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# BLAST INTERREG IV North Sea Region Program

## Work Package 3 Developing the Marine & Coastal Reference Base

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### Summary Report

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## Document history

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## 1 Introduction

### 1.1 Introduction to this report

Work Package 3 of the BLAST INTERREG IV North Sea Region Program deals with developing the Marine and Coastal Reference Base.

This report summarises the activities within Work Package 3, including their objectives and deliverables, and references the technical reports that have been produced by the various Project Partners as part of the project.

This report does not contain a detailed analysis of each work package activity, but guides the reader to the relevant reports and outputs.

### 1.2 Work Package 3 Project Partners

Work Package 3 Title: Developing the Marine and Coastal Reference Base

Work Package 3 Leader: SeaZone Solutions

Work Package 3 Partners:

- SeaZone Solutions (SZ)
- Danish National Survey and Cadastre (KMS)
- Norwegian Coastal Administration (NCA)
- Agency for Maritime and Coastal Services (MDK)
- Norwegian Hydrographic Service (NHS)
- British Geological Survey (BGS) (NERC)
- Federal Maritime & Hydrographic Agency (BSH)
- DTU Space - National Space Institute
- TU Delft – Delft University of Technology
- UK Hydrographic Office (UKHO)

### 1.3 Work Package 3 Rationale

The overall aim of the BLAST project, as stated in the Project Description published in December 2009, was to improve Integrated Coastal Zone Management and Planning (ICZM&P) and maritime safety in a broad sense, by improving and contributing to harmonising terrestrial and marine geographical data and by developing planning and visualisation tools, in the context of climate change.

Within this overall aim, Work Package 3 addressed the need for wider interoperability of marine and land information across the North Sea coastal zone for use in decision making and resource management, with a specific objective of creating interoperable land-sea reference bases across the project area.

At present, there is little collaboration between EU Member States and within Member states at the national, regional, and local level, to integrate marine and land information. The problem relating to coastal and near shore marine information is that geographic data on the landward side is collected and maintained by topographic mapping and/or cadastral agencies, while seaward the data is collected by hydrographic survey services, focusing primarily on marine navigation issues.

Work Package 3 has developed best practice solutions in support of the overall project aims and has formed a network of stakeholders from data providers to data users. It has developed pilot studies focusing on the practical issues and solutions of the harmonisation of marine hydrographic, terrestrial topographic, geological and environmental datasets. In doing so, it has assessed current best practices amongst major public and private sector information stakeholders who collect and use such datasets.

EuroSDR (European Spatial Data Research) held a land-sea data workshop in Dublin, Ireland in March 2007. The findings from this workshop strongly supported the need to further explore the way in which interoperability might be achieved across national boundaries along the coast and offshore. Work Package 3 of the BLAST project has provided examples of practical implementation of these aims.

## 1.4 Overall Work Package 3 Objectives

The overall objectives of Work Package 3 have been defined as follows:

- Design and develop a marine reference base (digital marine map) for the project area (North Sea);
- Harmonise marine reference base with land reference base for a selection of agreed project pilot sites;
- Deploy, update and test reference base against user requirements.

Each of these objectives has been achieved. The results from all the activities in Work Package 3 have been posted on the BLAST website: <http://blast-project.eu/?page=articles&artid=167>

## 1.5 Summary of Work Package 3 Activities and Responsibilities

Work Package	Activity	Responsible Partner
WP3.1	Review of 'state of play' with regard to data in and along the coastline	Danish Ministry for the Environment: National Survey and Cadastre
WP3.2	Data Audit for North Sea Region Reference Base	Danish Ministry for the Environment: National Survey and Cadastre
WP3.3	Data Collation and Assessment for North Sea area to support Reference Base Creation	SeaZone Solutions
WP3.4	Create Prototype Reference Base for North Sea Marine Map	SeaZone Solutions
WP3.5	Develop Vertical Reference Frame for North Sea Area	DTU Space - National Space Institute
WP3.6	Surveys to Support High Resolution Mapping in Use Case Study Areas	Agency for Marine and Coastal Services, Belgium
WP3.7	Land-Sea Interoperability Audit, Methodologies and Tool Creation	SeaZone Solutions
WP3.8	Develop Prototype Land-Sea Interoperable Reference Base for Use Case Study Areas	SeaZone Solutions
WP3.9	Collate and assimilate WP3 activities into reference documentation.	SeaZone Solutions
WP3.10	Project management	SeaZone Solutions
WP3.11	Development and application of a new methodology for the unification of chart datums in the North Sea area and connection to the onshore height systems	TU Delft

## 2 Review of Work Package 3 Activities and Deliverables

### 2.1 Initial Literature Review and Data Audit

The activities involved in WP3.1 (Review of 'state of play' with regard to data in and along the coastline) and WP3.2 (Data Audit for North Sea Region Reference Base) were led by the Danish Ministry for the Environment: National Survey and Cadastre.

