2nd Tidal, Water Level and Currents Working Group Meeting

Chateau Victoria Hotel and Suites in Victoria, British Columbia, Canada
8 - 12 May 2017

(Paragraph numbering is the same as the Agenda Item numbering and does not necessarily reflect the order in which matters were discussed. ISO three letter country codes have been used to identify individual participants)

1 Opening

1.1 The Chair, Mme Gwenaële Jan (France) opened the meeting and welcomed all participants. She also thanked the Canadian Hydrographic Service (CHS) for hosting the meeting and arranging excellent support and facilities. She noted the contribution made by Bodo de Lange Boom over the years and wished him a happy retirement. She highlighted the work required on the S-100 based PS and the need for all to contribute and share experience. She hoped the worked achieved at TWCWG1 would be continued.

1.2 Vice-chair, M Louis Maltais (Canada), welcomed all on behalf of the CHS. He highlighted the number of representatives from the various regional offices participating in the meeting. He then provided details of logistics and the general programme. He finished by highlighting the importance of standards and information commonality.

1.3 David Wyatt (IHO), on behalf the Secretary General of the IHO and Director Gilles Bessero (Director Programme 2), thanked the CHS for hosting the meeting and providing a high level of support and excellent facilities. He noted the results of the elections at the recent first session of the IHO Assembly and highlighted the work that had been progressed on the S-100 based Product Specifications (PS) since the last meeting (TWCWG1). He also noted that final approval of the revised version of IHO resolution 3/1919, as amended, had been achieved in February, which was considered to be a significant achievement. He also noted the other work items, which were being progressed and encouraged all participants to remain engaged and to contribute to the collective efforts of the WG.

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.

The Chair then invited all delegates – representing Australia, Brazil, Canada, Finland, France, Germany, Japan, Korea, Netherlands, Norway, Perú, South Africa, USA and invited expert contributor from academia/ industry – to introduce themselves, Annex A.

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, New Zealand and UK.

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 Chair highlighted some changes which had been made to the published programme; see list of documents is at Annex C.

2.3 CAN provided a short brief covering the extracurricular activities and the visit to the CHS offices at the Institute of Ocean Science.

2.4 The Chair noted that significant intersessional activities would be covered by the various national presentations. She provided a brief on the report of the TWCWG to the HSSC8, including the presentation given at the meeting.

2.5 The Secretary went through the action items from TWCWG1 noting that 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 IHO 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 contribute to the progress of agenda item actions and to regularly check the website for new items and information.

3 National Presentations

3.1 National presentations were received from Finland, Germany, USA and Korea, all of which are available under the meeting document section, Annex C.

3.1.1 FIN provided a presentation on national activities, which included:

Baltic Sea Hydrographic Commission harmonized vertical datum and Baltic Sea Chart Datum 2000;
Definition and realization of the Baltic Sea Chart Datum 2000;
Finland's transition to the Baltic Sea Chart Datum 2000 (Finnish realization: N2000-height system); and
Finland's transformation parameters ITRF -> ETRF (EUREF-FIN).

Presentation initiated in depth discussion on the achievable GNSS vertical accuracies and how the high levels demanded could be achieved for this project.

3.1.2 DEU provided a presentation covering oceanographic data available at the Bundesamt für Seeschifffahrt und Hydrographie (BSH) and on BSH activities related to ENCs. The Copernicus Marine Environmental Monitoring Service was described with details of products available. The ImoNav - *Integration of high resolution marine geodata into electronic navigation systems* – project was described and the anticipated future developments. Oceanographic products and activities were detailed including the various products being developed to support ENCs and website applications. Two animations were demonstrated, which illustrated the potential benefits for safe navigation within the river channels into the North Sea ports for pilots.

Numerous questions resulted; the size of the different grid-squares (900m and 90m) was confirmed and why the particular size was selected, USA indicated at least 2 to 3 grid-cells were needed to resolve for the width of a channel, the necessity to reduce the amount of data portrayed needs to be considered, the timescale for development was indicated and the availability of data from the website was confirmed. It was confirmed that that the ImoNav project will be led by BSH and supported by two companies. SevenCs will work on portrayal and presentation.

3.1.3 USA provided a presentation brief on the Centre for Operational Oceanographic Products and Services (CO-OPS) and current activities. The Physical Oceanographic

Real Time Systems (PORTS) was described and the partnership arrangements with individual ports and local communities. The short term infrastructure-free water level measurement requirements and the deployment of sensors into sites which have limited access or physical challenges, such as Arctic locations were discussed. The presentation generated numerous questions and comments.

USA provided a short brief on support to current survey operations and the challenges using ADCPs. This generated considerable discussion and questions.

USA provided an overview of NOS Surface Currents Data sources and processing, which cover real time and historical current observations, the expansion of coverage of the Forecast Systems, the data processing for NOS Forecast Systems, automated data processing for the Model Forecast data which is in development, including the challenges of moving the quantities of data as well as providing the final product into the public domain.

3.1.4 KOR gave a presentation on processing Tidal information for the General Public, which covered the real time high tide information service. KOR provided some examples of ocean forecast charts for review. Participants were requested to complete a short questionnaire to provide comment and feedback on the service and assist in the further development.

4 Product Specification Presentations

4.1 Water Level Information for Surface Navigation (S-104)

AUS gave a short update on progress and the work that needs to be addressed at the meeting. It was noted the challenge where customer and producers were non-government organization and authorities.

4.2 Surface Current Product Specification (S-111)

CAN provided an update brief on the progress and present state of development of S-111 with some examples of portrayal of compatible datasets generated by KOR from datasets provided by CAN. CAN also briefed on Canada's Ocean Protection Plan and the impact on activities the significant investment has generated.

USA briefed on the components of an S-100 Product Specification as back ground for the breakout sessions and discussions. The current status of the S-111 PS was described and the work with the IHO GI Registry manager was detailed. It was noted that a number of terms were not included in the HD, although defined in the registry; it was noted that work was commencing to resolve these issues with harmonization between the HD and the registry and inclusion of S-100 related terms directly into the HD.

S-62 Producer Code Information is being proposed to be moved into the Registry. There is a need to make a distinction between Official (HOs authorised data) and non-Official (privately/commercially created) information in all S-100 based Product Specifications.

Object Catalogues - there were discussions at the recent S-100WG meeting to review the content of the Feature Concept Dictionary (FCD) register which impacted on the Catalogues. Those leading their development need to be engaged and ready to provide input/comment. A number of duplications have been identified already. All

portrayal and symbols need to be submitted to the NCWG for checking against already in use symbols.

