



# 15<sup>th</sup> Meeting of the Hydrographic Services and Standards Committee

## **Report of the MASS Navigation Project Team & Recommendations**

### **Maritime Autonomous Surface Ships and S-100**

#### **Agenda Item 15-05.9A**

HSSC-15, Helsinki, Finland, 5 – 9 June 2023



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# PRESENTATION CONTENT

International  
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Organization

1. MASS Problem and context
2. MASS Nav Project Team establishment
3. MASS Nav Project Team work plan
4. Remaining challenges and considerations
5. MASS Nav PT recommendations



## IoT World Today

### SUPPLY CHAIN, TRANSPORTATION & LOGISTICS



## Autonomous Marine Drone Carrier Revealed

It can deploy boats, subs and drones and communicate with them while they are operating autonomously.

Written by Graham Hope 25th May 2022



As the world gets used to the idea of self-operated cars and aircraft, China is taking things to the next level with an autonomous sea vessel that carries an army of more than 50 drones and unmanned ships and submersibles.

The Zhu Hai Yun was produced in Guangzhou by the Huangpu Wenchong Shipyard, a subsidiary of China's largest shipbuilding company the China State Shipbuilding Corporation, and is being hailed as a new kind of "marine species," according to the South China Morning Post, which cited the state-run Science and Technology Daily.

### Related Content

[Argo AI to Run Driverless Robotaxis in Austin and Miami](#)

[IoT Product Roundup: PTC, Nokia, Arm and More](#)

[Tesla Plans 'Many Cool Updates' at Annual Event](#)

[Kia to Build Massive Factory for Autonomous, Electric PBVs](#)

### ROUNDUPS

[View all](#)



**IoT Deals, Partnerships Roundup: Google, Arm, Senet and More**

26th May 2022



**IoT Product Roundup: PTC, Nokia, Arm and More**

19th May 2022



**IoT Deals, Partnerships Roundup: Intel, Nauto, Helium and more**

14th May 2022





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# DEGREES OF AUTONOMY

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- **Degree 1 - Ship with automated processes and decision support (most likely to be a conventional ship):** seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated.
- **Degree 2 - Remotely controlled ship with seafarers onboard:** the ship is controlled and operated from another location, but seafarers are on board (which would include a Periodically Unmanned Ship and a ship with a Periodically Unmanned Bridge).
- **Degree 3 - Remotely controlled ship without seafarers on board:** the ship is controlled and operated from another location. There are no seafarers onboard.
- **Degree 4 - Fully autonomous ship:** the operating system of the ship is able to make decisions and determine actions by itself.



