



IHO/HSSC

Hydrographic Surveys Project Team

1st Meeting / 20-21-22 June 2017 / PARIS

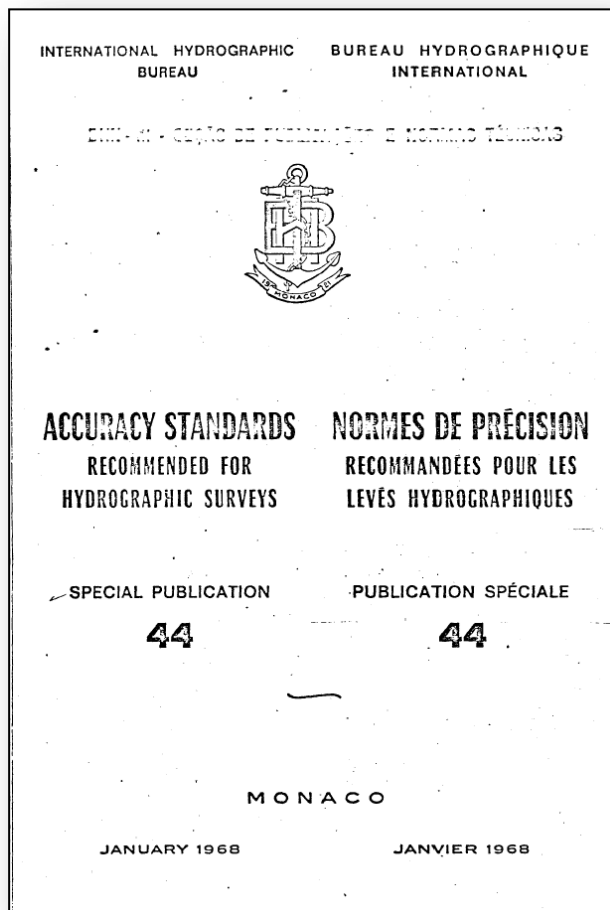
1st day outcomes



1st meeting of HSSC Project Team on Standards for Hydrographic Surveys (HSPT1) at Palais de la Porte Dorée, Paris, France, 20th to 22th June 2017



S-44 (1st edition –1968) :



Section II. — Vertical control

1. *Measurements of depth*

Allowable errors:

- (a) 0 - 20 m (0-11 fm): 0.3 m (1.0 ft)
- (b) 20 - 100 m (11-55 fm): 1.0 m (0.5 fm)
- (c) Deeper than 100 m (55 fm): 1% of depth.

Section IV. — Sampling of bottom characteristics

In general, sufficient sampling should be done to demarcate the limits where one general type of bottom changes to another.

In waters that may be used for anchoring, samples should be taken at regular intervals not to exceed 5 cm (2 in) at the scale of the survey. In other areas, shoaler or deeper, a spacing of 8 cm (3 in) is sufficient depending on the regularity of the bottom. Deep-water bottom samples, over 100 m (55 fm), are classed as oceanographic observations requiring special equipment and samples will be taken as required.

Section III. — Current measurements

The velocity of the current at each station should be determined to the nearest 0.1 knot and the direction of the current to the nearest 10 degrees.

Section VI. — Current observations

When velocity is expected to exceed 0.2 knot, both velocity and direction of currents shall be observed at entrances to harbours or channels, at any change in direction of channels, in anchorages, and adjacent to a pier or wharf area. It is also desirable to measure coastal and offshore currents when they are of sufficient strength to affect shipping.



