

## Minutes

### 26<sup>th</sup> Meeting of the North Sea Hydrographic Commission Tidal Working Group (NSHC TWG26)

6<sup>th</sup> - 7<sup>th</sup> February 2024

Swedish Maritime Administration / Hydrographic Office ([SMA](#))  
[Simulator Centre](#)

Hörselgången 4, Göteborg, Sweden

For reference, see the [NSHC TWG Website](#).

#### Participants (See also Annex A)

Belgium (BE)	– Johan Verstraeten (JV)
Denmark (DK)	– Nicki Riber Andreasen (NRA)
Denmark (DK)	– Kristian Villadsen Kristmar (KVK)
France (FR)	– Gaël Andre (GA)
Germany (DE)	– Andreas Boesch (AB)
Netherlands (NL)	– Ronald Kuilman (RK)
Norway (NO)	– Aksel Voldsund (NO)
Sweden (SE)	– Thomas Hammarklint (TH) (Chair)
United Kingdom (UK)	– Chris Jones (CJ)

#### Opening / Welcome

- Mr. Thomas Hammarklint (SE), Swedish Maritime Administration (SMA) and Chair of the NSHC Tidal Working Group, opened the meeting at 0900 CEST and welcomed all participants [[List of Participants](#), [Photo](#)]. The group commented on the excellent facilities offered at the Swedish Maritime Administration's (SMA) Simulator Centre.

#### Appointment of a Secretary for the meeting

- BE and UK jointly volunteered to act as Secretary / note takers for the meeting.

#### List of Participants

- The List of Participants was reviewed and accepted.
- See Annex A and also '**Updates to the List of Members**' later in the report.
- No response had been received from Ireland (IE).
- It was stated that Árni Vésteinsson (IS) is leaving as the Head of the Hydrographic and Maritime Safety Department (Icelandic Coast Guard) and will be replaced by Guðmundur **Birkir** Agnarsson. Árni will continue to working as a senior expert in nautical charting. TH will contact IS about their participation in TWG.
- Ole Baltazar Anderson (DTU) was unable to attend.
- There was a round-table introduction session, where each Member State (MS) introduced themselves.

#### Programme & Administrative Arrangements

- SE (Chair) went through the programme of activities for the day, including the administrative arrangements. See Annex B.

### Adoption of the Agenda

- The latest version of the agenda was discussed. NL requested an additional item to be added to the session on “S-104 and S-111 implementation”, to present on NLHO’s developments of S-104 & S-111. The agenda was then adopted without further amendment. See Annex C.

### Minutes of the 25th NSHC TWG Meeting (7 February 2023, VTC)

- The [Minutes of the last \(25th\) NSHC TWG25](#) were displayed by the Chair and were briefly discussed. No amendments or questions arose, and so the minutes were approved and accepted by the group.

### Review of Actions & Decisions

#### List of Actions from NSHC35 Meeting (5-6 April 2022, VTC) [those relevant to NSHC TWG]

No/year Agenda item	Subject	Action	Who	When	Status
15/2022 D.4.2	TWG	Permanent chair for TWG to be chosen per correspondence. SE (Thomas Hammarklint) serves as Chair until permanent chair elected.	Chair	NSHC36	Ongoing
8/2021 B.10	Risk Assessment	Need of a well-founded clarification for the use of 1% of LAT as the norm;	TWG	NSHC35	Ongoing. Passed on to NSHC36
6/2016 B.5	Vertical reference (LAT) comparison	Continue to investigate and reduce the differences between the LAT along boundaries in accordance with the action items of TWG WP 18/1. Publication of those differences is paused until the outcomes of the investigations are available.	Chair TWG	NSHC 34	Different approach on this matter has been endorsed. AP maintains OPEN until the Tidal WG closes this AP.

legend	
White	Open (action) item
Light grey	Continuous (action) item
Light green	Completed or Closed item

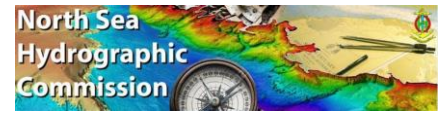
#### List of Actions from NSHC36 Meeting (29-30 March 2023 VTC) [those relevant to NSHC TWG]

No/year agenda item	Subject	Decision / Action	Responsible	Time frame	Status
Decision 6/2023 C.2	S-104/S-111 coordination	The Commission decided to task the TWG with S-104 and S-111 implementation coordination, and to report to NSICCWG on the progress.			
6/2023 C.4	S-104 and S-111 coordination	TWG to report to NSICCWG on the progress of S-104 and S-111 implementation.	TWG Chair	Before NSHC37	New
Decision 11/2023 C.4	TWG ToR	The Commission approved the ToR for the TWG.			
Decision 12/2023 C.4	TWG LAT related work	The Commission decided to close Actions 6/2016 and 8/2021 and approved the proposed way forward.			
15/2022 D.4.2	TWG	Permanent chair for TWG to be chosen per correspondence. SE (Thomas Hammarklint) serves as Chair until permanent chair elected.	Chair	NSHC37	Ongoing

Green text: Decisions taken at NSHC36

Red text: New NSHC36 action items

- Action 15/2022 D.4.2**
  - The TWG needs to submit its report no later than 6 weeks prior to the 37<sup>th</sup> NSHC meeting (to be held 8-10 April 2024 in Malmö, Sweden).



