NORTH ATLANTIC TREATY ORGANISATION
(NATO)

ADDITIONAL MILITARY LAYERS
GRIDDED SEDIMENT
ENVIRONMENT SEABED & BEACH
PRODUCT SPECIFICATION
Draft 1.0, 28 July 2005

FOR APPROVAL BY GMWG

Document Control

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CONTENTS

1   INTRODUCTION

1.1   SCOPE

This Product Specification (PS) describes the content and defines the data dictionary of the Additional Military Layers: Gridded Sediment – Environment Seabed & Beach (AML GS-ESB) product, independent of any exchange standard data format. The schema and data format imposed by the chosen exchange standard implementation are defined in separate annexes (where provided).

This is a supplementary Product Specification which describes an improved modelling of the geo-acoustic subset of parameters contained in the AML ESB PS. This PS will cease to exist as a separate entity when aligned with the ESB PS at its next revision. The NetCDF annex C to this document will then apply to the geo-acoustic subset of the ESB PS.

It has been prepared in accordance with NATO STANAG 7170, Additional Military Layers and the draft NATO STANAG 4564, Performance Standards for Warship Electronic Chart Display and Information System (WECDIS) Data Products It is based on the proposed Common Product Specification Framework (CPSF) which is contained as Annex B to the draft STANAG 4564.

The AML GS-ESB Product Specification is designed to facilitate the encoding of the following components:

- Geo-acoustic properties of the sediment layer, at one or more fixed (X,Y) grid points.

AML GRIDDED SEDIMENT – ENVIRONMENT SEABED & BEACH MUST NOT BE USED IN ISOLATION FOR NAVIGATIONAL PURPOSES

1.2   GENERAL INFORMATION ON THE PRODUCT SPECIFICATION

1.2.1   Version Number

The Version Number is 1.0

1.2.2   Date of Issue

The Date of Issue is 28th July 2005

1.2.3   Custodian of the Product Specification

The Custodian of this specification is The United Kingdom Hydrographic Office.

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1.2.4   Relevant STANAG Number

STANAG 7170 Additional Military Layers (AML)

1.3   STATUS OF THE PRODUCT SPECIFICATION

This product specification will be endorsed by the Geospatial Maritime Working Group of the NATO Geographic Conference and is subject to the change control procedures implemented by that group.

1.4   SECURITY

1.4.1   Security Classification of the Specification

The Product Specification is UNCLASSIFIED

1.4.2   Security Classification of the Product

AML GS-ESB can be issued at various security classification levels according to content. AML GS-ESB products of differing security levels (specified at the dataset level by the 'Protective Marking' and 'National Caveat(s)' details) are physically partitioned.

The table at section 5.3 contains details of how AML GS-ESB security classification information must be described in this product.

1.4.3 Copyright Statement

Producers of AML datasets must ensure that:

• the Intellectual Property Rights of those owning the information that has been used for production of the AML product is not compromised.

• sufficient mechanisms are put in place to ensure that material is not copied either in whole or part, except as specifically required within the host system, without prior agreement of the data producer and any other copyright holders.

Copyright statements should be shown at the following locations:
• on the product label
• on the product packaging
• within the product

1.5   CONTENTS OF THE DOCUMENT

The AML GS-ESB Product Specification defines the real-world features, attributes and metadata required for the production and use of the data product. It is laid out as described in the table of contents.

Also included, as annexes to the Product Specification, are details of the implementation using the relevant exchange standard(s).

Each annex (if included) is identified as follows:
• AML GS-ESB NetCDF Implementation (ANNEX C)

A cross-reference in the text will be included for instances when there are relevant details in one or more of the implementation annexes.

1.6   REFERENCES

The following standards and specifications affect the content of this Product Specification.

