

## 1<sup>st</sup> Tidal, Water Level and Currents Working Group Meeting

Directorate of the Centro do Hidrográfico Marinha - Marinha do Brasil (CHM), Niterói,  
Brazil

25 - 29 April 2016

*(Paragraph numbering is the same as the Agenda Item numbering and does not necessarily reflect the order in which matters were discussed.)*

### 1 Opening

- 1.1 The Chair, Ms Gwenaële Jan (France) opened the meeting and welcomed all participants. She also thanked the Directorate of Hydrography and Navigation of the Brazilian Navy for hosting the meeting and providing excellent support and facilities. She then invited all delegates – representing Australia, Brazil, Canada, Finland, France, Germany, Japan, Netherlands, Norway, Perú, Russian Federation, UK, USA and invited expert contributors from academia and industry – to introduce themselves, Annex A.

The chair then continued her introduction, in which she detailed the progress which had been achieved over the past few years, highlighting the amalgamation of the TWLWG and SCWG into the TWCWG. She then described the work which needs to be addressed during the meeting and the year ahead, she noted particular focus was needed on the three S-100 base Product Specifications (S-104, S-111 and S-112) so that progress on their development could be achieved. She noted there were the other Work Plan items which need to be addressed and taken forward. Finally she noted the HSSC directive to complete the final drafting of the revision of the Resolution 3/1919. She looked forward to the participation and input of all those present and encouraged all to participate in the discussions.

- 1.2 Captain Carlos Augusto Chaves Leal Silva, Director of the Centro do Hidrográfico Marinha - Marinha do Brasil (CHM) , welcomed all to the meeting and to Brazil. He was pleased particularly to note this was the first meeting of the TWCWG. He highlighted the Directorate of Hydrography and Navigation (DHN) of the Brazilian Navy in its century of operations has always striven to apply and achieve the highest standards of and participate in the activities of the IHO. He noted DHN produces approximately 50 graduates annually from its IHO accredited Cat A and Cat B courses. He noted the second regional office of IC-ENC will soon be established in Brazil at the BHMN. Finally he noted that Brazil, as a founder member of the IHO, had provided two past Directors of the IHB and that Brazil is supporting the candidacy of a past Director of DHN in 2017.
- 1.3 David Wyatt (IHB), on behalf the Directing Committee, thanked the Directorate of Hydrography and Navigation of the Brazilian Navy for hosting the meeting and providing a high level of support and excellent facilities.

The Chair endorsed these sentiments and highlighted a need for continued active engagement by the TWCWG members during and between meetings to progress actions and WP items.

### 2 Administrative Arrangements

- 2.1 The Secretary introduced the Agenda which was adopted, Annex B. He reported that apologies for non-attendance had been received from Chile, Italy, New Zealand, South Africa and Spain.

- 2.2 The draft timetable was introduced, it was explained that this was intended for guidance only and was not intended to be a rigid structure. Where necessary time spent on individual topics would be amended to allow an appropriate discussion. The list of documents is at Annex C.
- 2.3 BRA provided a short brief covering the extracurricular activities and the visit to a tide station at Ilha Fiscal.
- 2.4 The Chair noted that significant intersessional activities would be covered by the various national presentations.
- 2.5 The Secretary went through the action items from TWLWG7 and SCWG3 noting that all the outstanding items were covered in the agenda for the meeting and it was agreed these should be taken under their appropriate agenda item. He reiterated the need for all those leading on actions to keep the Chair, vice-Chair and IHB informed of progress and completions, so that the Action List can be kept up-dated intersessionally. A new list of Action Items would be prepared for the meeting, Annex D.

The Secretary encouraged all to provide feedback on progress of agenda item actions and to regularly check the website for new items and information. The TWCWG webpage was highlighted and the relevant sections explained.

### **3 National Presentations**

National presentations were received from Brazil, Canada, all of which are available under the meeting document section, Annex C. The national presentation received from Italy was highlighted and the contents noted.

- 3.1 Brazil gave an overview presentation on the current work being undertaken by DHN and future developments; particularly noting national tidal network, ocean modelling system, associated products and S-100 based Product Specifications under development. The need to gain information on the data delivery rate was noted.
- 3.2 Canada - World Class Tanker Safety Project with national government support; model calibrated via transect ADCP surveys with horizontal looking ADCP from the Port Authority. Combination of model/predicted data and real time observations, leaving the mariner to make final decision on use for final operational decision-making. The similarities with S-412 were noted and therefore the need for harmonization and engagement with the development of both PS. FRA questioned how the uncertainty was calculated and subsequently transferred to the mariner.
- 3.3 Finland gave a presentation on the harmonization of vertical datums in Baltic Sea, status in Finland on harmonization and improving the geoid model for the Baltic Sea area. Forecasting the theoretical mean sea level over five year period has become more difficult and that is one reason to change MSL based vertical datum to European Vertical Reference System (EVRS) based datum. Improving water level predictions as well as the geoid model gives the possibility to utilize the benefits of the new vertical datum. Intelligent Fairway R and D project is ongoing and one of its goals is to study methods to provide real time water level information and water level forecast models to mariners. In Finland tide stations output water levels in currently used MSL (Mean Sea Level) datum and in N2000-height system which is in accordance with the new harmonized vertical datum in the Baltic Sea.

- 3.4 Norway gave a brief update on current activities which covered the status of permanent tide gauges, the development of a common reference frame in the Søre Sunnmøre area and a report on sea level change at +2mm/year in the period 1960 to 2010. Results were presented on the study of sea level rise and NOR expressed the possibility to participate actively in the task: The study of long term data sets for the determination of global sea level rise {H.1}. This is an ongoing action and NOR will volunteered to take an active role.
- 3.5 Germany, Canada and France presented overviews of their forecast services: How products are portrayed and delivered.
- 3.6 Perú gave a presentation on the national sea level network, the upgrade process for tide gauges and data transmission, as well as details of the network of stations, the tide table predictions, the development of real time data services and subsequent data usage for operational and scientific purposes. The national focus remained el Nino, sea level global effects and Tsunami detection.
- 3.7 USA gave a short presentation on the retirement of Steve Gill, past chair of TWLWG.

The national report received from Italy was highlighted and the contents noted.

The presentations generated numerous questions and discussion on open water and stilling-well generated measurements and the impact of rough weather on the resultant data quality.

#### **4 Product Specification Presentations**

##### **4.1 Tidal Information for Surface Navigation.**

AUS provided a report on S-104 covering need to review attributes against revised ISO 19115:2014 and the need to start discussions on portrayal in detail. A number of portrayal issues, which need to be addressed, were highlighted and questions were asked of the TWCWG to consider. The data format and generation of displayed data, a gridded format was suggested potentially to create layers. Visualization of the final product needs consideration. Jeppesen provided information of the difference between HOs approaches and industry driven by customers, need HOs to decide on the way forward.

##### **4.2 Surface Current Product Specification**

USA provided an update brief on development since SCWG3 and the questions asked of S-100WG. It was noted that V1.8 was issued on 28 March 2016 after reviews of V1.5 – V1.7, and that the recent version was available on the website. Vector scale colours were displayed and the resultant scale bar, the problem of night time and dusk environment remained to be resolved. The data product architecture was described with the associated coding format. The questions passed to the S-100WG were highlighted. The next steps of the development process were articulated and the areas of future focus and effort were identified. Jeppesen highlighted the review of Part 8 of S-100 and the implications for the development of S-100 based PS. CAN asked SPAWAR the status with test datasets. JPN reported on their work with test HDF5 file datasets and provided a brief on the work undertaken with JHOD data and the file size comparisons and relationships between the grid and point forecast data. UNH highlighted some portrayal issues related to colour vs. background uncovered using v1.6.