4.3 Dynamic Water Level Data Transfer (S-112)

No update provided.

It was agreed to request guidance from HSSC and the S-100WG on whether a generic S-100 data transfer standard would developed, as it was felt this would be an issue for a great many S-100 based product specifications. An alternative approach may be to include the transfer standard as part of the S-104 development, again this would be brought to the attention of HSSC and S-100WG for further guidance.

5 Product Specification Work Packages

5.1 Meeting conducted a comprehensive review of the draft S-104 PS, numerous amendments and changes were made as result of considerable and wide ranging discussions. It was questioned whether the PS should narrow its focus to be more directed towards Tides and Water Level data standards and leave portrayal to other PS using tide and water level data in the stipulated format. CAN volunteered to encode water level data in the Surface Current encoding HDF5. **Action CAN** Noting that the terms increasing and decreasing water level were defined, it was agreed there was a need to generate a definition for 'steady' tidal state for inclusion in the Registry, which needed to be clear and simple and useable across all tide and water level regions. Participants developed a proposed definition of steady for consideration by the HDWG and the S-100 Registry. **Action Chair/AUS**

CAN agreed to generate more S-104 compatible datasets using an S-104 updated CARIS encoder. NLD agreed to generate compatible datasets from existing data using the CARIS encoder. FRA intended to install the S-111 tool available from CAN and produce HDF5.2 data for testing, also to create a directory and viewer on the TWCWG page. FIN noted it would liaise with the Finnish Meteorological Commission to commence work to create compatible datasets. DEU agreed to create water level HDF5 files, as well as current datasets but in a second time. AUS agreed to finalize the next draft version of S-104 and circulate for comment; no expertise available to commence encoding in HDF5 format. NOR to liaise with Norwegian Meteorological Institute and to commence work on encoding water level data into HDF5 format. JPN agreed to commence work to create compatible datasets in HDF5 format for selected locations for water level and currents. FIN will contact the Finnish Meteorological Centre to check their output files forma and will try to link to S-104. KOR noted that it would continue testing of datasets against S-104 and S-111 PSs as they are developed. Other TWCWG members were encouraged to contribute and build up their national and organizational knowledge base.

5.2 USA provided an update on discussions and progress achieved during the breakout session. A number of issues were highlighted which were addressed during the discussions. USA decided that the addition of data for a following day is a new product not an update of an existing product. Following discussions on file naming convention, it was confirmed by Chair S-100WG that no standard naming convention had been determined. Questions arose on redundancy data checks and checks on received compressed and encrypted files; it is not clear if this has been addressed by S-100WG.

It was requested that an amended page structure be created on the TWCWG page to allow uploading of datasets, results of testing and converter/validator tools and notes. **Action IHO**

5.3.1 S-104 – *Water Level Information for Surface Navigation*
S-111 – *Surface Currents*
S-112 – *Dynamic Water Level Data Transfer*

Changes to S-104 and S-112 have been endorsed by HSSC8.

From TWCWG1, S-111 raised the point of the file size limit (10MB). This limit applied to the file will substantially influence the organization as defined in the PS. Points that required inputs to be improved are: production of the feature and portrayal catalogue. There is an outstanding question for S111 and ECDIS manufacturers on what the user is allowed to change. Ex: input and display parameters, in an ECDIS (this is an unresolved question addressed to S-100WG).

Chair received the S-100WG report at the end of the workshop week. Chair provided this information and raised the fact that the S-100 report contains several elements of answers to our WG questions and clarifies points for data size package, IALA system, data transfer, etc.

6 Programme Matters

6.1 Standard constituent list

Chair gave a short brief with information provided by GBR. It was indicated that the list was in the process of being updated to show the speeds of each harmonic to 7 decimal places of precision but some values remain at 6 decimal places as more precise speeds are not known. A list was provided with the amended values shown in red, it was highlighted that some needed completing. It was requested whether other members of the WG could assist with the task in coordination with GBR. **Action GBR/FRA** All participants were encouraged to provided updates to improve the list, to the email addresses as requested on the website. **Action All** IHO was requested to updated the front covering page and upload the revised list to the website. **Action IHO**

6.2 Standard for digital tide tables

USA provided an update brief on the work completed on the Standard for digital Tide Tables. It was suggested that the work should be expanded to include current data. Discussion on how to control distribution of disc versions of sold hard copy versions. NLD explained that data sold with a key that had limited user capability to control distribution. The various different formats were discussed. The SOLAS carriage requirements and port State control checks are the most effective control on non-official data use. It was highlighted that the standards were minimum standards and were voluntary. All participants were requested to provide feedback and comment to USA by 29 September 2017 on the draft standards for the development of a revision. **Action All** USA to circulate a revised draft by 29 December 2017 for further comment and preparation a final draft version for discussion prior to TWCWG3. **Action USA**

6.3 Inventory of tide gauges used by IHO Member States

IHO highlighted the list and its location on the TWCWG webpage, it was noted that not all TWCWG members had supplied information. IHO noted that only one update had been received in the past year. It was highlighted that the list should contain information from all IHO MS, not just TWCWG participants; therefore all were requested to contact their representatives at RHC meetings to encourage provision of details from all coastal states 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 was provided a brief presentation on the study of long term datasets for the determination of sea level rise undertaken in Norway. Detail on the results obtained to date, on-going work and studies, and a project for portrayal of future sea level rise were highlighted; examples of potential inundation of coastal cities were provided.

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

USA provided brief background on the current analysis of datasets available from the website. Reports of the analysis need to be generated and uploaded to the website for all to consider, reports to be provided to USA by 28 July**. Action USA/GBR** Chair request other datasets be made available to IHO for upload. **Action All** ZAF requested details of constituents used be notified or provided datasets so that equivalent comparisons can be undertaken. ZAF explained the background to the original project, basically a check on individual national software programs using external datasets and comparing results between different national programs. Once analysis completed discussion should be initiated to discuss differences. **Action All** The IHO was requested to investigate amending the current page for Tidal Datasets to enable the associated tidal constituents to be uploaded with the respective datasets. **Action IHO**

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

NLD provided a presentation on a seamless LAT on the North Sea, work undertaken by the NSHC TWG. A number of examples of differences in LAT across maritime boundaries and the impacts on tidal values; also indicated the intended actions to reduce the differences. An agreement of the rate of 1% or less (LAT difference divided by depth) was acceptable difference across a maritime boundary. DEU asked whether NSHC TWG had identified methods and way to reduce the differences. CAN asked whether the reasons for the differences had been identified. NLD noted that the focus was the impact on the mariner and charting, hence the threshold of 1% had been agreed. NLD noted work was progressing on the development of a homogeneous VRF for the North Sea.