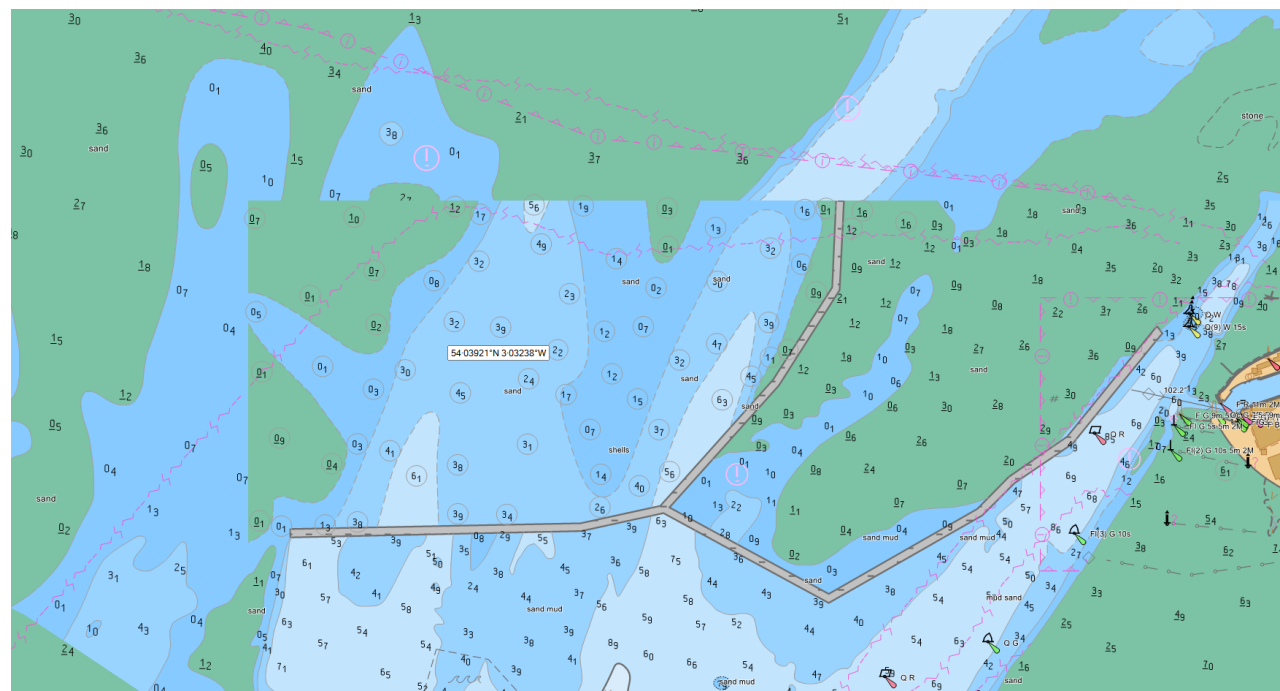


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# CURRENT CHARTS NOT FIT FOR PURPOSE FOR MASS NAVIGATION

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- Charts (ENC) are still fundamentally designed to be viewed and interpreted by a human being
- Charts are a subjective cartographic representation of the real world
- Charts suffer from data inconsistencies
- Charts suffer from horizontal inconsistencies
- A lot of contextual information is captured in text notes
- S-57 will no longer be developed - frozen







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# CURRENT CHARTS NOT FIT FOR PURPOSE FOR MASS NAVIGATION

## APPENDIX I

### *Speed Limits in Certain Areas*

- 10.(1) Except as provided for in paragraph (2) below no vessel shall exceed a speed of 10 knots through the water north of  $50^{\circ} 20'.0$  North (the latitude of Plymouth Breakwater) or any waters of the Dockyard Port within 400 metres of the shore, save with a licence in writing signed by the Queen's Harbour Master.
- (2) Vessel;s under 15 metres in length overall may exceed the speed limit specified in paragraph (1) above in the following areas:
  - (a) Such waters of the Dockyard Port that are outside 400 metres from the shore and in the access lane for water skiers and jet-skiers which is bounded to the east by the line joining Fisher's Nose to the western extremity of Mount Batten Breakwater, and bounded to the west by the line joining the western extremity of the Royal Plymouth Corinthian Yacht Club to the West Mallard Buoy;
  - (b) water skiing Areas shown on current Admiralty charts;
  - (c) Such other areas of the Dockyard Port as the Queen's Harbour Master shall from time to time determine and publish as a local Notices to Mariners.
- (3) No vessel within the Dockyard Port shall exceed a speed of 8 knots through the water to the east of a line drawn from Fishers Nose to the western end of Mount Batten Breakwater, save with a licence in writing signed by the Queen's Harbour Master and where authorised in accordance with paragraph (2) (b) above.
- (4) No vessel within the Dockyard Port shall exceed a speed of 4 knots through the water in the approaches to Sutton Harbour north of a line drawn due east from Fishers Nose save with a licence in writing signed by the Queen's Harbour Master.
- (5) No vessel shall exceed a speed of 4 knots through the water in designated Bathing Areas shown on current Admiralty charts.
- (6) No vessel shall exceed a speed of 4 knots through the water in designated Diving Areas shown on current Admiralty charts.



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# S-100 – MAYBE?

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# **MASS NAVIGATION PROJECT TEAM ESTABLISHED**

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In May 2021 HSSC established the MASS Navigation Project Team with a 2 year remit to carry out the following:-

- To identify and prioritize MASS navigation requirements.
- To analyse their impacts on hydrographic standards and services (i.e. S-100).
- To develop a set of recommendations/issues to be addressed by existing working groups.





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# **MASS NAVIGATION PROJECT TEAM**

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Project team chair – Mark Casey (UK)

Vice chair – Dongli Sun (China)

Secretary – Annie Biron (Canada)

Project Team membership - Brazil, Canada, China, Denmark, Finland, France, Iran, Japan, Norway, Rep of Korea, Sweden, UK, USA, Singapore & Malta.

(A reasonable membership list with a number of MASS activity hot spots covered within the group).

