



Testing S-100: Simulated trials in Greece


16-20 March 2026





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S-100 Simulator Testing: Greece

Collaborators

 <p>MINERVA MARINE Inc.</p> <p>Minerva Marine operates around 100 ships across tanker and dry cargo sectors, making it a significant large private shipping fleet.</p>	 <p>ANGELICOUSSIS GROUP</p> <p>The Angelicooussis Group operates one of the largest privately owned fleets in the world. Operating approximately 160 ships, the fleet is diversified across, Oil tankers, LNG (liquefied natural gas) carriers and Dry bulk vessels</p>
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Company	Role	Representative	
 <p>KONGSBERG</p>	<p>KONGSBERG is an international technology group that delivers advanced, sustainable and reliable solutions that contribute to safety and efficiency in complex operations under extreme conditions.</p>	<p>Simulator provider</p>	<p>Eivind Ringstad</p>
 <p>seall</p>	<p>SEALL ECDIS Ltd is a British software development company providing services for the maritime industry, based in Aberdeen they specialise in Electronic Chart Display and Information Systems (ECDIS) and back of bridge tools. Their innovative software products are used on vessels worldwide.</p>	<p>Original Equipment Manufacturer (OEM) Partner</p>	<p>Laura Neill</p>
 <p>NorthStandard</p>	<p>NorthStandard are a leading global marine insurer and one of the largest P&I clubs in the International Group.</p>	<p>P&I loss prevention</p>	<p>John Southam</p>
 <p>UK Hydrographic Office</p>	<p>The UK Hydrographic Office (UKHO) is a world-leading centre for hydrography, delivering data and expertise to support safe, secure and thriving oceans. 90% of large ships trading internationally rely on its ADMIRALTY portfolio to support safe, efficient and compliant navigation.</p>	<p>S-100 Data</p>	<p>Tom Mellor</p>

Background

The UK Hydrographic Office and NorthStandard have been collaborating for a number of years on various ECDIS initiatives aimed at improving mariner understanding of their navigational equipment, with the ultimate goal of improving underlying navigational safety. With the imminent introduction of new S-100 ECDIS, both organisations are collaborating again to carry out shore-based simulation testing. The goal of the testing is to gather mariner feedback on the use of the new S-100 products and to feedback into the IHO standards development process where possible improvements and issues are identified.

As an international hub for ship operators and owners, NorthStandard facilitated access to two established maritime training centres located in Athens: the **Athina Maritime Learning and Development Center** and the **Angelicoussis Delphic Maritime Training Centre**

Both organisations operate as specialised training providers, delivering structured programmes designed to enhance competence, safety awareness and operational effectiveness of seafarers. Their facilities utilise advanced simulation technology, practical instruction and regulatory-aligned curricula to ensure personnel meet international maritime standards and are fully prepared for onboard responsibilities.

Collectively, these centres support the ongoing professional development of maritime personnel and contribute to the wider industry objective of improving safety, compliance, and performance across global shipping operations.

Simulation and testing facilities

Athina Maritime Learning and Development Center is the dedicated training arm of **Minerva Marine**, designed to provide high-quality, simulator-based education and professional development for ship officers and crew. Located in Athens, Greece, Athina are focused on developing the skills and competence of seafarers and maritime professionals working for the Minerva group. Athina provided access to their full mission bridge simulator created and maintained by **Kongsberg**.



S-100 products in scope

The following phase 1 product specifications were in scope for testing as part of the simulated trials:

S-100 product specification	Description
S-57	ENC
S-101	ENC
S-102	Bathymetric Surface
S-104	Water Level
S-111	Surface Current
S-124	Navigational Warnings

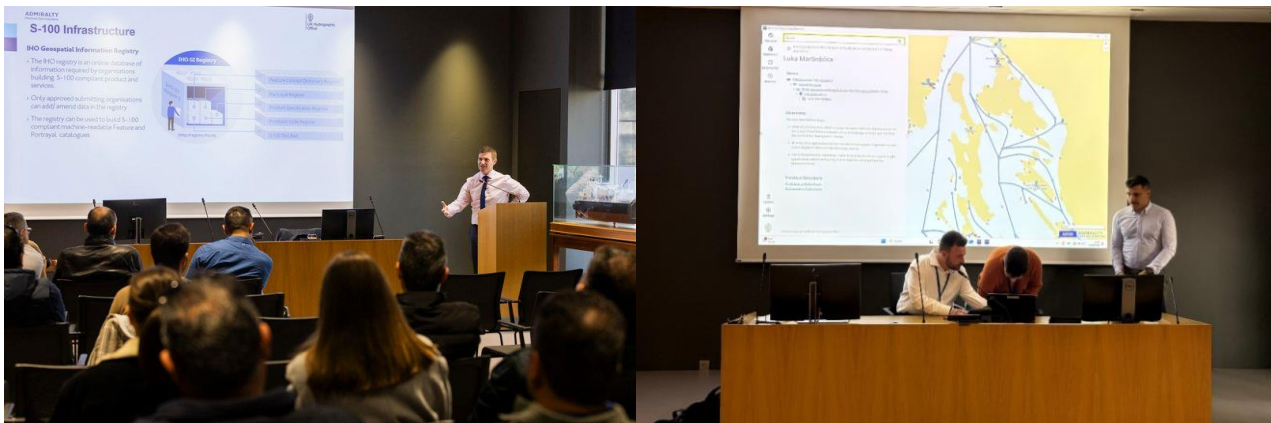
Participating mariners and end-users

Many of the ADMIRALTY S-100 tests and trials conducted to date have included participation from passenger ferry and cruise ship operators.

To understand if requirements for the new S-100 data products differ between vessel types, this project specifically targeted crew from VLCCs, LNG tankers and bulk carriers to get a robust cross section of feedback.

S-100 briefing sessions

To support the testing process and to obtain meaningful feedback, the UKHO ran briefing sessions with the crews and training school lecturers to introduce the new IHO S-100 standard and the underlying concepts of the product specifications. These sessions were carried out prior to the practical testing scenarios to ensure a common baseline understanding and allowed crews the opportunity to ask questions to support the next stage of testing.



Passage planning

None of the participating bridge teams had experience of navigating in Southampton, therefore took the opportunity to showcase the new ADMIRALTY Virtual Ports and ADMIRALTY Digital Sailing Directions to help familiarise the users with the area in scope.

This afforded the opportunity to gather insight and feedback on these emerging products to feed into the UKHO's product management teams. Both Minerva and Angelicoussis are keen to support trials and testing of the products on their vessels in live sea trials. Contact details have been passed to product managers to progress discussions.

Testing methodology and findings

Vessel parameters

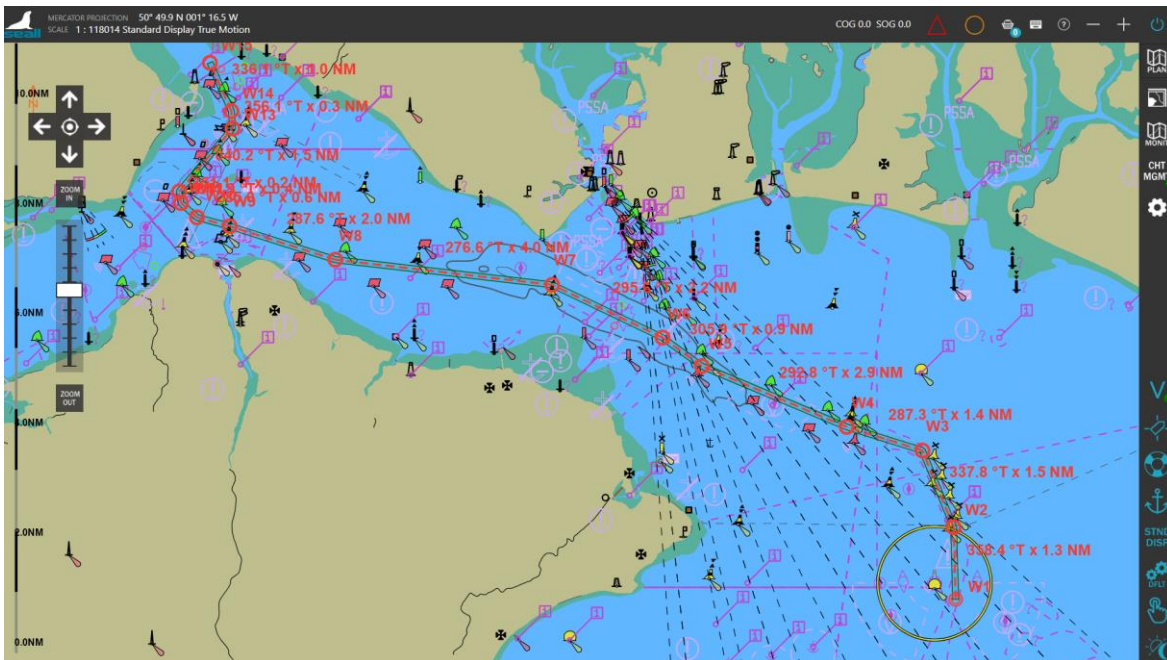
For the testing scenario, the S-100 ECDIS was set up using the following vessel parameters:

