# The New standards of Competence for Hydrographers and Nautical Cartographers S-5B and S-5A

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FIG/IHO/ICA International Board for Standards of Competence (IBSC) for Nautical Hydrographers and Cartographers

Pr. Delf Egge, IBSC member, 2003-2015

Delf was a member of the Board since 2003, one of four representatives offering the IHO contribution to the Board's membership.

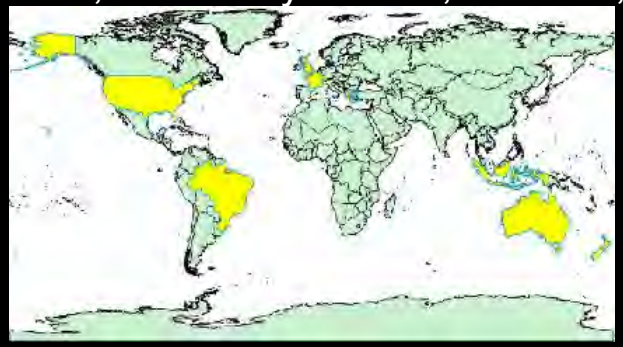
His involvement in the work of the Board was greatly valued, especially with his specific professional contributions brought from his expertise of geodesy.

In Board meetings, Delf always came up with a sharp point, often contributing uniquely to a particular programme evaluation and similarly to development of the standards.

# The International Board for Standards of Competences

- 10 members from parents organisations (4 FIG, 4 IHO and 2 ICA), from governemental, educational and civil sector;
- Experienced professionals in education, hydrography and cartography, from various areas of the world (Australia, Brazil,France, Caribbean, Greece, Indonesia, New Zealand, UK, USA

