the entire territory of Portugal mainland in one sheet and is updated every year since 1998.

##### **5.5 National Topographic Map Series 1:1500 000**

This map covers the entire territory of Portugal mainland in one sheet and is updated every year since 2014.

##### **5.6 National Orthophotos coverage**

DGT produces a full coverage of orthophotos of Portugal mainland with a 50 cm GSD using digital aerial photophographs obtained with a digital camera since 2004. The last coverage was done in 2012.

##### **5.7 EuroglobalMap**

The first version was produced with the coordination of EuroGeographics in 2003. It was updated in 2013.

##### **5.8 EuroRegionalMap**

The first version was produced with the coordination of EuroGeographics in 2007. It's being updated every year, since then, according to EuroGeographics solicitations.

## 6 - CORINE LAND COVER

In 2014 DGT, with the support of the European Environment Agency, finished the production of the CORINE Land Cover Map 2012 for the territory of Portugal.

DGT did also the validation of 6 high resolution layers: Wetlands 2006-2009-2012, Permanent Water Bodies 2006-2009-2012, Degree of Imperviousness 2012, Permanent Grassland 2006-2009-2012, Forest Type 2012 and Tree Cover Density 2012. It was also done Enhancement of 5 high resolution layers: Wetlands 2006-2009-2012, Permanent Water Bodies 2006-2009-2012, Degree of Imperviousness 2012, Forest Type 2012 and Tree Cover Density 2012.

## 7 - Geodetic Reference Frames

In 1989 Portugal participated in the first GPS campaign promoted by EUREF (the IAG Sub-Commission for the European Reference Frame) with the purpose of connecting the European countries. Given that these measurements did not cover appropriately the Iberian Peninsula, a densification network was measured later on in the IBERIA 95 campaign. Between 1999 and 2004 the 1st and 2nd orders geodetic networks (around 1000 trig points) were measured with GPS and connected to the results of IBERIA95. The geodetic network of Portugal mainland is now a realization of the ETRS89, called PT-TM06/ETRS89.

In the Azores and Madeira archipelagos a group of points was measured in the international GPS campaign TANGO1994 (Trans-Atlantic Network for Geodynamics and Oceanography). In the subsequent years the geodetic networks of all the islands were measured with GPS and a realization of ITRS93 (PTRA08-UTM/ITRF93) was established as the reference frame for the archipelagos.

The parameters for coordinate transformation from the old geodetic reference systems to PT-TM06/ETRS89 and PTRA08-UTM/ITRF93 were calculated. DGT also provide software for coordinate transformation and applications for the transformation of vector data to these new systems.

## 8 - ReNEP – The Portuguese GNSS CORS (Continuously Operating Reference Stations) Network

In 1997 DGT installed the first CGPS station in Cascais (CASC), near the reference tide gauge, which is in operation since 1882. In the following years, until 2002, seven more stations were installed, having as main goal the maintenance of the Portuguese reference frames.

Since 2006 DGT is being working on the densification and the upgrade of the GNSS CORS (Continuously Operating Reference Stations) network - ReNEP - with two main goals: i) the maintenance of the national reference frames; and ii) to provide a real time precise point positioning service. In 2015 DGT finished the network, which consists of 48 CORS: 42 in the mainland and 7 on the islands (Azores and Madeira Archipelagos). All the stations collect both GPS and GLONASS data, 6 are part of the EPN (EUREF Permanent Network) and 3 of these also belong to the IGS (International GNSS Service) network.

ReNEP provides data for post-processing (hourly RINEX files at 5 seconds rate) and real time applications. ReNEP also provide, on-demand, RINEX files at 1 second rate.

The real-time corrections are distributed in RTCM format over the NTRIP protocol. There are three different types of products available: i) single-base station, for those users whose equipments cannot send NMEA messages; ii) nearest-site; and iii) network coverage.

The services and products provided by ReNEP are free of charge. Presently there are about 1700 registered users for the access of real-time data, and this number is continuously increasing.

## 9 - Tide Gauges

IGP is responsible for two tide gauges, at Cascais and Lagos. In 2004 DGT acquired 2 new acoustic tide gauges, in order to replace the floating tide gauges systems. These systems record sea level measurements at 5 seconds rate and all the data are streamed to DGT central office. Both tide gauges contribute with their data to SLEAC (Levels along the European Atlantic Coastline) and IOC (Intergovernmental Oceanographic Commission of UNESCO).

The Cascais tide gauge is the reference for the mainland ordnance *datum* and the floating tide gauge (Borel type), installed in 1882 is still working.

## 10 - PROJETOS DE INVESTIGAÇÃO

### **FIRELAND – Wildfire Effects on the Vegetation Dynamics at the landscape scale in Portugal**

The main objective of this project is the comprehensive and detailed analysis of the wildfire-driven spatio-temporal forest dynamics in Portugal, at the landscape level.

Such analysis is performed using old and recent cartography, spanning a time period of three to four decades (e.g. Land Cover Map of Continental Portugal for 1990 - COS'90; Land Use and Land Cover Map of Continental Portugal for 2007 - COS2007; National Forest Inventory of 1965/78 – IFN'70; cartography of burnt areas for the period 1975-2008).

The results of this study will contribute to improve the present knowledge on fire-driven landscape dynamics in Portugal, since it will gather a considerable amount of information on land use (especially on forest use), which has never been analyzed before.

Moreover we hope to contribute to the state-of-the-art of wildland fire research since we will approach aspects which have not been sufficiently explored, such as the relationships between weather and fire selectivity and the confrontation of different approaches to assess fire selectivity

### **CVS - Wildlife Corridors Based on Spatial Modeling of Human Pressure and their usefulness on the preservation of the Iberian Wolf**

The main task would be the creation of an alternative strategy for conservation developed over the concept of wilderness adapted to the European reality, subject to a long history of anthropogenic occupation. This strategy is based on information about the human influence on the territory, oriented to the identification of areas with less human disturbance for wildlife, since wild species do not usually tolerate well the human presence and are sensitive to environmental disturbances generated by human activities. Those less disturbed areas are potentially suited for protection of wildlife. The project CVS - Corridors for wildlife: spatial modeling of human pressure and its usefulness to the conservation of Iberian Wolf, funded by the Portuguese national science foundation, intends to lead to the development of a methodology that aims to contribute to break the isolation between national protected areas, through the identification of corridors, as preferentially connecting paths allowing the migration of existing wild species. This project has been concluded in September 2014.

### **eENVplus - Environmental services for advanced applications within INSPIRE (ainda a decorrer)**

We aim to unlock huge amounts of environmental data, managed by Environment Agencies and other environmental stakeholders, through the integration and harmonisation of existing services.

Starting from the results of previous European experiences, eENVplus integrates existing infrastructures into an operational framework able to overcome cross-border and language barriers.

The main purposes are:

- A comprehensive, open and scalable infrastructure able to **integrate existing infrastructures according to the INSPIRE requirements**, open standards and interoperable innovative services
- A common **Environment Thesaurus Framework**, supporting the integration of existing thesauri relevant for the environmental sector via Linked Data and providing added-value services for its integration and exploitation in pilot applications
- A comprehensive toolkit with **procedures, guidelines and examples for data harmonisation and validation** supporting Member States during INSPIRE implementation
- A set of **innovative added-value interoperable services** aiming to facilitate the development of innovative environmental applications
- A **Training Framework** to support, with eLearning tools, the development of the necessary capacities and knowledge to implement INSPIRE, to develop a SEIS and to keep this new adapted infrastructure operational.

### **LANDYN Changes on Land Use and Occupation in Portugal: Characteristics, Driving Forces and Future Scenarios**

[http://www.igeo.pt/gdr/index.php?princ=PROJECTOS/LANDYN&sessao=m\\_projectos](http://www.igeo.pt/gdr/index.php?princ=PROJECTOS/LANDYN&sessao=m_projectos)

**Objectives:** (i) provide a clear and reliable information of use changes and land use have occurred in mainland Portugal in 1960, 1980, 1990 and 2000, (ii) identify and understand the main drivers of these changes, (iii) build the main change scenarios for use and occupation up to 2040, using a spatial model, and (iv) use the information generated to make a study related to energy demand and emissions and removals greenhouse gases. The entire

project will be done at two scales: Continental Portugal and regions (NUTS - Nomenclature of Territorial Units for Statistics - 2). Project in development

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#### **SmartOpenData - Open Linked Data\* for environment protection in Smart Regions**

The SmartOpenData project has, as main objective, the creation of a Linked Open Data infrastructure based on existing software tools and datasets. But not only, because the project has also the aim of developing new tools and building new datasets.

In order to avoid and reduce the gap between geospatial community and Semantic Web movement led by international standards bodies and universities, SmartOpenData is focused on how Linked Open Data can be explained to and disseminated into geospatial community and applied generally to spatial data resources. At this time, there are several issues that have already been properly answered regarding GIS systems and datasets, but there are still open questions in the context of spatial data as Linked Open Data as (i) Geometries encoding, (ii) Implementation of topological functions, (iii) Additional metadata required for spatial datasets and (iv) Geometries description as WKT literals. WKT are large objects, however Linked data are usually simple and smaller literals. Currently, SmartOpenData is working in all these areas.

In the same way, SmartOpenData is committed to reusing and recycling existing information from several sources as public open data portals like GEOSS/GEO Portal (to access GEOSS Data-CORE info), INSPIRE and voluntary data sources (OpenStreetMap, GEOWIKI, etc.). All these data sources will be always related with European Environmental data and Biodiversity information.

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### **1. INTRODUCTION**

The Army Geographic Institute (IGeoE) is a military Institute that develops and produces geographic information, based upon experience and tradition dating back to more than 80 years, according to the highest international standards of quality, precision and accuracy.

IGeoE 's mission is to provide geographic information to the Army, the Armed Forces, the Security Forces and the civil community, ensuring the execution of activities related to cartographic technique, and promote monitoring and the development of scientific and technological research activities within the geographical science.

The geographic information produced by IGeoE is more and more necessary to all those who need updated, consistent, reliable geo-referenced data to support projects in areas such as Planning, Management and Administration of the territory and also in Research and Training or even, in social and recreative activities.

### **2. RESEARCH AND DEVELOPMENT**

#### **2.1. Multinational Geospatial Co-Production Program (MGCP)**

MGCP is a coalition of nations participating in the production of global high-resolution vector geospatial data.

All MGCP data co-producers are producing information for the dataset at International Geospatial Warehouse (IGW) for storage, exchange and use of geospatial information. The IGW is established and maintained by the United States National Geospatial-Intelligence Agency (NGA).

At the moment, 30 countries are participating in the Program and each member state is required to produce information of five production units. Each production unit is a cell, whose size equals one degree Latitude x one degree longitude.

The data, in 2D shapefiles format, is obtained from high resolution commercial imagery with a horizontal accuracy of 25 meters. The density/portrayal of the vector geospatial data is either 1:50k, 1:100k or both.

There is no specific software requirement, as long as the data is compliant to the TRD (Technical Reference Documentation) and the standard NATO mapping Specification is guaranteed: supports 95% of Topographic Line Map specification.

#### **2.2. Geographic Information System for Military Operations (SIGOpMil)**

The SIGOpMil, available at the Army data network, aims to provide geographic information and geospatial support to the Armed Forces in planning, conducting and executing operations, exercises and daily activities of the Army.

Its purpose is to be a tool adapted and adjusted to the geographic information needs of the users. The IGeoE-SIG portal allows the users access to the IGeoE product's (Cartographic Series, Digital Terrain Models, Serving Network, etc).

#### **2.3. SIG3D**

The IGeoE by acquiring its geographic base information, used to produce the 1:25 000 military maps, and by using a 3D Geographic Information System (GIS), is providing to all decision makers access to crucial territory information, essential to support their decisions.

With this format, it is possible to take maximum profitability of the acquired information for the Military Maps. In addition to all the analysis that can be carried out in a 2D GIS, such as proximity, neighborhood, inclusion, and others, it is possible to further extend this analysis to the space modified by human action, according to the scale.

The process consisted of an adaptation of the methodology used in CAD (Computer-Aided Design), having been created for this purpose a Geographic Database, whose objects are modulating in a 3D GIS format of the IGeoE object catalog. Those objects are optimized for a 3D GIS and its several applications, so that both military and civilian can use these technologies for different purposes.

