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**The Interreg IVB  
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Programme**

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**Task 5.1.17**

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## ***Service Description: Vessel Operations Coordination Tool (VOCT)***

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## *Executive Summary*

A simple approach to a search and rescue assistance tool was previously tested in the EfficienSea project with promising results.

As part of the ACCSEAS project WP6, it was decided to develop and test this concept further, and based on analysis and user feedback, to expand on the initial idea of simple communication to allow calculations and more detailed display of Search and Rescue relevant information. The service mirrored the requirements from the practical application of SAR and allowed both the provider and the consumer of SAR data.

This document describes the results of the effort to devise an assistance tool for Search and Rescue operations including calculation, portrayal, communication and monitoring of SAR operations.

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**Document Information**

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## **1 Introduction**

When a serious accident occurs at sea, human lives will be at risk. This might be an aircraft performing an emergency landing at sea, a vessel taking on water, a man overboard or a small boat lost during a storm.

In such incidents, a Search and Rescue (SAR) operation is initialized by the government with jurisdiction over the specific areas in which the accident has occurred. This operation helps to locate people and vessels in risk and resolve the situation.

An operation such as this requires key coordination of a myriad of vessels and personnel ranging from fishing boats to dedicated Search and Rescue vessels and navy vessels. As the ocean is constantly changing, so does the area which needs to be searched which adds to the complexity of the rescue operation.

To rescue someone at sea, access to all possible information, regarding wind, sea currents, ships available for the search and the movements of the ocean are all vital, literally.

The VOCT seeks to solve these issues by allowing automatic distribution of SAR relevant data to all relevant participants in a SAR situation. The VOCT allows for seamless and automatic sharing of relevant data. The VOCT follows the organizational structure of the current standards, allowing an On Scene Coordinator (OSC) or the SAR Mission Coordinator (SMC) the tools to distribute and coordinate any participating Search Rescue Units. Once an operation is underway the OSC can monitor the progress for participating vessels and electronically update the search areas via the Maritime Cloud. The VOCT allows the OSC to calculate SAR data using the built-in SAR calculator or import the SAR data from commonly used commercial drift calculation systems.

## 2 Portrayal and functional description of developed service

The following services were identified as integral to search and rescue during the work.

### 2.1 Ability to calculate Search and Rescue Areas:

When an incident occurs the first steps in a SAR operation is to calculate the likely place that the search object is located. This is done by applying wind and current information to the drifting object to establish a likely search area. The VOCT applies the theory outlined in the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR) and presents the user with an intuitive interface. Once the user enters the necessary data the software performs the calculations. The SAR area is then displayed directly on the electronic chart (for vessels it's displayed on the ECDIS).

Calculation of search area is described below:



Figure 1: Initiating SAR calculation

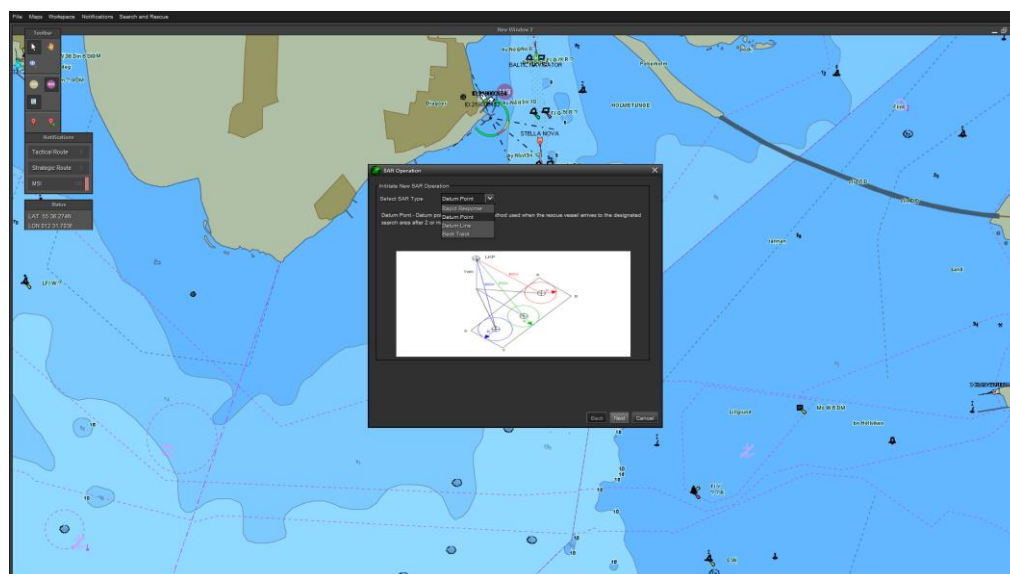


Figure 2: Choosing calculation method (Rapid Response, Datum Point, Datum Line or Back Track)