1.6.1 Standards

NATO STANAG 1059(Edn 6)	Distinguishing Letters for Geographical Entities for use in NATO.
NATO STANAG 2211	Geodetic Datums, Ellipsoids, Grids & Grid References
NATO STANAG 7170	Additional military Layers.
NATO STANAG 4564	Standard for Warship Electronic Chart Display and Information System (WECDIS), Edition 1, Annex B, Data Products.

| ISO 8859 | Information processing - 8-bit single-byte coded graphic character sets |
| | Part 1: Latin alphabet No.1 |

| ISO 9660 | Information Processing - Volume and File Structure of CD-ROM for Information Interchange. |

| ANSI/IEEE 802.3 | IEEE Standards for Local Area Networks, Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications |

| ISO/IEC 8211, | Information processing - Specification for a data descriptive file for information interchange |

| ISO/IEC 10646 | Information technology - Universal Multiple-Octet Coded Character Set (UCS) |
| | Part 1: Architecture and Basic Multilingual Plane |

1.6.2   Specifications

| The Open GIS Abstract | Open GIS Consortium. Topic 9: Quality Version 4 Specification 1999 |

1.6.3   Other References

| AML | Feature and Attribute Catalogue |

1.7   DEFINITIONS

AML   AML is a unified range of digital geospatial data products designed to satisfy the totality of NATO non-navigational maritime defence requirements.

1.8   KEY WORDS

AML
GS-ESB
PRODUCT SPECIFICATION
GEOACOUSTICS

1.9   MAINTENANCE AND SUPPORT OF THE PRODUCT SPECIFICATION

Specific processes and mechanisms that are established for the maintenance of AML Product Specifications are described in the sections 1.9.1 to 1.9.6 below.

1.9.1   Frequency of Review

The AML GS-ESB Product specification (version 1.0) will be frozen until the full ESB product is unfrozen in July 2006 at which point a reconciliation of the ESB Product Specifications will take place.

1.9.2   Method of Maintenance

Corrections, clarifications and requests for change will be administered by the custodian. Discussion regarding proposed changes will be carried out by correspondence with national Points of Contact. Consolidated maintenance documents will be issued periodically containing published corrections and clarifications together with details of agreed extensions (these will be formally incorporated into the Product Specification and become live at its next revision).

Changes to the Product Specification beyond extensions will be reviewed by committee[1] during preparatory work for production of the next edition of the specification.

1.9.3   Method of Promulgation

Maintenance documents, new editions of specifications, and related documentation will be sent to nations through their appointed AML point of contact or published on the AML website.

1.9.4   Authority Responsible for Maintenance

AML Product Specifications will be maintained by the Custodian specified in section 1.2.3.

1.9.5   Error Reporting/Change Request Procedure

Comments concerning the content of the AML Product Specifications and requests for change should be addressed to the Custodian.

1.9.6   Available Support

Contact the Custodian for guidance and advice relating to this product specification.

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[1] Will be a specific group reporting to the GMWG or its successor.

2   GENERAL PRODUCT DESCRIPTION

PRODUCT TITLE

Additional Military Layers – Gridded Sediment – Environment Seabed & Beach.

SHORT TITLE

AML GS-ESB

REFERENCE

NATO STANAG No.7170 (Additional Military Layers).

NATO STANAG No. 4564 (Performance Standards for Warship Electronic Chart Display and Information System (WECDIS), Edition 1, Annex B, Data Products.

2.1   MAINTENANCE OF THE DATA PRODUCT

The frequency and method of provision of update or replacement data will be defined by each AML producing agency.

2.2   SUPPORT FOR MULTIPLE MODES OF OPERATION

Data may be made available at the grid sizes shown in the following table.

SCALE BAND	COMPUTATION GRID SIZE
1	20 degrees or coarser
2	5 degrees
3	1 degree
4	30 minutes
5	6 minutes
6	1 minute
7	30 seconds
8	6 seconds
9	1 second or finer

Data may be used or displayed in information systems at a range of grid sizes as shown in the following table.

SCALE BAND	USAGE GRID SIZE
1	8 degrees or coarser
2	2 to 12.5 degrees
3	24 minutes to 2.5 degrees
4	12 minutes to 1.25 degrees
5	2.4 to 15 minutes
6	24 seconds to 2.5 minutes
7	12 seconds to 1.25 minutes
8	2.4 to 15 seconds
9	0.4 to 2.5 seconds or finer

2.3   GEOGRAPHIC ORGANISATION

2.3.1   Regional Scheme

AML GS-ESB products may be global or partitioned by geographic region.

2.3.2   Tiling Scheme

See appropriate annex.

