

IHO MASS PT S100 Gap Analysis

Member State/Organization	Canada
S100 Standard Reviewed	S-129
Maturity of Standard	Reasonably mature at V1.0 (issued 2019) – live testing done - updates planned for 2023
S100 Standard Chair	S129 – Jason Rhee (Aus) – j.rhee@omcinternational.com

Issue/Requirement (take from Spreadsheet)	Issue addressed?	More content?	Gap in standard?	Potential Solution/s	Ease to implement?
MASS will require fairways to be captured as polygons and features in their own right.	<input type="checkbox"/>	✓	<input type="checkbox"/>	<p>The gap is in other standard like S101 but will affect S-129</p> <p>Areas requiring UKC will need to be identified (and defined) as objects (polygons), in order for proper MASS planification and operation, conform with regulated areas.</p>	Easy
MASS will require port areas/limits to be captured as polygons with relevant attribution.	<input type="checkbox"/>	✓	<input type="checkbox"/>	<p>The gap is in other standard like S101 but will affect S-129</p> <p>Areas requiring UKC will need to be identified (and defined) as objects (polygons), in order for proper MASS planification and operation, conform with regulated areas.</p>	Easy

IHO MASS PT S100 Gap Analysis

<p>MASS will require the natural language data in publications, charts (pick reports) and MSI to be made machine readable and interpretable. Natural language is difficult for machines to read and interpret, we need to move to a feature and attribute model for all aspects of data for MASS. This will also need to cover meta data for the actual data.</p>	<input type="checkbox"/>	✓	<input type="checkbox"/>	<p>The gap is in other standard like S101, S-126, S-131 but will affect S-129</p> <p>Information pertaining UKC Areas (regulation, operational process, communication info, etc..)will be required in language readable and interpretable by machine</p>	Moderately
<p>MASS will require more frequent or real-time updates of the data contained in the S100 products, which should be pushed from official sources that the vessels can 'listen' out for and update their navigational database and products automatically irrespective of where they are in the world. Event driven data updates and near real time updates will be required for MASS as MASS will always need to be up to date.</p>	<input type="checkbox"/>	✓	✓	<p>The update rate might need to be more frequent for better planning and operation purpose.</p> <p>As of now, a UKC plan is sent 24h previous, and then 5-10 minutes prior to passage. Maybe several intermediate updates will be necessary (eg: 12h-6h-2h-1h-...)</p> <p>Requires only push of ship data, recompilation of passage data by UKC agency, and pull of data by ship</p>	Easy
<p>The communication infrastructure necessary to sustain data exchange is not reliable and affordable today. Thought needs to be given to data packets sizes for data and updates for MASS.</p>	✓	<input type="checkbox"/>	<input type="checkbox"/>	<p>The size of S-129 exchange set does not seem to be large.</p>	Choose an item.
<p>MASS will require full bathymetric coverage datasets/DTM, gaps in data will pose a problem for MASS.</p>	✓	<input type="checkbox"/>	<input type="checkbox"/>	<p>The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to make the plan, therefore a lack of data is not an issue per se.</p>	Choose an item.

