

Appendix 1-B

System Requirements

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1. Introduction

The system must be technically designed to enable the customer to deliver products in accordance with internal quality requirements as well as international standards.

The system should enable a higher degree of automation in the production process while ensuring that the current high level of quality is maintained. It is essential that the solution supports both existing and future standards, including S-4, S-57, S-101, INT-1, and INT-2 to ensure compatibility and future development.

Furthermore, the system must be intuitive and user-friendly, allowing operators with varying levels of expertise to use it effectively. The user interface should support an efficient workflow and help reduce manual processes where appropriate. The system will be a central tool in our chart production and contribute to strengthening the quality, efficiency, and reliability of our deliverables.

Below you will find the requirements that have been set for the system we wish to use in the production of our nautical products, ENC and paper charts.

2. Organizational requirements

The system shall support approximately 20 users with different responsibilities and access requirements. The system shall provide role-based access control, enabling administrators to assign and manage permissions according to defined user roles.

The following user roles are identified:

- System administrator: extended access to database, access to customize and configure system.
- Supervisor: Determine and manage jobs and system processes. Determine and

update ENC and Paper chart templates. Supervisors can determine jobs for large updates and jobs for production of various products.

- Validator: Validate the data.
- Operator: Add, delete or update object attributes and geometry.
- Viewer: Can view and analyse database data and make prints to paper or PDF. Can view data and products.

The system shall support integration with Microsoft Entra ID (Azure Active Directory) for authentication and user management.

The system shall be fully compatible with Microsoft Windows operating systems.

The system shall support operation both on local workstations and within a Virtual Desktop Infrastructure (VDI) environment, while maintaining acceptable performance and response times under normal operating conditions.

The system shall support concurrent use of multiple application instances by the same user. Users shall be able to run and work in multiple modules, workspaces, or installations simultaneously, including combinations of local workstation sessions and Virtual Desktop Infrastructure (VDI) sessions, without degradation of functionality, licensing restrictions, or unacceptable performance impacts.

The system will be operated and hosted on the Norwegian Mapping Authority's infrastructure by the customer.

The customer shall retain full ownership of all data stored within the solution.

3. Onboarding and training

ID	Delivery requirements	Requirements type	Response code A/B/C
3.1*	The Vendor should provide structured startup and onboarding support that enables the Customer to independently configure, administer, and successfully adopt the solution.	Should	
3.2*	A high-level description should be included in the proposal to provide sufficient insight into the proposed solution and how it will be implemented, while detailed and comprehensive documentation should be provided after contract award.	Should	
3.3*	Regular follow-up meetings should be conducted between the Vendor and the Customer, during the implementation phase.	Should	
3.4	The Vendor should assign a dedicated resource (e.g., consultant) who will serve as the Customer's primary point of contact throughout the implementation phase.	Should	
3.5*	The Vendor should provide role-based training programs (e.g., administrator, super user, and end-user training). The Customer prefers instructor-led classroom training in Stavanger. The Vendor should offer one round of training prior to the implementation phase and a second round before go-live.	Should	
3.6*	The Vendor should provide access to a knowledge base, e-learning platform, self-service learning resources, or	Should	

	equivalent training materials to support ongoing competence development.		
3.7*	The Vendor should provide comprehensive user documentation, including user manuals, administration guides, and reference materials. Documentation should be regularly updated and easily accessible to all relevant users.	Should	
3.8	The Vendor should, at no additional cost, correct any errors, defects, or non-conformities identified by the Customer during the implementation and acceptance testing period where the issue is related to functionality, capabilities, or requirements included in the standard solution offered under this procurement.	Should	

4. System and operational requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
4.1*	The system must support role-based authorization for data access and manipulation.	Must	
4.2*	A fully separated test environment should be provided as part of the system. This environment shall support both functional testing and training of new users. It must be capable of handling multiple simultaneous users and allow for safe testing of new system versions without impacting the production environment.	Should	
4.3*	The system should support scripting and APIs to enable NHS to automate and streamline processes. The scripting must be able to run outside an application process, so it can be called from other systems.	Should	
4.4*	The system must provide open access to underlying data in a documented and standardized format, available at all times and not only on export or exit.	Must	
4.5	If there are special adaptations provided by vendor, they must also function after updates to the system.	Must	
4.6*	The vendor shall have established routines for receiving, assessing, and implementing requests for software adaptations, including processes for prioritization and approval.	Should	