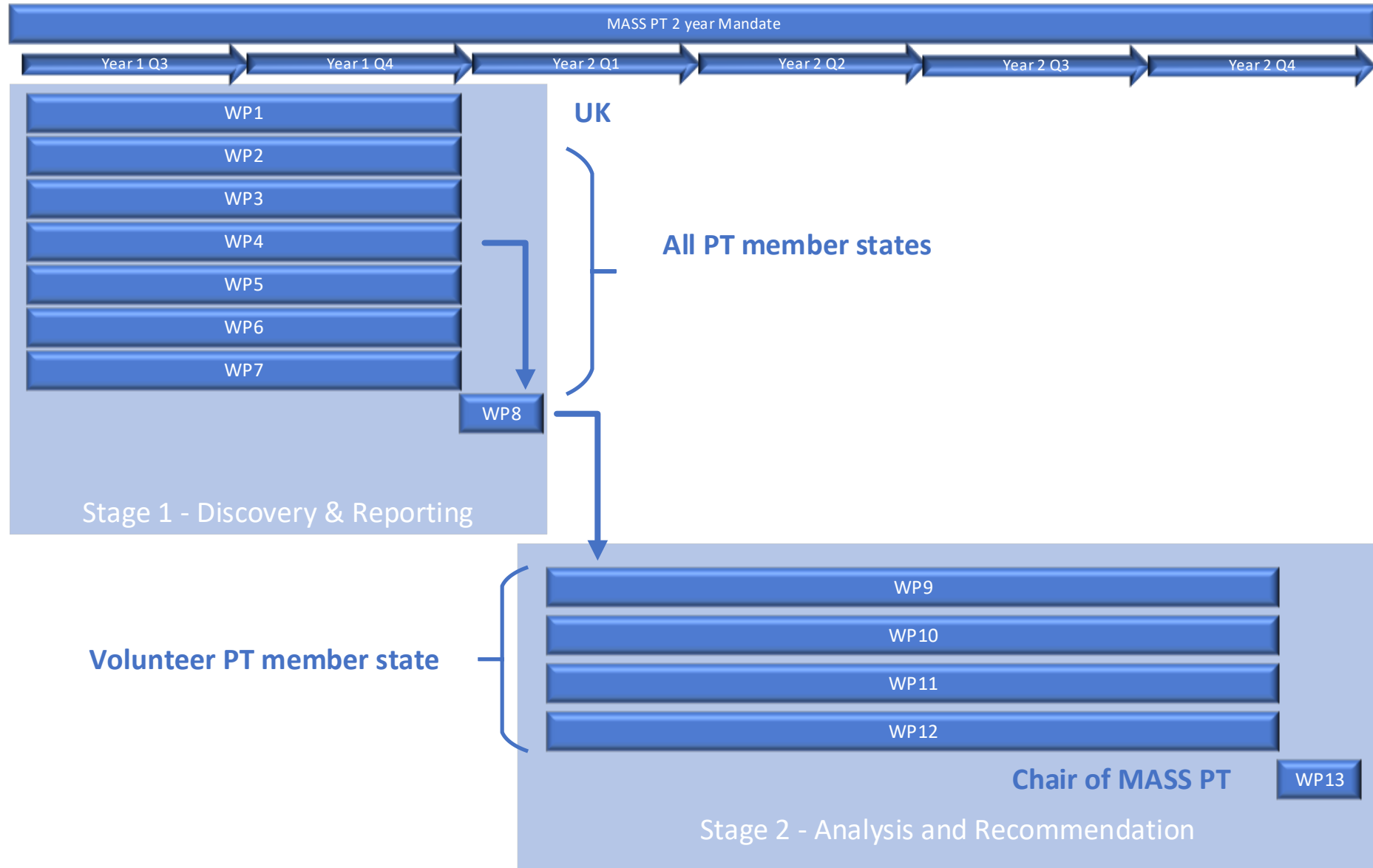




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# MASS NAVIGATION PROJECT TEAM PLAN

International Hydrographic Organization





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# **MASS NAVIGATION PROJECT TEAM ACTIVITIES**

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## Meetings Held During Reporting Period

1. The Inaugural meeting was on 17th December 2021
2. The 2nd was held on the 25th Feb 2022
3. The 3rd was held on the 25th May 2022
4. The 4th was held on the 5th Oct 2022
5. The final and 5th was held on the 25th Jan 2023

All meetings were held online using Microsoft Teams and with the exception of the 4th meeting we had almost 100% attendance.

The use of online meetings allowed the team to move at pace and meet more frequently than in person meetings. This method of working was chosen due to the constrained time lines the Project Team were working to.





