

Automated Behaviour Monitoring WG Workshop 4

Meeting Minutes
Held in Lisbon on
05 December 2018

List of Abbreviations

AIS	Automatic Identification System
ABM	Automated Behaviour Monitoring
AOI	Area of Interest
CSD	Central Ship Database
EC	European Community
EMSA	European Maritime Safety Agency
EU	European Union
IMDatE	Integrated Maritime Data Environment
IMS	Integrated Maritime Services
LRIT	Long Range Identification and Tracking (vessel position data based on telecommunication satellites)
IUU	Illegal Unreported and Unregulated Fishing
MAOC-N	Maritime Analysis and Operations Centre – Narcotics
MRS	Mandatory Reporting System
MSS	EMSA's Maritime Support Services
SADV	Statistical anomaly detection
SAT-AIS	Satellite Automatic Identification System (AIS data transmitted by satellite)
SSN-EIS	SafeSeaNet European Index Server
VDS	Vessel detection system (vessels detected on SAR satellite images)
VHF	Very high frequency (radio signals)
VMS	Vessel Monitoring System (tracking of commercial fishing vessels based on communications satellites)
VOI/ TOI	Vessel (Targets) of Interest
VTMIS	Vessel Traffic Monitoring and Information System
WUP	Web User Portal, also referred to as web user interface

Background

On the 05 December 2018 the European Maritime Safety Agency (EMSA) hosted the 4th Operational Workshop on Automated Behaviour Monitoring (ABM). ABMs are Integrated Maritime Services (IMS) tools automatically analysing various position reports for the detection of specific ships' behaviours. Their aim is to support the maritime surveillance operators by providing an increased maritime situation awareness and alerting. They are used by EU Member States and EU Bodies executing functions in safety of marine traffic, environmental protection fisheries control, border control and security.

1. Opening and welcome

The meeting was opened and chaired by Mr Ivo Kupsky, Chairman of the Integrated Maritime Services (IMS) Group.

The EU Member States (MS) and the EU Bodies actively using, or willing to start utilizing ABMs for surveillance purposes were invited to the workshop. Delegations attended from: **Belgium, France, Greece, Ireland, Italy, Latvia, Malta, Montenegro, Poland, Spain, Sweden, United Kingdom** as well as from the **European Border and Coast Guard Agency (Frontex)** and **Maritime Analysis Operation Centre – Narcotics (MAOC-N)**. **EU NAVFOR and EFCA** were represented by the EMSA's service managers.

Following the opening, and tour-de-table introduction of the participants, the chairman introduced the main objectives of the meeting, which were to:

- 1) **To discuss and share operational aspects and best practices on the use ABMs by different communities, Member States and EU bodies;**
- 2) **To present and discuss state-of-play of the ABM-related developments, referring to the priorities set during previous ABM Workshops;**
- 3) **Promote the use of the ABMs for the enhanced awareness, detection of specific situations as well as assessment of risks in the maritime domain.**

The agenda (see **Annex 1**) was adopted without changes. The list of participants is presented in **Annex 2** and the Workshop 4 action points in **Annex 3**. All the meeting presentations are available at:

<http://emsa.europa.eu/workshops-a-events/188-workshops.html>.

2. Executive summary of the Workshop

Member States and **EU bodies** provided feedback on the operational use of ABM algorithms and expressed their additional requirements for the possible changes. The future developments' priorities, as identified at the ABM Workshop 3, were reviewed.

The related discussions can be summarized as follows:

- **Member States** acknowledged the on-going work on the inclusion of uncorrelated targets (Earth Observation based product - Vessel Detection Service) in ABMs, expected during 3rd quarter (Q3) of 2019.
- There is a growing interest in the Increase of the T-AIS rate (from every 6 minutes to every 1 minute) for the better detection of specific situations in ABMs (**Action WS4.3**).
- There is a growing interest in the use of new technologies (e.g. machine learning, cloud-based solutions, statistical approach) for the detection of anomalies and for the assessment of risks in the maritime domain. These aspects should be reflected in the work conducted by the group at the future ABM Workshops (**Action WS4.10; Action WS4.7**).
- EMSA should continue working on historical ABMs and combination of the multiple algorithms to detect interlinked situations (**Action WS4.4**).
- EMSA should analyse additional filtering criteria, based on SafeSeaNet data or the Central Ship Database (CSD), for the selection of vessels of interest (**Action WS4.5**).