The IHO S-44 provides standard for Hydrographic surveys, dedicated for safety of navigation and the protection of marine environment

IHO STANDARDS FOR HYDROGRAPHIC SURVEYS (S-44) 5th Edition February 2008

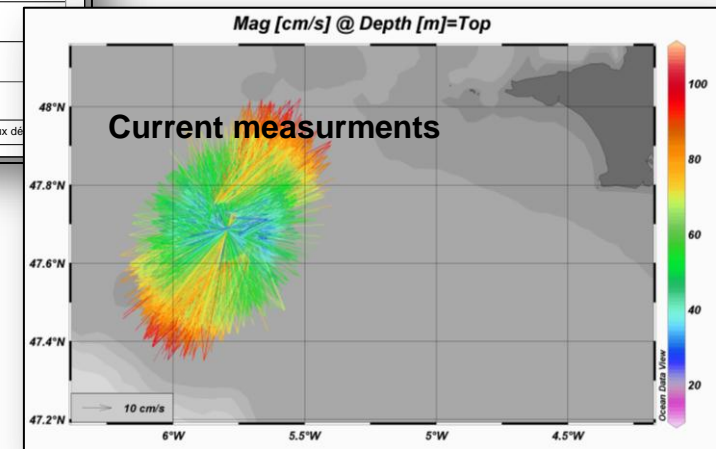
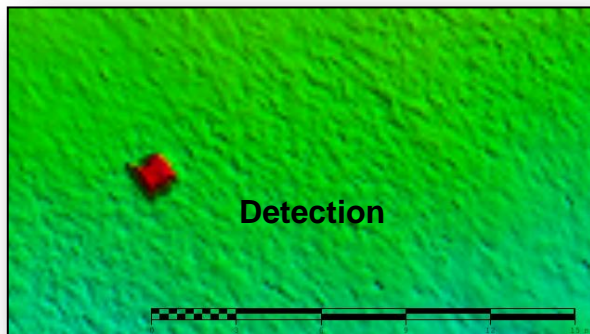
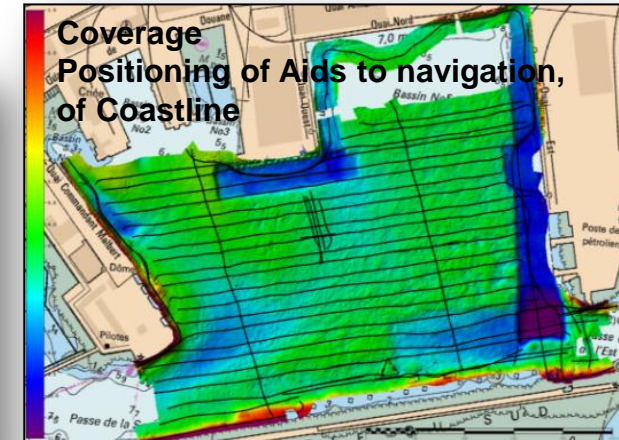
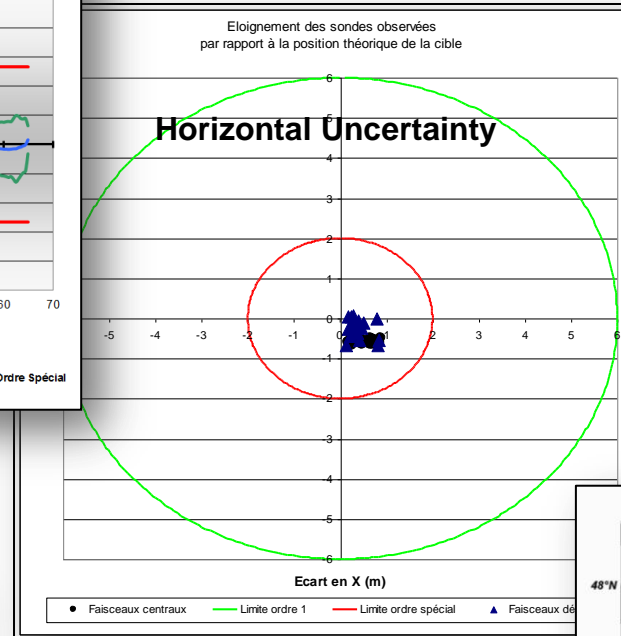
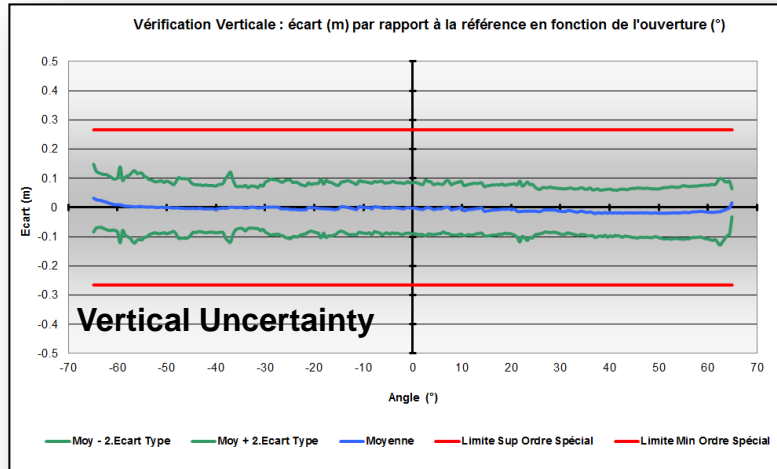
INTRODUCTION