Length	177m
Beam	33m
Draught	9m

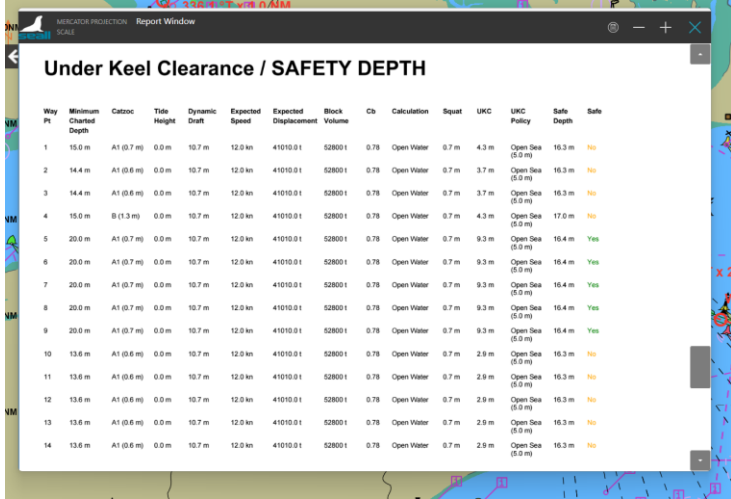
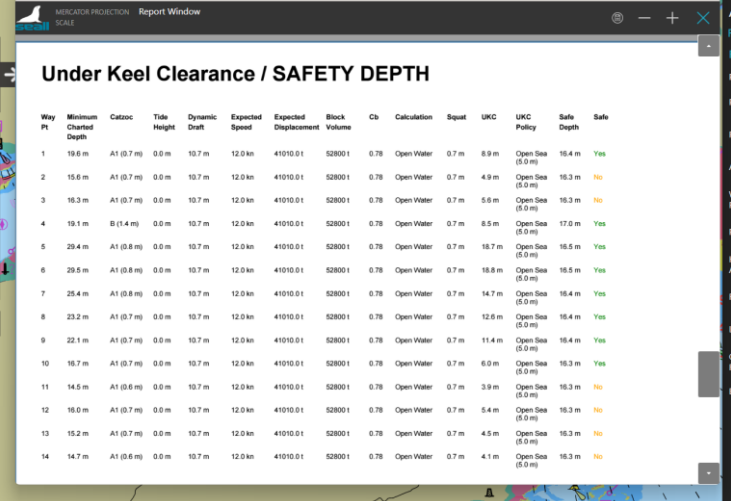
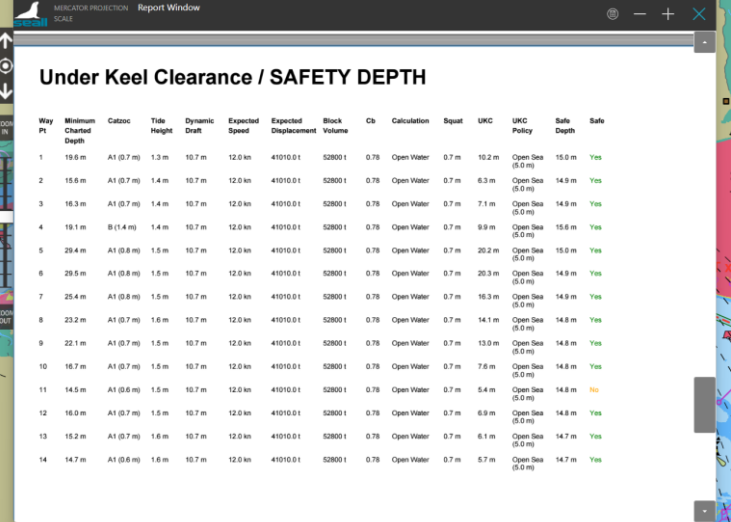
Test scenarios

Bridge teams were first required to plan a route from the **Portsmouth Pilot Station** to **Fawley Oil Terminal**, leaving at 11am. Using only S-57 ENC data, they were then requested to run a route check.

Throughout the scenario testing, bridge teams were introduced to the enhancements in the S-101 cells and comparisons were made against the S-57 charts.



The following safe waypoints were observed when using the product specifications in scope:

Using S-57 ENC	5/20 waypoints reported safe																																																																																																																																																																																																																																	
Using S-101 ENC	<p>7/20 waypoints reported safe</p>  <table border="1"> <thead> <tr> <th>Way Pt</th> <th>Minimum Charted Depth</th> <th>Catoc</th> <th>Tide Height</th> <th>Dynamic Draft</th> <th>Expected Speed</th> <th>Expected Displacement</th> <th>Block Volume</th> <th>Cb</th> <th>Calculation</th> <th>Squat</th> <th>UKC</th> <th>UKC Policy</th> <th>Safe Depth</th> <th>Safe</th> </tr> </thead> <tbody> <tr><td>1</td><td>15.0 m</td><td>A1 (0.7 m)</td><td>0.0 m</td><td>10.7 m</td><td>12.0 kn</td><td>41010.01</td><td>528001</td><td>0.78</td><td>Open Water</td><td>0.7 m</td><td>4.3 m</td><td>Open Sea (5.0 m)</td><td>10.3 m</td><td>No</td></tr> <tr><td>2</td><td>14.4 m</td><td>A1 (0.6 m)</td><td>0.0 m</td><td>10.7 m</td><td>12.0 kn</td><td>41010.01</td><td>528001</td><td>0.78</td><td>Open Water</td><td>0.7 m</td><td>3.7 m</td><td>Open Sea (5.0 m)</td><td>16.3 m</td><td>No</td></tr> <tr><td>3</td><td>14.4 m</td><td>A1 (0.6 m)</td><td>0.0 m</td><td>10.7 m</td><td>12.0 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4	19.1 m	B (1.4 m)	1.4 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	9.9 m	Open Sea (5.0 m)	15.6 m	Yes																																																																																																																																																																																																																				
5	29.4 m	A1 (0.8 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	20.2 m	Open Sea (5.0 m)	15.0 m	Yes																																																																																																																																																																																																																				
6	29.5 m	A1 (0.8 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	20.3 m	Open Sea (5.0 m)	14.9 m	Yes																																																																																																																																																																																																																				
7	25.4 m	A1 (0.8 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	16.3 m	Open Sea (5.0 m)	14.9 m	Yes																																																																																																																																																																																																																				
8	23.2 m	A1 (0.7 m)	1.6 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	14.1 m	Open Sea (5.0 m)	14.8 m	Yes																																																																																																																																																																																																																				
9	22.1 m	A1 (0.7 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	13.0 m	Open Sea (5.0 m)	14.8 m	Yes																																																																																																																																																																																																																				
10	16.7 m	A1 (0.7 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	7.6 m	Open Sea (5.0 m)	14.8 m	Yes																																																																																																																																																																																																																				
11	14.5 m	A1 (0.6 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	5.4 m	Open Sea (5.0 m)	14.8 m	No																																																																																																																																																																																																																				
12	16.0 m	A1 (0.7 m)	1.5 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	6.9 m	Open Sea (5.0 m)	14.8 m	Yes																																																																																																																																																																																																																				
13	15.2 m	A1 (0.7 m)	1.6 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	6.1 m	Open Sea (5.0 m)	14.7 m	Yes																																																																																																																																																																																																																				
14	14.7 m	A1 (0.6 m)	1.6 m	10.7 m	12.0 kn	41010.01	528001	0.78	Open Water	0.7 m	5.7 m	Open Sea (5.0 m)	14.7 m	Yes																																																																																																																																																																																																																				
Adjusting the departure time from the pilot station to leave at 13h00	20/20 waypoints reported safe																																																																																																																																																																																																																																	

S-100 ECDIS simulator trials

The SEALL S-100 ECDIS was connected into the Kongsberg Simulator to test the S-100 data sets, the crew transferred the valid route, and the new S-100 functionality was evaluated for usability and operational performance by end users.



Post-trial analysis

Both bridge teams and training school lecturers were surveyed to gather feedback from the trials. A short summary of findings is given below with full details in **Annex A bridge team results** and **Annex B training school lecturers**.

Feedback

This summary presents feedback from two sets of bridge simulation trials utilising S100 data sets, involving crews from VLCCs, dry cargo vessels, liquid tankers and gas carriers.

Feedback was collected from 33 respondents (as of 20 March 2026) covering the use of five primary S100 data sets:

- › S-101 (ENC)
- › S-102 (Bathymetric Surface)
- › S-104 (Tidal Data),
- › S-111 (Surface Currents)
- › S-124 Navigational warnings

<p>S-101 feedback</p>	<p>Respondents noted that S-101 ENC, while visually similar to S-57 ENCs, introduced several usability improvements:</p> <ul style="list-style-type: none"> › The coloured buoyage feature aligns chart displays with real-world visual cues, addressing previous gaps in crew understanding. › Rotatable text enhances chart clarity, reducing clutter and allowing important information to remain visible without obstructing navigational areas. › Enhanced symbology for mooring areas now distinguishes these from anchorage zones, aiming to prevent navigational incidents. › Sector lights are proposed to display their nominal ranges, improving situational awareness for bridge teams.
<p>S-102 feedback</p>	<p>The S102 bathymetric surface layer provides improved depth accuracy, offering features like sun illumination and user-configurable depth shading.</p> <ul style="list-style-type: none"> › Most participants favoured four-colour depth shades for clearer visualisation of safety margins and navigable waters, though some prefer two-colour schemes for simplicity and reduced screen clutter. › Concerns were raised about masking S-101 features (such as rocks, wrecks and obstructions) when S-102 is enabled, potentially reducing situational awareness – especially in anchorage operations. › S-102 allowed safety contours to be set at precise values, rather than defaulting to the nearest available contour line, enhancing navigational accuracy.
<p>S-104 feedback</p>	<p>S-104 provides dynamic water level (DWL) information, supporting live tidal data for up to five days. This enables dynamic UKC (Under Keel Clearance) calculations and the ability to plan safe passage through restricted areas, reducing human error and time spent consulting traditional tide tables.</p> <ul style="list-style-type: none"> › Respondents appreciated the time-saving benefits and improved reliability, but cautioned against over-reliance on automation and stress the need for clear interface displays and the ability to toggle data layers. › Concerns included the accuracy of real-time data, potential loss of familiarity with charted depths, and the limited forecast window.
<p>S-111 feedback</p>	<p>The S-111 layer visualises surface currents via arrows denoting strength and direction, applicable in coastal and deep-sea contexts.</p> <ul style="list-style-type: none"> › Respondents found S-111 most valuable during pilotage, confined waters, berthing, and docking – where safety margins are smallest and accurate information is critical. › Surface current data was also considered beneficial for ETA planning, fuel savings, river passages, traffic separation schemes, and straits. › While some believed existing current knowledge suffices, most saw added value in integrating S-111 data for operational efficiency.

