



Data Quality
Working Group

IHO Data Quality Working Group

VTC, Feb. 8-9, 2022



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Kastrisios
CCOM

**Survey-QoBD
Matrices**

Morgane
Gaumet
SHOM

ZOC / QoBD Matrices

Christos Kastrisios
February 9, 2022

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
2		ZOC\Order		Special	1a	1b	2																						
3		A1		Valid	Valid<145	Invalid	Invalid																						
4		A2		Valid	Valid	Invalid	Invalid																						
5		B		Valid	Valid	Valid	Valid																						
6		C		Valid	Valid	Valid	Valid																						
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Code 72 - CATZOC - Category of zone of confidence

1.Co.34Replace the existing ZOC table and the associated comments with the following:

"ZOC Table:

1	2	3		4	5
ZOC ¹	Position Accuracy ²	Depth Accuracy ³		Seafloor Coverage	Typical Survey Characteristics ⁵
A1	± 5 m	=0.50 + 1% <i>d</i>		Full area search undertaken. All 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	± 0.6		
		30	± 0.8		
		100	± 1.5		
A2	± 20 m	= 1.00 + 2% <i>d</i>		Full area search undertaken. All 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	± 1.2		
		30	± 1.6		
		100	± 3.0		
B	± 50 m	= 1.00 + 2% <i>d</i>		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	± 1.2		
		30	± 1.6		
		100	± 3.0		
C	± 500 m	= 2.00 + 5% <i>d</i>		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	± 2.5		
		30	± 3.5		
		100	± 7.0		
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				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	
1	Depth					Special		Orders 1a - 1b			Order 2							ZOCA1			ZOCA2			ZOC B			ZOC C			ZOC D		
2						TVU	THU		TVU	THU		TVU	THU					TVU	THU			TVU	THU		TVU	THU		TVU	THU		TVU	THU
3						0.25	2		0.5	5		1	20					0.5	5			1	20		1	50		2	500			
4						0.0075	0		0.013	0.05		0.023	0.1					0.01	0.05			0.02			0.02		0.05					
5	50					0.450694	2		0.820061	7.5		1.523975	25					1	7.5			2	20		2	50		4.5	500			
6	5					0.252797	2		0.504207	5.25		1.006591	20.5					0.55	5.25			1.1			1.1		2.25					
7	10					0.261008	2		0.516624	5.5		1.026109	21					0.6	5.5			1.2			1.2		2.5					
8	15					0.274146	2		0.53668	5.75		1.05784	21.5					0.65	5.75			1.3			1.3		2.75					
9	20					0.291548	2		0.56356	6		1.100727	22					0.7	6			1.4			1.4		3					
10	25					0.3125	2		0.596343	6.25		1.153527	22.5					0.75	6.25			1.5			1.5		3.25					
11	30					0.336341	2		0.634114	6.5		1.214949	23					0.8	6.5			1.6			1.6		3.5					
12	35					0.3625	2		0.676036	6.75		1.283754	23.5					0.85	6.75			1.7			1.7		3.75					
13	40					0.390512	2		0.721388	7		1.358823	24					0.9	7			1.8			1.8		4					
14	45					0.420007	2		0.769562	7.25		1.439175	24.5					0.95	7.25			1.9			1.9		4.25					
15	50					0.450694	2		0.820061	7.5		1.523975	25					1	7.5			2			2		4.5					
16	55					0.482345	2		0.872482	7.75		1.612521	25.5					1.05	7.75			2.1			2.1		4.75					
17	60					0.514782	2		0.926499	8		1.70423	26					1.1	8			2.2			2.2		5					
18	65					0.547865	2		0.981848	8.25		1.798618	26.5					1.15	8.25			2.3			2.3		5.25					
19	70					0.581485	2		1.038316	8.5		1.895284	27					1.2	8.5			2.4			2.4		5.5					
20	75					0.615554	2		1.09573	8.75		1.993897	27.5	$TVU_{max}(d) = \sqrt{a^2 + (b \times d)^2}$				1.25	8.75			2.5			2.5		5.75					
21	80					0.65	2		1.15395	9		2.094182	28					1.3	9			2.6			2.6		6					
22	85					0.684767	2		1.212858	9.25		2.195911	28.5					1.35	9.25			2.7			2.7		6.25					
23	90					0.719809	2		1.27236	9.5		2.298891	29					1.4	9.5			2.8			2.8		6.5					
24	95					0.755087	2		1.332376	9.75		2.402962	29.5					1.45	9.75			2.9			2.9		6.75					
25	100					0.790569	2		1.392839	10		2.507987	30					1.5	10			3			3		7					
26	105					0.82623	2		1.453694	10.25		2.613853	30.5					1.55	10.25			3.1			3.1		7.25					
27	110					0.862047	2		1.514893	10.5		2.72046	31					1.6	10.5			3.2			3.2		7.5					
28	115					0.898001	2		1.576396	10.75		2.827724	31.5					1.65	10.75			3.3			3.3		7.75					
29	120					0.934077	2		1.63817	11		2.935575	32					1.7	11			3.4			3.4		8					
30	125					0.970261	2		1.700184	11.25		3.043949	32.5					1.75	11.25			3.5			3.5		8.25					
31	130					1.006541	2		1.762413	11.5		3.152792	33					1.8	11.5			3.6			3.6		8.5					
32	135					1.042908	2		1.824836	11.75		3.262058	33.5					1.85	11.75			3.7			3.7		8.75					
33	140					1.079352	2		1.887432	12		3.371706	34					1.9	12			3.8			3.8		9					
34	145					1.115866	2		1.950186	12.25		3.481699	34.5					1.95	12.25			3.9			3.9		9.25					
35	150					1.152443	2		2.013082	12.5		3.592005	35					2	12.5			4			4		9.5					
36	155					1.189078	2		2.076108	12.75		3.702597	35.5					2.05	12.75			4.1			4.1		9.75					
37	160					1.225765	2		2.139252	13		3.81345	36					2.1	13			4.2			4.2		10					
38	165					1.2625	2		2.202504	13.25		3.924541	36.5					2.15	13.25			4.3			4.3		10.25					
39	170					1.299279	2		2.265855	13.5		4.035852	37					2.2	13.5			4.4			4.4		10.5					

