ADDITIONAL MILITARY LAYERS

AML Implementation Guidance Document

Edition 1

Published March 2018

Produced and issued under the direction of

NATO's Geospatial Maritime Working Group

CONTENTS 2

1 INTRODUCTION 3

2 REFERENCES 4

3 CONTACT INFORMATION 4

4. IMPLEMENTATION OF AML 5

5 DATA PRODUCT SPECIFICATIONS 6

6 AML S-57 IMPLEMENTATION GUIDANCE 7

6.1 COMPARISON BETWEEN ENC AND AML 7

6.2 AML S-57 SUB-FIELD VALUES 9

6.3 AML S-57 SUB-FIELD VARIANCES 10

7 FEATURE CATALOGUES 12

8 PORTRAYAL 12

9 TEST DATA 12

Annex A GLOSSARY 14

1 INTRODUCTION

Additional Military Layers (AML) is a unified range of geospatial products designed to satisfy military requirements for situational awareness. AML is defined within NATO STANAG 7170 which specifies a number of product specifications which define the content and structure of specific geospatial data products. AML is intended to be used in military systems to support the planning and conduct of operations. AML includes both vector and gridded data products.

This document provides additional guidance to those implementing AML within software systems on how the various specifications should be used. It highlights differences from the IHO Electronic Navigational Chart (ENC) Product Specification and provides explanations of the components of the product specifications.

AML is intended to be supported in a broad range of systems including Warship Electronic Display and Information System (WECDIS), Command Systems and Tactical Decision Aids (TDAs).

A more general introduction to AML is provided in the AML Handbook which is available from the AML pages of the UKHO website.

AML product specifications are listed in Table 1;

Short Title	Product Specification Title	Vector/Grid	Version	Date
AMC	ATMOSPHERIC AND METEOROLOGICAL CLIMATOLOGY	Grid	1.0	3rd November 2004
CLB	CONTOUR LINE BATHYMETRY	Vector	1.0	1st November 2001
ESB	ENVIRONMENT SEABED & BEACH	Vector	1.0	1st November 2001
LBO	LARGE BOTTOM OBJECTS	Vector	1.0	1st November 2001
MFF	MARITIME FOUNDATION & FACILITIES	Vector	1.0	1st November 2001
RAL	ROUTES AREAS & LIMITS	Vector	1.0	1st November 2001
SBO	SMALL BOTTOM OBJECTS	Vector	1.0	1st November 2001
CLB	CONTOUR LINE BATHYMETRY	Vector	2.1	1st November 2005
ESB	ENVIRONMENT SEABED & BEACH	Vector	2.1	1st November 2005
LBO	LARGE BOTTOM OBJECTS	Vector	2.1	1st November 2005
MFF	MARITIME FOUNDATION & FACILITIES	Vector	2.1	1st November 2005
RAL	ROUTES AREAS & LIMITS	Vector	2.1	1st November 2005
SBO	SMALL BOTTOM OBJECTS	Vector	2.1	1st November 2005
IWC	INTEGRATED WATER COLUMN	Grid	2.1	30th June 2006
AML 3.0	ADDITIONAL MILITARY LAYERS	Vector	3.0	1st August 2008
Unendorsed Product Specifications				
GS-ESB	GRIDDED SEDIMENT ENVIRONMENT SEABED & BEACH	Grid	1.0	28th July 2005

Table 1 – Summary of all AML Product Specifications

2 REFERENCES

IHO DOCUMENTS

Available from the IHO website www.iho.int

A. S-57 IHO Transfer Standard for Digital Hydrographic Data

B. S-57 Appendix B.1 - ENC Product Specification

C. S-52 Specifications for Chart Content and Display Aspects of ECDIS

D. S-64 IHO Test Data Sets for ECDIS

NATO DOCUMENTS

Available from the NATO Standardisation Office Portal https://nso.nato.int/nso/

E. STANAG 4564 - WARSHIP ELECTRONIC CHART DISPLAY INFORMATION SYSTEM (WECDIS)

F. STANAG 7170 - ADDITIONAL MILITARY LAYERS (AML) – DIGITAL GEOSPATIAL DATA PRODUCTS

AML DOCUMENTS

Available from the AML pages of the UKHO website
http://www.ukho.gov.uk/Defence/AML/Pages/Home.aspx