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# DISCOVERY AND REPORTING PHASE



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The Discovery and Reporting phase consisted of a number of work packages covering the following activity:-

- Identify and report what test bed activities are happening in each region and which degree of autonomy is predominantly used.
- Report on what data MASS operators and MASS navigation systems are using today.
- Report what navigational data each PT Member States' regulators are specifying should be used for MASS navigation in either trials or operations of MASS.
- To what degree are PT Member States involved in MASS trials or operations and what data are they currently providing.
- Report on what trailing has been done with new navigation standards (e.g. S-100) for MASS, or what research into machine readable data has been carried out in each region?
- Conflation of reports and synthesis of detailed navigation requirements for MASS.





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## DISCOVERY AND REPORTING PHASE



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The reports were consolidated into an Issues and Requirements spreadsheet. In this phase, 45 individual issues and requirements were captured covering a number of themes:-

- Modelling certainty/uncertainty of positions
- Modelling certainty/uncertainty of tidal height information and seabed mobility.
- A need for more visually conspicuous features to be shown along with more land based topography.
- A need for more geospatial polygon features with appropriate attribution to capture constraints and restrictions.
- A need for near or real time data feeds.
- 3D synthetic environments for navigation purposes.
- Removal of verbose natural language text paragraphs to be replaced with machine readable attributes and enumerations.



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# DISCOVERY AND REPORTING PHASE

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## General conclusions from Discovery and Reporting Phase:-

- Member States' hydrographic offices have only provided S-57 to MASS projects
- There is a huge void in global or localised regulation for MASS activity.
- There has been very little research or testing carried out using machine readable data
- Very limited exposure of S-100 to MASS operators.
- The MASS industry is aware of limitations in S-57 but is making do or working around issues.
- The lack of awareness of S-100 presents an opportunity to address issues and requirements whilst maturing the S-100 product specifications.





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# ANALYSIS AND RECOMENDATIONS PHASE



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1. Commenced in May 2022.
2. Each MS assigned a S-100 product specification and tasked to –

- To identify if the reported issue still existed in the new S-100 product specification
- If the reported issue was still present (i.e. there is a gap), to then make a recommendation how to address the issue.
- Discuss their findings with the appropriate WG/PT chair for implementation

The table shows which MS performed analysis against 1 or more S-100 product specifications:-

Member State	Product Specification
UK	S-101 + S-131
Finland	S-102
China	S-104 + S-111
Denmark	S-122
Norway	S-123
USA/NGA	S-124
Korea	S-125
Brazil	S-126
USA/NOAA	S-127
Canada	S-128 + S-129
Japan	S-130 + Security Protection Scheme



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## ANALYSIS AND RECOMENDATIONS PHASE



1. On the whole, a good number of key issues identified have already been considered or addressed in the S-100 product specifications.
2. A number of issues and requirements did identify gaps or issues that needed to be catered for in the S-100 product specifications
3. WG/PT chairs have been briefed on these gaps and will address in future iterations of the standards
4. Some of the requirements we gathered from the MASS industry are not covered at all by a S-100 product specifications.

Details of the findings can be found in the Project Team's report





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# REMAINING CHALLENGES AND CONSIDERATIONS

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1. Of the 45 issues and requirements discovered, a number of issues came up that aren't currently planned for S-100 (e.g. 3D models and/or Digital Twins).
2. The MASS industry is still developing and evolving.
3. We didn't cover all areas of the globe and may have missed regional developments and requirements.
4. There is complimentary work that the IHO Project Team could help support (IALA & WMO).
5. MASS industry developers were not part of the Project Team.
6. Concern surrounds the potential for data providers to still use unstructured natural language text as an easy migration path.





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## RECOMENDED ACTIONS FOR HSSC

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1. It is the recommendation from the MASS Navigation Project Team for HSSC to establish a permanent MASS Navigation Working Group.
2. The purpose of the group will be to address the challenges just mentioned by:-

- Addressing outstanding issues/requirements for further analysis to make recommendations on how to address these issues.
- Seek to add new member states to gain greater global coverage to ensure all regional activity is captured.
- Invite representation from industry and academia into the group to keep gathering requirements as the industry develops.
- Repeat the discovery and analysis exercise on an annual or biennial basis.
- Work with the S-100 WGs, PTs alongside the DQWG to ensure product specifications are aligned to MASS requirements and to provide appropriate challenge.
- Work with complimentary organizations such as IALA and WMO.





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# **QUESTIONS**

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