

Dynamic Water Level Data Product Specification

TWLWG7 -4.2.2

TWLWG7-4.2.3

TWLWG7-4.2.4

Introduction/Background

- Action from HSSC5/54
 - TSMAD to assist the TWLWG in the development of a tidal product specification for navigational surface and tidal data transfer that could be used for generating dynamic water levels and navigational surfaces in ECDIS

Introduction/Background

- UKHO volunteered to assist TWLWG in cooperation with the Singapore MPA to develop the first draft of an S-100 product specification that used Automatic Identification System (AIS) messages.
 - Initially used an example of an AIS sample string from the Singapore MPA
 - Moved to using the IMO approved Meteorological and Hydrographic Data AIS Application Specific Message
- DRAFT specification is TWLWG7 – 4.2.3

Analysis/Discussion

- IMO provides for a number of AIS Application-Specific Messages
 - Dynamic water level data
 - Wind
 - Weather
 - Surface currents
 - Sea state
 - Salinity
 - Ice

Analysis/Discussion

- Draft Product Specification conforms to S-100
- Draft Application Schema and Feature Catalogue
 - Both need review by TWLWG for content and scope for what should be contained within the message

Application Schema

- Feature
 - MetHydroDataAISMessage
- Attributes
 - Any attributes related to surface currents or weather that TWLWG opts to retain needs to be harmonized with the domain experts
 - Surface Currents WG
 - WMO Met-Ocean Forecast

«FeatureType» MetHydroDataAISMessage
<ul style="list-style-type: none"> + messageID: text + repeatIndicator: real + sourceID: text + spare: text + IAI: IAI + longitude: int + latitude: int + positionalAccuracy: real + timeStamp: TimeStamp + averageWindSpeed: real + windGust: real + windDirection: real + windGustDirection: real + airTemperature: real + relativeHumidity: real + dewPoint: real + airPressure: real + airPressureTendency: airPressureTendency + horizontalVisibility: real + waterLevelNoTide: real + waterLevelTrend: waterLevelTrend + surfaceCurrentSpeedNoTide: real + surfaceCurrentDirection: real + currentSpeed2: real + currentDirection2: real + currentMeasuringLevel2: real + currentSpeed3: real + currentDirection3: real + currentMeasuringLevel3: real + significantWaveHeight: real + wavePeriod: real + waveDirection: real + swellHeight: real + swellPeriod: real + swellDirection: real + seaState: seaState + waterTemperature: real + precipitationType: precipitationType + salinity: real + ice: ice + spareEndOfMessage: text

«ComplexAttributeType» IAI
<ul style="list-style-type: none"> + DAC: text + FI: text

«ComplexAttributeType» TimeStamp
<ul style="list-style-type: none"> + UTCDay: real + UTCHour: real + UTCMinute: real

«Enumeration» airPressureTendency
<ul style="list-style-type: none"> steady decreasing increasing not available

«Enumeration» waterLevelTrend
<ul style="list-style-type: none"> steady decreasing increasing not available

«Enumeration» seaState
<ul style="list-style-type: none"> calm light air light breeze gentle breeze moderate breeze fresh breeze strong breeze near gale gale strong gale storm violent storm hurricane notAvailable reserved reserved for future use

«Enumeration» precipitationType
<ul style="list-style-type: none"> reserved rain thunderstorm freezing rain mixed/ice snow reserved for future use not available

«Enumeration» ice
<ul style="list-style-type: none"> no yes reserved for future use not available

Analysis/Discussion

- UKHO presented the draft product specification at TSMAD₂₉
- Subsequently a breakout session was held to further discuss the details and recommend a way forward for TWLWG
 - Numerous ECDIS manufacturers were present to help frame the practical implementation of this product specification
- Details of this discussion have been submitted for TWLWGs consideration in paper 4.2.4

Introduction – Paper 4.2.4

- Primary focus was to discuss implementation of an AIS Application Specific message with the equipment manufactures that attend TSMAD.
- Provide recommendations to TWLWG on moving forward with the Product Specification

Discussion highlights

- Noted that this methodology could be implemented in an S-57 ECDIS
- Noted that even with a quick turnaround with data transmission that the water level values would still be predicted
- Investigation on data security is needed
- This method would not change the underlying ENC data

General Conclusions

- Create a new AIS Application-Specific Message containing only the relevant data fields. The input is to be resolved and agreed with TWCWG.
 - Review the Feature and attributes in the draft product specification
 - Determine the relevant fields that are needed
- Investigate how OEMs will use the AIS Application-Specific Message in ECDIS systems.

General Conclusions

- There may be a requirement for a separate S-100 based Product Specification for tidal prediction tables which could utilise the same polygons.
 - Opportunity to tailor for different/specific purposes.
 - Each HO should have the expertise in their area to calculate and produce the coverage of polygons for their waters.
- A paper for HSSC7 is required clarifying the use of supplementary layers for dynamic water level data.
 - TWLWG/S-100 Working group?