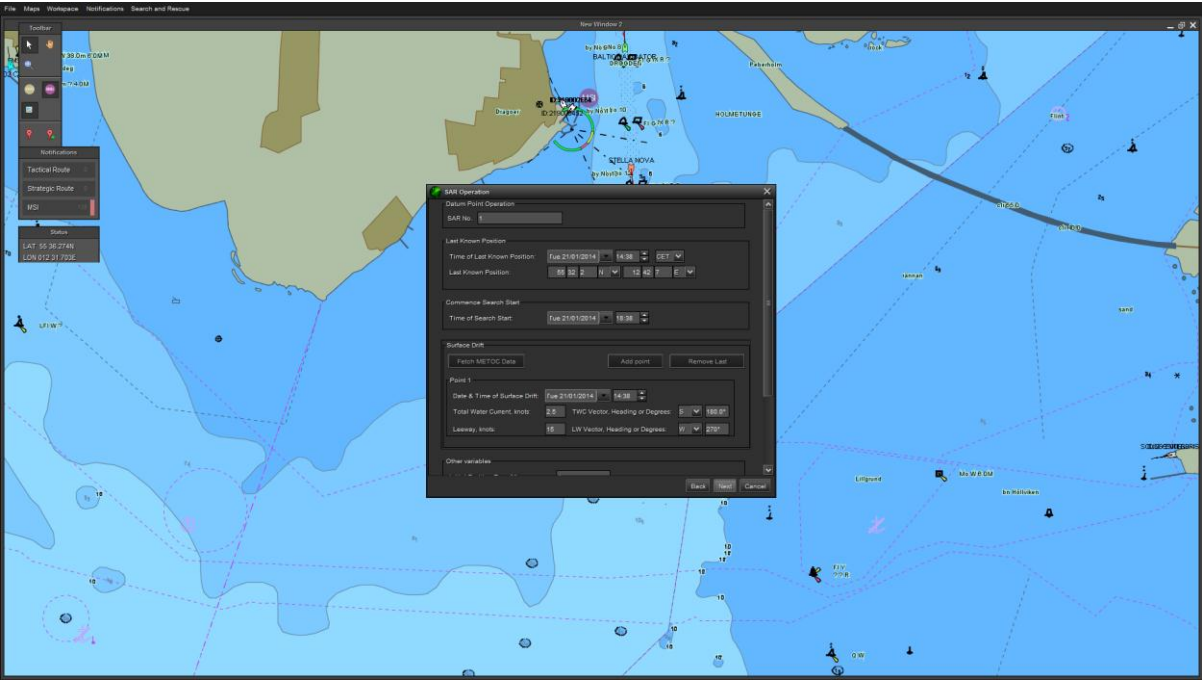


Figure 3: Input window

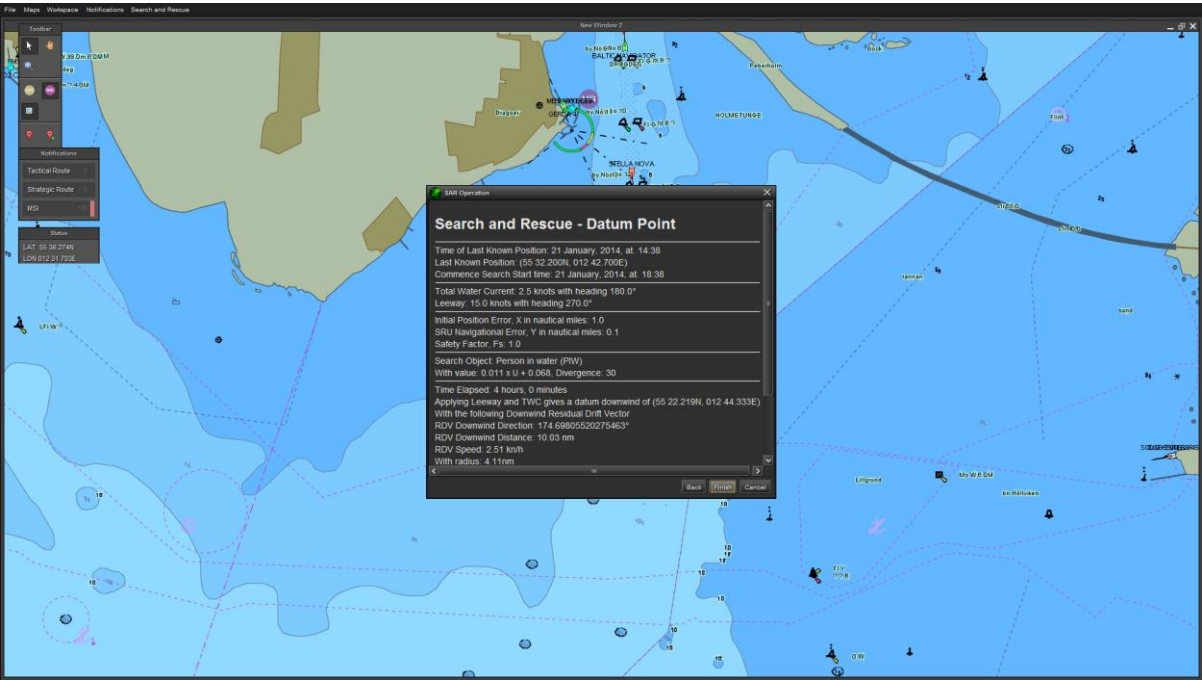


Figure 4: Calculation results, may be exported or printed



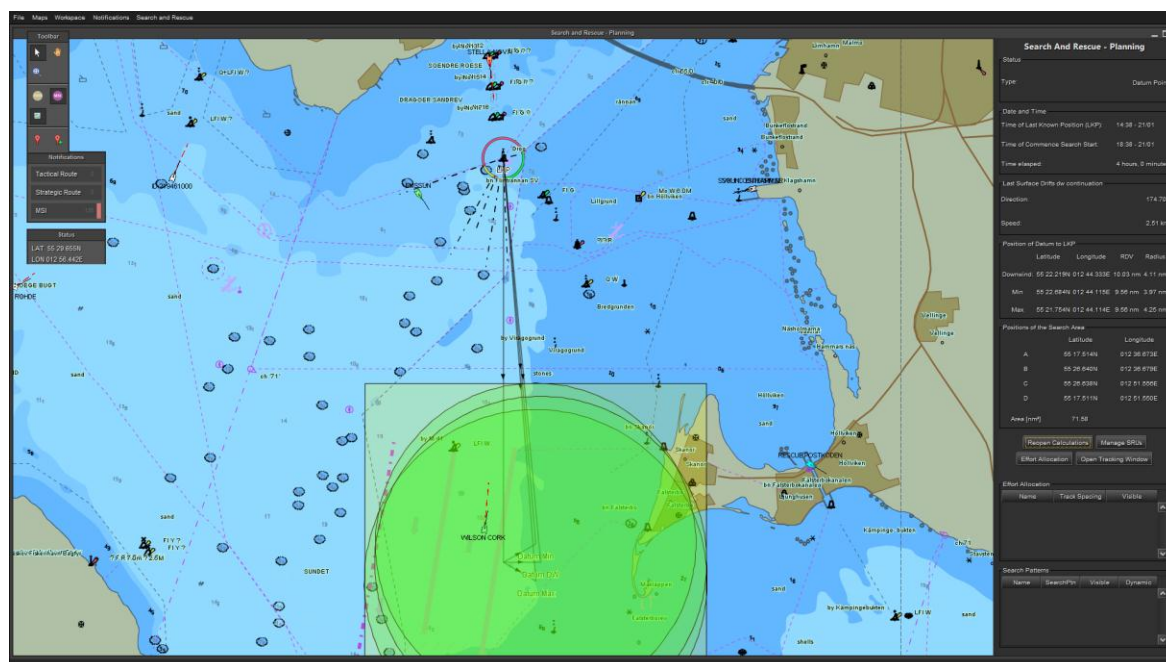


Figure 5: Presentation of calculated search area

## 2.2 Ability to Calculate Effective Search areas

Once the SAR area has been calculated, an effective search area can be calculated. This is a statistical calculation that determines the maximum track spacing for a given vessel to maximize their likelihood of finding an object under certain weather conditions with a given search speed.