2.4   LAYER ORGANISATION

The content of the product is not layered. However, specific exchange standards may impose their own internal layering requirements. See appropriate annex.

2.5   EXCHANGE STANDARD IMPLEMENTATION

This product specification has been written to be independent of the exchange standard used. Details of exchange standard implementations are given in the relevant annex.

2.5.1   Spatial Data Type

AML GS-ESB contains gridded data, each grid point consists of the two spatial dimensions; x (eastwards) and y (northwards). Sediment details are attributes of the point data.

2.5.2   Level of Topology

See appropriate annex.

2.5.3   Relationship with Layering

See appropriate annex.

2.5.4   Textual Information

Attributes that contain free text must not be used when it is possible to encode the information by means of any other attribute.

2.5.5   Reference to External Files

Text and picture files may also be included in the AML product to provide additional information.

Below are examples of potential formats.
·   ASCII
·   TIFF
·   PDF
·   HTML
·   JPEG
·   AVI
·   MPEG

2.6   SIZING REQUIREMENTS

Data producers should partition datasets such that data access time in the receiving system is acceptable to users. This will vary between data types and receiving systems.

2.7   GENERAL SOURCE DESCRIPTION

2.7.1 Minimum Source Requirements

Sources detailed in section 5.5.1 meet the following requirements

- the data capture point-density fulfils the data capture requirements appropriate to the scale bands specified in section 2.2.

- the mandatory attribution levels for each object, specified in section 5.5.2, are met.

- There is no minimum grid resolution requirement but it should be (as fine as possible) supported by observations and rendered at the appropriate grid size.

2.7.2 Applicable Sources

All sources used must meet the minimum requirements.

3   GENERAL DATA DESCRIPTION

3.1   DATUMS

Please refer to NATO STANAG 2211 - Geodetic Datums, Ellipsoids, Grids & Grid References, which establishes the NATO guidelines to the use of horizontal and vertical datums.

3.1.1   Horizontal Datum

The horizontal datum for the AML GS-ESB is the World Geodetic System 1984 (WGS 84).

3.1.2   Vertical Datums

3.1.2.1   *Height Datum*

     N/A

3.1.2.2   *Sounding Datum*

     N/A

3.2   UNITS

The default units to be used in AML GS-ESB are:

- Position: latitude and longitude in decimal degrees
- Depth/Height/Length/Width: metres
- Positional accuracy: metres
- Distance: nautical miles or metres
- Layer Thickness: metres
- Two way travel time: seconds
- Sediment density: Kilograms per cubic metre
- Sound speed gradient: s^{-1}
- Sound speed curvature: $m^{-1}s^{-1}$
- Absorption coefficient: Decibels per wavelength
- Absorption coefficient gradient: Decibels per wavelength per metre
- Porosity: Percentage
- Shear sound speed: Metres per second
- Shear absorption: Decibels per wavelength

3.3   CO-ORDINATE SYSTEM

The co-ordinate system used by AML GS-ESB is Latitude and Longitude. These will be recorded as:

Positive values: Used for latitudes **north** of the equator and longitudes **east** of the Greenwich Meridian.

Negative values: are used for latitudes **south** of the equator and longitudes **west** of the Greenwich Meridian.

3.4   PROJECTION

AML GS-ESB is based upon geographical co-ordinates and is not projected.

3.5   LANGUAGE AND CHARACTER SETS

3.5.1   Language

The exchange language used by AML GS-ESB is English.

3.5.2   Character Sets

ISO 8859-1 supports English and most European languages. For those languages that it does not support ISO/IEC 10646 shall be used.

3.6   DATA QUALITY

AML GS-ESB data quality information should be encoded at an appropriate level, as defined in sections 5.3.1 & 5.5.2 and as specified by the exchange standard implementation.

AML data quality information encompasses the following categories:

*   Quality of observed data
*   Quantity of observed data
*   Source(s) of the data
*   Completeness for the Product Specification
*   Data processing techniques

Data quality information defined for AML GS-ESB can be encoded in the dataset as:

*   Dataset metadata (see sections 5.3.1)
*   Attribute on a Sediment Layer Distribution Grid Point (see sections 5.5.2)

3.6.1   Quality of observed data

It is assumed that the observed data will have been subject to a degree of scrutiny appropriate to the quality standards of the originating authority. The originating authority should be consulted for details of the quality standards applied.