4.7*	The vendor shall maintain a helpdesk service for receiving error reports and inquiries from the customer. All inquiries shall be duly logged, and the customer shall have access to view the status and resolution deadlines for all inquiries submitted to the vendor. The helpdesk shall be available on all business days, in accordance with standard Norwegian working hours.	Should	
4.8	System error messages should be consistent and understandable.	Should	
4.9*	The system should support the creation and customization of user-defined menu bars. Users should be able to add, remove, and reorganize menu items in accordance with the operational needs of the organization.	Should	
4.10*	The system should support the use of shortcuts to reduce number of clicks, option to define own shortcuts.	Should	
4.11	The system must, at a minimum, support the global coordinate system WGS84 (EPSG:4326), and be capable of handling geographic data from both the Northern and Southern Hemispheres.	Must	
4.12*	The system should respond without relevant lag. E.g. the system responds immediately on mouse clicks.	Should	
4.13*	The system should support remote work without significant reduction in performance. If there is an environment that is better suited for remote work, we would appreciate a recommendation for that.	Should	
4.14	The system should be able to work in an environment without internet connection.	Should	
4.15*	The system should be able to edit, extract, commit, and validate large amounts of data without significant reduction in performance.	Should	
4.16	The nautical production system must be capable of supporting simultaneous use by up to 20 employees during full-scale production without increased response time. The user group consists of personnel engaged in paper chart handling, and ENC (Electronic Navigational Chart) production.	Should	

5. Access Control, Authentication and License Management

ID	Delivery requirements	Requirements type	Response code A/B/C
5.1*	The system should support flexible administration of user access and license management.	Should	
5.2*	The system must support role-based access control to ensure that only authorized users have access to sensitive	Must	

	data and functions, and it must allow authentication via Single Sign-On (SSO) solutions.		
5.3	Single Sign-On authorization should be possible with NHS's existing Active Directory solution.	Should	
5.4	The users should be able to view what type of permissions they have been granted.	Should	
5.5	It should be possible to define different permissions for usage of different database layers.	Should	

6. Data Handling, Storage, and Integration

ENC– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
6.1	The system should be configured to be able to connect to external map providers using WMS, WMTS or OGC API as background charts.	Should	
6.2*	The system should provide functionality for registering and importing metadata compliant with the ISO 19115 standard, ensuring that metadata can be structured, stored, and shared in line with current requirements for geographic information.	Should	
6.3*	The system must have the functionality to log all changes to an object to ensure traceability. It must be an easy task to find a complete history per object. Metadata and connection to the source must follow both data set and object.	Must	
6.4	The system should support the use of a PostgreSQL database.	Should	
6.5*	The system should export production data in standard raster and vector formats, as files and/or standards-based services, such as: • vector export to GeoJSON, Geopackage, GML; • raster export to GeoTIFF and georeferenced PDF; • and publishing of the system's own data for OGC API (Features, Maps and/or Tiles), WMS and WMTS services. Underlying data must be accessible in an open, documented and standardized format. All output must conform to the relevant established standards (S-52/S-101 portrayal, ISO 19115 metadata).	Should	

6.6	It should be possible to access data stored in the database from other GIS-systems. The main purpose is to view and analyse the data.	Should	
6.7*	The system should support partial migration to S-101 to enable the NHS to start S-101 dual production in selected areas to build a robust production line, before the entire portfolio is moved to S-101.	Should	

