



HSPT-2

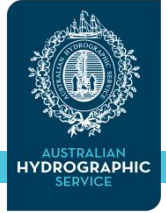
S-44 Edition6 Inputs

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10 Limitations:

- 1 – Currently S-44 is focused only on a final objective, which is the nautical chart, with a depth classification (possible solution to consider: updated table or matrix)
- 2 - Difficulty to have an overview of all requirements (possible solution: updated table or matrix)
- 3 - Limited number of definitions (possible solution: support and liaison with the DQWG and VIM3)
- 4 – Misalignment/lack of connection between S-44 and CATZOC
- 5 - Grid resolution and bathymetric surfaces not addressed
- 6 - Confusion on S-44 use between a-priori TPU and a-posteriori Qualification
- 7 - S-44 should remain technology neutral, be focused on the resultant data and not focus on specific systems or methods
- 8 - Confusion of attributes in metadata and the importance of metadata to support the resultant dataset
- 9 - Outdated chapters
- 10 - Annexes A & B could be placed in C-13 - *Manual on Hydrography*

Inputs



■ Received:

- SHOM
 - 1,2,3,4,6,10
- OMC (Aus UKC developer)
 - 1,4,5,6,10
- BSH
 - 1,3,5,6,7

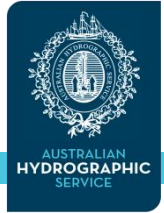
■ Expected:

- NOAA (Neil Weston) – limitation 5

■ Questionnaire



Limitation 1 – Chart Focused



- Currently S-44 is focused only on a final objective, which is the nautical chart, with a depth classification (possible solution to consider: updated table or matrix)
 - Questionnaire: 60 % respondents think S-44 should be extended for other purposes
 - SHOM: Provided 3 suggested options – see next slide
 - OMC: Requested extensions to support UKC systems
 - BSH: Agree S-44 should be extended. Provided a possible structure for 6th Ed



Possible Table over Matrix
layout version 3
(based on PRT-BRA-CAN
work)

5th Edition S-44 Orders

Criteria

Criteria	Special	1a	1b	2
Description	UKC critical	Areas <100m UKC required	Areas <100m UKC not required	Areas >100m
Total Horizontal Uncertainty (m)	2.0	5+5% depth	5+5% depth	20+10% depth
Total Vertical Uncertainty (m)	a = 0.25 b=0.0075	a = 0.5 b=0.013	a = 0.5 b=0.013	a = 1.0 b=0.023
Feature Detection (m ³)	1.0	2 or 10% Depth after 40m depth	NA	NA
Seafloor Coverage / Line Spacing	100%	100%	3 x average depth or 25 meters	4 x average depth
Positioning of Fixed Aids (m)	2	2	2	5
Positioning of Coastline & Topography (m)	10	20	20	20
Floating Navigation Aids (m)	10	10	10	20

Option A : Table 1 with slight modifications

Criteria	Special	1a	1b	2
Description	UKC critical	Areas <100m UKC required	Areas <100m UKC not required	Areas >100m
Total Horizontal Uncertainty (m)	2.0	5+5% depth	5+5% depth	20+10% depth
Total Vertical Uncertainty (m)	a = 0.25 b=0.0075	a = 0.5 b=0.013	a = 0.5 b=0.013	a = 1.0 b=0.023
Feature Detection (m³)	1.0	2 or 10% Depth after 40m depth	NA	NA
Seafloor Coverage / Line Spacing	100%	100%	3 x average depth or 25 meters	4 x average depth
Positioning of Fixed Aids (m)	2	2	2	5
Positioning of Coastline & Topography (m)	10	20	20	20
Floating Navigation Aids (m)	10	10	10	20
Current (speed/direction)	0.1 knot / 10° if current exceed 0.5 knot on specific areas (see XX) B11	0.1 knot / 10° if current exceed 0.5 knot on specific areas (see XX) B11		
Seafloor characterization	on specific areas (see YY) A12	on specific areas (see YY) A12		

Option B : Option A + Matrix

Cells in grey used for S-44 Orders (Safety of Nav. Hydrographic Survey)