6.7 Exchange of harmonic constants / predictions

No actions or updates. 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

NOR provided a brief update report on activities to determine the ellipsoidal height of MSL at the coast, originally reported at TWCWG1. A number of challenges and questions, which had arisen, were highlighted for consideration by the participants. CAN detailed experience of equipment deployed in a remote area for an unintended

extended period, all equipment had continued to operate even under the low power conditions with no impact on the data or the equipment. CAN asked if long term gauges were to be deployed to help determine accurate values of Zo.

NLD provided a brief on ellipsoidal reference surface determination activities and on-going work. LAT2016 (GRS80 – LAT surface) has closed the gaps in LAT2013 (GRS80 – LAT surface) near the coastline by using straight interpolation with direction determined by the orientation of the coastline. Proposed output of the Vertical Reference Frame for the Netherlands Mainland, Wadden Islands and Continental Shelf (NEVREF) late in 2017.

6.9 Actual tides on-line link status

The Actual Tides and Currents on-Line links were highlighted and requests for all to check their national details and provide amendments, corrections and updates to keep the list current. It was recognized as a highly valuable and unique resource, which needed to be expanded beyond the member states represented in the TWCWG; all were encouraged to contact their national representations for RHC meetings to advertise the list and request additional inputs from all coastal states. **Action All**

7 IHO Resolutions and Charting Specifications

IHO provided a presentation on the changes to IHO organization and processes resulting from the approval of the Protocol of amendments to the IHO Convention, which came into force on 8 November. This generated numerous questions on the impact of the work of the TWCWG, particularly how the Council would engage with the HSSC and IRCC and the way proposals would be managed in the future.

7.1 The IHO Resolutions relevant to the TWCWG were reviewed and it was agreed that no amendments were necessary at present.

The final approved version of IHO Resolution 3/1919 was displayed and the reviewed. PER and ZAF indicated their concerns on the application of some of the recommendations; it was highlighted that the resolution contained only recommendations to try and achieve global harmonization of processes and procedures, they were not mandatory, and therefore regional variations were accepted noting that reasons and justifications for not following the recommendations may be required in the event of an incident; it was suggested that organizations should consider and develop these and then publish them with their products or provide them to customers. These reasons and justifications should be periodically reviewed to ensure their currency and appropriateness.

7.2 The IHO Charting Specifications were reviewed. It was agreed that all should provide comments and feedback to the Chair by 29 September. **Action All** Chair would circulate the consolidated comments for review by 29 December in preparation for discussion at TWCWG3. **Action Chair**

8 IOC/GLOSS Programme

8.1 NOR provided a short brief on EOOGS Tide Gauge Task Team activities, which covered technology, non-safety of navigation uses, increased focus on redundancy as well as standards, formats and metadata. USA and BRA noted they would be attending the next GLOSS meeting in New York and agreed to represent the IHO TWCWG as well as providing a short post bulletin brief report to the IHO and more comprehensive report to TWCWG3. Clarification should be sort from the GLOSS

Group of Experts on the delivery of requested training requirements made by some member States interested in expanding their knowledge of tidal currents and sea level changes. **Action USA**

8.2 No attendance by TWCWG at the TOWS-9 meeting in Paris.

9 Capacity Building (CB)

ZAF provided a background brief on the reasons for the development of the course and the problems it was designed to address. It was noted that many of the issues encountered in some regions required a basic level of introduction and material; the course was designed with the flexibility to enable some material to be missed depending on the knowledge basis and skills of the students. ZAF described some of the challenges typically encountered and advice on how to address them. ZAF invited comment, input and additional material by 26 May and requested that more comprehensive notes and details be provided to enable a better level uniformity be achieved when the course is delivered by different instructors. **Action All** ZAF and AUS would collate the material into a more comprehensive course. **Action ZAF/AUS**

It was agreed that some form of end of course assessment should be conducted to consolidate the knowledge and provide a record of participation. BRA suggested WG developed free software to create predictions from Harmonic analysis software already available free from BRA. IHO provided details on the CB process, highlighting the role of the Regional CB Coordinators. The importance of providing details on the student profiles and backgrounds and future employment to the Regional CB Coordinators when arranging a course and accepting candidates was highlighted. ZAF and AUS agreed to coordinate with CBSC, Regional Coordinators and IHO Secretariat. **Action ZAF/AUS** It was agreed that modulization of the course material was recommended. ZAF agreed to provide the completed material to organizations for translation. **Action ZAF** There was an identified need for the material to be translated into additional languages; USA and FRA volunteered to arrange translation of the material into Spanish and French. **Action USA/FRA** It was agreed that some form of end of course test/assessment should be conducted and certificates issues to successful students, it was agreed that this would be undertaken by the instructor in coordination with the IHO CBSC.

10 Election of Chair and vice-Chair

The current chair, Mme Gwenaële Jan (France), and vice-Chair, M Louis Maltais (Canada), were unanimously re-elected for the period 2017-2020.

11 Any other business

11.1 A request had been received from the USA for a definition of 'Geostrophic Equilibrium'. It was agreed the information obtained from the Meteorology Glossary, American Meteorological Society glossary of meteorology, should be the definition used:

geostrophic equilibrium: A state of motion of an inviscid fluid in which the horizontal Coriolis force exactly balances the horizontal pressure force at all points of the field so described:

$$2\boldsymbol{\Omega} \times \mathbf{v}_g = -\alpha \nabla_H p,$$

where Ω is the vector angular velocity of the earth, vg the geostrophic wind velocity, α the specific volume, p the pressure, and ∇H the horizontal del operator. With respect to cyclone-scale motions in extratropical latitudes, the free atmosphere frequently approaches a state of geostrophic equilibrium.

11.2 It was agreed there was no requirement to establish PTs.

11.3 DEU introduced a request for development of a chapter for service oriented streaming of S-100 data for the IALA ENAV21WG. It was considered this would be covered by the development of S-112. It was noted that there are a number of organizations already developing similar data exchange protocols such as the European SaeDatNet. It was noted that the TWCWG had little experience or expertise and therefore it was recommended that contact was made with non-maritime organizations, which were undertaking similar developments.

11.4 CAN provided a brief on some issues with printed Tide Tables, particularly the displayed time which is currently written PST Z+8 and has caused some confusions. It was agreed that CAN would investigate the format used and decide how the time used in the tables was articulated. It was highlighted that there were a number of ways in use by other national HOs. It was suggested that a verbal description would be clearer.