Each participating Search and Rescue Unit (SRU) gets their own calculated Effective Area. Using the calculated track spacing and the selected search time, an area can be precisely calculated. These areas can then be selected and moved / resized (length vs width, area size remains constant) to better cover the calculated search area.

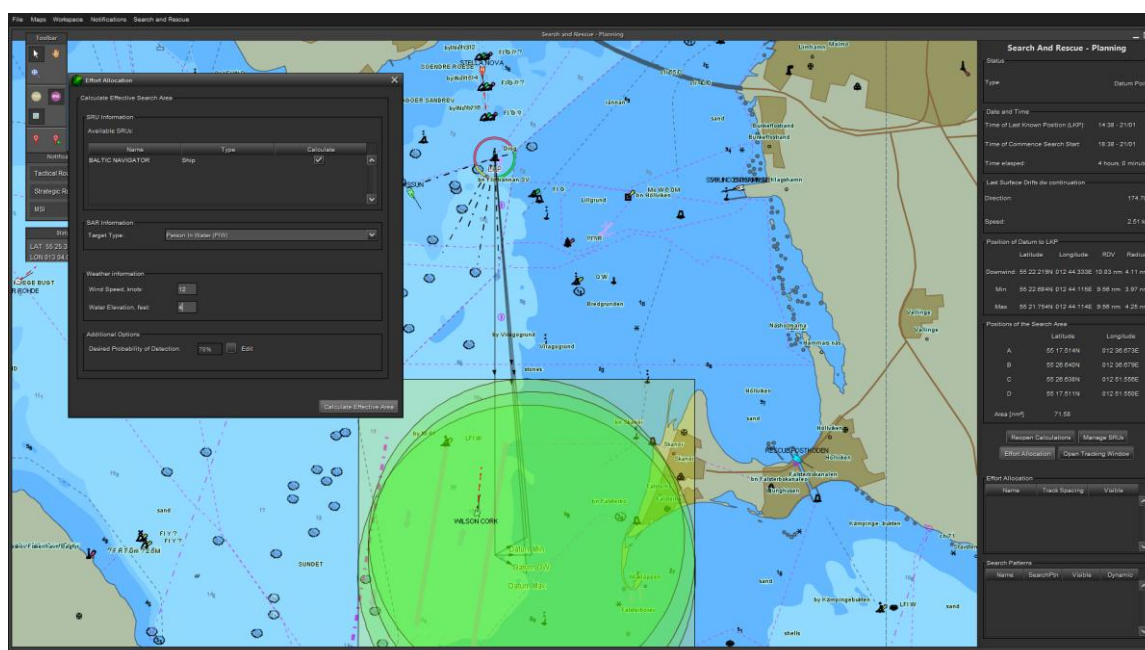


Figure 6: Effort allocation, finding and inviting suitable SRU's.



