EIGTH MEETING OF THE INTER-REGIONAL COORDINATION COMMITTEE (IRCC8)

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IBSC response to the paper submitted by Japan "syllabus of Cat. A for Hydrographic Surveyors for the Cat. B holder"

Submitted by:	**IBSC**
Executive Summary:	This paper responds to the paper submitted by Japan on Syllabus of Cat. A for Hydrographic Surveyors the Cat. B holders.
Related Documents:	*a) Draft IHO Publication S-5A Standards of Competence for Hydrographic Surveyors Category "A"* *b) IHO Publication S-5B Standards of Competence for Hydrographic Surveyors Category "B"* c) *IHO Strategic Plan (2009)*
Related Projects:	*1) IHO Work Programme 2016 (Task 3.3.9.1)* *2) HSSC WP 2016-2017*

Introduction and Background

1. Japan proposes the IBSC to create a "syllabus of Category A for Hydrographic Surveyors for the Category B holder" .

2. Japan arguments are based on the fact that experienced Category B hydrographers should progress through a Category A course faster than inexperienced students. A proposition is made to reduce the minimum time frame of Category A programmes for Category B holders to 24 weeks (6 months).

3. The need for separation of Category A and Category B standards, was recognized during the XVIIIth International Hydrographic Conference, and tasks 3.39 of the 2013-2017 IHO Work Programme was approved, to create two separate Standards.

4. The IBSC recognized that the in case where a Category A programme is preceded prior by a Category B programme, then the time frames for the Category A programme may take into account the time devoted to the Category B programme.

5. Under the S-5 standards the minimum duration for category B was 24 weeks, with a minimum of 16 weeks with exemptions, and the category A was 1 academic year. Within the S-5 standards the category A included the category B with additional requirements, an example is provided in Table 1 and under this arrangement a category A could incorporate a category B programme and develop the skills, such practice was recognized by the IBSC and some submissions for category A recognition included the category B elements provided that these had been completed within the six year time frame as described in the guidelines.

Item and Title	Level A B	Both Category B and A	Only for Category A
Essential 3: Positioning			
E3.1 Geodesy			
(a) Introduction to Geodesy	F F	Describe the shape of the Earth and explain the ellipsoid of revolution and its relationship to the Geoid. Describe the principles of gravity models.	Describe the nature of the gravity field, how it is measured, monitored and modelled, together with associated uncertainties. Explain the role of the gravity field in hydrography and in particular in obtaining predicted bathymetry from satellite altimetry.
(b) Co-ordinate Systems for Positioning	P F	Define the celestial sphere and other astronomical terms including sidereal and solar time. Describe geodetic, astronomic, orbital and geocentric systems. Describe the Conventional Terrestrial System and some of its practical realizations, such as GRS80, WGS84 etc.	Calculate transformations between co-ordinate reference systems. Define various realizations of solar time, such as UTC TAI, GPS time etc.

Item and Title	Level A B	Both Category B and A	Only for Category A
Essential 1: Bathymetry			
E1.1 Underwater acoustics			
(a) Acoustic Fundamentals	F F	Distinguish between plane and spherical waves. Distinguish between sound speed and particle velocity. Describe the Active Sonar Equation. Define acoustic units, intensities and sound levels	
(b) Generation of Acoustic Waves	P F	Describe how acoustic waves are generated, define source level. Define frequency, wavelength, amplitude, pulse duration (pulse length), and pulse repetition rate.	Determine source level from typically available sonar specifications.
(c) Transmission of Acoustic Waves	P F	Explain the causes of propagation loss and list the differences in water properties that affect propagation loss.	Explain how the acoustic medium affects the propagation of acoustic waves. Calculate propagation loss in practical situations, using water property observations and available tables.

Table 1. Extract from the S-5 standard with category A as additional requirements to category B.

6. At IRCC4 the IBSC presented a case for separating category A from category B and hence developing two separate standards. This was endorsed by IRCC4 and the IHO Member States and the Board has since been working on S-5B, which is now operative, and S-5A, which has been circulated to member states, comments have been received and addressed, the final draft now submitted to IRCC8 for endorsement.

