

**5<sup>TH</sup> MEETING OF THE HYDROGRAPHIC SERVICES AND STANDARDS COMMITTEE  
Shanghai, China, 5-8 November 2013**

**Paper for Consideration by HSSC5**

**Strengthening the requirement to construct paper charts on WGS84**

<b>Submitted by:</b>	Chairman CSPCWG
<b>Executive Summary:</b>	To draw HSSC's attention to the strengthening of guidance relating to the construction of paper charts on the global horizontal reference datum WGS84 (World Geodetic System 1984)
<b>Related Documents:</b>	S-4, S-11 Part A, CSPCWG9 (Nov 2012) actions 47 & 48.
<b>Related Projects:</b>	Improving guidance in IHO product specifications

### **Introduction / Background**

1. Historically paper charts have been constructed and positioned on a variety of local, national and regional horizontal datums. Many of these charts remain current within the portfolios of individual MS's chart series.

### **Analysis / Discussion**

2. S-4 B-201 (edition 4.3.0 August 2012) stated [underlining added; it is not in the text]:
  - B-201.2** The **World Geodetic System (1984) (WGS84)** should be used as a basic worldwide reference system for nautical charts until an adequate alternative geodetic datum is adopted by the relevant international organizations to be used as the international geodetic reference system for cartographic work on land and sea areas.
  - B-201.3** Internationally recognized **regional datums or local datums** may continue to be used for the graduation of paper charts in areas where they apply; however, a transformation adjustment to WGS84 should be included on any such chart....
3. CSPCWG understands and agrees that the adoption of WGS84 Datum, or its equivalent, for all charting is a long term objective of the IHO and, by extension, all chart-producing MS. This supports international standardization of position referencing across nautical products and services, mitigates the risk of error arising from misunderstanding and/or mis-converting positional information, and thereby eases the task of the mariner. Further, it meets users' needs and expectations in today's navigation environment.
4. Mariners are increasingly reliant on GNSS for their navigation and positioning. The understanding and practical application of 'traditional' positioning techniques may be declining, notwithstanding the good practice of not relying on a single positioning tool.
5. ENCs must be referenced to WGS84; and positional quality attributes are available to provide further information within the ENC dataset (e.g. accuracy, CATZOC).
6. In positioning source data during chart compilation (paper charts or ENC), it is recognised that the vast majority of this data was acquired before the advent of accurate satellite-derived positioning and thus needs to be 're-positioned' to make it compatible with a WGS84-referenced chart frame. For HO's, standardizing the position reference of data will bring benefits for processes and,

indeed, may be an essential requirement (e.g. in populating a coherent hydrographic database).

7. The priority given by MS to pursuing conversion to WGS84 Datum as part of their paper chart maintenance and modernization programmes varies significantly. It is also recognized that certain issues may need careful consideration before implementing this change, such as:
  - Consulting all appropriate authorities, noting the potential impacts on, for example, legal statutes, territorial considerations, positions given in shipping broadcasts, etc.
  - Managing the transfer in a coherent programme to avoid a mix of charts on different datums in the same region for any significant period.
8. However, it is apparent that opportunities to modernize charts in this aspect have been missed. And where such charts (national, INT) are adopted by other MS, the progress to achieving the overall objective is further compromised.
9. At its November 2012 meeting, CSPCWG considered it desirable to strengthen and clarify the S-4 guidance in respect of the horizontal datum for paper chart construction. This noted the similar approach used to express the standardization of vertical datums (e.g. S-4 B-405.3), which originally derived from IHO Resolution 3/1919. At Annex is the clarified guidance now provided in S-4 (edition 4.4.0 September 2013) following development by CSPCWG.
10. It is recognised that precise and accurate geodetic terms relating to geocentric position reference systems exist, and that this also applies within the International Terrestrial Reference System (ITRS), of which one of its realizations is the World Geodetic System 1984 (WGS84). However, for navigation purposes, 'WGS84' has come to mean that a chart is referred to a datum which is compatible and can be used directly with positions from global navigation satellite systems (GNSS). This is what is significant for navigators and, therefore, for the nautical chart.

