



A Common Situation Awareness System as a Joint Platform for Multi-Agency Oil Spill Preparedness and Response

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Abstract

There are several challenges linked to multi-agency response: how can effective communication within and across organisations be ensured? How can information overload be managed without losing anything relevant? How can we establish and maintain common situational awareness? And how do we ensure that all actors have sufficient understanding of the roles, responsibilities, needs, priorities, plans, tactics, knowledge, skills and terminology of other actors?

In Finland oil pollution prevention, preparedness and response are based on a wide multi-agency collaboration between governmental and regional authorities. To ensure the most effective cooperation and the most coherent response measures, the response authorities need a common and shared understanding of the situation. The BORIS situation awareness system was renewed to provide the authorities with a modern internet-based tool for this purpose.

BORIS is also used as a common multi-agency platform for training, exercises and planning oil spill responses. BORIS tabletop workshops focus not only on achieving consensus on priorities and tactics but also on developing joint multi-agency operational response plans for site-specific marine oil spills.

This paper will discuss multi-agency response challenges that have been identified either at past oil spill response operations or that were revealed during the BORIS development and first years of use. In parallel with the identified challenges, the paper will present solutions developed during the BORIS implementation stage.

Background, aims and focus of the paper

Finland published the latest version of the map-based BORIS situation awareness system in 2013 to provide national authorities with a modern internet-based platform for multi-agency oil spill preparedness and response. BORIS has been taken into use both as a common national situation awareness system and as a competence- and collaboration-building platform.

In 2014, the Finnish Environment Institute (SYKE) and Kymenlaakso University of Applied Sciences (Kyamk) launched a combined training, exercise and tactical planning programme to take national multi-agency oil spill preparedness and response to a new level. The programme is based on using BORIS as a joint multi-agency platform and BORIS tabletop exercises and workshops as some of the main methods. Several national oil spill response experts as well as authorities participating in oil spill response are involved in implementing the programme. The authors of this paper have influenced the contents of the programme significantly.

The organisations represented by the authors of this paper have significant roles in Finnish oil spill response and preparedness:

- The Finnish Environment Institute (SYKE), operating under the Ministry on Environment, is the competent governmental oil pollution response authority. SYKE is responsible for the nationwide organisation and development of the prevention of and response to oil spills and chemical spills from ships.
- The Finnish Border Guard (FBG) has national responsibilities related to maritime Search and Rescue (SAR) and border security. Added to these missions, the FBG takes part in maritime environmental protection operations by providing marine communication networks, maritime surveillance data and multipurpose vessels capable of open sea oil spill recovery. In addition, FBG is responsible for conducting aerial surveillance in environmental protection operation.
- Regional rescue services are responsible for the oil spill response on their own area (AOR), including coastal sea areas. Helsinki City Rescue Department (HCRD) has strongly developed its oil spill response capacity and capability during the last decade, and it is now the best prepared rescue service for oils spills in Finland and is seen as a national resource in the event of a large scale incident.
- Kymenlaakso University of Applied Sciences (Kyamk) has contributed to oil spill response contingency planning by providing response guidelines on managing major marine oil spills. The guidelines are achieved by a joint effort between the response authorities, educational institutions, non-governmental organisations and businesses. This multi-agency and interdisciplinary cooperation has enabled extensive and thorough research on which to base response recommendations, and has resulted in the creating response management model taken into use nationwide.

This paper will discuss multi-agency oil spill response challenges that have been identified during oil spill response operations or were revealed during the BORIS development and first years of use. In parallel with the identified challenges, this paper will present solutions developed during the BORIS implementation stage.

This paper concentrates on multi-agency cooperation between governmental and regional authorities – although we recognise that in addition to governmental and regional authorities, local and non-governmental organisations as well as response teams and units from neighbouring countries, and representatives of shipping companies, P&I, the international compensation funds, salvage companies and so on are also strongly involved in oil spill response operations.

The main aim of the paper is to analyse how a common situation awareness system as a joint platform for multi-agency oil spill preparedness and response can enhance interoperability between authorities.