This publication is designed to provide a set of standards for the execution of hydrographic surveys for the collection of data which will primarily be used to compile navigational charts to be used for the safety of surface navigation and the protection of the marine environment.

It must be realised that this publication only provides the **minimum** standards that are to be achieved. Where the bathymetry and expected shipping use requires it, hydrographic offices / organisations wishing to gather data may need to define more stringent standards. Also, this

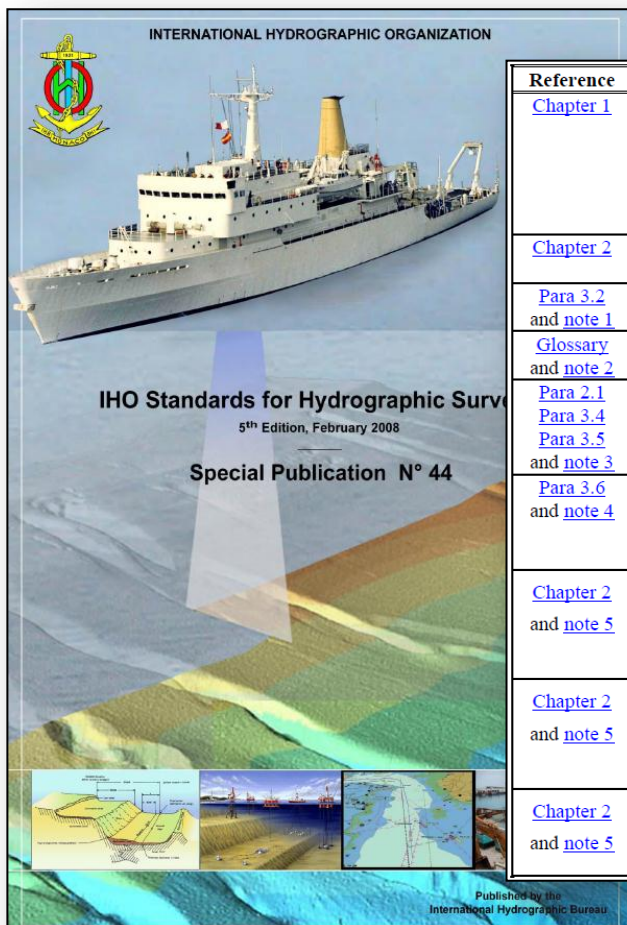
The IHO S-44 provides guidelines A & B for Quality Control and Data processing (to be moved to the M-13)

have at their disposal and the type of topography that they intend to survey. Annexes A and B provide guidelines for Quality control and Data Processing and it is intended that these will be moved to the Manual on Hydrography (IHO Publication M-13) which provides further guidance on how to perform hydrographic surveys.





S-44 Related to technology..... and depth specific (is it clearly mandatory?)



