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| IALA Guideline |

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Guidance on the marking of different restrictions areas

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# Introduction

IALA recognises the necessity to mark restrictions areas to navigation and has developed this guideline to assist its

members and other Competent Authorities, when they consider the use of Marine Aids to Navigation (AtoN) to

mark and avoid this kind of hazard for mariners.

# SCOPE

This guidance is for stakeholders such as competent authorities, lighthouse, port, and other maritime authorities, aids to navigation providers, and the contractors, developers and operators involved about maritime restrictions areas mentioned in the following sections.

## OBJECTIVES

This Guideline has the following objectives in the context of the requirements for stakeholders:

1 To provide and increase a broad understanding of different kinds of maritime restrictions areas.

2 To strengthen the practice of maritime restrictions areas by providing standardization based on good example of know how.

3 To offer general guidance about the choice of different kinds of maritime restrictions areas.

# FIELD OF APPLICATION

The guidance contained in this document applies to different kinds of marine restrictions areas fixed in position temporarily or permanently, which can be extend above or below the surface of the sea and which are obstructions to navigation.

Restricted areas present different characteristics, which have been grouped as follows:

* Section 4: test areas for autonomous and unmanned/remote controlled ships and vehicles
* Section 5: ice roads
* Section 6: sports events areas, and
* Section 7: prohibited areas

# MARKING OF ~~TEST~~ Trial AREA FOR AUTONOMOUS SHIPS AND VEHICLES

## In general

**With the aim of experimenting and testing, in designated areas, autonomous and unmanned/remote-controlled ships and vehicles, or other technologies in subsurface, surface (land and water), and aerial environments (MASS UxV)** and due to the fact that industry and scientific have experimental needs, there are some countries implementing restricted areas for this kind of vehicles.

### Type of mass / vehicle

The type of systems or vehicles to be operated within the area must be clearly identified. This includes surface autonomous vehicles (ASVs), unmanned surface vehicles (USVs), autonomous underwater vehicles (AUVs), remotely operated vehicles (ROVs), aerial drones (UAVs), and hybrid or multimodal systems capable of transitioning between domains (designated at MASS UxV in this guideline). For each category, key characteristics should be defined, such as dimensions, operating speed, control method, range, and whether a support vessel or land-based control station is required.

## Type of area

Test areas are dedicated to experiments and operational testing of autonomous ships and vehicles, as well as associated sensors and technologies operating on the surface, subsurface, land and aerial environments (MASS UxV).

These zones can be classified according to various criteria:

• Location (~~marine~~[maritime], coastal, ashore);

• Kind (consists of water surface, combined (land or aerial);

• Type (permanent, temporary or dormant).

From a geographical standpoint, such areas may be located offshore, in coastal waters, or onshore when applicable. In terms of their operational use, they may be defined as permanent, temporary, or dormant. The latter referring to pre-approved but inactive areas that may be reactivated as required.

It is the responsibility of [competent/relevant] Government authorities to determine the locations for trial areas. They should pay attention when and how these areas are determined.

The [competent/relevant] Government authorities may require specific restrictions or recommendations regarding to the determined trial area, type of autonomous ships and vehicles, duration of trial and type of planned trials, if applicable.

Restrictions and recommendations may relate to factors such as:

* Ships and vehicles itself with their characteristics;
* The presence of a support operational vessel;
* Degree of autonomy;
* The number of parallel [simultaneous] trials;
* Seasonal weather conditions;
* Limitations due to poor visibility [restricted visibility or adverse environmental factors];
* Distance from heavy traffic, other restricted areas, recommendation routes [or sensitive zones] and etc;
* Environmental characteristics of trial areas;
* Any other specific [or operationally relevant] [and or safety-related] factors .

In any case, [such] restrictions should be clearly stated in the authorisations [or permits] issued by [competent] Government authorities.

### Environmental description

Environmental and oceanographic characteristics such as: bathymetry, seabed composition, tidal regime, current profiles, and seasonal ice conditions, should also be considered when selecting the location.

The test areas for MASS UxV could meet the following conditions:

1 It should be deep, unconfined but sheltered waters areas to meet the requirements for the heading stability and turning performance of test vessels. The water depth should exceed four times the mean draught of the ship.