#### 4.3 Dynamic Water Level Data Transfer Product Specification

GBR gave a presentation on the progress with S-112, highlighting some of the background to the requirement and current developments for the Meteorological and Hydrographic Data AIS Application Specific Message (ASM), the draft product specification (from Nov 2014) was provided noting that it required further development. Areas of the PS that require discussion/further development were articulated. Interoperability between S-112 and S-101 PS, and ideas from TSMAD29 on how they will interoperate within a single system were noted and highlighted.

The Chair asked if there was a case of combining S-104 and S-112 and whether this should be addressed to HSSC. There was a clear confusion between the two PS, but in consultation with IHB, it was explained that S-104 is the data model and portrayal of tide and water level heights for navigational use, whereas S-112 was focused on the data transfer from HOs to various users – ECDIS, product creators, etc, for example via AIS-ASM and XML. Thus S-104 and S-111 PS may have a number of similarities and S-112 will remain has the data transfer between HOs and users.

### 5 Product Specification Work Packages

The Chair briefed on the way the developments of the PS would be undertaken by the creation of breakout groups. It was suggested that two groups address the work and provide an interim progress up-date mid-session with a more formal round up at the end of the allocated time. One group was identified to progress S-111 and gridded products, the other to work on S-104 and S-112 issues.

Considerable discussion over the scope and therefore the S-112 PS title. Noting the advice from the IHB, it was agreed the title needed to better describe the intended use and thus it was agreed to remove direct reference to AIS ASM and expand the title to be ‘Dynamic Water Level Data Transfer Product Specification’ as described to HSSC6. The final proposed PS titles were confirmed as:

*S-104 – Water Level Information for Surface Navigation*

*S-111 – Surface Currents*

*S-112 – Dynamic Water Level Data Transfer*

It was agreed the changes to S-104 and S-112 would be submitted to HSSC8 for endorsement.

The two breakout groups progressed the development of the draft PS documents and reported back their progress to the TWCWG.

The Chair displayed information and feedback received from industry stakeholders relevant to S-104 and S-112 PS. This generated wide ranging discussion.

SPAWAR provided a brief on an S-111 Dataset template which detailed a number of attributes and groups of information from which analysis can be conducted. Formatting into HDF5 for validation of surface current data and identification of critical values and errors in terms used such as case mismatch or not found in HDF5 dataset. HDF5 is the chosen encoding format for S-111 and it remains an option for the other PS although other formats should be investigated for completeness (ex: NetCDF, etc.)

Identified Table 10.3 in PS S-111 as the critical element which it was recommended to follow for the other PSs, as the table contained the key details for use by manufacturers. Table 10.3 was displayed and some of the parameters and fields were explained. GER asked if some test datasets could be made available, USA recommended waiting until next version 1.9 of PS was issued. It was suggested datasets could be uploaded to the TWCWG website for downloading as required; a suitable section would be required. **Action IHB** It was agreed that test datasets would be provided to allow further analysis. **Action All**

USA provided a brief on the progress achieved on S-111 during the breakout sessions, which generated further discussion and questions. Noted 3 countries would produce test datasets once version 1.9 was released.

The Chair provided a summary of the work undertaken on the development of the draft S-104 and S-112 PS documents, highlighting what had been achieved and noting what next needed to be addressed to continue the development. It was noted that some of the vertical datums in use in Canada were not on the current list, AUS noted that the list was articulated in S-100 and if there was a need to add and describe a new datum it need to be passed to the S-100WG. It was agreed that all MS would review their vertical and chart datums and recommend additions to the S-100 list. **Action All**

Chair highlighted that the term ‘water level’ is increasingly being used in place of ‘tidal’ or ‘tides’ in the Working Group and she also noted that many of the list of actions have a tidal purpose. Water Level came from, (a) an amendment to the name of the WG in order to take into account of areas where astronomical tidal forcing doesn’t drive the circulation and (b) water level has been added to the framework of the PS in recognition that by adding Current to the Tidal PS, the Water Level takes a logical share overall. However, for S-100WG looking at water level, their first expectation is for the TWCWG to specify a tidal PS; therefore the TWCWG needs to progress step by step, and the Chair TWCWG would recommend starting with the specification for tide dynamics.

(Post meeting note by chair in reply to query: No new PS. Just a note to suggest a way to progress on PS: to start with the specification on tidal water level. Then complete the PS with necessary characterization for other dynamics impacting the water level. This point just suggests a starting point for PS, a kind of organisation of work based on the group core work and experience: on tide and current. First task was dedicated to tide. So let’s start with current and water level (1) tide, (2) + variables required for a proper PS.)

It was noted from S-111 discussions the limit for the file size was 10MB, this limit applies to the file generating organization as it is stipulated in the PS. It was highlighted that significant changes had been agreed to the contents S-111 of table 10.3, which would be included in version 1.9. The production of the feature and portrayal catalogue needed to be progressed. A further three member states agreed to provide test datasets. There is an outstanding question for S111 on what the user is allowed to change, such as input and display parameters, in an ECDIS (this is an unresolved question within S-100WG).

It was agreed S-104 PS should state all levels will be in metres, thus allowing it to be removed from the remarks.

Jeppesen recommended that TWCWG forward comments to S-100WG regarding the need to have the ability to communicate up-dates/time expiry/issue date and what happens if the data is not received by the mariner; it was noted that the warning and

alarms document was being developed. Guided by Jeppesen, the WG were able to complete the first specification draft for a Water Level Product Specification (S-104).

It was suggested by the Chair that WP3 (gridded data) should be moved to WP1 of S-104.

## **6 Programme Matters**

### **6.1 Standard constituent list**

GBR provided background to the Standard Constituent List as uploaded on the website. GBR confirmed the work was on going. **Action GBR/All**

### **6.2 Standard for digital tide tables**

USA provided a presentation on the Standard for Digital Tide Tables to define specification for electronic tide prediction products, either web based or stand alone. This generated a number of questions and comments highlighting the different national needs and policies. USA agreed to expand to include Tidal Current prediction tables. CAN suggested also to expand to include Observations. AUS noted that not all countries can make observations available. AUS noted the basis was for a standalone product rather than one which required internet access. The revised fundamental list is to be included as Annex E to the final meeting report and feedback should be provided to the USA to allow a finalised list to be developed for discussion at TWCWG2. **Action USA/All**

### **6.3 Inventory of tide gauges used by IHO Member States**

IHB highlighted the list and its location on the TWCWG webpage, it was noted that not all TWCWG members had supplied information. CAN noted that their list was in the process of being updated and validated by their regions. All were requested to contact their representatives at RHCs to encourage provision of details from all IHO MS to make the list more comprehensive. **Action All**

### **6.4 The study of long term data sets for the determination of global sea level rise**

NOR highlighted their work on the study of sea level change, which was reported in their national presentation. The effort obtaining old sets was highlighted and the need for Member States to search out and make their old data available was emphasised. **Action All**

### **6.5 Compare Tidal Predictions generated as a result of analysis of a common data set by different analysis software**

IHB highlighted where the raw data and the results of the analysis are available on the TWCWG webpage. The Chair asked all to make raw datasets available and for the results of any analysis to be made available. GBR suggested expanding to including current dataset for analysis. **Action All**

### **6.6 Establishment and maintenance of vertical reference frameworks for the high resolution bathymetric surfaces**

GBR briefed on the work of the NSHC TWG and provided a presentation on the development of a Vertical Reference Frame for High Resolution Bathymetric Surfaces and the associated analysis. FRA noted the draft report had not been

received, GBR to ensure a copy is provided. **Action GBR** CAN noted work had been undertaken over a number of years and it was anticipated the Vertical Datum would be in use later this year. The Chair requested if a section could be created on the TWCWG webpage to make details of VRF GNSS datums available. **Action IHB** It was agreed that details of VRF datums would be provided to allow further analysis. **Action All**

#### 6.7 Exchange of harmonic constants / predictions

It was suggested to remove this item from the agenda and from the Work Plan.