IBSC MEETING, hosted by SHOM, BREST, April 2016



IBSC members distribution

## The new standards

S-5B

S-5A

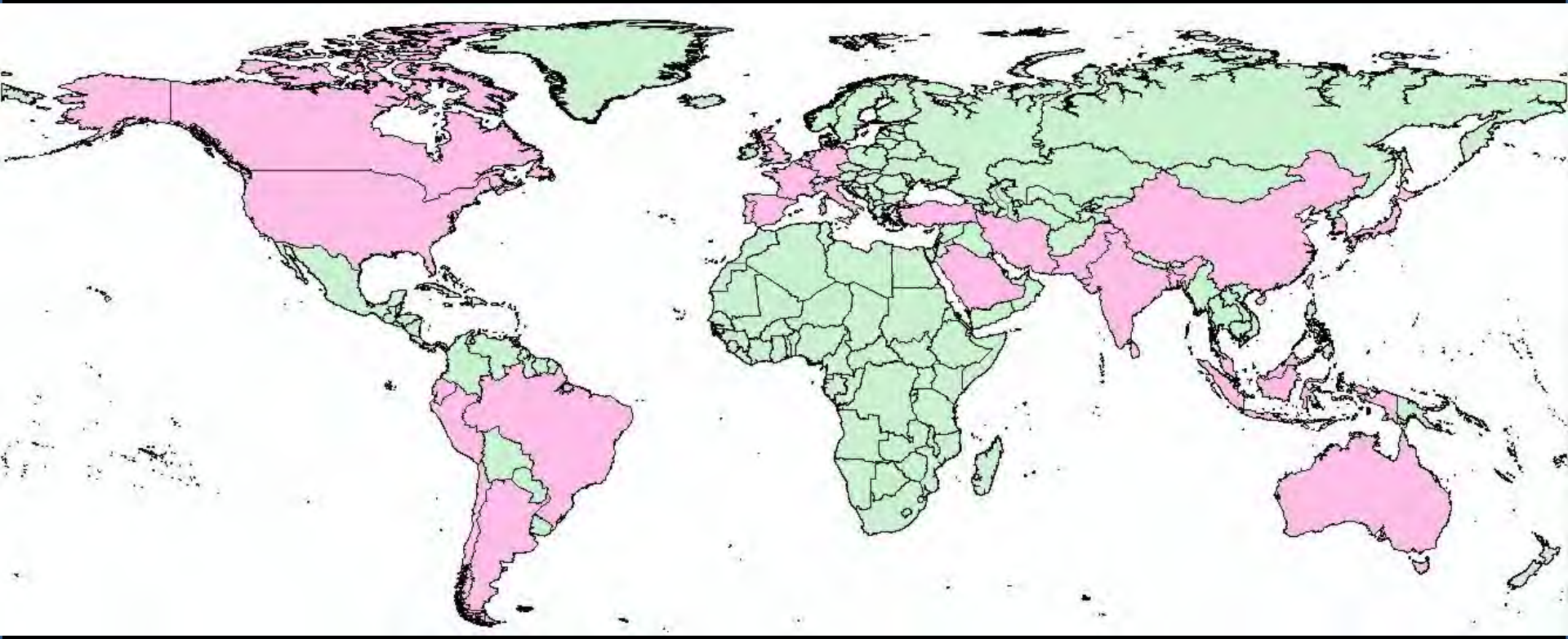
**GUIDELINES FOR THE IMPLEMENTATION OF THE STANDARDS OF COMPETENCE**

## The role of the Board

- **Review** syllabi of programmes and individual recognition schemes from education and training organizations (50 recognized programs, est. 15-18 submissions in Dec. 2015);
- **Maintain IBSC publications**
- **Provide guidance** to education and training institutions;
- **Supports the IHB** in the establishment of new hydrographic programs where regional training capacity does not exist.

# Recognized Programmes Distribution

More than 50 programmes are recognized by the IBSC



## IBSC workprogram (2013-2017)

**“IBSC to develop a new Standards framework to separate competency requirements for Cat A and Cat B hydrographers and nautical cartographers by :**

- developing **two discrete parts** in the standards S-5 and S-8 ;
- **updating their content to comply with the scientific and technological developments in the fields of Hydrography and Nautical Cartography.”**

# Category A

- Project leader : design, plan, choose appropriate technology, select and supervise a survey team
- Should be familiar with underlying physics and mathematics of survey or cartographic works
- Able to evaluate survey or cartographic product against initial expectations
- In the navy : hydrographer in charge of a major survey unit
- In the industry: lead hydrographer or chief surveyor of a major project

# Category A Standards

**Cat A standards** are be aimed at *theoretical educational and foundational background* necessary for Hydrographers/Nautical Cartographers-In-Charge and hydrographic/cartographic managers who will

- Develop specifications for surveys and charts;
- Establish quality control and quality assurance systems;
- Respond to the specific requirements of a full range of hydrographic/cartographic projects.

# Category B

- Watchleader : reports to a category A project leader
- Should be familiar with fundementals and practical aspects of hydrographic surveying and/or cartographic works
- In the Navy : junior officer in charge of a survey launch
- In the Industry: team leader in charge of localized surveys

Standards will be aimed at the *Basic educational level and training of survey technicians*

# Field projects

**For both categories, the ability:**

- to conduct or operate hydrographic surveys in the field;
- to utilize hydrographic/cartographic databases to compile and produce charts,

**remains a fundamental competence**, and thus

A significant part of education and training through **practicals** (field exercises and/or projects) should be part of recognized programmes

## From Content to Intended Learning Outcomes (ILO's)

- Initially S-5 was written as content
- In the late 1990's Blooms taxonomy was used to add active verbs
- Now we use more generic Intended Learning Outcomes (ILO's) and return to content

Competences are for instructors, to support preparation of programmes and modules:

- Generic ILO's give expectations;
- Content places the learning outcome into a set of essential topics that must be covered towards meeting an ILO

# ILO's

For example from the draft S-5B an ILO is written:

"*Using appropriate units, describe acoustic wave behavior with reference to physical properties of the water column*"

Would be covered differently by a student in acoustics or in physics.

The specified content should place the ILO into context, but the material could still be covered at different levels.

It is therefore important for the Board to receive information relating to time allocated and method of delivery.

# Example from S-5B

| | | | | | |
|---|---|---|---|---|---|
| | | | | (vii) Sextant<br>(viii) Total station<br>(ix) Theodolite<br>(x) Electromagnetic positioning devices | appropriate methods and use corresponding instruments for positioning.<br><br>Establish azimuth using astronomic methods. |
| E4.2b Satellite positioning | | | | (xi) Intersection, Resection, Polar and Traverse<br>(xii) Astronomic methods for determination of orientation.<br>(xiii) Expansion of traditional geodetic networks<br>(xiv) Principle of GNSS positioning | Explain the GNSS concept and principles. Define pseudo ranging and carrier phase based modes of satellite positioning<br><br>Differentiate between base station and permanent networks, real-time and post-processing. |
| E4.2c Positioning systems | | | | (xv) GNSS services characteristics (single baseline, network, Precise Point Positioning)<br>(xvi) Performance of code vs. carrier; differential vs. autonomous modes; multiple vs. single frequency; fixed vs. float ambiguity resolution<br>(xvii) Control stations | Field test and use distance and angle measurement instruments. Apply field validation procedures<br><br>Operate GNSS and DGNSS equipment, assess accuracy and precision, post-process GNSS data using appropriate software |
| E4.2d Historical surveys | T | 5 | H3 vii)ix)x) | (xviii) Economic and logistical aspects of providing | Relate historical surveys to legacy positioning systems |