General Conclusions

- Potentially three Product Specifications are required:
 - Dynamic Water Level Data using zones (S-112),
 - Product Specification for predicted tides with time interval,
 - Product Specification for observed tides.
- Each zone would contain a single value for a given moment in time.

Recommendation

- Note the draft product specification
- TWLWG to further develop and finalize S-112
 - Opportunity for a joint TWLWG/S-100 wg to establish a project team

Zone Model for dynamic tide and water level for ECDIS

TWLWG7 -4.2.1

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Introduction

- Tidal and water level adjustment has been an ECDIS end user's wish list for a number of years
 - Currently prohibited by the S-52 presentation library
- HSSC actioned both TSMAD and TWLWG to provide a model on how tidal and water level adjustment can be allowed for ECDIS
- UKHO provided an initial draft of S-112 for delivering tide and water level adjustments via AIS application specific messages

Introduction

- During the subsequent breakout session at TSMAD it was noted that while the data can be transmitted via AIS the receiving system needed information
 - Apply the data within the system
 - Visualize the data

Analysis/Discussion

- Tide and water level adjustment has been available to Portable Pilot Units
 - Utilize a broadband data link between shore and vessel
 - Source of the tidal information could be public or private
 - Non-standardized

Analysis/Discussion

- For SOLAS navigation we are limited to what communication channels are available and affordable
- Propose to leverage AIS ASM (Application Specific Message) as a real time dynamic information channel
- Because of the low throughput for AIS ASM, much of the information that is needed to process and visualize the information will need to be transferred to the ECDIS using other methods

Analysis/Discussion - Zones

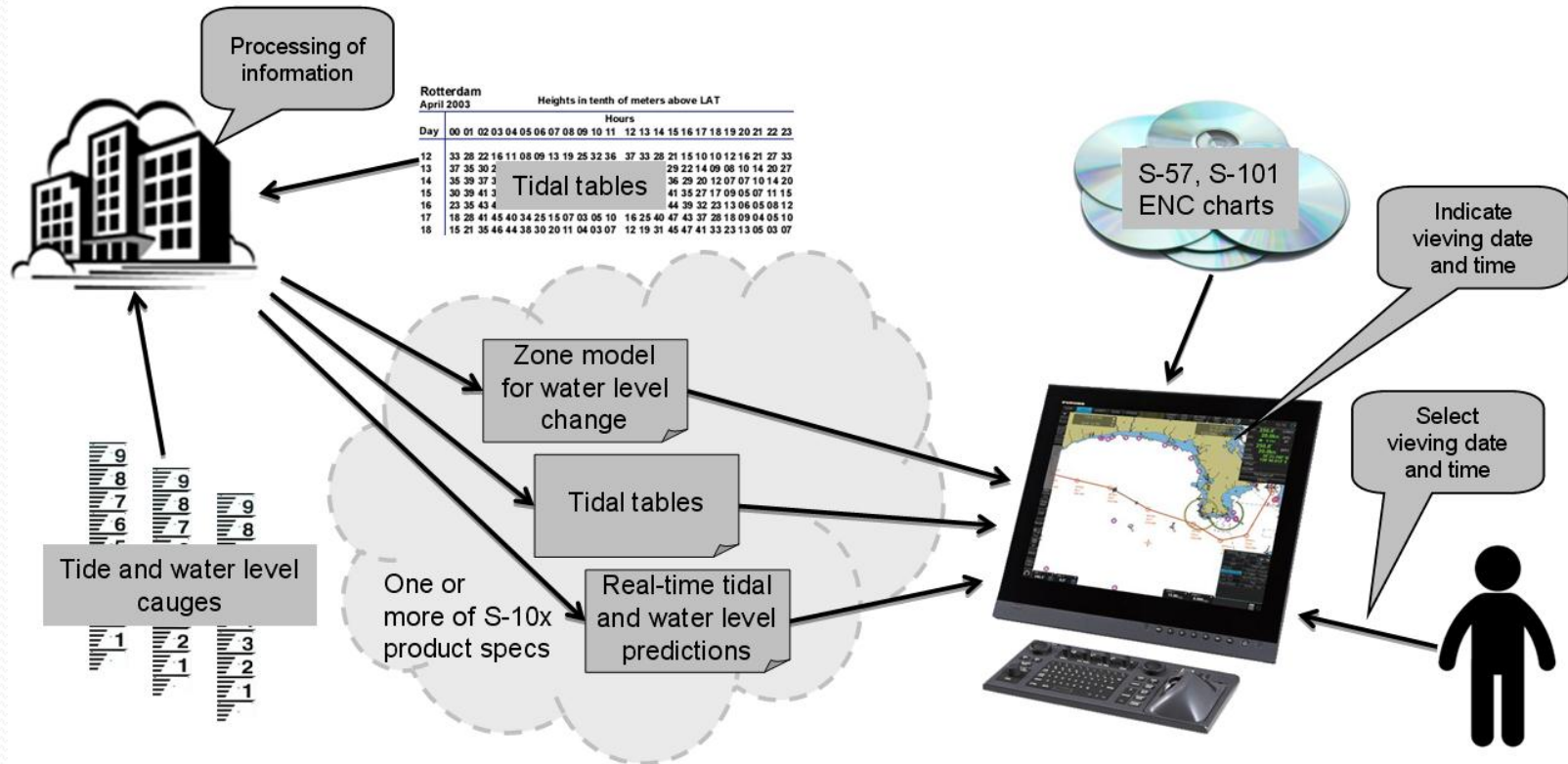
- Areas for which change of water level is sufficiently equal
- Unique identifier and therefore the correction value processed by the shore service can directly applied to the area of the zone by the ECDIS onboard.
- Processing performed onboard by the ECDIS is simple, transparent and predictable.