These activities reviewed the available data, and of the quality of this data, in the participating countries, assessed against a number of criteria. A register of information needed to assess the degree to which data could be harmonised (e.g. licensing terms, specifications, geographic extent) was compiled.

To facilitate the collection of metadata, an online metadata catalogue was created and made available as a means of reporting data in a standardised way.

The key deliverable for this activity was the creation of a Report:

***“State of the Art and Data audit for North Sea Region - WP 3.1 and 3.2 – Final Report”, Dated 24<sup>th</sup> June 2011. Authors: S Hohwü-Christensen, J Nørgaard Andersen and B Gaardsvig Kjeldsen (The Danish National Survey and Cadastre)***

This report is available to download from the BLAST website:  
<http://blast-project.eu/?page=articles&artid=167>

Within this report, the first section identified projects that may have produced relevant datasets for the BLAST project and identified whether standardised metadata exists for these datasets. The second section of the report describes the considerations and concepts behind the BLAST metadata catalogue, and the collection of metadata for the population of this catalogue.

The Metadata Catalogue is available to access via the BLAST website:  
[http://mimmetadatatest.kms.dk/geonetwork\\_blast/srv/en/main.home](http://mimmetadatatest.kms.dk/geonetwork_blast/srv/en/main.home)

This Metadata Catalogue (metadatabase) is a tool that allows all the metadata for the BLAST project datasets to be compiled and distributed. This metadatabase is fully ISO and INSPIRE-compliant and has been developed to meet the needs of the BLAST project partners.

Development of this metadatabase has been based on an initial review of the state of metadata distribution among the BLAST participants, as well as the requirements of the INSPIRE Directive. Built on open-source technologies and to current best practice and standards, the metadatabase meets the BLAST partners' current needs but can also be adapted for future developments.

### 2.2 Data Collation and Assessment

This activity (WP3.3), led by SeaZone Solutions, developed the specifications for the spatial database, reviewing and using existing best practice where it existed. This involved the acquiring and set up

hardware and software for the database. Data was acquired from multiple sources and assessed against the specification and register from WP3.1 and WP3.2.

The database was populated as required for the Project, including the ingestion of metadata and its creation (if not supplied).

The database population is the deliverable for this activity, but since this is an internally held database, it is not being made available on the BLAST website.

### 2.3 Creation of the Prototype Reference Base for North Sea Marine Map

This activity (WP3.4) is the first stage in creating the Prototype Interoperable Land-Sea Reference Base and was led by SeaZone Solutions. The activity developed the specifications for the reference base and complementary data model, utilising best practice from participating countries and wider afield. A Feature Catalogue and Application Schema were also produced. The data held in the spatial database was tested against and mapped on to these specifications and any gaps identified and documented.

This marine map was not delivered as a separate output dataset to BLAST project partners, rather incorporated into the final Interoperable Land-Sea Reference Base created as part of WP3.8 (see section 2.8)

### 2.4 Development of the Vertical Reference Framework for North Sea

This activity (WP3.5) was led by DTU Space (National Space Institute) and reviewed existing vertical reference models across the North Sea area, defining relationships to respective in country land datums. Existing geodetic and tidal models were examined to confirm connectivity and these were incorporated into a seamless datum surface model for the North Sea area.

The deliverable from this activity is the development of a vertical offshore reference system to resolve sea surface in the North Sea area, incorporating and improving existing models where available, and the creation of a tool to realise vertical data transformations in the North Sea Area.

The deliverables from this activity are as follows:

- 1 Report “BLAST Vertical Datums: Overview, conventions and recommendations” Dated 20<sup>th</sup> June 2011. Authors: G Strykowski, O B Andersen, I Einarsson and R Forsberg (DTU Space, Denmark) and L Doorst, T Ligteringen (Hydrographic Service of the Royal Netherlands Navy, The Netherlands).**
- 2 Report “BLAST Height Transformation Tool” Dated 25<sup>th</sup> October 2011. Author: I Einarsson (DTU Space)**
- 3 Tool development: “BLAST Height Transformation Tool”**

These reports and the tool are available to download from the BLAST website:  
<http://blast-project.eu/?page=articles&artid=167>



## 2.5 The development of a new methodology for the realisation of a Chart Datum for the North Sea Area

In addition to the work undertaken to define the North Sea's vertical reference frame as noted in section 2.4, another work package activity (WP3.11) dealt with the development and application of a new methodology for the unification of chart datums in the North Sea area and the connection to the onshore height systems. The output surfaces created from this work have been incorporated into the BLAST Height Transformation Tool (mentioned in section 2.4) so that data users can choose which method to use when vertically transforming their data.