- RE: **Election of Permanent Chair:** NSHC would prefer to see a permanent Chair of this WG. Discussion ensued around the Chair of NSHC TWG going forward. If we cannot find a permanent Chair, what should we propose to NSHC? SE would continue as rep and administer the website on the BSCD website. (see later in this report for resolution of this item).
- **Action 8/2021 B.10** – addressed later under **Presentations and Discussions**
- **Action 6/2016 B.5** – addressed later under **Presentations and Discussions**
- **Decision 6/2023 C.2 & Action 6/2023 C.4**
  - NSHC TWG is to report to the North Sea International Charting Co-ordination Working Group (NSICCWG) on the progress of coordination of the individual S-104 & S-111 work / products / coverages in the North Sea Region – the question was raised, “what are we doing as a group to do this?”.
  - **Action:** TH advised he would contact Ashley Hawkins (UKHO and Chair of NSICCWG to ask how this should be reported (via some template or similar) and also mention the recent S-100 survey, coordinated by Belgium, in case there may be some duplication of effort.
  - NO suggested that we could firstly describe national initiatives, for example ports and harbours, or coastal coverage, or wider area coverage. Then we could discuss collaborative ventures, some which are already in place, for example between, FR & UK, SE & NO.
  - NO suggested to split the task into three parts:
    - a) to implement the Standard based on existing products.
    - b) to improve and develop new products.
    - c) to make the datasets.
  - SE suggested we need a harmonized way to compare the S-104 & S-111 datasets between countries.
  - NO referenced the example of Saltstrømmen: a region which experiences a 60cm difference in height either side of a constricted channel and extremely strong currents.
  - NL & SE mentioned the Canadian Hydrographic Service (CHS) presentation on [First Canadian S-111 Technical Briefing on Currents \(youtube.com\)](#)

DK suggested that S-104 implementation should consider the appropriated grid size in connection to S-102 implementation (i.e. assumption is there is a dependency)

- **Decision 12/2023 C.4** – noted as closed

**TWG Action Points that were reviewed.**

Item Number (TWG/Item)	Objective (Why/Priority)	Task Description (What/How)	HO Involved	Status	Corresponding Work Plan Item
AP 22/01	Investigate the differences in national LAT reference surfaces at all borders.	Each member state should supply information on how their LAT surface was built to NL who will analyse this information and compare the surfaces	NL, All	Done	WP 18/01
AP 23/02	Investigate all LAT differences at the borders and overlapping parts of surfaces using the redefined norm.	Investigate the differences at all MS borders (and overlapping parts of surfaces) between national LAT reference surfaces	All	Permanent	WP 22/01

**AP 23/02 Investigate all LAT differences at the borders and overlapping parts of surfaces using the refined norm.**

- It was noted that AP 23/02 now extends and expands the original work done under AP 22/01, over the whole of the NS region.
- FR and BE discussed their gapped data (a small portion of their common boundary which was missing ETRF to LAT separation values. This missing part will be completed in a new version of the French surface.
- RK (NL) displayed on screen the Danish National Space Centre (DNSC) [Ole Baltazar Anderson] model of the 'Danish-French' LAT to Ellipsoid, between FR and UK (an example of the 'overlapping parts' of the NSHC region, as described in AP23/02).
- It showed some evident 'tracks' on the image on the south-west coast of France. Possibly the satellite 'footprint' tracks?
- AV (NO) explained that although NO have an LAT model of the whole of the North Sea, they have not done a lot of work in the 'whole ocean model' (it is currently the 'old' DTU model of "MSS – MSL+LAT"; therefor the English Channel is not too well represented – differences between NO/FR in this area should be considered as "border issues" of the model well beyond its intended area of use : NO waters. ).
- RK (NL) advised that the surface comparisons can now be made quite easily by NLHO (via Thijs Ligteringen's code), so any new or updated surfaces from Member States can be supplied any time. TH expressed his thanks to the NLHO in their support and work in these tasks.
- There was some discussion around what did Member States want to achieve through this new Action Point 23/02?
  - JV (BE) reminded that the initial scope was to achieve minimal difference in CD and LAT at the national boundaries.
  - AB (DE) commented that it is very interesting to see the differences, so what is the goal of the action item for the future? The 'general theme' of comparing surfaces has been on the work plan for some time.
  - NRA (DK) suggested it could be a good ongoing tool for assessing new models against each other.

- RK (NL) questioned if the TWG should close the action item and amend it as per DK's comment.
- AV (NO) referred to the fact that the BSCD has achieved a common CD; so the NSHC TWG region should also achieve the same.

#### **WP 16/04 - Enable GNSS- based tidal reduction and the connection with the vertical datum on land**

- There was some discussion on this item. The [EMODnet Bathymetry](#) portal was referenced; it is understood this uses a single LAT model to refer bathymetry, which is based on the [NevRef](#) project.

