Input paper: [[1]](#footnote-1) ARM21-7.5.1

**Input paper for the following Committee(s):** **Purpose of paper:**

(Select as appropriate)

ARM  ENG  PAP  Input

ENAV VTS  Information

Agenda item [[2]](#footnote-2) 7.5

Technical Domain / Task Number 2 Task 2.1.1

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Proposal on formulating the chapter of marking test of area for autonomous and unmanned remote controlled ships in the Guideline of Marking Different Restricted Areas

# Summary

The task of compiling guidelines for marking different restricted areas was initiated at the 20th IALA ARM meeting. Chinese representatives participated in compiling the chapter on marking test areas for autonomous and unmanned/remote-controlled vessels. According to the arrangements discussed at the meeting, this proposal has compiled relevant chapters on marking the test areas of autonomous and unmanned/remote-controlled vessels from the requirements of test areas, marking areas, information release, safety management and emergency response and coordination.

## Purpose of the document

This paper aims to provide assistance in promoting the revision of the chapter on marking test areas for autonomous and unmanned/remote-controlled vessels in the guideline of marking different restricted areas.

## Related documents

[1] IALA-Committee-work-programme-2023-2027

[2] DRAFT Task 2.1.1 Guideline on the marking of different restrictions areas Ver 00.02

# Background

The task of compiling guidelines for marking different restricted areas was initiated at the 20th IALA ARM meeting. This task is divided into the compilation of three sections: marking the test areas for autonomous and unmanned/remote-controlled vessels, marking the recreational areas, and marking the ice roads. According to the discussion at the meeting, Chinese representatives participated in compiling the chapter on marking test areas for autonomous and unmanned/remote-controlled vessels.

# Discussion

Based on the latest meeting discussion results, the relevant chapters of the guidelines for marking the test areas of autonomous and unmanned/remote-controlled vessels have been compiled and improved.

## TEST AREA OF AUTONOMOUS AND UNMANNED/REMOTE-CONTROLLED

### Selection of test areas for autonomous and unmanned/remote-controlled vessels

The test areas for autonomous and unmanned/remote-controlled vessels shall meet the following conditions:

a） It should be sufficient open water areas to meet the requirements for the heading stability and turning performance of the vessels under test;

b） It should have an appropriate water depth and suitable bottom material to meet the requirements of the rich water depth for navigation and anchoring tests of the vessel under test;

c） It should be kept away from main waterways or recommended navigation routes, frontier defence area, fishery operation areas, and nature reserves, so as to reduce the impact of unexpected situations such as emergency anchoring and the ship out of control of the test ship on maritime safety;

d） It should have a relatively safe underwater environment and avoid obstacles such as reefs, shallow spots and sunken ships that may affect the safety of the test vessel;

e） It should be close to the anchoring area with soft bottom material to ensure that the vessel under test can be anchored for emergency avoidance or towed back to port when it fails;

f） It should be covered by necessary test infrastructure such as communication networks, or communication facilities that can temporarily cover the test area shall be set up;

g）Meteorological and hydrological conditions including wind, waves, currents and other conditions of the test water area shall meet the test requirements;

h） The relevant areas shall not overlap as far as possible, avoid collision to the maximum extent, and ensure the safety of maritime navigation.

The test area can be fine-tuned according to the actual test situation or other navigation activities.

Where it is not possible to establish such areas at a safe distance from active navigation zones, all necessary mitigation measures must be implemented to ensure the safety of navigation both within and around the designated zone.

### Test area restrictions

These areas could be permanent, temporary or dormant.

If the use of the test area is restricted, for instance, during a special period of time, the area is reserved for other circumstances and cannot be used for test purposes, it is recommended that the area has a rest period after the test, that is, the area remains in a non-test state after the test period to facilitate the next step of activities.

### Type of ship to be tested

**The vessels to be tested shall include but not be limited to:**

Ship with automated processes and decision support;

Remotely controlled ship with seafarers on board;

Remotely controlled ship without seafarers on board;

Fully autonomous ship.

With the increase of ship size, the required supporting facilities, such as the size of the wharf and the power of the emergency tugboats, will also increase.

Unrelated vessels that have not applied for testing are not allowed to operate in the restricted waters such as the channels, anchorages and port areas designated in the test area.

If an unrelated vessel needs to enter restricted waters due to emergency avoidance, special route requirements, or other exceptional circumstances, it shall notify the relevant authorities in advance and proceed at a safe speed. Anchoring, staying, lagging or drifting is strictly prohibited.

## MARKING TEST AREA

### Signs of Test Area

The test area must be clearly defined through an effective marking system, which is used to inform vessel operators of information regarding navigation restrictions, so as to identify the relevant area and help ships avoid potential dangers. The signs may include:

* Physical AtoN such as special marks (yellow buoys);
* Lateral mark or cardinal mark (available when crossing the fairway);
* Floating, visible panels or flags;
* Different characteristics of light flashes, etc;
* Virtual solutions such as AIS AtoN or VDES-transmitted digital marks.

At the same time, necessary safety facilities or alert vessels, drones can be equipped at the boundary to deal with emergencies beyond the test items.

### Setting and Requirements for Signs of Test Area

The setting of signs for restricted areas of ships needs to comply with relevant standards and regulations to ensure that ships can clearly and accurately identify the meaning of the sign. The setting of general signs should comply with the following standards:

-- Signs need to be designed and laid out in accordance with the requirements of relevant standards and regulations.