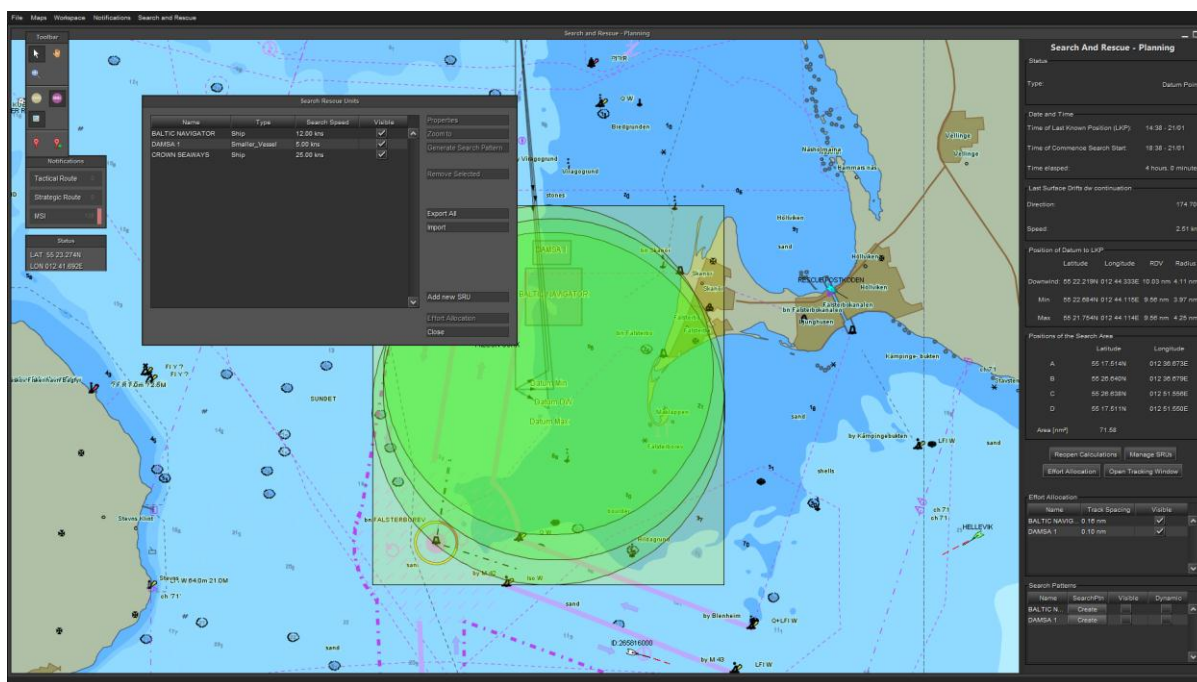


Figure 7: Managing search effort.

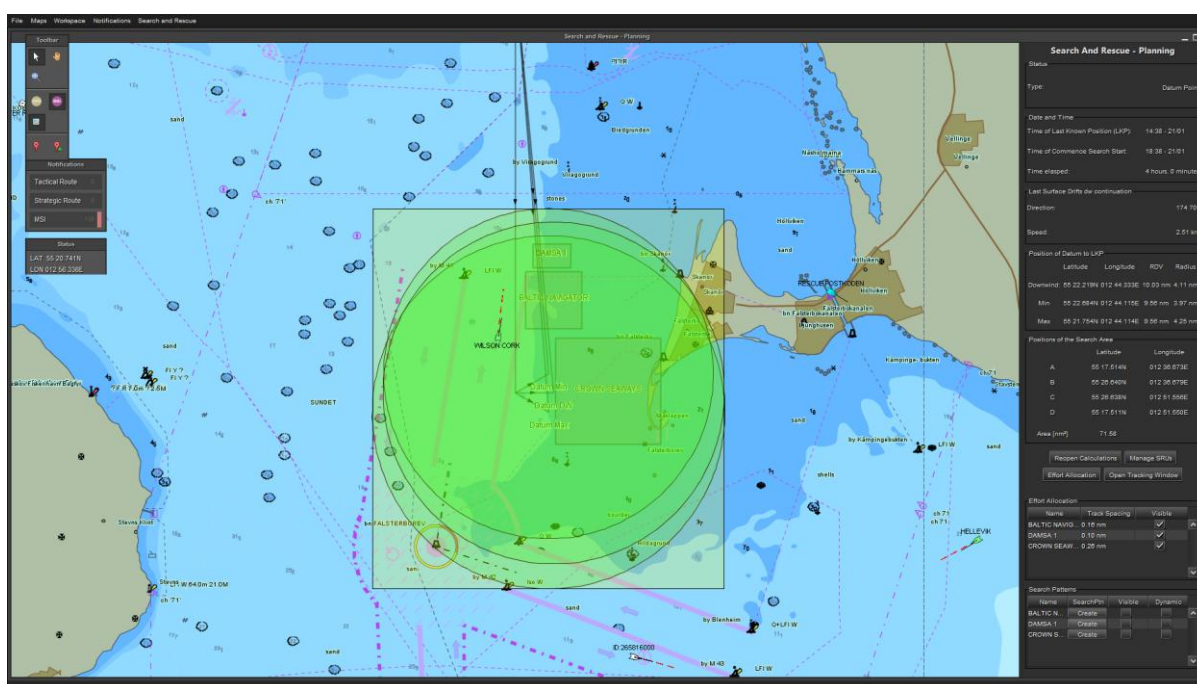


Figure 8: Allocating search areas.

## 2.3 Ability to create search patterns

With the search area and the effective SRU search areas created the OSC can create individual search patterns for the participating vessels.

The VOCT allows creating of the common search patterns outlined in the IAMSAR Manual. Each pattern functions as a *route* for the selected vessel thus the OSC or the SRU can change the route to accommodate their current position and any possible hazardous terrain.