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2		ZOC\Order	Exclusive	Special	1a	1b	2																						
3		A1/1	Valid	Valid	Valid<145	Invalid	Invalid																						
4		A2/2	Valid	Valid	Valid	Invalid	Invalid																						
5		B/3	Valid	Valid	Valid	Valid	Valid																						
6		C/4	Valid	Valid	Valid	Valid	Valid																						
7		D/5	Valid	Valid	Valid	Valid	Valid																						
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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.
		100	± 52.0		
		1000			
U	Unassessed - The quality of the bathymetric data has yet to be assessed				

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Format Table

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Sort & FilterFind & Select

AnalysisSensitivity

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC
2		ZOC\Order	Exclusive	Special	1a	1b	2	CSB/VBI	Other Source	SDB																			
3		A1/1	Valid	Valid	Valid<145	Invalid	Invalid	Invalid	Invalid	?																			
4		A2/2	Valid	Valid	Valid	Invalid	Invalid	Invalid	Invalid	?																			
5		B/3	Valid	Valid	Valid	Valid	Valid	Invalid	Invalid	?																			
6		C/4	Valid	Valid	Valid	Valid	Valid	Valid	Invalid	?																			
7		D/5	Valid	Valid	Valid	Valid	Valid	Valid	Invalid	?																			
8		U	Valid	Valid	Valid	Valid	Valid	Valid	Valid	?																			
9		Oceanic	Valid	Valid	Valid	Valid	Valid	Valid	Valid	?																			
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		Depth (m)	Accuracy (m)		
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		Depth (m)	Accuracy (m)		
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		30	± 3.5		
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.
		Depth (m)	Accuracy (m)		
		10	± 7.0		
		30	± 52.0		
U	Unassessed - The quality of the bathymetric data has yet to be assessed				

7.3 TABLE 1 - Minimum Bathymetry Standards for Safety of Navigation Hydrographic Surveys						
To be read in conjunction with the full text set out in this document, m = metres, all uncertainties at 95% confidence level, * = Matrix Reference.						
Reference	Criteria	Order 2	Order 1b	Order 1a	Special Order	Exclusive Order
Chapter 1	Area description (Generally)	Areas where a general description of the sea floor is considered adequate.	Areas where underkeel clearance is not considered to be an issue for the type of surface shipping expected to transit the area.	Areas where underkeel clearance is considered not to be critical but features of concern to surface shipping may exist.	Areas where underkeel clearance is critical	Areas where there is strict minimum underkeel clearance and manoeuvrability criteria
Section 2.6	Depth THU [m] + [% of Depth]	20 m + 10% of depth	5 m + 5% of depth	5 m + 5% of depth	2 m	1 m
Section 2.6 Section 3.2 Section 3.2.3	Depth TVU (a) [m] and (b)	a = 1.0 m b = 0.023	a = 0.5 m b = 0.013	a = 0.5 m b = 0.013	a = 0.25 m b = 0.0075	a = 0.15 m b = 0.0075
Section 3.3	Feature Detection [m] or [% of Depth]	Not Specified	Not Specified	Cubic features > 2 m, in depths down to 40 m; 10% of depth beyond 40 m *Bc5, Bf3 beyond 40m	Cubic features > 1 m *Be5	Cubic features > 0.5 m *Be9
Section 3.4	Feature Search [%]	Recommended but Not Required	Recommended but Not Required	100% *Bg9	100% *Bg9	200% *Bg12
Section 3.5	Bathymetric Coverage [%]	5% *Bh3	5% *Bh3	≤ 100% *Bs9	100% *Bh9	200% *Bh12