#### 6.8 Determining Ellipsoidal Height of MSL at the Coast

CAN suggested this had been covered in 6.6. CAN asked USA how they were determining ellipsoidal heights. GBR explained shore side gauges were used as a quality control method. USA provided a brief on their use of Ellipsoidal Reference Surfaces (ERS). CAN asked which method was used to reduce the soundings, they presently use a traditional method. AUS provided details on their national network and some of the challenges encountered. The Chair provided a short brief on the SHOM work and developments for their gridded offshore vertical reference frame. GER noted their surfaces were up-dated every five years in their vertical datums; JPN commented that ellipsoid height of MSL had recently been studied, although traditional methods were still in use, after the earthquake and tsunami all the tide gauges and benchmarks had been destroyed and it took six months to recommence the measurement, it was highlighted that the work recently undertaken would allow a much more rapid recovery and re-establishment of their network should a similar incident take place in the future; NOR noted that traditional methods were used, although work was being undertaken to improve the methods of determining GNSS height separation; NLD provided information on their national work and developments; GBR, USA, CAN, AUS and FRA presented their methods used to compute chart datum and how it is used.

#### 6.9 Actual tides on-line link status

IHB highlighted the list and its location on the TWCWG webpage, it was noted that not all TWCWG members had supplied information. All were requested to contact their representatives at RHCs to encourage provision of details from all IHO MS to make the list more comprehensive. IHB requested details of current meters were supplied, as only USA had provided it to date. **Action All**

### 7 IHO Resolutions and Charting Specifications

#### 7.1 Review of relevant IHO resolutions

The IHO Resolutions relevant to TWCWG were reviewed and amendments to 3/1919 were agreed, revised version is at Annex F.. No other amendments were deemed necessary.

#### 7.2 Review of relevant IHO Charting Specifications (S-4)

The IHO Charting Specifications relevant to TWCWG were reviewed and no amendments were deemed necessary.

### 8 IOC/GLOSS Programme

- 8.1 No report was available from the recent GLOSS meeting held in Goa.
- 8.2 No attendance by TWCWG at the TOWS-9 meeting in Paris.

## 9 Capacity Building (CB)

SAN briefed, via Skype, on the courses delivered highlighting that the workshop was aimed at developing marine states either to establish tide stations or maintain them; there was less need for tidal theory. Training on software was not considered a benefit. SAN highlighted the need for close coordination with Regional CB Coordinators to ensure the correct candidates are nominated with the required language skills. Need to have participants with approximate same knowledge and background to ensure all benefit. SAN suggested the course is amended to be three days' duration, one day theory and two days field work/problem solving. Chair asked if a FAQ could help to start questions from participants. BRA appreciated that courses are not targeted at Cat A and Cat B qualified surveyors. SAN asked for TWCWG members to review the contents to suggested amendments by end of June. **Action All** Need to translate course material into other IHO languages (French and Spanish) was identified; USA offer to provide a translation service for course material in to Spanish, SAN to provide material. **Action SAN/USA** The need for liaison between SAN and BRA to ensure MACHC, SWatHC and SEPHC Regional CB Coordinators select appropriate candidates. **Action SAN/BRA**

## 10 Any other business

- 10.1 USA gave a presentation asking 'Tidal Datum Updates in the World with Sea Level Rise - What to do?' It was noted that a steady rise in MSL had been recorded, if an increase in the rate of change was detected, this could make the current USA update cycle of 20-25 years questionable with potentially significant repercussions. AUS gave a short presentation on their calculation of LAT over different epochs to take account of sea level change. It was noted the 1992-2011 LAT value was found to be accurate as minimal change had been detected. It was agreed this should be an area for further research and analysis through the continued study of long term data sets. The Chair requested all to provide long term datasets to assist in this work. **Action All**
- 10.2 TWCWG decided not to create PTs as the method of work during the meeting of creating Breakout groups was successful and it was not seen as necessary to change this approach.

## 11 TWLWG Work Plan and ToRs

- 11.1 TWCWG ToRs and RoPs

The ToRs and RoPs for TWCWG as approved by HSSC7 were displayed, Annex G. No changes were considered necessary.

- 11.2 TWCWG Work Plan 2017-2018

The IHB displayed the draft work programme for 2017-2018 which had been prepared in advance of the meeting. Amendments were made to reflect discussion and progress during this meeting, Annex H. It was noted that the updated version would be included in the meeting report and that all delegates would therefore have a further opportunity to comment before it was submitted to HSSC8 for approval. **Action Chair/IHB**



## 12 Venue and dates of the 2<sup>nd</sup> TWCWG Meeting

The Chair asked if any MS would volunteer to host TWCWG2. CAN offered to host the next meet, TWCWG2, in Victoria, Canada during the week 8-12 May 2017.

## 13 Review of Action Items

- 13.1 A draft list of Action Items from the meeting were reviewed and agreed. All Action Items are marked in this report and are collected together at Annex D. It should be noted that the list of action items does **NOT** include tasks that are in the TWCWG Work Plan. An updated list of the Action Items will be maintained on the TWCWG2 web page and all those who have actions to complete should keep the IHB informed of any progress. **Action ALL.**

## 14 Draft Report to the HSSC / Draft Agenda for TWCWG2

- 14.1 It was agreed that the IHB would circulate a draft meeting report to all attendees by 13 May. **Action IHB.** Participants were requested to provide any comments by 27 May. **Action ALL.** It was intended the final meeting report would be published by 10 June. **Action IHB**
- 14.2 The IHB, Chair and vice-Chair would prepare the final report to HSSC8 using the format required by HSSC. Representation of TWCWG at the HSSC8 meeting would be discussed between the Chair and the vice-Chair. **Action IHB, Chair & vice-Chair**
- 14.3 A draft Agenda was presented to the meeting and is included at Annex I to this report. The draft Agenda may require further amendment following the outcome of HSSC8.

## 15 Closing remarks

The Chair closed the meeting by thanking all for their efforts and hard work, particularly noting the significant progress achieved on the development of the draft Product Specification documents. She also noted how the focus had moved from the term ‘tides’ to ‘water levels’, indicating the broader understanding and scope of the work of the TWCWG. She identified the pleasing progress on finalising the Standards for Digital Tide Tables and the wide discussion on Vertical Reference Frames and the determination of ellipsoidal heights. The maturing of the capacity building course material was in most part due to the efforts of SAN, for which all were most grateful and the successful use of the material would require regular review and input from all members of the TWCWG. Finally she noted the agreed revised version of IHO Resolution 3/1919, as amended, which could now be submitted to IHO Member States with a high degree of confidence of approval.

The Chair thanked the vice-Chair for his support and constructive interventions, which had helped greatly the flow of the discussions as well as the many points and questions he had raised throughout the meeting. His input had been invaluable and an important element in the success of the meeting. Finally the Chair thanked the Directorate of Hydrography and Navigation of the Brazilian Navy for hosting the meeting and providing excellent support and facilities, without which the meeting would have achieved little. She wished all a safe trip back to their home countries and looked forward to seeing everybody in Victoria, Canada, in May 2017.

