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EfficienSea Activity 5.3

Final report

Regarding the development of EAVDAM –

the EfficienSea AIS VHF Datalink Management application

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Executive Summary 

This report describes the activity 5.3 of the EfficienSea project, and the elaborations that have lead to the development of the EAVDAM application. EAVDAM is a software tool facilitating transnational cooperation on management of the AIS frequencies to ensure the integrity of the AIS VHF Datalink within the Baltic Sea Region, the European Union and ultimately on a global scale.

The EAVDAM application is primarily a tool aimed at coordinating FATDMA slot allocation between operators of fixed AIS station networks, which is freely available for all interested parties to download, use, integrate into other systems, or develop further.

In fact, it is the intention that this software application will evolve through other projects or initiatives by maritime stakeholders in the future.

The report describes the Open Source Software Strategy, which was developed in cooperation with Work Package 4 on e-Navigation, to foster a cooperating community of stakeholders in the maritime domain, sharing highly specialized software tools, demonstrations and reference implementations, in an effort to promote common interests while reducing cost.

Finally, the report recommends the nations of the Baltic Sea Region, and the European Union in general, should pursue the primary recommendation from an EU AIS Masterplan workshop, conducted in January 2008 at EMSA's headquarters in Lisbon: *To ensure that national competent authorities are appointed with the responsibility - and relevant legal instruments – to monitor and manage the safe function of the AIS VHF Datalink.*

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Background and scope of this activity

Prior to the definition of the EfficienSea project, based upon concerns raised in 2007 by COSS (the Committee of Safe Seas) that the importance of the AIS system and the rapid growth in the population of AIS equipped vessels, along with the rapid introduction of shore based AIS stations, could pose a threat to the frequencies allocated for the AIS system. It was recommended that the management of these frequencies should be strengthened in order to ensure the integrity of the AIS VHF Datalink, and ultimately the safe function of the AIS system in Europe.

On this basis, the European Commision requested EMSA (the European Maritime Safety Administration) to conduct an expert correspondence group. In January 2008 a workshop was conducted in Lisbon on 'An AIS Masterplan for Europe'. Out of this workshop came a recommendation for EMSA to facilitate cooperation on AIS Datalink Management between the European Member States, and in particular coordination of FATDMA slotallocation and the use of AIS Application Specific Messages, in order to ensure the integrity of the AIS VHF Datalink in Europe.

In the EfficienSea project, activity 5.3 – AIS VDL management and FATDMA planning tool - the aim has been to develop a software tool - as proposed at the AIS Masterplan workshop - supporting the process of managing the AIS frequencies (the AIS VHF DataLink) and making the tool available to the European Member States, to promote transnational cooperation on the protection of the AIS VHF Datalink.

Conducted activities

Workpackage 5 of the EfficienSea project, was supported by all partner organizations involved in the project, however this particular activity was especially focused on the partner organizations operating AIS networks, such as DaMSA (the Danish Maritime Safety Administration), SMA (the Swedish Maritime Administration), FMA (the Finnish Maritime Agency), EMA (Estonian Maritime Administration) or bringing particular competences into the project team, such as the National Institute of Telecommunication in Poland or the Gdynia Maritime University.

The following sections describe how a team of experts were gathered, and how requirements for the planning tool to be developed were gathered, elaborations on theoretical basis for the planning tool, architectural design, and development and maintenance strategies. Finally, the development process and gathered experience is described.

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Gathering of expert team

A team of domain knowledge experts were collected for the activity. The participants were:

Name	Organisation	Background
Mr. Jens K. Jensen	DaMSA / DMA (During the last phase of the project, DaMSA, the Danish Maritime Safety Administration, was dissolved. This activity continued under the responsibility of DMA - the Danish Maritime Autority)	Activity lead – former participant in the EMSA expert correspondence group and workshop on an AIS Masterplan for Europe. Previous Danish representative to HELCOM AIS Expert Working Group. Member of the AIS Working Group under IALA's e-Navigation committee.
Mr. Claus Sølvsteen	DaMSA / Danish Navy (After the Danish Maritime Safety Administration being dissolved, Claus Sølvsteen is working for the Danish Defence Acquisition and Logistics)	Ph.D., Senior analyst, expert on analysis and quality of data derived by the AIS system, and quality of data reception by shore- and satellite based AIS systems.
Mr. Rolf Zetterberg	STA / SMA (During the project reorganizations involving the Swedish Transport Authority and the Swedish Maritime Administation caused Rolf to switch positions between these two, while remaining active in the project.)	Former participant in the EMSA expert correspondence group and workshop on an AIS Masterplan for Europe. Chairman of the HELCOM AIS Expert Working Group. Chairman of the AIS Working Group under IALA's e-Navigation committee.
Mr. Alar Sith	EMA (Estonian Maritime Administration)	Estonian representative to the HELCOM AIS Expert Working Group. Member of the AIS Working Group under IALA's e-Navigation committee.
Ms. Kaisu Heikonen	FMA (Finnish Transport Agency)	Finnish representative to the HELCOM AIS Expert Working Group. Member of the AIS Working Group under IALA's e-Navigation committee.
Mr. Rafal Niski	NIT (National Institute of Telecommunication, Poland)	Manager, Dept. Of Marine Telecommunications, NIT
Mr. Krzyztof Bronk	NIT (National Institute of Telecommunication, Poland)	Radio engineer, Dept. Of Marine Telecommunications, NIT
Mr. Marcin Waraksa	GMU (Gdynia Maritime University)	Assistant professor at GMU, Marine Telecommunications Department, Former HELCOM AIS EWG member, Senior specialist in IT networks and radionavigation systems
Mr. Nick Ward	Trinity House Lighthouse Service (Associated partner to the EfficienSea project)	Director of Research for the General Lighthouse Authorities, Vice Chair of IALA's e-Navigations committee, Chairman of the former IALA AIS committee. Joined the project to strengthen close liaison with IALA.