Summary of findings

The S100 data sets were widely regarded as significant advancements in navigational safety, clarity and operational efficiency.

Key benefits included:

- › **Improved visualisation**
- › **Enhanced situational awareness**
- › **Time savings in passage planning**

However, there was a consistent emphasis on maintaining safety margins, avoiding over-reliance on automation, and ensuring user interfaces are clear and flexible.

The integration of these data sets marks a substantial step forward, but ongoing refinement and user feedback will be essential to optimise their adoption and effectiveness.

Training school summary

Training for S-100 will require significant adaptation, with most respondents expecting increased training time and cognitive load due to new data layers and system complexity. Practical, scenario-based training and frequent refresher sessions are strongly recommended.

Early adoption of S-100 is widely supported, but respondents emphasised the need for a controlled rollout – thorough training and standardisation – in order to manage risks, especially during the transition period when both S-57 and S-100 are available.

There is a clear call to shift training focus from paper charts to ECDIS, with more realistic policies, targeted support materials and company-driven guidance to address gaps until formal regulations are updated. This approach aims to reduce human error and manage cognitive overload effectively.

Annex A – Bridge team S-100 trials feedback report

Executive Summary

This report presents feedback from three sets of bridge simulation trials utilising S-100 data sets, involving crews from dry cargo vessels, liquid tankers, gas carriers, and pilots worldwide.

The simulations were conducted at C-SMART simulator in the Netherlands, Athina Training Centre in Athens and Delphic Training Centre in Athens.

Feedback was collected from 33 respondents (as of 20 March 2026), covering the use of four primary S-100 data sets:

- › S-101 (ENC)
- › S-102 (Bathymetric Surface)
- › S-104 (Water Levels)
- › S-111 (Surface Currents)

<p>S-101 feedback</p>	<p>Respondents noted that S-101 ENCs, while visually similar to S-57, introduce several usability improvements. The coloured buoyage feature aligns chart displays with real-world visual cues, addressing previous gaps in crew understanding. Rotatable text enhances chart clarity, reducing clutter and allowing important information to remain visible without obstructing navigational areas. Enhanced symbology for mooring areas now distinguishes these from anchorage zones, aiming to prevent navigational incidents. Sector lights are proposed to display their nominal ranges, improving situational awareness for bridge teams.</p>
<p>S-102 feedback</p>	<p>The S-102 bathymetric surface layer provides improved depth accuracy, offering features like sun illumination and user-configurable depth shading. Most participants favour four-colour depth shades for clearer visualisation of safety margins and navigable waters, though some prefer two-colour schemes for simplicity and reduced screen clutter. Concerns were raised about masking S-101 features (such as rocks, wrecks, and obstructions) when S-102 is enabled, potentially reducing situational awareness—especially in anchorage operations. S-102 allows safety contours to be set at precise values, rather than defaulting to the nearest available contour line, enhancing navigational accuracy.</p>
<p>S-104 feedback</p>	<p>S-104 provides dynamic water level (DWL) information, supporting live tidal data for up to five days. This enables dynamic UKC (Under Keel Clearance) calculations and the ability to plan safe passage through restricted areas, reducing human error and time spent consulting traditional tide tables. Respondents appreciate the time-saving benefits and improved reliability, but caution against over-reliance on automation and stress the need for clear interface displays and the ability to toggle data layers. Concerns include the accuracy of real-time data, potential loss of familiarity with charted depths, and the limited forecast window.</p>
<p>S-111 feedback</p>	<p>The S-111 layer visualises surface currents via arrows denoting strength and direction, applicable in coastal and deep-sea contexts. Respondents find S-111 most valuable during pilotage, confined waters, berthing, and docking—where safety margins are smallest and accurate information is critical. Surface current data is also considered beneficial for ETA planning, fuel savings, river passages, traffic separation schemes, and straits. While some believe existing current knowledge suffices, most see added value in integrating S-111 data for operational efficiency.</p>

Overall findings:

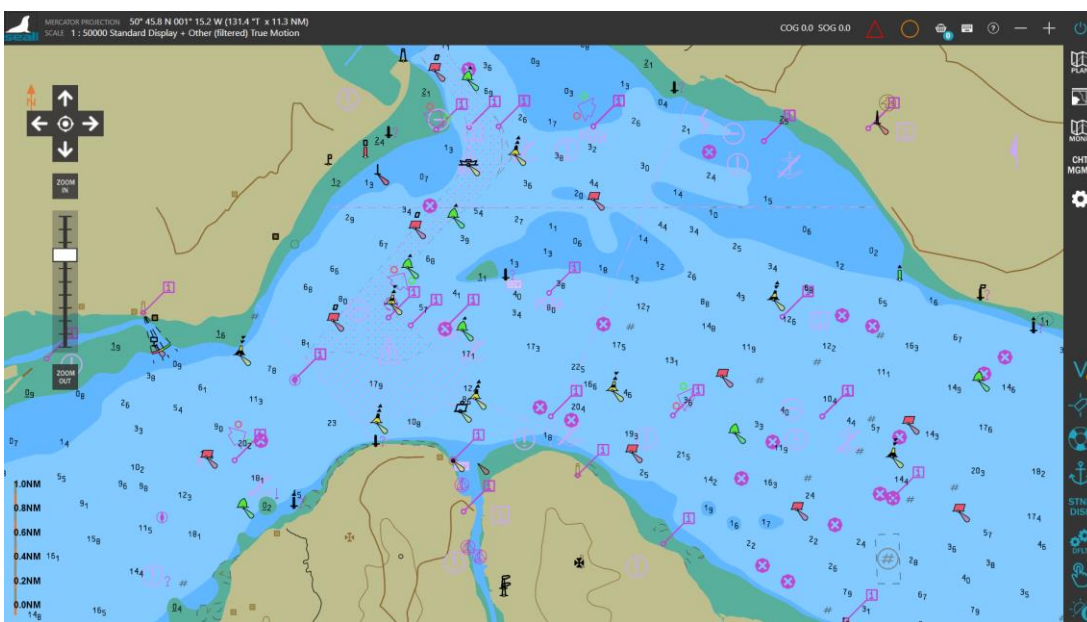
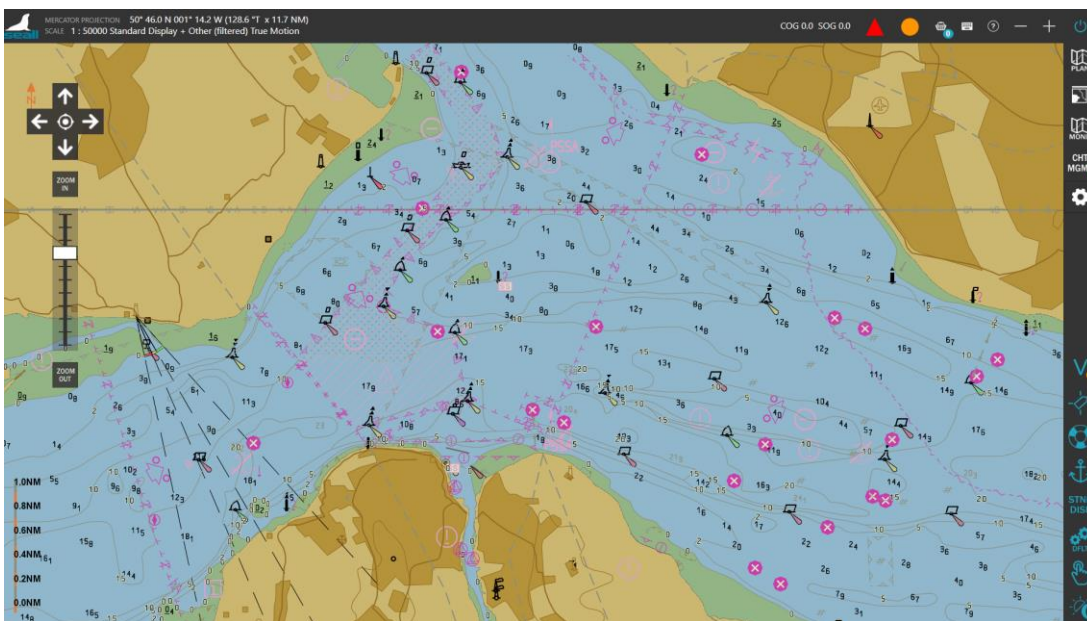
The S100 data sets are widely regarded as significant advancements in navigational safety, clarity, and operational efficiency. Key benefits include improved visualisation, enhanced situational awareness, and time savings in passage planning. However, there is a consistent emphasis on maintaining safety margins, avoiding over-reliance on automation, and ensuring user interfaces are clear and flexible. The integration of these data sets marks a substantial step forward, but ongoing refinement and user feedback will be essential to optimise their adoption and effectiveness.

S-101: ENC

Whilst S-101 ENCs look like S57, there are several new features that are intended to improve the usability for the seafarer. The first of these is the coloured buoyage feature. As opposed to S-57 the buoyage can appear in traditional format with the correct colouring so the ENC reflects what the seafarer can see in reality. Assessment of knowledge have shown that S-57 buoyage symbology still shows significant gaps with regard crew understanding.