Analysis/Discussion - Zones

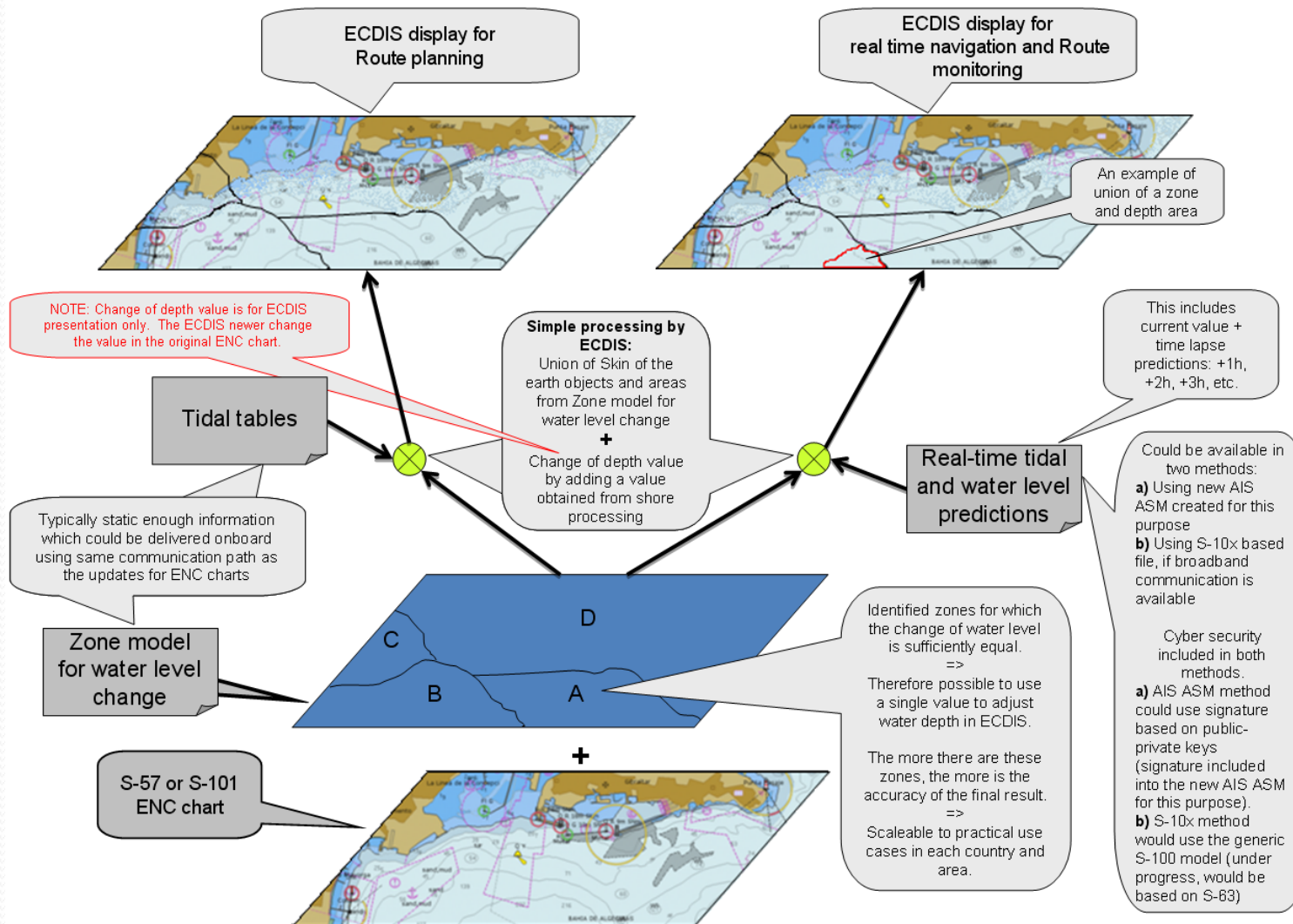
- Result is that the whole adjustment process is controlled by the supplier of the shore service.
 - If the supplier of the shore service is a local Hydrographic office then they can control every detail of this tidal and water level adjustment.
 - Process would not change the underlying ENC data, thus still complying to S-52.
- Method is scalable
 - Can be used worldwide to suit each area and use case