#### **AP 24/03 Total Vertical Uncertainty (TVU) norm for comparing differences in LAT surfaces at the national boundaries**

- Marked as 'done'.

#### **AP 24/01 - UK and FR to supply 'CD to Ellipsoid' separation values along their common boundary to NL to investigate if this improves the result in any way.**

- **Action:** FR suggested comparing MSL, CD and LAT, each to the Ellipsoid, on the same 0.02 degree grid, and to add these to the 'matrix' of comparisons.

#### **AP 19/03 - Make an overview over existing separation and hydrodynamic models, including metadata**

- **Action:** The TWG recommended this is marked as 'done', as it relates at AP 22/01 which itself is already done.

#### **AP 26/01 - Provide links to S-104 and S-111 test datasets**

Link to existing IHO website, which already coordinates this. <https://iho-ohi.github.io/S100Resources>

#### **Tidal Data Rescue & Data Archaeology**

- The group recognized the importance of monitoring this topic, given the key links of this activity related to climate change.
- The group acknowledged this was also part of the IHO Tides Water Levels and Currents Working Group (TWCWG) work plan as a permanent action, and also the remit of the Global Sea Level Observing System (GLOSS).
- TH briefly mentioned that Sweden had completed a large project of data recovery many years ago (TH was involved in this work); there was specific software that was used in the task.
- From NSHC TWG25 minutes, FR mentioned that it is an ongoing topic, FR refers to an interesting article about data rescue:  
<https://rmets.onlinelibrary.wiley.com/doi/epdf/10.1002/gdj3.179>

#### **S-104 & S-111 collaboration in the NS region; the 'new' work plan item WP 24/01.**

#### **Opening discussions**

- It was agreed this is now a major focus of the NSHC TWC.
- NSICCWG (North Sea International Chart Co-ordination WG) have also been tasked (by NSHC) with doing the same for S-102 & S-101.
- TWG needs to report to the NSICCWG on its actions-to-date regarding S-104 & S-111. (see comments and action at **Decision 6/2023 C.2 & Action 6/2023 C.4** above).

- A detailed discussion followed about S-104 developments in IHO and the water level adjustment (WLA) aspects (i.e. a regularly gridded S-104 'sitting on top of' the same regularly gridded S-102).
- In many countries responsibility for calculating tidal water levels and currents is a task for different agencies. It requires for additional coordination as compared to bathymetric charting.

**Presentations and Discussions (all presentations are available [here](#)).**

### **S-104 & S-111 Presentations**

**TH (SE) presented the Baltic Sea project, called e-Nav, which will aim to coordinate S-104 and S-111 across the Baltic Sea region:**

- This was the subject of TH's presentation, "*Shared Waters same Standards*"
- 5 million Euro Interreg / EU funding.
- Background is all about S-100 implementation.
- Planning firstly for 2024-2026, then 2026 onwards.
- The Finnish Meteorological Institute (FMI) will be responsible for testing S-104 in FI waters; with an aim to output a 'best practice' guide designed to be used for other MS to use in their implementation.
- Establish harmonization rules for S-10x products, under the BSHC umbrella.
- S-98 interoperability standard is key - this is why they have OEM involvement.
- SINCERE application to [Horizon Europe](#) regarding Under Keel Clearance Management (UKCM); but did not get funding.
- Poland (PL) and Lithuania (LT) are not involved; LT are not a full member of IHO and PL are military and so cannot receive funding from EU (but are a part of the project in terms of their associated membership).

**AB (DE) presented on Germany's plans for S-104 & S-111:**

- They are more preliminary plans for S-104, less-so S-111 (not a main focus just yet).
- S-100 development is spread over several sections at BSH:
  - Nautical Information Service: S-101, S-102, S-124
  - Forecasting Services: S-104 & S-111
  - Possible cooperation with German Weather Service for Storm Surge Warnings (S-412, Weather & Wave Hazards), plus S-411 Ice Information.
- National S-100 Strategy; includes the Federal Ministry for Digital and Transport and other agencies in Germany.
- AB described the planned S-104 & S-111 Products.
- S-104 was originally planned to be Data Coding Format (DCF)=8 (Stationwise time series at one or more fixed stations, updated over various time periods depending on the type of S-104 data, e.g. annual predictions through to observations).
- Discussed the challenge of changing from DCF=8 to DCF=2 (Regularly-gridded data at one or more times) given the amended scope for S-104 Ed 2.0.0.
- The 'official' water level forecast has some manual intervention. Therefore, raw model output (on regular grid) cannot be published as official forecasting product.
- AB asked the question "should S-102 gridded bathymetry match the S-104 grid?" Answer = "yes".
- Delivery via IC-ENC. Additionally it could also be available from BSH.
- Unified publication scheme for all S-100 products.

Discussion on interpolating between known points; Germany is developing forecasts and predictions that are adjusted to match the officially published data at tide gauge locations.