Above: Examples of coloured buoyage.

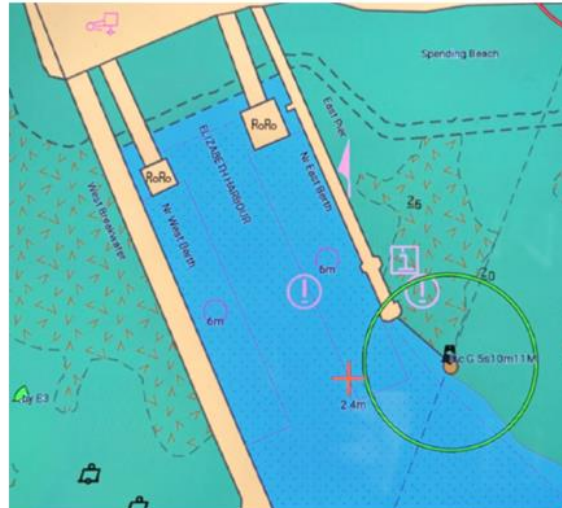


Above: Comparison of buoy symbology in an S-57 ENC and an S-101 ENC

S-101 will allow for text on the ENC to be rotated. Previously on S-57 the text simply replicated that of the original paper chart and therefore led to the screen being cluttered and the crew removing data layers. As such now it will be possible to rotate the text to allow it to be kept without interfering with navigational areas.



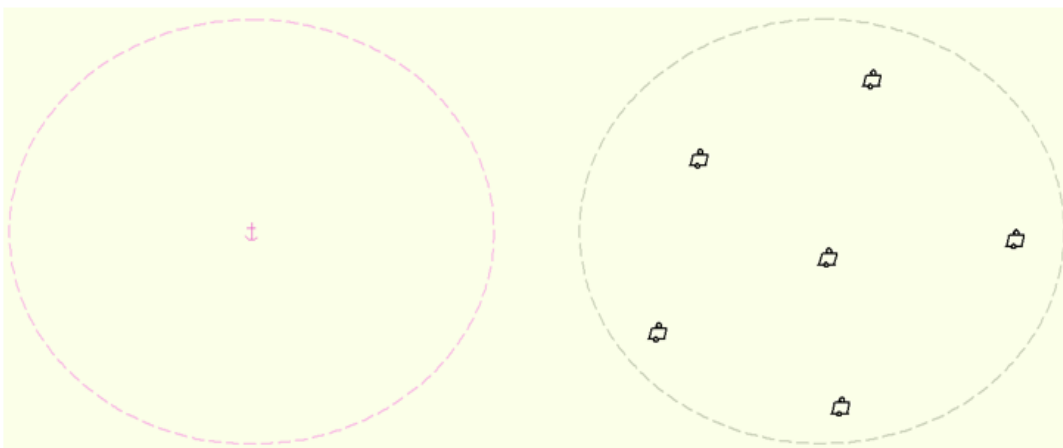
S-57 ENC



S-101 ENC

Above: An example of the text obstructing the navigational area in an S-57 ENC, vs an S-101 ENC where the text is rotated inside the berth and basin.

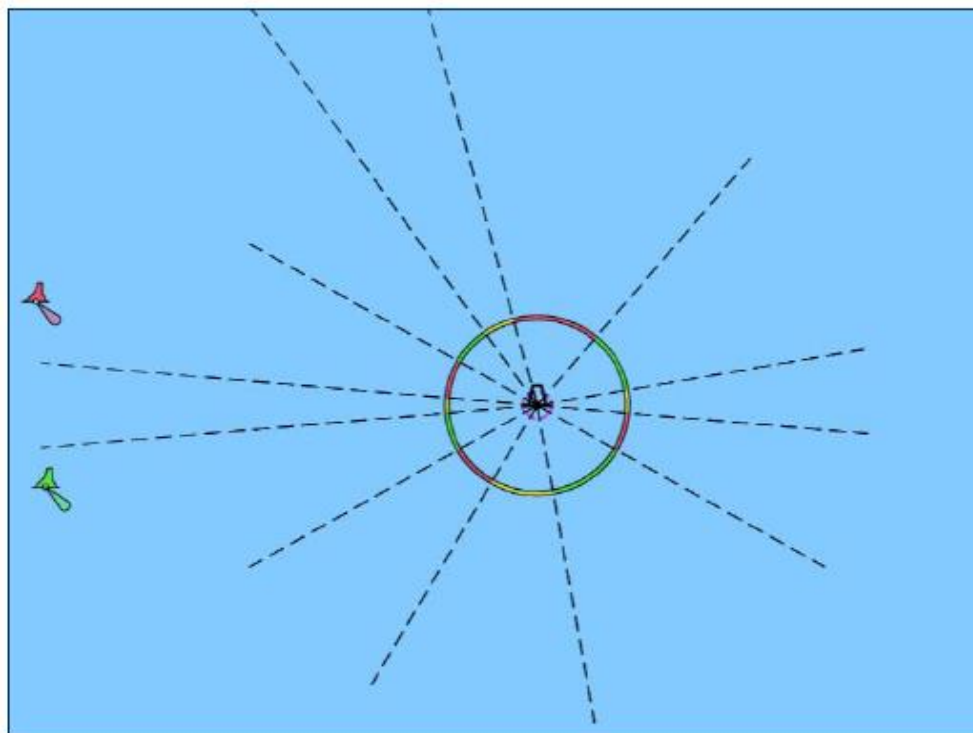
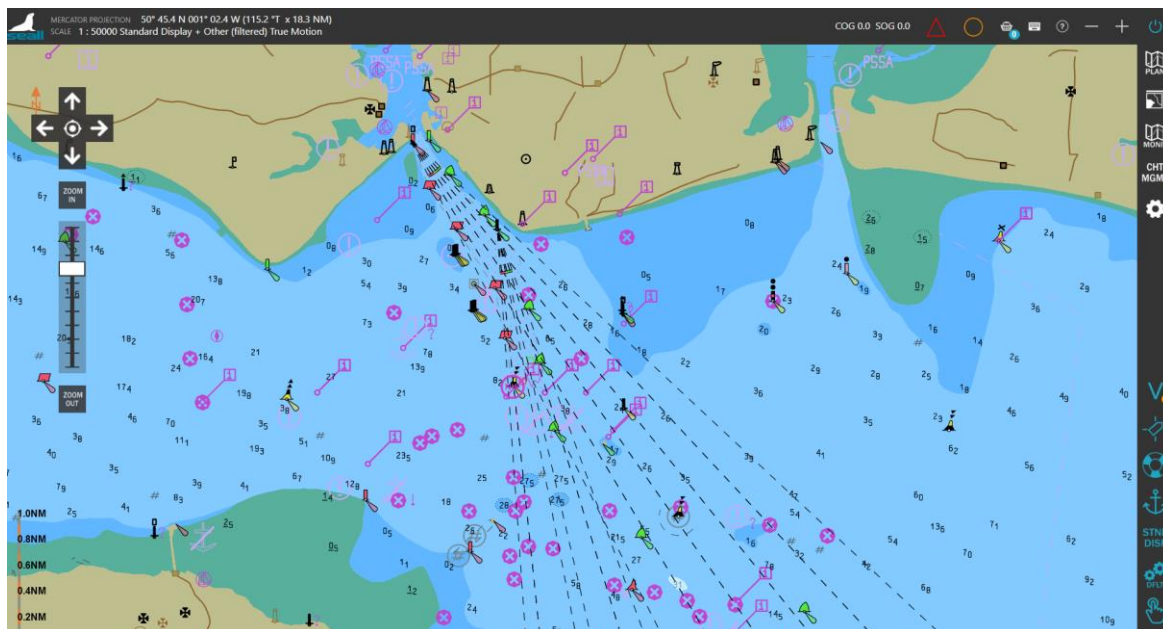
There are also changes to small boat mooring areas. Previously small boat mooring areas in S-57 were showing as an anchoring area. This has led to some incidents of larger commercial vessels navigating inside these areas. As such there will be a change to separate these two areas more clearly.



Left: Current portrayal

Right: Proposed portrayal (buoy symbols should be CHGRF in colour)

Beacons and navigational marks with sector lights are proposed to have their sectors extended to their nominal range meaning the bridge team can see which sector they are current navigating in and this should be easily identifiable.

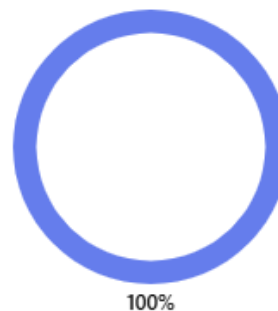


Above: Shows an example of a sector light and its corresponding colours for each sector.

S-101 feedback questions:

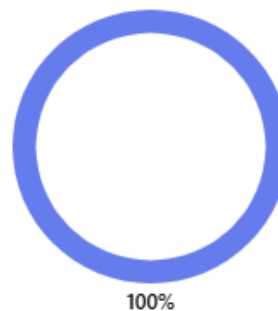
S-101 coloured buoyage - Is the presentation of coloured traditional buoyage in S-101 an improvement when compared to the display of buoys in S-57?

- YES 33
- NO 0



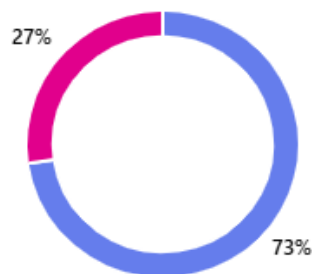
S-101 text placement - Does the presentation of rotated text improve the display of the chart?