Aiming for the top of the pyramid: reaching for maximum capability and interoperability through competence- and collaboration-building

Below is a picture of a pyramid illustrating the elements supporting Finnish authorities to achieve the interoperability and capability needed to respond to major oil spills. Each step of the pyramid is needed to be able to reach the top of the pyramid – and each step needs to be solid and sufficiently well-established. In this paper we present the steps of the Finnish pyramid and especially its central part, the BORIS common situation awareness system, which constitutes a joint platform for multi-agency oil spill preparedness and response.



Picture 1. The Finnish preparedness for oil spill response is based on multi-agency collaboration. Next chapters will introduce how the bases and center of a pyramid are supporting Finnish authorities to gain the top of the pyramid. Graphics: Katri Eerikäinen, Kyamk

The bases of the pyramid: cultural backgrounds and limited resources as a starting point, national legislation and multinational agreements as a framework

The Finnish approach: decentralisation and divided tasks – also as a basis for crisis management

In Finland, there is a long tradition of multi-authority cooperation and collaboration. The reasons for this are historical but also practical: Finland is a small country with limited resources. Thus it is reasonable to combine the efforts of different authorities. Preparedness based on multi-agency cooperation has also proven to be highly cost-effective (National Audit Office of Finland 2014), which is especially in current economic situation increasingly valued.

When Finland gained independence in 1917, the country already had a hundred years of experience of running its own administration and historical links with Nordic administrative culture (Suomi.fi 2015).

One of the prevailing principles in Finland is a strict legality in administration. Horizontally, every sector has rather independent powers in decision-making, and vertically the possibilities that upper administrative levels have to lead directly over the lower levels are restricted by law (Visuri and Hellenberg 2013).

For example, the Finnish civil security system could be characterised as having a high degree of decentralisation and divided tasks based on substantial expertise in competencies across many levels and issues (Visuri and Hellenberg 2013).

Even during various emergencies or crisis situations, each sectoral authority conducts their normal tasks and responsibilities. An emergency situation can be managed with the usual administrative measures without special crisis management arrangements, but the same system of alarm and decision-making should be used as a basis for preparedness concerning all kinds of crises and other emergency situations following the “all-hazards” principle (Emergency Powers Act. 1552/2011, Visuri and Hellenberg 2013).

Finnish multi-agency oil spill response and preparedness is largely based on procedures and collaboration established for conducting a wide range of other security and maritime authority tasks.

One of the national risk scenarios is a multi-type maritime accident that simultaneously launches a search and rescue operation commanded by Finnish Border Guard (Search and Rescue Act 1145/2001) and an oil spill response operation commanded by the Finnish Environment Institute (the Act on Oil Pollution Response (1673/2009). Most of the authorities involved and many of the procedures to be followed would be the same in both operations.

National oil pollution response legislation requirement for multi-agency cooperation

The duties and rights of Finland's different prevention and response authorities are described in law (the Act on Oil Pollution Response (1673/2009) and Oil Pollution Decree (249/2014)):

- The Ministry of the Environment has the overall responsibility for the management and supervision of response to pollution caused by oil and other harmful substances.
- The Finnish Environment Institute (SYKE), operating under the Ministry of the Environment, is the competent governmental oil pollution response authority. It is responsible for measures to tackle pollution incidents in the open sea and whenever the severity of an incident so necessitates. SYKE is empowered to request and provide international assistance.
- Sixteen governmental pollution response vessels are owned and operated by different authorities: the Navy, the Border Guard and the state-owned shipping company "Meritaito Ltd". In addition, two pollution response vessels are owned by private companies. During pollution response operations, all these 18 vessels are under the command of SYKE. The Åland government also owns one pollution response vessel.
- In coastal and inland areas, each of the 22 Rescue Services Districts is responsible for pollution response in its own area. Thanks to national Oil Pollution Compensation Fund Rescue Services Districts own altogether over 140 oil recovery boats and plenty of other oil response equipment like sea booms.
- Other authorities have special duties related to pollution response. The total number of governmental and regional authorities participating in oil pollution response is almost 40.

According to the law (Act (1673/2009) and Decree 249/2014)) the authorities responsible for the prevention of and response to oil and chemical spills from ships must collaboratively draw up a cooperation plan for oil and chemical spill prevention and response for each sea area (the Gulf of Finland, the Archipelago Sea and the Gulf of Bothnia) and for Lake Saimaa.