2 It should have an appropriate water depth and [good holding ground] to meet the requirements of the rich water depth for navigation and anchoring tests of the MASS UxV;

3 It should have a relatively safe underwater environment and avoid obstacles such as reefs, shallow waters and wrecks that may affect the safety of the test vessel;

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

5 Meteorological and ~~hydrological~~ oceanographic conditions including wind, waves, currents and other conditions of the test water area shall meet the test requirements;

6 It should be covered [supported] by the necessary testing infrastructure, such as communication networks. Where permanent infrastructure is not available, temporary communication facilities should be deployed to ensure full coverage of the test area;

7 It should be far away from infrastructures or any kind of electromagnetic equipment because of the interferences with this type of vehicles;

8 If the area cannot be avoided has the situation about seasonal ice, it shall not to conduct tests during the ice period

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.

If it is not possible to locate at a sufficient distance, all possible actions should be taken to ensure the safety navigation in and outside the area;

### Navigational description (FILIPE)

The determination and implementation of these areas should take into account a set of operational, geographical and safety-related considerations. These include their proximity to recommended navigation routes or shipping fairways, the intensity of local maritime traffic, and the presence of other restricted areas

These may include the promulgation of Navigational Warnings (NAVWARN) Notices to Mariners (NtM), local coordination with VTS Centres, or the establishment of temporary traffic separation schemes.

The following factors may be taken into account in the establishment of test areas for autonomous, unmanned or remotely controlled vessels:

1 Adequate open water space should be provided to meet the requirements for the heading stability, turning performance and safe manoeuvring of the vessels under test;

2 The test area should be located away from main waterways, recommended navigation routes, precautionary areas, fishing grounds, and Particularly Sensitive Sea Areas (PSSA) to minimise the risk of interference and ensure safety of navigation;

3 Overlap with other restricted or regulated zones should be avoided as far as practicable to prevent interference and confusion among users of the sea;

4 Boundaries of the test area may be adjusted as necessary according to operational requirements or the evolution of other maritime activities in the vicinity;

5 These areas should also be sufficiently distant from coastal infrastructure and sources of electromagnetic interference that may affect the operation of autonomous systems and communications;

6 Where a test area is of considerable size or extends into zones of access to ports, designated traffic corridors or controlled transit routes should be promulgated to ensure safe passage of conventional vessels to and from port approaches, avoiding potential conflict with MASS UxV operations.

In all cases, coordination with relevant authorities, including VTS, port administrations and hydrographic offices, should be undertaken to ensure that the area’s establishment and operation are consistent with existing navigational arrangements and internationally recognised safety standards. :

### Vehicles operated within the area

Test areas may be classified according to their operational status and frequency of use. Three main categories are defined:

* **Permanent Areas** – These zones are continuously available for testing and demonstration activities. They are typically equipped with established infrastructure such as marine aids to navigation (AtoN), communication systems, and safety monitoring equipment. Permanent areas are designed to support routine operations and long-term testing campaigns.
* **Temporary Areas** – These are designated for testing during specific timeframes or for particular projects. Activation is limited in duration and may require advance notification to relevant maritime or aviation authorities. After testing concludes, the area reverts to normal use. It is recommended that temporary test [trial] areas observe a **rest period** following each operation to allow recovery of normal navigational and environmental conditions before reactivation.
* **Dormant Areas** – Dormant test zones are pre-approved and inactive but can be rapidly reactivated when required. They provide operational flexibility for future missions or contingency scenarios without the need for full re-authorization procedures.

Test areas may be located within **national waters**, **exclusive economic zones (EEZs)**, or in **international waters**, depending on project requirements and applicable regulatory frameworks.  
In international waters, coordination with relevant international bodies and maritime authorities is required to ensure safety, transparency, and compliance with international conventions (e.g., UNCLOS, COLREGs).

When defining a test area, the following parameters should be specified:

* **Size and Coordinates** – Clearly define geographic boundaries (latitude and longitude).
* **Type** – Indicate whether the area is permanent, temporary, or dormant.
* **Date and Time of Activation** – For temporary areas, specify the operational window.
* **Status** – Define the operational status (Open, Restricted, Confidential).
* **Navigational Routes and Fairways** – Identify existing shipping lanes, fishing zones, or aerial corridors intersecting or adjacent to the test area.
* **Traffic Intensity** – Assess vessel and aircraft density to evaluate potential conflicts and determine necessary safety measures.