12 TWCWG Work Plan and ToRs

12.1 TWCWG ToRs and RoPs

The ToRs and RoPs for TWCWG were displayed, Annex G. The amendments resulting from the coming into force of the Protocol of Amendments to the IHO Convention were highlighted.

12.2 TWCWG Work Plan 2017-2018

The IHO displayed the draft work programme for 2018-2019 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 HSSC9 for approval. **Action Chair/IHO**

13 Venue and dates of the 3rd TWCWG Meeting

The Chair asked if any MS would volunteer to host TWCWG3. It was noted that an offer had been received from SHOA, Chile, to host the next meet, TWCWG3, in Valparaíso during the week 16-20 April 2018. It was agreed to accept this kind offer and the IHO was requested to liaise with SHOA to make the necessary arrangements and upload them to the website. **Action IHO/CHL**

14 Review of Action Items

14.1 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 TWCWG3 web page and all those who have actions to complete should keep the IHB informed of any progress. **Action ALL.**

15 Draft Report to the HSSC / Draft Agenda for TWCWG3

15.1 It was agreed that the IHO would circulate a draft meeting report to all attendees by 26 May. **Action IHO.** Participants were requested to provide any comments by 9 June. **Action ALL.** It was intended the final meeting report would be published by 23 June. **Action IHO**

15.2 The IHO, Chair and vice-Chair would prepare the final report to HSSC9 using the format required by HSSC. Representation of TWCWG at the HSSC9 meeting would be discussed between the Chair and the vice-Chair. **Action IHO, Chair & vice-Chair**

15.3 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 HSSC9.

16 Closing remarks

TWCWG2 outcomes were displayed during the closing session.

On behalf the group, the Chair thanked the Canadian Hydrographic Service for hosting this meeting and for their warm hospitality. Chair thanked all working group members for their participation and excellent contributions. She noted important steps of the work plan were progressed. Thus, several data test sets for future water level and surface current products for e-navigation will be delivered before the end of this year. Also a number of the other identified actions are underway.

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 Canadian Hydrographic Service 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 Valparaíso, Chile, in 16-20 April 2018.

The meeting closed at 12:00 on 12 May 2017

The following Annexes are attached:

A. TWCWG2 – List of Participants.
B. TWCWG2 – Agenda
C. TWCWG2 – List of Documents
D. TWCWG2 – List of Actions
E. TWCWG2 – List of fundamental attributes for Digital Tide Tables
F. TWCWG2 – TWCWG ToRs and RoPs
G. TWCWG2 – TWCWG draft Work Programme 2018-2019
H. TWCWG2 – TWCWG3 Draft Agenda

LIST OF PARTICIPANTS

Country	Name	Organization	E-mail
Australia	Zarina Jayaswal	AHO	zarina.jayaswal@defence.gov.au
Brazil	Cesar Henrique de Oliveira Borba	CHM	cesar.borba@marinha.mil.br
Canada	Louis Maltais (vice-chair)	CHS	louis.maltais@dfo-mpo.gc.ca
Canada	Neil Dangerfield	CHS	Neil.Dangerfield@dfo-mpo.gc.ca
Canada	Denny Sinnott	CHS	Denny.Sinnott@dfo-mpo.gc.ca
Canada	Phil MacAuley	CHS	macaulayp@mar.dfo-mpo.gc.ca
Finland	Jyrki Mononen	FTA	jyrki.mononen@fta.fi
France	Gwenaële Jan (Chair)	SHOM	gwenaele.jan@shom.fr
Germany	Stephan Dick	BSH	stephan.dick@bsh.de
Japan	Hideo Nishida	JHA	nishida-vu2@jha.jp
Japan	Harumi Taka	JHA	taka-hr3@jha.jp
Korea	Heungbae Choi	KHOA	hbchoi@geosr.com
Korea	Ji-Hun Boo	KHOA	jhboo@korea.kr
Korea	Won-Jin Choi	KHOA	Ch8331@korea.kr
Netherlands	Ronald Kuilman	RNlN	RB.Kuilman@mindef.nl
Norway	Hilde Sande Borck	NHS	Hilde.sande.brock@kartverket.no
Perú	Fernando Vegas	DHN	fvegas@dhn.mil.pe
Perú	Carol Estrada	DHN	cestrada@dhn.mil.pe
South Africa	Ruth Farre	HydroSAN	ruth.farre@sanavy.co.za
South Africa	Gailen Pietersen	HydroSAN	hydrosan@iafrica.com
USA	Kurt Hess	NOAA	kurt.hess@noaa.gov
USA	Peter Stone	NOAA	peter.stone@noaa.gov
USA	Carl Kammerer	NOAA	carl.kammerer@noaa.gov
USA	Douglas Roush	NGA	douglas.l.roush@nga.mil
IHO	David Wyatt (secretary)	-	adso@iho.int
Expert Contributor	Ed Weaver	SPAWAR Atlantic	eweaver@wrsystems.com

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 IHO Secretariat

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"

.1 Finnish activities – FIN
.2 Oceanographic data available at BSH and on our activities related to ENCs – DEU
.3 Brief overview of NOS surface currents data sources and processing – USA
.4 National Tidal and Current issues and projects – KOR

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) – AUS
.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} – GBR
.2 Standard for digital Tide Tables {B.2} – USA
.3 Inventory of Tide gauges used by IHO Member States {F.1} – IHO
.4 The study of long term data sets for the determination of global sea level rise. {H.1} – GBR, NOR, USA & ESP
.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} – GBR & NLD

.7 Exchange of Harmonic Constants / Predictions – GBR
.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 – IHO
.2 Review of relevant IHO Charting Specifications – IHO

8. IOC/GLOSS Programme

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

9. Capacity Building

.1 Tides and Water Levels Workshop training material

10. Elections

.1 Election of chair and vice-chair for period 2017 to 2020 in accordance with ToRs – Secretary

11 Any Other Business

.1 Request for definition of 'Geostrophic Equilibrium' – USA
.2 Consider need to create/continue Project Teams (PTs)
.3 Development for service oriented streaming of S100 data for ENAV21WG – DEU
.4 Time zone details displayed in Tide tables – CAN