7.6 MATRIX														
Matrix for Hydrographic Surveys. To be read in conjunction with the full text set out in this document, m = metres, all uncertainties at 95% confidence level.														
Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
BATHYMETRY														
a Depth THU [m]	500	200	100	50	20	15	10	5	2	1	0.5	0.35	0.1	0.05
b Depth THU [% of depth]	20	10	5	2	1	0.5	0.25	0.1						
c Depth TVU "a" [m]	100	50	25	10	5	2	1	0.5	0.3	0.25	0.2	0.15	0.1	0.05
d Depth TVU "b" Note 1	0.20	0.10	0.05	0.023	0.02	0.013	0.01	0.0075	0.004	0.002				
e Feature Detection [m]	50	20	10	5	2	1	0.75	0.7	0.5	0.3	0.25	0.2	0.1	0.05
f Feature Detection [% of Depth]	25	20	10	5	3	2	1	0.5	0.25					
g Feature Search [%]	1	3	5	10	20	30	50	75	100	120	150	200	300	
h Bathymetric Coverage [%]	1	3	5	10	20	30	50	75	100	120	150	200	300	

Table A1 - Matrix Classes and Description									
Class	Description								
B	Bathymetry								
P	Other Positioning								
W	Water Flow								
N	Nature of the Bottom								

Criteria	1	2	3	4	5	6	7	8	9
OTHER POSITIONING ABOVE THE VERTICAL REFERENCE									
a Fixed Aids, Features Significant to Navigation THU [m]	50	20	10	5	3	2	1	0.5	0.2
b Fixed Aids, Features Significant to Navigation TVU [m]	3	2	1	0.5	0.25	0.1	0.05	0.01	
c Floating Aids and Objects THU [m]	50	20	10	5	2	1	0.5		

Figure A1 - Example: (Pb4) derivation of Fixed Aids, Features Significant to Navigation TVU = 0.5 m

7.4 TABLE 2 - Other Minimum Standards for Safety of Navigation Surveys						
To be read in conjunction with the full text set out in this document. Standards for Table 2 data types only apply where such measurements are required for the survey.						
m = metres. All uncertainties at 95% confidence level. * = Matrix Reference.						
Reference	Criteria	Uncertainty Type	Order 2	Order 1b	Order 1a	Special Order
Section 5.2	Fixed Objects, Aids, Features Above the Vertical Reference Significant to Navigation	THU [m]	5 m	2 m	2 m	2 m
		TVU [m]	2 m	2 m	1 m	0.5 m
Section 5.3	Floating Objects and Aids to Navigation	THU [m]	20 m	10 m	10 m	10 m
Section 5.4	Coastline (high, low, MWL water lines, etc)	THU [m]	10 m	10 m	10 m	10 m
Section 5.5	Features Above the Vertical Reference Less Significant to Navigation	THU [m]	20 m	20 m	20 m	10 m
		TVU [m]	3 m	2 m	1 m	0.5 m
Section 5.6	Overhead Clearances and Range Line, Sector Light Heights	THU [m]	10 m	10 m	5 m	2 m
		TVU [m]	3 m	2 m	1 m	0.5 m
Section 5.7	Angular Measurements	[degrees]	0.5 degrees			
Section 5.4	Water Flow Direction	[degrees]	10 degrees			
Section 5.4	Water Flow Speed	[knots]	0.1 knots			

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
OTHER POSITIONING ABOVE THE VERTICAL REFERENCE														
a Fixed Aids, Features Significant to Navigation THU [m]	50	20	10	5	3	2	1	0.5	0.2	0.1	0.05	0.01		
b Fixed Aids, Features Significant to Navigation TVU [m]	3	2	1	0.5	0.25	0.1	0.05	0.01						
c Floating Aids and Objects THU [m]	50	20	10	5	2	1	0.5							
d Coastline THU (high, low, MWL water lines, etc.) [m]	20	10	5	1	0.5	0.25	0.1							
e Features Less Significant to Navigation THU [m]	50	20	10	5	3	2	1	0.5	0.2	0.1	0.05	0.01		
f Features Less Significant to Navigation TVU [m]	3	2	1	0.5	0.3	0.25	0.1	0.05	0.01					
g Overhead Clearance and Range line, Sector Light Heights THU [m]	10	5	2	1	0.5	0.2	0.1	0.05	0.01					
h Overhead Clearance and Range line, Sector Light Heights TVU [m]	3	2	1	0.5	0.3	0.1	0.05	0.01						
i Angular Measurements [degrees]	5	2.5	1	0.5	0.2	0.1	0.05							