Based on the intensity of navigation and operational risk assessment, it may be necessary to install or activate AtoN, in accordance with IALA (International Organization for Marine Aids to Navigation) standards and be integrated into the local maritime traffic management system.

## Marking

### Marks 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 mark needs to comply with the relevant regulations of R1001 The IALA Maritime Buoyage System, may include:

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

In addition to the above marks, the floating, visible panels or flags can also be adopted to marking the area;

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.

### Design and setting for marks of test area

The marking scheme should be designed and setting comply with standards and regulations such as IALA and PIANC, it should comply with the following requirement:

* It should be designed and setting to address the needs of various users, including large commercial vessels (e.g. tankers, cargo ships, passenger ferries), small crafts (motorboats, yachts), and the autonomous vehicles themselves.
* The color, shape and size of the mark should comply with relevant standards, which to ensure that meaning of the marks can be identify and recognized clearly and accurately.
* For different water area scenes, corresponding mark should be set. Considerations include, but are not limited to water resources, waterway location, environmental factors, navigation rules, etc.
* Marks should be kept clear, obvious and easily identifiable to ships. Digital marks can be used as substitutes or to enhance the display if the area affected by factors such as environment, weather or light.
* Digital marks 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.
* The marks must be categorized according with R0130, so they can be inspected and maintained according to the requirements of different levels. If 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 test area 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 with navigation warning 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 ENC. All markings and relevant information in the chart products will be removed when the area is no longer reserved as a test area.

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. The system should also provide contingency in the event of communication loss or loss of control, notices to Mariners (NtM) must be issued.

## safety mangement

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, it is to recommended to have a Rapid Environmental Assessment team, then the impact of extreme weather changes on the test can 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 AtoN 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

The IALA Risk Management Toolbox is described in IALA Guideline on Risk Management. Assessing maritime risks pertaining to a spatial plan can be done according to the IMO Formal Safety Assessment (FSA) procedure. The IALA risk assessment tools, and simulation can be used in the process

## Coordination

The Competent authority will inform the applicant about the area designated for trial, about the progress of the application review and provide all interested parties with information related to ensuring the safety, reliability and environmental friendliness of the trial.

In case of emergency situations, if necessary, the Competent authority, makes changes into the trial program or stops the trial. This is especially important when the tests are conducted in the VTS area or the MRS area. The competent organization monitors the readiness for testing in accordance with internal requirements.

While the applicant has the uninterrupted responsibility for the trial, the VTS should be actively involved in all stages of the trial process, depending on the case from application stage to the debriefing meeting. VTS should be provided with relevant data relating to MASS UxV and the typology of trials that are planned to be carried out. VTS, depending on the risk assessment and type of trials, should have the ability to:

* Communicate directly with other «conventional» traffic that may be affected by the trials;
* Supervise the trials;
* Promulgate any information related to the trial/s within the VTS area to «conventional» vessels that may be affected by the trial (information, warnings, instructions, etc.).

MRCC/SAR activities are carried out in accordance with the requirements International Convention for the Safety of Life at Sea (SOLAS), Chapter V, Regulation 7 and International Convention on maritime search and rescue (SAR).

Information of hazards received from any reliable source should be promptly reported by the Responsible organisation to all concerned participants including notification to other interested Responsible organization (International Convention for the Safety of Life at Sea (SOLAS), Chapter V, Regulation 4 and Manual on maritime safety information (MSI), IHO S-53).

# Marking of ice roads

## In general

In areas where ice roads are constructed in winter, for example on lakes, rivers and in archipelago areas in the coastal zone for car and truck traffic, it is very important to prevent ice channels for maritime traffic from being established in the same area.



Figure 1. Ice roads in coastal zone. Source: Estonia.

## Type of area

Ice roads can be established temporarily on frozen lakes, rivers, and within archipelagos in the coastal zone, in order to allow passenger and goods transportation during winter.