### 3. EDUCATION AND TRAINING

Year	Courses
2011	Curso de Informação Cartográfica Curso de Fotogrametria Curso de Cartografia Digital Curso de Topografia 1º Curso de PCMap 2º Curso de PCMap 3º Curso de PCMap 4º Curso de PCMap
2012	Curso de Informação Cartográfica Curso de Cartografia Digital Curso de Topografia Curso de Interpretação de Imagem 1º Curso de PCMap 2º Curso de PCMap 3º Curso de PCMap 4º Curso de PCMap
2013	Curso de Informação Cartográfica Curso de Cartografia Digital Curso de Fotogrametria 1º Curso de PCMap 3º Curso de PCMap
2014	Curso de Informação Cartográfica Curso de Fotogrametria Curso de Cartografia Digital 1º Curso de PCMap 3º Curso de PCMap

### 4. CARTOGRAPHIC MAP PRODUCTION

From 2011 to 2014, the IGeoE produced the following maps:

#### 4.1. 121 maps at scale 1:25 000

This map series is the main production of IGeoE and the only full coverage of Portugal at scale 1:25 000. It comprises a total of 632 sheets for the continental territory plus 15 sheets for Madeira island and 35 sheets for Azores island.

#### 4.2. 35 maps at scale 1:50 000

This map series is produced using the data from geographic base information, used to produce the 1:25 000 military maps. The national frame consists of a set of 175 sheets and the M783 series began in 2006 with a change in symbology and marginal information in order to comply with the Standardization Agreement NATO STANAG 3676.

#### 4.3. 2 maps at scale 1:250 000

This map series was produced by IGeoE in partnership with “Instituto de Infraestruturas Rodoviárias”. It’s the official Portugal road map at scale 1:250 000, where the symbols used in the representation of the road network were changed to facilitate the interpretation.

#### 4.4. 3 maps at scale 1:500 000

This map series was produced by IGeoE in partnership with “Instituto da Mobilidade e dos Transportes”. It’s the official Portugal road map at scale 1:500 000, being only one sheet and provided in a folding version.

### 5. PUBLICATIONS

#### 5.1. Topographic Maps produced and published from 2011 to 2014

##### 5.1.1. 2011

YEAR	SCALE	NUMBER	NAME	EDITION	
2011	1:25 000	82	Póvoa de Varzim	New Edition	
		83	Vila Nova de Famalicão	New Edition	
		96	Vila do Conde	New Edition	
		97	Trofa	New Edition	
		502	Amareleja : Moura	New Edition	
		503	Noudar : Barrancos	New Edition	
		504	Barrancos : Norte	New Edition	
		513	Safra : Moura	New Edition	
		514	Santo Aleixo da Restauração : Moura	New Edition	
		515	Barrancos-sul	New Edition	
		522	Brinches : Serpa	New Edition	
		523	Pias : Serpa	New Edition	
		524	Sobral da Adiça : Moura	New Edition	
		525	Negrita : Moura	New Edition	
		525A	Cortes da Contenda : Moura	New Edition	
		532	Serpa	New Edition	
		533	Vila Nova de São Bento : Serpa	New Edition	
		534	Vila Verde de Ficalho : Serpa	New Edition	
		541	Mosteiro : Mértola	New Edition	
		542	Vales Mortos : Serpa	New Edition	
		543	Crespo : Serpa	New Edition	
		550	Corte Gafo : Mértola	New Edition	
		551	Corte do Pinto : Mértola	New Edition	
		558	Mértola	New Edition	
	559	Santana de Cambas : Mértola	New Edition		
	566	Espírito Santo : Mértola	New Edition		
	567	Pomarão : Mértola	New Edition		
		1:50 000	34_2	Lisboa	New Edition
			42_1	Figueira dos Cavaleiros	New Edition
			42_2	Aljustrel	New Edition
			43_2	Serpa	New Edition
			43_3	Beja	New Edition
			43_4	Cuba	New Edition
	45_1		Messejana	New Edition	
	45_2		Ourique	New Edition	
	46_1		Corte do Pinto	New Edition	

		46_2	Mértola	New Edtion
		46_3	Almodôvar	New Edtion
		46_4	Castro Verde	New Edtion
	1:250 000		Mapa Oficial de Estradas de Portugal Continental, IGeoE/INIR	New Chart
	1:500 000		Carta Oficial de Estradas de Portugal Continental, IGeoE/INIR	New Chart

**5.1.2. 2012**

YEAR	SCALE	NUMBER	NAME	EDITION	
2012	1:25 000	58	Salto : Montalegre	New Edtion	
		72	Cabeceiras de Basto	New Edtion	
		74	Vila Pouca de Aguiar	New Edtion	
		84	Selho : Guimarães	New Edtion	
		85	Guimarães	New Edtion	
		86	Mondim de Basto	New Edtion	
		87	Vilar de Ferreiros : Mondim de Basto	New Edtion	
		88	Telões : Vila Pouca de Aguiar	New Edtion	
		98	Santo Tirso	New Edtion	
		99	Felgueiras	New Edtion	
		100	Arnóia : Celorico de Basto	New Edtion	
		101	Lordelo : Vila Real	New Edtion	
		102	Vila Real	New Edtion	
		109	Lavra : Matosinhos	New Edtion	
		110	Maia	New Edtion	
		111	Paços de Ferreira	New Edtion	
		112	Penafiel	New Edtion	
		123	Valongo	New Edtion	
		124	Marco de Canaveses	New Edtion	
		133	Valadares : Vila Nova de Gaia	New Edtion	
		134	Lever : Vila Nova de Gaia	New Edtion	
		135	Castelo de Paiva	New Edtion	
		143	Espinho	New Edtion	
		144	Canedo : Santa Maria da Feira	New Edtion	
		145	Santa Eulália : Arouca	New Edtion	
		230	Coimbra	New Edtion	
		241	Coimbra : sul	New Edtion	
		500	Selmes : Vidigueira	New Edtion	
	501	Moura	New Edtion		
	511	Pedrógão : Vidigueira	New Edtion		
	512	Machados : Moura	New Edtion		
	1:50 000		9_1	Guimarães	New Edtion
			9_2	Penafiel	New Edtion
		9_4	Póvoa do Varzim	New Edtion	
		43_1	Moura	New Edtion	
		44_1	Barrancos	New Edtion	
		44_3	Vila Verde de Ficalho	New Edtion	
		44_4	Amareleja	New Edtion	
		47_4	Crespo	New Edtion	
1:500 000			Carta Aeronáutica OACI-Portugal Continental, IGeoE/INAC	New Edition	

## 5.1.3. 2013

YEAR	SCALE	NUMBER	NAME	EDITION
2013	1:25 000	9-A	Cisterna : Vinhais	New Edtion
		10	Moimenta : Vinhais	New Edtion
		22	São Vicente : Chaves	New Edtion
		23	Vinhais	New Edtion
		31	Outeiro : Montalegre	New Edtion
		32	Montalegre	New Edtion
		33	Sarraquinhos : Montalegre	New Edtion
		34	Chaves	New Edtion
		35	Lebução : Valpaços	New Edtion
		36	Rebordelo : Vinhais	New Edtion
		44	Ruivães : Vieira do Minho	New Edtion
		45	Alturas do Barroso : Boticas	New Edtion
		46	Boticas	New Edtion
		47	Chaves : Sul	New Edtion
		48	Vilarandelo : Valpaços	New Edtion
		49	Torre de Dona Chama : Mirandela	New Edtion
		59	Dornelas : Boticas	New Edtion
		60	Vidago : Chaves	New Edtion
		61	Carrazedo de Montenegro : Valpaços	New Edtion
		62	Valpaços	New Edtion
		63	Mascarenhas : Mirandela	New Edtion
		73	Ribeira de Pena	New Edtion
		75	Jou : Murça	New Edtion
		76	Mirandela	New Edtion
		77	Mirandela : este	New Edtion
		89	Murça	New Edtion
		90	Franco : Mirandela	New Edtion
		91	Frechas : Mirandela	New Edtion
	103	Sanfins do Douro : Alijó	New Edtion	
	104	Vilas Boas : Vila Flor	New Edtion	
	105	Vila Flor	New Edtion	
	122	Porto	New Edtion	
	1:50 000	6_2	Vila Pouca de Aguiar	New Edtion
6_3		Cabeceiras de Basto	New Edtion	
9_3		Porto	New Edtion	
10_1		Vila Real	New Edtion	
10_4		Celorico de Basto	New Edtion	
11_4		Vila Flor	New Edtion	
13_1		Castelo de Paiva	New Edtion	
13_4	Espinho	New Edtion		

## 5.1.4. 2014

YEAR	SCALE	NUMBER	NAME	EDITION
2014	1:25 000	1	Melgaço	New Edtion
		2	Valença	New Edtion
		3	Monção	New Edtion

		4	Castro Laboreiro : Melgaço	New Edtion
		5	Seara : Melgaço	New Edtion
		7	São Pedro da Torre (Valença)	New Edtion
		8	Cabreiro (Arcos de Valdevez)	New Edtion
		18	Pitões das Junias : Montalegre	New Edtion
		19	Tourém : Montalegre	New Edtion
		20	Vilar de Perdizes : Montalegre	New Edtion
		21	Vilarelho da Raia : Chaves	New Edtion
		325-AB	Berlengas : Peniche	New Edtion
		326	Caldas da Rainha	New Edtion
		327	Benedita : Alcobaça	New Edtion
		328	Alcanede : Santarém	New Edtion
		329	Torres Novas	New Edtion
		337	Peniche	New Edtion
		338	Obidos	New Edtion
		339	Rio Maior	New Edtion
		340	Tremês : Santarém	New Edtion
		341	Pernes : Santarém	New Edtion
		349	Lourinhã	New Edtion
		350	Bombarral	New Edtion
		351	Manique do Intendente : Azambuja	New Edtion
		352	Santarém : Oeste	New Edtion
		353	Santarém	New Edtion
		361	A dos Cunhados : Torres Vedras	New Edtion
		362	Ramalhal : Torres Vedras	New Edtion
		363	Aveiras de Cima : Azambuja	New Edtion
		364	Cartaxo	New Edtion
		365	Almeirim	New Edtion
	1:50 000	2_2	Vilar de Perdizes	New Edtion
		2_3	Tourém	New Edtion
		3_3	Vinhais	New Edtion
		6_1	Chaves	New Edtion
		6_4	Montalegre	New Edtion
		7_3	Mirandela	New Edtion
		7_4	Rebordelo	New Edtion
	1:250 000		Mapa Oficial de Estradas de Portugal Continental, IGeoE/INIR	New Edition
	1:500 000		Carta Oficial de Estradas de Portugal Continental, IGeoE/INIR	New Edition

## 5.2. Other publications:

- 5.2.1. Boletim IGeoE 2011
- 5.2.2. Boletim IGeoE 2012
- 5.2.3. Boletim IGeoE 2013
- 5.2.4. Boletim IGeoE 2014
- 5.2.5. Sistemas de Georreferenciação, 4.ª ed. Nov. 2014

## 6. EXHIBITIONS

Published from 2011 to 2014:

**6.1. CartÁFRICA - CARTOGRAFAR ÁFRICA**

Memórias da construção do império à guerra colonial

Authors: Maria Helena Dias, Instituto Geográfico do Exercito

Colaboração: Sandra Fernandes, Luísa Remédios

**6.2. 80 Anos a Cartografar Portugal**

Acção Cartográfica do Exército Português

Legados Seculares

Authors: Maria Helena Dias, Instituto Geográfico do Exercito

**6.3. Odisseia da Carta Geral de Portugal**

A acção de Francisco António Ciera e contributo dos engenheiros militares

Authors: Maria Helena Dias, Instituto Geográfico do Exercito

**6.4. 150 anos do Tratado de limites entre Portugal e Espanha (1864)**

Missões militares de soberania & representações da fronteira

Authors: Maria Helena Dias, Instituto Geográfico do Exercito

Collaboration: Instituto Diplomático do Ministério dos Negócios Estrangeiros



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### **1. INTRODUCTION**

The Portuguese Hydrographic Institute (IHPT), an agency of the Portuguese Navy, was created by Decree-Law No. 43177 of 22 September 1960. The IHPT works in direct dependence of the Admiral Chief of Naval Staff. The National Defense Minister in conjunction with the Education and Science Minister and the Agriculture and Sea Minister define the strategic guidelines and monitor their implementation. The IHPT is recognized as a national State Laboratory, with both administrative and financial autonomy.

The fundamental task of the IHPT is to ensure activities related to the sciences and techniques of the sea, with a view to their application in the military area, and contribute to the Portuguese development in the science and in the protection of marine environment.

Under the new Law of Cartography, in force since 2007, IHPT is the national authority in the matter of hydrographic cartography for public purposes, produced by other entities. In this area, IHPT published in 2008/2009 the following documents:

"Technical Specifications for Planning, Execution and Processing of hydrographic surveys"; and  
"Specifications for the Production of Hydrographic Cartography".

