

12th CHRIS MEETING
Valparaiso, Chile, 23-25 October 2000

REPORT ON TIDAL MATTERS IN RELATION TO CHRIS
(by Cdr. A. Cabezas, Chile, Chairman IHO Tidal Committee)

1. BACKGROUND

In 1989 IHO established a Working Group on Standards for Release of Tidal Data to Commercial Organizations, which began its work in 1990. In 1995 the WG was renamed as Working Group on Tidal Matters. In 1997, the IH Conference resolved that the working group should be given a long-term mandate and reformed it as IHO Tidal Committee. Currently, according to its Terms of Reference the TC is involved in all matter related to tides.

The Committee has held six meetings from its establishment, being the last of them held in Cadiz, Spain, April 2000.

2. ACTIVITIES IN RELATION TO CHRIS

TC has made recommendations on several matters related to ECDIS and digital data, falling in the scope of CHRIS. Here is a summary of such matters. The full text of concerned recommendations are given in attached annexes:

- Standards for Tidal Data Exchange Formats (see Annex 1); Display of Tidal Information (see Annex 2); Real or Near-real time Data Transmission (see Annex 3); Formats for Digital Tide Tables (see Annex 4).
- Tidal overlays in ECDIS (see Annex 5) and three-dimensional representation of Currents and Tidal Stream (see Annex 6).
- Guidelines for digital tide tables in connection with S-57 data

After discussion, on Digital Tide Tables using S-57 data and ECDIS methodology, the TC agreed that no extra guidelines were needed. Resolution A6.9 covered this matter adequately. Any HO is free to decide whom they authorize to produce digital tide tables using their own official predictions that could be used as a replacement of the printed version. The method of display is to be determined by such an authorized producer according to customer needs and in consultation with the HO concerned. The data displayed must exactly replicate that supplied by the relevant HO.

- Examination of the use of digital tidal products outside ECDIS

HO's should actively pursue the development of digital tidal products. These products should not be a "digital" reproduction of the corresponding paper product but have more functionality and "intelligence" built into it; price should be low enough to allow wide acceptance. If such development does not seem attractive for an HO, cooperation with industry is recommended.

In the long term, it might be necessary to declare that "digital" products are "official" products provided their accuracy is at least as good as that of official paper products.

Data might become more useful by integration with information from other disciplines, e.g. meteorology; this approach requires cooperation between several bodies in a country or region. Such a cooperation is encouraged by this TC.

Special digital products could include the provision of tidal information along a planned route as well as open sea predictions.

- Future information services for Internet, ECDIS and real-time prediction.

When printed long-term predictions are of limited use, real time data should be used to obtain short-term forecasts (integrating other data).

The TC pointed:

Tides should be mandatory for ECDIS

The use of real time data should be discussed by the CHRIS Technical Assessment Working Group.

The TC should be involved in these discussions.

Quality assurance criteria of observations for real time applications should be observed.

- Treatment of storm surges in both tidal and non-tidal waters

How should surges be handled? It is necessary to collect data on surges, to prepare short-term forecasts and to distribute information to the clients. TSMAD should create a DEPVAR object to describe this variation.

- Additional recommendations to TSMAD are in Annex 7.

3. FINAL REMARKS

One additional point of interest to CHRIS would be our work on determination of vertical datum. ENC's at the moment use the vertical datum of the paper charts from which they were digitized, and since there is no legend on the screen, the datum can be accessed only through the pick report. We know that the chart datum and that of tidal predictions used with it must be the same, but it is not always easy with ENC's, and any discrepancy not easily noticed.

Another point worth mentioning is the question of symbology, which is determined by the Colours and Symbols WG of CHRIS - only minimum requirements are listed for both, tidal heights and streams. Cooperation with TC is proposed on this subject.

Finally, the question of dynamic tides - i.e. changing the depth information in the ENC depending on tidal height. This matter is becoming more and more important, since the users want this facility, but it is prohibited at present. Again, cooperation between our TC and the relevant CHRIS WG (i.e. MIO) should be sought.

Many other aspects have been addressed by the TC in the past and probably most of CHRIS delegates are not familiar with them. Copies of the minutes of TC meetings can be provided at request.

RECOMMENDATIONS FOR TIDAL EXCHANGE FORMATS

1. It is recommended that two formats be allowed for the exchange of tidal data between HO's.
 - a. When both HO's are developing/using ENC: S-57, Ed. 3;
 - b. When only one or no HO is developing ENC: ASCII.