The meeting closed at 1130 on 29 April 2016

The following Annexes are attached:

- A. TWCWG1 – List of Participants.
- B. TWCWG1 – Agenda
- C. TWCWG1 – List of Documents
- D. TWCWG1 – List of Actions
- E. TWCWG1 – List of fundamental attributes for Digital Tide Tables
- F. TWCWG1 – Proposed revised IHO Resolution 3/1919, as amended
- G. TWCWG1 – TWCWG ToRs and RoPs
- H. TWCWG1 – TWCWG draft Work Programme 2017-2018
- I. TWCWG1 – TWCWG2 Draft Agenda

## LIST OF PARTICIPANTS

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**Tides, Water Level and Currents Working Group**  
*Niterói, Brazil – 25-29 April 2016*  
**Draft Agenda – (TWCWG1)**

**1 Opening**

- .1 Opening address by the Chairman
- .2 Address by host nation
- .3 Welcome by the IHB

**2 Administrative Arrangements**

- .1 Adoption of the Agenda and Apologies – Chair/Secretary
- .2 Programme and timetable of the Sessions – Chair/Secretary
- .3 Meeting administration, including H&S – Host
- .4 Report on Intercessional Activities including HSSC7 – Chair
- .5 Matters arising from TWLWG7/Review of Action Items – Secretary
- .6 Matters arising from SCWG3/Review of Action Items – Secretary

**3 National Presentations**

- .1 Presentations by delegates on “National Tidal and Current issues and projects”

**4 Product Specification Presentations**

- .1 Tidal Product for Surface Navigation (S-104) – AUS
- .2 Surface Current Product Specification (S-111) – USA/CAN
- .3 Real Time Tidal Data Transfer (S-112) – GBR

**5 Product Specifications Work Packages**

- .1 WP1 Product Specification - Dynamic application of tides in ECDIS {C.1} - (Leader: Australia/Participants: All) – Australia
- .2 WP2 Real time data transfer format - Standard for the transmission of real time tidal data {C.2} - (Leader: UK/Participants: All) – GBR
- .3 WP3 Gridded product (Leader: USA/Participant: All) – USA
- .4 WP4 Surface Current Product Specification - Navigationally significant surface current - (Leader: USA/Participants: All) – USA/CAN

**6 Programme Matters**

*Note:{xx} indicates TWCWG Work Plan reference*

- .1 Standard Constituent List {A.1} – UK
- .2 Standard for digital Tide Tables {B.2} – USA
- .3 Inventory of Tide gauges used by IHO Member States {F.1} – IHB
- .4 The study of long term data sets for the determination of global sea level rise. {H.1} – UK, Norway, USA & Spain
- .5 Compare Tidal Predictions generated as a result of analysis of a common data set by different analysis software {A.2} – USA
- .6 Establishment and Maintenance of VRF for High Resolution Bathymetric Surfaces {E.1 – E.3} – UK & NLD
- .7 Exchange of Harmonic Constants / Predictions – UK
- .8 Determining ellipsoidal height of MSL at the coast – All
- .9 Actual Tides On-line Link status – All

**7 IHO Resolutions and Charting Specifications**

- .1 Review of relevant IHO Resolutions – IHB
- .2 Review of relevant IHO Charting Specifications – IHB

**8. IOC/GLOSS Programme**

- .1 Update on IOC/GLOSS Programme items and events – GLOSS/IHB
- .2 TOWS-9 meeting outcomes – JPN

**9. Capacity Building**

- .1 Tides, Water Level and Currents Workshop training material

**10. Any Other Business**

- .1 Consider need to create Project Teams (PTs) to progress S-100 based Product Specifications (S-104, S-111 and S-112)

**11 Work Plan and ToRs**

- .1 TWCWG Work Plan up-dates – IHB
- .2 Review TWCWG ToRs and RoPs – IHB
- .3 Review SCPT ToRs and RoPs – IHB

**12 Venue and dates of the 2<sup>nd</sup> TWCWG Meeting (TWCWG2)**

**13 Review of Action Items from TWCWG1**

**14 Draft Report to HSSC8/Draft Agenda for TWCWG2**

**15 Closing remarks**

### TWCWG1 - List of Documents

Document No	Document Title
TWCWG1 Letter 1	<a href="#">Letter of Invitation</a>
TWCWG1 Annex B	<a href="#">TWCWG1 Registration</a> (Word version)
TWCWG1 Annex D	<a href="#">Rates - H Niteroi Hotel</a>
TWCWG1 Annex E	<a href="#">H Niteroi Hotel Information</a>
TWCWG1-1.1	<a href="#">Chair Opening Address</a>
TWCWG1-1.2	<a href="#">CHM Opening Address</a>
TWCWG1-1.3	<a href="#">IHB Opening Address</a>
TWCWG1-2.1	<a href="#">Agenda v2.0</a>
TWCWG1-2.2	<a href="#">Programme v5.0</a>
TWCWG1-2.3	<a href="#">Daily Menu</a>
TWCWG1-2.4a	<a href="#">TWLWG Report to HSSC7</a>
TWCWG1-2.4b	<a href="#">SCWG Report to HSSC7</a>
TWCWG1-2.4c	<a href="#">SCWG Presentation to HSSC7</a>
TWCWG1-2.4d	<a href="#">Extract from HSSC7 Report</a>
TWCWG1-2.5a	<a href="#">TWLWG7-List of Actions</a> - 2 October 2015
TWCWG1-2.5b	<a href="#">SCWG3-List of Actions</a> - 8 April 2016
TWCWG1-3.1	<a href="#">Italy National Report</a>
TWCWG1-4.2.1	<a href="#">Furgo Surface Current Data</a>
TWCWG1-4.2.2	<a href="#">Questions for S-100WG regarding the surface currents PS</a>
TWCWG1-4.2.3	<a href="#">S-111 Version 1.8 2016.02.06</a>
TWCWG1-7.1.1	<a href="#">IHO Resolutions</a>
TWCWG1-7.1.2a	<a href="#">Resolution 3/1919 (Track change)</a>
TWCWG1-7.1.2b	<a href="#">Resolution 3/1919 (Clean)</a>
TWCWG1-7.1.3	<a href="#">HSSC7-05.8C Comments on TWLWG Report</a>
TWCWG1-7.2	<a href="#">Review of relevant IHO Charting Specifications</a>
TWCWG1-9.1.1	<a href="#">SAN TWC CB Workshop</a>
TWCWG1-9.1.2	<a href="#">SAN TWC CB Workshop Presentation</a>
TWCWG1-11.1	<a href="#">TWCWG Work Plan 2017-2018</a>
TWCWG1-11.2	<a href="#">TWCWG ToR</a>
TWCWG1-11.3	<a href="#">Draft SCPT ToRs</a>
TWCWG1-14	<a href="#">TWCWG 2 - Draft Agenda</a>

TWCWG1-15	<a href="#">Chair Closing Remarks</a>
TWCWG1 Presentations	<a href="#">Presentations.zip</a>
TWCWG1 Participants	<a href="#">List of Participants</a>

