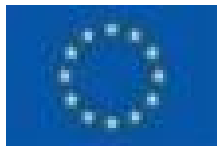


# Analysis and technical functional modelling for the improvement of the vessel traffic management in the Adriatic Region

Assessment of the alarm systems functionalities, rules and algorithm in the Adriatic Region and proposal of integration



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# Analysis of the traffic monitoring systems

## Project overview

The purpose of the project is to define a new procedural, technical and data model, which integrates information managed by monitoring systems of all the Adriatic States involved in it: Italy, Slovenia, Croatia and Montenegro.

The model will promote a streamlining and will enable the efficient coordination of potential emergency situations . Moreover, it will represent the bases of the proposal for the review of the Resolution IMO MSC n.139 (76) adopted on 5 December 2002 , shared by the Maritime Authorities interested in the monitoring of the vessel traffic in the Adriatic Sea.\*

STEPS	DESCRIPTION	OUTPUT
Regulations	Analysis of the Italian regulation context about responsibilities of the maritime safety operators and realization of the amendment proposal about ADRIREP Resolution	<ul style="list-style-type: none"> <li>Document of the Italian regulations overview</li> </ul>
Traffic monitoring systems	Technical-functional analysis and data mapping of the vessel traffic monitoring systems used in the Adriatic REGION to define a technical proposal shared inside the REGION for the realization of an integrated vessel traffic monitoring system	<ul style="list-style-type: none"> <li>Document of the functionalities mapping of the monitoring systems + document of the technical proposal</li> </ul>
Alarm systems	Analysis of the functionalities, the rules and the algorithms developed in the alarm systems in support of vessel traffic monitoring systems used in the REGION to define a technical proposal shared inside the REGION for an alarm system which helps to realize a unique monitoring	<ul style="list-style-type: none"> <li>Document of the functionalities mapping of the alarm systems and analysis of alarm algorithms + document of the technical proposal</li> </ul>
Term of Reference	Definition of a collaboration document between the Administrations and elaboration of the Term of Reference document aimed to define objectives of the macro-regional EUSAIR Strategy for the safety navigation and the formalities for the declaration of the ship arriving and/or leaving	<ul style="list-style-type: none"> <li>Term of Reference (Object, Governance, Participation, Activities, Meetings, Fees, Agreement, Amendments e Approvals)</li> </ul>
Maritime casualties	Collection and analysis of all data and information about maritime casualties and definition of the correlation with the vessel traffic separation schemes defined by the REGION	<ul style="list-style-type: none"> <li>Correlation Analysis between maritime casualties and vessel traffic separation schemes</li> </ul>
Proposals for IMO modifications	Definition of a new amendment proposal for the IMO Resolution realized by the analysis of the different vessel traffic monitoring systems in scope and the analysis of the technical proposals of the systems developed after doing the regulation overview about the different operators involved in the project	<ul style="list-style-type: none"> <li>Amendment for the IMO resolution</li> </ul>



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(\*Source: Decreto Legislativo 16 febbraio 2011, n. 18



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# Analysis of the traffic monitoring systems

## Overview of alarm system – Assessment of functionalities

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- The analysis of alarm functionalities and algorithms, driving the implementation, are analyzed in order to provide a common basis for possible implementation of the alarms system to increase the level of support to the monitoring performed by the operator
- To carry out the assessment of alarm systems, implemented in countries bordering the Adriatic, has been provided to each country a survey for the detection of functionalities that aimed to detect the following information:
  - Typology of coverage report
  - Algorithm
  - Alarm Criteria
  - Alarm Timing
  - Alarm Recipient
- Based on the information contained in the responses of individual countries, it was carried out comparison analysis in order to identify and compare the different systems developed. For this purpose the individual functionality have been associated on the basis of alarm purposes
- **The result of this analysis, for ease of reading of the information, is reported in the excel file Annex.**
- **Details of this information in relation to different functions for each system is shown in prepared cards for each country.**