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Requirements elaboration

Through a series of initial meetings, the expected outcome of the activity in terms of operational scope, necessary and desired functionality and related documentation requirements of the task was elaborated.

The intended users of a tool to support AIS VDL Management and FATDMA planning, were identified to be primarily technical personell at organisations involved in operating (networks of) fixed AIS stations, but also case officers at authorities assigned with responsibilities related to AIS VDL Management within their area of responsibility. The expert team however acknowledged that the distribution of responsibility in this rather specific area of frequency management, may vary greatly between nations, and is not always absolutely clear. The group agreed that rather than building the application based on specific user roles of authorities and operators of stations in frequency management, the tool should remain a technical analysis and decision support tool, facilitating cooperation.

Based on previous experience by the members of the expert team, it quickly became evident that the theoretical foundation for part of the desirable functionality was not necessarily well understood or described in depth, and would have to evolve together with the conduction of the project.

It was also identified as an inherent risk, that the list of requirements and desirable functions for the development of a support tool could quickly exhaust the available budget for software development.

Furthermore, it was acknowledged that the tool to be developed would target a very small and highly specialized user group, making it a product that would be difficult and / or expensive to find support for on common commercial terms. The incentive for any supplier in maintaining future support or further developing such a product with a very small market would be limited.

Also, the success of such a tool, to assist cooperation on datalink management issues, would be highly dependent on the tool being available to all parties involved – or at least all relevant competent authorities in a certain region. Thus the barriers (including cost) for introducing the tool should be low.

There was general agreement that the HELCOM AIS Experts Working Group (HELCOM AIS EWG) would be a suitable forum for testing and evaluating the planning support tool.

An initial list of requirements was collected, but further elaborations went towards ensuring the development of the theoretical foundations the tool would have to be based upon, and developing a strategy for the software implementation process, that would address the concerns above.

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Theoretical and standards foundation

The Expert team identified that the theoretical and standards foundation, on which the tool would have to be built, primarily consisted of:

- IMO RESOLUTION MSC.74(69) – Performance standards for AIS
- ITU Recommendation M 1371, the radiotechincal standard for the AIS system (for which IALA maintains technical clarifications to the latest revision)
- IALA Recommendation A-124

As both the ITU-R M.1371 and IALA A-124 were under revision at the initiation of the project, it was quite clear for the expert team, that close liaison with the IALA AIS Technical Working Group was necessary. To support this process, the vice chairman of the IALA e-Navigation committee, under which the AIS Technical Working Group belongs, was invited into this group: Dr. Nick Ward of the Trinity Lighthouse Service.

Liaison with IALA

The Expert team, through it's members participation at regular IALA committee meetings, liaised with the IALA AIS Technical Working Group regularly during the project, to ensure that the theoretical foundation of the AIS VHF Datalink Management tool was in sync with recent developments.

The group decided specifically to send participants to one specific intercessional meeting of IALA's AIS Techincal Working Group, specifically aimed at revision of appendices of IALA recommendation A-124, relevant for this activity. During this meeting, the content of the appendix on FATDMA planning was confirmed ready for internal approval by IALA, and effectively forms the foundation implemented FATDMA functionality. The development of an appendix on AIS Channel Management issues proved to be challenging based on experience from the USA and Canada, and since no European member states seem to eagerly focusing on the need for Channel Management for the AIS, it was decided to give Channel Management issues low priority on the list of desirable functionality. Elaborations on the issues of coverage definitions also proved to be difficult, and the finalization of an appendix to IALA A-124 on the data distribution model for an AIS service, intended to address this issue, did not appear to be ready for publication.

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AIS coverage

One of the requested functions for the AIS VDL management tool to address, was coverage planning and coverage verification for AIS systems, however one theoretical definition lacking, was identified to be a good definition of 'AIS coverage'.

First of all, the AIS is a digital system intended to exchange position reports between vessels, to facilitate situational awareness in terms of identity and current navigational parameters of surrounding vessels. It is considered an 'oversampled' system – this means that the individual position report is in itself not critical information – it is the continued stream of regular updates, which provides the strength of the system.

The datalink mechanism is rather robust to interference, or the presence of a high volume of vessel traffic. When loading of the frequencies reaches a certain limit, the throughput may go down, but the required SOTDMA (Self Organised TDMA) access schemes for class A AIS stations will ensure that vessels will remain to have a high probability of regularly receiving position reports from those vessels in closest proximity.