The key deliverable for this activity was the creation of a Report:

***“Establishing a consistent vertical reference frame for the North Sea area “ Dated 8<sup>th</sup> August 2012. Authors D C Slobbe and R Klees (Delft University of Technology).***

This report is available to download from the BLAST website:  
<http://blast-project.eu/?page=articles&artid=167>

## 2.6 Surveys to Support High Resolution Mapping in Use Case Study Areas

This activity (WP3.6) specified the survey work needed to provide high resolution mapping data across pilot sites in both Belgium and Denmark, in order to strengthen the reference base in these areas. The scope and specifications of the survey work were defined, tender documents and contracts prepared. Survey work was undertaken by contractors and comprised bathymetric/ topographic LiDAR, supplemented by vessel mounted acquisition where required for infill. Data delivered by the survey contractors was assessed against the specifications and existing information, ready to be assimilated into the reference base. The results were validated for input into the prototype interoperable land-sea reference base datasets.

For the pilot sites in Belgium, a report was prepared by the Agency for Maritime and Coastal Services (Belgium) following the survey work that was completed. This report details the comparative study of different LiDAR techniques and platforms in the pilot sites. For each site, three LiDAR techniques on different platforms (airborne, mobile and static) were used on the intertidal zone. The results, in terms of output data accuracy, point density, cost-benefit analysis, employability and more general benefits are presented in the Report.

The key deliverable for this activity was the creation of a report:

***“Comparative study of airborne, mobile and static LiDAR in a coastal environment” Dated August 2012, Authors: T Petermans (The Flemish Geographical Information Agency), E Van Quickelborne and A Geldhof (Agency for Maritime and Coastal Services, Belgium)***

The report is available to view on the BLAST website: <http://blast-project.eu/?page=articles&artid=167>

## 2.7 Land-Sea Interoperability Audit, Methodologies and Tool Creation

This activity (WP3.7) was led by SeaZone Solutions and focused on bringing together the marine based and terrestrial based datasets available across the BLAST project area. The main objective of this work was to develop a strategy and methodology for integrating topographic, elevation and geological mapping data between land and sea.

The activity also developed appropriate toolsets for uploading, processing and integrating the land and sea datasets, as well as a Feature Catalogue and Application Schemas covering land and marine feature types.

The key deliverable for this activity was the creation of a report (which references work carried out in WP3.3, WP3.4, WP3.7 and WP3.8):

***“Land Sea Interoperability Audit, Methodology and Tool Creation; A technical report for Work Packages 3.3, 3.4, 3.7 and 3.8 of the BLAST INTERREG IVB North Sea Region Program” Dated 15th August 2012. Author: A M Rust (SeaZone Solutions)***

The report is available to view on the BLAST website:

<http://blast-project.eu/?page=articles&artid=167>

In addition to this, work was undertaken to define a methodology for the integration of terrestrial and marine geological data, and to create one seamless land-sea geological data layer to use as input into the final Interoperable Land Sea Reference Base. This work was undertaken by the British Geological Survey for both the UK and Norwegian pilot sites.

A technical report detailing the methodology for this work has been created:

***“Merged Solid and Drift Geology of the Forth Estuary” British Geological Survey Commissioned Report CR/11/160 2011 Authors: A Leslie & R Cooper (British Geological Survey)***

This report is available to download from the BLAST website:

<http://blast-project.eu/?page=articles&artid=167>

## 2.8 Development of the Prototype Land-Sea Interoperable Reference Base

This activity (WP3.8) involved the work required to integrate the land and sea data for the agreed project pilot sites, in order to develop the output prototype Interoperable Land-Sea Reference Base. Using the knowledge gained from all of the activities in Work Package 3, and the data gathered as part of Work Package 3.4 and 3.6, a Prototype Reference Base (one for topographic data and one for elevation data) was created for each pilot site.

This output reference base was tested against initial user requirements and distributed for use within the BLAST Project. Feedback from users was assessed, documented and improvements were made to the

data specification where required, followed by the re-issue of the reference base to the BLAST project as necessary.

The methodology undertaken as part of this WP3.8 has been detailed in the Report mentioned in section 2.7, above.

Images of each of the reference base output datasets are available to view on the BLAST website:

<http://blast-project.eu/?page=articles&artid=167>

The key deliverable for this activity was the delivery of the output datasets to the other BLAST Project Work Packages, to use as input into their work as appropriate. In particular, the output datasets were used as a key input in Work Package 6 (Climate Change in the Coastal Zone).

### 3 References

“State of the Art and Data audit for North Sea Region - WP 3.1 and 3.2 – Final Report”

Dated 24<sup>th</sup> June 2011

Authors: S Hohwü-Christensen, J Nørgaard Andersen and B Gaardsvig Kjeldsen (The Danish National Survey and Cadastre)

“Comparitive study of airborne, mobile and static LiDAR in a coastal environment”

Dated August 2012

Authors: T Petermans (The Flemish Geographical Information Agency), E Van Quickelborne and A Geldhof (Agency for Maritime and Coastal Services, Belgium)

“Establishing a consistent vertical reference frame for the North Sea area”

Dated 8<sup>th</sup> August 2012

Authors D C Slobbe and R Klees (Delft University of Technology)

“BLAST Vertical Datums: Overview, conventions and recommendations”

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