Paper Chart– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
6.8	The system must support the import of S-57 files and S-101 files for ingesting data from ENC's, land information, place names, and other relevant or future data sources for both migration and new production.	Should	
6.9	The system must support exporting paper charts and data as raster export to GeoTIFF, PDF and georeferenced PDF.	Should	
6.10*	The system should provide a seamless chart database containing all chart information, ensuring that data in overlapping areas does not require duplicate editing.	Should	
6.11*	The system should support the handling of overlapping areas, including sector lights and place names, ensuring consistent representation of data across the database.	Should	
6.12	The system should support exporting metadata for charts and chart series, including information such as name, geographic extent, scale, latest edition date and initial edition date.	Should	
6.13*	If the solution includes a database, objects present in multiple maps (e.g., in overlapping areas) should be maintained as a single unique instance in the database.	Should	
6.14*	The system must detect and clearly notify users of potential conflicts when multiple users operate in the same geographical area.	Should	

7. Quality, Traceability and Validation

ENC– Requirements

ID	Delivery requirements	Requirements type	Response code
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			A/B/C
7.1*	Functionality to display and analyse traceability logs must be integrated in the system.	Must	
7.2*	ENC version management must be clear and unambiguous.	Must	
7.3*	The system must provide traceability of key events in the system, at least; saved changes (versions) of geographic- and cartographic data including time stamp and the editing actor e.g. who has done what.	Must	
7.4*	It should be possible to extract information about published editions and update numbers. This is to ensure that these numbers in the database are the same as published by Primar.	Should	
7.5*	It should be possible to attach automatic validation rules to edit operations (i.e., give immediate feedback to users if an invalid object is created).	Should	
7.6*	The system should offer the option of adding comments associated with the quality control integrated into the system. The comments must be traceable to a position or an object. This information is to facilitate others to check what has been performed in the update. It should be easy to see the status on each comment, if it has been accepted or rejected, and by who. The validator needs write access to comments.	Should	
7.7*	It would be preferable for the system to have the ability to establish check lists with the option of text to describe what has been done. The check list follows the "task" (rather than who has performed the task or who has checked it) from start to published update (ER or NE).	Should	
7.8*	When updating objects that are scale independent, they are updated automatically in all relevant products. All automatic changes are thoroughly logged, and these logs are easily available for controls and history	Should	
7.9*	The system must provide tools to perform a comprehensive set of validation checks on updated objects before they are committed to the production database. These validation checks must comply with the IHO S-58 and S-158 standard for validation of ENC products, ensuring data integrity and consistency according to international requirements.	Must	

Paper Chart– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
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7.10*	The system should support management of date-related information for all charts, including issue date, last check date and a log of updates, ensuring full traceability and version control.	Should	
7.11	The system should be able to perform validation checks on paper chart outputs to detect potential errors, including geometric and topological inconsistencies.	Should	
7.12	The system should be able to apply knockout masking beneath inset maps to prevent underlying map content (e.g., text and geometry) from appearing within the inset area.	Should	
7.13	The system should be able to perform map frame validation to detect nodes located outside the map area.	Should	
7.14*	The system should support clipping of adjacent or overlapping areas against each other.	Should	
7.15	The system should be able to perform validation to ensure full coverage (“skin of the earth”) and detect missing or overlapping (duplicate) areas.	Should	
7.16*	The system should perform metadata validation of POD charts by comparing them with the previous run (14 days prior).	Should	

8. Data editing

ENC– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
8.1*	The system should allow the user to define their own objects (outside the S-57/S-101 standard) for internal use, such as polygons with user defined attributes for use in production.	Should	
8.2	The system should support retrieving an objects coordinates/position and query a given position.	Should	
8.3*	The system should be able to handle multiple layers, change priority to layers and let user adjust transparency.	Should	
8.4	The system should provide support for setting data layers visible/not visible.	Should	
8.5	The system should provide support for functionality to use mouse to define an area to zoom to, as well as the ability to lock zoom.	Should	
8.6	The system should have the opportunity to set bookmarks for AOIs.	Should	
8.7	The system should provide support for functionality to go back to last level of zoom.	Should	