Alarm  
Functionalities



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## *Italian Alarm system*



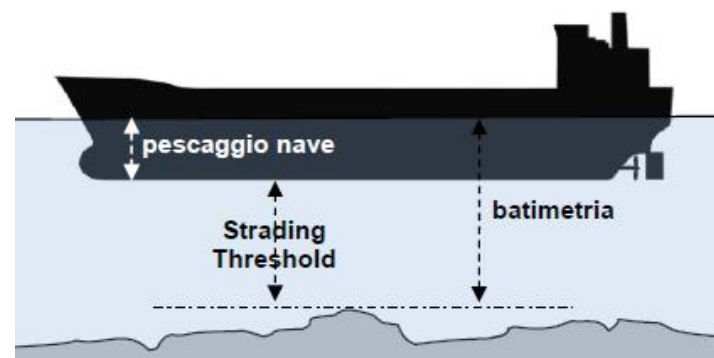
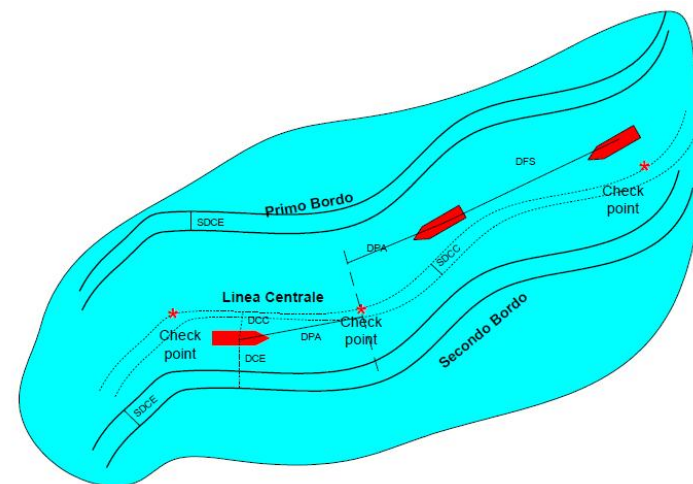
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# Analysis of the traffic monitoring systems

## VTS Alarm system

- The VTS module of the Italian maritime traffic alert system allows the generation of alarms through the control of certain defined parameters
- The main action areas of the system are the following:
  - ü Control of compliance with speed limits
  - ü Control of the areas in which is not allowed ships to anchor
  - ü Control of fixed tracks location such buoys, ships anchored etc.
  - ü Control of parameters defined in order to avoid the collision
  - ü Control of the channel areas through the ability of systems to recognize the position of tracks in order to keep under control parameters to be respected in the navigation of the channels
  - ü Navigation Control Areas forbidden
- In each case, the objective of the checks is the generation of alarms which are activated whenever the threshold is exceeded for the relevant parameter



# Analysis of the traffic monitoring systems

## Assessment of VTS alarm functionalities (1/3)

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
1	VTS	System Max Speed	<b>Defines the maximum speed that the track can have (Speed Limit)</b>	The alarm is generated by defining a maximum permitted speed, which can be set to a value belonging to the range 0-99 knots	Maximum speed: setting a maximum permitted speed	A speed alarm is generated when it is reached or exceeded the value of SMS
2	VTS	Probable Anchorage Speed (PAS)	<b>Prevents anchoring in areas where this is not allowed (No Anchorage Areas)</b>	The alarm is generated through the definition of a minimum allowed speed, which can be set to a value belonging to the range 0-9 knots	Minimum speed: setting a minimum permitted speed	An alarm is generated every time the system find a trace, inside a No Anchorage Area, which reduces the speed below the value defined by the PAS
3	VTS	Floating Buoy / Floating Ship	<b>Check the position of fixed tracks (buoys and anchored ships)</b>	The alarm is generated by defining: -a maximum range permitted in FMR, which can be set to a value belonging to the range 0-999 meters and which is fixed to buoys, platforms, etc. -a maximum range permitted in MAR, which can be set to a variable value depending on the ship and that depends on the length of the anchor chain	Position: the reference point is the position of the track when is defined as fixed. The position of the track can not be outside the circle of range FMR or MAR	An alarm is generated when the track position is outside of a circle of range: -FLOATING MAXIMUM RADIUS for items not included in the current traffic (buoys, platforms, wrecks etc) (Alarm "buoy outside the security») -maximum ANCHORAGE RADIUS to anchored ships (Alarm "Ship outside the anchoring»)



