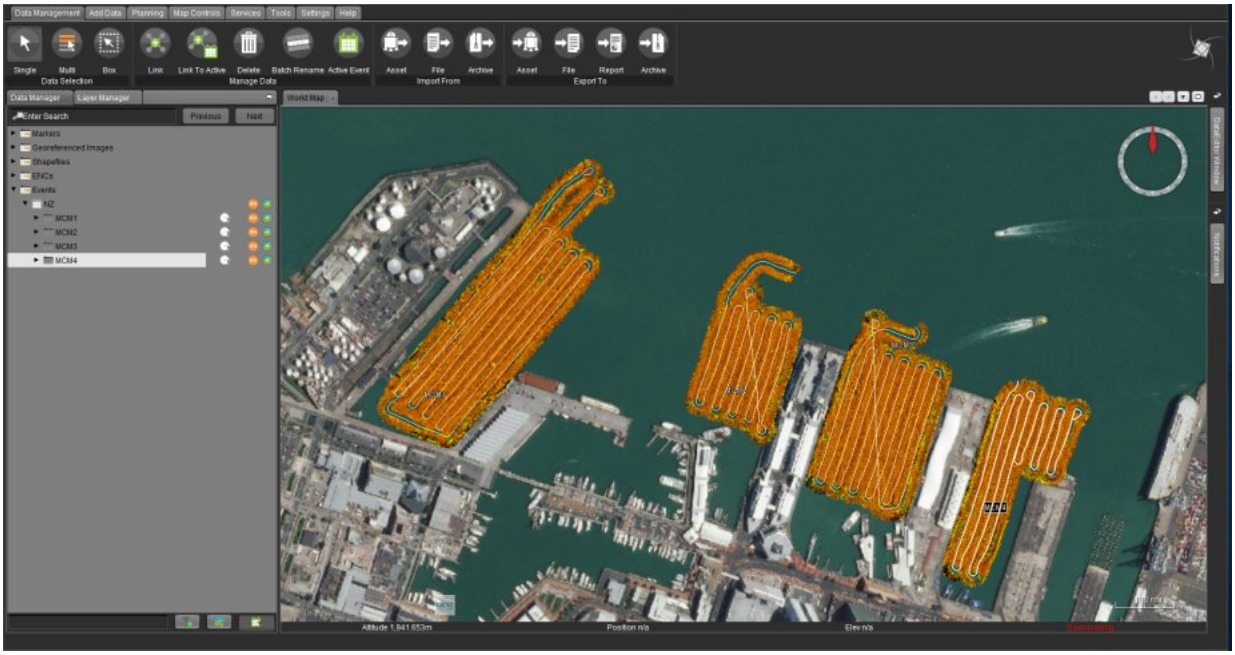
SeeTrack v4

Technical Whitepaper

seebyte

1 INTRODUCTION

SeeTrack v4 is the leading technology used by Explosive Ordnance Disposal (EOD) and Clearance Divers around the world, to achieve success in managing their off-board assets during dangerous and demanding missions. So far, SeeTrack has been chosen as the tool of choice by over twenty navies worldwide. As a commercially available, equipment independent mission planning, monitoring and post-mission analysis tool, SeeTrack generates a single integrated picture of events from multiple sensors and platforms, providing actionable information and fast results when it matters most. Designed with the operator in mind, this unique system for rapid on-site analysis and fusion of sensor data has been effectively utilized within numerous military & security exercises, surveys and operations.



SeeTrack User Interface

SeeTrack is designed to work seamlessly with a fleet of heterogeneous Unmanned Marine Systems (UMS) including Unmanned Underwater Vehicles (UUV), Unmanned Surface Vehicles (USV) as well as manned assets. Using an intuitive user interface the operator can simply plan their mission and perform post-mission analysis for all their UMS. With the mission saved though SeeTrack, future repeat missions can be conducted then contrasted simply and efficiently post-mission. Without SeeTrack, an operator has to plan and program the mission with expert knowledge of each UMS and its corresponding software, launch the UMS and, upon its return, individually assess all data gathered during the mission from each sensor and sonar before finally repeating any parts of the mission which were unsuccessful.