### **Conclusions**

11. As a community, is the standardization of paper charts to a common global horizontal reference ('WGS84') being given sufficient priority in chart maintenance and production plans?
12. By elevating this matter to the attention of HSSC, CSPCWG seeks to:
  - enhance the visibility of the subject to all MS which produce paper charts;
  - accelerate the timescale in reaching the community objective.
13. 'WGS84' should continue to be the standardised term used for horizontal datum references on all nautical charts (paper charts and ENC).

### **Recommendations**

14. CSPCWG to continue to support and emphasise this standardization principle within IHO standards (e.g. S-4, S-11A), applying improvements, as necessary.
15. The term 'WGS84' will be used in IHO's product standards and specifications which reference the horizontal datum of charts and their content compatible with positions obtained from GNSS,.

### **Justification and Impacts**

16. To raise the profile and priority with chart producers of strengthening the requirement to construct paper charts on WGS84.

17. To accelerate the adoption of WGS84 Datum, or its equivalent, for all charting in accordance with the objective of the IHO and the expectations of the mariner.

**Action required of HSSC**

The HSSC is invited to endorse the principles and recommendations outlined above.

**ANNEX to HSSC5-05.5C**

**IHO Specifications relating to Horizontal and Vertical Chart Datum**

**1. IHO Specifications relating to Horizontal Chart Datum**

**S-4 Part B: Chart Specifications of the IHO Medium and Large-scale Charts**

- S-4 B-201 (edition 4.3.0 August 2012) stated:

**B-201.2** The **World Geodetic System (1984) (WGS84)** should be used as a basic worldwide reference system for nautical charts until an adequate alternative geodetic datum is adopted by the relevant international organizations to be used as the international geodetic reference system for cartographic work on land and sea areas.

**B-201.3** Internationally recognized **regional datums or local datums** may continue to be used for the graduation of paper charts in areas where they apply; however, a transformation adjustment to WGS84 should be included on any such chart (see B-202).

- Revised S-4 B-201 (edition 4.4.0 September 2013) now states:

**B-201.3** Internationally recognized **regional datums or local datums** may continue to be used for the graduation of paper charts in areas where they apply. A note providing the transformation adjustment to WGS84 should be included on any such chart (see B-202). However, the adoption of WGS84 Datum, or its equivalent, for all charting is a long term objective. This supports international standardization of position referencing across nautical products and services, mitigates the risk of error arising from misunderstanding and/or mis-converting positional information and meets chart users' needs and expectations in today's navigation environment. For hydrographic offices, standardizing the position reference of data will bring benefits for processes and, indeed, may be an essential requirement (e.g. in populating a coherent digital database from which to derive both paper and electronic products, noting that ENCs must be referenced to WGS84).

In positioning chart source data during chart compilation, it is recognized that the vast majority of this data was acquired before the advent of accurate satellite-derived positioning and thus needs to be 're-positioned' to make it compatible with a WGS84-referenced chart frame; see also B-202.4. Hydrographic offices should manage the transfer of charts to WGS84 in a coherent programme, to avoid a mix of charts on different datums in the same region for any significant period.

**2. IHO Specifications relating to Vertical Chart Datum**

**S-4 Part B: Chart Specifications of the IHO Medium and Large-scale Charts**

**B-405.3** Where the tidal range is appreciable, the Lowest Astronomical Tide (LAT), or as closely equivalent to this level as is practically acceptable to Hydrographic Offices, should be adopted as CD. .... Since LAT is the recommended CD with worldwide application, and has the additional merit of removing all negative

values from tide tables, this should be adopted as a long term objective, and be considered when opportunity for change arises.

Highest Astronomical Tide (HAT) should be adopted as the datum for vertical clearances. ....

(see Technical Resolution 3/1919 as amended 2008).

### **M-3: Resolutions of the IHO**

#### **IHO Programme 2 “Hydrographic Services and Standards”, 2.2 - Tides and Water Levels**

##### **DATUMS AND BENCH MARKS ref 3/1919 as amended; last amendment CL 19/2008**

- 4 It is resolved that ellipsoidal height determinations of the vertical reference marks used for tidal observations should be made, in order to support the production of seamless data sets; i.e. to allow the translation between data sets with differing vertical datums. It is further resolved that such observations should relate to a geocentric reference system, preferably the International Terrestrial Reference System (ITRS) or one of its realizations e.g. the World Geodetic System 1984 (WGS84).