8.8	The system should provide support for functionality to zoom to user defined scale.	Should	
8.9	The system should provide support for measure distance in relevant units.	Should	
8.10*	The system should provide support for merging topologies such as areas and lines.	Should	
8.11	The system should provide the opportunity to find and delete orphan geometry.	Should	
8.12*	The system must be able to establish correct topology both manually and by copying from other layers.	Should	
8.13*	The system should provide support for performing spatial analysis such as buffer, overlay and distance, as well as spatial analysis across different layers.	Should	
8.14	The system should provide support for undo and redo edits.	Should	
8.15	It should be possible to set edit tools to snap to vertex, edge or intersection. Snap tolerance must be adjustable.	Should	
8.16*	It should be possible to display and edit information in attribute table format or similar.	Should	
8.17*	It should be possible to edit geometry in multiple ways: -Type accurate coordinates -Paste coordinates -Digitize on the screen by mouse -Move/update existing geometry	Should	
8.18	The system should support functionality to calculate and display area and length of geometry.	Should	
8.19*	The system should support that objects found in a query based on attributes can easily be found on the map.	Should	
8.20	It should be possible to query inside a user defined polygon.	Should	
8.21	It should be possible to create a query on data found in a previous query.	Should	
8.22	It should be possible to save any query made by the user.	Should	
8.23*	It should be possible to change the feature class of an object, e.g. change an UWTROC to a SOUNDG	Should	
8.24	It should be possible to split areas and line features.	Should	
8.25	It should be possible to split and delete data inside a selected polygon (cookie cut).	Should	
8.26*	The system should provide the opportunity to set predefined rules for how object types interact, such as cutting submarine cables against land areas to avoid such object types crossing coastline.	Should	
8.27	The system should provide the functionality to go through a list of queried objects, zooming to objects as user goes through list. How far into the list the user had paused, will be remembered by the system, even if user stops using the query to perform other task in data set.	Should	

8.28	User should be able to determine selectable layers from all layers. System should allow selecting features only from those layers that user has defined to be selectable layers.	Should	
8.29	It should be possible to see all feature objects and attributes in a position defined by a mouse click, simultaneously for all layers/files and background layers/files in the same window. To be able to compare attributes and geometry.	Should	
8.30	System should show how many features have been selected and from which layers selected features are from.	Should	
8.31*	The system should support updates of multiple objects based on queries. The user shall be able to define a selection of objects based on attributes, geographical area or both.	Should	
8.32*	A modification to a line that defines the boundary of a surface/area with shared geometry will result in all affected surfaces being updated simultaneously. Shared geometry must be maintained in accordance with S-57/S-101 standards (chain-node topology, ISO 8211 standards).	Must	
8.33*	The system should provide support for copying objects including geometry and attributes from other data sets/files into active layer.	Should	
8.34*	It should be possible to edit attributes in multiple ways: -Type value -Batch values for many features at same time -Multiscale features attributes should be possible to edit once from one place.	Should	
8.35	The system should provide drop down menus for allowable values when relevant.	Should	
8.36	The system should provide the functionality of visualizing a circle with a given radius around the mouse pointer for the user to easily assess the distance between objects. The user shall be able to adjust the radius of the circle, as well as set it to different units such as meters and mm.	Should	
8.37	User can at any time edit layer symbolization on the fly (colour, point marker size, line width, symbol transparency, visualization order, fill colour, edge colours and size) to help the editing process. Data shall be seen easily when the data is overlapping with each other.	Should	
8.38*	The system shall provide functionality related to testing and error handling, including: - automatically fix certain warnings and errors - the option to manually selects which parts of the test to run - the ability to sort and scroll through the test - the list of warnings, errors and criticals must be connected to the geometry to be easily found in the chart - option to develop our own tests - zoom in to area generating issues in the test	Should	
8.39*	SOUNDG/UWTROC selection must ensure safe and efficient navigation and complement depth contours by keeping any depth points that would not be expected by looking at the	Should	

	depth contours alone. The system must, the greatest possible extent, be able to automate the selection of soundings and underwater rocks by considering: - neighboring topography - category, such as underwater rock, quay depth etc. - the overall terrain (narrow straits etc) - depth contours and coastline - non-bathymetry data such as pontoons It must be easy to manually select/unselect single points by mouse for either inclusion or deletion. This function must also be available for vector data.		
8.40*	The system should support bundling of soundings in an easy way.	Should	
8.41*	The system should provide the means to create queries on values connected to geometry, such as the z-value of an edge. It will be possible to perform basic queries on z-value and present selection for further use.	Should	
8.42*	The system should provide tools for automatically integration of new survey data into existing ENC, based on both geometry and features. This can include all types of ENC objects, not only depth information. (See 3.19 for bulk/automated population)	Should	
8.43*	The system should have the opportunity to define and display a safety depth contour.	Should	