Overall view of the zone method

Model to arrange tide and water level adjustment both for Route planning and Real time navigation



Zone model to process information from multiple sources to adjust tide and water level in ECDIS



Analysis/Discussion

- Holistic view for adjusting water levels
 - Covers both route planning before sailing
 - Real time dynamic adjustment while underway
- Can use the same zone model
 - Only difference is in the method and update frequency of the water level adjustment data

Planning Purposes

- Product could be the electronic equivalent of tide tables
- Utilize the same method of publishing frequency and delivery methods that is currently employed for ENC
- S-100 based dataset
 - 8211 encoding
 - Feature catalogue
 - Portrayal catalogue
 - Data security
- Forecast water level changes a few months ahead

Dynamic Use - underway

- Information is less static and requires sufficient update frequency.
- Delivery method that is proposed is based on AIS ASM, which is both already available in every vessel
 - AIS transponder is a mandatory carriage requirement for SOLAS class) and affordable as being free of charge for usage.
- In order to scale, then next level of higher performance is to use the future VHF Data Exchange System (VDES)
- The ultimate scalable solution is to use 3G/4G/5G/etc. mobile phone based broadband or satellite based broadband. Such a solution will enable scaling of the zone system down to centimetre accuracy at the cost of paying for the transmission of data between shore and vessel.

Analysis/Discussion

- The assigned name for Dynamic water level product is S-112. This proposal includes 3 main items which will be transferred from shore to vessel:
 - Zone model for water level change
 - Tidal tables
 - Real-time tidal and water level predictions
- This proposal does not have any opinion if all three above could be components under the given name S-112 or if the case should be subdivided under several S-10x names.

Why a zone model

- Gives the shore service full control of the tidal and water level adjustment.
 - Define the zones
 - Adjustment values
 - Updating frequency

What also needs to be considered?

- The file for zone model should include information which ENC charts are applicable to be used with available zones.
 - Stored as metadata.
 - Limits the application of the zones only for the ENC charts which the shore service feels acceptable.
 - Enable the issuing authority to limit tidal and water level adjustment for such ENC charts which have sufficient amount of depth contours instead of a few in 0, 5, 10, 20, 30, etc. meter model.
- The dataset for the zone model should include information about achievable accuracy connected to frequency and delivery method of Real time tide and water level predictions.
 - Essential for the end user when making decisions around use of his water level adjusted ECDIS.
 - Connection with update frequency gives possibility to specify the timeout of the application of the water level adjustment since last received update.
 - Could also be in the metadata part of the zone dataset.
 - Would reduce over reliance of the end user for the accuracy of information presented in the ECDIS.
- Both are scalable solutions. Even for a single harbour approach there could be multiple accuracy levels depending available zone model file and delivery method.

Other Considerations

- This proposal compliments the work done by the UKHO on the specification for the new AIS ASM needed for this service.
- The AIS-ASM portion of the specification can be easily done in parallel with the effort to develop the feature-attribute model that is needed to represent the tidal zones.
- It was recognized in the TSMAD breakout session that there was a need for the feature-attribute model and the tidal zone dataset for the AIS-ASM messages to be effective.
- Cybersecurity

Conclusions

- While the S-100 working group has the expertise in developing S-100 based product specifications, it is not the subject matter expert for developing the features and attributes for tidal zones that are needed as part of the product specification.
- This proposal shows the way forward for enabling water level adjustment in the ECDIS by developing an S-100 based product specification for tidal zone information that can be used in conjunction with AIS-ASM transmission of tidal data.

Recommendations

- TWLWG take into consideration the need for a base dataset that contains the tidal zone information which may include information for predicted tides.
- Develop an S-100 product specification to have a consensus based underlying data model which includes the features that will need to be included in the dataset.
- As stated in the analysis, this proposal does not have an opinion on if this piece should be included as part of the AIS-ASM product specification that was developed by the UKHO or if it should be a separate product specification.

Justification and Impacts

- Once completed and operational this will fulfill a long time wish of ECDIS users to show both predicted and real time tidal adjustment on the ECDIS
- Methodology will not change the underlying ENC data
- Provides the mechanism for tidal corrections to be applied and displayed on the ECDIS

Action required to TWLWG

- Discuss and agree the issues presented in this paper
- Further develop the final S-112 Product specification based on the ideas of this paper