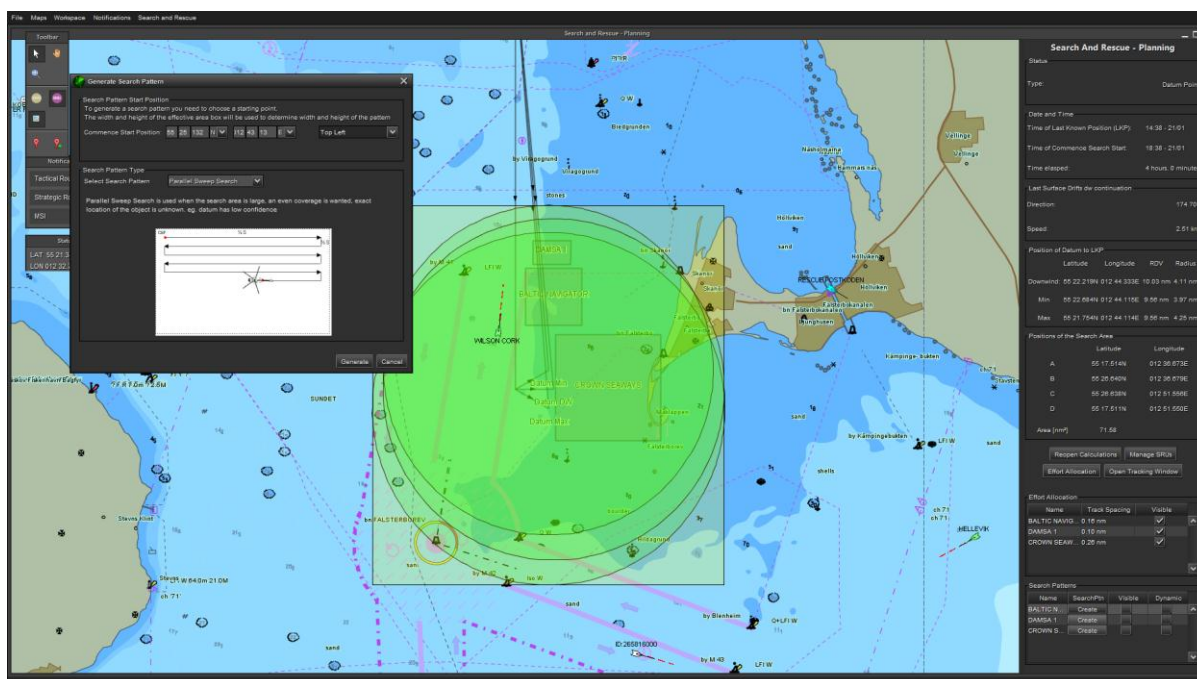


Figure 9: Creating search patterns

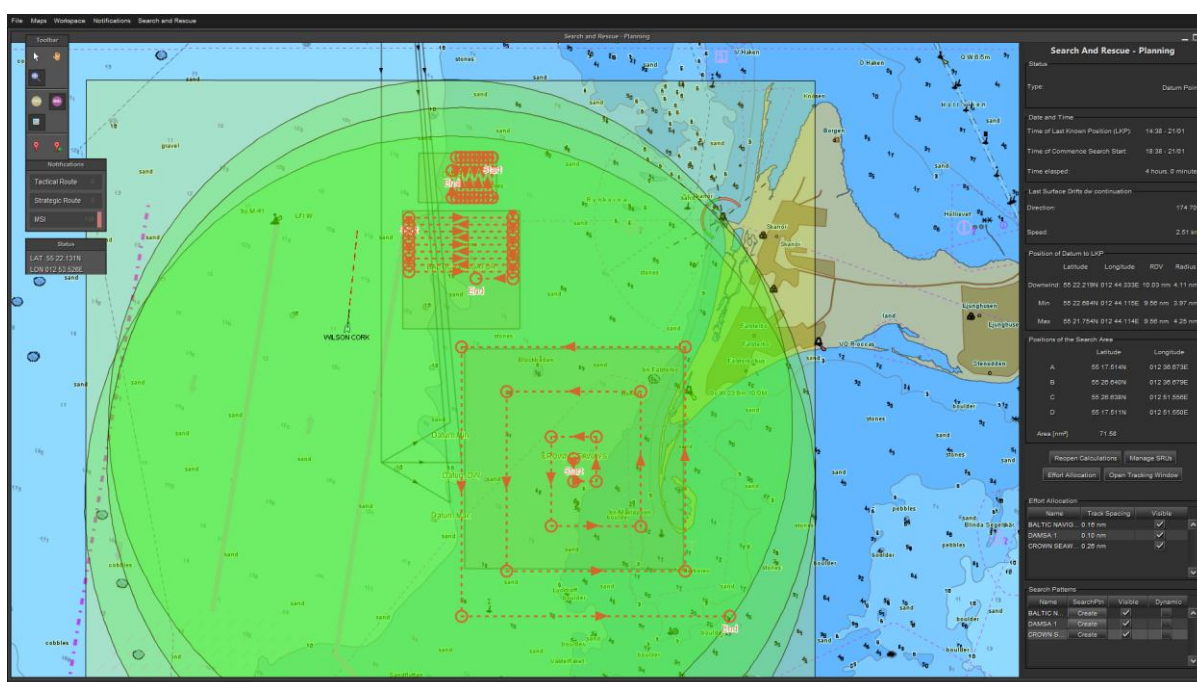


Figure 10: Search pattern examples (Parallel Sweep Search, Creeping Line Search, Track Line Search or Expanding Square Search).

## 2.4 Transfer of data / Monitoring.

With the SAR operation created the OSC can switch to the tracking view. In the tracking view the OSC can send out the previously generated data and monitor each vessel as they proceed with the search. The OSC can re-transmit updated information while automatically receiving the status of the search route for each vessel.



