



## MASS Nav PT Work package 2-6 report template

### Member State:

**WP2:** Identify and report what test bed activities are happening in each member state’s region and which degree of autonomy is predominantly used.

Project	Purpose	Web site	Mass degree
USV TUPAN	Multi-purpose vessel, to operate in offshore environment. It can be integrated with a full suite of sensors for collection of environment data.	<a href="https://www.tidewise.io/usvtupan?lang=en">https://www.tidewise.io/usvtupan?lang=en</a>	3. Test program in place to achieve degree 4.
VSNT-E (USV-E) (Experimental)	Experimental USV designed to serve as laboratory for test and evaluation of AI decision making, classification, algorithms and sensors used in maritime autonomous systems. Usage focused on logistics, bathymetry, and surveillance missions.	<a href="https://www.marinha.mil.br/casnav/?q=node/169">https://www.marinha.mil.br/casnav/?q=node/169</a>	4

**WP3:** Report on what data MASS operators and MASS navigation systems are using today in each member state’s region.

MASS Degree	MASS operators	MASS navigation systems
3. Ship is remotely controlled and operated from another location. There are no seafarers on board.	Operators use onboard and external situation awareness sensing. The USV Tupan collects, process and delivers to the operator targets detected by: visual cameras (360deg), AIS, LiDAR and Radar. Navigation data is published to the operator, such as: water depth, speed over water, speed over ground, positioning (lat/long), heading and course. System status is also published: Generator’s status (on/off/failure/starting), power load, shafts RPMs and rudder angle. The	Tidewise proprietary autonomous navigation software, WiseControl™ utilizes the following data: 6 DoF motion data, heading and course, speed over water, speed over ground, water depth. Data fusion happens on board, is available to the system but is not used for fully autonomous navigation yet. Fused obstacle avoidance data (AIS, radar, cameras, LiDAR).

	<p>USV integrity is also monitored via alarms like : water ingress, over temperature, voltages and currents thresholds.</p> <p>Data transmission from USV Tupan and fairway infrastructure enables situational awareness for remote seafaer. Situational awareness tools comprise of static and dynamic data from the vessel, fairway imaging, VTS data, fairway radar imaging, digital twin of the fairway and vessel, ECDIS chart and shared route data with the vessel.</p>	
4. Ships is able to conduct a navigation mission without seafarers on board.	Operators rely in a Command and Control (C2) data link for telemetry and streaming of cameras for safety of operation and assuming control in case of any need.	Navigation systems use GNSS positioning with differential correction, computer vision pattern recognition and inertial navigation system (IMU). Data from radar, AIS, echo sounder and sidescan sonar also feed guidance and control algorithm.

Have any data limitations been identified?

No information.

**WP4:** Report what navigational data each member states’ regulators (e.g., MCA in the UK) are specifying should be used for MASS navigation in either trials or operations of MASS.

“Provisional Regulation for the Operation of MASS” was issued in Brazil for MASS, considering its interaction and coexistence with conventional vessels. In this regulation, it is highlighted that MASS with a length of more than 12 meters are not authorized to operate in Brazilian waters. The regulation defines levels of control and not levels of autonomy, as shown in the table below:

<b>MASS Degree</b>	<b>MASS operators</b>	<b>MASS navigation systems</b>
0. Seafarer on board	Vessel is controlled by seafarer on board	Seafarer on board
1. Controlled	All functionality is up to the seafarer on board. He has total control of the vessel and makes all decisions, directs, and controls all functions	Seafarer on board
2. Directed	Under directed control, some degree of assessment and responsiveness is implemented on the vessel. It can assess the environment, report its situation, and suggest one or several actions. It can also suggest possible actions to the operator, requesting information or decisions. However, the authority to make decisions rests with the operator. The vessel will only act if commanded and/or allowed to do so	Seafarer on board
3. Delegate	MASS is authorized to perform certain functions. It assesses the environment, report the situation,	Program on board

	define actions and report your intent. The operator has the option of modifying the vessel's reported intentions for a period, after which the vessel and decision-making is shared between the operator and the vessel	
4. Monitored	MASS assesses the environment and reports its status. defines actions, decides, and acts by reporting its action. The operator can monitor the events.	Program on board
5. Autonomous	MASS, endowed with a maximum degree of independence and self-determination, assesses the environment and its situation. It defines actions, decides and act.	Program on board

**WP5:** To what degree are member states Hydrographic Offices involved in MASS trials or operations and what data are they currently providing.

Directorate of Hydrography and Navigation (DHN) is not involved in MASS trials or operations. Brazilian Navy and mainly oil and gas industry have been demonstrated interest in autonomous vehicle, recently in surface ships.

The growth of research on MASS seems to be growing in view of the information from recent partnerships between academia and companies that need the type of service provided by MASS.

There have been no tests or operations of MASS in navigation channels or access to ports despite its enormous potential.

Have any data limitations been identified?  
No information.

**WP6:** Report on what trailing has been done with new navigation standards (e.g. S100) for MASS, or what research into machine readable data has been carried out in each member state's region. There is no information about this.

Have any data limitations been identified?  
No information.