IHO MASS PT S100 Gap Analysis

<p>To avoid large volumes of bathymetric data (i.e. S102 gridded data), there is a need for conspicuous seabed features to be highlighted (such as sea mounts, obstacle or trenches) for use with Inertial Navigation Systems in GNSS denied environments. Similar to land based visually conspicuous objects captured in ENCs today.</p>	✓	<input type="checkbox"/>	<input type="checkbox"/>	<p>The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to make the plan, therefore a lack of data is not an issue per se.</p> <p>In GNSS denied environment, data might be necessary in order for MASS to position itself to follow plan.</p>	Choose an item.
<p>MASS will require certainty of seabed and associated features. High resolution data is great, but if it changes regularly, then that needs to be made clear and articulated in some way (example Humber estuary). Understanding when highly mobile seabed was last surveyed will also be important.</p>	✓	<input type="checkbox"/>	<input type="checkbox"/>	<p>The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to make the plan, therefore a lack of data is not an issue per se.</p> <p>In GNSS denied environment, data might be necessary in order for MASS to position itself to follow plan.</p>	Choose an item.
<p>MASS will require an understanding of the reflective nature of the seabed, possibly associated with grab sample data for use in Inertial Navigation Systems.</p>	✓	<input type="checkbox"/>	<input type="checkbox"/>	<p>The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to make the plan, therefore a lack of data is not an issue per se.</p> <p>In GNSS denied environment, data might be necessary in order for MASS to position itself to follow plan.</p>	Choose an item.
<p>MASS will require an understanding of the acoustic qualities of the water column for Inertial navigation Systems.</p>	✓	<input type="checkbox"/>	<input type="checkbox"/>	<p>The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to make the plan, therefore a lack of data is not an issue per se.</p>	Choose an item.

IHO MASS PT S100 Gap Analysis

				In GNSS denied environment, data might be necessary in order for MASS to position itself to follow plan.	
MASS has an issue with edge matching on charts. Often there is a discontinuation of data, particularly on depth contours. Described as a "leap of faith" when transitioning from one chart to another.	<input type="checkbox"/>	✓	<input type="checkbox"/>	The gap is in other standard like S101 but will affect S-129 Areas requiring UKC will need to be identified (and defined) as objects (polygons), in order for proper MASS planification and operation, conform with regulated areas.	Easy
MASS will require shipping lanes to be made available and captured as polygons with suitable attribution.	<input type="checkbox"/>	✓	<input type="checkbox"/>	The gap is in other standard like S101 but will affect S-129 Areas requiring UKC will need to be identified (and defined) as objects (polygons), in order for proper MASS planification and operation, conform with regulated areas.	Easy
MASS will require certainty of tidal heights and surface currents at a given point and time, particularly in congested water space and shallower waters. Bramble bank in UK was used as an example, being shoalier by 0.5m could lead to a grounding. Predicted and forecast tidal height and surface currents are essential but certainty factors surrounding the predictive nature is important for decision making and risk profiling a route for MASS.	✓	<input type="checkbox"/>	<input type="checkbox"/>	The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to make the plan, therefore a lack of data is not an issue per se.	Choose an item.

IHO MASS PT S100 Gap Analysis

<p>MASS will require more geographical polygons to describe areas (such as speed restriction and constraints), with suitable attribution for MASS to interrogate and act appropriately. This information is often captured in text boxes, Sailing Directions or Pick Reports in natural language with very little geographic descriptors, making it impossible for MASS to interrogate, read and act upon. These could be created as instructional layers which are geographically location based containing attribution such as name of feature, type of feature, unique number, reason for speed restriction or constraint etc in a machine readable format.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>The gap is in other standard like S101, S-126, S-131 but will affect S-129</p> <p>Information pertaining UKC Areas (regulation, operational process, communication info, etc..)will be required in language readable and interpretable by machine</p>	<p>Moderately</p>
<p>MASS will require communication zones to be captured as polygons with appropriate attributes. As an example currently the rules for radio communications are within the Admiralty list of radio signals volumes 1-6, these volumes are particularly difficult for an autonomous vessel to understand.</p>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>The gap is in other S-100 standard, but info will be required to enable data exchange for UKC plan transmission</p>	<p>Moderately</p>
<p>MASS will require real time tidal data which is crucial in shallower waters.</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>The UKC plan will provide the ship navigation plan, therefore, MASS doesn't have to analyze data to</p>	<p>Choose an item.</p>