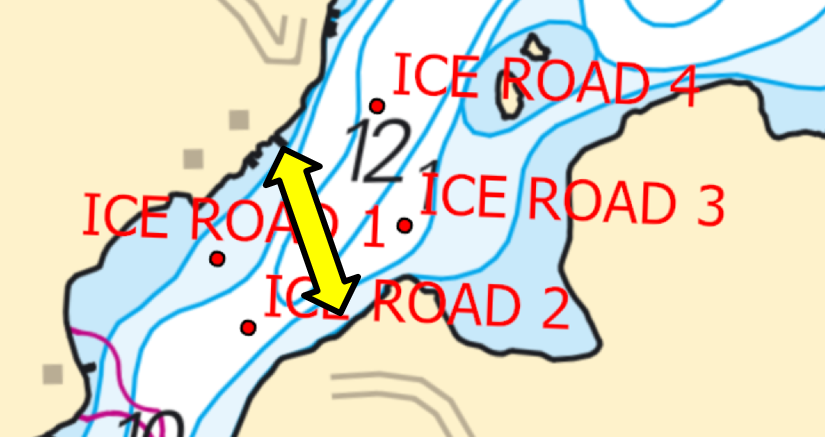


Figure 2. Ice roads in archipelagos. Source: Swedish Maritime Administration.

## Marking

In accordance with the IALA MBS, special mark AtoN are suitable for the purpose of marking ice roads using physical and/or virtual marking. If needed, physical AtoN can be enhanced with pictograms. The restricted areas for the ice roads will be marked by AtoN at suitable intervals along the borders.

## Risk assessment

To avoid hazards and accidents in areas where ice roads are planned to be established, a risk assessment must first be carried out by the competent authority, in order to determine whether any safety-enhancing measures need to be taken relating to sea traffic before opening of ice roads.

## Coordination

#### Information

The competent maritime authority are responsible for informing mariners of the establishment of ice roads using Notice to Mariner (NtM) and Maritime Safety Information (e.g. navigational warning).

The competent authority should also make regular public announcements on the current status of ice roads through public service announcements (e.g. local radio stations, websites). Any changes must be promptly communicated by the competent authority, to ensure that information provided to the public is up to date and accurate.

#### Readiness

The operator of the ice road is responsible for preparing emergency procedures for rescue operations and coordination with the relevant maritime competent authority.

#### Monitoring

IfVTS monitoring is available within the geographical area, the risk of maritime traffic damaging the ice road when entering the restricted area could be reduced.

#### Maintenance

The operator of the ice road is responsible for the inspection and maintenance of AtoN to ensure compliance with any competent authority licencing conditions.

Any failure must be corrected within the specified time for level of service as directed by the competent authority within the ice road operator’s licence.

# Marking of competion and event areas etc.

## In general

Competition and event areas may be established temporarily or permanently for organizing various types of competitions and events. Examples include sailing or powerboat races, public demonstrations, or other similar activities that may temporarily influence vessel movements or navigation in the area.

To ensure safety of navigation and protection of participants, these areas should be clearly marked and coordinated with the competent authorities.



Figure 3. Swimrun. Source: ÖTILLÖ.

## Type of areas

Events may be temporary and short-term in nature or organized on a recurring basis. For recurring events, a permanent event area may be designated for continuous or seasonal use.

Events can involve both motorized and non-motorized activities. Examples include powerboat and personal watercraft races, sailing regattas, as well as rowing and canoeing competitions.

## Type of events

Events may be temporary and short in duration or organized on a regular basis. For recurring events, a permanent event area may be reserved for continuous or seasonal use.

Events may involve motorized or non-motorized activities. Examples include powerboat or personal watercraft races, sailing regattas, and rowing or canoeing events.

## Marking

In accordance with the IALA MBS, special mark AtoN are suitable for marking competition and event areas using physical and/or virtual aids.