Paper Chart– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
8.44	The system should provide functionality to use PDF, GeoTIFF and other relevant file formats as transparent background layers in paper charts to support editing and production workflows.	Should	
8.45	The system should provide search functionality within individual charts and across the entire chart portfolio, enabling efficient retrieval of relevant data.	Should	
8.46	The system should support common map projections, including Gauss-Krüger (Transverse Mercator), Mercator, UTM and stereographic projections.	Should	
8.47	The system should provide search functionality for place names across the entire chart portfolio, including search by name and place identifier.	Should	
8.48*	The system should support automatic abbreviation of place names based on predefined rules.	Should	
8.49*	The system should support automatic splitting of place names where required for cartographic representation.	Should	

8.50*	The system should support automatic generation of grouped lists for place names.	Should	
8.51	The system should support fonts and sizes in accordance with current practice, as defined in existing procedures, using attributes from S57.	Should	
8.52	The system should support functionality to horizontal space the display of place names when required.	Should	
8.53	The system should support placement of place names along lines and curves, such as along fjords, rivers or coastlines.	Should	
8.54	The system must support handling of multiple language variants for place names, including Norwegian, Sami and Kven, with defined priority order and full support for special characters.	Must	
8.55	The system should allow working on a larger set of changes within a chart and only commit the changes to the main database once they have been completed and approved.	Should	
8.56*	The system should provide support for a “Paragraph” data type, allowing storage and presentation of structured text blocks.	Should	
8.57	The system should provide a simple search function to locate and open a specific paper chart.	Should	
8.58*	The system should support updating a defined area of the map, including cut-and-paste operations.	Should	
8.59*	The system should provide standard GIS editing capabilities, including data search, feature manipulation (move), merging, and generalization.	Should	

9. Production management and Monitoring

ENC– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
9.1*	The system should be able to handle multiple users within the same geographical area. It should be possible to publish ER-updates while another user is working on a new edition.	Should	
9.2*	The system should display ongoing working areas. The system should have a functionality to display both as a list and graphically ongoing active tasks and areas and their statuses.	Should	
9.3*	When a user is working on a set of changes in the database, and abandons the work (due to vacation, other priorities, etc.), it must be possible for another user to clean up the work, including unlocking objects if applicable.	Should	

9.4*	The user should be able to pause ongoing task, save and resume task later.	Should	
9.5*	Any new object created should automatically be distributed to relevant products (ENC and/or paper chart). The distribution process shall be documented in a way that ensures easy verification of the object having been correctly handled.	Should	
9.6*	The system must provide an easy-to-read overview of the status of each ENC and associated workflow. It shall be simple to identify which ENC are being processed, controlled, approved or published.	Should	

Paper Chart– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
9.7*	The system should provide functionality for handling metadata, including support for product accounting, coverage management and date management for paper chart products.	Should	
9.8*	The system should support management of the paper chart portfolio, including handling of chart status such as published, planned and archived.	Should	