IHO MASS PT S100 Gap Analysis

				make the plan, therefore a lack of data is not an issue per se.	
MASS will need to know where reporting points or areas are geographically. As an example knowing at what point to contact Falmouth Coastguard to say whether you were passing between UK mainland and the Isles of Scilly or not.	<input type="checkbox"/>	✓	<input type="checkbox"/>	Reporting points might be used for UKC plan updating. Information pertaining UKC Areas (regulation, operational process, communication info, etc..)will be required	Choose an item.
MASS will require polygons denoting what level or Degree of MASS operation is allowed. As an example Degree 4 may not be allowed in a port. MASS and MASS operators will need to know what areas they can go into or not as they may need to move from Degree 4 to 3 when entering specific areas.	<input type="checkbox"/>	✓	<input type="checkbox"/>	The gap is in other standard like S101, S-126, S-131 but will affect S-129 Information pertaining UKC Areas (regulation, operational process, communication info, etc..)will be required in language readable and interpretable by machine	Moderately
MASS will require precise information regarding the interface between autonomous and human operation at points such as mooring operations, canal transit	<input type="checkbox"/>	✓	<input type="checkbox"/>	The gap is in other standard like S101, S-126, S-131 but will affect S-129 Information pertaining UKC Areas (regulation, operational process, communication info, etc..)will be required in language readable and interpretable by machine	Moderately

IHO MASS PT S100 Gap Analysis

Description (high level):

- S-129 is a vector product specification: extent and nature of UKCM info
- The Ship's master selects approximate time window (ship's passage plan)to transit through area and sends info (draught, stability, speed, position,...) to UKCM provider. The UKCM provider completes calculations, and sends a UKCM plan back. The UKCM plan contains a route (vector) with control points. Plan is updated and validated as ships arrives near (under) the UKCM area.

Questions (answers from S129-WG chair):

- How will communications be done with UKCM provider (data transfer)? Is communication infrastructure/protocols machine to machine ready? (Does it link to VTS?)

The current PS states that the S-129 dataset distribution media or transmission method is at the discretion of the of the producer.

As an example, OMC International currently provides a web API to which an end user product can connect to, and retrieve S-129 datasets.

A possible limitation for potential UKCM areas is the dataset sizes, should a very large area is to be covered.

From MASS perspective, does communication assume a certain level of 'commercial' network connectivity by either terrestrial or satellite communications?

- Is there a way to automatically trigger the exchange of data from the ship to UKCM provider?

If end-user software/interface is set up to automatically receive live updates, exchange of the latest S-129 data can happen automatically, at certain refresh/update rates.

MASS might need more UKCM plan updates, other than 24h prior, then 5-10 min prior, and as it progresses? Maybe 12h-6h-2h-1h updates prior to estimated passage. Is it possible?

The UKCM service is able to provide updates in more frequent intervals leading up to the passage.

Hence, as long as the consumer software is able to receive live updates, data exchange intervals such as proposed would be possible.

I will revisit the S-129 PS Section 7.1.1, as it may not be providing a clear indication of the expected update intervals of "actual plans".

However, Sections 7.1.2 and 15.1 seem to outline the following:

IHO MASS PT S100 Gap Analysis

Section 7.1.2: “Approximately 24 hrs before the time when a ship enters the UKCM area, the ship will need a more detailed UKC plan. This plan usually considers more up to date information and will typically need to be updated more frequently. In this case, the non-navigable and almost non-navigable areas, any tidal windows (via Control Points), and some metadata will have changed. Depending on the variability of the met-ocean conditions, the update frequency could vary between 10 and 60 minutes.” (From S-129 UKCM PS Ed 1.0.0 Final(13Mar19).docx)

Section 15.1: *“About 24 hours before the time when the ship enters the UKCM area the ship will need a more detailed passage plan, which will be updated more frequently. Depending on the variability of the observed and forecast conditions in the UKCM area, the update frequency might range between 10 minutes to 60 minutes.”*

- Is there a way (imbedded data exchange protocol mechanism - back and forth validation checks) to confirm reception, acknowledgement of reception of plan by MASS? In the same way confirmation that plan will be followed by MASS as provided? (I saw the action pt5 in the last WG meeting document on data encryption.)

Acknowledgement of reception by the data consumer doesn't seem to be mandated by S-100 (but I may be wrong, I can double check), nor in scope of current S-129 PS.