- Creation of a new ABM algorithm should be considered, for the detection of the ships' navigational status, especially the 'not under command' (NUC) status (**Action WS4.6**).

EMSA presented an update on the status of ABMs (data refers to October 2018):

- ABMs are used by 15 EU Member States and 4 EU Bodies. There are over 70 administrator users that distribute ABM-related alerting to over 200 users.
- There are over 300 active ABMs and another 500 have been used up to this moment.
- Twenty-four different ABM algorithms are available for operational use.

Analysis of the ABM usage, presented by **EMSA**, allowed identification of the most popular ABM algorithms ('In' or 'Out Area'; 'Not Reporting'; 'At Sea Encounter'; 'Drifting'). Additionally, the prototype of the ABM administration console in SEG was demonstrated. It was noted that the first validation of the tool was performed with the support of **Italy** and **Denmark** and their feedback was considered in further developments. **France** and **Sweden** volunteered to participate in the early validation/tests of the new ABM-related developments and will join **Denmark**, **Croatia** and **Italy** in these activities (**Action WS4.1**). **EMSA** also updated participants on the on-going actions aiming at the improvement of the quality of ship reference data bases, that are used for the filtering of the vessels of interest (VOI).

Plans for 2019 development were discussed and acknowledged by the participants. They covered:

- Testing of the new, cloud-based technologies.
- Development of the ABM admin console in the new SEG front end interface.
- Use of the System-to-System (S2S) interfaces for setting ABMs and for distributing the related alerting.
- Use of the reference databases and the Earth Observation data/products in the ABMs.

EMSA's Frontex team demonstrated outcomes of the proof of concept (PoC) project on the 'Deep Learning', whose objective is to map usual, common behaviours of certain vessel types. These analyses will serve as inputs for the supervised or unsupervised 'Machine learning' and subsequent detection of anomalous behaviours.

Participants welcomed this presentation with interest and requested to be briefed on the final outcome of the project, as well as on the subsequent ABM-related developments in this domain (**Action WS4.7**).

Poland presented a summary of the on-going developments for the provision of the ABM-related alerting and for setting ABMs via System-to-System (S2S) interfaces. The overall objective of this implementation is to allow ABM configurations and provide ABM alerts to the national system for exchanging maritime safety and security information (SWIBZ). This is a first development of that kind in the IMS for MS. Participants requested additional information on the available documentation for the S2S interface (**Action WS4.8**).

3. Operational feedback from the ABM users

Before the WS, **EMSA** encouraged participants to prepare for the active discussions by covering, at least, some suggested aspects of the ABM usage:

- The operational use of ABMs – how ABMs help or may help in the daily duties;
- What are the most relevant/ commonly used ABMs;
- What other modifications or changes would be required from the ABM tools/services to address new operational use cases;
- What other ABM-alike tools and functions are used at national level, and how their capabilities could be reflected in the IMS ABMs to present an added-value to the end-users;
- How ABMs contribute or could contribute to the enhanced awareness and assessment of risks in the maritime domain.

The aforementioned topics were covered by all representatives and can be summarized as follows:

- **Belgium** shared operational experience and expected a higher usage of the ABM tools by the safety community (Belgian Federal Government bodies) following the on-going, internal trainings.