12. Work Plan and ToRs

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

13 Venue and dates of the 3rd TWCWG Meeting (TWCWG3)

14 Review of Action Items from TWCWG2

15 Draft Report to HSSC9/Draft Agenda for TWCWG3

16 Closing remarks

TWCWG2 - List of Documents

Document No	Document Title
TWCWG2 Letter 1	Letter of Invitation
TWCWG2 Annex B	TWCWG2 Registration (Word version)
TWCWG2 Annex C	Logistic Information
TWCWG2 Annex C Additional	Transport options between Vancouver Airport and Vancouver Island
TWCWG2-1.1	Chair welcome comments
TWCWG2-2.1	Agenda v4.0
TWCWG2-2.2	Programme v4.0
TWCWG2-2.4a	TWCWG Report to HSSC8
TWCWG2-2.4d	Extract from HSSC8 Report
TWCWG2-2.5	TWCWG1-List of Actions - 20 June 2016
TWCWG2-3.1.1	National Report-FIN
TWCWG2-3.1.2	BSH Oceanographic data for ECDIS/ENCs-DEU
TWCWG2-4	IHO A-1 Proposal to amend Resolution 2/2007
TWCWG2-4	IHO Resolution 2/2007
TWCWG2-4.2.3	S-111 Version 0.1.10 - Clean and Track Change versions
TWCWG2-6.2	List of Fundamental Attributes for Digital Tide Tables-v1.1 (initial draft for comment)
TWCWG2-6.4	Results Study Long Term Datasets-NOR
TWCWG2-7.1a	IHO Resolutions
TWCWG2-7.1b	IHO Resolution 3/1919
TWCWG2-7.2	Review of relevant IHO Charting Specifications
TWCWG2-8.1	EuroGOOS TGTT LaRochelle-November2016-NOR
TWCWG2-9.1.1	SAN TWC CB Workshop
TWCWG2-9.1.2	SAN TWC CB Workshop Presentation
TWCWG2-11.3	Development for service oriented streaming of S-100 data for ENAV21WG
TWCWG2-12.1	TWCWG Work Plan 2018-2019
TWCWG2-12.2	TWCWG ToR
TWCWG2-15	TWCWG3 - Draft Agenda
TWCWG2-16	Chair Closing Remarks
TWCWG2-Presentations	Presentations.zip
TWCWG2-Participants	List of Participants

LIST OF ACTIONS – Updated 27 June 2017

Agenda Item	Subject	Status/Date	Comments	Action
Continuous				
6.1	Standard Constituent List	On going	Add additional data and upload to website for further comment.	All
6.5	Compare tidal predictions	On-going	Provide additional datasets for analysis, with constituents used, to IHO for uploading to web page	All
6.5	Compare tidal predictions	On-going	Provide reports of analysis to USA/GBR/NOR and IHO for wider discussion and comments	All
6.3	Inventory of tide gauges	On going	Contact national representative attending RHC meetings to raise awareness of inventory and encourage input and updating of information	All
6.3	Inventory of tide gauges	On going	Regularly check entries and provide up-dates and amendments to IHO as necessary	All
6.4	Study of long term data sets	On going	Circulate to TWCWG national reports on studies into sea level rise and trends	All
6.9	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 IHO	All
TWCWG2				
5	S-100 based Product Specification	TWCWG3	Provide S-104 and S-111 test datasets to IHO for uploading to the website	All
5	S-100 based Product Specification	28 Jul	Check current S-100 registry list of vertical datums to ensure all national vertical datums are included, provide details to Chair, for submission to S-100WG, of any additional datums, which require to be added,	All
5.1	S-104	TWCWG3	Encode Water Level data in the Surface Current encoding HDF5	CAN
5.1	S-104	HSSC9	Submit proposed definition for ‘steady’ water level state for consideration and inclusion in S-100 registry and HD	AUS/Chair
5.1	S-104 Product Specification	28 Jul	Provide feedback on draft S-104 Product Specification document	All

5.2	S-111 Product Specification	28 Jul	Create an amended page structure on the TWCWG page to allow uploading of datasets, results of testing and converter/validator tools and notes	IHO
5.2	S-111 Product Specification	28 Jul	Provide S-111 validator tool for upload on TWCWG web page	CAN
6.1	Standard Constituent List	On-going	Assist in generating amended values in coordination with GBR	GBR/FRA
6.1	Standard Constituent List	On-going	Provide updates to constituents to 7 decimals to email detailed on list front cover page of the list	All
~~6.1~~	~~Standard Constituent List~~	~~19 May~~ Complete	~~Amend front cover page and upload current revised list to web page~~	~~IHO~~
6.2	Standard digital Tide Tables	29 Sep	Provide feedback to USA on current draft	All
6.2	Standard digital Tide Tables	29 Dec	Circulate revised draft for comment and prepare final version for discussion at TWCWG3	USA
6.5	Compare tidal predictions	28 Jul	Collate reports of previous analysis and pass to IHO for uploading to web page	USA/GBR
~~6.5~~	~~Compare tidal predictions~~	~~28 Jul~~ Complete	~~Investigate amending the current Tidal Data Sets page to enable tidal constituents to be uploaded~~	~~IHO~~
7.2	IHO Charting Specifications	29 Sep	Provide comments on current specifications to Chair	All
7.2	IHO Charting Specifications	29 Dec	Circulate consolidated comments in preparation for discussion at TWCWG3	Chair
8.1	IOC/GLOSS Programme	TWCWG3	Provide short bulletin brief on completion of meeting to IHO and prepare more comprehensive report for TWCWG3	USA
9.1	Capacity Building	26 May	Review contents of Tides, Water Level and Currents course material and provide comments, amendments and feedback to ZAF and AUS	All
9.1	Capacity Building	TWCWG3	Collated material into comprehensive modular course	ZAF/AUS
9.1	Capacity Building	CBSC15	Liaise with CBSC, Regional CB Coordinators and IHO on appropriate student profiles for attendance on course	ZAF/AUS
9.1	Capacity Building	28 Jul	Provide completed course material for translation into French and Spanish	ZAF/AUS
9.1	Capacity Building	TWCWG3	Translate course material into French and Spanish	FRA/USA/BRA
13	TWCWG3	13 Oct	Circulate an initial letter of invitation and post on the website.	CHL/IHO

14	Action List	TWCWG2	Keep IHB and the Chair and vice-Chair informed of progress with allocated actions	All
~~15~~	~~TWCWG2 Draft Report~~	~~26 May~~ Complete	~~Draft to be circulated for comment~~	~~IHO~~
~~15~~	~~TWCWG2 Draft Report~~	~~16 Jun~~ Complete	~~All to provide comments on draft report~~	~~All~~
~~15~~	~~TWCWG2 Final Report~~	~~23 Jun~~ Complete	~~Publish final report~~	~~IHO~~
15	Report to HSSC9	8 Sep	Draft report for review and amendment.	Chair/vice-Chair/IHO