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
WATER FLOW														
a Flow Direction [degrees]	10	7.5	5.0	2.5	1.0	0.5	0.25	0.10						
b Flow Speed [knots]	2	1	0.5	0.25	0.10									

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14
NATURE OF THE BOTTOM														
a Bottom Characterisation Method Note 2	PHY - VIS	PHY - LAB	PHY - VIS & LAB	INF	INF w/ GT (VIS)	INF w/ GT (LAB)	INF w/ GT (VIS & LAB)							
b Bottom Sampling Frequency approximate [m]	As Req to GT	10,000	5,000	2,500	1,852	1,000	500	250	100	75	50	25	10	5

Note 1: To use the parameter "b", as a percentage of depth, multiply it by 100.

Note 2: PHY = Physical Sampling. VIS = Visual Analysis. LAB = Laboratory Analysis. INF = Inference Technique. w/ = With. GT = Ground Truth. As Req to GT = As Required to Ground Truth any Inference Technique (see [section 3.8](#)).

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
Depth	Exclusive Order			Special		Orders 1a - 1b		Order 2								ZOC A1 / QoBD 1		ZOC A2 / QoBD 2		ZOC B / QoBD3		ZOC C / QoBD 4		ZOC D / QoBD 5						
		TVU	THU		TVU	THU		TVU	THU		TVU	THU					TVU	THU		TVU	THU		TVU	THU		TVU	THU		TVU	THU
2																														
3	a	0.15	1		0.25	2		0.5	5		1	20					0.5	5		1	20		1	50		2	500			
4	b	0.0075	0		0.0075	0		0.013	0.05		0.023	0.1					0.01	0.05		0.02			0.02			0.05				
5	50	0.403887361	1		0.450694	2		0.820061	7.5		1.523975	25					1	7.5		2	20		2	50		4.5	500			
6	5	0.154616461	1		0.252797	2		0.504207	5.25		1.006591	20.5					0.55	5.25		1.1			1.1			2.25				
7	10	0.167705098	1		0.261008	2		0.516624	5.5		1.026109	21					0.6	5.5		1.2			1.2			2.5				
8	15	0.1875	1		0.274146	2		0.53668	5.75		1.05784	21.5					0.65	5.75		1.3			1.3			2.75				
9	20	0.212132034	1		0.291548	2		0.56356	6		1.100727	22					0.7	6		1.4			1.4			3				
10	25	0.240117159	1		0.3125	2		0.596343	6.25		1.153527	22.5					0.75	6.25		1.5			1.5			3.25				
11	30	0.270416346	1		0.336341	2		0.634114	6.5		1.214949	23					0.8	6.5		1.6			1.6			3.5				
12	35	0.302334666	1		0.3625	2		0.676036	6.75		1.283754	23.5					0.85	6.75		1.7			1.7			3.75				
13	40	0.335410197	1		0.390512	2		0.721388	7		1.358823	24					0.9	7		1.8			1.8			4				
14	45	0.369332168	1		0.420007	2		0.769562	7.25		1.439175	24.5					0.95	7.25		1.9			1.9			4.25				
15	50	0.403887361	1		0.450694	2		0.820061	7.5		1.523975	25					1	7.5		2			2			4.5				