Reference	Order	Special	1a	1b	2
Chapter 1	Description of areas.	Areas where under-keel clearance is critical	Areas shallower than 100 metres where under-keel clearance is less critical but features of concern to surface shipping may exist.	Areas shallower than 100 metres where under-keel clearance is not considered to be an issue for the type of surface shipping expected to transit the area.	Areas generally deeper than 100 metres where a general description of the sea floor is considered adequate.
Chapter 2	Maximum allowable THU 95% Confidence level	2 metres	5 metres + 5% of depth	5 metres + 5% of depth	20 metres + 10% of depth
Para 3.2 and note 1	Maximum allowable TVU 95% Confidence level	a = 0.25 metre b = 0.0075	a = 0.5 metre b = 0.013	a = 0.5 metre b = 0.013	a = 1.0 metre b = 0.023
Glossary and note 2	Full Sea floor Search	Required	Required	Not required	Not required
Para 2.1 Para 3.4 Para 3.5 and note 3	Feature Detection	Cubic features > 1 metre	Cubic features > 2 metres, in depths up to 40 metres; 10% of depth beyond 40 metres	Not Applicable	Not Applicable
Para 3.6 and note 4	Recommended maximum Line Spacing	Not defined as full sea floor search is required	Not defined as full sea floor search is required	3 x average depth or 25 metres, whichever is greater For bathymetric lidar a spot spacing of 5 x 5 metres	4 x average depth
Chapter 2 and note 5	Positioning of fixed aids to navigation and topography significant to navigation. (95% Confidence level)	2 metres	2 metres	2 metres	5 metres
Chapter 2 and note 5	Positioning of the Coastline and topography less significant to navigation (95% Confidence level)	10 metres	20 metres	20 metres	20 metres
Chapter 2 and note 5	Mean position of floating aids to navigation (95% Confidence level)	10 metres	10 metres	10 metres	20 metres



5 LINZ Orders

The table below details LINZ's standards for depths, sounding positions, target detection, seafloor coverage and ancillary feature positions for SBES and MBES surveys and is partly based on the IHO Standards for Hydrographic Surveys (S-44).

Table 3 – Standards for LINZ Hydrographic Surveys

LINZ Order		LINZ - Special	LINZ-1	LINZ-2	LINZ-3
IHO SO Multiplier for Depth Uncertainty (M)		1	1.5	2	2.5
Maximum Allowable Uncertainty of the Horizontal Position of Soundings		2m	5m + 5% of depth	5m + 5% of depth	20 m + 10% of depth
Target Detection		Minimum Horizontal Size of Target to be Detected			
Water depth < 40m	MBES	1m	2m	4m	8m
	SBES	1m	2m	Not Applicable	Not Applicable
Water depth > 40m	MBES	2.5% of depth	5 % of depth	10% of depth	20% of depth
	SBES	1m	10% of depth	Not Applicable	Not Applicable
Seafloor Coverage to be Achieved					
MBES Swath to Swath Area Coverage		200%	100%	100%	100%
SBES Full sea floor search		Compulsory	Selected Areas	As Specified	Not Applicable
Ancillary Features		Maximum Allowable Uncertainty of the Horizontal Position of Ancillary Features			
Fixed Aids and Features Significant to Navigation		2m	2m	2m	5m
Drying Rocks		2m	5m	5m	10m
Natural Coastline		10m	10m	15m	20m
Mean Position of Floating Aids to Navigation		10m	10m	10m	20m
Topographical Features		10m	10m	10m	20m



Table 1 Standards for Hydrographic Surveys

ORDER	Exclusive	Special	1a	1b	2	3 (Imprecise)
Examples of Typical areas	Shallow water in Harbours, berthing areas, and associated critical channels with minimum under-keel clearances or engineering surveys	Harbours, berthing areas, and associated critical channels with minimum under-keel clearances	Areas shallower than 100 metres where under-keel clearance is less critical but features of concern to surface shipping may exist.	Areas shallower than 100 metres where under-keel clearance is not considered to be an issue for the type of surface shipping expected to transit the area.	Areas generally deeper than 100 metres where a general description of the sea floor is considered adequate.	All areas where the accuracies do not meet the requirements of the previous orders
H Horizontal Accuracy (95% Confidence Level)	1m	2m	5m + 5% of depth	5m + 5% of depth	20m + 10% of depth	> 20m + 10% of depth
V Depth Accuracy for Reduced Depths (95% Confidence Level) ¹	a = 0.15m b = 0.0075	a = 0.25m b = 0.0075	a = 0.5m b = 0.013	a = 0.5m b = 0.013	a = 1.0m b = 0.023	Same as order ²