3.6.2   Source(s) of the data

The source of the data should be quoted, refer to the originating authority for further details.

3.6.3   Completeness for the Product Specification

AML products may be produced to fulfil operational requirements, and therefore, may not contain all available information.

All AML datasets must specify instances when:

*   All available data/information has been encoded. Missing data means that the information is not available
*   Only specified/required data/information is encoded.

3.6.4 The following are not explicitly encoded due to the complexity of the subject but short comment may be made in the "supporting textual information" field

3.6.4.1 Quantity of observed data

It is assumed that the quantity of observed data is sufficient to support the resolution of the GS-ESB product supplied by the originating authority. The originating authority should be consulted for details of the data density standards applied.

3.6.4.2 Data processing techniques

The originating authority should be consulted for full details of the standards and or techniques applied.

4   **DATA STRUCTURE**

Refer to the appropriate implementation annex for details of specific implementation, format, and structure.

5   DATA DICTIONARY

5.1   GENERAL GUIDELINES

This section provides real-world descriptions for the metadata, features and attributes contained within the AML GS-ESB dataset. Details of how this information is to be encoded (e.g. using the chosen Exchange Standard) can be found in the implementation annexes.

5.2   UNKNOWN/MISSING ATTRIBUTE VALUES

The way in which an unknown or missing attribute value is handled is dependent upon the exchange standard implemented, see appropriate annex.

5.3   USE OF META INFORMATION

Any meta information stored as attributes of features will override meta information stored at the data-set level. AML datasets contain the following meta-information:

5.3.1   Dataset Metadata

The following table provides the descriptions of dataset meta information required by AML GS-ESB to conform to this Product Specification.

For details of how to represent the dataset metadata described, refer to the appropriate exchange standard implementation annex.

General/Production Information	Description
Production Agency	The agency responsible for the production of the data
Dataset Name	The name of the dataset
Edition Number	The edition number of the dataset
Date of Release	The date the dataset was made available by the data producer (e.g. edition or revision date)
Product Specification Description	The name of the AML Product Specification to which the dataset conforms (see section 2)
Product Specification Version Number	The version number of the AML Product Specification to which the dataset conforms (section 1.2.1)
Product grid size/scale band	The grid size or scale band of the dataset (see section 2.2)
Data Quality	Red = Poor, Amber = Marginal, Green = Reliable.
Completeness for the Product Specification	All available data has been encoded, or not
Data coverage	The content of the data-set described as geographic coverage, extent of spatial objects or inclusion of features.

Security Classification Information	Description
International Defence Organisation (IDO) status (see note)	The International Defence Organisation (IDO) status (if applicable) that must precede, and be applied to, the Protective Marking thus making it an IDO Marking. - North Atlantic Treaty Organisation (NATO) - North Atlantic Co-operation Council (NACC) - Partnership for Peace (PfP) - Western European Union (WEU)
Protective marking	A marking indicating the minimum standards of protection required of the data. - COSMIC TOP SECRET - FOCAL TOP SECRET - TOP SECRET - SECRET - CONFIDENTIAL - RESTRICTED - UNCLASSIFIED
Owner Authority	The NATO country code (NATO STANAG 1059) denoting the 'owner' that is responsible for establishing and setting the protective marking level
Caveat (see note)	A component of a security clearance and/or security class used for computing access rights and controlling information flow by authorising a specific group of subjects to have access to the information
Copyright Statement	Indicates any copyright or releaseability restrictions on the data
Grid Type	Statement of whether the grid is a lattice, domain or other type.

NOTE:

International Defence Organisation (IDO) markings and caveats are mutually exclusive. If the data has an IDO status, then the caveat is not applicable. Additionally, caveats only apply to data that has a Protective Marking of CONFIDENTIAL or above.

5.4   MANDATORY META INFORMATION

All dataset meta information stated in section 5.3.1 is mandatory, see 5.5.2 for mandatory associated attributes.

5.5   SCHEMA

The following tables (5.5.1, 5.5.2 and 5.5.4) provide the descriptions of meta information, real-world features, and associated attributes required by AML GS-ESB to be attributed as complete for this Product Specification. Regular grid points or centres of

latitude/longitude cells can be considered as zero-dimensional or point features, and geo-acoustic parameters at these points as associated attributes.