Mechanisms such as the FATDMA (Fixed Access TDMA) may be used by AIS Base Stations to protect own transmissions from the transmissions of mobile stations, however FATDMA reservations will only be respected by mobile stations, who are able to receive the reservations. Thus, mobile stations outside reach of a Base Station may not receive FATDMA reservations – but their transmissions may interfere with the transmissions of a Base Station, near the outer limits of a base stations coverage area.

Thus, the AIS VHF Datalink is not perfect – all broadcasts are not guaranteed to be received by all mobiles 'within coverage', even if the signal strength is sufficient for signal detection. The AIS VHF Datalink operates with a statistical probability of signal detection – and this is what a definition of coverage needs to address.

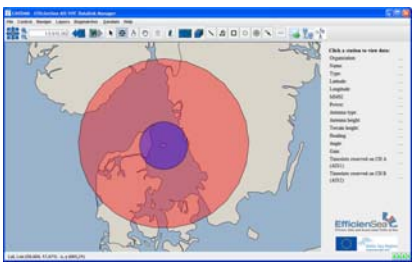
The Expert team identified 3 approaches to estimating AIS coverage. Only the Rough estimation approach is included in the final version of this tool, but documentation preparing later implementation of the more advanced approaches as a native part of the tool have been prepared during the EfficienSea project:

Rough estimation – based on GMDSS definition for A1 area VHF coverage

"Sea Area A1 is that area which is within a circle of radius A nautical miles over which the radio propagation path lies substantially over water. The radius A is equal to the transmission distance between a ship's VHF antenna at a height (h) of 4 metres above sea level and the height (H) of the antenna of the VHF coast station which lies at the centre of the circle. The following formula should be used to calculate the range A in nautical miles

A=2.5(Square root of H (in metres) + Square root of h (in metres))

H is the height of the coast station VHF receiving antenna and h is the height of the ship's transmitting antenna, which is assumed to be 4 metres."



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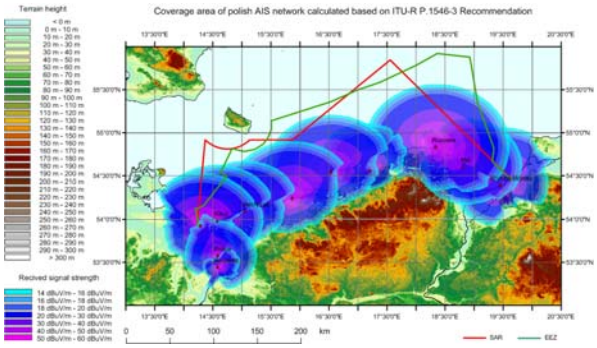
This approach provides a 'rule of thumb' approach to identifying the area, where AIS coverage with a high probability of detecting signals can be assumed - basically assuming that base stations are using omnidirectional antennas. The defined coverage is a circle around the position of the fixed station, based on antenna heights. This approach is chosen as the basis for rough estimation of coverage areas, however it is commonly observed, that this provides a coverage estimation, which is an area somewhat smaller, than the area where vessels can commonly be tracked using AIS.

To define a rough estimation of the interference range – the extent, to which a given AIS station has the ability to affect the probability of detecting signals transmitted by other stations or affect the ability of mobile AIS station in selecting free slots for its own transmissions, we have chosen to define a circle of 120 nautical miles from the transmitting station, based on the 120nm rule, within which FATDMA reservations have to be respected by mobiles, if received.

Radio propagation simulation

The National Institute of Telecommunications in Poland has developed software based on ITU recommendation ITU-R P.1546-4, which enables the calculation of estimated coverage ranges based on radio propagation simulation.

Using detailed parameters on base station antenna type, height, signal loss in antenna cables, filters, etc. together with a 3-D terrain model, a detailed engineering evaluation can calculate statistical estimations of coverage and interference ranges for transmitted AIS signals, assuming that mobile AIS stations generally have a certain receiver sensitivity, antenna height, and assuming a certain quality of the installation on board.



This approach is described in the report ‚D_WP5_3_2_AIS Coverage Analysis'.

This method can be used at planning time to perform a detailed estimation of transmit coverage, before a fixed AIS station is established. The method will however not reveal any anomalies or deficiencies in the installation, which affects the actual extent of coverage, nor will it address the effects of channel loading or protection of timeslots by the use of FATDMA techniques.

The software developed by NIT requires expert radio engineering knowledge, and it was not possible during the project to integrate this software directly into the EAVDAM application.