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© 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

	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Th	0048 0741 1317 2026	5.1 155 −0.3 −9 5.5 168 −0.4 −12	**16** F	0026 0705 1241 2006	4.2 128 0.4 12 5.0 152 0.4 12
2 F	0142 0833 1407 2120	5.1 155 −0.3 −9 5.5 168 −0.4 −12	**17** Sa	0121 0803 1331 2101	4.3 131 0.3 9 5.2 158 0.2 6
3 Sa	0233 0922 1454 2210	5.1 155 −0.3 −9 5.6 171 −0.5 −15	**18** Su	0211 0858 1417 2153	4.4 134 0.1 3 5.4 165 0.0 0
4 Su ○	0321 1009 1538 2256	5.1 155 −0.2 −6 5.5 168 −0.4 −12	**19** M	0257 0952 1503 2243	4.6 140 −0.1 −3 5.6 171 −0.2 −6
5 M	0408 1054 1621 2341	5.0 152 −0.1 −3 5.4 165 −0.3 −9	**20** Tu ●	0343 1044 1549 2331	4.8 146 −0.2 −6 5.7 174 −0.4 −12
6 Tu	0454 1136 1702	4.9 149 0.1 3 5.3 162	**21** W	0430 1136 1639	4.9 149 −0.4 −12 5.7 174
7 W	0022 0540 1216 1742	−0.2 −6 4.8 146 0.2 6 5.1 155	**22** Th	0018 0520 1227 1733	−0.5 −15 5.0 152 −0.4 −12 5.7 174
8 Th	0103 0625 1255 1822	0.0 0 4.7 143 0.4 12 5.0 152	**23** F	0106 0612 1320 1830	−0.5 −15 5.1 155 −0.4 −12 5.6 171
9 F	0141 0710 1334 1901	0.1 3 4.6 140 0.5 15 4.9 149	**24** Sa	0154 0708 1414 1931	−0.5 −15 5.2 158 −0.4 −12 5.5 168
10 Sa	0219 0755 1416 1940	0.2 6 4.6 140 0.6 18 4.8 146	**25** Su	0244 0806 1511 2032	−0.4 −12 5.2 158 −0.3 −9 5.4 165
11 Su	0256 0839 1503 2021	0.3 9 4.6 140 0.7 21 4.6 140	**26** M ◐	0336 0904 1610 2132	−0.3 −9 5.3 162 −0.2 −6 5.2 158
12 M	0334 0922 1559 2115	0.4 12 4.7 143 0.8 24 4.4 134	**27** Tu	0429 1002 1710 2231	−0.3 −9 5.3 162 −0.1 −3 5.1 155
13 Tu ◑	0416 1006 1701 2220	0.4 12 4.7 143 0.8 24 4.3 131	**28** W	0524 1101 1810 2330	−0.2 −6 5.3 162 −0.1 −3 5.0 152
14 W	0507 1055 1806 2325	0.5 15 4.8 146 0.8 24 4.2 128	**29** Th	0620 1159 1908	−0.1 −3 5.3 162 −0.1 −3
15 Th	0605 1148 1908	0.5 15 4.9 149 0.7 21	**30** F	0028 0715 1255 2004	5.0 152 −0.1 −3 5.3 162 −0.2 −6
			31 Sa	0123 0808 1347 2057	5.1 155 −0.1 −3 5.4 165 −0.3 −9

February

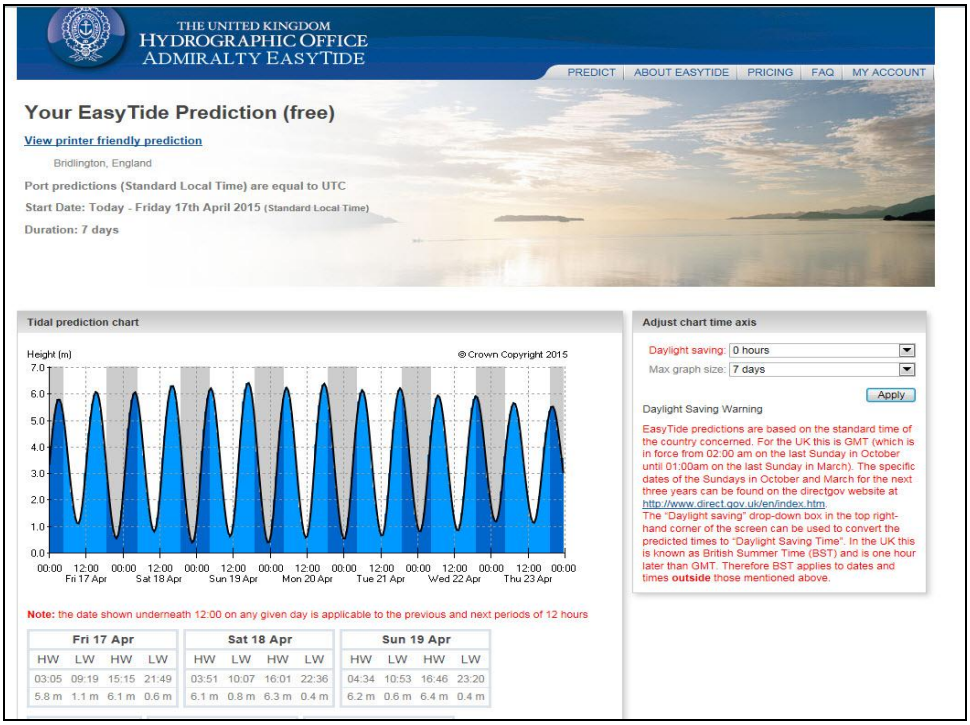
	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Su	0214 0859 1435 2145	5.2 158 −0.1 −3 5.4 165 −0.3 −9	**16** M	0144 0836 1353 2127	4.8 146 0.3 9 5.6 171 0.1 3
2 M	0302 0946 1519 2230	5.2 158 −0.1 −3 5.4 165 −0.3 −9	**17** Tu	0234 0933 1445 2217	5.0 152 0.1 3 5.7 174 −0.1 −3
3 Tu ○	0348 1030 1600 2313	5.2 158 0.0 0 5.4 165 −0.2 −6	**18** W ●	0322 1027 1535 2306	5.3 162 −0.2 −6 5.9 180 −0.2 −6
4 W	0431 1112 1640 2352	5.1 155 0.1 3 5.3 162 −0.1 −3	**19** Th	0409 1119 1626 2353	5.4 165 −0.3 −9 5.9 180 −0.3 −9
5 Th	0513 1152 1718	5.1 155 0.2 6 5.2 158	**20** F	0458 1211 1719	5.6 171 −0.4 −12 5.9 180
6 F	0029 0553 1231 1754	0.0 0 5.0 152 0.3 9 5.1 155	**21** Sa	0040 0549 1303 1815	−0.3 −9 5.6 171 −0.3 −9 5.8 177
7 Sa	0104 0632 1310 1826	0.2 6 5.0 152 0.5 15 5.0 152	**22** Su	0128 0642 1356 1913	−0.2 −6 5.6 171 −0.2 −6 5.6 171
8 Su	0137 0706 1350 1851	0.3 9 5.0 152 0.6 18 4.9 149	**23** M	0216 0739 1452 2012	−0.1 −3 5.6 171 −0.1 −3 5.5 168
9 M	0208 0730 1434 1924	0.4 12 5.0 152 0.7 21 4.8 146	**24** Tu ◐	0307 0837 1549 2111	0.1 3 5.6 171 0.1 3 5.4 165
10 Tu	0240 0752 1526 2009	0.5 15 5.1 155 0.8 24 4.6 140	**25** W	0400 0935 1647 2210	0.2 6 5.5 168 0.2 6 5.3 162
11 W ◑	0320 0832 1627 2109	0.5 15 5.2 158 0.9 27 4.5 137	**26** Th	0455 1034 1746 2309	0.4 12 5.4 165 0.3 9 5.2 158
12 Th	0413 0923 1733 2234	0.7 21 5.2 158 0.9 27 4.4 134	**27** F	0552 1133 1843	0.5 15 5.4 165 0.3 9
13 F	0520 1028 1837 2348	0.7 21 5.2 158 0.8 24 4.4 134	**28** Sa	0007 0648 1231 1938	5.3 162 0.5 15 5.4 165 0.2 6
14 Sa	0631 1149 1938	0.7 21 5.2 158 0.6 18			
15 Su	0050 0736 1256 2034	4.5 137 0.5 15 5.4 165 0.4 12			