G. AML Handbook

H. AML Product Specifications

I. AML Production Specification

J. AML Portrayal Specification (available upon request from UKHO to organisations that hold the S-52 Presentation Library)

K. AML Test Data

3 CONTACT INFORMATION

For further information about AML including further guidance on implementation, please contact the UKHO;

Additional Military Layers
United Kingdom Hydrographic Office
Admiralty Way
Taunton
Somerset
TA1 2DN
United Kingdom

Tel +44 (0) 1823 4844444
Email *tbc*
http://www.ukho.gov.uk/Defence/AML/Pages/Home.aspx

4 IMPLEMENTATION OF AML

AML is intended for use within a wide range of systems including the following;

- Navigation Systems (to support situational awareness)
- Command Systems
- Sensor Systems
- Airborne Systems

Requirements for the implementation of AML vary between systems and application. These may include;

- Import
- Display
- Querying
- Export

For Navigation Systems, the Warship ECDIS (WECDIS) STANAG 4564 states the requirement to support AML. However it is necessary to establish more detailed testable requirements to ensure that implementations achieved the expected user experience. In addition specific national requirements may exist which go beyond those detailed in the WECDIS STANAG. Typically systems will already support IHO S-57 ENC and therefore support for AML is largely an extension of this functionality. Key differences are summarised as follows;

1. AML uses a slightly modified ISO 8211 encapsulation see section 6.1 of this document for more information.

2. AML utilizes expanded feature catalogues which defines additional objects and attributes using lowercase names. As a number of versions of AML are in active use it is necessary to support multiple feature catalogues. Section 7 covers these in more detail.

3. Adapted Portrayal Specification, AML extends and adapts the IHO S-52 Presentation Library to provide a default set of display rules and symbols. This does not prohibit more specific display specifications for particular applications. See section 8 for more details.

4. For gridded data products more significant adaptation is required to support the required encapsulations and content of this data.

5 DATA PRODUCT SPECIFICATIONS

AML data products are defined in a series of product specifications. This section of the document describes how AML product specifications are divided into component parts. This structure allows the separation of the ‘content’ (Objects and Attributes) and the ‘carrier’ encoding. The various components are described as follows;

5.1 MAIN DOCUMENT

These documents define the key requirements and details for the product specification. This includes a data schema which describes the objects and attributes used within a data product.

5.2 IMPLEMENTATION ANNEXES

Each product specification has one or more implementation annex which describes how the data content shall be encapsulated into a file using a specific encoding. For Vector data products AML uses the IHO S-57 Exchange Standard and its ISO 8211 encoding to encapsulate content. More details of this encoding is defined in section 6.

Gridded data products utilize the NetCDF format, which is widely used for the exchange of meteorological and other coverage datasets.

5.3 OBJECT AND ATTRIBUTE CATALOGUES

Each vector data product specification utilizes an Object and Attribute Catalogue and these are described in section 7.

5.4 PORTRAYAL SPECIFICATION

In order to specify how AML content should display within systems a Portrayal specification for vector AML data has been developed and this is described in section 8.

6 AML S-57 IMPLEMENTATION GUIDANCE

AML uses the S-57 exchange standard as its encapsulation for vector data products. It utilizes the same ISO 8211 encoding used for ENC. This section described the differences between the AML and ENC S-57 encodings and details specific variances. This will assist implementers when extending an application to support AML products in addition to ENC.

6.1 COMPARISON BETWEEN ENC AND AML

This section provides a comparison between the S-57 constructs used within AML and ENC. Refer to Table 2;

S-57 CONSTRUCTS USED	AML		ENC	
	Base cell	Update	Base Cell	Update
Dataset General Information Record				
DSID - Dataset Identification field *(for AML sub-field variations refer to section 6.3)*	✓	✓	✓	✓
DSSI - Dataset Structure Information field	✓	✓	✓	✓
Dataset Geographic Reference Record				
DSPM - Dataset Parameter field	✓		✓	
DSPR - Dataset Projection field				
DSRC - Dataset Registration Control field				
Dataset History Record				
DSHT - Dataset History field				
Dataset Accuracy Record				
DSAC - Dataset Accuracy field				
Catalogue Directory Record				
CATD - Catalogue directory field	✓	✓	✓	✓
Catalogue Cross Reference Record				
CATX - Catalogue Cross Reference field				
Data Dictionary Definition Record				
DDDF - Data Dictionary Definition field				
DDDR - Data Dictionary Definition Reference field				
Data Dictionary Domain Record				
DDDI - Data Dictionary Domain Identifier				
DDOM - Data Dictionary Domain field				
DDRF - Data Dictionary Domain Reference field				
Data Dictionary Schema Record				
DDSI - Data Dictionary Schema Identifier field				
DDSC - Data Dictionary Schema field				
Feature Record				
FRID - Feature Record Identifier field *(for AML sub-field variations refer to section 6.3)*	✓	✓	✓	✓