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# Analysis of the traffic monitoring systems

## Assessment of VTS alarm functionalities (2/3)

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
4	VTS	Collision	<b>Control of parameters defined in order to avoid the collision</b>	<p>The alarm is generated by defining values and relationships between the following parameters:</p> <ul style="list-style-type: none"> <li>-distance To the Closest Point of Approach (DCPA), with respect to each track (excluding boe) or at special points (obstacles)</li> <li>-Time To reach the Closest Point of Approach (TCPA), with respect to each track (excluding boe) or at special points (obstacles)</li> <li>-Decision Distance (DD), defined for vessels that are found in the sea in a radius defined by the DD, which can take values in the range 0-9999 meters</li> <li>-Standard Separation (SS), set minimum range between two ships or between a ship and a point and can take values from 0 to 9999 meters</li> <li>-Collision Time, minimum time required to maneuver to evade a collision, which can take values in a range of 0-59 minutes</li> </ul>	<p>For each track are calculated CPA and TCPA values compared to each track (boe excluded) or special points (obstacles) included in a circle of range centered around the DD track</p>	<p>Every time that:</p> <ul style="list-style-type: none"> <li>- DCPA &lt; SS</li> </ul> <p>AND</p> <ul style="list-style-type: none"> <li>- TCPA &lt; Collision Time</li> </ul> <p>The system generate an allarme of TCPA type</p>



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# Analysis of the traffic monitoring systems

## Assessment of VTS alarm functionalities (3/3)

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
5	VTS	Control canal area	<b>Recognition of the position of the tracks and parameter control to be respected for navigation in the canals</b>	<p>The alarm is generated by defining the values of the following parameters:</p> <ul style="list-style-type: none"> <li>• Ship Safe Domain (SSD): Safety distance that vessels must keep the canals, variable in the range 0-999 meters</li> <li>• Minimun Delta Time at Turning Point (MDTTP): time that must elapse between two transits (of two different ships) on the same turning point of a canal; variable in the range 0-59 minutes</li> <li>• Safety Distance from Centre Channel (SDCC): distance must maintain a ship from canal center. Can assume values in the range 0-99 meters</li> <li>• Safety Distance to Channel Edge (SDCE): distance than the canal edges and can take values in the range 0-999 meters</li> <li>• Lane Check: lane defined by directions of travel within the canal</li> <li>• Time Extrapolation Stranding (TES): time within which a ship is approaching to an area in the bottom lower than the draft of a certain nature</li> </ul>	<p>The system is able to recognize the positions of the tracks, and then the possible violation of the navigation parameters defined in the canals safety. The alarm is generated at the violation of at least one of the parameters</p>	<p>Alarm generated when:</p> <ul style="list-style-type: none"> <li>• The safety distance between the two vessels is less than the threshold SSD</li> <li>• Two ships arrive at the action point with a time lag below the threshold MDTTP</li> <li>• The distance of the ship with respect to the center line the canal is less than SDCC</li> <li>• The distance of the ship with respect to the edges of the canal is less than SDCE</li> <li>• The ship does not comply with the Check Lane</li> <li>• The ship, which is known draft, is approaching a bottom area within a time TES</li> </ul>
6	VTS	Forbidden Area	<b>Controlling of "no transit" areas</b>	<p>The alarm is generated by defining of "no transit" areas</p>	<p>position of the track: the alarm is generated when the track moves within a prohibited area</p>	<p>Whenever the system find a track inside the "no transit" area, gives an alarm</p>