March

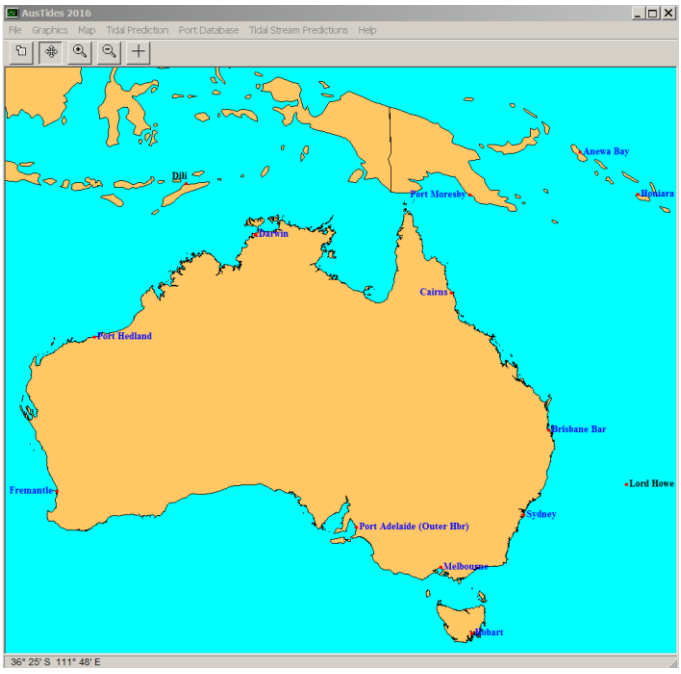
	Time	Height		Time	Height
	h m	ft cm		h m	ft cm
1 Su	0102 0743 1324 2029	5.4 165 0.5 15 5.5 168 0.1 3	**16** M	0023 0715 1230 2006	5.1 155 0.9 27 5.7 174 0.7 21
2 M	0153 0834 1413 2117	5.5 168 0.4 12 5.6 171 0.1 3	**17** Tu	0120 0817 1333 2059	5.4 165 0.6 18 5.9 180 0.5 15
3 Tu	0241 0922 1457 2201	5.6 171 0.4 12 5.6 171 0.1 3	**18** W	0212 0915 1428 2160	5.7 174 0.3 9 6.0 183 0.3 9
4 W	0325 1006 1538 2241	5.7 174 0.4 12 5.6 171 0.1 3	**19** Th	0300 1009 1519 2239	6.0 183 0.1 3 6.2 189 0.1 3
5 Th ○	0406 1049 1617 2319	5.7 174 0.4 12 5.5 168 0.3 9	**20** F ●	0347 1102 1610 2326	6.2 189 −0.1 −3 6.2 189 0.1 3
6 F	0444 1130 1654 2354	5.6 171 0.4 12 5.4 165 0.4 12	**21** Sa	0435 1154 1702	6.3 192 −0.1 −3 6.1 186
7 Sa	0520 1209 1728	5.6 171 0.5 15 5.3 162	**22** Su	0013 0523 1245 1756	0.2 6 6.3 192 0.0 0 6.0 183
8 Su	0027 0550 1249 1757	0.5 15 5.6 171 0.6 18 5.2 158	**23** M	0100 0615 1337 1853	0.3 9 6.2 189 0.1 3 5.8 177
9 M	0058 0607 1330 1821	0.6 18 5.7 174 0.7 21 5.2 158	**24** Tu	0148 0710 1431 1951	0.5 15 6.1 186 0.3 9 5.7 174
10 Tu	0129 0627 1414 1855	0.7 21 5.8 177 0.8 24 5.1 155	**25** W	0238 0807 1526 2049	0.7 21 5.9 180 0.5 15 5.6 171
11 W	0202 0704 1504 1942	0.8 24 5.8 177 1.0 30 5.0 152	**26** Th	0331 0906 1622 2147	0.9 27 5.8 177 0.6 18 5.5 168
12 Th	0245 0751 1602 2041	0.9 27 5.8 177 1.1 34 4.9 149	**27** F ◐	0426 1005 1718 2245	1.0 30 5.6 171 0.7 21 5.3 162
13 F ◑	0341 0844 1705 2201	1.0 30 5.8 177 1.1 34 4.9 149	**28** Sa	0522 1104 1814 2342	1.1 34 5.6 171 0.8 24 5.6 171
14 Sa	0453 0947 1808 2318	1.1 34 5.6 171 1.1 34 4.9 149	**29** Su	0619 1202 1907	1.2 37 5.6 171 0.7 21
15 Su	0607 1110 1909	1.1 34 5.6 171 0.9 27	**30** M	0037 0714 1256 1957	5.7 174 1.1 34 5.6 171 0.6 18
			31 Tu	0128 0806 1346 2043	5.9 180 1.0 30 5.7 174 0.6 18

Time meridian 75° W. 0000 is midnight. 1200 is noon. Times are not adjusted for Daylight Saving Time.
Heights are referred to mean low water during lowest river stages which is the chart datum of soundings.