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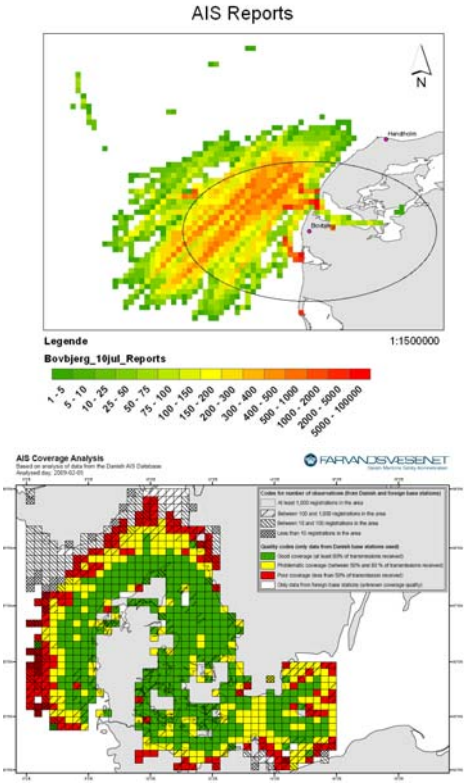
Emiprical analysis of received AIS data

The Danish Maritime Authority (former Danish Maritime Safety Administration) has developed another approach, based on empirical data. The approach is to estimate AIS coverage based on quality assessment of received AIS position reports.

By comparing the number of reports received from individual vessels with the number of broadcasts expected from that vessel, based on it's navigational parameters, the probability of reception of the average population of vessels in an area, may be assessed.

This approach is described in the report ‚D_WP5_3_1_AIS Coverage Analysis'.

While this approach supports verification of the actual quality of reception coverage, it does not support detailed coverage estimation at planning time, and is susceptible to influence from a number of statistical factors, including abnormal VHF radio propagation phenomena. Neither does it take into account the effects of protecting transmission timeslots by the use of FATDMA techniques, for transmit services.



Architectural design

Early in the project, a discussion was raised on whether the AIS VDL Management tool should be based on a central server solution or a distributed application with facilities for peer-to-peer data exchange.

Based on experience from work conducted in the HELCOM AIS EWG in 2005, it was acknowledged that a central server solution had been tried, but had it's limitations, unless it would be available to all countries globally. Radio waves have a tendency to neglect administrative boundaries – and all parties involved need the information about the configuration of neighbouring networks, regardless of whether they are part of a particular regional or not. The identication a body willing to operate and support a central server for all of the world – and be willing to support upgrading the tool in the future - could become a difficult task.

The alternative – a distributed peer-to-peer application capable of exchanging data amongst users based on XML files, could be supported by commonly available communication means, such as a simple central file repository, or even e-mail correspondence. Such a cooperation repository could easily be set up regionally by EMSA to support a coordinated VDL Management in Europe in accordance with the proposal for an AIS

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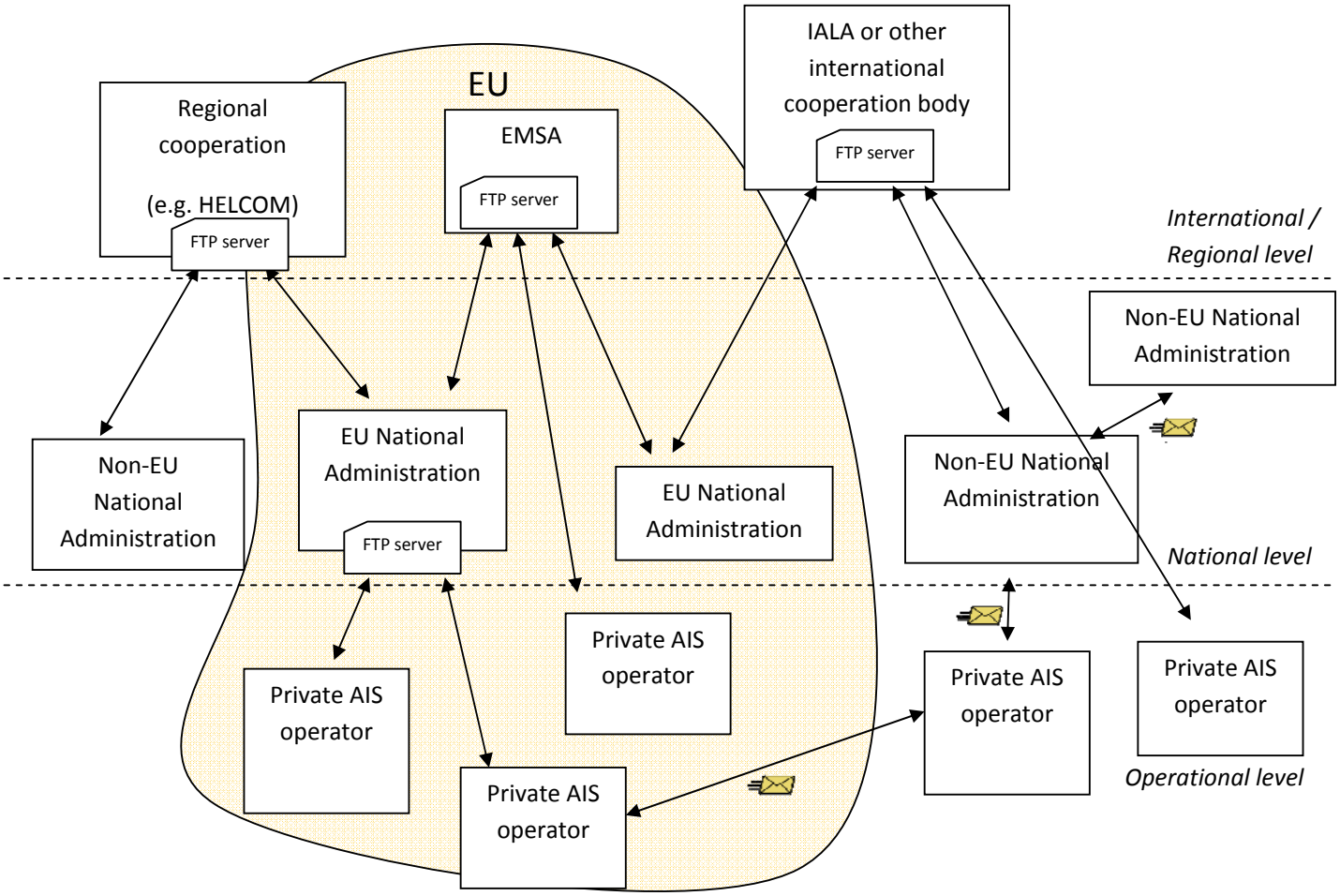
Masterplan – or in the Baltic Sea Region by the HELCOM AIS EWG enabling regional cooperation beyond EU member states. Ultimately, a body like IALA could set up a global data repository in support of the efforts of it's members on global cooperation on AIS VDL Management issues.