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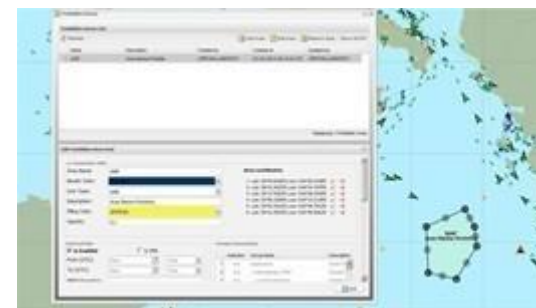


# Analysis of the traffic monitoring systems

## *Pelagus Alarm system*

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- Inside the pelagus system has been developed the Forbidden Areas alarm functionality, which aims to generate alarms created by the definition of prohibited areas inside the navigation area responsibility of the the Italian Harbour Master, by specific criteria defined by the operator. The logic at the base of the alarm system are:
  - ü AND logic, the alarm is generated when all defined criteria are violated
  - ü OR logic, the alarm is generated when at least one of the defined criteria is present)
- The criteria underlying the establishment of alerts implemented in the function are:
  - ü TEMPORAL: (i.e. just from 8.00 to 9.00);
  - ü MMSI: deny the entrance in a defined area to a list of MMSI and/or IMO codes;
  - ü IMO: deny the entrance in a defined area to a list of MMSI and/or IMO codes;
  - ü HAZMAT: deny the entrance in a defined area to ships of HAZMAT type;
  - ü SHIP TYPE: deny the entrance in a defined area to specific ship categories;
  - ü COUNTRY: deny the entrance in a defined area to specific flags;
  - ü SPEED OVER GROUND: setting a maximum permitted speed over ground;
  - ü DRAUGHT: setting a maximum permitted value for the draught;
  - ü GT: setting a maximum permitted value for the tonnage



# Analysis of the traffic monitoring systems

## Assessment of Pelagus alarm functionalities

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
1	PELAGUS	Forbidden Area	Forbidden Area	The alarm is generated by the creation of Forbidden Areas inside the navigation area referring to the Italian Port Authorities. They are based on specific criteria inserted by the operator of the port Authority and that are concatenated through a AND logic (the alarm is generated when all defined criteria are violated) or a OR logic (the alarm is generated when at least one of the defined criteria is present)	TEMPORAL: (i.e. just from 8.00 to 9.00); MMSI: deny the entrance in a defined area to a list of MMSI and/or IMO codes; IMO: deny the entrance in a defined area to a list of MMSI and/or IMO codes; HAZMAT: deny the entrance in a defined area to ships of HAZMAT type; SHIP TYPE: deny the entrance in a defined area to specific ship categories; COUNTRY: deny the entrance in a defined area to specific flags; SPEED OVER GROUND: setting a maximum permitted speed over ground; DRAUGHT: setting a maximum permitted value for the draught; GT: setting a maximum permitted value for the tonnage.	At the entrance of the ship in the area



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## *Slovenian Alarm system*



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# Analysis of the traffic monitoring systems

## Assessment of Slovenian alarm functionalities

- Inside the Slovenian traffic monitoring systems, the following alarms are defined:
  - ü **Anti Collision Alarm**
  - ü **Anti Grounding alarm**
  - ü **Alarm Anti Speed**
  - ü **weather alerts**, detections of problems related to wind or fog.
- However, the operators may not use these alarms because it was not developed the algorithm inside the system.

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
1	Transas NH 4.55	Collision alarm	<i>Alarm not in use / switched off by users</i>	N/A	N/A	N/A
2	Transas NH 4.55	Restricted area alarm	<i>Alarm not in use / switched off by users</i>	N/A	N/A	N/A
3	SITRAC	Receiving DSC alarm	<i>Sounds alarm when DSC message is received</i>	On receipt of Distress / Urgency / Safety / Routine DSC (for each category of DSC a different alarm sound is generated.	Receipt of DSC	On Receipt



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## *Croatian Alarm system*



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# Analysis of the traffic monitoring systems