In 2007 a Quality Management System (QMS) was implemented. Procedures for the paper and the electronic navigational chart production were approved under the general chart production program. Obtaining NP EN ISO 9001:2000 Certificate of Compliance proves that IHPT produces its paper and electronic nautical charts with a QMS, which aims to ensure a continuous improvement in achieving high standards of quality, thus increasing customer satisfaction.

### **2. RESEARCH AND DEVELOPMENT**

The IHPT develops research in the scientific areas of hydrography, geodesy, oceanography, geology and chemistry of the marine environment. Examples of these activities, carried out under the following projects:

- Cartography of the Douro River;
- EMODNet;
- Coastal Mapping;
- MONIZEE.

### **3. EDUCATION AND TRAINING**

The IHPT has in its organization a specialized school in hydrographic and oceanographic areas, EHO, which offers, among others, courses accredited by IHO, FIG and ICA.

During the period of this report, IHPT provided 8 internships.

During the period of this report two courses "CAT A" and one "CAT B" (accredited by OHI, FIG, ICA) and several training courses with the software used for Nautical Charts and ENC production were organized. In addition several training courses were organized in the following software tools:

- CARIS Bathy Database;
- IC-ENC Validation Training Course.

#### 4. CARTOGRAPHIC PRODUCTION

IHPT produces Nautical Charts (NC) in paper and Electronic Navigational Charts (ENC) in vector format.

In the context of Nautical Charts production from the Portuguese responsibility areas, production programs were created as follows:

- **New Charts:** The aim of this program is to cover, with New Charts, in different scales, all maritime areas of national responsibility, and other areas where Portugal has assumed international commitments in the context of the International Hydrographic Organization (IHO);
- **New Editions:** The aim of this program is to ensure the coverage of the maritime areas of national interest and responsibility with updated editions of charts previously published.

IHPT produces also other hydrographic cartography such as “Fishery”, “Recreational Boating”, “Bathymetric” and “Sedimentological” Series.

The data produced is based on ETRS89 and ITRF 93 geodetic reference systems.

The Production of the hydrographic cartography (nautical and thematic charts) is carried out by computerized methods since 2004. All charts are stored in a Data Base System and in digital support for print purposes.

A new system was implemented (CARIS HPD) to manage the cartographic data and produce the two different kinds of navigational cartographic products, the Nautical Charts and the Electronic Navigational Charts. CARIS HPD is intended to be the only system to produce and update the hydrographic cartography.

##### 4.1 Nautical Charts

IHPT organizes its NC portfolio as follows:

- **Small scale** charts are provided for passage planning and for navigation out of sight of land. These charts are typically in scales from 1: 1 million to 1: 3,5 million;
- **Medium scale** charts (coastal chart series) are provided for passage along the coast. These charts are typically in scales from 1: 350 000 to 1: 150 000;
- **Large scale** charts are provided for harbour approaches, ports and inner waters. These charts are typically in scales greater than 1: 30 000.

The existing nautical chart portfolio was planned taking into consideration that: the number of charts should be as minimal as possible; should comply with the navigation safety principles; and, be in accordance with the requisites of the International Hydrographic Organization (IHO). The nautical chart portfolio was completed in 2014.

Beyond the production of a nautical chart portfolio, IHPT had also developed two other portfolios: one for recreational boaters (with 12 charts) and other for fishery navigation (with 6 charts). Both recreational and fisheries charts are based on the medium scale nautical charts (1: 150 000). They have the base information from the corresponding nautical chart and meet IHO specifications.

We produce two charts for the Portuguese Navy exclusive use and are also responsible for some International Nautical Charts (INT) from some African Portuguese speaking countries.

The existing nautical chart portfolio aims to meet the specific needs of mariners, lying grouped according to their purpose, in the following series:

- Oceanic;
- Coastal or approach;
- Harbour;
- Approach with harbour or berthing inset;
- Berthing;
- Inland water way;
- Fisheries;
- Recreational Boating;
- Military.

##### 4.1.1 Paper Chart production

Paper chart production is based on CARIS Software. Some developments were conducted using several CARIS modules. Namely: chart correction, several scripts for Quality Control (QC) and spatial data assimilation, using mainly Visual Basic, C and TCL/TK programming languages.

Since 2005, the Nautical Charts are printed on demand (PoD) using large ink jet plotters.

#### 4.1.2 Nautical Paper Charts produced from 2011 to 2014

YEAR	NUMBER	NAME	EDITION
2011	46404	Ilha Graciosa (Planos dos Portos de Santa Cruz, Folga e Vila da Praia)	1 <sup>st</sup> Edition
	27M01	Planos de Portos Militares	2 <sup>nd</sup> Edition
	26312	Barra e Porto de Vila Real de Santo António	3 <sup>rd</sup> Edition
	41101 (INT 1089)	Arquipélago dos Açores	3 <sup>rd</sup> Reprint
	43102 (INT 1893)	Arquipélago dos Açores - Grupo Central	2 <sup>nd</sup> Reprint
	67501	Cabo Verde – Portos das Ilhas de Santo Antão e de São Nicolau	1 <sup>st</sup> Edition
	43101 (INT 1892)	Arquipélago dos Açores – Grupo Ocidental	2 <sup>nd</sup> Edition
	26307 (INT 1879)	Rio Tejo (De Sacavém a Vila Franca)	4 <sup>th</sup> Edition
	26407	Sesimbra (Plano do Porto de Sesimbra)	1 <sup>st</sup> Reprint
	26409	Caminha a Vila Praia de Âncora (Plano do Porto de Vila Praia de Âncora)	1 <sup>st</sup> Edition
	24P02	Aveiro a Peniche	1 <sup>st</sup> Edition
	24202 (INT 1814)	Aveiro a Peniche	3 <sup>rd</sup> Edition
	43103 (INT 1894)	Arquipelago dos Açores – Grupo Oriental	3 <sup>rd</sup> Edition
2012	24P03	Nazaré a Lisboa	1 <sup>st</sup> Edition
	21101 (INT 1081)	Cabo Finisterre a Casablanca	4 <sup>th</sup> Edition
	67502	Cabo Verde – Portos das Ilhas Brava, Fogo, Santiago e Maio	1 <sup>st</sup> Edition
	27M01	Planos de Portos Militares	3 <sup>rd</sup> Edition
	24203 (INT 1815)	Nazaré a Lisboa	2 <sup>nd</sup> Edition
	26303 (INT 1875)	Baía de Cascais e Barras do Rio Tejo (Porto de Lisboa)	9 <sup>th</sup> Edition
	26304 (INT 1876)	Porto de Lisboa (De Paço de Arcos ao Terreiro do Trigo)	8 <sup>th</sup> Edition
	26M01	Baía de Cascais e Barras do Rio Tejo	3 <sup>th</sup> Edition
	23202 (INT 1810)	Cabo Sileiro ao Cabo Carvoeiro	1 <sup>st</sup> Reprint
	33101 (INT 1921)	Arquipélago da Madeira	1 <sup>st</sup> Reprint
	11101	Portugal	2 <sup>nd</sup> Edition
	36201 (INT 1919)	Ilha da Madeira e Ilhas Desertas	1 <sup>st</sup> Reprint
	46406 (INT 1890)	Ilha de São Miguel (Plano do Porto de Ponta Delgada)	1 <sup>st</sup> Reprint
	27502	Portos e Enseadas (Costa Sul – Zona Oeste)	1 <sup>st</sup> Reprint
46407	Ilha de Santa Maria e Ilhéus das Formigas (Plano do Porto de Vila do Porto e da Baía de São Lourenço)	1 <sup>st</sup> Reprint	

	46403 (INT 1891)	Ilha do Faial e Canal do Faial (Planos dos Portos da Horta e da Madalena)	1 <sup>st</sup> Reprint
	46405	Ilha Terceira (Planos dos Portos de Angra do Heroísmo e da Praia da Vitória)	1 <sup>st</sup> Reprint
	46201	Canal de São Jorge (Ilhas de São Jorge e Pico)	2 <sup>nd</sup> Edition
	73201	Pointe Tchitembo à Cabeça da Cobra	1 <sup>st</sup> Edition
	36401 (INT 1992)	Ilha do Porto Santo (Planos da Baía e do Porto do Porto Santo)	1 <sup>st</sup> Reprint
	46401	Ilha das Flores e Ilha do Corvo (Planos dos Portos das Lajes das Flores, Santa Cruz e do Porto da Casa)	1 <sup>st</sup> Reprint
2013	26302	Porto da Nazaré	1 <sup>st</sup> Reprint
	26401 (INT 1870)	Aproximações a Viana do Castelo (Plano do Porto de Viana do Castelo)	1 <sup>st</sup> Reprint
	43102 (INT 1893)	Arquipélago dos Açores - Grupo Central	3 <sup>rd</sup> Edition
	73202 (INT 2550)	Cabeça da Cobra ao Cabo Ledo	1 <sup>st</sup> Edition
	73203 (INT 2560)	Cabo Ledo ao Lobito	1 <sup>st</sup> Edition
	73204 (INT 2570)	Lobito à Ponta Grossa	1 <sup>st</sup> Edition
	73205 (INT 2580)	Ponta Grossa à Foz do Cunene	1 <sup>st</sup> Edition
	72101 (INT 2089)	Gamba a Luanda	1 <sup>st</sup> Edition
	72102 (INT 2050)	Luanda à Baía dos Tigres	1 <sup>st</sup> Edition
	61101 (INT 104)	Lisboa a Freetown	1 <sup>st</sup> Edition
	26305 (INT1877)	Porto de Lisboa (De Alcântara ao Canal do Montijo)	5 <sup>th</sup> Edition
2014	26404 (INT 1873)	Aproximações à Figueira da Foz (Plano do Porto da Figueira da Foz)	2 <sup>nd</sup> Edition
	26302	Porto da Nazaré	2 <sup>rd</sup> Edition
	26410	Póvoa do Varzim e Vila do Conde	1 <sup>st</sup> Edition
	27M01	Planos de Portos Militares	4 <sup>th</sup> Edition
	26402 (INT1871)	Aproximações a Leixões e à Barra do Rio Douro	3 <sup>rd</sup> Edition
	26310 (INT1884)	Barra e Porto de Portimão	5 <sup>th</sup> Edition

## 4.2 Electronic Charts

### 4.2.1 ENC Production Plan

The ENC portfolio, with all planned ENC, was completed in 2014.

The Portuguese ENC portfolio is composed by 113 cells organized in 6 Usage Band as follows:

- Usage Band 1: Overview;
- Usage Band 2: General;
- Usage Band 3: Coastal;
- Usage Band 4: Approach;
- Usage Band 5: Harbour;
- Usage Band 6: Berthing.

In accordance with the IHO recommendations, Portugal should produce some International Nautical Charts (INT) from Africa, as well as the equivalent ENC. IHPT produced one ENC (Usage Band 2) from Angola, Mozambique and Cape Vert. From Cape Vert, twelve more ENC from the main harbours (Usage Band 5) were produced, and we are starting the production of two ENC cells from Usage Bands 4 and 5 (Approach and Harbour) from São Tomé and Príncipe Island.

#### 4.2.2 Quality Control / Quality Assurance

Quality Control / Quality Assurance (QC/QA) of ENC requires not only the verification of all objects correct graphic representation, according to the IHO S-57<sup>(1)</sup> dictionary, but also the integrity of the data in accordance with the IHO S-58<sup>(2)</sup>. IHPT defined that QC/QA of their ENC should be made using the programs included in the tools used for the ENC production, and also with other independent programs. In the final phase of this process, the ENC production is externally audited.

The first step of the QC/QA process is performed using the tools of the production software, CARIS Hydrographic Object Manager (HOM) from USL, and ENCAalyzer from SevenCs.

In the second step it is used software independent from the production process. IHPT choice was dKart Inspector, from HydroService AS.

#### 4.2.3 External Audit

During QC/QA procedures, a large percentage of errors and warnings are detected and corrected. Then the ENC is verified in the environment where it will be used, the Electronic Chart Display and Information System (ECDIS). For that purpose, two software of certified ECDIS systems are used, the Navi Sailor 2400 ECDIS from TRANSAS and the ECPINS from Offshore Systems. The software runs under the S57 file, interprets it and if this file is in agreement with the S57 publication, converts it to a SENC format (System Electronic Navigational Charts). This SENC file represents the database used by ECDIS and is equivalent to the updated paper chart. When visualized in the display, the SENC allows a manual verification of objects and attributes.