Discussion

1. The new standards are drafted in terms of constructive alignment, the modern principles of academic delivery, with assessment being based on learning outcomes. In drafting the standards the Board has considered the level of knowledge and associated skills required within each of the elements under the subjects and prescribed learning outcomes accordingly. As indicated in Tables 2a and 2b for Geodesy and Tables 3a and 3b for acoustics, the expectations at category A and category B levels have different expectations of the candidate.

Element	Hours			Module and content	Content	Learning outcomes
	T	P	SG			
E4.1 Geodesy						
E4.1a Introduction to Geodesy *(B)*					(i) Shape of the Earth as a sphere, ellipsoid of revolution and the geoid; (ii) Definitions of astronomical terms and time. (iii) Geodetic computations on the ellipsoid. (iv) Local geodetic reference frames (v) Vertical datums (vi) Terrestrial reference systems and reference frames. (vii) Modern geodetic datums WGS84, GRS80. (viii) Datums and datum transformation techniques	Describe the shape of the Earth in terms of potential and ellipsoidal models
E4.1b Coordinate systems, frames and datums *(B)*						Describe modern geodetic reference systems and associated reference frames.
E4.1c Geodetic transformations and associated computations *(B)*						Describe horizontal and vertical datum transformation concepts
E4.1d Ellipsoidal computations *(B)*						Describe geometry of lines on the ellipsoid and perform forward and inverse computations on the ellipsoidal surface using available software.

Table 2a. Extract from S-5B standards for Geodesy.

2.

F1.2 Coordinate Systems						
F1.2a Coordinate Systems for Positioning					(i) Traditional geodetic datums (ii) Terrestrial reference systems and reference frames. (iii) Modern geodetic datums based on terrestrial reference frames. (iv) Datum transformation techniques including similarity transformations and grid based approaches.	Explain principles of astronomic and geocentric datums together with their practical realisations.
F1.2b Datum transformation techniques						Compare datum transformation methods and transform coordinates between datums and between reference frames. Estimate transformation parameters from observations.
F1.2c Geodetic computations on the ellipsoid					(i) Grid computations and spherical trigonometry. (ii) Forward and inverse computations for geodesic and normal section curves on the ellipsoid.	Assess the various solutions available for forward and the inverse computations on the ellipsoid. Compare grid and spherical methods with ellipsoidal computations.
F1.2d Three-Dimensional Geodetic Modeling					(i) Local and global Cartesian coordinate frames. Reference to physical plumbline and ellipsoidal normal. Geoid heights and deflections of the vertical. (ii) 3D observation equations and 3D adjustment. Laplace equation.	Explain the mathematical model of 3D geodesy, integrating satellite and terrestrial observations. Evaluate a typical hybrid network, using commercial software. Describe application of 3D Geodesy to hydrographic survey control and 3D positioning of survey vessels.

Table 2b. Extract from the S-5A for some components of Geodesy.

E1.2 Single Beam Systems & Side Scan Sonar						
E1.2a Single beam echo sounders *(I)*					(i) Split beam and dual beam echo sounders (ii) Components of a single beam echo sounder. (iii) Operation of single beam echo sounders. (iv) Bottom detection principles. (v) Full echo envelope returns (vi) Sub-bottom profiling systems. (vii)Validation & Calibration. (viii) Principles, components, geometry and deployment of side scan sonar systems. (ix) Side scan sonar backscatter and sea floor reflection. (x) Side scan images and sources of distortion. (xi) Combining sources of uncertainty.	Set up, deploy and operate a single beam echo sounder. Select appropriate range, scale, frequency and pulse repetition rate for specific applications in relation to spatial resolution, bottom penetration and depth of water.
E1.2b Single beam echo sounder data recording. *(I)*						Interpret echo sounder returns through differentiation between return signals.
E1.2c Range uncertainty *(I)*						Detail and quantify components contributing to uncertainty in derived ranges.
E1.2d Side scan sonar *(I)*						Set up, deploy and operate side scan sonar. Interpret side scan sonar records considering target characteristics, system configuration, potential sources of noise and distortion.