- **France** confirmed that the ABM tools are mainly used by the MRCCs, those in charge of the VTS-es, MRS-es, overseas territories, customs authorities and the Navy. It was important for the users to have the capability of the anomaly detection over very large areas, to combine filtering per specific ships, their types and flags and improve exclusion criteria in the ABMs settings (**Action WS4.5**).
- **Greece** – who is not yet an active user of the ABMs – suggested an operational scenario for the monitoring of vessels that are subject of embargos, underlined importance of the ‘In Area’ algorithm and increase of the T-AIS rate.
- **Ireland** summarized the use of the five active ABMs used in the MRCC Dublin (National Maritime Operations Centre - NMOC). It was clarified how the exclusion criteria could be set for the detection of drifting of vessels close to the areas of the wind-farms, or during towing operations with the usage of the ‘navigational status’ (**Action WS4.6**). Ireland expressed their interest in grouping - or chaining the ABMs status’ (**Action WS4.4**).
- **Italy** – summarized the usage of the ABMs, with focus on the detection of the ‘InArea’ and ‘AtSeaEncounter’ and expressed interest in the detection of ‘drifting’ vessels. Reference was made to the rule-based national system used in similar context with better filtering options. **Italy** expressed their interest in detecting vessel changing the navigational status (**Action WS4.6**.) and detection and display of the AIS SART. The related alerting should be presented in the graphical interfaces to attract the attention of the duty officers/ users. **Italy** suggested usage of the SSN enrichment information (namely HAZMAT) as a filter for the ABMs. A reference was made to the AIS data for 3rd countries, as available in the MARES regional server.
- **Latvia** – confirmed interest in using the ABMs by the Coast Guard services. LV plans a number of demonstration sessions for the national users on the IMS, ABMs and their graphical interfaces. Latvia also expressed their interest in the M2M interfaces, as developments are planned in the national system (**Action WS4.8**).
- **Malta** – provided a presentation on the usage of ABMs for the fisheries monitoring in the 25 Nm zone and trawling zones around Malta. Operational experience was shared by Malta on the usage of Vessel Monitoring System (VMS) position reports available every two hours in the context of ABMs. It was underlined that the AIS system and related position reports can be manipulated much easier than the VMS. **Malta** also presented practical, operational scenario on the usage of the ‘Heading to Shore’ algorithm and confirmed that the ABMs support identification of risk in their domain.
- **EUNAVFOR** – shared experience on the usage of ABMs for the anti-piracy operations off the coast off Somalia. It was confirmed that the ABM algorithms (‘InArea’) can be also used for statistical purposes and data analysis when monitoring commercial shipping in the areas endangered by piracy. (ref. **Action WS4.10**). **EUNAVFOR** complimented **EMSA** for the provision of the remote training – webinar on the usage of ABMs.
- **Montenegro** – shared experience on the usage of the national VTMISS/ VTS that contains ABM-alike tool allowing automatic detection of specific patterns as well as its visual presentation and email-based alerting. A comparison was made, and advantages and disadvantages of both systems compared. As regards the EMSA based services, **Montenegro** considered that ‘InArea’ and ‘OutArea’ and ‘Speed Anomaly’ ABMs could be used for safety purposes, monitoring of the Mandatory Reporting System (MRS) ADRIREP, by the PSC officers to support inspection process, and for monitoring of wrecks and sensitive Areas. **Montenegro** provided an example of the yachts ignoring the speed limits in sensitive areas. **Montenegro** also expressed interest in the increase of the AIS reporting rate in the EMSA system and provided suggestions on the use of ‘augmented reality’ technology to be used in the Mobile App.
- **Poland** – explained responsibilities of the Maritime Offices and their areas of interest and confirmed number of IMS and ABM users. The IMS interfaces in Poland are mainly used as a back-up of the national system, whereas ABMs provide early warning for specific situations to the Maritimes Safety Centre. Poland expressed interest in the development of the functionality allowing national users to define ABM alert distribution lists by the national users. **EMSA** confirmed a dependency with the on-going STAR-ABM technical module and thanked **Poland** for the collaborative efforts in the implementation of the ABM alerting via S2S interface.
- **Spain**- confirmed the usage of ABMs by Customs. ABMs support targeting specific ships and allow a better use of resources. **Spain** proposed an expanding filtering options to allow selection of the ship(s) by Length Overall (LOA), and would be in favour of setting some ABMs via the Mobile App **Action WS4.5**). As regards maritime rescue services, **SASEMAR** representative described tools used in the MRCCs and

expressed interest in using the ABMs, suggesting additional developments, like: mapping of the AIS coverage, chaining or combining ABM algorithms (**Action WS4.4**).