#### 4.2.4 ENC Distribution - World-wide Electronic Navigational Chart Database scheme

The first hurdle to the ECDIS acceptance was related with the low quantity of ENC available in number and in coverage. The scheme adopted in 1994 by IHO, had in mind a concept of a world database and makes a perfect distinction between the databases of national data created and updated by each IHO Member State, and the production and diffusion of databases of regional data, under the responsibility of Regional Coordinating Centres (RENC–Regional Electronic Navigational chart coordinating Centres).

Since 2001, the commercialization and distribution of IHPT ENC is carried out through the services of the International Centre for ENC (IC-ENC).

#### 4.2.5 ENC produced from 2011 to 2014

YEAR	NUMBER	NAME	EDITION
2011	PT436401	Ilha de Porto Santo	3 <sup>rd</sup> Edition
	PT436402	Da Ponta Gorda à Ponta de São Lourenço	4 <sup>th</sup> Edition
	PT436406	Ilhas Desertas	2 <sup>nd</sup> Edition
	PT446401	Ilhas das Flores e Corvo	3 <sup>rd</sup> Edition
	PT446404	Ilha Graciosa	2 <sup>nd</sup> Edition
	PT526311	Barra e Portos de Faro e Olhão	3 <sup>rd</sup> Edition
	PT526312	Barra e Porto de Vila Real de Santo António	2 <sup>nd</sup> Edition

<sup>1</sup> IHO Special Publication 57– Transfer Standard for Digital Hydrographic Data .

<sup>2</sup> Special Publication 58, Edition 2 – recommended ENC Validation Checks.

	PT528M03	S. Martinho do Porto	1 <sup>st</sup> Edition
	PT538M01	Fundeadoiro da Enseada da Doca	1 <sup>st</sup> Edition
	PT548507	Porto de Vila da Praia	2 <sup>nd</sup> Edition
	PT548M01	Ilha Graciosa –Santa Cruz	1 <sup>st</sup> Edition
	PT548M02	Ilha Graciosa - Folga	1 <sup>st</sup> Edition
	PT548M03	Ilha de São Jorge - Calheta	1 <sup>st</sup> Edition
	PT548M04	Ilha do Pico - Lajes	1 <sup>st</sup> Edition
	PT548M05	Ilha do Pico – Santa Cruz das Ribeiras	1 <sup>st</sup> Edition
	PT548M06	Ilha de São Miguel - Capelas	1 <sup>st</sup> Edition
	PT548M07	Ilha de São Miguel – Rabo de Peixe	1 <sup>st</sup> Edition
	PT548M08	Ilha de São Miguel – Porto Formoso	1 <sup>st</sup> Edition
	PT548M09	Ilha de São Miguel – Porto de Vila Franca do Campo	1 <sup>st</sup> Edition
	PT548M10	Ilha de São Miguel – Ribeira Quente	1 <sup>st</sup> Edition
	PT56601A	Porto de Porto Novo	1 <sup>st</sup> Edition
	PT56601B	Tarrafal – Ilha de São Nicolau	1 <sup>st</sup> Edition
	PT56603A	Porto Sal-Rei	1 <sup>st</sup> Edition
	PT56603B	Porto Santa Maria	1 <sup>st</sup> Edition
	PT56603C	Baía da Palmeira	1 <sup>st</sup> Edition
	PT627M01	Alfeite - Base Naval de Lisboa	4 <sup>th</sup> Edition
	PT627M02	Doca da Marinha	1 <sup>st</sup> Edition
	PT627M04	PAN Tróia	1 <sup>st</sup> Edition
	PT627M05	PAN Portimão	1 <sup>st</sup> Edition
2012	PT221101	Monte de S.Gian a Ayamonte	2 <sup>nd</sup> Edition
	PT324202	Aveiro ao Penedo da Saudade	5 <sup>th</sup> Edition
	PT343101	Arquipélago dos Açores – Grupo Ocidental	3 <sup>rd</sup> Edition
	PT426408	Aproximação a Sines	5 <sup>th</sup> Edition
	PT526307	Rio Tejo (de Sacavém a Vila Franca de Xira)	3 <sup>rd</sup> Edition
	PT528505	Porto de Leixões and Douro River Entrance	5 <sup>th</sup> Edition
	PT528514	Porto de Sines	5 <sup>th</sup> Edition
	PT528M01	Caminha a Vila Praia de Âncora	1 <sup>st</sup> Edition
	PT528M04	Ericeira	1 <sup>st</sup> Edition
	PT548505	Porto da Madalena	2 <sup>nd</sup> Edition

	PT56601C	Desembarcadouro da Preguiça	1 <sup>st</sup> Edition
	PT56602B	Vale de Cavaleiros	1 <sup>st</sup> Edition
	PT56602D	Porto Porto Inglês	1 <sup>st</sup> Edition
	PT627M01	Alfeite - Base Naval de Lisboa	5 <sup>th</sup> Edition
2013	PT111101	Portugal, Arquipélago dos Açores e Arquipélago da Madeira	6 <sup>th</sup> Edition
	PT324203	Nazaré à Ericeira	4 <sup>th</sup> Edition
	PT324204	Ericeira à Praia das Areias Brancas	5 <sup>th</sup> Edition
	PT343102	Arquipélago dos Açores – Grupo Central	3 <sup>rd</sup> Edition
	PT446201	Canal de São Jorge (Ilhas de São Jorge e Pico)	3 <sup>rd</sup> Edition
	PT548504	Porto da Horta	2 <sup>nd</sup> Edition
	PT56602A	Furna	1 <sup>st</sup> Edition
	PT56602C	Tarrafal – Ilha de Santiago	1 <sup>st</sup> Edition
2014	PT221101	Monte de S.Gian to Ayamonte	3 <sup>rd</sup> Edition
	PT233101	Arquipélago de Madeira	3 <sup>rd</sup> Edition
	PT241101	Arquipélago dos Açores	2 <sup>nd</sup> Edition
	PT271101	Cabinda à Baía dos Tigres	2 <sup>nd</sup> Edition
	PT324201	Vila Praia de Âncora ao Furadouro	5 <sup>th</sup> Edition
	PT324202	Aveiro ao Penedo da Saudade	6 <sup>th</sup> Edition
	PT426404	Aproximações à Figueira da Foz	2 <sup>nd</sup> Edition
	PT526302	Porto da Nazaré	2 <sup>nd</sup> Edition
	PT526303	Baía de Cascais e Barras do Rio Tejo (Porto de Lisboa)	8 <sup>th</sup> Edition
	PT526304	Porto de Lisboa (Ribeira do Jamor ao Terreiro do Trigo)	6 <sup>th</sup> Edition
	PT526305	Porto de Lisboa (Canal do Barreiro ao Canal do Montijo)	6 <sup>th</sup> Edition
	PT528507	Porto da Figueira da Foz	2 <sup>nd</sup> Edition
	PT528M02	Póvoa do Varzim a Vila do Conde	1 <sup>st</sup> Edition
	PT627M01	Alfeite - Base Naval de Lisboa	6 <sup>th</sup> Edition
	PT627M05	PAN Portimão	2 <sup>nd</sup> Edition

#### 4.3 Updates

All ENC, as well as NC, must be kept updated. IHPT also assures the production of the updates to the produced ENC and Nautical Charts.

## 5. PUBLICATIONS

### 5.1 Nautical publications produced from 2011 to 2014

YEAR	NUMBER	NAME	EDITION
2011		Índice de Cartas Náuticas e Cartas Eletrónicas de Navegação de 2011	New Edition
2012		Índice de Cartas Náuticas e Cartas Eletrónicas de Navegação de 2012	New Edition
2013		Índice de Cartas Náuticas e Cartas Eletrónicas de Navegação de 2013	New Edition
2014		Catálogo de Cartas e Publicações Náuticas do Instituto Hidrográfico	New Edition

### 5.2 Articles, Studies and Oral Communications.

- VICENTE, J., MONTEIRO, C., VEIGA, L., SANCHES, P., ARTILHEIRO, F., (2011). “Modelação de dados batimétricos com estimação de incerteza”, Conferência Nacional de Cartografia e Geodesia, Porto
- PRELHAZ, A., (2013) “ A cartografia náutica nos Países Africanos Lusófonos: perspectivas de desenvolvimento”, Dia da Cartografia Hidrográfica, Instituto Hidrográfico, Lisboa.
- SANCHES, P., (2013) “ A cartografia náutica portuguesa na atualidade: da carta de papel à carta eletrónica”, Dia da Cartografia Hidrográfica, Instituto Hidrográfico, Lisboa.
- CRUZ, J, VICENTE, J., MIRANDA, M., MARQUES, C., MONTEIRO, C., ALVES, A. (2014). Benefícios da utilização de sondadores interferométricos. Actas das 3as Jornadas de Engenharia Hidrográfica (junho de 2014), p.21-24, Lisboa – Portugal.
- MONTEIRO, C., ESPINOSA, S., CORREA, A., ALMEIDA, R., MARQUES, C., CRUZ, J. (2014). Colaboração Hidrográfica entre Portugal e Espanha. Actas das 3as Jornadas de Engenharia Hidrográfica (junho de 2014), p.25-28, Lisboa – Portugal.
- MOURA, A., SANCHES, P., MONTEIRO, C., SILVA, M., MARIANO, A. (2014). Integração dos dados LiDAR batimétrico na Cartografia Náutica. Actas das 3as Jornadas de Engenharia Hidrográfica (junho de 2014), p.29-32, Lisboa – Portugal.
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- MIRANDA, M., VICENTE, J., MARQUES, C., CRUZ, J. (2014). Benefícios da utilização do Sistema Sondador Multifeixe EM3002 Dual. Actas das 3as Jornadas de Engenharia Hidrográfica (junho de 2014), p.53-56, Lisboa – Portugal.
- VICENTE, J., ARENGA, M., MARQUES, C., MIRANDA, M., CRUZ, J. (2014). A Equipa Hidrográfica de Intervenção Rápida. Actas das 3as Jornadas de Engenharia Hidrográfica (junho de 2014), p.65-68, Lisboa – Portugal.
- CAPELO, V., VICENTE, J., SILVA, R. (2014). Levantamentos Hidrográficos com Sondador de Feixe Simples. Actas das 3as Jornadas de Engenharia Hidrográfica (junho de 2014), p.69-72, Lisboa – Portugal.



## **LABORATÓRIO NACIONAL DE ENERGIA E GEOLOGIA (LNEG)**

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### **1 – INTRODUCTION**

The National Laboratory of Energy and Geology (LNEG) is a State Laboratory of the Ministry of Environment, Spatial Planning and Energy that makes RD&D oriented to the needs of society and enterprises. Investing in a sustainable research, along with the international best practices, ensures that its areas of expertise allow an adequate response to the needs of the business sector.

LNEG's mission is to promote technological innovation science and technology oriented for economic development contributing to increase competitiveness of economic agents in the context of sustainable progress of the Portuguese economy.

Within the scope of its competences and in accordance with the Portuguese Government's strategies and policies for economic and social development, LNEG takes up the role of an interface between results generated by R&D programs and their technological transfer and integration into the energy and geology productive sector.

LNEG's participation in a broad range of international projects confers it the role of a key partner for internationalization, as well as of a source of specialized information over a number of R&D fields. LNEG was awarded with the "HR Excellence in Research" Logo from the European Commission. This award acknowledges the efforts in implementing the principles of The European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. LNEG is the first Portuguese institution awarded with this Logo. LNEG was certified according to the NP EN ISO 9001:2008 for Quality Management System and with the NP 4457:2007 for the System of Research, Development and Innovation.

### **2 – RESEARCH AND DEVELOPMENT**

LNEG's Laboratory of Geology and Mines (LGM) performs systematic geological and hydrogeological surveys with the preparation of geological and hydrogeological mapping. LGM develops studies on the occurrence, the inventory, the characterization, the evaluation and preservation of geological resources and also conducts studies and research projects on the application of geological knowledge in the areas of geological hazards, location of major infrastructure, geothermal energy, geological storage, CO<sub>2</sub> and in geological heritage.

### **3 – EDUCATION AND TRAINING**

LGM provides education and training in the area of geological and hydrogeological mapping, coastal geology, geological resources, SIGs and in the management and provision of information.

During this report period, several researchers in LNEG finished their PhD and MSc degrees. Additionally, several training courses were undertaken by staff.