**LIST OF ACTIONS** – Updated 20 June 2016

Agenda Item	Subject	Status/Date	Comments	Action
Continuous				
-	Compare tidal predictions	On going	Additional suitable data sets for general analysis to be provided by members to IHB	All
-	Compare tidal predictions	On going	Report progress on results and analysis	All
-	Standard Constituent List	On going	Add additional data and upload to website for further comment.	All
-	Study of long term data sets	On going	All to take long term records to conduct analysis of constituents and to exchange the results	All
-	Inventory of tide gauges	On going	Contact national representative attending RHCs to raise awareness of inventory and encourage input and updating of information	All
-	Inventory of tide gauges	On going	Regularly check entries and provide up-dates and amendments to IHB as necessary	All
-	Actual Tides On-line Link	On going	Check and provide up-dates and amendments to the information provided to ensure content is current and all links work	All
-	TWCWG reports	On going	Provide input to Chair for 6 monthly reports to IHB	All
TWCWG1				
5	<del>S-100 based Product Specification</del>	<del>27 May Complete</del>	<del>Create section on TWCWG webpage to make S-104, S-111 and S-112 datasets available</del>	<del>IHB</del>
5	S-100 based Product Specification	TWCWG2	Provide S-104, S-111 and S-112 test datasets to IHB for uploading to the website	All
5	S-100 based Product Specification	2 Sep	Provide current draft documents for uploading to the website	AUS/USA/GBR/CAN
5	S-100 based Product Specification	2 Sep	Upload presentations of the encoding tool for S-111 and describe how they work	SPAWAR/CAN
5	S-100 based Product Specification	27 May	Discuss with chair S-100WG the creation of Basecamp access for S104, S111 and S112	USA
5	S-100 based Product Specification	29 Jul	Check current S-100 list of vertical datums to ensure all national vertical datums are included, provide details to S-100WG via IHB of any additional datums,	All



			which require to be added,	
5.1	S-104 Product Specification	29 Jul	Provide feedback on draft S-104 Product Specification document	All
5.1 & 5.2	S-104 and S-112 Product Specifications	2 Sep	Review table 10.3 from S-111 Production Specification and use it as a template to create a similar versions for S-104 and S-112	USA/AUS/GBR/CAN
5.1 & 5.2	S-104 and S-112 Product Specifications	16 Dec	Provide details of various data formats defined in S-111 Product Specification for consideration and use in S-104 and S-112	USA/AUS/GBR/CAN
6.2	Standard for Digital Tide Tables	TWCWG2	Provide feedback on list of fundamental attributes to allow revised list to be created	USA/All
6.4	Study of long term data sets	TWCWG2	Provide a document on the results obtained to date for publication on the IHO website	USA/NOR/All
6.6	<del>Vertical Reference Frame</del>	<del>27 May Complete</del>	<del>Create section on TWCWG webpage to make VRF GNSS datums details available</del>	IHB
6.6	Vertical Reference Frame	TWCWG2	Provide details of VRF GNSS datums to IHB for uploading to the website	All
9.1	Capacity Building	24 Jun	Review contents of Tides, Water Level and Currents Workshop and provide comments, amendments and feedback to SAN	All
9.1	Capacity Building	30 Sep	Liaise with SAN to commence translation of Workshop material into Spanish	USA
9.1	Capacity Building	24 Jun	Establish coordination between MACHC, SWAtHC and SEPHC Regional CB Coordinators to ensure appropriate candidates are selected for next Workshop	SAN/BRA
12	TWCWG2	12 Nov	Circulate an initial letter of invitation and post on the website.	CAN/IHB
13	Action List	TWCWG2	Keep IHB and the Chair and vice-Chair informed of progress with allocated actions	All
14	<del>TWCWG1 Draft Report</del>	<del>13 May Complete</del>	<del>Draft to be circulated for comment</del>	IHB
14	TWCWG1 Draft Report	10 Jun Complete	All to provide comments on draft report	All
14	TWCWG1 Final Report	17 Jun Complete	Publish final report	IHB

14	Report to HSSC8	2 Sep	Draft report for review and amendment.	Chair/vice-Chair/IHB
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TWCWG 1 Programme Matters – P.Stone 06/20/2016

## **List of Fundamental Attributes for Digital Tide Tables**

### **Standards for Digital Tide Tables**

The following is a list of fundamental attributes that digital tide prediction tables should have.

#### **General Guidelines for all types of Digital Tide Tables**

- Documentation (either printed on CD or provided prior to download) on how to install tables, office producing the tables (including both address and website), information on how to obtain annual updates, and how to obtain interim updates or errata information.
- There should be a statement outlining minimum computer system requirements,
- There should be user license and/or condition of use information.
- There should be a statement concerning the standing of the digital tables as meeting the applicable maritime regulations, either SOLAS and/or local country carriage requirements.
- Information on how to obtain product support should be provided.

Digital tide predictions can follow one of two formats.

#### **1. Scanned image of Tide Tables:**

This format consists of scanned images of the paper tide tables. This format should have the following attributes.

- A. Should be a faithful reproduction of all the pages of printed tide tables.
- B. The images should be formatted in a widely available, common format. Examples formats include, but not limited to, PDF, tiff, Jpeg, Gif. If PDF files are provided, then information on how to download Adobe<sup>®</sup> Reader must be provided.
- C. If multiple books are published, then each book should be located within its own folder.
- D. No modification of the scanned images is permitted.

#### **2. Electronically Generated Tide Predictions**

##### **A. Station Selection:**

Can either be map based or list based, organized by water body

##### **B. Station Information**

Station Name

Body of Water Descriptor (if appropriate)

Station Number (as appropriate)

Latitude and Longitude (degrees:min:sec and tenths? or decimal equivalent)

Location Map with nearby stations

##### **B. Earth-Moon-Sun Astronomical Calendar Information (Tabular and/or integrated with graphical data output)**

C. Sunrise/Sunset Calendar Information (Tabular and/or integrated with graphical data output)

E. Datum reference for all predicted data

Default Reference Datum is the Chart Datum used by the Country.

Ability to reference predictions to LAT if not the default Reference Datum.

Ability to reference predictions to other tidal datums (such as HAT, MHW, MSL) and user identified datum such as a national geodetic datum or other coastal engineering or threshold datums.

F. Data displays and tables in Metric or English units, with default depending upon country

G. Time Zone display with Local Standard Time as default, with user selected option for UTC/GMT , daylight savings time, etc.

H. Source of tidal predictions is provided via links to metadata information:

Harmonic Constants or Time and Range Correction to Reference Station

Dates of Harmonic Analyses time series used to create the set of Harmonic Constants used in the prediction.

Links to list of the Harmonic Constants used in the Prediction

Dates of the observations used to create tabular time and height corrections (for Table 2 or secondary port stations) to a reference Station.

I. Ability to obtain graphical and tabular output for desired time period (historical and into the future) for:

Time series at minimum 1- hour increments.

Times and heights of predicted high and low tides.

Time series plots non-harmonic stations using curve fit to times and heights of high and low waters

J. Ability to obtain output in PDF, TXT, XML, CSV, S-112 single point formats

K. Readme files for special warning notes explaining areas of anomalous tidal conditions, special datums, or tidal based hazards to navigations (dual high or low waters, tidal bores, river flow dependencies and river datums, frequent non-tidal conditions, etc..)