10. ENC and Paper Chart product

ENC– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
10.1	The system must have support for the S-57 and S-101 (import, edit and export).	Must	
10.2	The system should support presentation according to the S-52 and S-101 Portrayal Catalog (standard, full, base display) during production/editing.	Should	
10.3*	Rounding rules: it must be possible to adjust the number of decimal points for objects such as soundings, underwater rocks, obstructions and wrecks and any rounding must be towards the safe side both when data is entered in the	Should	

	system and during map production. Rules should be adjustable for different depth intervals.		
10.4	The system must support the Norwegian, Kven and Saami alphabet.	Must	
10.5*	The system should include a product management view for ENC providing an overview of all existing products, versions, and publication dates.	Should	
10.6	The system must be able to handle exact sector lengths and present them correctly according to S-101.	Must	
10.7*	ENC - dual fuel: It must be able to edit in one standard and distribute in both standards (new edition and updates).	Must	
10.8	The system should support opening several windows in the same software to do a side by side comparison of S-57 and S-101 data.	Should	
10.9*	The system should automatically support digital signatures for ENCs and support files when the exchange set is created (S-101 compliant).	Should	
10.10	The System must support creation and cancelling of S-57 and S-101 EN cells.	Must	
10.11*	If the produced ENC cell or ER contains errors, user should have possibility to easily reverse the process.	Should	
10.12*	The system must be capable of handling any support file allowed by S-57 and S-101.	Must	
10.13*	The system must be able to safely smooth and generalize depth contours, depth areas, coastline, land areas and constructed coastline for different scales towards safe side (e.g. Douglas-Peucker, Mc Master algorithms). This should also be possible for features found in a query or a manually chosen edge. This function must also be available for vector data.	Should	
10.14*	It should be possible to easily merge isolated shallower depth areas of matching attributes with each other or larger appropriate depth areas. It would also be appreciated to have a tool where areas can be selected to be automatically merged.	Should	
10.15*	The system should be able to automatically generalize data from one usage band to the next while ensuring consistency between usage bands is maintained. The parameters of generalization should be manually adjustable. Identical parameters should consistently yield identical result if run on identical data. This function must also be available for vector data and has to be shoal biased.	Should	
10.16*	The system should be able to fill inn holes in topology created by deleting TG1 objects from surrounding object. E.g. if a 20-30m DEPARE is completely surrounded by one 15-20m DEPARE and the 20-30m DEPARE is deleted, the hole shall be filled with the 15-20m DEPARE.	Should	

10.17	The system allows the compilation scale of an ENC to be changed.	Must	
10.18*	Scamin values for features should be added automatically to ENC based on HO's predetermined values. It shall be possible for the operator to modify scamin values for selected objects. This modification should be stored for future use.	Should	
10.19*	It should be possible to publish several changes in one ER-file.	Should	
10.20*	The system should provide the option to choose what changes to the database that will be updated in ENCs and when. Less significant updates can be postponed and published along with a more significant update as ER or NE.	Should	
10.21	It should be possible to set the edition number manually if necessary.	Should	
10.22	It should be possible to visualize a user defined grid. This would make it easier to keep track of work progress when working on larger common compilations. For this reason it should be possible to mark sub sections as completed.	Should	

Paper Chart– Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C
10.23	Maps must be exportable to PDF, georeferenced PDF and GeoTiff.	Must	
10.24*	The system should support automated scheduled production runs in batches.	Should	
10.25	The system should have ability to execute processing during nighttime.	Should	
10.26	The system should allow selection of charts for production based on update status, including the option to process only charts that have been updated since the previous POD run or all charts.	Should	
10.27*	The system should include POD date information in the chart frame, including the date of the latest edition and the reference to the applicable Ntm/date used for updating the chart.	Should	
10.28	The system should support inclusion of reseller logos as selectable layers within the generated PDF files.	Should	
10.29	The system must support INT-1 chart frames.	Must	
10.30*	The system should support the use of a secondary grid, including UTM grid.	Should	
10.40	The system should support annotation of grids in accordance with INT-2 frame standards.	Should	