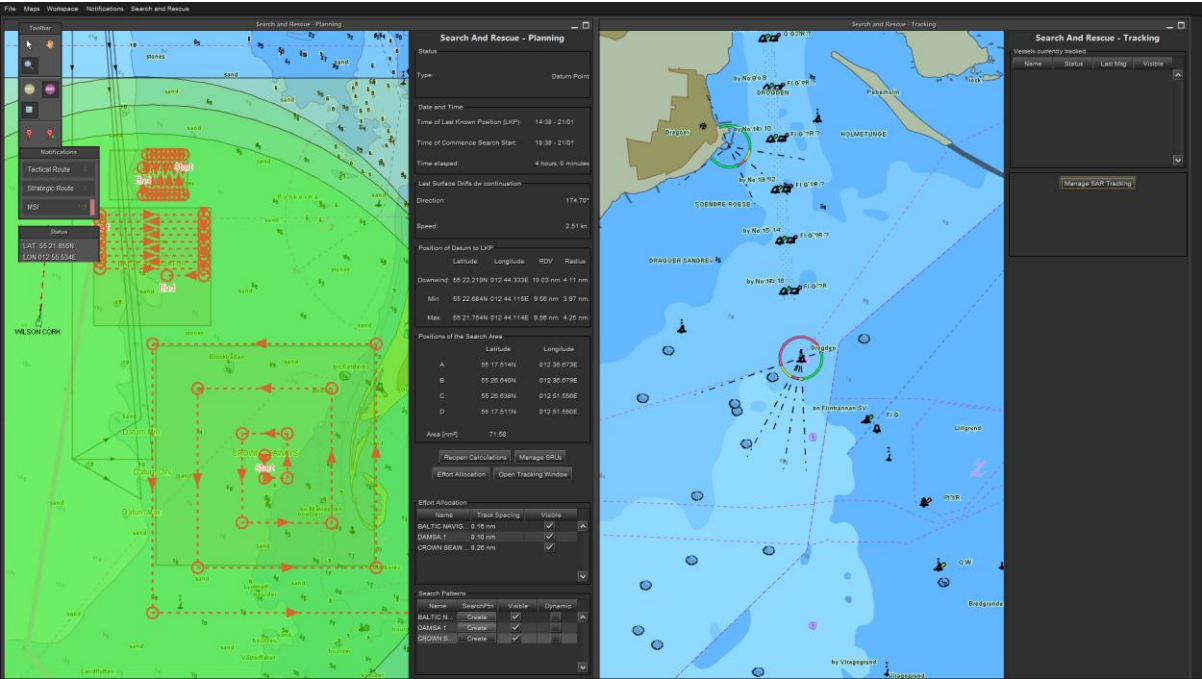


Figure 11: Tracking window

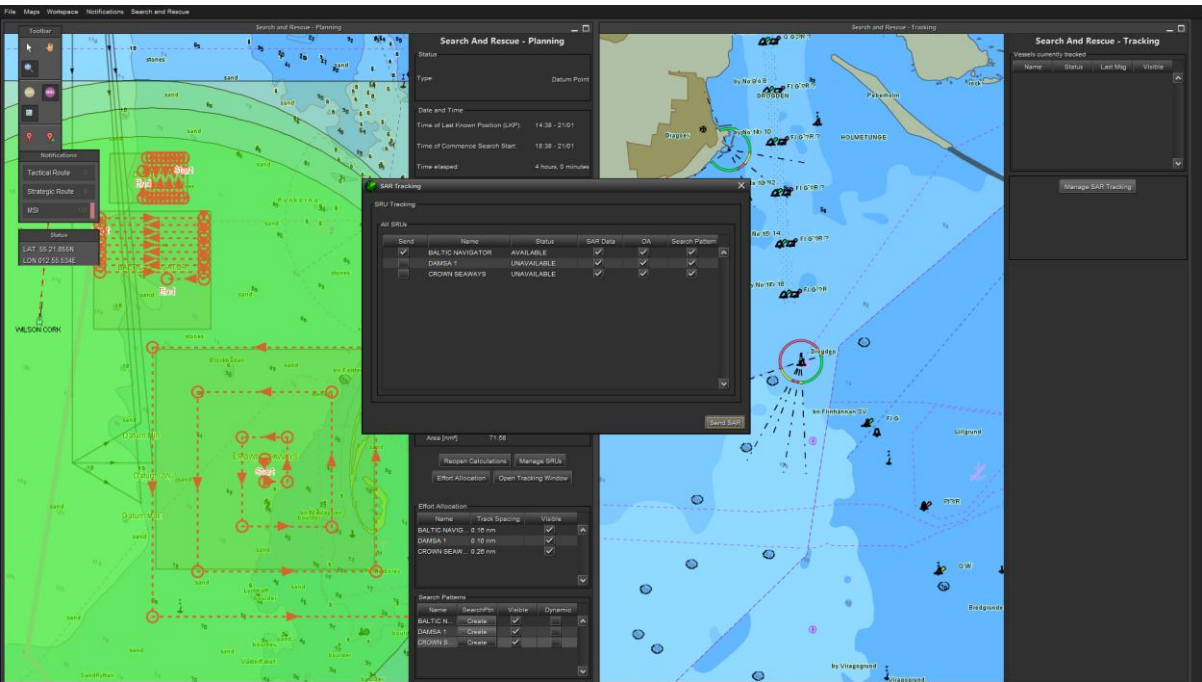


Figure 12: Sending updated search areas and patterns.