- YES 33
- NO 0



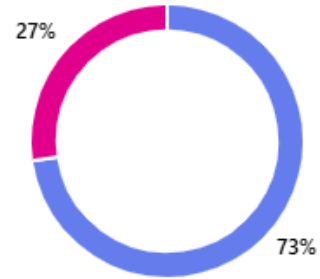
S-101 text placement - If you were using S-101 would you leave the text turned on?

- YES 24
- NO 9



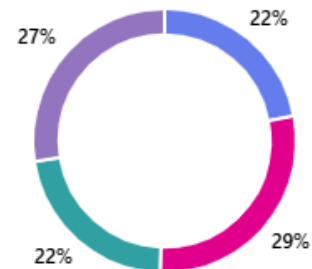
S-101 text placement - Do you think text for all features should be able to be rotated?

- YES 24
- NO 9



S-101 text placement - Which navigationally significant chart features would you select for rotated text?

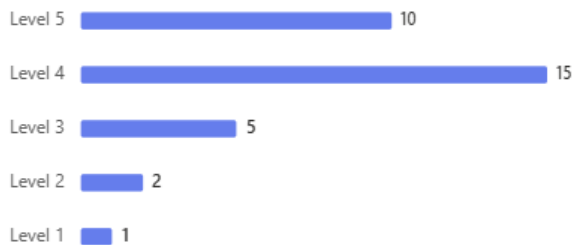
- Geographic Names 20
- Berths 26
- Lights/Buoys/Beacons 20
- Fairways/Sea Names 25



S-101 text placement - Can you list any other features rotated text would be useful for?

- › Anywhere if it means text can be on land rather than the water.
- › Any feature where it would improve clarity, reduce clutter in the chart or make it more obvious to which attribute the text belongs.
- › Text along linear features - port limits, 12-mile limit and ESSA.
- › For traffic information.
- › In any straits.
- › Any text that would get in the way of required information especially with scale changes.

S-101 light sectors - Rate the usefulness of extended light lines during vessel monitoring.
(5 being very useful and 1 being not useful at all)



S-101 light sectors – Why do you feel this way about the light sectors?

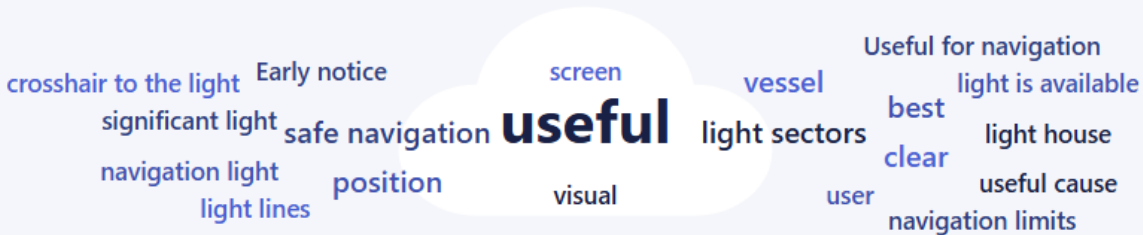
Positive responses:

- › Early notice that a significant light is available for use is good.
- › I occasionally use the feature in the Norwegian fjords, which serves as a useful visual cross check as you go. Otherwise, they are too cluttered. I would hope that S-101 would give cartographers the flexibility to design how the light sectors work in a more user-friendly manner.
- › It gives a clear visual indication of safe navigation limits and can therefore help confirm a vessel's position relative to hazards.
- › It is another way of confirming position in restricted waters.
- › The feature is paramount to safe navigation.
- › It is helpful in the navigation of the vessel.
- › Useful for safe navigation.
- › Gives full information about safe navigation light sectors.
- › Gives a better understanding of what to expect.
- › It makes it easier to identify the mark.
- › A good feature.
- › Gives good early notice.
- › I think it is useful.
- › A good safety feature.
- › It is a very useful feature.
- › I believe that this is very useful especially in case of an emergency I can easily tell my bearing from the light house or beacon.
- › It is useful because it saves time from cursor pick and reading the data of the light sectors.
- › It becomes easier to locate and get familiar with the position and range of the light, even though it can prove to cause some clutter in 'light' dense areas.
- › Very good idea but needs development and more optimisation.
- › It's clearer to see by looking at the ENC if it's visible from the vessel.

Negative responses:

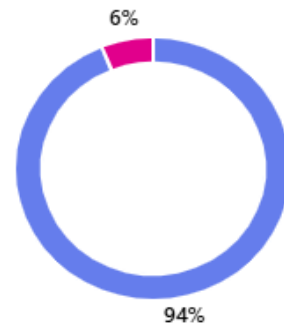
- › Too much information that may confuse the navigator.
- › Nowadays light sectors are not relevant anymore.
- › There are many other aids and therefore the extended lines may clutter the screen.
- › It could overcrowd the screen with lines, so the best method that may be used is for it to appear when you hover the crosshair / cursor over the light.
- › It may overcrowd the screen.
- › Sometimes it will be misleading the end user when creating the passage plan, thinking of it as a recommended route or some borders of a route.

6 respondents (18%) answered useful for this question.



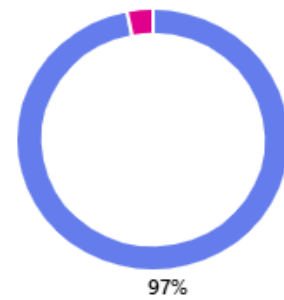
S-101 mooring area – Does the new symbology for mooring areas improve understanding?

● Yes 31
● No 2



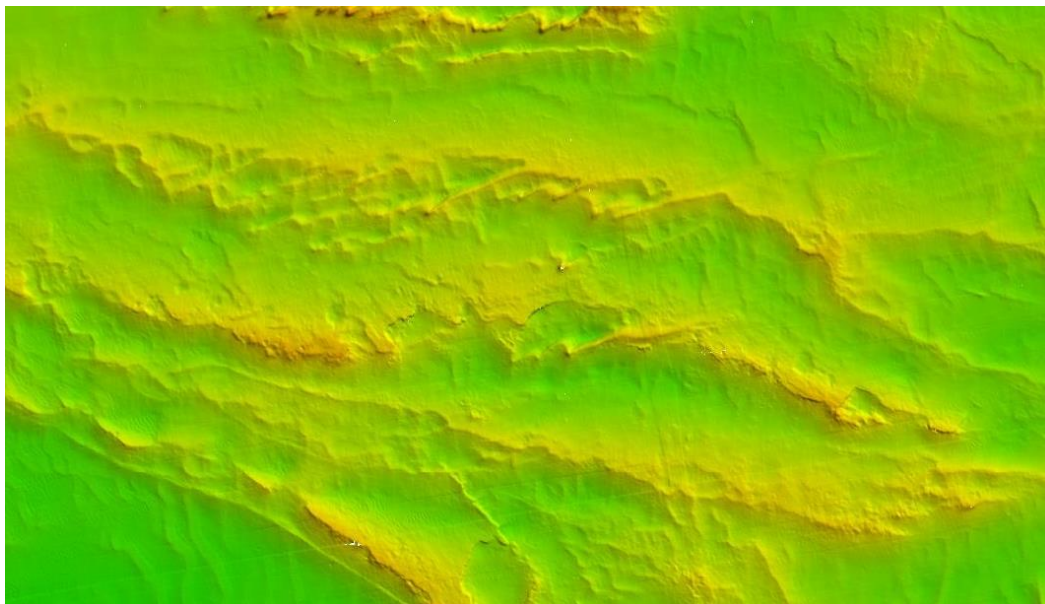
S-101 mooring area – Does the separation of mooring areas and anchorage areas improve navigation?

● Yes 32
● No 1



S-102 Bathymetric Surface

S-102 is the bathymetric surface data layer providing greater depth accuracy. The initial positive of this is normally an instant improvement on the CATZOC value. Another feature possible is the sun illumination; this is essentially a 3D layer where depths are assigned a colour leading to shallows and banks being shown more clearly. (Users currently have the choice of whether to use this feature or not.)



Above: A close-up example of sun illumination showing banks on the seabed.

The 2 and 4 colour depth shade settings in ECDIS – which will continue to be relevant in the S-100/S-101 era for determining navigation safety and display clutter – allow mariners to configure how water depths are visualised based on the vessel's draught. 2 colour depth shade displays only two shades for water depths in addition to the intertidal area – blue for shallow and unsafe water, and white/grey for safe water based on the safety contour.

4 colour depth shades subdivide the depth areas into four shades using user-defined shallow and deep contours.

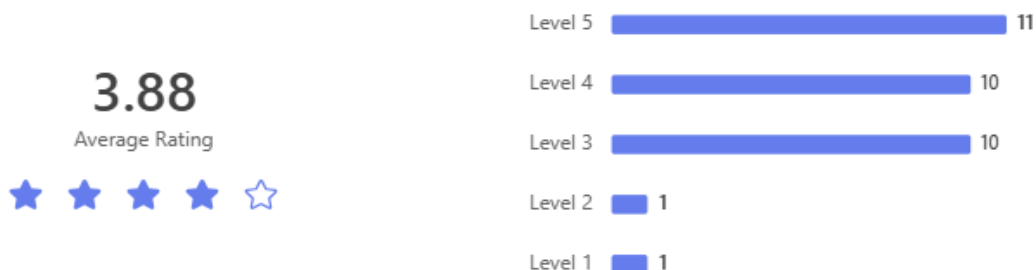
- **Very shallow** (unsafe): Dark blue (from 0m to the user-defined shallow contour)
- **Shallow** (caution): Light blue (between the user-defined shallow contour and the safety contour)
- **Deep** (safe): Grey (between the safety contour and the user-defined deep contour)
- **Very deep** (safe): White (deeper than the user-defined deep contour)

One contentious issue is the masking of soundings, wrecks and obstructions of S-101 features when using S-102. When the S-102 layer is applied, there are no soundings showing and any obstructions on the seabed below the safety contour do not show, meaning that only dangers are showing. It is important to understand that if the user adds S-104 (water levels) to S-102 it becomes dynamic and the depth will change on the screen. Should soundings be left on the screen, these will remain static and not change, creating potential confusion.