UK Example



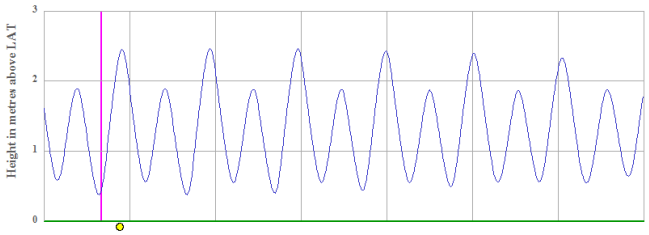
Australian Example



BRISBANE BAR

Local Standard Time Zone: -10:00 U.T. | **27° 22' S 153° 10' E** | **Year 2016**

PREDICTION DATUM below MSL: 1.31 (m) | **Port 59980**



16:00 0.4m

Jun 20 Mo		21 Tu		22 We		23 Th		24 Fr		25 Sa		26 Su	
Time	m	Time	m	Time	m	Time	m	Time	m	Time	m	Time	m
0343	0.6	0423	0.6	0503	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

Moon phases supplied by Sydney Observatory

No account is taken of Daylight Saving Time

These predictions are identical to those published in ANTT 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.

Tides, Water Level and Currents Working Group (TWCWG)

Terms of Reference and Rules of Procedure

References: *6th HSSC Meeting (Viña del Mar, Chile, November 2014)*
7th 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~~ IHO Secretariat~~("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~~ Assembly ~~(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 2018-19

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 and tidal current 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 (S-111) (IHO Task 2.13.4)
G	Develop, maintain and extend a Product specification for dynamic ~~tides~~ water level in ECDIS (S-104) (IHO Task 2.7.5)
H	Liaise with S-100WG on ~~tidal~~ water level and current matters relevant to ECDIS applications
I	Liaise with industry experts on the development of product specifications for ~~tides~~ water level and currents
J	Prepare and maintain an inventory of ~~tide~~ water level gauges and current meters used by Member States and publish it on the IHO/TWC~~L~~WG web site (IHO Task 2.7.2.4)
K	Review ~~feedback~~ and maintain the Actual Tides and Currents On-Line links as published on the IHO TWCWG website~~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~~ at least annual 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~~ Hilde Sande Borck * 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 final draft Standard	2009	~~2016~~ ~~2017~~ 2018	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~~	~~2017~~ ~~2018~~ ~~2019~~	~~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~~	~~2017~~ ~~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 (S-111)	H		2013	~~2017~~ 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~~ water levels in ECDIS	H	~~Prepare~~ Develop draft Product Specifications (S-~~1xx~~104) for ~~tidal~~ water level information for surface navigation~~data~~ in S-100. ~~Prepare draft Portrayal model for tidal data in S-100.~~	2009	~~2017~~ ~~2018~~ 2019	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~~ water level 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~~ water levels and currents	H		-	Permanent	O	All		
J.1	Maintain an inventory of ~~tide~~ water level 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.

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
K.1	Review and maintain the Actual Tides and Currents On-Line links as published on the IHO TWCWG website~~Review feedback of on-line real-time water level observation document~~	L		-	Permanent	O	~~Zarina Jayaswal~~David Wyatt* All		
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~~ ~~2017~~	O ~~O~~ ~~C~~	Gwenaële Jan	IHO Resolutions in M-3 S-60 User's Handbook on Datum Transformations involving WGS 84	See IHO CL10/2017 dated 1/02/2017
N.1	Develop and maintain material for CB course on Tides and Tide gauges	H	~~Delivery in 2015~~ Complete translate of course material into French, Spanish and Portuguese by 2018 in liaison with Regional CB Coordinator requirements	-	Permanent	O	Ruth Farre* ~~Louis Maltais~~ Peter Stone Zarina Jayaswal Gwenaële Jan Cesar Borba		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
8-12 May 2017	Victoria, Canada	TWCWG-2
16-20 April 2018	Valparaíso, Chile	TWCWG-3

Chair: Gwenaële Jan (France) Email: gwenaele.jan@shom.fr
Vice Chair: Louis Maltais (Canada) Email: Louis.maltais@dfo-mpo.gc.ca
Secretary: David Wyatt Email: adso@iho.int

Tides, Water Level and Currents Working Group
Valparaíso, Chile – 16-20 April 2018
Draft Agenda – (TWCWG3)

1 Opening

.1 Opening address by the Chairman
.2 Address by host nation
.3 Welcome by the IHO Secretariat

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 HSSC9 – Chair
.5 Matters arising from TWCWG2/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 Water Level Information for Surface Navigation (S-104) – AUS
.2 Surface Current Product Specification (S-111) – USA/CAN
.3 Dynamic Water Level 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) – AUS
.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} – GBR
.2 Standard for digital Tide Tables {B.2} – USA
.3 Inventory of Tide gauges used by IHO Member States {F.1} – IHO
.4 The study of long term data sets for the determination of global sea level rise. {H.1} – GBR, NOR, USA & ESP
.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} – GBR & NLD
.7 Determining ellipsoidal height of MSL at the coast – All
.8 Actual Tides On-line Link status – All

7 IHO Resolutions and Charting Specifications

.1 Review of relevant IHO Resolutions – IHO

.2 Review of relevant IHO Charting Specifications – IHO

8. IOC/GLOSS Programme

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

9. Capacity Building

.1 Tides and Water Levels Workshop training material – ZAF/AUS

10 Any Other Business

.1

11. Work Plan and ToRs

.1 TWCWG Work Plan up-dates – IHO
.2 Review TWCWG ToRs and RoPs – IHO

12 Venue and dates of the 4th TWCWG Meeting (TWCWG4)

13 Review of Action Items from TWCWG3

14 Draft Report to HSSC9/Draft Agenda for TWCWG4

15 Closing remarks