S100WG_VTC2_ INF01

Paper for Consideration by S100WG

S-98 Update Water Level Adjustment on S-100 ECDIS

Submitted by:	S100WG Chair, S-98 Review Team
Executive Summary:	Summary of progress made specifying Water Level Adjustment
Related Documents:	S-98 Annex C
Related Projects:	S-100 ECDIS, S-100 Edition 5.0.0

Background

This information paper summarises the activity of the S-98 Review team in respect of water level adjustment specification in S-100 ECDIS.

The current IMO Performance Standard is prescriptive on "degradation" ENC content and S-52 (as referenced by IEC61174) contains specific guidance on depth information prohibiting its adjustment by tidal height.

5.4.3 Tidal adjustment

(See 6.8.7)

(S-52/1.2(f)) *Depth information* shall *only be displayed as it has been provided in the ENC and not adjusted by tidal height.*

Figure 1: IEC61174 extract

4.3.6 Information content

(232/A5.10) *The ENC and all updates to it* shall *be displayed without any degradation of their information content.*

Degradation shall be understood as degradation in information quantity as well as quality with respect to the IHO S-64 test data set.

Figure 2: IEC61174, referring to MSC 232

Proposed Revision for S-100 ECDIS.

With the advent of S-102, S-104 and S-111 a number of potential enhancements to ECDIS functionality within S-100 are possible and desired by end user stakeholders, most notably the functionality for user defined safety contour operation and water level adjustment within ECDIS.

The drafting of S-98 Annex C provides an opportunity to define how such functionality should be accomplished on S-100 ECDIS. An initial draft of a clause for S-98 is reproduced below, originally defined by IEC.

"As default depth information should only be displayed as it has been provided in the ENC and not adjusted by tidal or water level height. If the ECDIS has integrated the use of a S-100 based tidal or water level product specifications and ENC charts, it may provide all depth related functionality based on the adjusted tide or water level. The data for the adjustment may be static (for example a forecast of future) or may be real-time (for example from water level measurements through radiocommunication).

The details of such integrated depth related functionality are specified both in S-98 and in related S-100 based Product specifications (for example S-101, S-102, S-104 and S-111). The related standard, S-98 and related S-100 based Product Specification, may include conditional model to limit applicability of individual products for adjustment of water level. For example, individual S-101 chart cells or individual S-102 bathymetric cells may include metadata or feature objects which limit the geographical area for which the depth adjustment is permitted. For example, individual S-104 cells may include limitations related to date/time period when the depth adjustment is permitted.

When providing depth related functionality that has adjusted the depth information in the ENC:

1. The ECDIS shall display a permanent and non-obscured indication of the adjustment in use and if the adjustment is based on static or real-time information. Further details of the adjustment, at least source and applied date/time period of the data used for adjustment shall be available at least on demand by single operator action. If displayed area consist of sub-areas based on different sources and applied date/time periods or include areas without applied depth adjustment the border of such areas shall be presented and it shall be possible to toggle between presentation of no area fill and transparent area fill of different areas by single operator action.
2. It shall be possible to toggle between the adjusted and non-adjusted depth functionality by single operator action. This toggle function shall apply to all functionality of the ECDIS which is subject to the tidal and water level adjustment.
3. It shall be possible to select date/time period of the data used for the adjustment by simple operator action.
4. It shall be possible by single operator action to see both the adjusted safety contour and the safety contour based on non-adjusted ENC chart. This functionality shall be available both when the functionality of ECDIS is based on adjusted depth and when the functionality of ECDIS is based on non-adjusted depth. The line styles of the separate safety contours shall be distinguishable.
5. The ECDIS shall be capable to provide functionality depth adjustment based on static data and the ECDIS may be capable to provide functionality depth adjustment based on received real-time measurements of water level,

The ECDIS shall record at one-minute intervals the use of depth adjustment: depth adjustment related user selections in use and details of used S-100 products such as cell name, edition, update, issue date as applicable For definition of 'single operator action' and 'simple operator action', see IMO MSC.252(83)"