Importantly, it means the set safety contour will not be set to the nearest available contour line (as it is in S-57) but will be shown at the actual set level. For example, currently if you set the safety contour at 8m, there is not likely to be an 8m safety contour available; as such, for safety it will set to the next contour line of 10m, so 2m of navigable water will be deemed unsafe. With S-102, this will always be at 8m.

S-102 feedback questions

S-102 sun illumination - Rate the value of sun illumination. Does sun illumination improve the navigational picture? (5 being very useful and 1 being not useful at all.)



S-102 depth shades - When navigating do you prefer 4 colours depth shades or 2 colour depth shades?



S 102 depth shades – Why do you feel this way about the use of 2 or 4 colour depth shades?

Why do you prefer 4 colour depth shades?

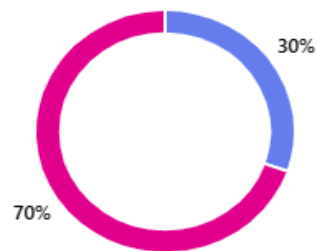
- › More clearly visualises no-go areas, navigable waters and safety margins.
- › I like to get a better visualisation of depth. It also highlights shallower water where the vessel may safely navigate but will handle differently.
- › It is clearer.
- › I find it clearer to understand areas of safe navigation.
- › Gives greater understanding.
- › It separates the shallow safety contour and navigable areas and depth.
- › It is more helpful for me for visual verification.
- › Both are useful depending on the circumstances of the voyage and the place.
- › I use it for more accuracy.
- › 4 shades for day and 2 shades for night
- › It is more accurate for the navigator.
- › Open sea navigation is better with 4 colour shades.
- › It depends on the place we navigate and the weather.
- › For a greater level of safety.
- › Better understanding in navigation.
- › More awareness.
- › Situational awareness.

Why do you prefer 2 colour depth shades?

- › It's clearer.
- › 2 shades for normal ENC – if high bathymetric ENC is available then 4 shades.
- › Less cluttering on the screen.
- › Clearer understanding of navigable waters.
- › Simpler. Avoids the risk of confusion.
- › Easier to look at and instantly understand.
- › It is clearer and less confusing.
- › I can see easily the path that I have to follow and what is safe or not safe.
- › Indicates navigable waters easier.
- › 4 colour shades is not necessary even in S-57.
- › The navigator needs to know where they can pass and where they can't.
- › Avoids errors during night / palette recognition.
- › 2 colour depth shades is easier and more practical.
- › Better visual understanding.
- › It is easier for the eye to differentiate safe and unsafe waters between 2 colours rather than 4, plus with the current technology 4 shades becomes harder to use with night mode illumination.
- › It's more useful.

S-102 depth shades - Does the masking of S-101 features (rocks, wrecks and obstructions) cause any concern when using S-102?

- Yes 10
- No 23



S-102 depth shades - What are your concerns over this masking?

- › Wrecks at low UKC are to be avoided and for anchoring etc.
- › There are situations you want these objects to be visible, for example in anchorage areas. A possible solution is that this feature/layer can be toggled on/off.
- › Better to see the underwater hazards. With a small S-102 resolution, one grid square will be hard to see.
- › We need to be sure that isolated dangers are always visible according to the user selected safety contour.
- › This could reduce situational awareness.
- › For certain operations understanding the seabed is important, for example dredging or anchoring.
- › They should always be shown regardless in case of anchoring or any other depth related operations.
- › It relies on excellent setting input and can also make it hard to determine an anchorage area if urgently required although it can toggle on and off. It could lead to less awareness of the area for the navigator.
- › Whilst using the S-102 the OOW can't cross reference these spots (wrecks, rocks, soundings) if they have been mentioned as remarks in the passage plan.

S104 Water Level Information for Surface Navigation

S-104 is the water level information for surface navigation; this allows for dynamic movement of the water depth and supports dynamic UKC calculations. The current plan is for the vessel to receive 5 days' worth of live tidal data (accounting for weather etc.) and this will not only allow this to be applied, but will enable the vessel crew to look ahead and scroll through the timeframes to see when it is safe to enter or exit restricted areas. This reduces the risk of human calculation error. When the user adds S-104, they get a dynamic water level (DWL) meaning their set safety contour will move and no longer be static.

S-104 feedback questions

S-104 dynamic water level (DWL) adjustment - Rate the usefulness of this feature.

(5 being very useful and 1 being not useful at all)



S-104 dynamic water level (DWL) adjustment - Do you have any concerns about the ECDIS calculating the safety contour based on S-102 and S-104?



S-104 dynamic water level (DWL) adjustment - What are your concerns about this?

- › Incorrect adjustment and losing familiarity with chartered depths.
- › No concerns about the calculation, however, the ECDIS should clearly display which layers are active and they should be easy to toggle on/off. During the planning process, it should also be easy for the voyage planning officer to identify the source/accuracy/resolution of these layers.
- › It may not be clear to the user that the S-104 layer is active. It should be very apparent. We want to avoid over-reliance on this feature particularly on a falling tide.
- › The accuracy of real-time data.
- › Over-reliance on automation.
- › The data has to be very accurate considering all environmental factors. Also, the additional clearance provided means there is no room for mistake, while on S-57 almost always there was more water available. If this was unofficially taken advantage of as a standard, this has to stop after the implementation because what you see is what you really get.
- › That it's only for 5 days and not for planning ahead e.g. 20 days ahead in the voyage.
- › That it does not change the soundings or create safety contour at particular value on ECDIS view. Should have dynamic appearance of the changes.

S-104 dynamic water level (DWL) adjustment - Compared to traditional tide tables and Notices to Mariners, how would you rate S-100 DWL for time saving? (5 being it saves a lot of time to 1 it does not save any time at all)

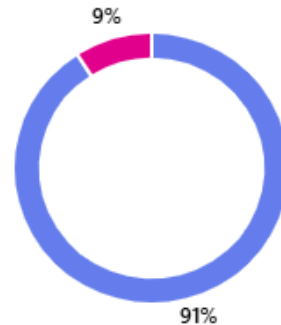


S-104 dynamic water level (DWL) adjustment – Why do you feel this way about the potential time savings from traditional means?

- › It's automatic.
- › You no longer would have to look at different sources but have all required information available in 1 place.
- › It would be much quicker as it is in one place.
- › Having real time astronomical data would help and save a lot of time.
- › It is a very useful feature.
- › Not requiring tide tables and constant checks.
- › It is very useful and practical.
- › Will improve passage planning.
- › Because we have more sufficient information.
- › The UKC calculation is heavily based on this, and all passage plans are created based on this point.
- › Real-time awareness.
- › Very easy and straight forward. This layering along with the SIII are the strong feature of the S-100.
- › The info can be found quicker. It is reliable and easier to verify.
- › Not only does it save time but it's also a way to cross check the calculations and the over reliance on the experience of the area.
- › It combines all information together.
- › Makes the job easier for passage plan and the navigation officer.
- › Time is very limited and whatever we can use for time saving it's good.
- › Better monitoring.
- › Because it automatically has all the information.
- › It covers only 5 days that is useful for approaching, but I think it can be improved.
- › Quite useful.
- › Good for safety purposes.
- › Partly visual but need the soundings to change as well on chart display basis the tide level and the CATZOC.
- › It saves a lot of time.
- › It gives you the tides automatically and you don't have to open the book and check.
- › The heavy limitation at the moment is the 5-day before period, if it was increased in let's say 30 days it would be for sure a 5 star. Because now during planning we still must use tide tables.
- › Since the current development stage offers only 5 days of forecast all the traditional methods used to calculate and create the passage plan will still be applied, because the navigation officer creates a berth to berth passage plan from before the vessel departs (thus making the feature not really usable for voyages of 5+ days)
- › Reduced time when planning.
- › Easily visualised.
- › It should be a bigger gap for days instead of 5 days

S-104 dynamic water level (DWL) adjustment - Is the DWL information clearly visualised within your ECDIS interface?

- Yes 30
- No 3

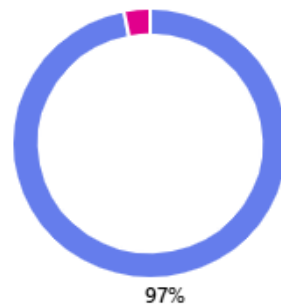


S-104 dynamic water level (DWL) adjustment – How could the information be clearer?

- › The display of the water heights is not very useful to an end user during the execution/monitoring phase unless you know the depth, which is not displayed.
- › Need to see what time the forecast is for. Need to see the components of the tide adjustment, how much is Astro, how much is weather.

S-104 dynamic water level (DWL) adjustment – Do you think DWL adjustment would enable more efficient tidal window planning?

- Yes 32
- No 1

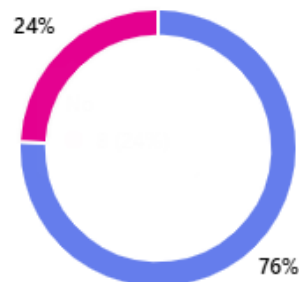


S-104 dynamic water level (DWL) adjustment – Why do you feel it would not enable more efficient tidal window planning?

- › The real advantage for mariners comes from the more accurate bathymetry since all the tide windows are precalculated with upmost precision with traditional means.