**NL (RK) presented on the NLHO S-1xx Stacked data trial production:**

- RK displayed the timeline related to the IHO target deadlines.
- Their trial production in 2023 focussed on the Phase 1 monitoring S-101, S-102, S-104 & S-111



- NLHO produced a 'stacked dataset' of the above, for Den Helder.
- Gridding plans for the ENC cells – used the same as UKHO, Scale band 5, 0.1 x 0.1 degree
- S-101 conversion from S-57 cell to S-101 cell.
- NLHO developed a S-1xx viewer: available here: <https://github.com/flappah/S1XViewer>
- S-102: .csar surface file.
- S-104: Data Coding Format (DCF)=8 (Station-wise data), twelve files, one per month; converts astronomical prediction xml files converted into the HDF5 format.
- S-111 is DCF=8.
- RK summarised the results of the trial, and there will be a "second trial" during 2024; Production Approach Westerschelde.
- They are sending trial data to IC-ENC for feedback.

Discussion: there was interest in how the coordination with IC-ENC worked out and also if the converter tool developed by NLHO would be shared and possibly used by other Member States.

#### **NRA (DK) presented on DK's Development status on S-104 & S-111:**

- DK recently established a National Forum for all S-10x services. ToR's established in 2024.
- Several participants; DK Hydrographic Office, Danish Maritime Authority, DMI, FCOO (Ministry of Defence).
- DK Hydrographic Office is not responsible for modelling water levels & surface currents.
- They are participating in the Interreg Baltic Sea E-Nav project.
- S-104 & S-111 development is split between DMI and FCOO.
- He described the Danish S-100 Expert Group TOR's

Discussion: it was a good idea to have this consolidated coordination group. SE expressed an interest in following this project. The example of [Australia Hydrographic Office S-100 work](#) was cited as a good approach [[Australia's S-100 Roadmap](#)].

#### **National Presentations on Tide Gauge Networks and Chart Datum**

##### **BE presented on updates to their tide gauge operations**

- S-104 & S-111; in development, just started so it is early days yet. Focus is currently on S-101 and S-102 production.
- New LAT surface project
- LAT project: commenced in November 2024 as a 2-year project.
  - BEHO is in charge, with UGent as contractor, with National Geographic Institute and Flanders Hydraulics offer support.

*Update from LAT-v10-BCP-NAP2007-interpol-200m* is the version used right now, results from G2LAT project (finished 2010) and BLAST project (finished 2012).

- Changed/updated inputs:
  - Updated geoids (HBg18, inc. NL & FR updates).
  - Changed from fully analogue to digital recording tide gauges.
  - Input from offshore locations: Hydrometeo platforms; ADCP measurements & GNSS Tide Level buoys.
  - Satellite data, Gravity Data, GNSS fixed location data (RTK, as per UK OS network), Ship-borne GNSS / IMU
- Current issues; change from analogue to digital tide gauge recordings where slight differences are noted ; this is a Work in Progress.
  - Ostend operations at the tide gauge. Ostend TG observations; 2 tide gauges since 1977; RTK GNSS (3 locations since 2003); Gravimetry (from 1996); GNSS-IR at tide gauges starting 2024.
  - GNSS-IR first results look good.

Discussion: there was interest in the details of the GNSS-IR, the locations of the tide gauges and the successes (or not) with GNSS buoys.



### **AB (DE) presented on the Update of Germany's Chart Datum surface 2026.**

- Currently using a "2021" surface; decision to update CD every 5 years.
- Uses Tide Gauge locations to calculate and monitor LAT and see how it changes, and whether it needs amending.
- Provide CD relative to ellipsoid (ETRS) and geoid (NHN) in one data set.
- To be decided; a new LAT calculation from a circulation model for the offshore region.
- No big changes expected; the differences at maritime boundaries are already well below the 50% TVU criterion.

### **NL (RK) brought to the group's attention a recent PhD project (Yosra Afrasteh) about Model-Based Hydrodynamic Levelling:**

- Title Defence: Model-Based Hydrodynamic Levelling - An Impact Study on the European Vertical Reference Frame (Yosra Afrasteh)
- [Link Livestream & On-demand playback](#)
- [Link to doctoral thesis](#)

### **TH (SE) presented on the Baltic Sea Chart Datum 2000 (BSCD2000) implementation:**

- A unified vertical datum for Land and Sea in the Baltic Sea.
- BSHC is the responsible hydrographic commission for the Baltic Sea.
- CDWCWG, Chart Datum, Water level and Currents WG (this is the recent name change of the CDWG group).
- It is an EVRS-based system now (on average between 0 to 30cm difference in BSCD200 compared to "MSL").
- Definition: Each MS has a defined height system used as a national realization of BSCD200 (EVRS-based), e.g. Sweden RH 2000, Denmark DVR90 etc.
- Included in the IHO GI Registry (No. 44 on the list).
- Discussed the Organizational scheme and workflow plus the BSCD2000 height transformation grid (geoid model).
- Illustrated an area of maximum change between the old chart and new chart (an area of extensive land uplift).
- MSL brought up to a common epoch (2000).
- Swedish Sea Level network; all data available to download via SMHI; real-time data is also available.
- All available Swedish sea level records digitized (starting in 1774 at Stockholm)
- MSL record from 1886-2023.
- Meteo-tsunami record 11-12 July 1959 Ystad.
- Land uplift effect; co-located GNSS with sea level records.
- Changes in MSL up to 2100+.
- Skagerrak region; where Norway's CD = LAT -20cm, and in Sweden CD = BSCD.
- Lots of educational information about this datum change.
- TH outlined the S-100 developments for SE: Real Time Hydrographic and Environmental System.
- Currents Göta älv River example (S-111) – simulated new lock development.