- **Sweden** – described the usage of ABMs mainly the ‘InArea’ algorithm and ‘At Sea Encounter’.
- **United Kingdom** – shared experience on the use of national the system, similar to ABMs, where additional filters, like vessel age are used. **UK** considered that ABMs could be potentially useful for the SAR and pollution response services, by the National Maritime Information Centre (NMIC). IMS and ABMs advantages were emphasised, among them possibility of linking ABM setting (administration) to individual user accounts.
- **Frontex** – described the usage of the ABMs (called anomaly detection in the **Frontex** services) by the 24/7 services for vessel traffic monitoring. **Frontex** suggested improvements in the usage of UNECE LOCODES and expressed their interest in the combinations of ABMs (detected anomalies) using ‘AND’ and ‘OR’ logic for the specific conditions. **Frontex** is also interested in the search tool for the ABM-related alerting. As for the future developments, the following were suggested: importing of areas of interest from KML files, detection of the AIS-based ‘destination’ change, pre-loading of the default configurations in the ABM administration tool, adding new filters for vessels attributes - LOA and the year of built. **Frontex** suggested that the ABM administrators could create their own distribution lists. On the visual display aspects, the grouping of alerts and specific display for the ‘blocked’ ABMs should be considered (**Actions WS4.4 and WS4.5**). **Frontex** underlined a need for further work on the ABM user guide (operational manual) to include explanations for the non-experts in the maritime domain (**Action WS4.2**). **Frontex** also confirmed that the ABM tools are used for the risk profiling/ assessment and share their experience in this matter, considering cross-border crime (**Action WS4.10**).
- **MAOC-N** – shared experience in the use of ABMs as well as the other tools available, stressing possibility of profiling vessels based on certain behaviour patterns. **MAOC-N** has interest in expanding the area limitations for the ABMs Areas of Interest (AOI) which, at the moment, represented the major limitation of the tool (**Action WS4.9**). **MAOC-N** has interest in combinations of the ABMs and would like to have an option of automatically profiling vessels or assigning specific risks to ships based on user-specific, customizable criteria (**Action WS4.11**).

Following the aforementioned discussions, EMSA will consult the IMS Group on the possible expansion of the scope of the ABM Working Group to address the growing needs for data analytics for the detection of specific risks in the maritime domain (**Action WS4.10**).

4. Closing remarks

At the end of the meeting the participants were requested to provide feedback on the 4th ABM Workshop. All MS and EU bodies underlined the importance of the ABM Workshop as a venue for sharing the ABM-related operational experiences, expressing requirements and awareness on the ABM-related developments. The Chairman thereafter thanked all representatives for their contributions and closed the meeting.

Annexes

Annex 1 – Meeting Agenda

Annex 2 – Participants List

Annex 3 - Action points ABM WS4

Annex 4 – Action points ABM WS 1- 3 state- of – play

Annex 1: Agenda



4th ABM Workshop – Agenda (Room -1.11)

Wednesday, 05 December 2018

Time	Agenda Item	Speakers/Comments
09:00 – 09:30	Registration and coffee	
09:30 – 09:45	1. Welcome, opening, Introduction	EMSA
09:45 – 11:00	2. IMS ABM operations <ul style="list-style-type: none"> ■ Status of the existing ABMs in IMS ■ Operational use of the ABMs by MS and EU Bodies 	EMSA / MS / EU Bodies
11:00 – 11:15	Coffee break	
11:15 – 12:30	3. IMS ABM operational aspects - cont. <ul style="list-style-type: none"> ■ Migration of the ABM admin module to SEG 	EMSA / MS / EU Bodies
12:30 – 14:00	Lunch break	
14:00 - 14:30	4. IMS ABM operational aspects – cont. <ul style="list-style-type: none"> ■ Most popular ABMs 	EMSA / MS / EU Bodies
14:30 – 15:15	5. ABM developments <ul style="list-style-type: none"> ■ Recent developments – historical and combined ABMs, deep learning ■ S2S developments 	EMSA / MS / EU Bodies
15:15 – 15:30	Coffee break	
15:30 – 16:00	6. ABM developments – cont. <ul style="list-style-type: none"> ■ ABM user guide/ manual and ABM trainings 	EMSA / MS / EU Bodies
16:00 – 16:30	7. Summary of the WS, conclusions AOB	MS / EU Bodies / EMSA