For details of how to represent the real-world features and associated attributes described, refer to the appropriate exchange standard implementation annex.

5.5.1   Meta Information

The following tables contain non-mandatory generic or data-set meta information.

External Reference Information	Description
Data Source	Reference volumes or external databases of geo-acoustic data.
Originating Authority	The supplier of the source data.
Data Type	General description of the various data types used in the compilation of the GS-ESB product
Image File Link	A reference to an image file containing a pictorial representation of the object
Text File Reference (in national language characters)	The file name relating to an external text file
Reference to a publication	Reference to a specific location of any relevant information within an external publication

Other Supporting Information	Description
Supporting textual information (in national language characters)	Supporting (free text) information relevant to the object that cannot be explicitly encoded by any other attribute. Eg. Data processing techniques

See also 5.3.1, 5.5.2 & 5.5.4

5.5.2   Features.

The Sediment Layer Distribution Grid Point in AML GS-ESB can be a grid point where a geo-acoustic parameter is sampled (lattice grid, in which case interpolation is valid) or the centre of a latitude/longitude cell over which the field is averaged (domain grid, in which case interpolation is not valid). The following table contains the information described below:

- Feature – gives the name of the feature.
- Description – describes the feature.
- Associated Attributes – indicates allowable attributes relevant to each feature. (see section 5.5.4 for attribute descriptions and values.)
- M – denotes that the attribute field is mandatory (also emboldened text)
- Form – indicates the geometric form that the feature class can take (i.e. **P**oint, **L**ine, or **A**rea)

Feature	Description	Associated Attributes		Form		
		Description	**M**	**P**	**L**	**A**
Sediment Layer Distribution Grid Point	A geographical point to which the sediment layer distribution information is appended	• **HF bottom loss category**	√	√		
		• **LF bottom loss category**	√			
		• **N-layer**	√			
		• **Layer thickness**	√			
		• **Two-way travel time**	√			
		• **Sediment Density**	√			
		• **Relative sound speed at the top of the layer**	√			
		• **Sound speed gradient**	√			
		• Sound speed curvature				
		• **Absorption coefficient**	√			
		• Absorption coefficient gradient				
		• Porosity				
		• Shear sound speed				
		• Shear absorption				
		• Quality				

In addition to the 'associated attributes' listed for individual real-world features 'generic attributes' are used at the data-set level. These encode meta and supporting information that may exist on any feature. Generic attributes used in AML GS-ESB are described in section 5.3.1 & 5.5.1.

For details of how to encode the features listed in this section, refer to the appropriate exchange standard implementation annex.

5.5.3   Mandatory Features

Sediment Layer Distribution Grid Point

5.5.4   Attributes

The geo-acoustic parameters can be considered as attributes of the point features. The table below displays the following information:

- Attribute – gives the name of attribute.
- Definition – gives a more detailed description of the attribute if required.
- Values – specifies the range of values and units of measurement the attribute may take

For details of how to encode the attributes listed in this section, refer to the appropriate exchange standard implementation annex.

Attribute	Definition	Values
HF bottom loss category	Defines the BL curve (BL vs Grazing Angle) appropriate to the specified location.	001 Hard bottom (till, also bedrock) 002 Hard bottom and sand bottom equally distributed 003 Sand bottom (sand and gravel) 004 Sand bottom with minor soft bottom areas 005 Sand bottom and soft bottom equally distributed 006 Soft bottom (silt, clay, and mud) 007 Soft bottom with minor hard bottom outcrops 008 Soft bottom and hard bottom equally distributed 009 Hard bottom with minor soft bottom areas -2 No data available -1 Land
LF bottom loss category	Defines the LFBL model appropriate to the specified location.	001 Low 002 Medium 003 High -2 No data available -1 Land
N-Layer	Defines the relative position of the sediment	No units