		A	B	C	D	E	F	G	H	I	J	K
1	Total Horizontal Uncertainty (m)	0.1	0.25	0.5	1.0	2.0	5.0	10.0	20.0	50.0	5+5% depth	20+10% depth
2	Total Vertical Uncertainty (m)	0.1	a = 0.15 b=0.0075	a = 0.25 b=0.0075	a = 0.5 b=0.013	a = 1.0 b=0.013	a = 1.0 b=0.023	10.0	20.0	50.0		
3	Feature Detection (m³)	0.1	0.25	0.5	1.0	2.0	5.0	10.0	20.0	10% depth		Not Required
4	Seafloor Coverage / Line Spacing	200%	100%	75%	50%	25%	10%	2 x average depth	3 x average depth or 25 meters	4 x average depth	5 x average depth	Not Required
5	Positioning of Fixed Aids (m)	0.1	0.25	0.5	1.0	1.5	2.0	2.5	5.0	10.0		Not Required
6	Positioning of Coastline & Topography (m)	0.5	1.0	2.0	5.0	10.0	15.0	20.0	25.0	50.0		Not Required
7	Floating Navigation Aids (m)	1.0	2.0	5.0	10.0	15.0	20.0	25.0	50.0	100.0		Not Required
8	Structure Heights (m)	0.1	0.25	0.5	1.0	1.5	2.0	>2.0				Not Required
9	Point Cloud Grid Res. (m)	0.1	0.25	0.5	1.0	1.5	2.0	5.0	10.0	20.0		
10	Point Cloud Density (pts/m²)	>100	100	50	25	10	5	1	<1			
11	Survey Data Grid Resolution(m²)	0.1	0.25	0.5	1.0	1.5	2.0	2.5	5.0	10.0	50.0	100.0
12	Grid Source Sounding Density									Interpolat		

Option B : Option A + Matrix (Table 1 with Matrix correspondances)

Criteria	Special	1a	1b	2
Description	UKC critical	Areas <100m UKC required	Areas <100m UKC not required	Areas >100m
Total Horizontal Uncertainty (m)	2.0 1E	5+5% depth 1J	5+5% depth 1J	20+10% depth 1K
Total Vertical Uncertainty (m)	a = 0.25 b=0.0075 2C	a = 0.5 b=0.013 2D	a = 0.5 b=0.013 2D	a = 1.0 b=0.023 2F
Feature Detection (m³)	1.0 3D	2 (3E) or 10% Depth (3I) after 40m depth	NA	NA
Seafloor Coverage / Line Spacing	100% 4B	100% 4C	3 x average depth or 25 meters 4H	4 x average depth 4I
Positioning of Fixed Aids (m)	2 5F	2 5F	2 5F	5 5H
Positioning of Coastline & Topography (m)	10 6E	20 6G	20 6G	20 6G
Floating Navigation Aids (m)	10 7D	10 7D	10 7D	20 7F
Current (speed/direction)	0.1 knot / 10° if current exceed 0.5 knot on specific areas (see XX) B11	0.1 knot / 10° if current exceed 0.5 knot on specific areas (see XX) B11		
Seafloor characterization	on specific areas (see YY) A12	on specific areas (see YY) A12		

Option C : Option B + Other Surveys Recommendations

TABLE 2
Minimum Standards for Hydrographic Surveys for other purpose beyond Safety of Surface Navigation.
(to be read in conjunction with the full text set out in this document.)