Annex 2: Participants List

Katrien Van Meerbeeck, Federal Public Service Mobility and Transport, Belgium
Bart Lauwers, Ship Guidance, Belgium
Katell Marcillaud, Directorate for Maritime Affairs/Subdirectorates of Maritime Information Systems, France
Andreas Moros, Hellenic Coast Guard, Greece
Dionysios Bilalis, Hellenic Coast Guard, Greece
Alan Osborne, Irish Coast Guard, Ireland
Pantaleo Dell'Olio, Italian Coast Guard, Italy
Dario Cau, Italian Coast Guard, Italy
Deniss Bickovs, Latvian Coast Guard Service, Latvia
Stephanie Bugeja, Department of Fisheries and Aquaculture, Malta
Christopher Sciberras, Department of Fisheries and Aquaculture, Malta
Nexhat Kapidani, Maritime Safety Department, Montenegro
Andrzej Kalata, Maritime Office Gdynia, Poland
Paulo Silva, MAOC (N)
José Cristóbal Maraver Romero, SASEMAR, Spain
Bardaji De Azcarate AEAT, Spain
David Herrera González, FRONTEX
Mats Kannerstål, Swedish Maritime Administration, Sweden
Peter Smith, Maritime and Coastguard Agency, United Kingdom
Ivo Kupsky, EMSA
Yann Le Moan, EMSA
Lukasz Bibik, EMSA
Joao Noronha, EMSA
Marc Journal, EMSA
Fionn Molloy, EMSA

Annex 3 – Action points ABM WS4

No	Action	Responsible	Status/ Target date
WS4.1	Involve volunteer MS and EU Bodies in the early validation of the new ABM-admin console in SEG	EMSA, MS, EU Bodies	Q3 2018-Q1 2019 On-going
WS4.2	New version of the ABM operational user manual to be drafted	EMSA	Q2 -Q3 2019
WS4.3	MS and EU Bodies interested in increasing the T-AIS messages frequency shall seek endorsement of the governance body (HIGH LEVEL STEERING GROUP for Governance of the Digital Maritime System and Services) and follow-up with relevant technical actions with regional servers and EMSA	MS and EU Bodies	N.A.
WS4.4	Work on the new developments – combination of ABMs, historical data, AIS coverage presentation, display of blocked ABMs, importing KML files.	EMSA	During 2019
WS4.5	Analyse inclusion of new filtering criteria in the selection of ships: SSN data (HAZMAT), LOA, Age of the Ship.	EMSA	During 2019
WS4.6	Development of new ABMs using the AIS transmitted data (change of destination and navigational status).	EMSA	During 2019
WS4.7	Brief MS and EU Bodies on the outcome of the 'machine learning' / Deep Learning project.	EMSA	At IMS UCM 13 and ABM Workshop 5
WS4.8	EMSA to provide S2S services documentations to interested MS and EU bodies.	MS and EU Bodies	As per requests
WS4.9	Analyse improvement of ABMs/ anomaly detection to work over larger areas.	EMSA	During 2019
WS4.10	Request expansion of the mandate of the ABM Working Group to include data analytics and the use of new technologies (i.e. big data) for the assessment of risks in the maritime domain.	EMSA and MS	At IMS UCM 13
WS4.11	Analyse option of adding risk profiling tools in the ABMs	EMSA	During 2019