### **4 – PRODUCTION**

Maps and databases 2011-2014:

- Carta Geológica de Portugal, Folha 42-A Grândola, 1:50 000, 2011
- Carta Geológica de Portugal, Folha 8-A S. Martinho de Angueira, 1:50 000, 2012
- Carta Radiométrica Nacional, 1:500 000, 2013

- Carta de ocorrências mineiras do Alentejo e Algarve, 1:400 000, 2013
- Carta de Depósitos Minerais da Região Norte, 1:200 000, 2014
- Carta de Recursos Argilosos da Orla Ocidental e Bacias Interiores, 1:300 000, 2014
- Carta Geológica da Região da Grande Beira, Moçambique, 1:50 000, 2011
- Carta Geoambiental da Região da Grande Beira, Moçambique, 1:50 000, 2011.
- Carta Geológica da República da Guiné-Bissau, 1:400 000, 2011.
- Notícia Explicativa da Carta Geológica de Portugal, Folha 06-D Vila Pouca de Aguiar, 1/50 000, 2011
- Notícia Explicativa da Carta Geológica de Portugal, Folha 34-B Loures, 1/50 000, 2011.
- Notícia Explicativa da Carta Geológica de Portugal, Folha 42-B Azinheira de Barros, 1/50 000, 2013.
- Notícia Explicativa da Carta Geológica de Portugal, Folha 11-D Carviçais, 1/50 000, 2014;
- Notícia Explicativa da Geológica da Região da Grande Beira, Moçambique, 1:50 000, 2011
- Notícia Explicativa da Carta Geoambiental da Região da Grande Beira, Moçambique, 1:50 000, 2011.

LNEG disseminates knowledge to society through the GeoPortal (<http://geoportal.lneg.pt/>) infrastructure supporting integrated management and spatial data visualization, which aims to provide, in a web environment, geo-referenced information on the activities of LNEG.

LNEG provides the WMS (Web Map Service) and WFS (Web Feature Service) services for the Geological Map of Portugal, scale 1:1M as well as the metadata for the One Geology -Europe project.

## 5 – PUBLICATIONS

Major publications in international journals

- Alvarenga, P., Simões, I., Palma, P., Amaral, O., Matos, J. X., 2014. Field study on the accumulation of trace elements by vegetables produced in the vicinity of abandoned pyrite mines. *Science of the Total Environment*, 470–471, 1233-1242 (doi: 10.1016/j.scitotenv.2013.10.087).
- Álvaro, J. J., Ezzouhairi, H. Clausen, S. Ribeiro M. L., Solá, R., 2014. Syn-rift unconformities punctuating the lower–middle Cambrian transition in the Atlas Rift, Morocco. *International Journal of Earth Sciences* 104, 3, 753-773, (doi: 10.1007/s00531-014-1108-4).
- Baroncini-Turricchia G., Francés A. P., Lubczynski M., Martínez-Fernández J., Roy J., 2014. Integrating MRS data with hydrologic model - Carrizal Catchment (Spain). *Near Surface Geophysics*, 12, 2, 255 - 269 (doi: 10.3997/1873-0604.2014003).
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- Bento dos Santos, T., Munhá, J., Tassinari, C., Fonseca, P., 2011. The link between partial melting, granitization and granulite development in central Ribeira Fold Belt, SE Brazil: new evidence from elemental and Sr-Nd isotopic geochemistry. *Journal of South American Earth Sciences*, 31, 2-3, 262-278 (doi: 10.1016/j.jsames.2011.01.004).
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## **ESTRUTURA DE MISSÃO PARA A EXTENSÃO DA PLATAFORMA CONTINENTAL (EMEPC)**

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### **1. INTRODUCTION**

The Portuguese Task Group for the Extension of the Continental Shelf (EMEPC) was established by the Council of Ministers Resolution No. 9/2005 of 17 January, having succeeded to the Interministerial Commission of the Continental Shelf, which led the project from 1998 to 2004. The EMEPC mandate was repeatedly extended by resolutions of the Council of Ministers No. 26/2006 of 14 March, No. 55/2007, dated April 4, and No. 32/2009 of April 16. Currently, EMEPC is governed by the provisions of the Resolution of the Council of Ministers No. 3/2011 of 12 January, in conjunction with the provisions of Decree-Law No. 7/2012 of 17 January (Article 34, paragraph 4, point h) and Decree-Law No. 18/2014, of February 4 (Article 2, paragraph p).

EMEPC is a governmental institution with the purpose of preparing and follow up the Portuguese Continental Shelf Extension Project. Currently is composed of about 30 members spread over several projects that make use of geographic information: PEPC –Extension of the Continental Shelf Project, M@rBis - Marine Biodiversity Information System, SNIMar - National Information System for the Sea. EMEPC also acts as a partner in BioMar PT project coordinated by IPMA (Portuguese Institute of the Sea and Atmosphere).

As mentioned before, EMEPC was assigned with the mission of preparing a proposal for the extension of the Portuguese continental shelf, beyond the 200 nautical miles. The resulting report was already delivered to the Commission on the Limits of the Continental Shelf (CLCS) in May 2009 and awaits the appointment of the subcommittee that will evaluate it. Further work is needed not only to better substantiate the legal and technical aspects of the delivered report but also to defend it before the commission.

### **2. RESEARCH AND DEVELOPMENT**

EMEPC's projects that use geographical information are the following:

#### **2.1. EXTENSION OF THE CONTINENTAL SHELF – PEPC**

On the scope of the PEPC, EMEPC aims to gather scientific information to delineate the outer limits of the Portuguese continental shelf and use it to prepare and submit a report to the CLCS (already delivered in May 2009). It is thus the responsibility of EMEPC to continue this process in accordance with the terms of the UNCLOS. Currently Portugal awaits, by the constitution of the sub-committee (from the CLCS elements), which will directly evaluate its proposal.

In this context, and to fulfill EMEPC's goals ("*... to prepare the database structure to support the extension of the continental shelf project (PEPC), in order to be able to serve, in the future, an integrated monitoring and management system for the ocean.*") a Marine Spatial Data Infrastructure (MSDI) to support the PEPC, name InforM@r is currently being developed. This MSDI gathers various types of marine data (gathered during the PEPC) and allows those who work in the continental shelf submission an easy access according to their specific needs. InforM@r is being developed using only open source technology, and the generated products meet the international standards in what regards geographic information.

EMEPC also uses a hydrographic data repository, called HDW - Hydrographic Data Warehouse, which stores and manages all bathymetric data used to support the extension project.

Until the establishment of the sub-committee it is possible to gather new Hydrographic, Geologic and Geophysical data to better justify the delivered report. To do so, vessels equipped with various sensors and capable of performing operations in the deep sea using the Luso ROV, are being used.

The Luso ROV is a remotely operated vehicle, capable of diving until 6000m depths. For Portugal, it means the ability to reach 100% of the ocean floor under national sovereignty (including the corresponding area of the extension of the continental shelf) and 97% of the seabed on a global scale. This equipment was purchased in 2008, on the scope of the PEPC, in order to make the selective collection of geological seafloor samples, for

scientific support of the Portuguese submission. It is also used to collect information for the M@rBis project by sampling and mapping, with analysis of high definition image, biological species in places where information is very scarce or even inexistent.

For Portugal the purchase of the Luso ROV represents the possibility of using this state of the art technology for a unique set of multidisciplinary research activities, development and innovation.

EMEPC held several scientific campaigns since 2006, including the following, from 2012 until 2015:

- **EMEPC/PEPC/Luso/2012**

The 2012 EMEPC oceanographic campaign, which took place between September 20 and October 6, had as main objective to collect rock samples on the southern side of the Portugal's continental shelf outer limit, next to Hayes Fracture Zone. However, even in Setubal Canyon, Luso ROV and the EMEPC pilot's team supported the CARCACE research project. Already in the Azores another dive was performed in Serreta's submarine volcano, in the vicinity of Terceira Island to collect rock samples under the collaboration with TerRiftic research project.

At latitude 33° North, the campaign faced the approach of Hurricane Nadine that forced a change on the sampling area, moving eastward towards the Madeira archipelago. The goals were thus redirected to collect data on seamounts along the Madeira-Tore Rise. Dives were performed southern of Madeira Island in the Siene, Josephine, Jo-sister, and Pico-Pia seamounts with a significant amount of geologic and biologic samples.

- **EMEPC/PEPC/Luso/2013**

2013 EMEPC's oceanographic campaign took place between June 3 and July 22, and had as main objectives the collection of geologic samples for the PEPC in the King's Through macrostructure, located on the NE edge of the outer limit of the Portuguese continental shelf at latitude 43° North, and consolidate the Portuguese team of ROV pilots and technicians. This campaign was also associated with the visit of the President of the Republic of Portugal to Selvagens Islands where two more dives were performed, first in the Selvagens Islands and the second in the Gorringe Bank for biological information collection within the M@rBis Project.

In order to support other research projects, additional dives were performed in the Condor seamount on the scope of the CARCACE project.

- **SUBVENT-2 LEG Madeira**

The SUBVENT-2 LEG Madeira campaign, was held between 4 and 10 April 2014 onboard the Spanish research vessel *Sarmiento de Gamboa*, in order to acquire data to better substantiate the extension of the continental shelf of Portugal in that region. SUBVENT-2 LEG Madeira resulted, once again, of technical and scientific cooperation between Portugal and Spain. Portuguese researchers from EMEPC and researchers from *Instituto Geológico y Minero, Instituto Español de Oceanografía, Universidad de Cádiz* and technicians from *Unidad de Tecnología Marina* of Spain were involved. The objective of this campaign was related with the investigation of the occurrence of massive sediment movement processes along the Madeira slope and adjacent abyssal plain, using bathymetry and high and medium resolution seismic reflection data acquisition.

- **EMEPC/PEPC/Luso/2014**

During the 2014 oceanographic campaign, from May 27 to June 22, the main objective was to collect geological samples on the northern edge of the outer limit of the Portuguese continental shelf at latitude 48° North near Maxwell Fracture Zone. The campaign was held on board the NRP *Almirante Gago Coutinho* and the training period with the ROV Luso took place off Cabo de S. Vicente. Like in previous years, the work was undertaken by a multidisciplinary team of several technicians and researchers with added value in the areas such as robotics, engineering, geology, biology and oceanography, in order to fully take advantage of the collected datasets and samples. This team was joined by researchers from Israel and Cape Verde within EMEPC's collaboration framework. The team also hosted a young researcher from Thailand who will receive training in geology and oceanography, having been selected by the training of young researchers from developing countries program, from the International Seabed Authority.

- **EMEPC/PEPC/LUSO/2015**

The campaign EMEPC/PEPC/LUSO/2015 took place between May 25 and June 3, off Portugal aboard the NRP *Almirante Gago Coutinho*, aiming to continue collecting Portuguese deep waters data.

Apart from a better knowledge of the Portuguese continental shelf and the Portuguese sea, campaign objectives were also oriented to the various EMEPC projects. In particular the development of Luso ROV system and the marine biodiversity mapping within the framework of M@rBis project. The results of this campaign will target the school environment by preparing educational activities within EMEPC's "Kit do Mar" project.

EMEPC's operational capability makes possible working in collaboration with public or private institutions in other countries. In addition to the campaigns carried out at the national level, the ROV Luso held in 2014 two international campaigns that aimed to support scientific research in the Gulf of Cadiz and the Canary Islands:

- **MOWER14 LEG1**

The MOWER14 LEG1 campaign was held at Gulf of Cadiz area between 1 and 12 September 2014, within the Spanish research project with the same name, aboard the Spanish research vessel *Sarmiento de Gamboa*. The main objective of this project is to study the erosive and sand deposits aspects associated with the Mediterranean Water along the Iberia, and its paleoceanographic, sedimentary and economic implications. Biological, sediments and rock samples were collected using the Luso ROV. After the success of SUBVENT-2 campaign, the MOWER14 LEG1 campaign stood itself as another opportunity for technical and scientific cooperation between Portugal and Spain by using the EMEPC's Luso ROV. Once more, under the EMEPC's collaboration framework, the campaign was joined by a team of researchers from different countries and institutions, including Portugal, Spain, Italy and the UK.

- **SUBVENT – 2**

Between 9 March and 13 April 2014 took place the SUBVENT-2 campaign, a joint expedition for the seabed exploration with the Luso ROV which allowed gathering images of the seabed of the Gulf of Cadiz, Canary Islands and Madeira, aboard the Spanish research vessel *Sarmiento de Gamboa*. This expedition was the result of the scientific cooperation between Portugal and Spain and aimed to sample and analyze existing mud volcanoes in the Gulf of Cadiz between 1000 and 3000 meters deep. In the Canary Islands were also collected for the first time underwater images of the volcanic relief formed during the last eruption off the island of El Hierro starting in late 2011.