# Assessment of ILO's

| Subject | T/P/SG | Hours | Course and content | Content | Learning outcomes |
|---|---|---|---|---|---|
| 1.2b. Single beam echo sounder data recording. | T | 5 | HYD01 (i)(ii)(iv)(v) | (i) Split beam and dual beam echo sounders<br>(ii) components of a single beam echo sounders.<br>(iii) Operation of single beam echo sounders.<br>(iv) Bottom detection principles. | Interpret echo sounder returns through differentiation between return signals. |
| | P | 3 | FW02 (iii)(iv)(v) | | |
| | SG | 10 | (ii)(iv)(x) | | |

ILO's should be assessed through

- Exams,
- Labs and projects,
- Field training

# Structure of the S-5B

| | |
|---|---|
| Basic subjects | Exemptions are possible |
| Essential subjects | NO Exemptions |
| Comprehensive Final Field Project | NO Exemptions |

## New category B standards (S-5B)

- Basics,
- Bathymetry,
- Water levels and flow,
- LiDAR and remote sensing,
- Positioning,
- Hydrographic practice,
- Hydrographic data management,
- Environmental Science,
- Law of the Sea ;
- Comprehensive Final Field Project;

Comment : No more options;

# Structure of the S-5A

Basic subjects

Foundation subjects

Exemptions are possibles

Hydrographic Sciences subjects — NO Exemptions

Complex Multidisciplinary Field Project — NO Exemptions

## New category A standards (S-5A)

- Basics (Maths, ICT, Physics, Nautical Science, Meteorology)
- Fundamentals (Earth models, Oceanography, Geology & geophysics)
- Positioning,
- Underwater sensors
- LiDAR and remote sensing,
- Survey operations
- Water levels and flow,
- Hydrographic data acquisition and processing
- Management of hydrographic data,
- Legal aspects,
- Complex Multidisciplinary Field Project;

Comment : No more options;

# S-5B for geodesy (extract)

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

The theoretical aspect at category B level in geodesy is purely descriptive with practical elements depending on use of computer software.

# S5-A for geodesy (extract)

| | | | | | | |
|---|---|---|---|---|---|---|
| **F1.2 Coordinate Systems** | | | | | | |
| F1.2a Coordinate Systems for Positioning | | | | | (i) Traditional geodetic datums<br>(ii) Terrestrial reference systems and reference frames.<br>(iii) Modern geodetic datums based on terrestrial reference frames.<br>(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.<br>Estimate transformation parameters from observations. |
| F1.2c Geodetic computations on the ellipsoid | | | | | (i) Grid computations and spherical trigonometry.<br>(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.<br>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.<br>(ii) 3D observation equations and 3D adjustment. Laplace equation. | Explain the mathematical model of 3D geodesy, integrating satellite and terrestrial observations.<br>Evaluate a typical hybrid network, using commercial software. Describe application of 3D Geodesy to hydrographic survey control and 3D positioning of survey vessels. |

At category A level, 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.

# Submission process

S-5B S-5A

**GUIDELINES FOR THE IMPLEMENTATION OF THE STANDARDS OF COMPETENCE**

Prepare Documentation:

- Cross-reference
- Module description
- Final project description

Submit documentation

Submit fees

- Confirm attendance to IBSC meeting
- Prepare presentation
- Discussion with IBSC

IBSC REVIEW

## Recognition of Individuals

- The Board recognises programmes, not individuals ;
- Individual Recognition Schemes objective :

To maintain the level of competence and field proficiency of hydrographers/cartographers;

- Individual recognition should be sought at national or regional level:
  - Recognition of individuals should not be left to HS, but preferably to Hydrographic Societies;
  - Should ideally involve both HS, Academia and the Industry.
- Life-long learning, refreshment and modular courses ;

**Contacts and informatrion:**

www.iho.int -> standards -> S-5B S-5A, guidelines

IBSC Secretary : alberto.neves@iho.int

IBSC Chair : adam.greenland@linz.govt.nz

Submission deadlines: 31 dec of year *N-1* for decision in year *N*

Next meeting : 20-31 March 2017, WELINGTON, New Zealand

# QUESTIONS ?