I also had a look at S-100 14-8.2.4 (S-100_OC_ExchangePattern), but from what I'm understanding, it does not seem to cover consumer's response back to the provider.

Action item PT5-5 around data encryption requirements is not something I had a chance to clarify yet. I am happy to keep you updated on this.

- Is the ship master required to validate plan or is the UKCM provider fully responsible for the issued plan? in the sense that ship maser is ultimately responsible for all navigation maneuvers... if ship master is responsible, how will the MASS be able to assess the validity of the plan, in the case of lack of data (bathymetry, water level,...)?

While the UKCM service enforces a level of validation checks of plan inputs, the user (e.g. ship master, pilot, VTS) is ultimately responsible for providing the accurate inputs.

IHO MASS PT S100 Gap Analysis

Currently, I'm unsure what the best method would be to enable MASS to assess the plan validity. Perhaps some form of new attribute or accompanying metadata could be used to indicate if an S-129 output is valid or not? E.g. to indicate the status of bathymetry or water level underlying the S-129 calculation?

As far as I'm aware, this is currently out of the S-129 scope, but it's something the PT can think about, and I'm happy to discuss ideas.

- Will the route and way points account for other ships' passage (same and opposite direction) at the same time in the UKCM area? Or will it be a general route (like middle of passage way)? If it is general, MASS will have to create its derived precise navigation plan in order to account for surrounding navigation.

In terms of the extent and location of the route and waypoints, they would reflect a "general route" in S-129.

Expected passing time & speed at each waypoint would be predetermined by calculations in the UKCM service based on user input (such as route, speeds), which may have taken traffic into account.

Are you aware of any other S-100 standards (such as S-421, maybe?) that might be dealing with MASS encounters with other vessels?

- Are there free text fields? Or all field with textual information contain predefined choices?

Under the current specification, all attributes are defined with required types.

While there are textual attributes as currently specified in the S-129 PS, they would be predetermined by the UKCMS service. For example, the UKCM service for a particular a port or waterway should provide "route name" from predefined options.

Comments (notes from S129-WG chair):

- UKCM areas will need to be defined as polygons, and all information pertaining them will need to be machine readable. (independent of S-129 standard) *Do we know what format MASS requires the polygons to be in? Would it be .GML or otherwise?*
- MASS doesn't need to use available data to calculate time window and route. MASS must use UKCM plan provided.
- MASS doesn't require display features imbedded in the S129 product.
- Any field with free text cannot be analyzed properly by MASS. Need predefined choices, predetermined remarks fields...
- Involvement with pilotage authorities if UKCM area is under their responsibility.

IHO MASS PT S100 Gap Analysis

IHO MASS PT S100 Gap Analysis

MASS GAP analysis

- In conjunction with the issues and requirements spreadsheet, use the attached template and use one template per standard you are looking at (i.e. if you have 2, then you will create 2 forms). ✓
- Enter the information at the top of the form to capture your country or organisation, the S100 standard you have assessed, the maturity of that standard and who is the chair of the standard WG or PT. ✓
- Look at all of the issues captured and assess against your standard. I have suggested the appropriate standard per issue, but that is from my own understanding and I may have missed something, so please be thorough. ✓
- Ensure you find out the current state of the standard/s you have been assigned, for example S101 is undergoing review, so I will ensure that UK speaks to the chair of the S101 PT to make sure that the latest version is assessed as the new changes may address some of the concerns. ✓
- Ascertain if each issue or requirement from the spreadsheet, relevant for your standard is either met and no further action is needed, the standard caters for the issue but HOs may want to consider adding more content (example more land based contours) or is unmet and therefore there is a gap identified in the standards. ✓
- Please have a go at suggesting a solution for the problem that will address the gap. Be as detailed as you can be, for example there is an issue with natural language text and it not being machine readable, but please don't put a simple statement that says "make all data machine readable". Our job is to help the respective WGs and PTs. ✓
- Also use the pulldown to assess whether the solution you have identified is "Easy", "Moderately" or "Hard" to implement. ✓