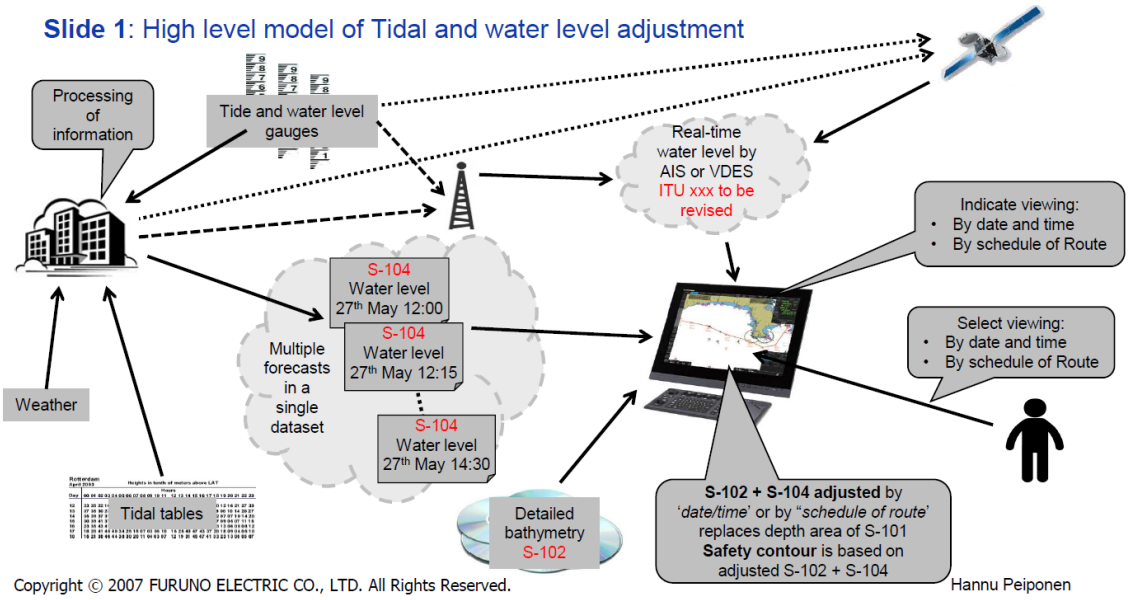
This has been reviewed by CIRM and a number of updates proposed. Some items remain for future discussion and agreement before final drafting in S-98. A summary of these is detailed below:

Revised clauses	**Comment.**
Depth information may be adjusted by water level height. When water level adjustment is provided: 1. The system shall default to no water level adjustment. 2. The mariner may select one for the following methods of depth adjustment: a. Current date and time b. A mariner specified date and time c. Where the ECDIS supports schedules, the depth at the predicted date and time of transit in each area along the route (*Comment: This is the feature that will reduce the mariner workload. Additionally, manually setting the time is prone to errors*) 3. When water level adjustment is applied:	Significant differences are: 1. CIRM does not include that the border between areas with tidal adjustment and no tidal adjustment should be presented => To be considered. 2. CIRM require removal of all tidal adjustment by simple operator action (= open a menu/dialog and select removal from the menu/dialog). Original required this by single operator action (= direct hard or soft button without a menu/dialog) => To be considered. 3. CIRM do not include mandatory toggle between tidal adjusted and non-tidal adjusted view => Could be acceptable as minimum requirement as manufacturers could provide such functionality over the required minimum.

a. The safety contour, depth zone shades, safety depth and indication of isolated dangers shall use the adjusted depth b. The pick report shall indicate both adjusted and unadjusted depth c. The applied water level adjustment method shall be provided in the legend. d. Other details of the water level adjustment shall be readily available, such as the data source, relevant times, and applicable areas. e. It shall be possible to remove all water level adjustment via simple operator action. f. There shall be a permanent indication "Water level adjustment". 4. ECDIS voyage recording shall include: a. The state of water level adjustment (method applied). b. All other information necessary to reconstruct depths as presented to the mariner.	4. CIRM use a single safety contour based on the adjusted depths. Original had two safety contours – one based on non-adjusted S-101 ENC and another based on the adjusted depths. => Accepted. 5. CIRM proposed adjustment by the schedule available in the Route => Accepted