### **National presentations on Vertical Reference Surfaces**

#### **GA (FR) presentation: Differences between UK and FR surfaces along maritime boundaries:**

- There are differences >80cm between UK & FR in the English Channel / La Manche.
- These are higher than max TVU (at Bassurelle Sandbank in the Channel).
- He compared MSL and LAT, both to the ETRF89 Ellipsoid. The MSL to Ellipsoid differences between UK and FR are around only 30cm.
- A large part of the differences come from the tide model used.
- GA looked at FES2014 MSL and LAT.
- He also looked at the recently released FES2022 model.
- A meaningful comparison requires access to 'MSL to Ellipsoid' at the same points. The UK VORF model does not provide data outside of UK national waters (i.e. no data in French waters in the Channel).



### **KVK (DK) presented on DK's work to unify vertical reference surfaces:**

- Satellite altimetry-based LAT and MSS published by The Danish Agency for Data Supply.
- >100-year-old surveys; old charts – unknown origin – loss of meta-data (Including loss of data through flooding of an archive facility).
- 2 official datums; LAT in the North Sea & BSCD2000(DVR90) in the Baltic Sea.
- Acceptable approximation; lots of other variables to account for, not just the transformation itself.
- EMODnet contribution; new & rediscovered surveys to be included.
- Timeline – should be completed by April 2024

Discussion: KVK mentioned the transition between LAT & BSCD2000(DVR90); they are increasingly incorporating gravimeter data gathered at sea in new DVR90 realisations. SE mentioned that SE tide gauges and DK gauges do differ in terms of water levels in the same region (Öresund Strait) partially due to weather effects and waves, but also due to different geoid models. KVK informed that there are three versions of “DVR90”, i.e. 2002, 2013 and 2023 realisations; but as far as is understood this is aimed at land-based application and not necessarily will be used in the BSCD2000 (DVR90).

### **IHO Tides, Water Levels and Surface Currents WG (TWCWG)**

#### **CJ (UK) gave a presentation on the IHO TWCWG Status & Update:**

- He explained the general structure of the IHO Hydrographic Service and Standards Committee (HSSC), under which the TWCWG sits, and reports back to.
- He outlined the TWCWG's core objectives.
- The last (7<sup>th</sup>) TWCWG meeting was summarised, with the main activities and achievements outlined, including interactions with other IHO WG (Hydrographic Surveys WG [HSWG], Data Quality WG [DQWG], Maritime Autonomous Surface Ships WG [MASS]).
- The S-104 and S-111 Product Specifications (PS) were outlined, as the Project Teams (PT's) responsible for their development 'sits inside' the TWCWG membership.
- S-104 Edition 1.1.0 and S-111 Edition 1.2.0 and the alignment to S-100 Ed 5.0.0 were explained.
- Development of Ed's 2.0.0 of both PS, aligned with S-100 Ed 5.2.0 were explained.
- The main revision to S-104 Ed 2.0.0 will be the 'paring back' of the permitted Data Coding Formats (DCF), to only DCF=2, which is the '*Regularly-gridded data at one or more times*', to be used on a grid resolution equal to that of the S-102 bathymetric grid, strictly for water level adjustment (WLA) purposes.

#### **Any other business**

- None

#### **NSHC TWG Terms of Reference (TOR's)**

- TH displayed these on screen.
- The TWG members agreed with the proposed change to amend the Section which currently reads “Composition and Chairmanship” to read “Composition and Chair”, reflecting the IHO requirement to use gender-neutral language within the TOR's.
- Therefore the only change is to amend the word “Chairmanship” to “Chair” (to reflect gender-neutral language).
- See Annex D.

#### **Election of Permanent Chair**

- Andreas Boesch (DE) most kindly volunteered to become the next Chair of NSHC TWG. This was warmly welcomed by the group, with unanimous agreement.
- The expected tenure will be three years (covering NSHC TWG 27 (2025), 28 (2026) and 29 (2027)).

#### **Updates to the List of Members**

[\[List of Members\]](#)

- UK - Colin Shepherd is removed from the list of members (he has left UKHO).
- IE – Sean Cullen – has not attended the NSHC TWG since the TWG21 meeting in Dublin, Ireland in 2017; CJ (UK) will make contact to check if the contact is still active.