-- For different water area scenes, corresponding sign should be set. Considerations include but are not limited to water resources, waterway location, environmental factors, navigation rules, etc.

-- The color, shape and size of the sign should comply with relevant standards to ensure that ship pilots can quickly identify the meaning of the sign.

-- Signs should be kept clear, obvious and easily identifiable to ships. Digital signs can be used as substitutes or to enhance the display if the area affected by factors such as environment, weather or light.

-- Digital signs must ensure that the displayed information is consistent with the physical entity, and the essence of the information must not be altered due to digitalization. It is also necessary to ensure that digital devices are functioning properly.

-- Signs need to be inspected and maintained regularly. If signs are damaged, they need to be repaired or replaced in time to ensure the clarity and effectiveness of signs.

## INFORMATION RELEASE

Maritime authority shall reasonably determine the scope of the safe operation zone based on factors such as the scope of the operation or activity water area, natural environment and traffic conditions, and release it to the public according to the needs (except in cases involving national security or military secrets). The information announced includes: the size of the area, the date range, the waterway/route, and the traffic volume. If any changes are needed, they shall be re-verified and announced by the maritime administrative authority.

Mark the test area in its printed nautical charts and Electronic Navigational Charts (ENCs). Additionally, it is possible to mark the corners or boundaries of the test area with virtual Automatic Identification Systems (AISs). Virtual AISs should be published also in ENCs. All markings in the chart products will be removed when use of the test area ends.

Maritime authority can list out the circumstances under which sea trials may affect the safety of water traffic and announce them to the public based on the actual situation of their jurisdiction. In the event of communication interruption or loss of control, it is necessary to promptly notify the public.

## SAFETY MANAGEMENT AND EMERGENCY RESPONSE

### Safety Management

It is suggested that a dedicated management authority be established to ensure the safety management of the testing area, mainly including:

1. The weather and hydrological environment conditions of the test area should be obtained in real time, the impact of extreme weather changes on the test should be evaluated, and risk warnings should be issued to the test vessels when necessary. And it provides the ship with the ability to provide shelter against severe sea conditions and adverse weather conditions.
2. The condition of relevant AtoNs in the area should be monitored in real time, and malfunctioning equipment should be repaired or replaced promptly.
3. Real-time observation of the traffic environment in the test waters should be conducted, and emergency navigation routes should be established to provide necessary navigation guidance, early warning and other support services for the tested vessels and intrusions.
4. Personnel should be kept on duty at the shore-based remote control console to monitor the status of the vessel in real time and take over the vessel promptly in case of any abnormal situation.
5. It is necessary to ensure that the communication facilities in the test area are reliable and stable, so as to have sufficient bandwidth to guarantee the safe and smooth exchange of data and information. In case of communication interruption or other situations, they can be restored in a timely manner or temporary alternative communication equipment can be adopted.

### Risk Assessment

Risk assessment is needed in the test area to identify all hazards that may lead to unexpected events or accidents. Risk assessment can be carried out in accordance with the integrated safety assessment method of the International Maritime Organization or recognized international and national standards. The considerations include but are not limited to the following aspects:

1. The expected test area and environmental conditions (including hydro-meteorology and traffic volume);
2. Proximity or intersection with other restricted areas;
3. Test ship performance;
4. Test operating scenarios;
5. Test operating mode;
6. Human factors.

### Emergency Management

1. Relevant vessels should formulate reasonable and effective emergency plans before entering the test area to reduce the impact of foreseeable events or malfunctions. In case of emergency situations such as communication interruption or equipment failure and loss of control of the test vessel, emergency response measures can be taken in accordance with the emergency plan, and the management authority should be reported proactively at the first time.
2. If other vessels enter the test area, the test area management institution should be able to identify and confirm them in a timely manner and send the information of the intruding vessels to the test vessels to prevent accidents such as collisions. At the same time, it is necessary to promptly guide the intruding vessels to safely leave the test area follow the emergency navigation route.
3. If floating fishing nets or other floating obstacles appear in the test area, the management institution should be able to detect and handle them in a timely manner to ensure the safety of the test route in the test area. The test vessel should be able to avoid these obstacles in a timely manner and report to the management authority.

## COORDINATION

The safety management organization of the test area should maintain communication with the VTS in the relevant area, in order to enable VTS to keep abreast of the situation in the test area at any time and manage it promptly.

If the test area needs to span different countries and regions, it is necessary to coordinate and meet the requirements of the involved countries for the test area, and release relevant information in a timely manner.

During ship tests, it is necessary to maintain coordination and communication among relevant management institutions and VTS to ensure the effective switching of regional management rights. Emergency communication channels can be coordinated and determined to ensure emergency communication when communication is interrupted.

In the event of a maritime accident in the test area or nearby, the test vessel and the support vessel shall carry out search and rescue assistance based on their own conditions.

# References

1. DRAFT Task 2.1.1 Guideline on the marking of different restrictions areas
2. INTERIM GUIDELINES FOR MASS TRIALS (IMO)
3. Interim Rules on Autonomous Navigation Test Technology and Inspection of Ships(China)

# Action requested of the Committee

The Committee is requested to:

1. Consider the proposal in section 3.
2. And incorporate the proposed chapter contents into the chapter on marking test areas for autonomous and unmanned/remote-controlled vessels in the draft guideline of marking different restricted areas.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)