16	55	0.438926247	1		0.482345	2		0.872482	7.75		1.612521	25.5					1.05	7.75		2.1			2.1			4.75				
17	60	0.474341649	1		0.514782	2		0.926499	8		1.70423	26					1.1	8		2.2			2.2			5				
18	65	0.510055144	1		0.547865	2		0.981848	8.25		1.798618	26.5					1.15	8.25		2.3			2.3			5.25				
19	70	0.546008242	1		0.581485	2		1.038316	8.5		1.895284	27					1.2	8.5		2.4			2.4			5.5				
20	75	0.582156551	1		0.615554	2		1.09573	8.75		1.993897	27.5					1.25	8.75		2.5			2.5			5.75				
21	80	0.618465844	1		0.65	2		1.15395	9		2.094182	28					1.3	9		2.6			2.6			6				
22	85	0.654909345	1		0.684767	2		1.212858	9.25		2.195911	28.5					1.35	9.25		2.7			2.7			6.25				
23	90	0.691465834	1		0.719809	2		1.27236	9.5		2.298891	29					1.4	9.5		2.8			2.8			6.5				
24	95	0.728118294	1		0.755087	2		1.332376	9.75		2.402962	29.5					1.45	9.75		2.9			2.9			6.75				
25	100	0.764852927	1		0.790569	2		1.392839	10		2.507987	30					1.5	10		3			3			7				
26	105	0.801658437	1		0.82623	2		1.453694	10.25		2.613853	30.5					1.55	10.25		3.1			3.1			7.25				
27	110	0.838525492	1		0.862047	2		1.514893	10.5		2.72046	31					1.6	10.5		3.2			3.2			7.5				
28	115	0.875446315	1		0.898001	2		1.576396	10.75		2.827724	31.5					1.65	10.75		3.3			3.3			7.75				
29	120	0.91241438	1		0.934077	2		1.63817	11		2.935575	32					1.7	11		3.4			3.4			8				
30	125	0.949424168	1		0.970261	2		1.700184	11.25		3.043949	32.5					1.75	11.25		3.5			3.5			8.25				
31	130	0.986470983	1		1.006541	2		1.762413	11.5		3.152792	33					1.8	11.5		3.6			3.6			8.5				
32	135	1.023550805	1		1.042908	2		1.824836	11.75		3.262058	33.5					1.85	11.75		3.7			3.7			8.75				
33	140	1.060660172	1		1.079352	2		1.887432	12		3.371706	34					1.9	12		3.8			3.8			9				
34	145	1.097796088	1		1.115866	2		1.950186	12.25		3.481699	34.5					1.95	12.25		3.9			3.9			9.25				
35	150	1.134955946	1		1.152443	2		2.013082	12.5		3.592005	35					2	12.5		4			4			9.5				
36	155	1.172137471	1		1.189078	2		2.076108	12.75		3.702597	35.5					2.05	12.75		4.1			4.1			9.75				
37	160	1.209338662	1		1.225765	2		2.139252	13		3.81345	36					2.1	13		4.2			4.2			10				
38	165	1.24655776	1		1.2625	2		2.202504	13.25		3.924541	36.5					2.15	13.25		4.3			4.3			10.25				
39	170	1.283793208	1		1.299279	2		2.265855	13.5		4.035852	37					2.2	13.5		4.4			4.4			10.5				