Nations around the world are making significant investments in heterogeneous fleets of UMS and the utilisation of smart software is required to increase the capabilities and the efficient utilisation of these fleets. SeeTrack, through its campaign management, mission planning, mission monitoring and post-mission data analysis functionality, provides this capability and successfully increases situational awareness across all UMS.

2 SEETRACK IN OPERATION

2.1 Campaign Management

Using powerful data management capabilities, SeeTrack provides the ability to manage all data for a campaign (set of missions). The system allows searching by location, date, sensor-type or asset, ensuring that operators can find the data they need quickly and easily. SeeTrack has been designed to cope with many years of operational usage and as such historical data is easily accessed. The Campaign Management functionality is complemented by a set of object (contact) management and reporting tools that can provide a flexible solution regardless of the workflow.

Mission Planning with ENC

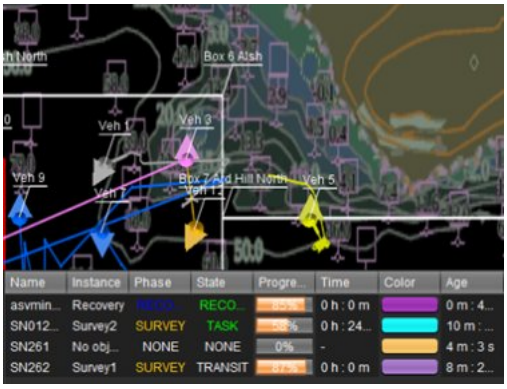
2.2 Mission Planning

Specific UMS platform planning capabilities can be configured for each asset type. SeeTrack dynamically reconfigures the mission planning interface to show the settings and configuration options specifics to each platform. This provides a single interface for planning multiple heterogeneous UMS assets while still retaining the unique capabilities of each platform. The concept of mission planning has been taken further to support the broader concept of campaign management, or sets of mission plans.

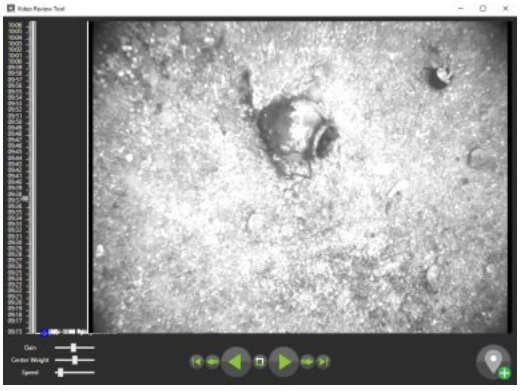
SeeTrack provides support for common Mine Countermeasure (MCM) data and interface formats. This includes Electronic Nautical Charts(ENC) and Additional Military Layers (AML) Small Bottom Objects. The addition of S57 / S63 Encrypted ENC Chart support ensures that users have the widest access to charts, wherever in the world they are currently operating.

2.3 Mid-mission Monitoring and Real-time Operations

The system has been designed to cope with a wide-range of UMS and a range of real-time data processing and visualisation tools have been developed to meet the operational requirements of these systems. Examples of tools available on request include: real-time waterfall display for sidescan sonars, video and



Monitoring the progress of several unmanned systems collaboratively mapping an area