D System Detection Capability	Features > 0.5m cubed	Features > 1m cubed	Features > 2m cubed in depths up to 40 m; 10% of depth beyond 40m ³	N/A	N/A	N/A
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C	Type of coverage (M270)
	1. complete coverage (multibeam, multi-transducer, acoustically swept);
	2. systematic survey (single-beam echo sounder lines run parallel at pre-planned line spacing, LiDAR);
	3. sparse coverage (lead-line surveys, reconnaissance, track soundings, spot soundings);
	4. unsurveyed

CHS Standard:
6 orders using
4 components (H, V, D & C)

A lot of standards exist,
mainly based on the S-44



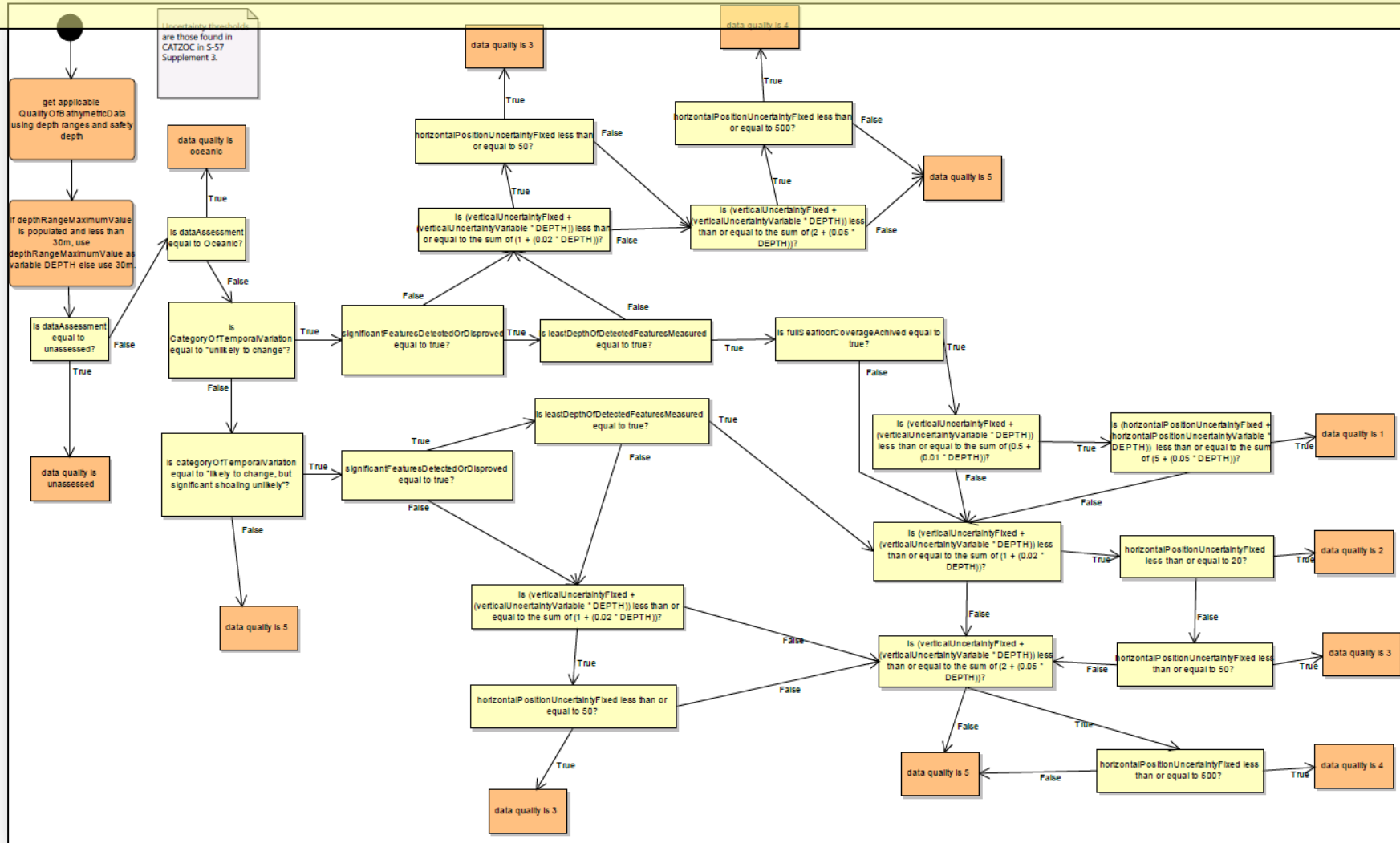
CAT ZOC (S-57) : A1, A2, B, C, D, U

ZOC Table:

1	2	3		4	5
ZOC ¹	Position Accuracy ²	Depth Accuracy ³		Seafloor Coverage	Typical Survey Characteristics ⁵
A1	± 5 m	a = 0.5 b = 1		Full seafloor ensonification or sweep. All significant seafloor features detected ⁴ and depths measured.	Controlled, systematic high accuracy survey on WGS 84 datum; using DGPS or a minimum three lines of position (LOP) with multibeam, channel or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10	± 0.6		
		30	± 0.8		
A2	± 20 m	a = 1.0 b = 2		Full seafloor ensonification or sweep. All significant seafloor features detected ⁴ and depths measured.	Controlled, systematic survey to standard accuracy; using modern survey echosounder with sonar or mechanical sweep.
		Depth (m)	Accuracy (m)		
		10	± 1.2		
		30	± 1.6		
B	± 50 m	a = 1.0 b = 2		Full seafloor coverage not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey to standard accuracy.
		Depth (m)	Accuracy (m)		
		10	± 1.2		
		30	± 1.6		