**Review the Provisional NSHC TWG Website**

- TH reminded the group that the NSHC TWG website, formerly hosted at [www.nshc.pro](http://www.nshc.pro) and supervised by the German Hydrographic Office (BSH) is now currently hosted on the Baltic Sea Hydrographic Commission (BSHC) website, at <https://www.bshc.pro/working-groups/twg>.
- It is not necessarily a permanent solution but will suffice for now.
- AB mentioned that there had been an issue some years ago with a withdrawal of the funding / permits for the BSH hosting the website (the nshc.pro domain expired) and so it became redundant.
- TH went on to say there was no particular desire for the development of a new NSHC TWG website from the parent NSHC.
- There was some discussion on whether NSHC TWG should continue to ask for a specific website to be established, but the agreement was to continue under the BSCD website.
- TH agreed to retain the maintenance of this website.

**NSHC TWG Report to the 37<sup>th</sup> NSHC Conference (9-10 April 2024, Malmö, Sweden)**

- SE will prepare the report and presentation and circulate beforehand in good time.
- SE as outgoing Chair of NSHC TWG will deliver the NSHC TWG26 [report](#) / [presentation](#) to NSHC37 in person.

**Date & Venue of TWG27**

- 4-5 February 2025
- To be held in UK (location tbc)

**Meeting Closed at 1430 CEST on Wednesday 7<sup>th</sup> February 2024**

## ANNEX A

**List of Participants**  
**NSHC TWG26**  
**6-7 February 2024**  
**Göteborg, Sweden**

Country	Organization	Name	E-mail address
Belgium	MDK	Johan Verstraeten	johan.verstraeten@mow.vlaanderen.be
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Denmark	GST	Kristian Villadsen Kristmar	krkri@gst.dk
France	SHOM	Gaël André	gael.andre@shom.fr
Germany	BSH	Andreas Boesch	andreas.boesch@bsh.de
Netherlands	MINDEF	Ronald Kuilman	rb.kuilman@mindef.nl
Sweden <sup>1</sup>	SMA	Thomas Hammarklint (Chair)	thomas.hammarklint@sjofartsverket.se
United Kingdom	UKHO	Chris Jones	christopher.jones@ukho.go.uk

## ANNEX B

**Program**  
**NSHC TWG26**  
**6-7 February 2024**  
**Göteborg, Sweden**

	Monday 5 February 2024	Tuesday 6 February 2024	Wednesday 7 February 2024
<b>Morning</b>		<b>09:00 Tidal WG Meeting commence</b>  <b>Guided tour</b> <a href="#">Simulator Centre</a>  <b>11:00 Tidal WG Meeting continue</b>	<b>09:00 Tidal WG Meeting continue</b>  <b>10:30 Break</b>  <b>11:00 Tidal WG Meeting continue</b>
<b>Lunch</b>		<b>12:00 Lunch</b>	<b>12:00 Lunch</b>
<b>Afternoon</b>		<b>13:00 Tidal WG Meeting continue</b>  <b>14:30 Break</b>  <b>15:00 Tidal WG Meeting continue</b>  <b>Tidal WG Meeting closed at 16:00 at the latest</b>	<b>13:00 Tidal WG Meeting continue</b>  <b>14:30 Break</b>  <b>Tidal WG Meeting closed at 15:00 at the latest</b>
<b>Evening</b>	<i>Participants arrive</i>	<i>Joint dinner 19:00</i>	

## ANNEX C

**Agenda**  
**NSHC TWG26**  
**6-7 February 2024**  
**Göteborg, Sweden**

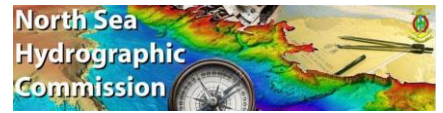
**Tuesday 6 February 2024**

09:00 - 11:30	<p>Tidal Working Group meeting commence</p> <p>Opening, welcoming notes</p> <p>Introduction round</p> <p>Appoint a secretary for the meeting</p> <p>Review the <a href="#">List of Participants [Photo]</a></p> <p>Review the <a href="#">Program</a></p> <p>Adoption of the <a href="#">Agenda</a></p> <p>Review the work of the TWG and <a href="#">List of Actions</a> since TWG25</p> <p>AP 25/01: Investigate LAT differences at overlapping parts of surfaces</p>	<p>All</p> <p>Chair</p> <p>All</p> <p></p> <p></p> <p></p> <p></p> <p>Ronald/Thijs</p>
10:45 - 11:00	Coffee break	
11:00 - 11:30	Adoption of the <a href="#">Minutes, Work Plan and List of Actions</a> from the TWG25 Meeting <a href="#">[Photo]</a>	All
11:30 - 13:00	Lunch	
13:00 - 14:15	<p>Review the <a href="#">Minutes</a> and <a href="#">List of Actions</a> from the <a href="#">36<sup>th</sup> NSHC Conference [Photo]</a></p> <p>Review the <a href="#">Program</a> and Agenda for the <a href="#">37<sup>th</sup> NSHC Conference, 8-10 April 2024, Malmö, Sweden</a></p> <p>Propose amendments to the <a href="#">Terms of Reference</a></p> <p><a href="#">Baltic Sea e-nav Interreg project: Shared waters - same standards</a> <a href="#">Baltic Sea partnership for future navigation</a>. S-100 implementation.</p> <p>Open discussion: how to coordinate the implementation of S-104 Water level and S-111 Surface Currents in the North Sea?</p> <p>We are expected to report on progress of <a href="#">the implementation of S-104/S-111</a> to the NSHC and to the North Sea International Charting Co-ordination Working Group (<a href="#">NSICCWG</a>) [<a href="#">NSHC36 Action 6/2023</a>], before <a href="#">NSHC37</a></p>	<p>All</p> <p></p> <p>Chair</p> <p>All</p>