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ZOC_THU-TVU

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA						
1	Horizontal	(see S-44 7.6 Matrix)										Vertical	(see S-44 7.6 Matrix)																			
2	a/b(%)	0.1	0.25	0.5	1	2	5	10	20		0.002	0.004	0.0075	0.01	0.013	0.02	0.022	0.05	0.1	0.2												
3	0.05	0.08	0.125	0.2	0.35	0.65	1.55	3.05	6.05	0.05	0.0781025	0.13	0.23048861	0.30413813	0.39319207	0.60207973	0.66189123	1.5008331	3.00041664	6.00020833												
4	0.1	0.13	0.175	0.25	0.4	0.7	1.6	3.1	6.1	0.1	0.11661904	0.15620499	0.24622145	0.31622777	0.40261644	0.60827625	0.66753277	1.50332964	3.0016662	6.00083328												
5	0.35	0.38	0.425	0.5	0.65	0.95	1.85	3.35	6.35	0.15	0.16155494	0.19209373	0.27041635	0.3354102	0.41785165	0.61846584	0.67683085	1.50748134	3.00374766	6.00187471												
6	0.5	0.53	0.575	0.65	0.8	1.1	2	3.5	6.5	0.2	0.20880613	0.23323808	0.30103986	0.36055513	0.43829214	0.63245553	0.68963759	1.5132746	3.00665928	6.00333241												
7	1	1.03	1.075	1.15	1.3	1.6	2.5	4	7	0.25	0.2570992	0.27730849	0.3363406	0.39051248	0.46324939	0.65	0.705762	1.52069063	3.01039864	6.00520607												
8	2	2.03	2.075	2.15	2.3	2.6	3.5	5	8	0.3	0.30594117	0.32310989	0.375	0.42426407	0.49203658	0.67082039	0.72498276	1.52970585	3.01496269	6.00749532												
9	5	5.03	5.075	5.15	5.3	5.6	6.5	8	11	0.5	0.50358713	0.51419841	0.5482928	0.58309519	0.63411355	0.78102497	0.82800966	1.58113883	3.04138127	6.02079729												
10	10	10.03	10.075	10.15	10.3	10.6	11.5	13	18	1	1.00179838	1.00717426	1.025	1.04403065	1.07335921	1.16619038	1.19816526	1.80277564	3.16227766	6.08276253												
11	15	15.03	15.075	15.15	15.3	15.6	16.5	18	21	2	2.0008998	2.00359677	2.01261646	2.02237484	2.03767024	2.0880613	2.10608642	2.5	3.60555128	6.32455532												
12	20	20.03	20.075	20.15	20.3	20.6	21.5	23	26	5	5.00035999	5.00143979	5.00505994	5.00899191	5.01518694	5.03587132	5.04337189	5.22015325	5.83095189	7.81024968												
13	50	50.03	50.075	50.15	50.3	50.6	51.5	53	56	10	10.00018	10.00072	10.0025309	10.004499	10.0076021	10.0179838	10.0217563	10.1118742	10.4403065	11.6619038												
14	100	100.03	100.075	100.15	100.3	100.6	101.5	103	106	25	25.000072	25.000288	25.0010125	25.0017999	25.0030418	25.007199	25.0087105	25.0449596	25.1793566	25.7099203												
15	200	200.03	200.075	200.15	200.3	200.6	201.5	203	206	50	50.000036	50.000144	50.0005062	50.0009	50.001521	50.0035999	50.0043558	50.0224949	50.0899191	50.3587132												
16	500	500.03	500.075	500.15	500.3	500.6	501.5	503	506	100	100.000018	100.000072	100.000253	100.00045	100.00076	100.0018	100.002178	100.011249	100.04499	100.179838												
17																																
18	maximum depth of survey	THU																														
19	30																															
20																																
21		Exclusive Order	Special		Orders 1a - 1b		Order 2			ZOC A1 / QoBD 1	ZOC A2 / QoBD 2	ZOC B / QoBD3		ZOC C / QoBD 4		ZOC D / QoBD 5																
22	Depth	TVU	THU	TVU	THU	TVU	THU	TVU	THU	TVU	THU	TVU	THU	TVU	THU	TVU	THU	TVU	THU													
23	30	0.27041635	1	0.3363406	2	0.63411355	6.5	1.21494856	23	0.8	6.5	1.6	20	1.6	50	3.5	500	0	0													
24																																
25	CATZOC/QoBD	A1 / 1	A2 / 2	B / 3	C / 4	D / 5																										
26	horizontal	6.5	20	50	500																											
27	vertical	0.8	1.6	1.6	3.5																											
28																																
29																																
30		Over 300 meters of depth, the THU for A1/1 is greater than A2/2...																														
31																																
32																																
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S-44 7.6 Matrix)

Criteria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
B	BATHYMETRY														
a	Depth THU [m]	500	200	100	50	20	15	10	5	2	1	0.5	0.35	0.1	0.05
b	Depth THU [% of depth]	20	10	5	2	1	0.5	0.25	0.1						
c	Depth TVU "a" [m]	100	50	25	10	5	2	1	0.5	0.3	0.25	0.2	0.15	0.1	0.05
d	Depth TVU "b" Note 1	0.20	0.10	0.05	0.023	0.02	0.013	0.01	0.0075	0.004	0.002				

Test	Insert depth at location	Insert vertical values fixed	Insert vertical values %	Insert horizontal values fixed	Insert horizontal values %
	30	0.05	0.013	5	5
	Calculated TVU from matrix based on above values		Calculated THU from matrix based on above values		
	0.393192065		6.5		
	QoBD Vertical		QoBD Horizontal		
	1		1		
	Maximum Combined QoBD for location				
	1				
	Derived value for ZOC Matrix (criterion 1)		Derived value for ZOC Matrix (criterion 2)		
	1		1		