S-57 CONSTRUCTS USED	AML		ENC	
	Base cell	Update	Base Cell	Update
FOID - Feature Object Identifier field	✓	✓	✓	✓
ATTF - Feature Record Attribute field	✓	✓	✓	✓
NATF - Feature Record National Attribute field	✓	✓	✓	✓
FFPC - Feature Record to Feature Object Pointer Control field		✓		✓
FFPT - Feature Record to Feature Object Pointer field	✓	✓	✓	✓
FSPC - Feature Record to Spatial Record Pointer Control field		✓		✓
FSPT - Feature Record to Spatial Record Pointer field	✓	✓	✓	✓
Vector Record				
VRID - Vector Record Identifier field	✓	✓	✓	✓
ATTV - Vector Record Attribute field	✓	✓	✓	✓
VRPC - Vector Record Pointer Control field		✓		✓
VRPT - Vector Record Pointer field	✓	✓	✓	✓
SGCC - Coordinate Control field		✓		✓
SG2D - 2-D Coordinate field	✓	✓	✓	✓
SG3D - 3-D Coordinate field [1]	✓	✓	✓	✓
ARCC - Arc/Curve Definitions field [2]	✓	✓		
AR2D - Arc Coordinates field [2]	✓	✓		
EL2D - Ellipse Coordinates field				
CT2D - Curve Coordinates field				

Table 2 – AML and ENC S-57 comparison

6.2 AML S-57 SUB-FIELD VALUES

The S-57 implementation annexes of the AML Product Specifications include the specification of certain sub-field values that must be set in the exported files. As there is commonality between ENC values and those required by AML, some of these values are retained. However, there are those that are modified for AML purposes.

Table 3 below provides a breakdown of the Subfield and their values that will be required in AML exported files. Values that are modified specifically for AML are indicated in bold (refer also to the notes below).

Always refer to the individual AML Product Specifications for further details concerning subfield values.

Field/Sub-field	AML Application Profiles	
	Base Application Profile values	**Update Application Profile values**
CATD - Catalogue Directory field		
RCNM - Record name	CD	CD
IMPL - Implementation	Examples .asc=Catalogue files .bin =Data set files .txt = Text files .tif = Picture files .pdf = Document files .htm = “ “ .jpg = Photo files .avi = video/film files .mpg = “ “	Examples .asc=Catalogue files .bin =Data set files .txt = Text files .tif = Picture files .pdf = Document files .htm = “ “ .jpg = Photo files .avi = video/film files .mpg = “ “
DSID - Dataset Identification field		
INTU - Intended usage	See section 0	See section 0
STED - Edition number of S-57	03.1	03.1
PRSP - Product Specification	See section 0	See section 0
PRED - Product specification edition number	1.0	1.0
PROF - Application profile identification	See section 0	See section 0
DSSI - Dataset Structure Information field		
DSTR - Data structure	{2} - chain node	{2} - chain node
AALL - ATTF lexical level	{0} or {1}	{0} or {1}
NALL - NATF lexical level	{0} to {2}	{0} to {2}
NOCR - number of cartographic records	{0}	{0}
NOFA - number of face records	{0}	{0}
DSPM - Dataset Parameter field		
HDAT - Horizontal geodetic datum	{2} - WGS84	
DUNI - Units of depth measurement	{1} - metres	
HUNI - Units of height measurement	{1} – metres	
PUNI - Units of positional accuracy	{1} - metres	
COUN - Coordinate units	{1} - lat./lon.	
SOMF - 3-D (sounding) multiplication factor	{10}	

Table 3 – AML S-57 Sub-field values

6.3 AML S-57 SUB-FIELD VARIANCES

AML Product Specifications modify the ENC S-57 implementation of Data Set header records to reflect differences in the intended usage, product specifications, and application profiles.