L. Estimates of uncertainty in the predicted times and heights of high and low waters.

NOAA Example  
Scanned Tide Table

80

**Albany, New York, 2015**  
Times and Heights of High and Low Waters

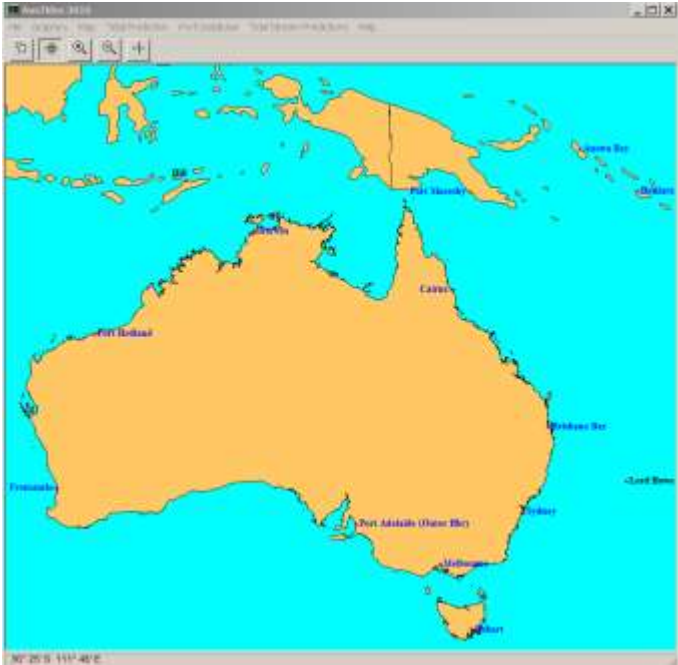
January			February			March		
Time	Height		Time	Height		Time	Height	
1 0648 2.1 23	10 0538 2.2 28	1	0124 2.2 19	16 0122 2.2 19	1	0122 2.2 19	18 0071 2.1 15	
T 0741 -0.2 -2	11 0738 0.4 17		T 0626 -0.2 -2	17 0625 0.2 17		T 0743 0.3 15	19 0715 2.9 21	
2 0846 4.9 -11	12 0838 0.4 11		2 0740 -0.3 -5	18 0739 0.1 13		2 0839 0.1 13	20 0800 8.1 21	
3 0948 8.1 10	17 0937 4.8 10	2	2 0928 5.8 10	17 0929 5.8 10	2	0929 5.8 10	19 0929 5.4 18	
4 1051 10.5 8	18 1037 7.8 10		3 1027 7.8 10	18 1027 7.8 10		3 1027 7.8 10	20 1027 7.8 10	
5 1153 12.5 6	19 1137 10.8 9		4 1126 10.8 9	19 1126 10.8 9		4 1126 10.8 9	21 1126 10.8 9	
6 1254 14.5 4	20 1237 13.8 8		5 1225 13.8 8	20 1225 13.8 8		5 1225 13.8 8	22 1225 13.8 8	
7 0156 16.5 2	21 0137 16.8 7		6 0124 16.8 7	21 0124 16.8 7		6 0124 16.8 7	23 0124 16.8 7	
8 0258 18.5 0	22 0237 19.8 6		7 0213 19.8 6	22 0213 19.8 6		7 0213 19.8 6	24 0213 19.8 6	
9 0359 20.5 -2	23 0337 22.8 5		8 0302 22.8 5	23 0302 22.8 5		8 0302 22.8 5	25 0302 22.8 5	
10 0459 22.5 -4	24 0437 25.8 4		9 0401 25.8 4	24 0401 25.8 4		9 0401 25.8 4	26 0401 25.8 4	
11 0559 24.5 -6	25 0537 28.8 3		10 0400 28.8 3	25 0400 28.8 3		10 0400 28.8 3	27 0400 28.8 3	
12 0659 26.5 -8	26 0637 31.8 2		11 0359 31.8 2	26 0359 31.8 2		11 0359 31.8 2	28 0359 31.8 2	
13 0759 28.5 -10	27 0737 34.8 1		12 0358 34.8 1	27 0358 34.8 1		12 0358 34.8 1	29 0358 34.8 1	
14 0859 30.5 -12	28 0837 37.8 0		13 0357 37.8 0	28 0357 37.8 0		13 0357 37.8 0	30 0357 37.8 0	
15 0959 32.5 -14	29 0937 40.8 -1		14 0356 40.8 -1	29 0356 40.8 -1		14 0356 40.8 -1	31 0356 40.8 -1	
16 1059 34.5 -16	30 1037 43.8 -2		15 0355 43.8 -2	30 0355 43.8 -2		15 0355 43.8 -2		
17 1159 36.5 -18	31 1137 46.8 -3		16 0354 46.8 -3	31 0354 46.8 -3		16 0354 46.8 -3		

Time numbers 17° W. 0000 is daylight, 1000 is noon. Times are not adjusted for Daylight Saving Time. Heights are referred to mean low water during lowest low stages which is the chart datum of soundings.

UK Example



Australian Example

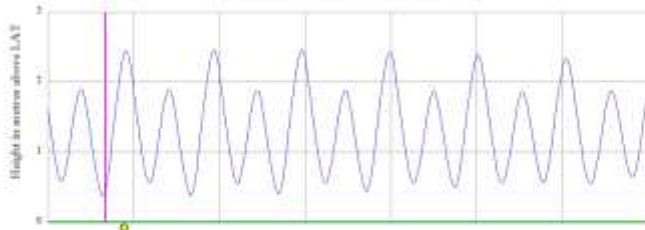


**BRISBANE BAR**

Local Standard  
Time Zone: -10:00 U.T.

27° 22' S 153° 10' E

PREDICTION DATUM below MSL: 1.31 (m)



Jun 20 Mo		21 Tu		22 We		23 Th		24 Fr		25 Sa		26 Su	
Time	ht	Time	ht	Time	ht	Time	ht	Time	ht	Time	ht	Time	ht
0543	0.6	0423	0.8	0505	0.5	0543	0.5	0624	0.5	0024	2.4	0109	2.3
0911	1.9	0951	1.9	1032	1.9	1115	1.9	1200	1.9	0707	0.5	0755	0.5
1520	0.4	1557	0.4	1635	0.4	1713	0.4	1755	0.5	1250	1.9	1347	1.9
2150	2.4	2227	2.5	2304	2.5	2343	2.4			1843	0.6	1939	0.6

Year 2016

Port 59500



1600 0.4m



Scale given supplied by Sydney Observatory

No account is taken of Daylight Saving Time

These predictions are identical to those published in AOTT and can thus be used as an official navigational publication.  
Prediction Datum is LAT, which may not be Chart Datum. Correction to Chart Datum can be found at:  
Level / To Chart Datum Corrections and Zero of Predictions Window  
© Copyright Commonwealth of Australia 2015

## IHO Resolution 3/1919, as amended – Draft Proposal

TITLE	Reference	Last amendment (CL or IHC)	1st Edition Reference
DATUMS AND BENCH MARKS	3/1919 as amended	<a href="#">49/2008</a> <a href="#">xx/2016</a>	A2.5

1 It is resolved that the datum of tide/water level observations and predictions for mariners shall be the same as chart datum (datum for sounding reduction).

2 It is resolved that chart datum and other tidal/water level datums used should be clearly stated on charts and all other navigational products.

3 It is resolved that chart datums (datums for sounding reduction), the datums of tide/water level prediction and other tidal/water level datums shall always be connected with the general land survey datum, and, in addition, with a prominent and permanent fixed mark in the neighbourhood of the tide gauge, station, observatory etc.

4 It is resolved that ellipsoidal height determinations of the vertical reference marks used for tidal/water level 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](#)~~another geodetic system~~; e.g. the World Geodetic System 1984 (WGS84).

In ocean tidal areas

5 It is resolved that heights on shore, including elevations of lights, should be referred to a [Highest Water \(HW\)](#) datum.

6 It is resolved that the Lowest Astronomical Tide (LAT\*), or a datum as closely equivalent to this level as is [practical andly](#) acceptable to Hydrographic Offices, be adopted as chart datum. Alternatively, another, similar datum may be used if low water levels in a specific area frequently deviate from LAT, or a different datum has been established by national policy.

7 It is resolved that Highest Astronomical Tide (HAT\*), or a datum as closely equivalent to this level as is practical and acceptable to Hydrographic Offices, be adopted as the datum for vertical clearances. Alternatively, another, similar datum may be used if high water levels in a specific area frequently deviate from HAT, or a different datum has been established by national policy.

8 It is recommended that LAT and HAT be calculated either over a minimum period of 19 years using harmonic constants derived from a minimum of one year's observations or by other proven methods known to give reliable results. Tide levels should, if possible, reflect the estimated uncertainty values obtained during the determination of these levels.