## Assessment of Croatian alarm functionalities

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
1	COAST WATCH	EU BANNED SHIPS		Operational alarms, active alarms		
2	COAST WATCH	NORTH KOREA BANNED		Operational alarms, active alarms		
3	COAST WATCH	AREA ALARM	<i>More than x vessels inside anchoring area b, more than x vessels under surveillance in sector a</i>	Operational alarms, active alarms	Rules which evaluate on each area	Workload alert
4	COAST WATCH	TRACK ALARM	<i>Speeding inside harbour area, cpa/tcpa alarm, cctv alarm.</i>	Operational alarms, active alarms	Rules which evaluate on each track	
5	COAST WATCH	BOUY ALARM	<i>For radar plots if no radar echo is received for a buoy in the given time interval</i>	Operational alarms, active alarms	Rules which monitor buoy location	Given time interval



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## *Montenegro Alarm system*



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# Analysis of the traffic monitoring systems

## Assessment of Montenegro alarm functionalities

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
1	VTMIS	Collision	<i>Real time collision detection</i>	distance and direction monitoring between targets and with reference point	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
2	VTMIS	Forbidden Area	<i>Real time forbidden area intrusion</i>	area intrusion detection with optionally filters (black/white lists, type of ships, type of cargo, navigational status, flag, speed, direction, etc.)	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
3	VTMIS	Speed limit	<i>Real time speed limit (min, max) threshold</i>	target speed limit	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
4	VTMIS	Route planning	<i>Real time route assignment</i>	target route deviation to an assigned route or traffic lane	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
5	VTMIS	Grounding	<i>Real time grounding prediction</i>	prediction of target grounding based on target draught and batymetric charts data	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
6	VTMIS	Dragging	<i>Vessel Dragging</i>	Detection of possible vessel dragging on dangerous area	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
7	VTMIS	Ancorage Area	<i>Monitor of target anchorage area</i>	detection of vessel that is leaving the assigned anchorage area	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
8	VTMIS	Sensors inconsistency	<i>AIS/RADAR data inconsistency</i>	detection of inconsistency between AIS and radar values (speed, course, etc.)	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)
9	GMDSS	Distress	<i>DSC Distress received</i>	Alarms on received distress calls	Operator console audio and visible alarm to be acknowledged	near real time (above 1 second)



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## *Albanian Alarm system*



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# Analysis of the traffic monitoring systems

## Assessment of Albanian alarm functionalities

For the mapping of Albanians alarm features, such as the Administration indication, It was used standard **alarms ARPA Radar**

#	System	Functionality	Type of monitoring case	Algorithm	Alarm Criteria	Alarm timing
1	AIS	GUARD ALARM	<i>A guard zone (guard alarm) may be set to alert the navigator to targets (ships, landmasses, etc.) entering a certain area with visual and audible alarms.</i>	n.a.	The guard zone (guard alarm) has a fixed width of 0.5 nm in the radial direction and is adjustable only within 3.0 to 6.0 nm from own ship. The guard zone (guard alarm) can be set to any sector angle between 0 and 360 in any direction	n.a.
2	AIS	ANCHOR WATCH	<i>The anchor watch feature helps you monitor whether own ship is dragged by wind and/or tide while at anchor.</i>	n.a.	This feature requires ship position data from a suitable radio navigational aid. Provided that own ship's physical data has been entered, an own ship mark can be displayed when the anchor watch feature is activated. The message "ANCHOR WATCH ERR" appears in red when position data is not inputted.	n.a.
3	AIS	CPA/TCPA alarm	<i>The predicted CPA and TCPA of any target become less than their preset limits.</i>	n.a.	Visual and aural alarms are generated when the predicted CPA and TCPA of any target become less than their preset limits. Press the AUDIO OFF key to acknowledge and silence the CPA/TCPA aural alarm.	n.a.
4	AIS	Lost target alarm	<i>Loss of a tracked target</i>	n.a.	When the system detects a loss of a tracked target, the target symbol becomes a flashing diamond. and the label "LOST" appears at the screen bottom. At the same time, an aural alarm is produced for one second.	n.a.