The permanent presence of multidisciplinary teams on board of all the EMEPC's oceanographic campaigns aims to maximize the potential arising from the vessel time operation at sea, particularly with respect to data acquisition and creation of scientific knowledge.

## **2.2. M@RBIS – MARINE BIODIVERSITY INFORMATION SYSTEM**

M@rBis is a national marine biodiversity information system, whose main goal is to provide geographic information necessary to the fulfillment of the commitments arising from the extension of the Natura 2000 network (RN2000) to the marine environment, in waters under national jurisdiction. The M@rBis Project is coordinated by EMEPC, in collaboration with Portuguese and international scientific community, Portuguese associated laboratories and other relevant institutions.

Thus M@rBis seeks to serve as a decision support tool within the RN2000 and be a powerful planning and analysis tool to the scientific community.

Towards the development and implementation of M@rBis several scientific campaigns have been held annually since 2010, aiming to conduct an inventory and census of marine species on national waters. To gather marine biodiversity information, diving operations with experimental protocols (visual censuses, sampling with squares, conspicuous species registration, photographic and video recording, etc.) are followed by sorting the material on board and insertion of data into the M@rBis database. These campaigns rely on the cooperation and participation of the scientific and academic national and international community.

The M@rBis scientific campaigns, held on the period of 2011 – 2015 were the following:

- **EMAM/PEPC\_M@rBis/2011**

The EMAM/PEPC\_M@rBis/2011 Campaign was held aboard the NTM *Creoula* from June 15 to July 25 2011, in Desertas islands, Madeira and Porto Santo, Formigas islets and Santa Maria island. The Campaign was co-organized with the Department of Science of the Funchal's Municipal Council, the Regional Directorate for Sea Affairs of the Government of the Azores and the Department of Oceanography and Fisheries of the University of the Azores, aiming the characterization and cataloging of species and habitat mapping.

- **EMEPC/M@rBis/Berlengas2012**

The EMEPC/M@rBis/Berlengas2012 Campaign, from 17 to 30 September 2012, aboard of NTM *Creoula* took place off the Berlengas Islands. The campaign aimed to map and characterize the marine species and habitats in the surroundings of the Berlengas Islands, allowing to fill site information gaps.

- **EMEPC/M@rBis/Algarve2013**

From June 12 to 10 July 2013, the Campaign EMEPC/ M@rBis/Algarve2013 was held on the Algarve coast, aboard the NTM *Creoula* with dives up to 30 m deep at points of interest. The main objective of the campaign was cataloging fauna and flora of the Algarve, mapping and characterizing species and marine habitats of the study area.

- **EMEPC/M@rBis/Arrábida2014**

From September 20 until October 4 2014, the EMEPC/M@rBis/Arrábida2014 Campaign was held, aboard the NTM *Creoula* in Sesimbra - Cabo Espichel area. The *Vera Cruz* caravel and the sailboat *Blaus VII* of the Naval Academy also joined this campaign. The purpose was to catalogue and perform inventories and characterization of marine biodiversity on the study area, with special focus on Professor Luis Saldanha Marine Park.

- **EMEPC/M@rBis2015**

The EMEPC/M@rBis2015 Campaign took place between May 25 and June 5 aiming the characterization of marine biodiversity Lisbon-Oeiras-Cascais area up until Cabo da Roca.

The intertidal zone of Avenças Biophysical Interest Area up until Parede was also studied and the characterization of existing non-indigenous species in this area was conducted under the BioMar PT project, on which EMEPC is a partner. It is also worth mentioning the various underwater archeology operations carried out on the scope Underwater Archaeological Chart of the Municipality of Cascais.

### 2.3. SNIMAR

The SNIMar - National Information System for the Sea, project is an initiative that aims to facilitate access to information on the marine environment in Portugal. The SNIMar will develop a geoportal supported by MSDI to enable users to share, search and access to information about the marine environment and the related activities. EMEPC is the promoter of this a pre-defined project of the programme "Integrated Management of Marine and Coastal Waters" of the financial mechanism of the EEA Grants, co-financed by the EEA Grants. Its framework follows the provisions of Directive 2007/2/EC of the European Parliament and of the Council of 14 March (INSPIRE directive), transposed by Decree-Law No. 180/2009 Decree of 7 August.

### 2.4. BIOMAR PT

The BioMar PT project is an initiative that aims to contribute to increase skills of public and private entities staff to ensure the implementation of the "Marine Strategy Framework Directive" (MSFD) in Portugal mainland. Providing training and technical skills for performing seabed and habitats mapping; compiling data related to MSFD relevant descriptors; identifying key-species or associations of species as ecological indicators and analysis of the feasibility of the assessment criteria of MSFD Good Environmental Status to the national waters, and improvement of those criteria.

This project results from a partnership between EMEPC, IPMA(project promoter) and CIIMAR, EEA Grants funding programme and the Portuguese Government, EEA PT02 - Notice No. 6, for their contribution to the qualification of human resources in the public and private sectors in various areas of expertise necessary to implement the MSFD.

### **3. EDUCATION AND TRAINING**

#### **3.1. PEPC**

EMEPC's vision, under the National Strategy for the Sea, is the return of Portugal to the sea, supported by knowledge and technological development and by the new territorial dimension, resulting from the Continental Shelf Extension Project.

This new territorial dimension embraces a wide array of opportunities based on knowledge and innovation that will continue to be enhanced through inter-institutional collaboration leading to the improvement of Portuguese employment and living conditions.

The particular specifications to accomplish EMEPC's mission, results in better technical and scientific ability to explore the deep sea, setting Portugal as an internationally recognized partner. In this context, EMEPC has been the promoter of various projects that reinforce this capability.

Some of EMEPC's goals take in consideration Education and Training including:

- *"To promote research and development projects with focus on PEPC's data and information exploration"*
- *"To reinforce the number of researchers nation wise with PEPC related PhD graduations, especially in geographic information systems (GIS), geology, geophysics and public international law."*
- *"Promote the participation of students and researchers on the PEPC "*
- *"Giving support to other States on the scope of their Continental Shelf Extension projects"*

#### **3.2. M@RBIS**

The M@rBis project alongside with other national and international research centers and universities, has contributed decisively to better know Portugal's marine biodiversity. M@rBis campaigns rely on national and international researchers performing various tasks related to their own projects, and students from different levels of education.

#### **3.3. SNIMAR**

Recently EMEPC has been leading the National Information System for the Sea (SNIMar) which aims to establish itself as a useful support tool for everyone involved in marine related activities. SNIMar has over a dozen grant scholarships for its development. There will be training sessions provided by the donor partners of the project: Norwegian Mapping Authority (Norway) and National Land Survey of Iceland (Iceland), having already held two on the implementation of a national infrastructure sea data, standards and geographic information standards (metadata and spatial data services), and technologies and open source software.

#### **3.4. BIOMAR PT**

BioMar PT Project includes training sessions to senior technicians who work for public administration, graduates and bachelors, from public and private entities in areas that contribute to the implementation of the MSFD. EMEPC will promote a total of 25 Geographic Information Systems (GIS) applied to Marine Biodiversity training courses. The trainees will acquire technical skills in the context of standardized classification methodologies of habitats and georeferenced information processing, in order to perform basic analysis operations of geographic information with interaction of different platforms and data formats. GIS systems will have a transversal application to various MSFD descriptors (D1, D2, D6, D8 and D10), since the mapping and spatial analysis of data acquired under various descriptors will be essential for assessing the good environmental state of marine waters.

### **4. PRODUCTION**

#### **4.1. EMEPC**

All the Oceanographic Campaigns undertaken by EMEPC contributed to the significant amount and variety of data and samples of Hydrology, Geology, Geophysics, Geochemistry and Biology.

Upon authorized request, EMEPC has provided numerous datasets to national and international researchers and institutions that can only be used for the expressly authorized purposes.

In the period between 2008 and 2014, 110 data requests were accepted by EMEPC, 86% of which from national institutions and 14% foreign. Biological samples (48.3%) are the most requested followed by Hydrography (26.7%), Geophysics (9.5%), Geology (7.8%), Oceanography (6%) and Outreach (1.7%). Universities and research centers



stand as the ones that post the higher number of requests (68.1%), followed by Institutes/state agencies (26.7%), Museums/Natural Parks (3.4%), schools (0.9%) and private entities (0.9%).

All the data is processed in such way to fulfill EMEPC's and associated projects needs. However, depending on the request it may be necessary to perform a specific processing.

Some of the data is confidential and cannot therefore be shared. Given this fact EMEPC reserves the right not to authorize sharing them.

#### **4.2. M@RBIS**

Within the M@rBis project a web mapping application was developed which is updated on a daily basis during the campaigns.

The application has the most common navigation tools such as zoom, pan, select, search, ability to turn on and off layers, change their order, access the attribute table, change the background map, measure distances and areas, and print maps.

#### **4.3. SNIMAR**

With the SNIMar project reaching a year old, there are already two available products: Collaborative keywords and Metadata Profile SNIMar.

The Collaborative Keywords application was developed to fulfill the need of a marine environment terms and definitions dictionary. Thus the terms identified as keywords associated with spatial datasets are well defined and accepted by the user community. It is possible to change existing keywords or propose new ones. After validation by a group of experts they can integrate the final keyword list.

The SNIMar metadata profile is based on the ISO 19115 standards, INSPIRE implementing rules and the national geographic data profile - MIG.

#### **4.4. PEPC's ATLAS**

Additional tasks are also part EMEPC's objectives, including *"To promote the publication of PEPC's data and information atlas"*. The release of the Atlas publication was completed in 2014.

### **5. PUBLICATIONS**

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## **INSTITUTO DE CONSERVAÇÃO DA NATUREZA E DAS FLORESTAS (ICNF)**

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### **1 – INTRODUCTION**

The Forestry and Nature Conservation Institute is a body of the Sea and Agriculture Ministry and has its head-office in Lisboa, whose mission is to

- propose, monitor and ensure the implementation of conservation policies of nature and forests;
- promote the conservation, sustainable use, appreciation, enjoyment and public recognition of the natural heritage;
- promoting sustainable development of forests and associated resources;
- increasing the competitiveness of the forestry sector;
- ensure the structural prevention as part of the planning and concerted action;

in the field of forest protection and hunting resources and aquaculture in inland waters and others directly associated with forest and forestry activities.

#### **1-1 Main Activities**

The ICNF plays the national authority functions for the conservation of nature and biodiversity and national forest authority, ensuring compliance of the respective legal regimes objectives;

It promotes the implementation of the National Conservation Nature and Biodiversity and National Strategy for Forests Strategy, as well as the coordination and integration of conservation objectives and sustainable use of natural resources in development policy of the territory and different sectorial policies and ensures the monitoring of implementation and compliance issues of Community and international law, and international representation in matters within its competence.

### **2 – RESEARCH AND DEVELOPMENT**

The main geographical information that ICNF produces is:

#### **2.1 Classified Areas**

Areas cartographically defined and delimited of the national territory and waters under national jurisdiction that, depending on their relevance to the natural conservation and the biodiversity. They are covered by specific regulation. This areas includes protected areas and Sites of Community Importance (SCI), Special Protection Areas (SPA)-

#### **2.2 Protected Areas Management Plan**

Plan and manage Protected Areas and its natural values using different thematic cartography that establishes protect regimes.

#### **2.3 Habitats and Bird Directive**

The national report on the implementation of the Habitats Directive (2007-2012) and Bird Directive (2008-2012) included a distribution maps for the renewed assessment of conservation status for species and habitats. The distribution maps will consist of 10 x 10 km ETRS 89 grid cells in the ETRS LAEA 52 10 projection. The gridded data consist of the 10 km grid cells where the species or habitat type is recorded as occurring. In some exceptional cases such as values with poorly knowledge were submit maps of 50 x 50 km. The links <http://www.icnf.pt/portal/naturaclas/rn2000/dir-ave-habit/rel-nac/rel-nac-07-12> and <http://www.icnf.pt/portal/naturaclas/rn2000/dir-ave-habit/rel-nac-art-12-diretiva-aves-2008-2012> presented all the cartographic information.