The Act on Oil Pollution Response (1673/2009) emphasises cooperation and the need for each unit to function under the command of their own managers in such a manner that their operations, as a whole, contribute to the effective response to the incident. The response commander, as the head of response operations, shall act as a general manager and ensure that, at all times, he or she has an overall picture of the situation.

(Finnish Environment Institute 2015)

Multinational cooperation based on international bilateral and multilateral agreements

The Baltic Sea countries are obliged to assist each other when responding to a pollution incident at sea or on the shore. This obligation was introduced at the Convention on the Protection of the Marine Environment of the Baltic Sea Area, 1992 (Helsinki Convention), signed by all Baltic Sea countries and the European Union. In addition to Helsinki Convention Finland has signed several other international agreements including provisions on bilateral or multilateral assistance to marine oil spill response operations. (Ministry of Environment 2015)

The governing body of the Helsinki Convention is HELCOM (Baltic Marine Environment Protection Commission - Helsinki Commission). (HELCOM 2015)

According to the Helsinki Convention and HELCOM recommendations, mechanical recovery is the preferred response strategy in the Baltic Sea area. The use of dispersants is restricted due to the limited water exchange and sensitivity of the marine environment. (HELCOM 2015)

General principles for a command structure for multinational Baltic Sea response operations are given in HELCOM Manual on Cooperation in Response to Marine Pollution and in HELCOM Recommendation 2/5. Multinational HELCOM BALEX DELTA exercises held since 1990 and various response operations in the Baltic Sea area have proved that joint multinational operations can be successfully carried out under the HELCOM Manual Command structure. This is quite an achievement, as joint operations at a multinational level could include many challenges, considering cultural backgrounds, languages and crises management systems between countries differ significantly from each other. (HELCOM 2015)

BORIS used as a national common oil spill response situation awareness system

BORIS supports oil spill response operations and preparedness

BORIS enables the response commander of an oil spill operation to view the different datasets that are necessary for response planning in a single map view: the locations of the resources, high priority protected targets, logistics routes, waste sites, harbours, and so on. Satellite and aerial surveillance imagery can be loaded into the view to estimate the extent of the spill. The system is connected to real time weather datasets and forecasts, and it enables the user to calculate a forecast of the drift of the oil. Onshore reconnaissance units can report their observations to the system. Based on all of these different datasets, the leading authority can plan the operations in map view and distribute the plans to all users or print them out on paper (BORIS 2014).

As the response operation progresses, new information and new plans are continuously fed into the system, providing the users with an up-to-date view of the current situation.

The practical use of BORIS is shared. Information is uploaded into the BORIS system by each responsible authority from their own command and coordination centre, surveillance centre or directly from the field. Some of the most detailed input can be uploaded directly from an operating response vessel or a reconnaissance team, for example. On the other hand mission data from surveillance aircraft can be uploaded semi-automatically to BORIS.