14:15 - 15:00	IHO TWCWG <a href="#">Tides, Water Level and Current Working Group (TWCWG)</a>  <a href="#">Presentation</a>  IHO Specifications and Resolutions <a href="#">Resolution 3/1919 - IHO CL10/2017</a> <a href="#">S-100 Implementation Strategy</a> <a href="#">S-100 Product Specifications</a> <a href="#">S-100 Testbed IHO Geospatial Information Registry</a>	Chris
15:00 - 15:30	Coffee break	
15:30 - 16:30	Presentations and discussions (20 min each)  Model-Based Hydrodynamic Levelling: An Impact Study on the European Vertical Reference Frame ( <a href="#">movie</a> , <a href="#">thesis</a> )  <a href="#">Baltic Sea Chart Datum 2000</a>	All  Ronald  Chair
19:00	Joint dinner at <a href="#">Restaurant Port Arthur</a> , Gamla Ceresgatan 3, Göteborg	All

### Wednesday 7 February 2024

09:00 - 10:15	Presentations and discussions (20 min each)  <a href="#">Germany's plan for S-104 and S-111 products</a>  <a href="#">Update of the chart datum surface planned for 2026</a>  <a href="#">Analysis of the differences between the VORF and BathYELLI surfaces along the maritime boundaries</a>  <a href="#">Unifying the vertical reference of bathymetric surveys within the Danish EEZ</a>  <a href="#">Denmark's development status of S-104 &amp; S-111</a>	All  Andreas  Andreas  Gaël  Kristian  Nicki
10:15 - 10:30	Coffee break	
10:30 - 11:40	Guided tour at the <a href="#">Simulator Centre</a>	All
11:40 - 13:10	Lunch	
13:10 - 13:50	Presentations and discussions (20 min each)  <a href="#">Netherlands's development status of S-104 &amp; S-111</a>  <a href="#">Update on Belgian tide gauge operations</a>	All  Ronald  Johan



<p>13:50 - 14:30</p>	<p>Any other business</p> <p>Proposal of a permanent TWG Chair [<a href="#">NSHC35 Action 15/2022</a>]</p> <p>Update the <a href="#">List of Members</a></p> <p>Review the provisional <a href="#">TWG Website</a></p> <p>Review the <a href="#">Work Plan and List of Actions</a> and unresolved issues of this meeting</p> <p><a href="#">TWG Report</a> to the <a href="#">37<sup>th</sup> NSHC Conference</a>, 8-10 April 2024, Malmö, Sweden and list of matters to be reported [<a href="#">TWG Presentation</a>]</p> <p>Proposal for the place and date of the next meeting [<a href="#">TWG27</a>]</p>	<p>All</p>
<p>14:30</p>	<p>Closing of the meeting</p>	<p>Chair</p>

**ANNEX D**

**NSHC Tidal Working Group  
Terms of Reference  
7 February 2024**

**To be approved by the NSHC 37<sup>th</sup> Conference, 9-10 April 2024  
Amendments marked in red**

**As proposed by TWG26 (7 February 2024)****1. Objective**

To provide technical advice and promote co-ordination on tidal issues especially within the North Sea Hydrographic Commission (NSHC).

**2. Authority**

The Tidal Working Group (TWG) is a subsidiary of the NSHC and its work plan is subject to NSHC approval. Subject to approval by NSHC the TWG is especially involved with the regional interpretation and implementation of tidal issues as identified by Tides, Water Level and Currents Working Group (TWCWG).

**3. Procedures****a. The TWG should:**

1. work according to the agreed NSHC work plan
2. monitor and report the progress of the work plan
3. propose new work plan items for consideration by the NSHC.

To support the identification of new work plan items deemed relevant for the NSHC, the TWG should:

4. liaise with relevant Hydrographic Services and Standards Committee (HSSC) working groups, such as TWCWG.
5. Exchange views and experiences concerning tidal issues like unifying vertical datum, analysis, modelling and related issues like sea level rise and surge.
6. Coordinate the implementation of S-104 Water Level and S-111 Surface Currents and report on the progress to NSICCWG.

**b. The TWG will conduct its business mainly by correspondence. Meetings and workshops should be scheduled as deemed necessary for the accomplishment of the work plan.**

**4. Composition and Chair**

1. The TWG shall comprise representatives of the NSHC Member State and expert contributors if applicable.
2. Decisions should generally be made by consensus, if a majority is required each Member State has one vote.
3. External contributors can contribute to the work plan but are not entitled to vote.
4. The Chair will be nominated by the TWG and approved by the NSHC Conference.
5. The Chair should monitor and report on the work plan to the NSHC.