In mixed water (where water level variability is due to both tidal and regionally specific forcing mechanisms) and inland waters

9 It is resolved that depths, and all other navigational information should be referred to an appropriate level that is practical and acceptable to Hydrographic Offices (such as lowest water (LW) as a reference level for depths and [highest water \(HW\)](#) for vertical clearances). The selection of which one of the alternatives to be used is a difficult issue which can only be determined locally and which will be largely dependent on seasonal hydrological conditions. LW and HW are defined preferably as the mean of lowest/highest water levels, or as a

**Comment [GB1]:** Text proposed in IHO CL 17/2014.

**Comment [GB2]:** As agreed at HSSC-7

**Comment [GB3]:** To be consistent with paragraphs 7 and 9

**Comment [GB4]:** See comment in paragraph 5 above.



suitable percentile of lowest/highest water levels, observed over a long time period [from a minimum of one year's observations](#).

In geographical areas where the tidal range is negligible and in non-tidal areas

10 It is resolved that depths, and all other navigational information should be referred to Mean Sea Level (MSL) or other level as closely equivalent to this as is [practically and acceptable](#) to Hydrographic Offices.

*Note: The adopted level may be a well-defined geodetic datum as used for heights in land survey applications or an observed local Mean Sea Level (MSL) based on long series of water level observations.*

11 In order to support other non-navigational applications and also to indicate the characteristics in the area, it is recommended to adopt the mean of yearly lowest/highest water levels, or as a suitable percentile of lowest/highest water levels, observed over a long time period [from a minimum of one year's observations](#).

\* *Note: LAT (HAT) is defined as the lowest (highest) tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.*

**Comment [GB5]:** To be consistent with paragraphs 7 and 9

## Tides, Water Level and Currents Working Group (TWCWG)

### Terms of Reference and Rules of Procedure

References: *6<sup>th</sup> HSSC Meeting (Viña del Mar, Chile, November 2014)*  
*7<sup>th</sup> HSSC Meeting (Busan, Republic of Korea, November 2015)*

#### 1. Objective

- a) To provide technical advice and coordination on matters related to tides, water levels, currents, relevant oceanographic data and vertical datum, including integrated water level/current data models.
- b) To support the development and maintenance of related specifications in liaison with the relevant IHO bodies and non-IHO entities;
- c) To develop and maintain the IHO publications for which the WG is responsible.

#### 2. Authority

This WG is a subsidiary of the Hydrographic Services and Standards Committee (HSSC). Its work is subject to HSSC approval.

#### 3. Composition and Chairmanship

- a) The WG shall comprise representatives of IHO Member States (MS), Expert Contributors (EC), observers from accredited NGIO, and a representative of the IHB ("IHB" to be replaced by "IHO Secretariat" when the IHO Secretariat is established). A membership list shall be maintained and posted on the IHO website.
- b) EC membership is open to entities and organizations that can provide a relevant and constructive contribution to the work of the WG.
- c) The Chair and Vice-Chair shall be a representative of a MS. The election of the Chair and Vice-Chair shall be decided at the first meeting after each ordinary session of the Conference (Conference to be replaced by Assembly when the revised IHO Convention enters into force) and shall be determined by vote of the MS present and voting.
- d) If a secretary is required it should normally be drawn from a member of the WG.
- e) If the Chair is unable to carry out the duties of the office, the Vice-Chair shall act as the Chair with the same powers and duties.
- f) ECs shall seek approval of membership from the Chair.
- g) EC membership may be withdrawn in the event that a majority of the MS represented in the WG agrees that an EC's continued participation is irrelevant or unconstructive to the work of the WG.
- h) All members shall inform the Chair in advance of their intention to attend meetings of the WG.
- i) In the event that a large number of EC members seek to attend a meeting, the Chair may restrict attendance by inviting ECs to act through one or more collective representatives.

#### 4. Procedures

- a) The WG should:
  - (i) monitor and develop the use of tidal, water level, current information and relevant oceanographic data including integrated water level/current data models;

- (ii) advise on the use of vertical datums;
  - (iii) advise on tidal, water level and current observation, analysis and prediction;
  - (iv) advise on matters concerning exchange, distribution and use of tidal, water level, current information and relevant oceanographic data related data/information;
  - (v) study principles and contribute to the development of improved methods for conveying tidal, water level, current information and relevant oceanographic data to mariners and other users;
  - (vi) keep under review the relevant IHO publications and resolutions in order to advise HSSC on their updating;
  - (vii) draft or revise guidance document(s), resolutions and specifications as appropriate and as instructed by HSSC; and
  - (viii) consider new related topics as instructed by HSSC and advise HSSC accordingly.
- b) The WG should work by correspondence, teleconferences, group meetings, workshops or symposia. The WG should meet about once a year. When meetings are scheduled, and in order to allow any WG submissions and reports to be submitted to HSSC on time, WG meetings should not normally occur later than nine weeks before a meeting of the HSSC.
  - c) Decisions should generally be made by consensus. If votes are required on issues or to endorse proposals presented to the WG, only MS may cast a vote. Votes at meetings shall be on the basis of one vote per MS represented at the meeting. Votes by correspondence shall be on the basis of one vote per MS represented in the WG.
  - d) The date and venue of group meetings shall normally be announced by the Chair at least six months in advance.
  - e) The draft record of meetings shall be distributed by the Chair (or the secretary) within six weeks of the end of meetings and participants' comments should be returned within three weeks of the date of despatch. Final minutes of meetings should be posted on the IHO website within three months after a meeting.
  - f) Sub-working groups and project teams may be created by the WG or proposed to HSSC to undertake detailed work on specific topics. The terms of reference and rules of procedure of the sub-working groups and project teams are determined or proposed by the WG as appropriate.
  - g) The WG should liaise with other IHO bodies, international organizations and industry to ensure the relevance of its work.
  - h) The WG should prepare annually a report on its activities and a rolling two-year work plan, including expected time frame.

## TWCWG WORK PLAN 2017-18

### Objective

- a) To monitor developments related to tidal and water level observation, analysis and prediction and other related information including vertical and horizontal datums;
- b) To develop and maintain the relevant IHO standards, specifications and publications for which it is responsible in liaison with the relevant IHO bodies and non-IHO entities;
- c) To develop standards for the delivery and presentation of navigationally relevant current information; and
- d) To provide technical advice and coordination on matters related to tides, water levels, currents and vertical datum.

### Tasks

A	Maintain the list of standard tidal constituents (IHO Task 2.7.2.3)
B	Compare the tidal predictions generated as a result of analysis of a common data set using different analysis software
C	Develop, maintain and extend a Product Specification for digital tide tables (IHO Task 2.7.3)
D	Develop, maintain and extend a Product Specification for the transmission of real-time tidal data (IHO Task 2.7.4)
E	Develop, maintain and extend a Product Specification for the transmission of real-time surface current data (S-111 - IHO Task 2.13.3)
F	Develop, maintain and extend a Product Specification for dynamic surface currents in ECDIS (IHO Task 2.13.4)
G	Develop, maintain and extend a Product specification for dynamic tides in ECDIS (IHO Task 2.7.5)
H	Liaise with S-100WG on tidal and current matters relevant to ECDIS applications
I	Liaise with industry experts on the development of product specifications for tides and currents
J	Prepare and maintain an inventory of tide gauges and current meters used by Member States and publish it on the IHO/TWLWG web site (IHO Task 2.7.2.4)
K	Review feedback of on-line real time water level observation document
L	Maintain and extend the relevant IHO standards, specifications and publications as required (IHO Tasks 2.7.2 and 2.13.2)
M	Conduct the 2016 and 2017 meetings of TWCWG and its sub-group(s) and project team(s) (IHO Tasks 2.7.1 and 2.13.1)
N	Develop and maintain material for course on Tides, Water Levels and Currents