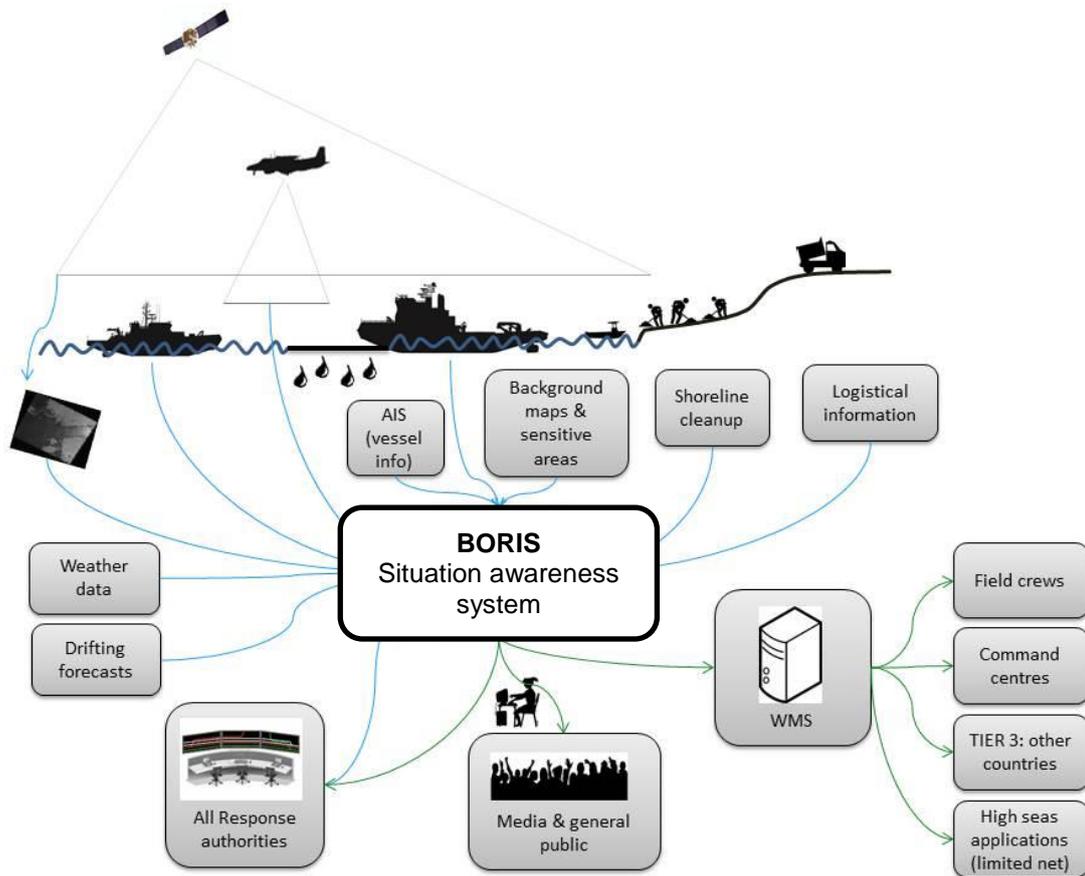
Ultimately, even though information is added to BORIS system jointly by all the authorities, the end result of the BORIS information system is centralised and it ensures operational information integrity as a basis for decision-making. The BORIS architecture (operating over the internet) allows it to be used in a very dynamic way through the end users' own networks and hardware.

The authority responsible for an operation's communications can extract map-based situation reports from BORIS to help inform local residents, the general public and the media.

In addition to actual response operations, BORIS also supports other duties related to oil spill response: it can be used in assessing and further enhancing the preparedness for spill response and in oil spill response training. BORIS also functions as an archive from which information related to a certain case can easily be retrieved at a later point in time. During the compensation negotiations BORIS information can be used to justify the decisions made to respond to oil spill by showing that the decisions were based on best available knowledge. (BORIS 2015)

Uploading and sharing BORIS data

The end users of the BORIS national situation awareness system are officers of either governmental or regional authorities who participate in oil spill response. They either use BORIS off-scene or on-scene. Picture 2 illustrates what kind of data is uploaded and shared on the BORIS situation awareness system and by whom.



Picture 2: BORIS situation awareness system: uploading and sharing data (Hietala, Tahvonen and Neuvonen 2014)

Reconnaissance is one of the many tasks of on-scene personnel, along with information-sharing with other actors and reporting the progress of the measures at the scene. To avoid delays or any loss of information, on-scene authorities are obliged to upload surveillance data as well as photographs and progress reports directly to BORIS.

According to BORIS policy, any authority possessing the most up-to-date information is responsible for sharing the information with other authorities by uploading the information onto the BORIS system. If some of the information is subsequently discovered to be incorrect, SYKE and any other authority is permitted to correct the information. Therefore, the latest information gained from the field is available to all authorities at the same time and without delay.

SYKE outputs the most essential incident information from BORIS to certain WMS interfaces, from where the information can be uploaded to other situation awareness systems and common operating images used by several maritime and security authorities.

Central parts of the pyramid: training, exercises and planning

Multilevel, multi-agency and multinational oil spill response exercises

Multi-agency oil spill response training, exercising and planning are elementary parts of competence- and collaboration-building. The Finnish authorities arrange oil spill response exercises at local, regional, national and multinational levels on a regular basis. In addition, Finland has decided to use the BORIS situation awareness system as a competence- and collaboration-building platform.

BORIS as a multi-agency competence- and collaboration-building platform

How can we recognise the most urgent challenges of multi-agency oil spill response operations? How are these challenges resolved or mitigated? And to address one of the central challenges: how do we ensure adequate situation awareness during multi-agency oil spill response operations?