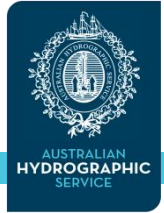
Reference	Purpose	Engineering		Other uses			
		Dredging	Submarine cables pipelines launching	Environmental Monitoring	Marine Archaeology	Habitat Mapping	Others
Order		Eng1	Eng2	Usage 1	Usage 2	Usage 2	Free Use
	2D seismic	Required	Required	Not required	Not required	Identify	Identify
	Seismic penetration	At least up to the minimum dredging/burial quota	At least up to the maximum burial quota	Not required	Not required	Identify	Identify
	Geological samples	Minimum recovery to maximum dredging quota	Minimum recovery to maximum burial quota	Minimum recovery 40 cm - Minimum 3 samples per recognized reflection pattern	Not required	Identify	Identify
	Sedimentological characterization (granulometry)	Characterize at least 4 seabed types: clay, silt, sand and gravel	Characterize at least 9 seabed types: clay, silt, sand (very fine sand, fine sand, medium sand, coarse sand, very coarse sand) and gravel	Characterize at least 4 seabed types: clay, silt, sand and gravel	Not required	Characterize at least 9 seabed types: clay, silt, sand (very fine sand, fine sand, medium sand, coarse sand, very coarse sand) and gravel	Identify
	CaCO3 content	Identify	Identify	Required	Identify	Identify	Identify
	Sediment accumulation rate	Required	Not required	Not required	Not required	Identify	Identify
	Sediment water content	0.1% resolution	0.1% resolution	Not required	Not required	Identify	Identify
	Sediment bulk density	Identify	Identify	Identify	Identify	Identify	Identify
	Water density	0.01% resolution	0.01% resolution	Not required	Not required	Identify	Identify
	Geotechnical testing	Not required	Non-dramed shear strength, void index, Atterberg (LL,LP,IP)	Not required	Not required	Identify	Identify
	Analysis of sediment contamination	Required	Not required	Required	Not required	Identify	Identify
	Total organic carbon in sediment	0.1mg/L resolution	Not required	0.1mg/L resolution	Not required	Identify	Identify
	Underwater acoustic noise	Not required	Not required	Required	Not required	Required	Identify
	Seabed dynamics	Required	Required	Required	Not required	Not required	Identify
	Bottom current	Identify	Identify	Required	Identify	Identify	Identify
	Surface current	Identify	Identify	Required	Identify	Identify	Identify

BSH example possible 6th Ed structure

IHO Standard for Hydrographic Surveys 6th Edition

- Section 1: Classification of Surveys
- Section 2: Sub-standard on Bathymetry
- Section 3: Sub-standard on the Nature of the Seabed
- Section 4: Sub-standard on Chart and Land Survey Vertical Datums Connection
- Section 5: Sub-standard on Tidal Predictions
- Section 6: Sub-standard on Tidal Stream and Current Observations

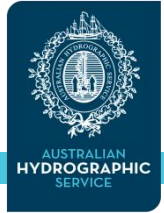
2 – See All Requirements



- Difficulty to have an overview of all requirements (possible solution: updated table or matrix)
 - SHOM: table 1 with slight modifications
 - NOAA stated some of their groups no longer use Table 1 as it doesn't provide required requirements
 - NOAA stated that the matrix has so much more to offer
 - From my experience people don't read S-44 text they mainly reference Table 1; I recommend embed as much into the table/matrix as practical



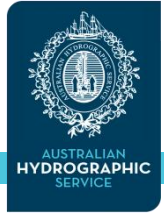
3 – Limited Definitions



- Limited number of definitions (possible solution: support and liaison with the DQWG and VIM3)
 - SHOM: provided update to Ref in Preface; suggested text amendments to Annex A (see “Shom-AnnexA-v0.3.doc”)
 - BSH: suggest terms be used from:
 - International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (known as the VIM)
 - Guide to the Expression of Uncertainty in Measurement (known as the GUM)
 - Provide update for Uncertainty, TPU, Confidence Level and True Value



4 – Misalignment with CATZOC



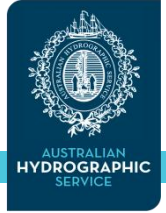
- **Misalignment/lack of connection between S-44 and CATZOC**
 - possible solution: contacts with S-101WG and DQWG
- DQWG have requested HSPT to think about a methodology from survey to CATZOC – **no modification of the CATZOC classification will be made at present**
 - **Do they mean S-57 CATZOC or S-101 M_QUAL?**
- Questionnaire: 55.2% consider it important to have a clearer connection between S-44 and CATZOC
- SHOM: suggest the Matrix approach can fix this by using CATZOC values inside some of the cells of the matrix
- We need to understand how S101 CATZOC will work and have values in Table/Matrix that align



5 – Grid Resolution Surfaces

- Grid resolution and bathymetric surfaces not addressed (contact with S-102)
- Questionnaire: 58% are moving from point measurements to bathymetric surfaces, and 30.4% are considering it in the future
- SHOM – input to add fields on cell size and min number samples
- NOAA – input on survey data grid and point cloud density and recommended values
- BSH – suggest surfaces should be addressed in Chapter 3 and the difference between depth and grid nodes needs explanation
- Could be achieved by adding fields to the Table/Matrix