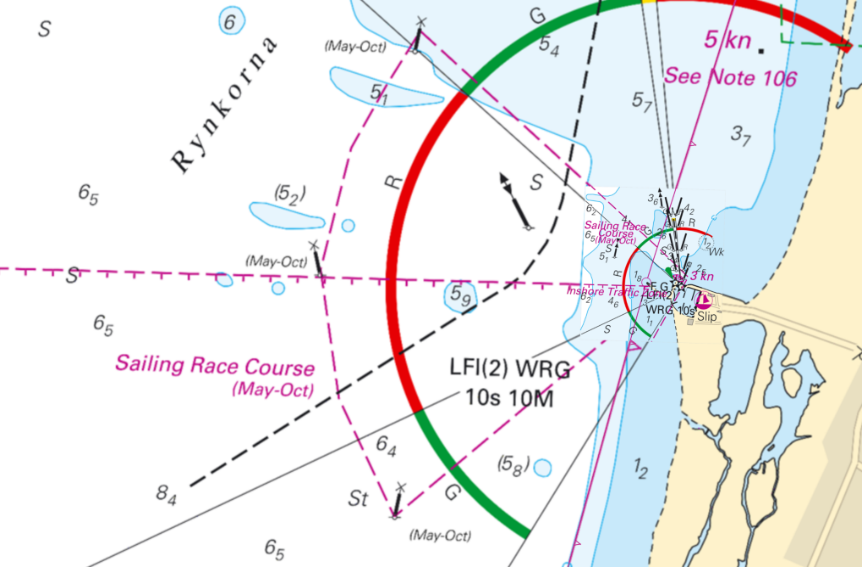


Figure 4. Sailing Race Course. Source: Swedish Maritime Administration.

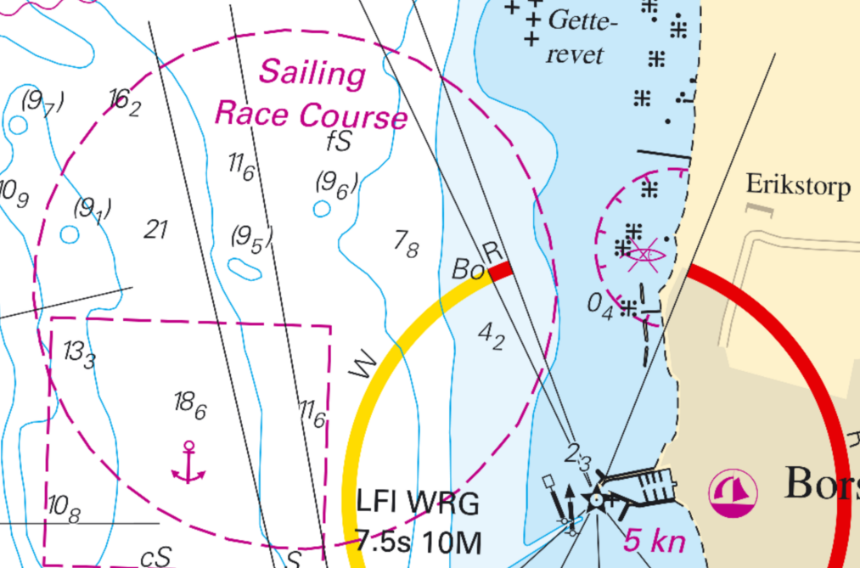


Figure 5. Sailing Race Course. Source: Swedish Maritime Administration.