Work item	Title	Priority H-high M-medium L-low	Next milestone	Start Date	End Date	Status P-planned O-ongoing C-completed S-Superseded	Contact Person(s)	Related Pubs / Standard	Remarks
A.1	Maintain the list of standard tidal constituents	M		-	Permanent	O	Chris Jones*		Review current list of published tidal constituents
B.1	Compare the tidal predictions generated as a result of analysis of a common data set using different analysis software.	M		-	Permanent	O	Hilda Sande * All		Select Common data set Analyze using different software Predict common set of tides Compare results
C.1	Develop, maintain and extend the standard for digital tide and tidal current tables	H	Prepare draft Standard	2009	<del>2016</del> 2017	O	Peter Stone* Chris Jones Zarina Jayaswal		
D.1	Develop and maintain a standard for the transmission of real-time tidal data (S-112)	H		2009	<del>2017</del> 2018	O	Chris Jones* All		Establish joint project teams as required. Liaise with S-100WG (see H.1) Liaise with industry experts (see I.1)
E.1	Develop and maintain a product specification for the transmission of real-time surface current data (S-111)	H		2013	<del>2017</del> 2018	O	Kurt Hess* Louis Maltais		Establish joint project teams as required. Liaise with S-100WG (see H.1) Liaise with industry experts (see I.1)
F.1	Develop and maintain a product specification for dynamic application of navigationally significant surface currents in ECDIS	H		2013	<del>2017</del> 2018	O	Louis Maltais* Kurt Hess		Establish joint project teams as required. Liaise with S-100WG (see H.1) Liaise with industry experts (see I.1)

Work item	Title	Priority H-high M-medium L-low	Next milestone	Start Date	End Date	Status P-planned O-ongoing C-completed S-Superseded	Contact Person(s)	Related Pubs / Standard	Remarks
G.1	Develop and maintain a product specification for dynamic application of tides in ECDIS	H	Prepare draft Product Specifications (S-1xx) for tidal data in S-100.  Prepare draft Portrayal model for tidal data in S-100.	2009	2017 2018	O	Zarina Jayaswal* Glen Rowe Jimin Ko  Peter Stone* Zarina Jayaswal		Establish joint project teams as required. Liaise with S-100WG (see H.1) Liaise with industry experts (see I.1)
H.1	Liaise with S-100WG on tidal and current matters relevant to ECDIS applications	H		-	Permanent	O	Gwenaële Jan Kurt Hess		Establish joint project teams as required.
I.1	Liaise with industry experts on the development of product specifications for tides and currents	H		-	Permanent	O	All		
J.1	Maintain an inventory of tide gauges and current meters used by Member States and publish it on the IHO/TWCWG web site.	H		-	Permanent	O	David Wyatt* All		Initial inventory from TWCWG members available on IHO web site.
K.1	Review feedback of on-line real time water level observation document	L		-	Permanent	O	Zarina Jayaswal* All		

Work item	Title	Priority H-high M-medium L-low	Next milestone	Start Date	End Date	Status P-planned O-ongoing C-completed S-Superseded	Contact Person(s)	Related Pubs / Standard	Remarks
L.1	Maintain and extend the relevant IHO standards, specifications and publications	M  M	Review wording of IHO Resolution 3/1919, as amended, in light of revised definitions for MSL and LAT	- 2014	Permanent 2015 2016	O  O C	Gwenaële Jan	IHO Resolutions in M-3 S-60 User's Handbook on Datum Transformations involving WGS 84	
N.1	Develop and maintain material for course on Tides	H	Delivery in 2015	-	Permanent	O	Ruth Farre* Louis Maltais Peter Stone Zarina Jayaswal		Adapt currently available course material to create a course suitable for delivery in support of CBSC requests

### Meetings (Task M)

Date	Location	Activity
25-28 Mar 2014	Wollongong, Australia	TWLWG-6
3-5 Jun 2014	Québec City, Canada	SCWG-2
21-24 April 2015	Silver Spring, Maryland, USA	TWLWG-7
13-15 May 2015	Tokyo, Japan	SCWG-3
25-29 April 2016	Niterói, Brazil	TWCWG-1
2017 (tbc)	tbc	TWCWG-2

Chair: Gwenaële Jan (France)  
Vice Chair: Louis Maltais (Canada)  
Secretary: David Wyatt

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**Tides, Water Level and Currents Working Group**  
*Victoria, Canada – 8-12 May 2017*  
**Draft Agenda – (TWCWG2)**

**1 Opening**

- .1 Opening address by the Chairman
- .2 Address by host nation
- .3 Welcome by the IHB

**2 Administrative Arrangements**

- .1 Adoption of the Agenda and Apologies – Chair/Secretary
- .2 Programme and timetable of the Sessions – Chair/Secretary
- .3 Meeting administration, including H&S – Host
- .4 Report on Intercessional Activities including HSSC8 – Chair
- .5 Matters arising from TWCWG1/Review of Action Items – Secretary

**3 National Presentations**

- .1 Presentations by delegates on “National Tidal and Current issues and projects”

**4 Product Specification Presentations**

- .1 Tidal Product for Surface Navigation (S-104) – AUS
- .2 Surface Current Product Specification (S-111) – USA/CAN
- .3 Real Time Tidal Data Transfer (S-112) – GBR

**5 Product Specifications Work Packages**

- .1 WP1 Product Specification - Dynamic application of tides in ECDIS {C.1} - (Leader: Australia/Participants: All) – Australia
- .2 WP2 Real time data transfer format - Standard for the transmission of real time tidal data {C.2} - (Leader: UK/Participants: All) – GBR
- .3 WP3 Gridded product (Leader: USA/Participant: All) – USA
- .4 WP4 Surface Current Product Specification - Navigationally significant surface current - (Leader: USA/Participants: All) – USA/CAN

**6 Programme Matters**

*Note:{xx} indicates TWCWG Work Plan reference*

- .1 Standard Constituent List {A.1} – UK
- .2 Standard for digital Tide Tables {B.2} – USA
- .3 Inventory of Tide gauges used by IHO Member States {F.1} – IHB
- .4 The study of long term data sets for the determination of global sea level rise. {H.1} – UK, Norway, USA & Spain
- .5 Compare Tidal Predictions generated as a result of analysis of a common data set by different analysis software {A.2} – USA
- .6 Establishment and Maintenance of VRF for High Resolution Bathymetric Surfaces {E.1 – E.3} – UK & NLD
- .7 Exchange of Harmonic Constants / Predictions – UK
- .8 Determining ellipsoidal height of MSL at the coast – All
- .9 Actual Tides On-line Link status – All

**7 IHO Resolutions and Charting Specifications**



- .1 Review of relevant IHO Resolutions – IHB
- .2 Review of relevant IHO Charting Specifications – IHB

**8. IOC/GLOSS Programme**

- .1 Update on IOC/GLOSS Programme items and events – GLOSS/IHB

**9. Capacity Building**

- .1 Tides and Water Levels Workshop training material

**10 Any Other Business**

- .1 Consider need to create/continue Project Teams (PTs) to progress S-100 based Product Specifications (S-104, S-111 and S-112)

**11. Work Plan and ToRs**

- .1 TWCWG Work Plan up-dates – IHB
- .2 Review TWCWG ToRs and RoPs – IHB
- .3 Review SCPT ToRs and RoPs – IHB

**12 Venue and dates of the 3<sup>rd</sup> TWCWG Meeting (TWCWG3)**

**13 Review of Action Items from TWCWG2**

**14 Draft Report to HSSC9/Draft Agenda for TWCWG3**

**15 Closing remarks**