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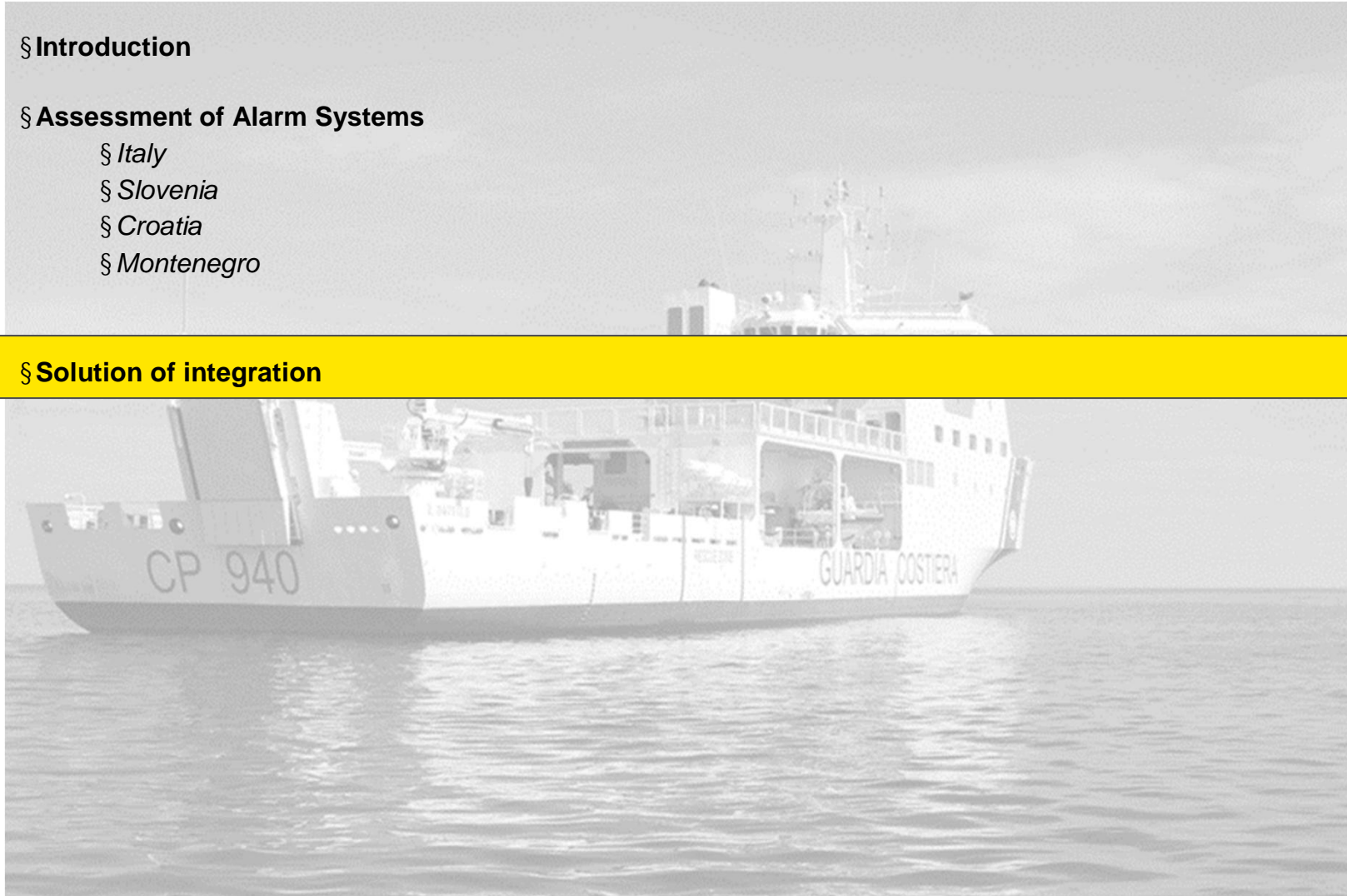
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# Analysis of the traffic monitoring systems

## *Integrated solution for alarm systems (1/2)*

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- The **alert functionalities and related algorithms** have been implemented in the **systems** used by operators to monitor vessel traffic:
  - **VTS and Pelagus for Italy**
  - **COAST WATCH for Croatia**
  - **Transas NH 4.55 for Slovenia**
  - **VTMIS for Montenegro**
  
- **All countries have developed a complete panel of alarm functionalities (with few exceptions and differences between each other)**
  
- **The level of utilization** of these functionalities, by the vessel traffic monitoring operator for the prevention of casualties **is medium**.
  