Tidal data being exchanged consists of either listings of constituents or time series/Hi-Low data. S-57 can handle all aspects of tidal data. Two types of ASCII files are recommended.

2. It is recommended that for exchange of constituent files the following format be adopted:

FILE HEADER:

Line 1 (Identifier)	:	Country abbreviation (ISO 3166),	Port Number
			Port Name
Line 2	:	Geographic coordinates	
Line 3	:	Time zone of the station (in hours and decimal fractions of an hour, positive West of UTC, negative East of UTC)	
Line 4	:	Time zone of data (in hours and decimal fractions of an hour, positive West of UTC, negative East of UTC)	
Line 5	:	Units of measure (m, ft, deg)	
Line 6	:	Datum description, value of Z0 (m, ft)	
Line 7	:	Datum of elevation, description, value (m, ft)	
Line 8	:	Length of original observations (days), dates	
Lines until separation	:	Comments (e.g. description of quality, tidal levels, analysis software source)	

FILE BODY:

Column 1	:	Constituent name (10 characters)
Column 2	:	Constituent speed in degrees per hour (12 digits)
Column 3	:	Amplitude (7 digits)
Column 4	:	Phase (g) (6 digits)

(e.g. S2 30.0000 2.3430 162.8)

3. It is recommended that, for exchange of time series/Hi-Low tidal height and stream data the following format be adopted:

FILE HEADER

Line 1 (Identifier)	:	Country abbreviation (ISO 3166),	Port Number Port Name
Line 2	:	Geographic coordinates	
Line 3	:	Time zone of the station (in hours and decimal fractions of an hour, positive West of UTC, negative East of UTC)	
Line 4	:	Time zone of data (in hours and decimal fractions of an hour, positive West of UTC, negative East of UTC)	
Line 5	:	Date and time in a user defined format (e.g. yyyy.mm.dd;hhmm)	
Line 6	:	Data type (observed/predicted/residuals)	
Line 7	:	Tidal Height/Tidal Streams	
Line 8	:	Upper and lower limit of tidal stream below surface (m, ft)	
Line 9	:	Units of measure (m, cm, dm, ft, m/s, cm/s, dm/s, knots, deg)	
Line 10	:	Datum description, value of Z0 (m, ft)	
Lines until separation	:	Comments	

FILE BODY

Column 1	:	Date and time (20 digits)
Column 2	:	Tidal height/stream rate (5 digits)
Column 3	:	(blank)/direction (in degrees from true N) (5 digits)
Column 4	:	Event type (High, Low, slack water, max flood, max ebb)
Column 5	:	Data quality code (optional)

E.g.: 1997.08.26;1630 3.60 - - -
1997.08.26;1640 3.85 - H -

Please note the recommended format in the date and time stamp is four digits for year, and for direction is in degrees from true North (as per S-57).

Each day starts at 00:00:00, ends at 23:59:59

4. It is also recommended that the maximum interval for time series data be 60 minutes.

RECOMMENDATION FOR THE DISPLAY OF TIDAL INFORMATION

1. TIDAL HEIGHTS

It is recommended that the minimum textual display (High/Low water data for the day plus the present tidal height) be supplemented by a tidal curve display. This curve should be scalable from 12h to 24h in the conning mode of ECDIS, and with no upper limit in the route-planning mode.

A cursor to read time/data value anywhere along the curve is to be provided. Interpolation between the time series values supplied by HO is allowed.

The vertical size of the display should be self-scaling to allow easy reading of data.

If available at source, a comparison of predictions against observations in form of a 2-sigma envelope of tidal curve should be shown as a user option. Levels of MSL (or MWL where applicable) and of the chart datum of elevation (HAT being the recommended datum) could be also shown as option.

2. TIDAL STREAMS

Present minimum standard for tidal stream display is an oriented arrow with textual display of the velocity near it.

For the rectilinear flows, it is recommended that the minimum standard be supplemented by a display similar to that for the tidal heights - a scalable graph with a cursor to read the values along the curve.

The vertical size of the display should be self-scaling to allow easy reading of data.

For the rotary flows, it is recommended that the minimum display be augmented to a polar envelope diagram for the period of 13h each side of present time, with the present time flow shown as a highlighted arrow within the envelope.