In order to meet stated requirements for AML products, the following variations from the ENC implementation of S-57 will be necessary. A summary of these amendments is given below.

6.3.1 Data Set Identification Field

These changes affect the following subfields within the Data Set Identification Field (DSID):

- INTU
- PRSP
- PROF

6.3.1.1 Intended Usage Sub-Field (INTU)

Values that AML will use in these sub-fields will be specified in individual AML Product Specifications. However, data may be compiled and made available at the scale bands shown in Table 4:

Scale Band	Data Compilation Scale	Display Scale Range
0	Unscaled	Unscaled
1	< 1:100,000,000	< 1:40,000,000
2	1: 25,000,000	1: 10,000,000 -- 1:62,500,000
3	1: 5,000,000	1: 2,000,000 -- 1:12,500,000
4	1: 1,000,000	1:400,000 -- 1: 2,500,000
5	1:250,000	1:100,000 -- 1:625,000
6	1:50,000	1:20,000 -- 1:125,000
7	1:10,000	1:4,000 -- 1:25,000
8	1:2,500	1:1,000 -- 1:6,250
9	> 1:1,600	> 1:1,500

Table 4 – AML Scale bands and scale values

6.3.1.2 Product Specification Sub-Field (PRSP)

This will be used to denote the appropriate AML Product Specification. Values for the individual AML Product Specifications for use in the PRSP sub-field are given in Table 5:

PRSP No.	AML Product Specifications	Acronyms
51	Maritime Foundation and Facilities	MFF
52	Routes, Areas, and Limits	RAL
53	Large Bottom Objects	LBO
54	Contour Line Bathymetry	CLB
55	Environment, Seabed and Beach	ESB
56	Small Bottom Objects	SBO

Table 5 – Product Specification Sub-Field values

6.3.1.3 Application Profile Sub-field (PROF)

Table 6 lists the mnemonics and associated binary values AML employs for the PROF subfield:

Product Specification	Base Cell File		Update Cell File	
	ASCII	BINARY	ASCII	BINARY
CLB	CN	4	CR	5
ESB	EN	6	ER	7
LBO	LN	10	LR	11
MFF	MN	12	MR	13
RAL	RN	16	RR	17
SBO	SN	18	SR	19

Table 6 – Application profile sub field

6.3.2 Comment Sub-field (COMT)

AML uses this sub field to hold the 'text string' information below:

- IDO Status
- Protective Marking
- Owner Authority
- Caveat

To encode multiple values (as specified above), each of the values are separated by a semi-colon. An example is provided below;

IDO Status = NATO; Protective Marking = Restricted; Owner Authority = UK

System implementations should use these values. For example, chart-like titles may be used to support chart catalogues and searching; protective marking should be displayed prominently when a cell is loaded into the display.

6.3.3 Vector records

The following vector record fields are only used in specific AML products. These are listed in Table 7. All fields are used in AML 3.0 due to the different structure of that product specification.

Field	Product
Arc/Curve Definition Field Structure - ARCC	RAL
Arc Coordinates Field Structure - AR2D	RAL
3-D Coordinate (Sounding Array) Field Structure - SG3D	CLB

Table 7 – Vector records used in specification AML Product Specifications

6.3.4 Feature records

For all AML products the Feature Record Identifier Field (FRID) is fixed to the value 255 = (null) in the GRUP subfield. This reflects that AML products do not use the group 1 and 2 objects as done within ENC to distinguish skin of the earth objects.

7 FEATURE CATALOGUES

For each vector AML Product Specification version there are corresponding Object and Attribute Catalogues. These list all objects and attributes which can be used within those products and list the relevant S-57 codes. However guidance in the product specification may override the Object and Attribute Catalogue content.

- AML 1.0 Object and Attribute O&A Catalogue, Version 1, v1.1.6
- AML 2.1 Object and Attribute O & A Catalogue version 2 & 2.1, v2.3.3
- AML 3.0 AML Feature and Attribute Catalogue v3.0.1

These catalogues are available to download from the AML web pages of the UKHO website.

8 PORTRAYAL

For many years no published display specifications for AML existed. It was envisioned that AML would have different displays for specific applications. However, experience has shown that although specific displays may exist, a common or default display specification was required. Therefore the GMWG set about developing an AML Portrayal Specification which was first published in February 2016. It is aimed primarily at WECDIS systems and provided as a S-52 .DAI file. However this does not prohibit implementation of the specification in other systems including web services.