A distributed peer-to-peer application could allow for a higher degree of freedom in local planning efforts, allowing users to analyze certain simulated scenarios without exchanging the elaborated options as operational information.

Based on these elaborations, and the requirements identified earlier, it was decided to pursue a solution based on a peer-to-peer local application architecture, capable of registering a local (network of) AIS stations own using a local database or file store, and enabling the application to exchange data on surrounding stations via XML data exchange, using relevant protocols. This application should be able to analyze the consequences of the summarized effects of all stations participating on the VDL – preferably also on planned or simulated scenarios.

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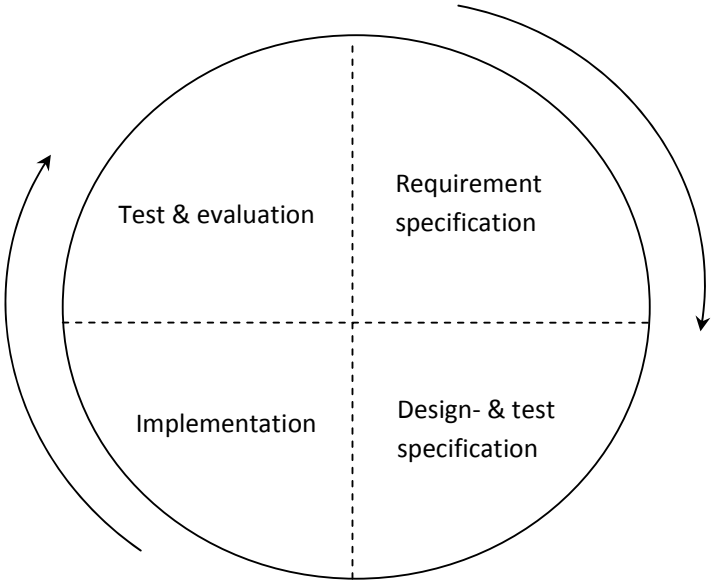
Development and maintenance strategy

In order to address the concern, that the budget for developing the software could quickly become exhausted, an agile development process was selected.

Based on a *prioritized* list of requirements, It was is envisioned that the most important requirements – the 'need to have' – would be developed through a number of iterations, first implementing those functions bringing the most value to users.

However less important functionality – the 'nice to have' – might not necessarily be realized by this project.

Instead those ideas which were not implemented could become part of a catalogue of ideas, to be implemented later, if a suitable maintenance process or another project could implement further desirable functionality.



Open Source Software Strategy

Previous experience within the HELCOM AIS EWG had demonstrated, that developing highly specialized software to support a very limited user group, would be likely to result in an expensive product, which was unlikely to be supported in the future, unless considerable funding was available.

In particular this activity on developing the AIS VDL Management and FATDMA planning tool, it was important that we would be able to freely distribute the final deliverable of our activity, to ensure that it be used widely.

In cooperation with Work Package 4 (e-Navigation testbed) we identified Open Source Software as a suitable strategic option, enabling not only the freedom to distribute the project deliverable for free at the end of the project – but also freedom for any stakeholder to choose any organization or supplier to support, integrate, modify or improve the software in the future.

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Both WP4 and WP5 activities needed the ability to conduct an agile software development process, and be able to deliver software, which could be introduced to a wider community of maritime stakeholders, with very low barriers – including cost. If this project could offer an output to be freely available to the maritime community on the right conditions, a future community for sharing highly specialized tools, demonstrations and reference implementations in software could be fostered.

This strategy would enable a maritime community to evolve an application like the AIS VDL Management tool in the future – provided that the right decisions on development strategy and licensing were in place, *before* the development process proceeded.

The issues related to Open Source Software licensing are important to understand and manage, if a future community for cooperation on shared development is to be sustainable.