S-104 dynamic water level (DWL) adjustment – Would you consider reducing safety margins (if at all) due to improved water level accuracy?

- Yes 25
- No 8

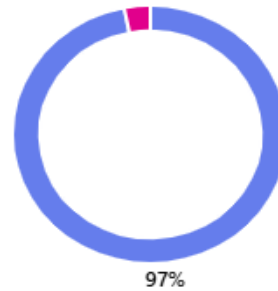


S-104 dynamic water level (DWL) adjustment – Why wouldn't you consider reducing safety margins due to improved water level accuracy?

- › Safety margins should not be reduced but it will more accurately allow to identify the available navigable water and accurately display the safety contour lines real time.
- › Safety of navigation is paramount and the reliance on these new data is not prudent.
- › Because the industry has to think of the worst-case scenario.
- › Safety of navigation.
- › I would prefer to keep the safety margins to the worst-case scenario but increasing the area of navigation.
- › To be on the safe side.
- › S-104 gives a better quality of seabed, making us able to have a safer voyage. Lowering the safety margins wouldn't.
- › This will have to wait until the system has been implemented and tested to confirm that the benefits are consistent and reliable.

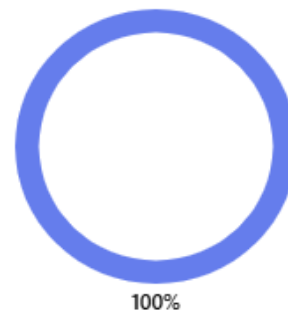
S-104 dynamic water level (DWL) adjustment – Do you think this feature could achieve measurable fuel savings, reduced waiting times or other commercial benefits?

● Yes 32
● No 1



S-104 dynamic water level (DWL) adjustment – Would DWL adjustment help improve confidence when transiting shallow or constrained waterways?

● Yes 33
● No 0



S-III Surface Currents

S-III is the layer for surface currents. The ECDIS user can turn on this data layer to present arrows showing the strength and direction of the surface currents. The colour and dimensions of the arrow denote the strength of the current. This layer is available in coastal water and deep sea.

Figure 9-1 – standard arrow symbols for use in representing surface currents

Speed Band	Minimum Speed (kn)	Width of Band (kn)
1	0.00	0.50
2	0.50	0.50
3	1.00	1.00
4	2.00	1.00
5	3.00	2.00
6	5.00	2.00
7	7.00	3.00
8	10.00	3.00
9	13.00	6.00

Table 9-1 – Speed ranges (knots) for the 9-band display

Speed Band	Colour	Colour Scale Intensity			Hex RGB	Displayed Colour
		Red	Green	Blue		
1	purple	118	82	226	7652E2	
2	dark blue	72	152	211	4898D3	
3	light blue	97	203	229	61CBE5	
4	dark green	109	188	69	6DBC45	
5	light green	180	220	0	B4DC00	
6	yellow-green	205	193	0	CDC100	
7	orange	248	167	24	F8A718	
8	pink	247	162	157	F7A29D	
9	red	255	30	30	FF1E1E	

Table 9-2 – Colour Schema for day conditions (informative)

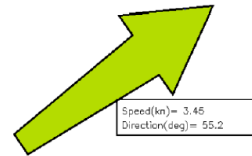


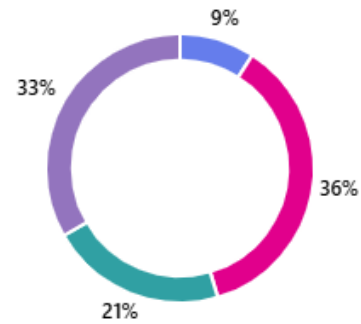
Figure 9-4 – Example of the display of the first level of numerical information available by cursor selection.
Note: Arrow length is not to scale

Above: A table showing the colours and dimensions.

S-III feedback questions

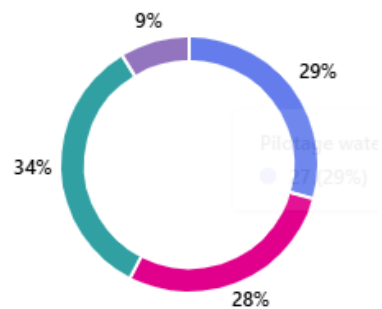
S-III surface currents - In which navigation phases do you think S-III is most valuable?

- Appraisal 3
- Planning 12
- Execution 7
- Monitoring 11



S-III surface currents - In which location do you think S-III is most effective?

- Pilotage waters 27
- During berthing 26
- When in confined waters 31
- Open sea 8

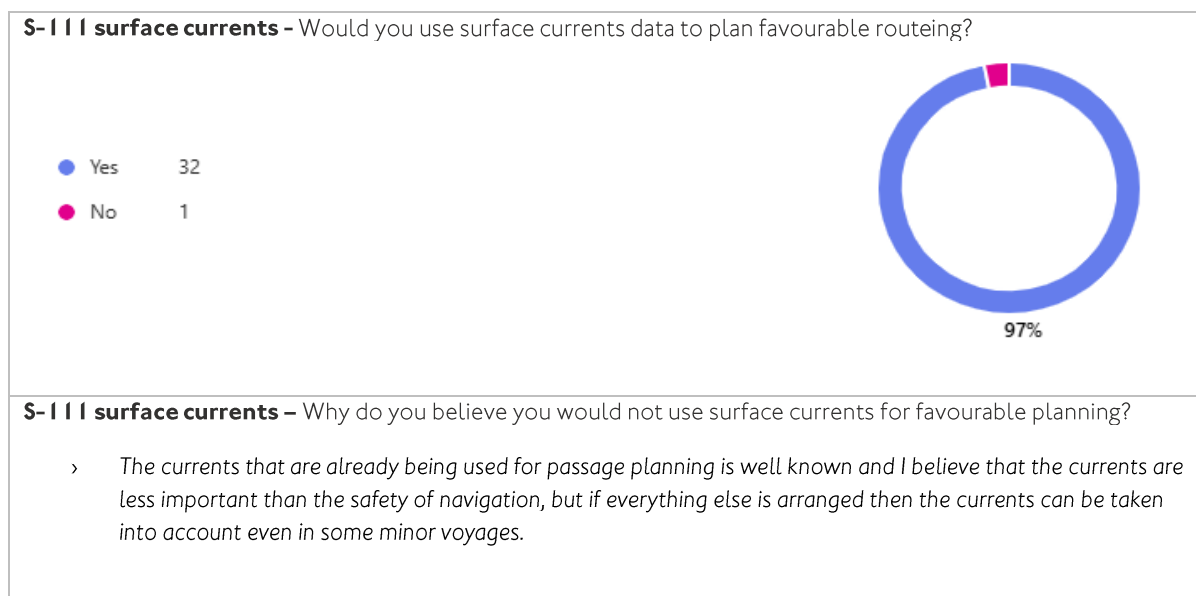


S-III surface currents – Why did you chose these locations?

- › I'm a pilot so chose pilotage waters.
- › In confined waters, including pilotage waters and manoeuvring close to the berth. The safety margins are smallest and accurate information is desired.
- › They are all important.
- › Surface current during docking is one of the most important factors, nevertheless also during sea passage it is very important for fuel consumption.
- › This feature is critical for all navigation.
- › These are all critical times.
- › Where navigable water is more restricted.
- › Confined, berthing and pilotage are the most dangerous waters.
- › Because confined water is more critical point.
- › Confined water is where we mostly need the new features.
- › It is useful for all of these.
- › Manoeuvring reasons when berthing.
- › Three first are for manoeuvring and ETA calculation and all of them for efficiency.
- › Open waters there is reduced risk. In pilotage you have additional assistance by pilot. In berthing you have other equipment
- › Cause it assist with the local current knowledge and changes when under pilotage and in confined waters.
- › The above are more critical operations – pilotage, confined waters and berthing.
- › It is always useful, in terms of danger at coastal, in terms of fuel efficiency in open sea.
- › The reason is that in open water doesn't matter that much – the others it is very helpful.
- › Because we want more information in confined waters, berthing and under pilotage about currents.
- › Current is always important and specially in confined waters and during approaching.
- › In my opinion, it is most effective when in confined waters.
- › Because currents are often stronger in confined waters.
- › It has the most effect in confined waters and your UKC.
- › These are the most important parts in navigating – confined waters, pilotage and berthing.
- › I believe that S-III is more effective in confined waters, while berthing and under pilotage as we have to be more vigilant.
- › Because it is always a plus for the OOW to receive additional information at all stages and utilize it to optimize the passage.
- › Because in confined waters we must navigate with more caution.

S-III surface currents – Do you think surface currents would be helpful in other areas not listed. If yes, please state which.

- › Planning for ETAs and fuel saving.
- › I would like a means of calculating the net current effect for the sea passage.
- › For river passages.
- › Surface currents are important in all places in which vessels navigate to aid in fuel consumption.
- › In traffic separation schemes.
- › Transiting straits.
- › Everywhere.
- › Traffic separation schemes and straits.
- › Currents must be known everywhere.
- › They would be useful in straits.
- › It would be very useful to have detailed and visible surface currents in anchorage areas because it would make it easier for Mariners to approach and "line up" the vessel for anchoring ops.



Conclusion of findings

The S-100 trials demonstrate clear potential to enhance navigational awareness, operational efficiency and decision making across bridge teams. Participants consistently valued the improved clarity, dynamic data integration and visual enhancements offered by S-101, S-102, S-104 and S-111.

At the same time, the feedback highlights the importance of cautious implementation, particularly around data accuracy, interface transparency and avoidance of over-reliance on automation.

Overall, the trials indicate strong support for the continued development of S-100 products, provided they are delivered with robust controls, user-friendly design and a firm commitment to maintaining conservative safety practices.