#### **2.4 Monitoring programme of cave-dwelling species**

A monitoring programme of the cave-dwelling species is in progress since 1987, coordinated by ICNF. This programme involves the estimation of bat numbers present in the most important wintering and maternity roosts. The surveys are carried out annually in most of the roosts. Recently, a report on the analysis of the data collected between 1988 and 2012 (ICNF, 2014) includes the trends of cave-dwelling species and the characterization of the 76 important roosts (seasonal occupation and evolution of the estimates of the most common species). The report can be consulted in the link <http://www.icnf.pt/portal/naturaclas/patrinatur/resource/docs/Mam/morc/prog-abri-sub1988-2012v3>

#### **2.5 Atlas of Portuguese bats (mainland)**

The Atlas project came up with the overall goal of doing an update of knowledge on the distribution of continental Portugal bats, responding to a need for cartographic information that is critical to the definition of land management measures relevant to the conservation of bats. The occurrence of the species was mapped in squares UTM 10x 10km.

#### **2.6 Monitoring water colonial birds**

Every year are identified the distribution of species that use wetlands, in particular species of colonial Ardeidae. The results of the distribution are presented in squares UTM 10x10km and by river basin. The report can be consulted in the link <http://www.icnf.pt/portal/naturaclas/ei/cempa/pp-monit/monit-aq-colon>.

#### **2.7 Monitoring white stork (*Ciconia ciconia*)**

In 2014 it was carried out in Portugal (mainland) the sixth national census of White stork, mapping the number of nests per municipality.

#### **2.8 Spanish imperial eagle (*Aquila adalberti*)**

Since 2008, ICNF, namely the Working Group for the imperial eagle, coordinates an annual monitoring scheme of the national breeding population of imperial eagle. The all-year observations of the species in Portugal were also gathered recently. The territories occupied by breeding pairs are characterized in terms of land use, nest preferences and main threats. The members of the breeding pairs are also identified each year in order to detect possible replacements of the members of the pair. This information is gathered in a GIS, coordinated by the working group. Internal annual reports are produced but they are not available due to the inclusion of sensitive information about the location of the nests.

#### **2.9 National Forest Inventory**

The National Forest Inventory (NFI) is the national-level evaluation and monitoring process of the Portuguese forest resources. The first NFI was developed in 1963, and since then a new NFI is completed in an approximate 10 years interval cycle. Presently, the 6th NFI is on-going and published results are expected for 2016. Within NFI framework, thematic cartography on forest land cover by tree species is produced and made available to public. This cartography is based on information obtained from aerial imagery and specific field surveys. In the earlier NFIs wall-to-wall 1:25,000 cartography for the Portuguese mainland territory was produced. In the more recent NFIs, a point sampling procedure, based on a national 500x500 grid, is the basis for land use/land cover data collection. Based on that large georeferenced dataset thematic land use and land cover cartography for a nominal scales of 1:500,000 are produced. The NFI results and its evolution over time are the basis for regional and national forest planning and are a main source of information for several international reporting processes, as are examples the UN-FAO Forest Resources Assessment, the UNFCCC and Kyoto protocol compliance reporting procedures. More information can be obtained from: <http://www.icnf.pt/portal/florestas/ifn>.

#### **2.10 Forest Fires**

The Forestry and Nature Conservation Institute (ICNF) is responsible, since 1990, for the production of yearly burnt area cartography, from continental site. This cartographic information is available for public on ICNF website. The European Forest Fire Information System (EFFIS), of the European Commission, supply this institute with cartographic information of burnt areas, obtained with low resolution satellite images.

ICNF has a partnership with Superior Institute of Agronomy – Forestry Department from where burnt areas cartography is produced, by using MODIS and LANDSAT satellites. Since 2007, risk site mapping is also produced.

It produces different cartographical information (fuel management, infrastructures, planning, etc.) and puts it available to National Authority on Civil Protection, becoming a decision support basis of relevant importance in what matters firefighting.

ICNF is compiling and integrating municipalities and district forest plans against fire.

#### **2.11 Sanity**

Development of a data bank that warehouses all operations related to quarantine organisms, eradication and prospection.

#### **2.12 Public Interest Trees**

ICNF produces cartography related to Public Interest Trees and maintain a database available to public. These Trees are classified as monuments because of their exceptional dimension, age, history, culture or special features and are iconographic for locations where they exist. The importance of classifying such trees relies on population awareness, conservation of biological heritage, historical motivations and as a source of value for increasing tourism, particularly ecotourism, around locations they are in. This cartography includes single trees, malls and clumps.

#### **2.15 Hunting**

In December 31, 2010 there were 4479 georeferenced specially managed hunting units, representing approximately 87 % of the Portuguese territory.

#### **2.16 Inland fisheries**

Between 2004 and 2010 ICNF developed the project “Projeto Aquariport – Programa Nacional de Monitorização de Recursos Piscícolas e de Avaliação da Qualidade Ecológica de Rios”, involving ADISA – Associação para o Desenvolvimento do Instituto Superior de Agronomia, ISA - Instituto Superior de Agronomia and ESAB – Escola Superior Agrária de Bragança. Monitoring involved 320 georeferenced points, and each should be sampled every 6 years.

Since 2004, ICNF has been developing a geographical database of fish passes existing in inland waters. ICNF has also been developing the geographical database of inland aquaculture and fishing areas managed by ICNF, Municipalities or fishing associations.

#### **2.17 Desertification**

Under the ICNF coordination between 2010 and 2014 was developed a new United Nations Convention to Combat Desertification National Action Programme (approval on 24th December) with the support of the monitoring and indicators for progress adopted by the convention, specially “Susceptible to desertification areas” (Aridity Index for 1980 / 2010 series), and “Land Degradation Index” (for 2000/2010 series, see San Juan et al 2011 e del Barrio et al. 2010).

### **3 - EDUCATION AND TRAINING**

During the period 2011-2015, ICNF has carried training courses in QGIS and in some special themes, like Coordinate Reference Systems and thematic analysis with GIS.

### **4 – PRODUCTION**

The main cartographic products are in progress and are frequently actualized (already described in chapter 2).

### **5 – PUBLICATIONS**

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- The core data and metadata from ICNF are available on the SNIG services, it can be consulted.

## **DIRECÇÃO REGIONAL DA CIÊNCIA, TECNOLOGIA E COMUNICAÇÕES (DRCTC)**

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### **1 – INTRODUCTION**

The Azorean Region is composed by 9 islands, aggregated in three groups: West, Central and East. The west group has the islands of Flores and Corvo; the central group is composed by the islands of Graciosa, Terceira, Pico, Faial and S. Jorge; finally, the eastern group has two islands: S. Miguel and Santa Maria.

With the decree law n. 362/2007 of 2<sup>nd</sup> November, were transferred to the Azores the attributions of the Portuguese Geographic Institute (IGP), in its regional context, in the fields of geodesy, cartography and cadastre. The regional decree n. 4/2011/A, approves Science, Technology and Equipment Regional Secretary (SRCTE) new structure and sets the referred attributions to Science, Technology and Communications Regional Directorate (DRCTC), among others, as follows:

- Promote the implementation of the regional geographic information system;
- Consider and formulate proposals for continued and improving the regional geodetic reference;
- Promote and disseminate mapping coverage of the regional territory;
- Promote the execution and conservation of regional cadastral parcels;
- Develop and propose legislative and regulatory necessary measures for the regulation of the production of geographic information, cartography and cadastre;
- Promote the referencing and identification of rural and urban buildings in the region;
- Monitoring the activity of entities licensed by the Portuguese Geographic Institute in the Azores;
- Cooperate with other agencies with interest in geographic information, mapping cadastre, in in order to adjust information contained in files and databases, and implementation of GIS sectored projects, or research projects;

### **2 – RESEARCH AND DEVELOPMENT**

#### **2.1 – Azorean Interactive Spatial Data Infrastructure (IDEiA)**

IDEiA is a GIS project, which has as main objective the development and management of a Reference Infrastructure for Spatial Data in Azores. This project aims to include at first, all Regional Government entities, and subsequently extend its scope to municipalities in the Azores, public institutes, the University of the Azores and businesses.

The fundamental aspect of this project lies in the ability of this infrastructure will make available spatial data services to those entities and the general public, they can access content whenever possible, in a free and without cost, such as orthophotos and / or base maps.

Given the existing guidelines by the EU with the Inspire Directive and the importance of infrastructure for spatial information as a vehicle to support access to datasets and spatial data services, it appeared necessary to establish appropriate coordination structures at the regional level, taking into account the division of powers and responsibilities in the production and sharing of geographic information. As said, it was established InspireAçores, within IDEiA, in order to make sure the Directive is correctly applied in the region. In this project it has been developed a metadata application to create metadata in the region, as well as the interpretation of data models and implementing rules of Inspire.

### **3 – EDUCATION AND TRAINING**

During the period 2011-2015, DROPC has received several training students from Technological Schools. These trainings last from one to two and a half months.



## **4 – PRODUCTION**

### **4.1 – SIGEndA**

According to the EU Directive INSPIRE, the various European regions should provide several themes of spatial data, including the one listed in Annex 1 as the fifth priority, "Addresses". Address is defined in the Directive as: "Location of properties based on address identifiers, usually the name of the street, the house number and postcode."

Despite the public nature of this information, it is primarily the responsibility of the Municipalities, as they have the assignment in the names of roads and the numbers. However, most of Municipalities in the Azores do not have a geographic database with this information, or when they have, it is not in accordance with the data model required by the Directive. Inspired by the urge to find alternatives, the regional government started this project, SIGEndA, in 2009 and we have been working in the compliance to inspire regulations. At this time, it is available to the public through a website (<http://ideia.azores.gov.pt/sigenda.aspx>), and there have been contacts with municipalities in order to participate in the maintenance of this information at the same time they access to the database.

### **4.2 – Pilot Project of Cadastre**

The pilot project was developed in order to test the proposed changes to the land register, with the application of new technologies and work methods, as well as with the implementation of the provisions of Inspire. It was intended to provide the region with a set of exhaustive, methodical and updated data, characterizing and identifying the owners of existing properties in the area. Its implementation is an indispensable tool for land-use planning policies, environment, economic, fiscal and public works, using new methods of acquiring registration information. This project lasted for six months, in the second half of the year, being completed in 2012. The work area was Cabo da Praia in Praia da Vitória Municipality.

### **4.3 – Digital conversion of Geometrical Cadastre**

DROPC continued the process, initialized by IGP, of digitalization into vector the Geometric Cadastre of S. Miguel Island, the only one existing in the region. Together with the Inspire Directive and its data modelling, we hope to allow citizens and all entities to access this data using IDEiA project.

### **4.4 – REPRAA**

In 2007 it was established the regional network of permanent reference stations (REPRAA). It started with one station, in Furnas (S. Miguel Island). Thanks to collaboration with IGP, research centres and municipalities, REPRAA has grown, and it has now 10 stations in all groups. REPRAA provides GNSS data for post-processing and RTK services and is testing network corrections. All services are free and can be accessed in through REPRAA's website ([www.repraa.azores.gov.pt](http://www.repraa.azores.gov.pt)).

### **4.5 – INSPIRE**

We have been developing data models, Inspire complied, in order to be used by the public entities in Azores. Therefore have been developed data models to all themes of the 3 Annexes of the Directive, which are available to download in <http://www.ideia.azores.gov.pt/projetos/inspire/Paginas/modelos-dados.aspx>. Corine Land cover 2006 view services are also available.

It has also been developed a metadata editor, GeMA. The production of metadata files for the spatial data sets and the spatial data set series in accordance to Inspire specifications it is also necessary to the spatial data services and to the correct behaviour of the network services also provided by the Directive and currently under development and implementation by the Azorean Regional Government.

## **5 – PUBLICATIONS**

«Metadata Manager of the Azores (GeMA)», World Geospatial Forum, Lisbon, 25-29 May 2015, Marlene Antunes, Raquel Medeiros, Vanda Marcos.

«Infraestrutura de Dados Espaciais Interativa dos Açores», EUE2013, Lisbon, 6th June 2013, Marlene Antunes, Raquel Medeiros

«IDEiA», EUE2012, Lisbon, 14-15 March 2012, DSCIG

«Cadastro Predial: O Projeto-Piloto da RAA» EUE2012, Lisbon, 14-15 March 2012, DSCIG, Marlene Antunes, Maria de Lurdes Gaspar

## **DIRECÇÃO REGIONAL DO ORDENAMENTO DO TERRITÓRIO E AMBIENTE (DROTA)**

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### **1 – INTRODUCTION**

In 2012, public administration reform established DROTA – Direção Regional do Ordenamento do Território e Ambiente - as the regional mapping authority and official cadastral office within the Madeira Autonomous Regional Government.

The regional decree n. 30/2012/M approves the new structure of DROTA and points out a new set of functions including those related to the geographic information and cadastral domains, to previous environmental, spatial planning and marine responsibilities of the previous Environmental regional entity.