Thus, an Open Source Software Strategy was developed for this activity, as well as Work Package 4, describing the licensing options that had to be taken into account, to promote the establishment of a maritime open source software community.

The strategy is described in the report *D_WP5_3_3 Open Source Software Strategy for EfficienSea WP4 and WP5.3*.

Strategy for future support

The Open Source Software Strategy has become an important unplanned output of this project.

IALA, with it's role in providing its members with good practice guidance and a membership consisting of both national administrations, industrial partners and associated stakeholders, is considered the right mix of stakeholders to sustain a cooperative community. It is therefore the intention of the Danish Maritime Authority is to bring forward the software deliverables along with the Open Source Software Strategy to the next session of IALA's e-Navigation committee. Here, it is the aim to make an attempt at fostering a community for sharing tools, demonstrations and reference implementations in software.

Already at the closing of the EfficienSea project, it has become evident that the WP4 deliverables related to the testbed activities in the evolution of e-Navigation, will be transferrable to another region, to facilitate further work in the ACCSEAS project, an Interreg project in the North Sea region.

Regarding the future maintenance and development of the deliverable from this activity, the Danish Maritime Authority is in the process of evaluating future options for funding such work, but provided that the AIS experts in IALA's AIS technical working group of its e-Navigation committee find the software deliverable useful, resources may very well turn out to be available elsewhere, for contributing to the evolution of this highly specialized tool.

'Crowd sourcing' in the maritime domain is a realistic opportunity in the very near future, initiated by the outcome of the EfficienSea project.

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Implementation process

Through a bid-at-three process, external software development resources were selected to assist in implementing the AIS VDL Management tool.

The basic request for bidding was specified to describe which required skills of the development resources the project needed, the overall scope of the intended work, plus the requirements made by the Open Source Software strategy: That the intellectual property rights of the software would belong to the lead partner of the project, not the software development organization supplying the development resources. Additionally – the project would have to be based on only using such existing components, that could be approved according to the open source licensing strategy. Based on this, the project evaluated that the VVT in Finland could provide the most hours of qualified developers time achievable for the available budget, to perform as many iterations of agile software development as possible for the money available.

Several tools to support a distributed development process with several stakeholders involved were tested. Work Package 4 had however already identified important resources for cooperating with several partners on developing software, and these were thosen to support this activity as well, to optimize synergies:

JIRA – a web based system supporting the planning and execution of agile development processes, including release planning, bug-tracking, etc. - http://en.wikipedia.org/wiki/JIRA

GitHub – a repository supporting ongoing Open Source software development by multiple stakeholders, revision control and branching of projects into different development organisations. The site also support publication of deliverables, and has proven to be a very good platform for crowd sourcing. http://en.wikipedia.org/wiki/GitHub

An Acronym for the **E**fficienSea **A**IS **V**HF **Da**talink **M**anagement tool was chosen as the name of the deliverable application: EAVDAM.

As the icon idenfitying the application was chosen a graphic to resemble the radio tower of an AIS base station, combined with the EfficienSea logo:

Through a series of internal agile development cycles, the most fundamental functionality was specified - based on the initial requirements and available theoretical elaborations - implemented and tested within the development team, and the progress presented to the expert team.

After a number of iterations, an ‘alpha release’ (version 1.4) was released within the expert team associated with the project, for internal testing. The purpose of this internal testing was to evaluate the available functionality in terms of correctness and usability, before releasing it to external users.

As the deadline for finalizing the project was approaching, and the most fundamental functions of the application had been implemented, a ‘beta release’ (version 1.5) was distributed amongst the HELCOM AIS EWG, to obtain an external user evaluation of the deliverable.

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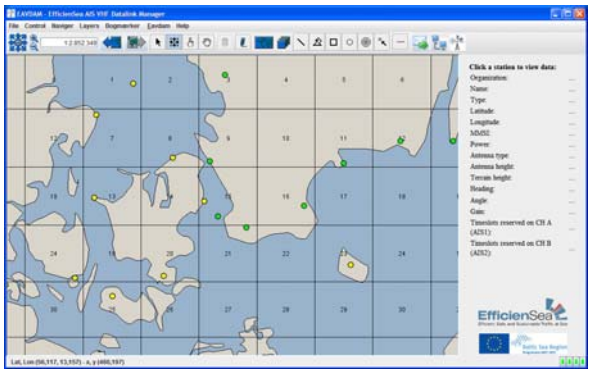
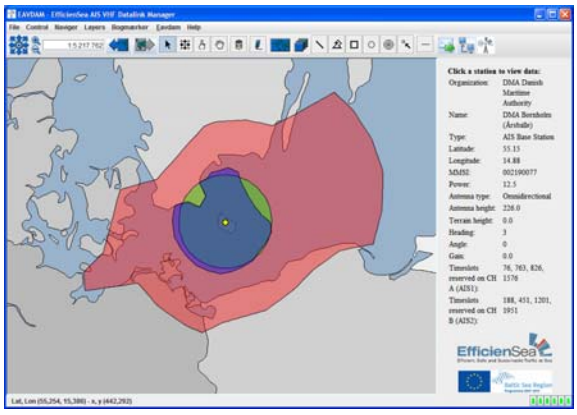
All user comments obtained from the alpha- and betatesting process of the EAVDAM application, were addressed in bug-fixing the final application (version 1.6) and amending the user manual.