Table 3a. Extract from S-5B standards for echo sounders and side scan sonar.

H2.2 Single beam systems						
H2.2a Single beam echo sounders principles					(i) Single beam, split beam and dual beam concepts (ii) Beam footprint (iii) Specification of a single beam echo sounder. (iv) Bottom detection principles (matched filtering, thresholding) and range resolution. (v) Full echo envelope returns and bottom characterization	Explain the principles of operation of a single beam sounder detailing how acoustic parameters influence sounder returns.
H2.2b Single beam returns interpretation						Interpret single beam returns including analysis of full echo envelopes and features of the sea bed and water column.
H2.2c Single beam survey system					(i) Components of a single beam echo sounder system to include: positioning system, motion sensor, acquisition system, source of reference level (i.e. tide gauge, GNSS) (ii) Acoustic parameters of single beam echo-sounders (iii) Reduction of soundings to the specified datum	Specify survey system to perform a single beam survey in accordance with application requirements. Select appropriate range, scale, frequency and pulse for specific applications in relation to spatial resolution, bottom penetration, depth of water and water column analysis.
H2.2d Processing of single beam data					(i) Systematic effects in system components: • Single Beam Echo-Sounders • IMU/INS • Sound speed profilers and other peripheral sensors (ii) Single beam echo sounders data processing workflows	Specify processing workflow for single beam data. Integrate and merge data of various sources and of various types in preparation for product generation.

Table 3b. Extract from the S-5A for single beam underwater acoustic systems.

- Within Table 2a from S-5B, the theoretical aspect at category B level in geodesy is purely descriptive with practical elements depending on use of computer software. At category A level, given in Table 2b, learning outcomes require a different level of knowledge for comparison and assessment of methods. This topic on Coordinate Systems is a foundation subject and could therefore be exempted for a candidate possessing for example a BSc degree in Land Surveying, but not for a candidate from a category B programme.

- Tables 3a and 3b make a comparison of requirements for single beam echo sounders at category B and category A levels respectively. To achieve category B requirements the depth of material covered within the principles is less and learning outcomes are primarily applied. At category A level the learning outcomes reflect a deeper knowledge of principles to enable selection of systems suited for purpose and analysis of signal returns.

3. During IBSC39 in April 2016, the Board discussed the proposal made by Japan, which calls for a third standard to upgrade from category B to category A. As indicated above, *the standards in their new format do not lend themselves to upgrade*. The learning outcomes requirement greater depth of knowledge would be those in the category A standards and the background principles required to achieve this level requires greater depth than that at category B. Having completed a category B programme a candidate entering a category A programme would need to cover the requirements of S-5A in their entirety, including Basics and Foundation materials that are at a different level to the Basics in S-5B.

4. The Board however considers that whenever an element of a programme is included in a Category B programme at a level which is judged as satisfactory against the S-5A Standards, exemptions can be granted for this element, if it is part of Basics or Foundation Subjects. Time frame to complete Catagory B and Cateory A programmes are not any more described in the S-5A and S-5B Standards, but in the “Guidelines for the implementation of the Standards of Competence for Hydrographic Surveyors”. They should therefore be taken as a recommended time period for programme completion.

Conclusion

5. The IBSC sees no need to develop new standards for the casea Category B programme would precede a Cateogry A programme. This would be in opposition to the decision taken during the XVIIth International Hydrographic Conference to separate Category B and Category A Standards.
6. Time frames for Category B and Cateogry A Standards are part of the “Guidelines for the implementation of the Standards of Competence for Hydrographic Surveyors”, and are therefore given as recommendation.
7. When Category B precedes a Category A programme, the submitting institution must demonstrate in their submission that in the total combined training, the student will receive the full Category A education at the level specified in the S-5A Standards.

Action Required of IRCC

8. The IRCC is invited to:

a. note this report;
b. take any other action as appropriate.