Finland decided to aim to solve the three challenges mentioned above simultaneously. To this end, Finland launched a competence- and collaboration-building programme in 2014 which concentrates on tabletop training and exercises. Throughout the programme, a map-based BORIS situation awareness system has been used as a joint multi-agency platform. Workshops and tabletop exercises are used as some of the programme's main methods.

The ongoing competence- and collaboration-building programme consists of three course levels:

1. Level 1 courses for learning how to use the BORIS system and familiarising oneself with the background information available on the system.
2. Level 2 courses for learning how to apply the most effective multi-agency based tactics to respond to oil spills in open seas, the archipelago and on the shoreline. Training courses at level 2 consist of theoretical lessons and tabletop exercises on the BORIS platform. They cover the most typical stages of oil spill response operations.
3. Level 3 courses for preparing joint multi-agency operational response plans for site-specific marine oil spills. These courses aim to prepare operational response plans to some of the main oil spill risk areas.

Oil spill scenarios calculated by the Russian oil spill model Spillmod are used as a basis for tabletop exercises on level 2 and 3 courses (Jolma 2014, Ivanov and Litovchenko 2009).

In 2015 the courses will be hosted mainly by SYKE or jointly by SYKE and KYAMK. In order to retain the multi-agency based nature of the courses, SYKE has limited the maximum number of participants from each organisation to 1-2 persons per course. The courses are mainly held in a computer room, where the total number of PCs limits the number of participants to 14. This number of participants has proven to be optimal: in a group of this size it is easy to ask questions and challenge thinking and established routines.

All participants carry out exercises simultaneously on PCs during the same class. Therefore, every participant is able to follow the progress of other participants. By seeing other organisations uploading data and trying at the same time to figure out how to best contribute to the ongoing tabletop exercise, participants tend to recognise highly relevant gaps. These gaps have been related to limited resources, a lack of thorough understanding of each other's capabilities and needs, and the need to enhance tactical joint multi-agency oil spill response planning.

Summary, findings and conclusions

Findings of the competence- and collaboration-building programme

The aim of the competence- and collaboration-building programme launched in 2014 has been two-fold: to enhance genuine multi-agency capability and interoperability, and on the other hand to increase the authorities' experience and skills in using the BORIS common situation awareness system.

Even though the programme is still ongoing, it is clear that it has succeeded in launching a significant development process. This success has been based on three elements:

- Authorities participating in oil spill response are highly committed to developing multi-agency capability and interoperability and have been willing to participate in the competence- and collaboration-building programme.
- The atmosphere at joint events like training courses, tabletop exercises and workshops has been trusting and confidential, which facilitates good communication between multi-agency authorities.
- A map-based situation awareness system has been used as a joint multi-agency platform and has facilitated thinking and discussions. – By sharing the information in map-based graphical format many issues are illustratively clarified and misunderstandings avoided.

A trusting atmosphere facilitates good communication between multi-agency authorities

The hosts of the training courses, tabletop exercises and workshops must create a trusting and confidential atmosphere to facilitate discussions. Knowing that trust between multi-agency authorities is generally achieved through fruitful shared exercises, one of the main aims of the programme's early events has been to launch a virtuous circle of trust building.

Discussions are needed to gain new levels of mutual understanding. There must be a willingness to thoroughly review the existing capacity and competence. Each of the participants as well as the training course hosts must have the courage to lay their thinking open for evaluation. At the same time, personal issues should be avoided in discussions.

In order to achieve improved level of understanding all the authorities have to be committed in continuous learning. - Often best learning results occur when individuals or organisations are brave enough to step out of their comfort zone. Discussions and especially active listening of different points of views often challenges too strict black and white thinking and leads to a shared learning experience.

A map-based situation awareness system as a joint multi-agency platform

Tabletop exercises at joint, map-based multi-agency forums have been a gentle yet effective way of facilitating discussions. When discussing challenges on the basis of the common map-based view, problems are less likely to be taken too personally. On the other hand, in these circumstances the participants are not able to avoid the challenges, because map-based information needs to be accurate. Interaction with other participants, negotiations and finally unanimity is needed in order to be able to draw joint multi-agency operational response plans on the map. Map-based discussions are also an effective way of sharing best practices between organisations.