10.41*	The system should support creation of chart frames for insets and special charts with non-rectangular shapes.	Should	
10.42*	The system should support configurable templates for consistent layout and formatting of marginal information surrounding the chart frame.	Should	
10.43	The system should support inclusion of a UTM reference diagram showing how to read UTM coordinates from a point in the chart.	Should	
10.44*	The system should support inclusion of a tidal information box displaying tidal corrections for a relevant nearby location.	Should	
10.45	The system should allow editing of map frame information, including the addition of elements such as QR codes.	Should	
10.46	The system should support insertion of image files, such as logos and QR codes, into chart layouts.	Should	
10.47*	The system should support generation of a ZOC diagram at 1/10 of the chart scale, showing areas with different data quality categories (CATZOC A1, A2, B, C, D and U).	Should	
10.48	The system should support efficient updating of the ZOC diagram when new data becomes available.	Should	
10.49	The system should support importing sector light data from external datasets in standard geospatial formats (e.g. S-57, S-101, GML, GeoPackage, GeoJSON or equivalent) while maintaining the geometry, attributes and relationships associated with the imported data.	Should	
10.50	The system should support symbolization of sector lights using arcs, sector lines, colour annotations (R, G, W), light names and characteristics, in accordance with INT symbol standards for international charts.	Should	
10.51*	The system should support handling of sector lights located outside the chart area that illuminate the chart.	Should	
10.52*	The system should support efficient updating and replacement of sector lights in connection with re-separation or adjustment of lights.	Should	
10.53*	The system must support display of leading lines in accordance with INT-1 standards.	Must	
10.54*	The system must support functionality for compass roses, including a simple and efficient user interface for updating compass roses with minimal manual effort.	Must	
10.55	The system should support selection between multiple compass rose sizes.	Should	
10.56	The system must support importing magnetic variation (MAGVAR) from S-57 and S-101 files and presenting this information as Isogones with annotations in paper charts.	Should	
10.57	The system must support the use of the INT-1 symbol library for international (INT) charts.	Must	

10.58	The system should support representation of bathymetric lines and depth values in accordance with INT symbol standards.	Should	
10.59	The system should support editing of contour labels, including the ability to move, create and modify contour values.	Should	
10.60	The system should support masking of contour labels to improve readability.	Should	
10.61	The system should support controlled symbolization of depth values based on defined rules, including handling of decimal precision.	Should	
10.62	The system should support manual editing of depth values and sounding data, including decimal adjustment, merging and generalization.	Should	
10.63	The system should support color coding of depth areas, including categories such as drying areas, shallow areas and harbor areas.	Should	
10.63	The system should support automatic underlining of quay depth values.	Should	
10.64	The system should support symbolization of shoals based on defined rules, including symbol type, placement of depth values and decimal handling.	Should	
10.65	The system should support search functionality for small contour features, small areas (e.g. islands) and isolated drying features.	Should	

11. Process Control and Workflow Management

ID	Delivery requirements	Requirements type	Response code A/B/C
11.1*	It's preferred that the system comes with integrated support for workflow management, a single overview of all updates with the option to set priorities, deadlines, allocate resources, and see the status of any given task. It must be possible for the customer to configure this template.	Should	

12. Safety and Contingency Requirements

ID	Delivery requirements	Requirements type	Response code A/B/C

12.1*	Detection and Reporting of Vulnerabilities The vendor must document established routines for continuous monitoring and vulnerability analysis of their own systems and its supply chain. • describe how the system is continuously monitored • explain how vulnerabilities are identified, assessed and remediated with timelines and prioritization of scanning, penetration testing and use of automated tools • provide examples of how monitoring and vulnerability data is reported and governed with reporting templates and governance structure	Must	
12.2*	Security in the Supply Chain The vendor must document a complete list of subcontractors' roles, location and jurisdiction that are involved in the delivery and what security requirements are imposed on them. There must be established routines for control, audit, and follow-up of security measures at subcontractors	Must	

These requirements serve as a baseline for evaluating the vendor's ability to deliver a secure, reliable, and compliant nautical production system. Vendors must demonstrate that their practices are not only documented but actively implemented and continuously improved. The comprehensiveness and maturity of these controls will be key factors in the assessment and selection process.

13. Compliance and documentation

This section outlines the essential non-functional requirements that vendors must meet to ensure the proposed solution is secure, reliable, compliant, and operationally robust. These requirements reflect best practices and internationally recognized standards across key domains relevant to nautical production systems.

Each requirement is designed to ensure the vendor's solution aligns with regulatory obligations, industry standards, and operational expectations necessary for long-term success and resilience.