Project result

The EAVDAM application is capable of registering a network of fixed AIS stations, including AIS base stations, AIS receivers, AIS repeaters and AIS AtoN stations, and exchanging configuration information amongst users of the application.

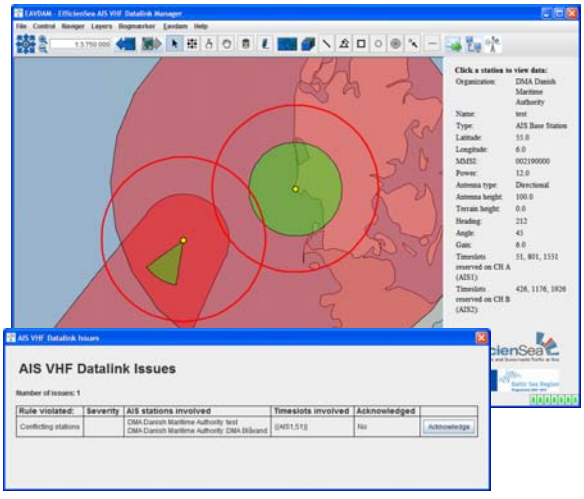


The application can support selecting FATDMA parameters for transmitting AIS stations, based on the good practice guidance available in the recently published update to IALA recommendaton A-124, including FATDMA parameter selection based on the Global geographical grid and default FATDMA schemes available in appendix 14 of this publication.



The application supports rough coverage estimation, but also manual declaration of transmit, receive and interference coverage areas, based on available analytical information.

Two output reports of this project describe methods for advanced coverage estimation. '*D_WP5_3_1_AIS Coverage Analysis*'describes radio propagation simulation with a 3-D terrain model, to estimate coverage ranges at planning time. '*D_WP5_3_2_AIS Coverage Analysis*' describes coverage quality verification based on received AIS data from vessels in the area. Both methods belong to the functionality which was not implemented in the application, however a method to import and visualize shape files describing the output of external analysis has been implemented.



The application contains advanced algorithms intended to aid the detection of conflicts between AIS base stations using FATDMA reserved slots, or to identify configurations which are not in accordance with the ITU-R M.1371 standard or relevant good practice guidance in IALA recommendation A-124, appendix 14 on FATDMA planning.

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The final software application and its source code, together with a Windows Install script, a Quick Start Guide, User Manual and System Documentation is available at GitHub:

https://github.com/DaMSA/EAVDAM/downloads

This site also contains a document describing functionality, which was proposed during the project, but not implemented, due to the time- and budgetary restrictions.

The EAVDAM project site on GitHub also contains a Wiki, which in the future is intended to host the ability of reporting bugs, commenting the application and raising suggestions for improvement, to promote a coordinated approach to broader community support for the further evolution of the application.

Elaborations on regulatory affairs

The following section is an extract of considerations made by the expert team associated with this activity, and recommendations stated on the basis of this.

International status of the AIS frequencies

Currently, the frequencies allocated internationally for the maritime AIS system, are part of the mobile VHF band, designated by the ITU for shared use by land- and maritime mobile services. They are thus not exclusively in use for the AIS system.

This has been known to cause interference in certain regions of the world, where Channel Management have been applied to address these issues locally, however across most of the world, landmobile use of these frequencies in coastal regions is now limited.

The introduction of satellite detection of AIS signals and the use of AIS on inland waterways have however revealed, that land mobile use still exist in regions far from the coastline in several parts of the world, and landmobile use of channels near the AIS frequencies continues to pose a threat to the safe function of the current AIS system and it's future posibilities.

At the time of writing this report, the World Radio Conference 2012 will be in the process of discussing the protecting the frequencies AIS1 (161.975MHz) and AIS2 (162.025MHz), hopefully designating them exclusively for the maritime AIS system.

World Radio Conference 2016 may contain an agenda item to address the needs of spectrum to accommodate future maritime needs in relation to the e-Navigation and GMDSS modernisation process – which could include a future second generation AIS system.

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Coordinated use of the timeslots on the AIS frequencies

Undetected misconfiguration of FATDMA parameters between multiple AIS stations, which may be within the responsibility of several different stakeholders in the same area, may effectively be detrimental to the purpose of the AIS stations involved, and ultimately the safe function of the AIS system in that area.

Coordinated efforts on AIS VDL Management is a must, when measures such as FATDMA reservation, Channel Management or Assigned Mode operations is applied.

Prior to setting up an AIS base station or an AIS Aids to Navigation Station it must be approved and granted a radio license and unique MMSI number by an appropriate radio licensing authority. If the station is going to transmit on fixed time slots, there is also need to coordinate and approve a FATDMA scheme.

In the Baltic Sea countries the management of AIS FATDMA time slots is not generally considered to be a task for the radio licensing authority. It is not considered a frequency management issue, although related. It has been seen as a task for the national AIS network owner. However the authority and liability to perform this task has not necessarily been written into national legislation. This would be needed to enable proper coordination of time slots cross border with neighboring countries.