C	± 500 m	a = 2.0 b = 5		Full seafloor coverage 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		
D	worse than ZOC C	worse than ZOC C		Full seafloor coverage 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		



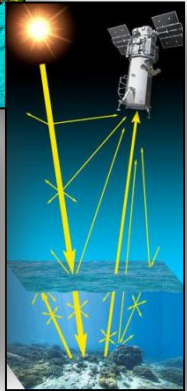
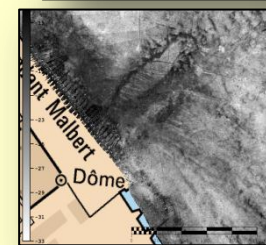
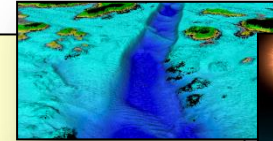
CAT ZOC (S-101) – Decision Tree : 1, 2, 3, 4, 5, Oceanic, Unassessed



Surveyors face Technologies more and more efficient (coverage, accuracy, new features)

- LIDAR
- MBES BS
- SDB
- Crowdsourcing Bat.
- ...

Does the S-44 need to be more constrained or at the opposite, more relaxed in order to accommodate data less accurate but priceless when information is missing?



Needs not only for safety of navigation

- Oceanic studies
- Wind Farm
- UXO
- ...



Does the S-44 have to deal with safety of navigation, without taking into account other hydrographic needs? (presumably the answer is NO according to S-44 intro.)

For public maritime policies: bathymetric Surveys sometimes done by un-experimented people, or using useless specifications for hydrography

Knowledge of surveys hydrographic standards is very important for the scientific community and private/public contracting bodies!



Tabulated format – seems to be very convenient solution, but,

- be careful to un-experimented contracting bodies who want the best as possible
- has to be “backward compatible”

Possible tabulated format?:

Survey/Data category →

Measured properties

	A	B	C	D	E	F
Total Horizontal Uncertainty						
Total Vertical Uncertainty						
Seabed search						
Feature detection						
Line spacing						
Fixing shore objects						
Floating nav aids						
Structure heights						
VRF error						
Etc.						