- **An harmonized solution, on alarm functionalities could be managed the following set of controls**, which is inclusive of all the possible cases of risk, modelling at least in one of the State analyzed:

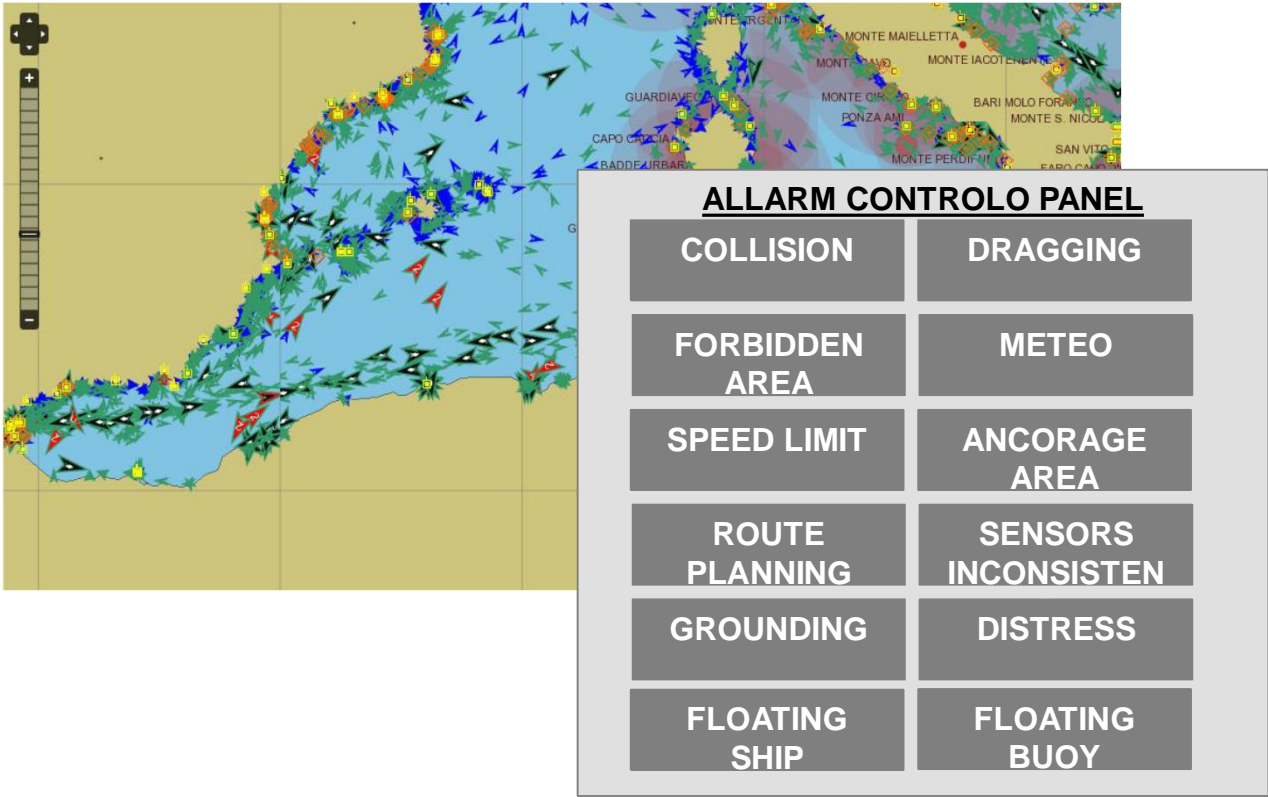


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# Analysis of the traffic monitoring systems

## Integrated solution for alarm systems (2/2)



- Through this solution all monitoring operators can take advantage of a homogenous support joined activity monitoring standards.



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