Annex B – S-100 trials training staff feedback

Executive summary

This report presents feedback from two sets of bridge simulation trials utilising S-100 data sets, involving training staff from Athina Training Centre and Delphic Training Centre in Athens. Feedback was collected from 5 respondents as of 20 March 2026.

Training for S-100 will require significant adaptation, with most respondents expecting increased training time and cognitive load due to new data layers and system complexity. Practical, scenario-based training and frequent refresher sessions are strongly recommended.

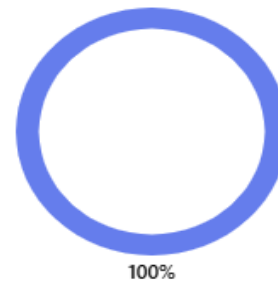
Early adoption of S-100 is widely supported, but respondents emphasise the need for a controlled roll-out, thorough training, and standardisation to manage risks, especially during the transition period when both S-57 and S-100 are available.

There is a clear call to shift training focus from paper charts to ECDIS, with more realistic policies, targeted support materials, and company-driven guidance to address gaps until formal regulations are updated. This approach aims to reduce human error and manage cognitive overload effectively.

Training staff questions and answers

Q. Given what you have seen, would you recommend that your company is an early adopter of S-100?

● Yes 5
● No 0

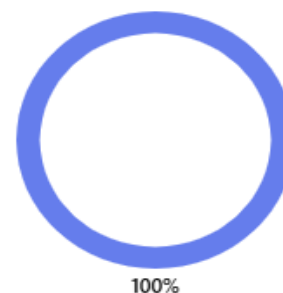


Q. Why do you feel this way about early adoption?

- › The future is near!
- › We need to take consideration that need a lot training to familiarised our seafarers.
- › This is an improvement and certainly it is a big step ahead. The sooner the better!
- › To make a smooth transition towards the ultimate date of compliance with the new standards.
- › S-100 offers significant improvements in situational awareness through enhanced data layers and dynamic information. From an operational perspective, early adoption will allow companies to build experience, identify practical limitations, and develop proper procedures before full industry implementation. However, this should be done in a controlled and phased manner to manage risks related to increased complexity and workload. Particular attention should be given to standardization of display settings and alarm philosophy. Standardization of display settings and alarm philosophy will be essential

Q. Do you feel that training will take more / less / or an equal amount of time than the current syllabus?

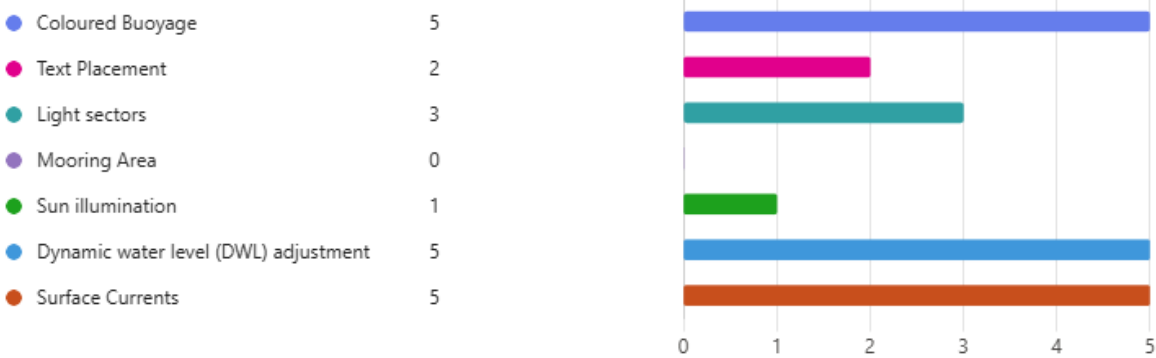
● More 5
● Less 0
● Same 0



Q. Why do you feel this is the case about the amount of training?

- > There is a lot of new information.
- > Because the new software needs time to familiarise the officer due to many layers.
- > Human error is the biggest risk over technical problems. Competency is of paramount importance.
- > More amount of information to be considered during passage planning and sailing. More time to explore the potential of new layers.
- > S-100 introduces additional layers of information and new functionalities that require deeper understanding compared to S-57. Navigators will need training not only on system operation but also on managing information, display settings, and alarms. This increases training requirements, particularly to ensure safe use under high workload conditions. Training should also focus on decision-making under increased information density.

Q. What do you feel are the key gains of S-100 based on what you have seen compared to S-57? (multiple choice)

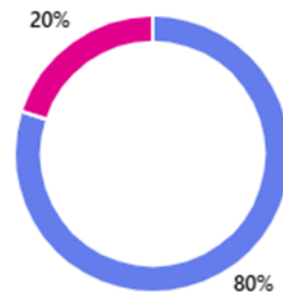


Q. It seems there will be a gap between the availability of S-100 for crew and its inclusion in STCW, how do you feel this gap could be bridged?

- > New STCW course.
- > It needs to be bridged but unsure how!
- > Organise in time training and set standards.
- > It is the right time as the STCW and its Code are undergoing a review that will end later than 2029. Apart from the model course on ECDIS, we should check separate training requirements on the management and OOW level.
- > The gap can be bridged through company-driven training and interim industry guidance. Shipping companies should introduce structured familiarization programs, supported by simulator-based training and onboard procedures. At the same time, training providers should develop standardized courses aligned with operational needs, until formal STCW requirements are established.

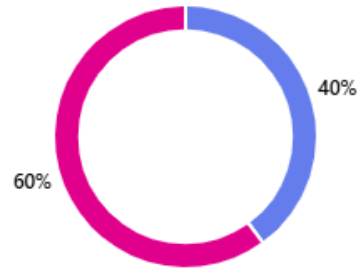
Q. Do you feel that a separate 'train the trainers' course is required for S-100?

- Yes 4
- No 1



Q. There will be a fairly long period of time where both S-57 and S-100 are available, does this period concern you?

- Yes 2
- No 3

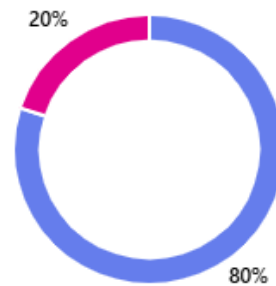


Q. What are your concerns about this dual fuel ECDIS period?

- > 2 sets of procedures is an issue.
- > The transition period where both S-57 and S-100 coexist may lead to confusion and inconsistency in bridge operations. Clear guidance, standardized display settings, and strong bridge team management practices will be essential to maintain situational awareness and avoid misinterpretation. Risk of over-reliance on system-generated information

Q. Do you feel wholesale change is required for the training of ECDIS, for example more time on ECDIS for crew and less time on paper charts?

- Yes 4
- No 1

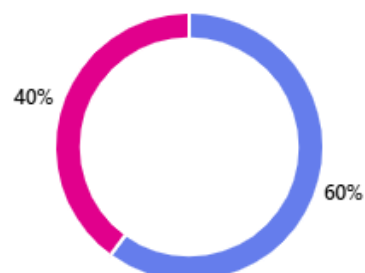


Q. Why do you feel this way about the current training systems?

- > We have new technology and the paper charts will be cancelled.
- > Must be focus for the correct use of ECDIS.
- > It is important to avoid misuse of the system. Correct configuration.
- > A new concept for the navigating officers.
- > The current training approach does not fully reflect modern bridge operations. ECDIS is the primary navigation tool onboard, yet training still allocates significant time to paper charts which are no longer operationally relevant in most cases. More focus is required on practical ECDIS use, including real scenarios, alarm management, data interpretation, and integration with other bridge systems. This will improve situational awareness, reduce human error, and better prepare officers for real operational condition

Q. Other than updated software, do you think you will require new training support material for S-100?

- Yes 3
- No 2

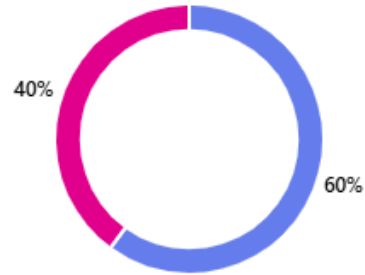


Q. What kind of new training support material do you think would assist?

- › More experience for vessel users of the ECDIS.
- › Instructions manual in order to learn how we train the seafarers
- › Practical, scenario-based training material will be most effective. This should include simulator exercises using S-100 data, real-case navigation scenarios, and guidance on interpreting new data layers. Clear operational guidance on alarm management, prioritization of information, and integration with existing bridge equipment is also essential. Short, focused modules and onboard refresher material would help ensure continuous familiarization.

Q. Do you believe the implementation of S-100 onboard will reduce the cognitive load on the bridge team?

- Yes 3
- No 2



Q. Why do you feel this way about the bridge team cognitive load?

- › It's need attention at the beginning for the settings.
- › Because it is full overreliance and we need a lot of attention.
- › The information is collected and easier found. Overreliance to be avoided and double verification of system configuration is required.
- › More precise information to handle.
- › The introduction of S-100 is expected to initially increase cognitive load due to additional data layers, new symbology, and more complex system behaviour. Bridge teams will need time to understand, interpret, and prioritize the increased amount of information. Without proper training and familiarization, there is a risk of information overload, distraction, and reduced situational awareness. Over time, with experience and well-structured systems, S-100 may improve decision-making, but during the transition phase the cognitive demand will be higher. Human-centred interface design will be critical.

Conclusion

S-100 is widely supported for early adoption, but success depends on a controlled rollout, stronger ECDIS-focused training, and clear company-driven guidance.

The transition period will increase cognitive load, making standardisation, practical scenarios, and robust familiarisation essential to ensure safe and confident use by bridge teams.