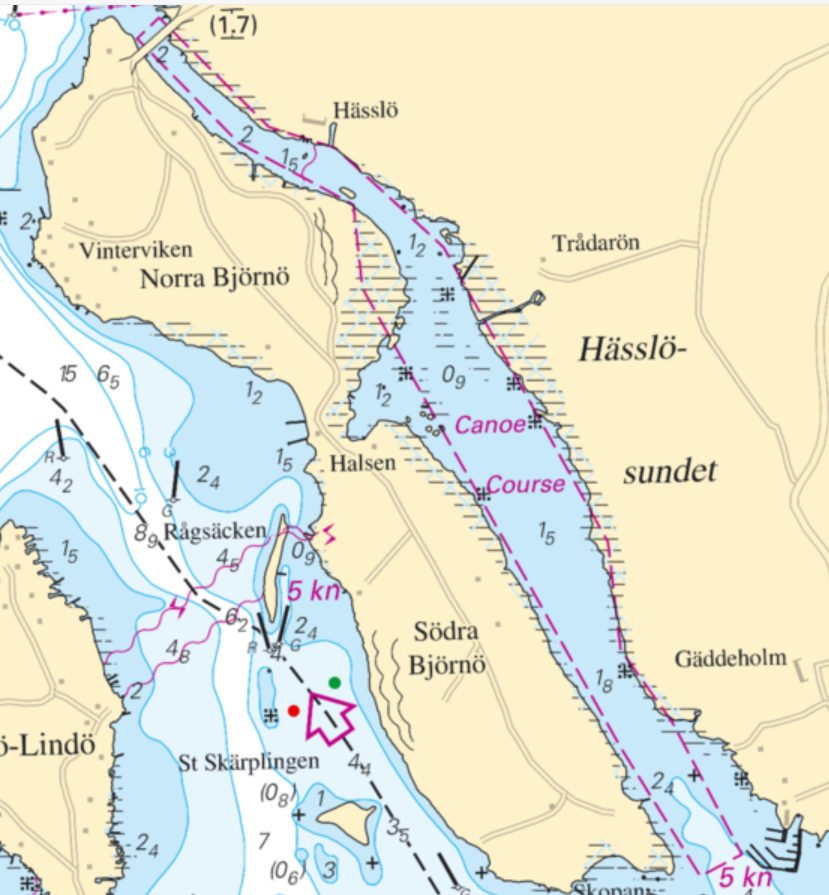


Figure 6. Canoe Course. Source: Swedish Maritime Administration.

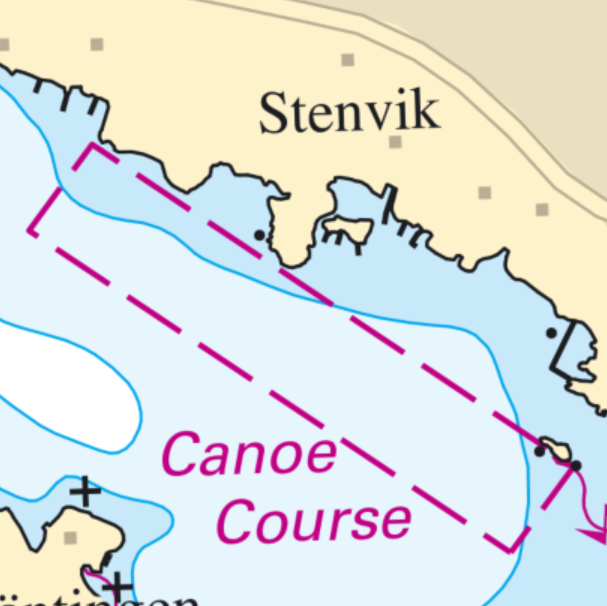


Figure 7. Canoe Course. Source: Swedish Maritime Administration.

## Risk assessment

To avoid hazards and accidents, a risk assessment shall be provided by the event organizer or the proponent of a permanent event area. The assessment shall identify potential risks and define appropriate measures to ensure safe navigation and the protection of participants and other waterway users.

## Coordination

#### Information

Where applicable, the competent maritime authority may issue information on competitions or events through a Notice to Mariners (NtM) or via the Vessel Traffic Service (VTS) to inform mariners. Permanent event areas shall, where appropriate, be marked on nautical charts.

#### Readiness

The event organizer is responsible for preparing emergency procedures for rescue operations and coordination with the relevant maritime competent authority.

#### Monitoring

* VTS information.
* safety boats arranged by the event organizer.

#### Maintenance

The event organizer or permanent area operator is responsible for the inspection and maintenance of AtoN ensuring compliance with the requirements set by the competent authority.

# Marking of PROHIBITED AREAS

## In general

Prohibited areas at sea can vary depending on purpose of the restriction and location. This may have an impact on sea traffic's room for manoeuvre, and freedom of movement, in for example a fairway or route.

Restrictions can generally be temporary, or permanent, depending on the need of action.

## Type of area

Prohibited areas in this regard may be nature reserves, bird protection, freshwater intakes, work, dredging, harbour, training, live fire exercise, and environmentally sensitive sea areas (ESSA).