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA							
1	Feature Detection		(see S-44 7.6 Matrix)				S-44				ZOC Requirement																							
2	a/b%	0.25	0.5	1	2	3	5	10	20	25		a/b(%)	0.25	0.5	1	2	3	5	10	20	25													
3	0.05	0.175	0.3	0.55	1.05	1.55	2.55	5.05	10.05	12.55		0.05	0.175	0.3	0.55	1.05	1.55	2.55	5.05	10.05	12.55		Feature detection: Ability of a system to detect features of a defined size.											
4	0.1	0.225	0.35	0.6	1.1	1.6	2.6	5.1	10.1	12.6		0.1	0.225	0.35	0.6	1.1	1.6	2.6	5.1	10.1	12.6													
5	0.2	0.325	0.45	0.7	1.2	1.7	2.7	5.2	10.2	12.7		0.2	0.325	0.45	0.7	1.2	1.7	2.7	5.2	10.2	12.7													
6	0.25	0.375	0.5	0.75	1.25	1.75	2.75	5.25	10.25	12.75		0.25	0.375	0.5	0.75	1.25	1.75	2.75	5.25	10.25	12.75													
7	0.3	0.425	0.55	0.8	1.3	1.8	2.8	5.3	10.3	12.8		0.3	0.425	0.55	0.8	1.3	1.8	2.8	5.3	10.3	12.8													
8	0.5	0.625	0.75	1	1.5	2	3	5.5	10.5	13		0.5	0.625	0.75	1	1.5	2	3	5.5	10.5	13													
9	0.7	0.825	0.95	1.2	1.7	2.2	3.2	5.7	10.7	13.2		0.7	0.825	0.95	1.2	1.7	2.2	3.2	5.7	10.7	13.2													
10	0.75	0.875	1	1.25	1.75	2.25	3.25	5.75	10.75	13.25		0.75	0.875	1	1.25	1.75	2.25	3.25	5.75	10.75	13.25													
11	1	1.125	1.25	1.5	2	2.5	3.5	6	11	13.5		1	1.125	1.25	1.5	2	2.5	3.5	6	11	13.5													
12	2	2.125	2.25	2.5	3	3.5	4.5	7	12	14.5		2	2.125	2.25	2.5	3	3.5	4.5	7	12	14.5													
13	5	5.125	5.25	5.5	6	6.5	7.5	10	15	17.5		5	5.125	5.25	5.5	6	6.5	7.5	10	15	17.5													
14	10	10.125	10.25	10.5	11	11.5	12.5	15	20	22.5		10	10.125	10.25	10.5	11	11.5	12.5	15	20	22.5													
15	20	20.125	20.25	20.5	21	21.5	22.5	25	30	32.5		20	20.125	20.25	20.5	21	21.5	22.5	25	30	32.5													
16	50	50.125	50.25	50.5	51	51.5	52.5	55	60	62.5		50	50.125	50.25	50.5	51	51.5	52.5	55	60	62.5													
17																																		
18	maximum depth of survey																																	
19	50																																	
20																																		
21	S-44 (See S-44 Table 1)												S-57	Significant Features		Corresponding to depth																		
22	Order	Exclusive	Special	1a	1b	2								Yes	No	Feature Size																		
23	Feature size	0.5	1	5	unspecified	unspecified								Detected		5																		
24																																		
25																																		
26	3.3 Feature Detection												Significant seafloor features are defined as those rising above depicted depths by more than:																					
27	Minimum standards for feature detection are specified in Table 1 . A cubic feature is used as a basic shape reference for a system feature detection ability and implies a symmetrical 3-D shape of six equal square sides.												Depth		Significant Feature																			
28													a. <40 m		2 m																			
29													b. >40 m		10% depth																			
30	In assessing a survey system's feature detection ability, the entire survey system, including equipment, methodologies, procedures, and personnel, must be assessed. It is the responsibility of the hydrographic office or authority that is gathering the data to assess the capability of any proposed survey systems to detect significant features .												A full seafloor search indicates that a systematic survey was conducted using detection systems, depth measurement systems, procedures, and trained personnel designed to detect and measure depths on significant seafloor features. Significant features are included on the chart as scale allows. It is impossible to guarantee that no significant feature could remain undetected, and significant features may have become present in the area since the time of the survey.																					
31																																		
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37																																		
38																																		
39																																		
40																																		
41	TABLE 1																																	
42	Reference	Criteria	Order 2	Order 1b	Order 1a	Special Order	Exclusive Order																											
43	Section 3.3	Feature Detection [m] or [% of Depth]	Not Specified	Not Specified	Cubic features > 2 m, in depths down to 40 m; 10% of depth beyond 40 m *Be5, Bf3 beyond 40m	Cubic features > 1 m *Be6	Cubic features > 0.5 m *Be9																											
44																																		
45																																		

Test	Insert depth at location	Insert detection values	
		fixed	%
	50	1	2
		Survey Detection Size for above input values	
		1	
		Achieved S-44 Survey Order SPECIAL	
		Required ZOC Feature Size 5	
		Significant Features Detected TRUE	
		Derived value for ZOC Matrix 1	

Test	Insert depth at location	Insert detection values	
		fixed	%
	50	1	2
Survey Detection Size for above input values			
		1	2
Achieved S-44 Survey Order SPECIAL			
Required ZOC Feature Size 5			
Significant Features Detected TRUE			
Derived value for ZOC Matrix 1			