3. GENERAL

The recommended displays of tidal heights and streams are the minimum standards only. Higher levels of developments should be encouraged.

**RECOMMENDATIONS FOR REAL - OR NEAR - REAL TIME DATA
TRANSMISSIONS**

1. This committee can address only the question of accuracy of transmitted data. As the meeting of the then TWG in Monaco in 1996 already recommended that the accuracy of tidal information be assessed to the confidence level of 95%, no further recommendations are required. A statistical on-the-fly method may need to be developed to produce the required assessment.

RECOMMENDATIONS FOR FORMATS FOR DIGITAL TIDE TABLES

1. It is recommended that no restrictions whatsoever are placed on the official digital tide tables produced by the HO's. Where available, a 2-sigma envelope should be shown around the prediction curves.

RECOMMENDATIONS FOR TIDAL OVERLAYS FOR ECDIS

1. It is recommended that any tidal overlays produced by ECDIS developers should adhere to the standards recommended for tidal data accuracy and display, and that ECDIS developers contact the appropriate HO's for the best method of modeling the tides and the spatial limits of tidal regimes.

**RECOMMENDATIONS FOR THREE DIMENSIONAL REPRESENTATION
OF CURRENTS AND STREAMS**

1. It is recommended that the minimum display for the tidal streams below surface should be an oriented outline arrow with the textual display of depth inside, and of the rate near it. When surface and subsurface stream(s) are present at the same location, the display should allow all arrows to be shown simultaneously or one at a time.
2. The above recommendation reflects the very early stage of development of the 3-D display. It is expected that other solutions will become viable with new methods of displaying data in 3-D, and these advances are encouraged.

RECOMMENDATIONS TO THE TRANSFER STANDARD MAINTENANCE AND APPLICATIONS DEVELOPMENT W.G. (TSMAD) OF THE COMMITTEE ON HYDROGRAPHIC REQUIREMENTS FOR INFORMATION SYSTEMS (CHRIS)

a) Authorized Tide and Tidal Stream Prediction Programs for Inclusion in ECDIS

The S-57 Standard allows an option of providing harmonic constants (tides and tidal streams) for producing tidal predictions within ECDIS.

In view of the above, it is recommended that:

- (1) For Standard Ports (see IHO definition below), the appropriate national Hydrographic Office or an organization authorized by it (e.g. RENC) should provide the predictions in a form determined by such HO.

(Standard Port - A place for which independent daily predictions are given in the tide current tables, from which corresponding predictions are obtained for other locations by means of differences or factors).

- (2) For Secondary Ports, the appropriate Hydrographic Office or an organization authorized by it should, where possible, provide the predictions in a form determined by such Hydrographic Office. Should such predictions not be available, the ECDIS manufacturers should approach the appropriate national HO for advice regarding the best methods of predictions for the Secondary Ports in their area of responsibility. Predictions produced by such methods are to be clearly flagged on the ECDIS display as being not authorized by an HO.

b) Accuracy of the Water Level Information

S-57 provides an attribute (T_ACWL) to describe the accuracy of the tidal predictions by harmonic and non-harmonic methods. It is also expected that the quality of the water level inputs from other sources (forecasts, models, real time transmissions, etc..) will have to be described.

It is recommended that the accuracy of water level data (be it predicted, forecast, modeled, real or near real-time) should not be referred to a Standard Port but assessed individually, to the confidence level of 95%. Thus the remarks in the attribute T_ACWL should be replaced with *"The attribute "Tide-accuracy of water level" encodes the accuracy of the water level to the confidence level of 95%."*

The appropriate national Hydrographic Offices or organizations authorized by them are to determine the best methodologies for assessing the accuracy of the water level.

c) **Spatial Limits for applying Tidal and Tidal Stream Information and the Number of Tidal Stations to be used in Modeling**

S-57 allows for all options of inputs of tidal information including results of modeling. In addition, all tidal data can have either point or area geometric primitive, thus requiring a capacity to describe the spatial limits for such data.

It is recommended that each appropriate national Hydrographic Office or an organization authorized by it should determine the spatial limits for applying tidal information where applicable and the number of tidal stations to be used in modeling. The HOs should be responsible for determining the best methodologies of tidal modeling to be used in their areas of responsibility.

The accuracy of tidal information is to be assessed to the confidence level of 95% irrespective of the method of application or its source.