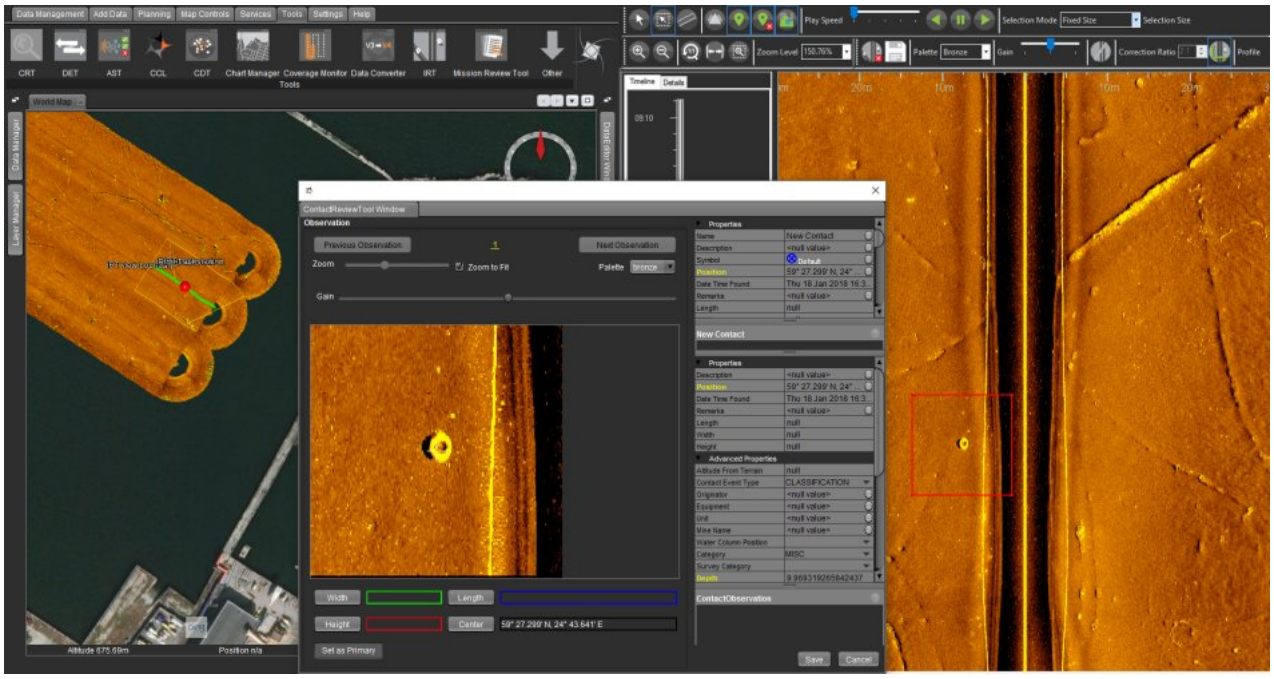


Specialist Review Tools for Video (VRT) and Forward-look Sonar (FRT)

forward-look sonar tools for data viewing, object marking and data geo-referencing, and SeeByte's goal based autonmy system, Neptune.

2.4 Post-Mission Data Analysis and Reporting

SeeTrack has been designed to handle large quantities of heterogeneous sensor data. For example SeeTrack includes the specialist processing and visualisation tools necessary to deal with the data volumes and the high resolution imagery associated with high fidelity sensors like Synthetic Aperture Sonar (SAS). Finally the system provides a flexible set of data management and reporting tools to enable end-to-end workflow in the SeeTrack architecture.



Contact Review Tool and Imagery Review Tool

3 MODULAR AND OPEN SYSTEM ARCHITECTURE

3.1 Overview

SeeTrack's Modular and Open Architecture has been designed specifically to take data from a wide range of sensors, including CTD, video, forward-look sonars and sidescan sonar for automated processing and visualisation. This design allows new sensor types and UMS assets to be quickly and easily integrated. The key features are:

- Logical Data Model core
- Open, modular architecture to allow easy extension and integration with new systems
- Net centric, including support for a wide range of standards (REST, WSN, AMQP, WFS, WMS, WCS)
- Ability to handle high-volume and high-bandwidth data sources
- Distributed System Management
- User Authentication and Role Assignment

3.2 Common Interfaces and Formats

A major theme throughout the design and implementation of SeeTrack is the use of common interfaces and common formats to ensure widespread interoperability and compliance. The two major subsystems for this are the web communication system and the web mapping system.

The communication backbone for the system is currently based on a combination of Advanced Message Queuing Protocol (AMQP) and Web Service Notifications (WSN). AMQP is taken from the world's busiest share trading systems to provide a proven "event notification" system capable of robust scalability. This system provides a subscription model to enable third-party modules to receive any system notification. For example, when a mouse click occurs or when a data source is updated a notification is triggered to alert all subscriber modules of the event. The Web Service chosen is the Simple Object Access Protocol (SOAP), which is an open-standard using standard technology (HTTP), which provides a simple method of passing data between different modules, regardless of their location or source language. Finally the Logical Data Model (LDM) supports adapters to allow interfacing with other middleware technologies, such as ROS or DDS, to increase compatibility.