Event participants have recognised relevant gaps in oil spill response preparedness. These gaps have been related to limited resources, a lack of thorough understanding of each other's capabilities and needs, and the need to enhance multi-agency tactical planning,

Fruitful discussions as one of the main results

At tabletop workshops and exercises, Finnish authorities have had fruitful discussions on many kinds of issues related to oil spill response operations:

- What is the time scale for oil spill response in various kinds of incidents?
- Which are the best tactical approaches?
- How can we prioritise our own response efforts to make use of the limited resources most effectively?
- How can our own activities be adapted to become a coherent and purposeful part of the main efforts of the whole response operation?
- How can mutual understanding with other agencies be achieved?
- How can up-to-date situation awareness information, including all relevant information on the incident, local circumstances, and current as well as planned response activities be achieved?
- How can we share information on our own activities with others?

Even if we have not been able to define absolute and final solutions for these kinds of challenges, the discussions have proven to be a way forward: workshops and tabletop exercises seem to be effective methods for developing mutual understanding, finding alternative solutions to **some** of the challenges and sharing best practices with each other.

In our experience, an important starting point for mutual understanding is to learn the terminology used by other authorities.

Findings related to decentralised way of uploading the situation awareness picture

Benefits of the decentralised approach

Knowing that in the event of a major oil spill both time and resources at every level would be limited compared to the incident to be responded to, SYKE has introduced a policy which relies on a decentralised way of uploading information to BORIS. Any of the authorities possessing the most up-to-date information are responsible for sharing it with others.

If some of the information uploaded to BORIS is subsequently discovered to be incorrect, other authorities are permitted to correct the information. Thus, the latest information gained from the field is available to all authorities at the same time and without any delay. An additional benefit is that the original interpretation of the situation is passed on to other authorities without any loss or bias of information. This kind of approach is possible because Finnish authorities trust each other.

There are some other additional benefits brought about by the decentralised way situation awareness information is uploaded to BORIS. With the responsibility to update information to common situation awareness system, every authority and BORIS operator is forced to see the activities of their own organisation as a part of the entire operation. This encourages each of them and their unit to take responsibility to adapt their own efforts to those of other actors.

The decentralised way of uploading a situation awareness picture is a continuous development process for all actors in a multi-agency landscape.

Challenges of the decentralised approach

According to the Finnish approach, dozens of multi -agency operators are supposed to be capable of uploading situation awareness information directly to the dedicated BORIS situation awareness system during oil spill operations. These operators also use many other ICT systems. It is a challenge to ensure that each of these operators maintain up-to-date know-how and routines for using BORIS.

Even information marked uncertain is an important part of the situation awareness picture. How can we encourage operators to upload all oil spill incident-related information to BORIS, even if some parts of the data might be uncertain?

An operator's uncertainty over correct terminology or the correct way to mark data may cause a barrier to sharing information on a joint ICT platform. This is related to the common fear of making mistakes or showing one's own weaknesses to others. How can we encourage operators to share data even with the wrong terminology?

An additional challenge is how to prevent cultural differences between organisations from causing misinterpretation of the situational awareness information uploaded to BORIS by other organisations?

Conclusions

During oil spill response operations, national common situation awareness system BORIS supports communication within and across Finnish organisations participating in oil spill response. Based on the information shared on BORIS, Finnish authorities are able to give each other timely and relevant support in oil spill response operations.

Finland relies on decentralised way to upload oil spill related information to BORIS. In addition to many other benefits, this kind of decentralised approach effectively encourages each authority and unit participating in oil spill response to take responsibility to adapt their own efforts to those of other actors and to develop genuine multi-agency interoperability and joint-operability.

The competence- and collaboration-building programme launched in 2014, which concentrates on tabletop training and exercises and using BORIS as a joint platform for multi-agency oil spill preparedness and response, is helping to increase knowledge and understanding which are the core elements of multi-agency capability and interoperability.

Coming back to the pyramid introduced at the beginning of the document, we can note that Finnish authorities participating in oil spill response have climbed good way towards the top of the pyramid, trying to reach to the improved level of multi-agency capacity and interoperability.

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