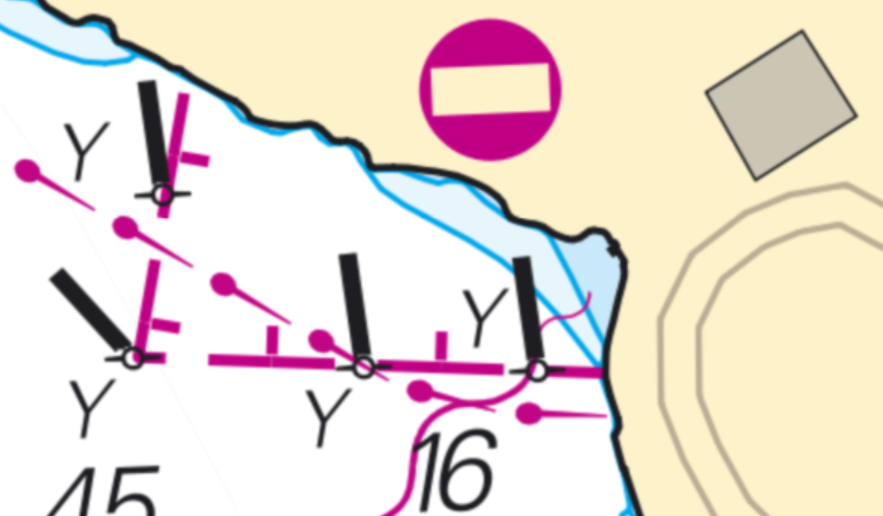


Figure 8. Freshwater intakes. Source: Swedish Maritime Administration.

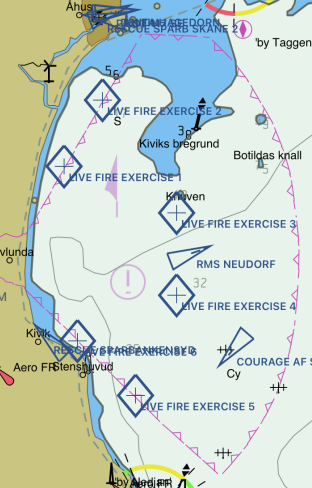


Figure 9. Virtual AtoN live fire exercise. Source: SeaPilot.

## Marking

In accordance with the IALA MBS, special mark AtoN are suitable for the purpose of marking prohibited areas using physical and/or virtual marking. If needed, physical AtoN can be enhanced with pictograms. The prohibited area should be marked by AtoN at suitable intervals along the borders.

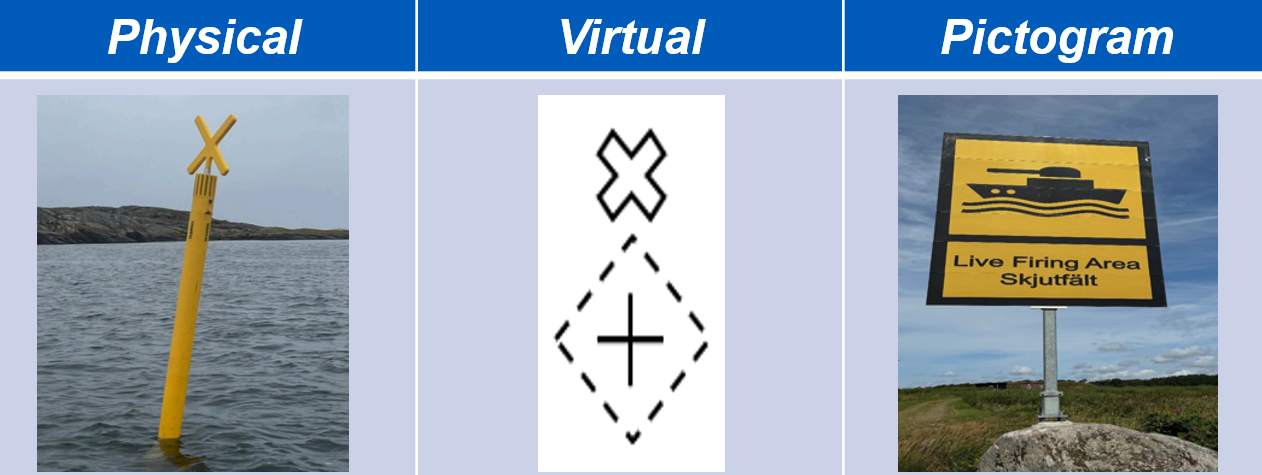


Figure 10. AtoN and Pictogram. Source: Swedish Transport Agency.