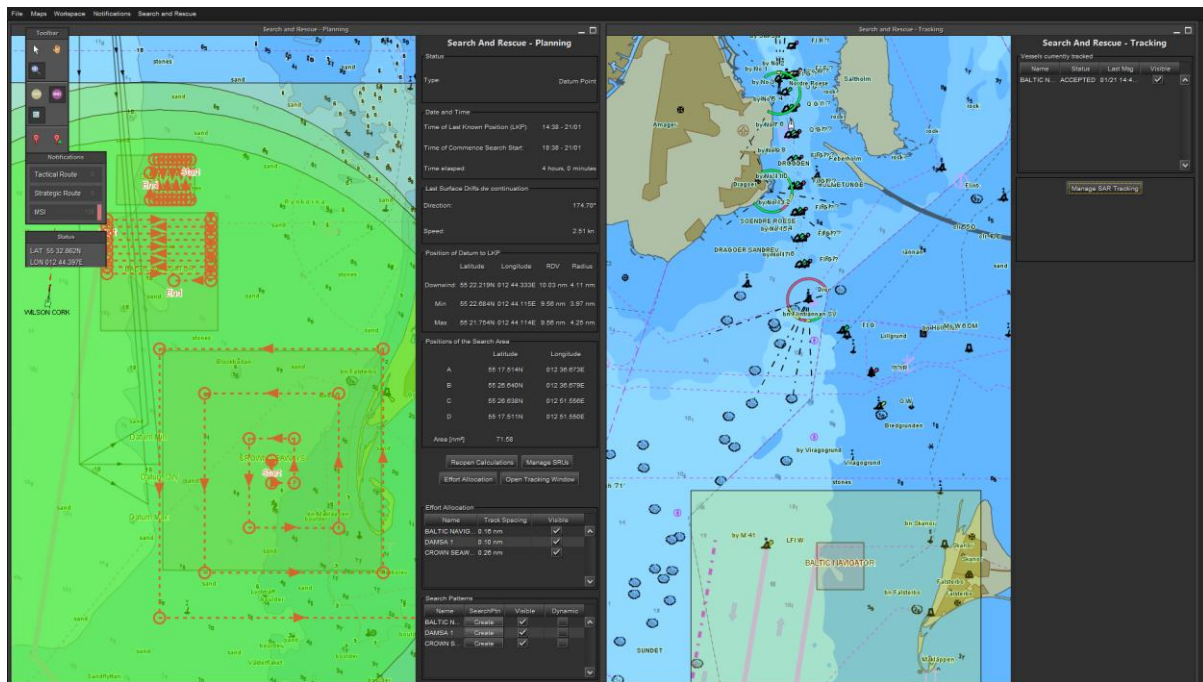


Figure 13: Invited SRU accept search area

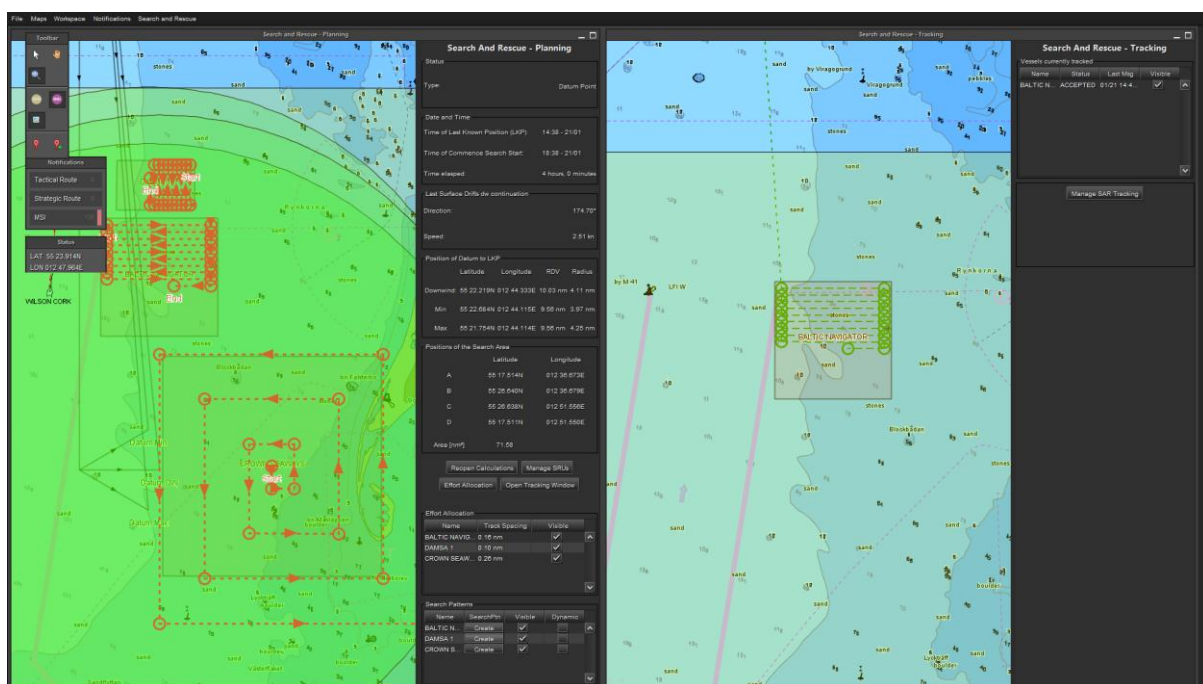
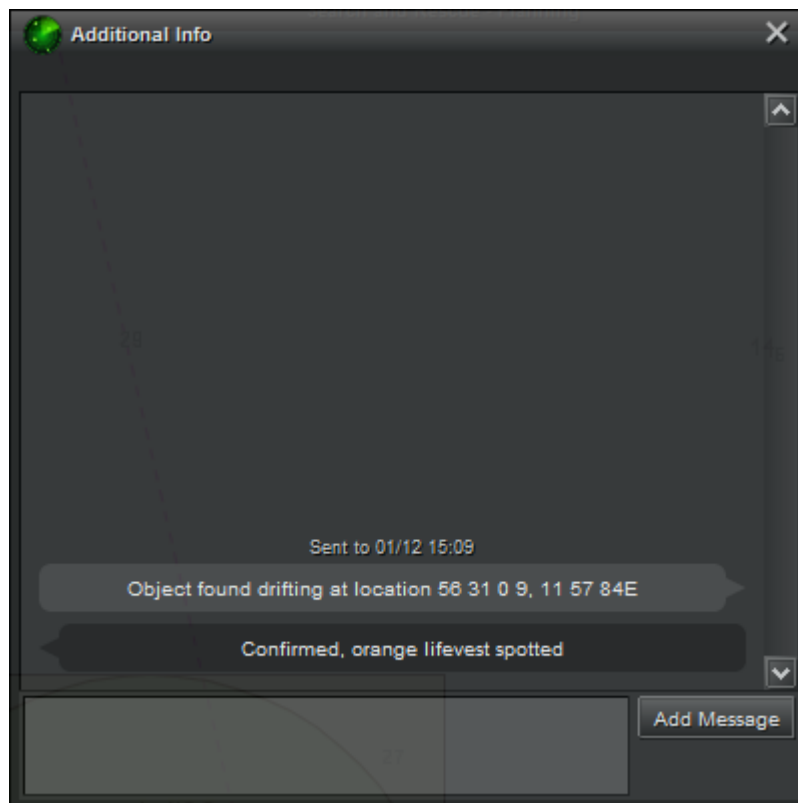