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	Survey-to-ZOC Matrix			Codes for QoBD categories																							
2				Codes																							
3				QoBD																							
4		Criterion		1	2	3	4	5	O	U	AutolInputs																
5		TVU	1	1	2	2	3	4	N/A	N/A	1																
6		THU	2	1	2	3	4	5	N/A	N/A	1																
7		Full Coverage	3	1	1	0	0	0	N/A	N/A	1																
8		Feature Detection	4	1	1	0	0	0	N/A	N/A	Example	11.22.31.41.51.61.72	1														
9		Feature Depth	5	1	1	0	0	0	N/A	N/A		11.22.31.41.51.61.73	1														
10		Uncharted Features	6	1	1	0	0	0	N/A	N/A	1																
11		Systematic Survey	7	1	1	1	0	0	N/A	N/A	1																
12		Temporal Variation	8	1	2	2	2	3, 4	N/A	N/A	1																
13		Currentness	9												0												
14		Cartography	10																								
15		Oceanic	11	0	0	0	0	0	0	1	N/A																
16																											
17																											
18																											
19				Permissible QoBD for achieved specifications																							
20				QoBD																							
21				Codes						Manually Insert Values			Max QoBD														
22		Criterion		0	1	2	3	4	5	6	e.g.	from above	For Criterion	Automated inputs													
23		TVU	1	N/A	1	2	4	5	N/A	N/A	11-->1	1	1	e.g.													
24		THU	2	N/A	1	2	3	4	5	N/A	22-->2	2	1	Where "0" == N/A (i.e., "something is wrong with the inputs!!")													
25		Full Coverage	3	3	1	N/A	N/A	N/A	N/A	N/A	31-->1	1	1	Where "0" == N/A (i.e., "something is wrong with the inputs!!")													
26		Feature Detection	4	3	1	N/A	N/A	N/A	N/A	N/A	41-->1	1	1	Where "0" == N/A (i.e., "something is wrong with the inputs!!")													
27		Feature Depth	5	3	1	N/A	N/A	N/A	N/A	N/A	51-->1	1	1	Where "0" == N/A (i.e., "something is wrong with the inputs!!")													
28		Uncharted Features	6	3	1	N/A	N/A	N/A	N/A	N/A	61-->1	1	1	Where "0" == N/A (i.e., "something is wrong with the inputs!!")													
29		Systematic Survey	7	4	1	N/A	N/A	N/A	N/A	N/A	72-->2	2	1	Where "0" == N/A (i.e., "something is wrong with the inputs!!")													
30		Temporal Variation	8	N/A	1	2	5	5	N/A	N/A	1																
31		Currentness	9												1												
32		Cartography	10																								
33		Oceanic	11	1	O	N/A	N/A	N/A	N/A	N/A	Assigned QoBD																
34															1												
35																											
36																											
37																											
38																											
39																											

...S-44 & ZOCZOC_THU-TVUCoverageFeature DetectionCurrentnessCartographyDataSourceZOC MATRIXS44-ZOC SummaryS-44 TablesZOC-QoBD TablesS44-ZOC S44 ...

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TBD

Member State	Used Values	Sources	Usage Band dependent	Downgrading with		Time dependent	
				time	gener/tion	1	5
Australia							
Brazil	All					A1	A2
Finland							
France							
Italy					Yes		
Japan							
Netherlan ds							
Norway							
UK							
USA							

Member State	Used values	Other source	Usage band dependant	Downgrading	Comments
Australia	A1, A2, B, C, D	Not specified	No information	No	CATZOC C is too wide
Brazil	A1, A2, B, C, D, U	Not specified	No information	No	Digitization from paper
Finland	A1, A2, B, C, U	Not specified	No information	No	CATZOC ENC=paper
France	A2, B, C, D	Not specified	Yes	No	Matrix ZOC/S-44
Italy	A1, A2, B, C, D, U	Not specified	Yes	Yes	Digitization from paper
Japan	A1, B, C, D, U	Not specified	No information	No	None
Netherlands	A1, A2, B, D	Rijkswaterstaat	No information	Yes	Dynamic seabed
Norway	A1, A2, B, C	Not specified	No information	No	Moving glaciers
UK	A1, A2, B, C, D	Not specified	No information	No	CATZOC U avoided
US	A1, A2, B, C, D	US ACoE / Navy	No information	No	US ACoE -> B value

DQWG16, 9/10 February 2021, VTC

Inputs

S-44 & ZOC

ZOC_THU-TVU

Coverage

Feature Detection

Currentness

Cartography

DaraSource

ZOC MATRIX

S44-ZOC Summary

S-44 Tables

ZOC-QoBD Tables

S44-Z ...

Ready

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THANK YOU!