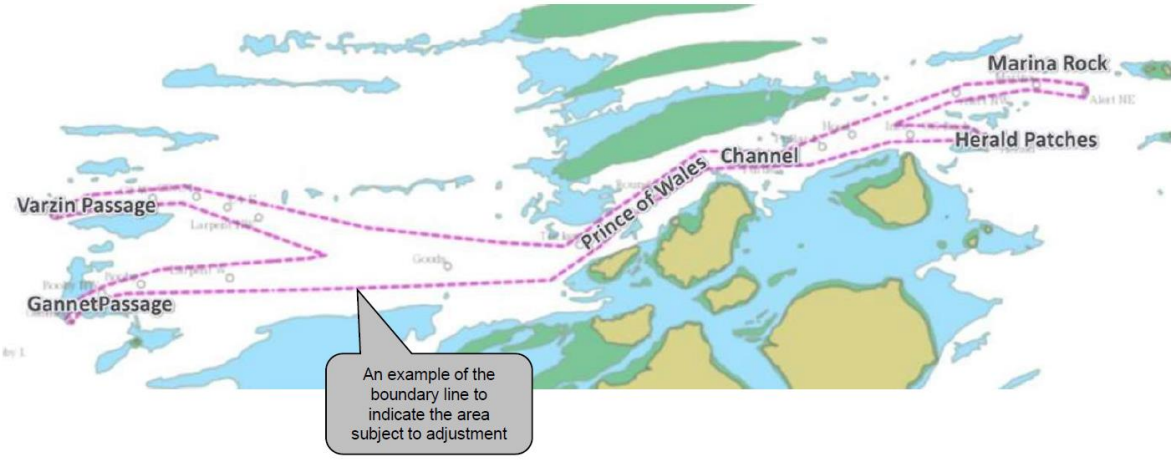
Analysis

During the HSSC Stakeholders presentations a summary of the "vision" for tide and water level adjustment by route schedule was presented by Furuno. Some selected images from the presentation are reproduced below.



In this slide multiple data sources are integrated to form a complete picture for the ECDIS user. Data is supplied to the ECDIS as prepared, processed form as well as in real-time via AIS or VDES data streams. The ECDIS is able to establish date/time information for each dataset and use "adjusted" depths in place of those included by default in the S-101 ENC. This functionality extends to viewing and planning by user selected date/time intervals and according to a route schedule (detailed below).

Slide 2: An example how the area subject to "tidal and water level adjustment" could be indicated for the end user



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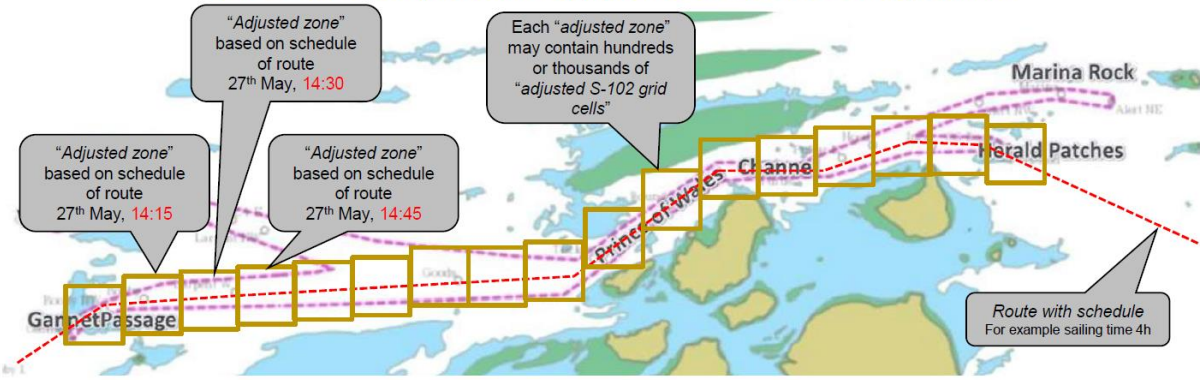
Indications of the limits of adjustment are an essential component of the proposal. For areas where tide and water level adjustment are able to be made, a specific portrayal is defined to indicate to the user.