The assignment of the legal authority and liability to manage FATDMA time slots would place some new obligations to the owner of the AIS network. Some of them connected to the approval of a new station and possible configuration updates:

- Approve the use of FATDMA according to IMO policy and IALA guidelines
- Allocate the FATDMA slots for stations (base stations and AIS AtoNs') and coordinate the total VDL loading
    - Maintain national list of stations, including FATDMA parameters
    - Provide information to regional or global VDL Management repository, using the tool developed within this activity, for cross border coordination purposes

And some of them connected to the run time quality control:

- Continuous monitoring of VDL loading
    - Scheduled inspections
    - Automatic self-checking functions incorporated to the AIS network
- Reported interference cases
    - Receive reports from FATDMA interference
    - Locate the source of FATDMA interference
    - Solve conflicts nationally and cross border

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Based on reported experience from different countries implementation of authority and liability to perform AIS VDL Management tasks, the efficient and effective performance of such tasks are observed to be closely related to the operational management of national AIS networks, rather than related to general frequency management. Especially in the case of deploying AIS AtoN devices or introducing new ASM based services, FATDMA planning will be of a fairly dynamic nature, requiring frequent changes.

'Creative use' of the AIS frequencies

The AIS system is a very open system. It is capable of accommodating a wide range of different stations, fixed and mobile, and a wide range of applications, provided that all stations are cooperative and behave responsibly.

This open system has given room for innovation – partly as a result of a young technology applied without extensive legal restrictions. While room for innovation is good, developments must generate value for users without posing risks of causing deficiencies in the AIS system for other users or cause ambiguity in the primary function of the AIS. A number of incidents of unauthorized use or unfortunate application of the abilities of existing AIS stations, have however been registered. Examples are AIS stations intended for use onboard vessels being used ashore to transmit commercial advertizing as safety related text messages, excessive use of bandwidth on the AIS frequencies to transmit information completely unrelated to maritime safety or the use of class B stations intended to mark small vessels, to mark something completely different like a drifting oilspill bouy or a man over board.

In particular the Application Specific Messages, which can be defined to carry any kind of information, has made the AIS system open for innovations that may benefit the evolution of advanced 2-way digital communication services in the maritime community, especially in relation to the e-Navigation strategy of the IMO – but only if the development remains a managed process can we ensure the integrity of the AIS VHF Datalink.

Application Specific Messages may be defined internationally under the responsibility of the IMO, or regionally (nationally) under the responsibility of a national competent authority. In the Baltic Sea Region, the responsibility for this task, just as for timeslot management, has so far not been clearly identified in national legislation.

The need for national competent authorities on AIS VDL Management

When establishing an AIS Base Station, it has the physical ability to regulate the behavior of other AIS stations participating on the AIS VHF Datalink. Such measures should according to ITU-R M.1371 be operated or configured under the responsibility of a competent authority.

The IMO Safety of Navigation circular 289 – Guidance on the use of AIS Application Specific Messages – states that: "*4.2: To ensure the safe use of the VDL, it may be beneficial that Contracting Governments*

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appoint one national administration with a task to monitor and coordinate the use of the VDL within its area of responsibility. Slot utilizations should be monitored to determine the feasibility of using AIS Application-Specific Messages in the intended area. Further, this monitoring process should be conducted on an ongoing basis."

IALA Recommendation e-NAV–144 - On Harmonized implementation of Application Specific Messages – request: *"National Members as a matter of priority take the steps necessary to ensure that a National Competent Authority is assigned the responsibility for managing the use of Regional ASM, as well as monitoring and managing the use of the AIS VHF Datalink, to ensure its safe function for safety of navigation"*

The need for appointing a national competent authority with the obligation and relevant legal instruments to properly coordinate AIS VDL Management issues, and the liability for monitoring and defending the safe function of the AIS VHF Datalink from unauthorized or excessive use for other purposes than originally intended, is quite clear.

Recommendations of this project

It is the recommendation of the Expert Team of this activity, that the nations of the Baltic Sea Region, and the European Union in general, should pursue the primary recommendation from the EU AIS Masterplan workshop, conducted in January 2008 at EMSA's headquarters in Lisbon: *To ensure that within each European nation, a relevant national competent authority is appointed with the responsibility - and relevant legal instruments – to monitor and manage the safe function of the AIS VHF Datalink.*

It is the opinion of the Expert Team that the role as national competent authority in this respect resides most efficiently within an authority with a direct relation to the operational management of a national AIS network, if such a national network exists.

It is the belief of the Expert Team that no matter how the responsibilities for AIS VDL management are distributed within individual countries, that the EAVDAM application developed by the EfficienSea project will facilitate transnational cooperation between all stakeholders. Not only in the Baltic Sea Region, or within Europe, but globally. It is our hope that this tool, through the Open Source Software Strategy, and the planned attempt at fostering a sustainable community for its support and development through IALA, may evolve to support more aspects of AIS VDL Monitoring and Management aspects in the future.

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