ID	Delivery requirements	Requirements type	Response code A/B/C
13.1	The vendor should implement and maintain a documented process for information security incident management in	Should	

	accordance with ISO/IEC 27001 and ISO/IEC 27035, or an equivalent standard. This process must include: • Procedures for logging, categorizing, and reporting security incidents and deviations. • Clearly defined roles and responsibilities for incident handling. • Established escalation paths for timely response and resolution. • A framework for post-incident analysis to identify root causes and implement corrective actions.		
13.2	The vendor should have a certified Quality Management System (QMS) in place, compliant with ISO 9001 or an equivalent internationally recognized standard. The QMS must ensure consistent delivery of products and services that meet both customer expectations and regulatory requirements.	Should	
13.3	The vendor should adhere to recognized cybersecurity frameworks and practices to ensure the protection of systems, data, and services. The vendor shall provide documentation showing implementation or alignment with a formal cybersecurity framework such as NIST Cybersecurity Framework (CSF), ISO/IEC 27001, or equivalent.	Should	
13.4	The vendor should comply with ISO 31000:2018 – Risk Management, or an equivalent internationally recognized standard. This includes having a structured risk management framework, documented policies and procedures, and evidence of implementation and competence.	Should	

In addition, the vendor must comply with statutory requirements:

- EU General Data Protection Regulation (GDPR) ensuring lawful, fair, and transparent processing of personal data, appropriate data protection measures, and adherence to data subject rights
- National Security Act, particularly in relation to protective security work, classified procurements, and handling of critical national infrastructure and information systems
- Norwegian Public Procurement Act, including principles of competition, transparency, equal treatment, and proportionality in all procurement-related activities
- Vendors must align with the Norwegian National Security Authority (NSM) principles for ICT security
- The system shall comply with the Norwegian Geodata Act (LOV-2010-03-19-8) and support the production and management of geographic information in accordance with national standards.
- The system shall support the production of nautical geospatial data in accordance with the INSPIRE Directive (2007/2/EC)

14. Technical Architecture and Non-Functional Requirements

This section outlines the required technical characteristics and performance expectations of the proposed solution. The vendor shall provide detailed descriptions of the system architecture, scalability, reliability, performance, and availability, as well as how the solution is maintained and updated over time.

ID	Delivery requirements	Requirements type	Response code A/B/C
14.1*	The vendor must provide a comprehensive description of the overall system architecture. This must include: • Technology stacks and supported platforms • Compliance with relevant architectural standards or frameworks An architectural diagram should be included to illustrate the system's structure and components, if available.	Must	
14.2*	The vendor shall ensure that the proposed solution supports both horizontal and vertical scalability to accommodate future growth in user volume, data size, and system functionality. The architecture must be capable of scaling efficiently by adding resources to existing components (vertical scaling) or by distributing load across additional components or nodes (horizontal scaling).	Must	
14.3*	The system must maintain consistent performance levels under increased demand, ensuring stable response times, availability, and reliability without degradation. The solution shall support configurable performance thresholds, such as maximum acceptable load times, to meet operational and user experience requirements. The vendor shall describe the scalability mechanisms, performance optimization strategies, and any architectural limitations. Documentation or references to previous implementations demonstrating successful scalability and sustained performance under defined thresholds shall be provided upon request.	Must	
14.4	The system shall be fast and responsive when displaying, updating, and validating data. The user experience shall not be negatively affected by data volume or complexity.	Should	
14.5*	The system must support:	Should	

	▪ Integration with common identity providers such as Azure Active Directory, SAML, and OAuth for secure and flexible authentication ▪ Open standards for interoperability, including REST, and OGC standards relevant to GIS systems The vendor shall describe how these requirements are met and provide documentation or references to supported technologies and standards.		
14.6*	The vendor shall ensure that a clear and secure exit strategy is in place to support the customer's transition away from the solution. On exit the vendor must enable the customer to migrate all data out of the system, with no exception for proprietary, internal or vendor-specific structures.	Should	