6 - TPU



- Confusion on S-44 use between a-priori TPU and a-posteriori Qualification (review specific chapters of the S-44)
- SHOM: word document suggested amendment to A3
- OMC: requested a standard TVU presentation, and TVU components to be provided
- BSH: Provided a definition from GUM to clarify
- S101 – layered depth TPU requirement wrt feature detection



7 – Tech Agnostic



- S-44 should remain technology neutral, be focused on the resultant data and not focus on specific systems or methods (review specific chapters of the S-44)
- Questionnaire:
 - MBES is the main sensor used by 88%
 - S-44 drives equipment procurement, capabilities or procedure for 60.2%
- BSH: S-44 should stay away from specific technologies



S57 specifies technology

1	2	3		4	5
ZOC ¹	Position Accuracy ²	Depth Accuracy ³		Seafloor Coverage	Typical Survey Characteristics ⁵
A1	± 5 m + 5% depth	=0.50 + 1% d		Full area search undertaken. Significant seafloor features detected ⁴ and depths measured.	Controlled, systematic survey ⁶ high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 0.6 ± 0.8 ± 1.5 ± 10.5		
A2	± 20 m	= 1.00 + 2% d		Full area search undertaken. Significant seafloor features detected ⁴ and depths measured.	Controlled, systematic survey ⁶ achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder ⁷ and a sonar or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0		
B	± 50 m	= 1.00 + 2% d		Full area search not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth but lesser position accuracies than ZOCA2, using a modern survey echosounder ⁷ , but no sonar or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0		
C	± 500 m	= 2.00 + 5% d		Full area search not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 2.5 ± 3.5 ± 7.0 ± 52.0		
D	worse than ZOC C	Worse Than ZOC C		Full area search not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.
U	Unassessed - The quality of the bathymetric data has yet to be assessed				

8 - Metadata

- Confusion of attributes in metadata and the importance of metadata to support the resultant dataset
- Not mentioned in Questionnaire nor any input received
- However suggest mandatory metadata be considered to support higher-order survey categories eg:
 - Can we accept a bathy dataset for charting as Special Order/ ZOC A1 if provided without metadata on TPUs, Datums, grid processing methodology? ie
- Which S101 attributes will be mandatory encoding? These become survey deliverables either as sounding attributes or survey metadata

S101

S-101 Metadata Feature: Quality of Bathymetric Data (M_QUAL)				
Primitives: Surface				
Real World		Paper Chart Symbol	ECDIS Symbol	
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of temporal variation		1 : unassessed 2 : event 3 : likely to change 4 : likely to change but significant shoaling unlikely 5 : unlikely to change	EN	1,1
Depth range maximum value	(DRVAL2)		RE	0,1
Depth range minimum value	(DRVAL1)		RE	0,1
Features detected			C	1,1
Least depth of detected features measured			(S) BO	1,1
Significant features detected			(S) BO	1,1
Size of features detected			(S) RE	0,1
Full seafloor coverage <u>achieved</u>			BO	1,1
<u>Horizontal position uncertainty</u>	(POSACC)		RE	0,1
Survey date range			C	1,1
Date end	(SUREND)	ISO 8601:2004	(S) <u>TD</u>	1,1
Date start	(SURSTA)	ISO 8601:2004	(S) <u>TD</u>	0,1
<u>Vertical uncertainty</u>	(SOUACC)		RE	0,1

Comment [A37]: Category of temporal variation is also a spatial attribute. Will need to be reconciled (see comment at 2.4.7).

Comment [A38]: DQWG discussion: This may be optional in the final modeling.

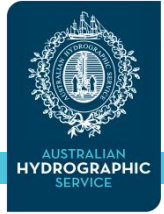
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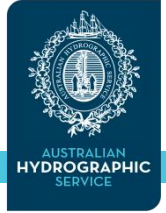
9 - Outdated



- 10 - Annexes A & B could be placed in C-13 - *Manual on Hydrography*
- Questionnaire: 91.81% think it relevant to update C-13
 - But who / when will this occur?
- Questionnaire: more than 75% want included guidelines for survey verification and for other activities
- As there is **no C-13 update schedule** I suggest the reality for S-44 6th Ed is the Annexes need to stay and be updated



10 - Annexes



- Will likely be retained in S-44 and require update
- May require more Annexes if S-44 extended to cover non-safety of navigation hydrography