## ANNEX E

**NSHC Tidal Working Group  
Work Plan and Actions  
7 February 2024**

**To be approved by the NSHC 37<sup>th</sup> Conference, 9-10 April 2024  
Amendments marked in red**

## Work Plan

Item Number (TWG/Item)	Objective (Why/Priority)	Task Description (What/How)	HO Involved	Status
WP 16/04	Enable GNSS-based tidal reduction and the connection with the vertical datum on land	Follow developments on geoid, MSL and LAT computations for the North Sea area	All	Permanent, see also WP18/01
WP 18/01	Improve North Sea wide realization of reference surfaces	Explain and reduce differences in reference surfaces at the international boundaries	All	Permanent
WP 18/02	Improve methodologies for ERS	Exchange between HO's on operational methodologies for ellipsoidal referenced surveying for GNSS based surveys	All	Permanent
WP 22/01	Ensure common European LAT surface adoption	Follow the developments of European initiatives on new LAT surfaces	All	Permanent
WP 24/01	Regional cooperation and coordination of the implementation of S-104 Water Level and S-111 Surface Currents	Coordinate the implementation of S-104 Water Level and S-111 Surface Currents and report on the progress to NSICCWG. Make available S-104 and/or S-111 test datasets which could be compared at national boundaries in the North Sea region, investigate and collaborate on resolving any differences.	All	Permanent
WP 24/02	Data Rescue and Data Archaeology	Exchange between HO's on details and methods used in the rescue of national / international archive tidal & water level datasets, for the purposes of climate change studies, tsunami research and any such activity requiring access to these important assets	All	Permanent

## List of Actions

Item Number (TWG/Item)	Objective (Why/Priority)	Task Description (What/How)	HO Involved	Status	Corresponding Work Plan Item
AP 18/01	Explain differences in realizations of LAT	Exchange on bilateral basis between involved HO's to investigate further the origin of observed differences at the boundaries between national reference surfaces	All	Permanent	WP 18/01
AP 19/03	Make an overview over existing separation and hydrodynamic models, including metadata	Each member state sends the information to UKHO	All, UK	Done	WP 18/01
<del>AP 22/01</del>	<del>Investigate the differences in national LAT reference surfaces at all borders.</del>	<del>Each member state should supply information on how their LAT surface was built to NL who will analyze this information and compare the surfaces</del>	<del>NL, All</del>	<del>Done</del>	<del>WP 18/01</del>
AP 22/02	Investigate the differences in national LAT reference surfaces at all borders.	Each member state should supply all LAT updates to NL who will update the LAT differences matrix accordingly	NL, All	Periodical	WP 18/01
AP 22/03	Investigate the differences in national LAT reference surfaces at all borders.	Make error estimates in LAT surfaces	All	Permanent	WP 18/01
AP 22/05	Ensure common European LAT surface adoption.	Follow the developments of European initiatives e.g. EMODnet on new LAT	All	Permanent	WP 22/01
AP 23/02	Investigate all LAT differences at the borders and overlapping parts of surfaces using the redefined norm.	Investigate the differences at all MS borders (and overlapping parts of surfaces) between national LAT reference surfaces	All	Permanent	WP 22/01

AP 24/01	UK and FR to supply 'CD to Ellipsoid' separation values along their common boundary to NL to investigate if this improves the result in any way	Charted depths in this region are reduced to 'CD', which is <b>approximately</b> LAT. Therefore it is important to ensure the correct surfaces are being compared with each other, then used in the 1% norm calculation (or other suitable method as decided by TWG)	FR, UK, NL	TWG27 Feb 2025	WP 18/01
<del>AP 24/02</del>	<del>NL to provide the TWG with the sources of the maritime boundaries that were used for the analysis of the LAT differences</del>	<del>Provide the TWG with a list of the sources to the relevant treaties and lists of coordinates that were used for the analysis (including the coordinate reference system)</del>	<del>NL</del>	<del>Done</del>	<del>WP 18/01</del>
<del>AP 24/03</del>	<del>Total Vertical Uncertainty (TVU) norm for comparing differences in LAT surfaces at the national boundaries</del>	<del>Propose suitable refinement (and explanation of the reasons) to the newly proposed norm connected to S-44 by the next meeting (TWG25). "Which percentage of the total vertical uncertainty (TVU, as defined in S-44) can be allocated by the LAT models?" Member states send their suggested values to NL.</del>	<del>DK, DE, NL All</del>	<del>Done</del>	<del>WP 18/01</del>
AP 24/04	Elect a permanent Chair of NSHC TWG	As directed by NSHC; the Chair should expect to be in place for a 5-year minimum term	All	Done	n/a
AP 25/01	Investigate LAT differences at overlapping parts of surfaces.	Each member state should supply LAT surfaces for an as large as possible area of the North Sea to NL who will compare the surfaces	All	TWG27 Feb 2025	WP 18/01

AP 26/01	Provide links to S-104 and S-111 test datasets	Link to existing IHO website, which already coordinates this. <a href="https://iho-ohi.github.io/S100Resource">https://iho-ohi.github.io/S100Resource</a>	All	TWG27 Feb 2025	WP 24/01
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