Figure 14: Invited SRU accept search pattern

## 2.5 Sharing of common log / messaging functionality

The VOCT also allows for text based communication and log keeping. At any point during an on-going operation the OSC or SRU's can share data via a common text log. This log is automatically transferred to everyone creating a *group chat*. Vessels will automatically receive and store the received messages with timestamps and sender of said message.



**Figure 15: Shared log**

## 2.6 EPD Integration

The VOCT was implemented and integrated as part of the e-Navigation Prototype Display (EPD), with chart and basic ECDIS/VTs/SAR functionality. The EPD-Shore platform functions as the OSC tool for planning and tracking of SAR operations while the EPD-Ship is utilized as the SRUs ECDIS like display.

The EPD-Shore can create and send SAR operations while the EPD-Ship can create local only (without possibility to invite other vessels) SAR and receive SAR data messages from the EPD-Shore.

All the communication transfer is done via the Maritime Cloud Framework (see separate documentation on this).

### 3 Technical Implementation

To enable communication via the Maritime Cloud a set of data packages were defined.

At the top level a SAR Data package were defined containing all SAR data as calculated see 2.1.

These data messages are always part of a message.

The data message has two optional fields.

Effective Search areas, see 2.2

Search Pattern, see 2.3

The organizer can choose how much data that needs to be transferred, however the SAR area must always be part of the message.

Furthermore to enable tracking and monitoring once a vessel has accepted to participate in a SAR operation and have an active search pattern, the search pattern is repeatedly broadcasted along with the vessels own position (as read from the vessels own GPS to ensure that the GPS position is as new as possible as opposed by AIS which can in some situations have a delay on broadcast).

A separate message is also defined by the broadcasting, which contains the ID of sender, a string message and a timestamp.



## **4 Observations and Feedback**

The VOCT concept was tested live off Den Helder, Netherlands with participation of Netherlands Coast Guard Joint Rescue Coordination Centre (JRCC) and a Coast Guard vessel.

A dummy was dropped off the coast before initiation of scenario. Drift, Search areas and search patterns were then calculated at JRCC and sent via the Maritime Cloud to the Coastguard vessel for direct presentation on EPD. When information was received on board, vessel was tracked for SAR unit management, and additional search information was shared between participants via the shared log functionality.

Both the build in calculation module (IAMSAR calculation) and import from the drift calculation system normally used by JRCC was tested.

The participants were a mix of experienced SAR Mission Coordinators/experienced SAR professionals and ship's crew with background as Master Mariners but without dedicated SAR training.

The VOCT concept was very well received by all participants.

On the shore side (JRCC) the possibility to transfer information digitally and graphically to SRU's were emphasized together with the shared log functionality. Communication is a huge and time consuming task in SAR operations today. Important information may be lost or forgotten when exchanged via voice. Information exchanged via the shared log is stored and may be extracted for later reference and the use of text messages and digital transfer will at the same time ensure that the information sent/stored is the same as received.

The basic calculation functionality based on the IAMSAR Manual may not be sufficient, so the import/export from other drift calculation systems will be very important or communication capabilities based on a standardized exchange format may be part of such systems in the future.

On ship side the crew not normally involved in SAR operations were very positive towards the VOCT concept. Especially when not involved in SAR operations or exercises often, the calculation and management may be time consuming and difficult. Graphic display and sharing of information may improve search results and reduce workload on ships crew during a SAR operation, also moving focus from communication to the important task of lookout.

All ship side participants expressed concerns on the size of text and numbers used on the screen which were hard to read. Text and numbers need to be bigger.

All participants had hopes that the VOCT concept would be developed further and result in future systems with VOCT-like capabilities.