The legal framework specifically dedicated to geographical and spatial information mention:

- the promotion of cartographic covertures;
- The maintenance of a regional level geographic information system;
- The disposal of a cadastral information system.

Budget constraints as well as the reduced strategic capacity toward the cartographic and geographical context resulted in a substantial decrease of new cartographic acquisitions. Nevertheless, it's expected the development of a cooperation framework involving other regional authorities in the setting and maturing of a spatial data infrastructure, in accordance with the values and resulting obligations from the INSPIRE Directive in Madeira Autonomous Region.

### **2 – RESEARCH AND DEVELOPMENT**

#### **2.1 – IRIG – Madeira's Regional SDI**

The Regional Infrastructure for Geographic Information (IRIG) is a regional SDI of administrative type, dedicated to the collection and disposal of spatial data produced and maintained by regional and local public entities.

Several access points through web services were developed, like the Geoportal whose purpose was to promote data and geographic services on a sharing and collaborative environment in conformance with the technical guidelines of INSPIRE.

Having in mind the general public, the GEOCID platform allows the access to a wide scope of territorial information, including institutional and municipal general interest information, statistics and, naturally, geographic data themes accessed through view services. The outcome of GEOCID is to promote citizenship awareness through spatial information.

#### **2.2 PRLU - Regional Urban Licensing Portal**

DROTA is the public entity responsible for the implementation of a territorial management system, which includes valid spatial management plans, both from the regional or local level of public administration. The Regional Urban Licensing Portal was designed for operational use by the entities that should manage the urban processes in a systematic approach, supported in a software environment that could handle up to date information to internal and external users.

#### **2.3. SNIMAR - Preparation of integrated geographic information for marine and coastal water management**

SNIMAR outcome is the constitution of a Marine Spatial Data Infrastructure. The geographical location of Madeira's archipelago provides several opportunities for scientific studies dedicated to the marine environment and a dedicated MSDI could improve the data discovery and sharing of marine spatial datasets. DROTA is SNIMAR leading institution within Madeira's Regional Government and recognizes the spatial marine data as vital for an effective environmental management of coastal and marine areas.

#### **2.4. – Assessment to epidemiological studies – Madeira Dengue outbreak**

DROTA has been providing permanent assessment to IASaúde, IP RAM, the regional health institute in charge of Madeira Dengue Surveillance System, the initiative taken after the detection in Funchal of *Aedes Aegypti* mosquito, the main dengue vector. GIS was used as a tool for spatial-temporal analysis and a geostatistical model for prediction of the outbreak behavior was developed on-site by DROTA personnel, whose tasks include the monitoring of the species distribution along the south coast of Madeira.

### **3 – EDUCATION AND TRAINING**

DROTA distributes free geographic data of Madeira for educational purposes, through commitment terms for end users. A variety of disciplines benefit from this institutional sponsorship, as biologists, geographers or architects look for specific data of Madeira for dedicated studies, reports or master thesis production.

We should mention that the comprehensive learning material available on the Internet encouraged a self-training paradigm by in-house GIS specialists already familiar to Geographical FOSS software, in such a way that almost 50% the internal activities dedicated both on data maintenance and dedicated enduser map production.

### **4 – PRODUCTION**

#### **4.1 - REPGRAM – GNSS Permanent Station Network of Madeira**

The GNSS Permanent Station Network of Madeira (REPGRAM) is composed of three stations located in Madeira Island (Santana, Funchal and Paul da Serra) and one in Porto Santo Island.

A fifth station, in the remote location of Selvagens Islands (Selvagem Grande), was installed in 2011 and provided positional data until midterm of 2012. This specific location is of great interest for international geodetic programs, but the exquisite logistic conditions of Selvagem Grande and funding restrictions blocked all the efforts for the definitive reactivation of the permanent station. REPGRAM positional data, including RTK mode operation is accessible through URL [www.repgram.org.pt](http://www.repgram.org.pt). This service is free of charge for registered users.

#### **4.2 - Geodetic Regional Network**

DROTA is responsible for the maintenance of the geodetic network of Madeira, consisting of 120 Geodetic 1st order Points and 278 Marks, with well known coordinates both in UTM – 28N Local Datum and WGS84.

A comprehensive re-observation of the geodetic network was put on place in 2012, including GNSS observations aiming the adjustment of the terrestrial geodetic network to the ITRF2008 datum definition.

Recently, a national decree-law established the ITRF93 as the official spatial reference system for Madeira.

#### **4.3 - Road Map 1:50 000 of Madeira**

The Road Map of the Madeira Island is a printed product that first came out in 2006 (December). This product represents motorways, main roads and secondary roads and paths, as well as regional and local designations at 1:50 000 scale. This product is available both in PDF digital format at [www.geocidmadeira.com](http://www.geocidmadeira.com) and printed format, with an annual update cycle.

#### **4.4 - Road Map 1:50 000 of Porto Santo**

Similar to Madeira Road Map, Porto Santo road map is distinct on the background presentation, while keeping its accuracy on the regional road network cartographic representation. The Road Map of Porto Santo was entirely conceived in GIS software environment, unlike the Madeira road map product originally made in CAD.

#### **4.5 – Madeira Topographic Map Series 1:5000**

This map series is similar to the obtained in 2007, but with a coverage area restricted to Madeira Island. It's composed of both elevation and planimetric features suitable for GIS integration.

#### **4.6 – Administrative Unit Basemap of Madeira Autonomous Region**

DROTA is responsible for the improving and updating of this administrative unit dataset (BARAM) dedicated to the boundary representation of local administrative units – municipalities and parishes. In 2014, an exhaustive revision was carried out for accuracy improvement, including the Savage Island coastline location adjustment. BARAM was then submitted to Direção-Geral do Território for integration in CAOP, the national administrative official map.

#### **4.6 – DROTA's thematic mapping production and technical assessment**

The cartographic and spatial data scope within DROTA is mostly done by the internal Geographic Information and Cadastral Unit. Other DROTA departments seek for technical cartographic support for advancing in their own activities, mostly related to environmental reporting obligations under different European Frameworks, namely the Water Framework , Marine Strategy Framework Directive, Floods Directive or the Bathing Water Directive. The wide scope of public regulatory functions within DROTA surely benefit from the potentialities provided by spatial data and expertise.

We could point out some of the thematic spatial data output.

- Mapping assessment of water bodies:
- River basin;
- Coastal Water Bodies;
- Flood Risk Map Area Proposal.
- Map production for the Marine Strategy for Madeira Subdivision.
- Map presentation for Bathing Water Profiles.
- Maritime Public Domain cartographic support.

#### **5 – PUBLICATIONS**

SRA (2014). Estratégia Marinha para a subdivisão da Madeira. Diretiva Quadro Estratégia Marinha. Secretaria Regional do Ambiente e dos Recursos Naturais. Abril de 2014

## **INSTITUTO SUPERIOR TÉCNICO - SISTEMAS DE APOIO AO PROJECTO (ICIST)**

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### **1 – INTRODUCTION**

Since its creation in 1911, Instituto Superior Técnico is the largest and most reputed school of Engineering, Science and Technology and Architecture in Portugal. At IST, we aim to give our students and alumni the education and the knowledge tools to improve, to change and to shape society through science, technology, and entrepreneurship. We provide top quality higher education, strongly exposed to Research, Development and Innovation (RD&I) activities, immersing our students in an exciting and global environment geared towards solving the challenges of the XXIst Century.

ICIST (Instituto de Engenharia de Estruturas, Território e Construção) is a research unit within Instituto Superior Técnico and financed by FCT (Fundação para a Ciência e a Tecnologia), the Portuguese governmental research agency.

The goal of ICIST is to develop scientific and technological research, promoting innovation and development, scientific dissemination and consulting in the areas of its six Research Groups: Earthquake Engineering and Seismology; Mechanics, Modeling and Analysis of Structures; Studies on Construction; Structural Design and Geotechnics; Information and Design Support Systems; Architecture. The main research scope of the Information and Design Support Systems group concerns the areas of Geographical Information Science and Information and Communication Technologies applied to Geomatics, Building Information Modelling, Sustainability, Information Technology in Construction and E-learning.

### **2 – RESEARCH AND DEVELOPMENT**

Over the period 2011-2014, the main activities developed in the domain of Geographical Information Science by the Information and Design Support Systems group have supported the development of the following projects:

#### International projects

- MIAVITA - Mitigate and Assess risk from Volcanic Impact on Terrain and human Activities (2008-2013). Módulo: Knowledge database and web-GIS design. Projeto no âmbito do 7.º PQ da União Europeia, ref. 211393-FP7-ENV-2007-1.
- Projecto “E-GIS+ - European Level Developments of Flexible Learning Models within Geographical Information Science (GIS) for Vocational Training, phase 2.

#### National projects founded by FCT

- AULIS – Automated landslides inventory based on very high spatial resolution images/Inventariação automática de deslizamentos com base em imagens de elevada resolução espacial: projeto FCT PTDC/ECM/116611/2010.
- FINDER – Fault investigation with LIDAR for earthquake reassessment/Investigação de falhas geológicas com recurso a lidar para reavaliação da atividade sísmica: projeto FCT PTDC/CTE-GIX /113866/2009.
- Estudo de Avaliação do Risco de Aluviões na Ilha da Madeira - Fase 2. (coord. Prof. Rodrigo Oliveira): colaboração IST/Univ. Madeira/Laboratório Regional de Engenharia Civil).
- Estudo da perigosidade sísmica e da perigosidade vulcânica das ilhas de Cabo Verde. Consultadoria ao abrigo de um projeto das Nações Unidas liderado pela empresa Muncípia (em curso, coord. João Fonseca)
- GUIOMAR - Interface Geo(gráfica) para Modelação Costeira e Marinha (2007-2012): PTDC/AMB/67450/2006.

- RETURN – Rare Earthquake and Tsunami Recurrence/Recorrência de sismos e tsunamis raros: projeto FCT PTDC/CTE-GIN/67367/2006.
- SUBSIn - InSAR detection and characterization of subsidence and landslides in the Lisbon region/Determinação de subsidências, por técnicas interferométricas, na região de Lisboa: projeto FCT PTDC/CTE-GIX/65261/2006.
- RIVERSAR – Exploiting SAR imagery to improve floodplain inundation models in the Tagus River/Exploração de imagens SAR para aperfeiçoar modelos de inundação no Rio Tejo: projeto FCT PTDC/CTE-GIX/099085/2008.
- SCENE - Site Condition Evaluation for National Seismic Hazard Estimation/ Avaliação dos efeitos locais para estimativa da perigosidade sísmica a nível nacional: projeto FCT PTDC/CTE-GIX/103032/2008.
- Plano Estratégico de Defesa contra as Aluviões da Região Autónoma da Madeira – PEDAM (coord. Prof. António Betâmio de Almeida): colaboração IST/Univ. Madeira/Laboratório Regional de Engenharia Civil.

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## **ESCOLA PROFISSIONAL DE CARTOGRAFIA E CADASTRO (EPCG)**

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### **3 – EDUCATION AND TRAINING**

Professional Education of technical level in the field of Geographical Sciences has been a tradition of all entities preceding the present “Direção Geral do Território (DGT)”.

In 1980’s was created a professional school to form and prepare technicians to carry out the tasks committed to the mission of the then called “Instituto Geográfico Cadastral (IGC)”. Its main aims were to ensure the professional education of the Institute’s technical staff,

- Land Surveying;
- Cartography;
- Photogrammetry.

Initially, the courses covered essentially the practical aspects, but later on, in 1983, were reformulated and framed in the Portuguese Professional Technical Education System.

In September 2000, was created the “Escola Profissional de Ciências Geográficas (EPCG), a public professional school that is installed in the DGT building.

EPCG has a long experience and training expertise in the Surveying and Cartographic fields, benefiting from its links to DGT, namely in terms of its technical team.

EPCG has two targets:

1. Provides initial education training in the following professional courses:
  - a. Surveyor Technician;
  - b. Cartographer Technician, which involves two specialisation, Cartography and Photogrammetry
  - c. Geographical Information Systems (GIS) Technician;
  - d. Environmental Management Technician.These courses award a secondary educational degree and a 4th level vocational qualification certificate (QNQ-National Qualification Catalogue).
2. Life Long Education:
  - a. Organise and teach short courses aiming at the education, training and updating of professional technicians, in the field of Land Planning and Environment Management.
  - b. Special up-dating courses, for technicians from others public organisations have also been organized, concerning subjects such as GPS, Cartography and GIS.  
Present we are working in some new training programmes, concerning new methodologies and digital technologies in Cartography, Cadastre, GIS and Survey Applications.