Attribute	Definition	Values
	layer	
Layer thickness i (i from 1 to n)	Vertical thickness of the sediment layer.	Metres
Two-way travel time (TWTT) i (i from 1 to n)	Two times the time taken for sound to travel from top to bottom of the sediment layer.	Seconds
Sediment Density i (i from 1 to n)	Density of the sediment layer.	Kilograms per cubic metre
Relative sound speed at top of layer i (i from 1 to n)	Ratio of sediment surface sound speed (C_0) to water sound speed (Cw) with a value normally >1.0.	No units
Sound speed gradient i (i from 1 to n)	Sound speed gradient at top of sediment column (at sediment water interface) g_0.	s^{-1} Can be a null value
Sound speed curvature i (i from 1 to n)	ß. This parameter quantifies the rate of decrease of the gradient g_0 with increasing depth (and increasing sound speed.	$m^{-1}s^{-1}$
Absorption coefficient i (i from 1 to n)	Loss of sound energy with distance travelled through the sediment.	Decibels per wavelength (dB/λ)
Absorption coefficient gradient i (i from 1 to n)	Rate of change of absorption coefficient with depth in the sediment layer, assumed linear.	Decibels per wavelength per metre (dB/λ/m)
Porosity i (i from 1 to n)	The ratio of aggregate volume of void space in a rock or sediment to its total volume, expressed as a percentage.	Percentage value
Shear sound speed i (i from 1 to n)	Speed of propagation of shear waves within the sediment layer.	Metres per second
Shear absorption i (i from 1 to n)	Absorption of shear wave energy within the sediment layer.	Decibels per wavelength (dB/λ)
Quality	Reliability of the data	Red, Amber, Green where green is good and red is poor. As defined by the Production Agency

6   DATA CAPTURE GUIDELINES

The 'AML GS-ESB carrier format annex provides guidance on the conventions that are to be used to encode grid points, and associated attribution (parameters), using a relevant implementation standard. The content of the AML GS-ESB is at the discretion of the producing authority.

6.1   CONTINUITY

Gridded datasets consisting of multiple digital source files should aim to be contiguous for consistency of display. To avoid duplication, grid points on the eastern and northern boundaries of a selected area should not be included, in case an adjacent area is added later.

7   DATA PRESENTATION

7.1   SCOPE

The way in which AML GS-ESB is displayed is dependent upon an individual customer's requirement. How their systems are developed to display AML GS-ESB data will largely be governed by the:

- Environment in which the data is to be viewed
- Types of products that are to be displayed with the AML product

This Product Specification is designed to support the production and supply of Gridded Sediment - Environmental Seabed & Beach data. It does not address data presentation.

8   PROVISION OF DATA

8.1   GENERAL

8.1.1   File Format (Encapsulation)

The file format or encapsulation is exchange standard specific.

8.1.2   Auxiliary Information

All media containing AML products will contain cataloguing information regarding the coverage of the products contained within it. A complete AML catalogue is planned for future development.

8.2   DISTRIBUTION MEDIA

AML is available in the following format(s):

- **CD-ROM**
- **DVD**

Other approved means of distribution will be promulgated in due course. While data must be available to users on standard media, other media/transmission means may be agreed directly between producers and recipients.

8.3   VOLUME NAMING

AML volumes (defined as packages) may contain several datasets, each from a different product specification. The volume naming convention for AML 'Packages' is not defined by AML Product Specifications.

8.4   FILE NAMING

CD-ROM   AML file naming conforms to ISO 9660, International Standards Organisation, Information Processing - Volume and File Structure of CD-ROM for Information Interchange.

8.5   DIRECTORY STRUCTURE

CD-ROM   The directory structure conforms to ISO 9660, International Standards Organisation, Information Processing - Volume and File Structure of CD-ROM for Information Interchange.

8.6   ERROR DETECTION

Datasets will undergo file integrity checks that are dependent upon the exchange standard implemented.

8.7   COMPRESSION

See appropriate implementation annex.

8.8   ENCRYPTION

All AML products are unencrypted, irrespective of security classification.

8.9   HARDWARE AND SOFTWARE REQUIREMENTS

N/A.

9   TESTING METHOD

This product specification has been designed to achieve interoperability of AML data products and other digital data products. This is achieved by the separation of the data dictionary from the standard used to encode the data and by the use of internationally recognised standards for the transfer of the data.

It is the responsibility of the data producer to ensure that AML data products fully conform to this Product Specification and to the chosen transfer standard.