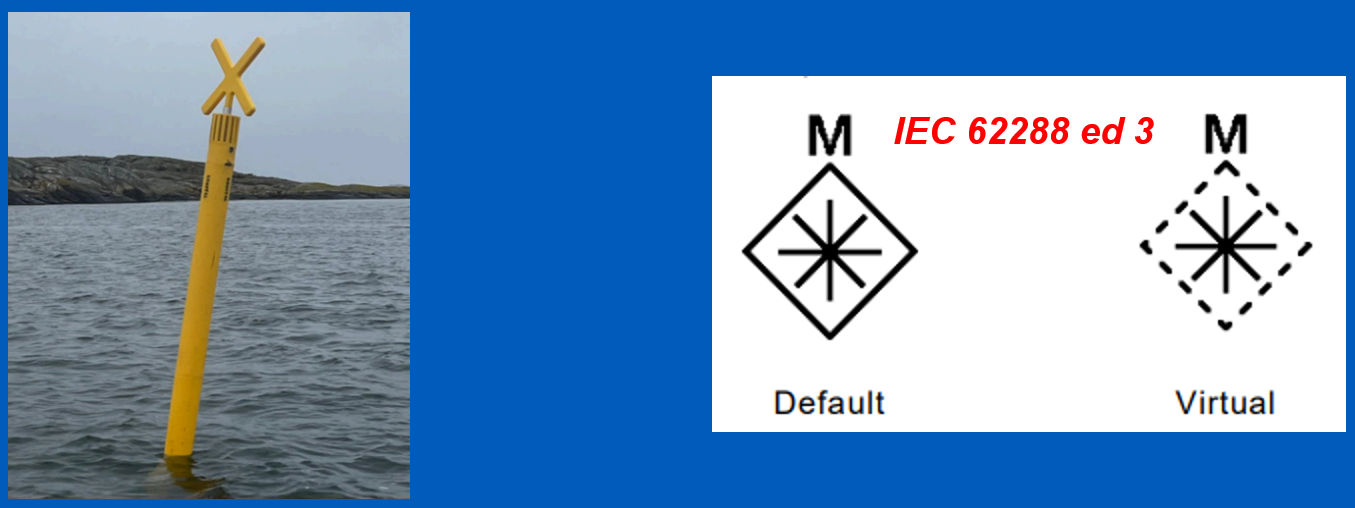


Figure 11. MAtoN by physical and virtual AtoN. Source: Swedish Transport Agency.

## Risk assessment

To avoid hazards and accidents in areas where prohibited areas are planned to be established, a risk assessment must first be carried out by the competent authority, in order to determine whether any risk mitigation measures need to be taken, relating to marine traffic, before implementing the prohibited area.

## Coordination

#### Information

The competent maritime authority are responsible for informing mariners of the establishment of prohibited areas using Notice to Mariner (NtM) and Maritime Safety Information (e.g. navigational warning).

#### Readiness

The organisation operating the prohibited area is responsible for preparing necessary procedures for search and rescue operations in the area and coordinating these with the relevant maritime competent authority.

#### Monitoring

If VTS monitoring is available within the prohibited area, the risks to marine traffic in the restricted area could be reduced.

#### Maintenance

The organisation operating the prohibited area is responsible for the inspection and maintenance of any associated AtoN to ensure compliance with any competent authority licencing conditions.

Any failure to the AtoN must be corrected within the specified time for level of service as directed by the competent authority within the operating authorities licences/permits.

# DEFINITIONS

The definitions of terms used in this Guideline can be found in the International Dictionary of Marine Aids to Navigation (IALA Dictionary) at http://www.iala-aism.org/wiki/dictionary and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

# abbreviations

AIS Automatic Identification System

AtoN Marine Aid(s) to Navigation

ESSA Environmentally Sensitive Sea Areas

MPA Marine Protected Area

VTS Vessel Traffic Services

# references

1. R1001 IALA MBS
2. R1010 Marine Spatial Planning
3. Guideline G1036 Environmental Management in Aids to Navigation
4. Guideline G1137 AtoN management in protected areas