Annex 3 – Summary of the action points from ABM WS1-3

No	Action	Responsible	Status/ Target date
1	There is a need for the common dictionary and harmonized terminology in the ABM context (ABM naming convention, parameters etc.).	ABM users and EMSA	Pending – implementation of the new SEG -based tool. Proposal is to involve ABM users once EMSA executes the review of the configuration (ABM admin) under new contract.
2	ABM operational user manual to be drafted	EMSA and IE	Done Versions: 1.0, 1.1.
3	Include the best practices and parameters setting	ABM users and EMSA	Done Best practices in the Manual, pre-setting as per action 1.
4	Confirm how the MS data is protected	EMSA	Done Information paper sent to the MS
5	Continue with the ABM capacities definition	ABM users and EMSA	Done Some ABM users responded to the questionnaires – their inputs are reflected in the new requirements doc.
6	Send the list of action points and requirements following ABM WS1	EMSA	Done with the ABM WS2 report.
7	Improve the quality of the IMDatE OVR by synchronizing it with the CSD	EMSA	Partially Done Pending connection to the CSD – central reference database of ships
8	Prepare the ABM WS2 MoM (report) and distribute to MS and publish together with the WS presentations	EMSA	Done
9	Improve the ABM admin/ configuration tool by completing the following topics: <ul style="list-style-type: none"> - implement ABM admin tool in the new graphical interface (SEG); - change units and apply default configurations for specific ABM algorithms; 	EMSA	Partially Done (Q4 2018) New ABM admin console, available in PRE-PROD since the beginning of 2019. Being tested with selected users from MS and EU Bodies.

	<ul style="list-style-type: none"> - modify visual aspects for the ABM with status 'blocked'; - consider connection to the Central Geographical Database (CGD) for the reference of the Areas of Interest (AOI); - revise ABM email alerts (HTML files) contents to make them more user-friendly and readable 		
10	Increase a number of ABM admin accounts available to the MS IMS users – and ensure the processing/ computing power, if needed.	MS and EMSA	Done
11	Consider new vessel attributes and elements (GT, Owner information, year built, fishing vessels identifiers etc.) in the ship reference database for the filtering of vessel of interest (VOI) in ABM configuration.	EMSA	Planned During CSD and ABM related future developments.
12	Improve further the ship reference database for ABMs. Validate it with MS (NL, IT).	EMSA, NL + IT	a.a.
13	In the future ABM developments EMSA should consider change of the existing system limitation, as regards repetition of the alerts after defined period of time (currently set to 12 hours).	EMSA	a.a.
14	Propose and agree a procedure for the quick/ fast-track creation of the distribution list for ABMs.	EMSA	Done Available via MSS 24/7 POC
15	Consider increase of the T-AIS rate in some cases.	EMSA in cooperation with MS hosting regional servers and providing T-AIS	Done For Romania requesting the service – available in PRE-PROD.
16	Provide Graphical layers with the T-AIS theoretical ranges.	a.a.	Not Done Pending availability of the source data from MS.
17	Reflect in the ABM version 2 (v.2), the prioritized topics: <ol style="list-style-type: none"> 1. Implementation of the ABMs based on the historical data analysis. 2. Increase of the rate of the T-AIS. 3. Use of the EO data – VDS. 	EMSA	Planned During ABM v2 (future) developments During 2019 (Q1-Q3) – EO based Increase of rate- during 2019 – pending requests from the MS Historical Data – planned development during 2019
18	Provide information paper on the protection of the ABM to Belgium.	EMSA	Done
19	Reflect use case scenarios, typical configurations, as well as the feedback from MS and EU Bodies, for specific ABMs in the new version of the ABM User Guide / manual.	EMSA + MS + EU Bodies	Done Available in the new SEG-based ABM admin console

European Maritime Safety Agency

Praça Europa 4

1249-206 Lisbon, Portugal

Tel +351 21 1209 200

Fax +351 21 1209 210

ems.a.europa.eu



Electronically signed on 06/03/2019 15:30 (UTC+01)