Need to articulate and describe properties and categories in main textual part of the publication.



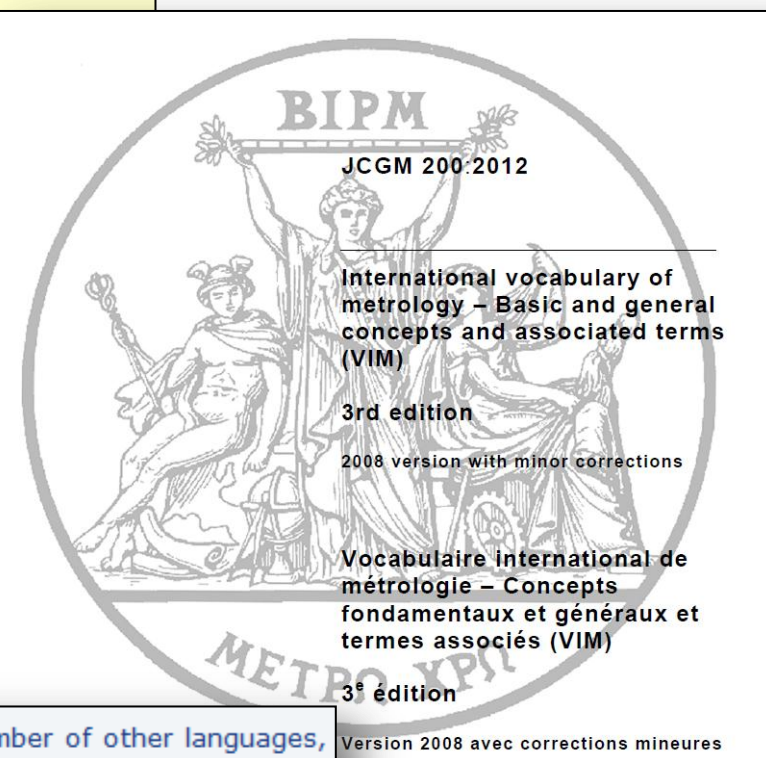
Does the S-44 need to be reviewed?

S-44 limitations:

- Related to technologies
- Misalignment between S-57 and S-44 (S101?)
- No surface resolution recommendation
- Not suitable in certain circumstances or for new needs (AUV survey close to the seafloor in deep water / When data are missing information are priceless / UKC ...)
- ...

Points to be considered:

- [Questionnaire](#) (in order to have an idea of the feelings of the hydrographic community)?
- Annexes A & B to be moved to M-13?
- Communication with DQWG and S100-WG? (UKCM PT?)
- Do we want to consider a Matrix alternative?
- VIM 3 (International Vocabulary of Metrology) compliancy?
- ...



The VIM, published by the JCGM in English and French, has been translated into a number of other languages, including:

Catalan, Croatian, Czech, German, Hungarian, Italian, Japanese, Portuguese (Portugal and Brazil), Romanian, Russian, Serbian, Spanish (Spain and Peru), Thai, Turkish, and Ukrainian.



- What are the limitations?
- Why are there limitations?
- How: First modification proposals (Why not use different levels of modifications Light, Medium, Strong?)
- When: Time schedule?

- Don't forget the report meeting!
- Identify a direction for the S-44 for the next HSSC meeting!
- Coordinating editor is needed!!!

Blue color = Order 1b



	A	B	C	D	E	F
Total Horizontal Uncertainty			5m+5%D			
Total Vertical Uncertainty			a= 0,5m b= 0,013			
Seabed search						
Feature detection						
Line spacing					3xDepth	
Fixing shore objects				2m		
Floating nav aids				10m		
Structure heights						
VRF error						
Etc.						



1st Step :

3 Groups, one topic: limitations of the S44

What are they?

Why are they limitations?

- One pilot for each group

1 hour before debriefing



2^d Step :

3 Groups (the same as Step1), one topic: HOW

Table / Matrix / Mixed (3 as to be considered)

Advantages + disadvantages

- One pilot for each group
- Debriefing