Slide 3: An example how to apply schedule of route for adjustment



S-102: Contains a "*grid of cells*" with depth values
S-104: Contains multiple "*grids of cells*" with +/- water level values. Each "*grid of cells*" is for specific date/time

Adjustment rules for zones

- S-102 provides bathymetric base
- S-104 provides multiple forecasts of +/- water level at given date/time
  - Each forecast is given for date/time
  - Adjusting by schedule may need more fine time division for "adjusted zones" than there are given date/time events in the S-104 forecast. In such case one takes two nearest date/time events in the S-104 forecast and one selects the value for each "*adjusted S-102 grid cell*" from the S-104 date/time source which gives minimum depth for the "*adjusted S-102 grid cell*"

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The illustration above shows how adjustment is defined across a number of adjusted zones, each one composed of a number of S-102 cells adjusted with S-104 levels. These zones are delimited by the date/time of the vessel schedule and integrate with standard ECDIS functionality (portrayal, interrogation, alerts and indications)

Current discussion topics.

Clear from the discussions within the S-98 group are a number of areas where the S-100 framework (and other ancillary standards) will require enhancement to accomplish this advance in ECDIS functionality. The most significant questions relate to:

Construction of user-defined safety contours. The clear user requirement is for extremely granular safety contours where S-102 coverage exists (even where water level adjustment is not implemented). This presents challenges for their definition and specification of algorithms for their generation in the ECDIS as the current portrayal is unable to define such surfaces and contours bordering them. A number of alternatives have been

discussed and current proposals are for a defined process, similar to Conditional Symbology Processes (CSP) which define user defined safety contours. The user should be able to select a safety contour (and experience ECDIS standard functionality) based on:

a. S-101 only
b. S-101 + S-102
c. S-101 + S-102 + S-104

Ensuring such areas and the associated contours (defined in a similar way to existing S-52 DEPARE01 CSPs) are computed to be topologically complete and sound is the main function of such a "CSP" like approach. The location for such a process to be defined is not decided (yet) but is likely to be either in the existing S-100 Portrayal or S-98 Annex C.

Overlapping coverage. A number of areas are to be resolved where S-101, S-102 and S-104 may (or may not) overlap. Already ECDIS is capable of dealing with overlapping coverage at different scales of ENC and resolving safety contour portrayal and operation. This indicates a concept of "scale" will need to be defined for gridded datasets to provide a sound foundation for the ECDIS. This will allow suppression of S-101 Depth Areas under S-98 in favour of those generated by the S-102 features. Some explanation to the S-100 implementer is likely to be required, probably in S-98 Annex C in order to ensure this is clear.

User Feedback. A clear requirement has emerged for delimiting of zones where adjustment is possible, and where it has been applied. User Notification during adjustment is clearly necessary. These functions are similar to existing ECDIS functionality for date-dependent features where users see permanent indications when portrayal is defined against specific dates. The existing portrayal mechanisms should be able to support messaging to users including pick reports.

Clear definition of OEM implementation. In order to provide the OEM with enough guidance for implementation elements like grid adjustment of values

Conclusions and Way Forward.

S-100WG is asked to note:

a. The progress made, stakeholder involvement and proposals submitted for inclusion in S-98 Annex C
b. The likely impact on the IMO ECDIS Performance Standard for ECDIS as the review/update process continues
c. The gaps identified and preliminary analysis/discussion taking place in the S-98 review team.