The AML Portrayal Specification defines symbols and rules for the display of vector AML datasets and supports AML 1.0, 2.1 and 3.0 vector products. It builds on the IHO S-52 Edition 6.1 standard and the Presentation library 4.0.

Additional symbols have been added where required, and additional viewing groups created to allow users to customize the display to meet their needs.

The priority for symbol sources was;

1. S-52
2. Geosym (MIL-89045A)
3. MIL-STD-2525C resp. APP-06(C)
4. Other sources / own creation

No additional Conditional Symbology Procedures as defined in S-52 are included although those in the S-52 Preslib 4.0 are referenced.

Unlike ENC display no simplified symbology is included. Generally colours have been used as follows within the specification;

a. Environmental: green
b. Operational: red
c. Air: blue
d. Seabed: brown

Where appropriate other symbology specifications have been used as the source for symbols and rules. These include IHO S-411, NATO APP-6, MIL STD 2525 and MIL DTL 89045A.

The specification is documented as a .dai file which contains the look up tables and symbols. In addition an Excel spreadsheet provides a human readable version of the specification. A number of additional viewing groups have been used beyond those defined in S-52 and these are also listed within the Excel spreadsheet and should be implemented in software using the names shown.

The specification carries no security markings.

The specification is available on request from GMWG (via the Secretary). It is not made openly available as significant content is common to the IHO S-52 Presentation Library which has to be purchased. The specification will be released to organisations which hold the current presentation library.

8.1 Testing

Due to its basis in S-52 the IHO Test Datasets for ECDIS S-64 Edition 3.0.1 provides a means to test S-52 display and therefore systems which pass these tests should support this specification. A specific test standard may be developed to accompany this specification in the future. Existing AML test data available on the UKHO website may also be useful for testing purposes.

8.2 Maintenance

GMWG welcome feedback on this specification and further versions will be prepared to reflect feedback received and to enhance the specification. This may also include extending this specification to cater for gridded AML data products.

Enquiries or requests for the specification should be directed to the following email address; aml@ukho.gov.uk

9. TEST DATA

AML test data is provided on the AML web pages hosted on the UKHO website LINK. It has been produced to support system development and testing. It is intended to provide representative coverage of the AML data model. To achieve this it contains examples of each object type with at least one example with fully populated attribute values.

9.1 Vector Product Specifications

- AML 1.0 datasets are provided as a set of S-57 base files covering the area of BA Chart 2045. These include a number of additional support files. For the CLB and RAL cells two new editions are also provided. The LBO, ESB and MFF cells also have updates provided.

- AML 2.1 – no specific test data is currently available.

- AML 3.0 – a set of AML 3.0 trials data has been produced by the German Bundeswehr. This covers the following content:

    - Land charts (LND) in different scale bands - derived from various sources as Continental data, VMap1, high resolution land survey data.
    - Bathymetric charts (CLB) in different scale bands -derived from the sea survey data base of the German Hydrographic Office.
    - Flight Aeronautical Information (FAI) - derived from NGA AVDAFIF.
    - Military Flight Information (MFI) - derived from NGA AVDAFIF.
    - Nautical chart background data (NCD) - derived from various German ENCs.
    - Q-Route (QRT), Sediment data - derived from the German Mine Warfare data centre.
    - One SBO cell containing fictitious data.

- One LBO cell containing fictitious data.

9.2 Gridded Product Specifications

- AMC – no test data is currently available.
- IWC – test data for Component 1 (Physical Climatology) and Component 2 (Marine Mammals) is available.

ANNEX A – GLOSSARY

AMC	Atmospheric and Meteorological Climatology
AML	Additional Military Layers
CLB	Contour Line Bathymetry
ECDIS	Electronic Display and Information System
ENC	Electronic Navigational Chart
ESB	Environment, Seabed and Beach
GS ESB	Gridded Sediment Environment Seabed and Beach
IHO	International Hydrographic Organization
IWC	Integrated Water Column
LBO	Large Bottom Objects
MFF	Maritime Foundation and Facilities
NetCDF	Network Common Data Form
RAL	Routes, Areas and Limits
SBO	Small Bottom Objects
STANAG	Standardization Agreement (NATO)
TDA	Tactical Decision Aids
UKHO	United Kingdom Hydrographic Office
WECDIS	Warship Electronic Display and Information System