The web mapping system uses Open Geospatial Consortium (OGC) standards to ensure widespread compatibility. The following three components are certified OGC compliant:

- Web Mapping Service (WMS)
- Web Feature Service (WFS)
- Web Coverage Service (WCS)

3.3 Data Management

A key to SeeTrack's successful adoption across domains and integration with existing and future systems is the utilisation of a Logical Data Model (LDM) [exemplars: UAS Control Segment (UCS) Architecture, Mine Warfare Data Model Working Group, NATO STANAG 4817 MDCS]. The LDM provides the backbone of the system by structuring items of importance and defining how these items relate to one another.

By adhering to an LDM, it is possible to easily develop modules that utilise the defined data flow, including input and output interfaces. This includes both the top-side software architecture and any embedded component on the UMS.

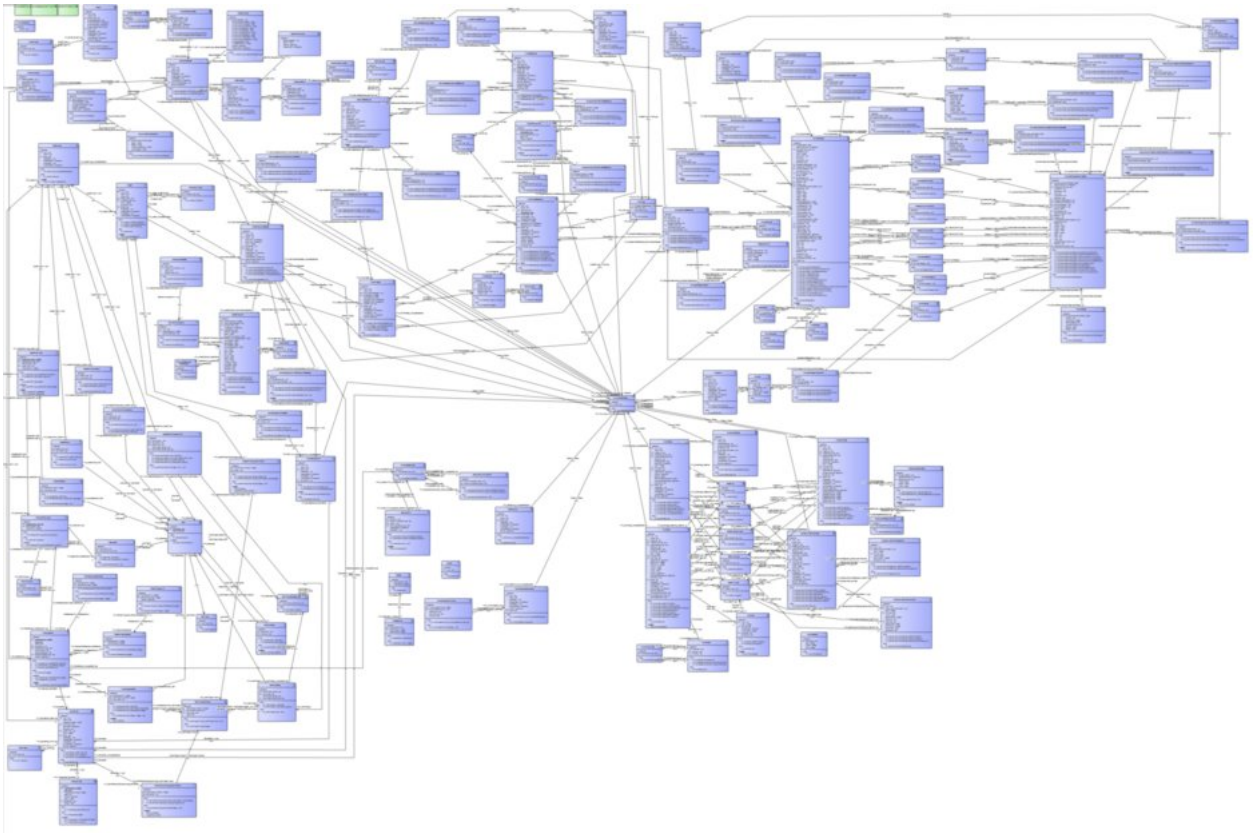
An overview representation of one of the elements of SeeTrack's Logical Data Model is shown below. SeeTrack has chosen to use the most advanced open-source database – PostgreSQL – to access a wide-range of features, including distributed access.

3.4 Software Development Kit

To further enhance the SeeTrack modular and open system architecture a Software Development Kit (SDK) is available to enable third-party integration. The SeeByte provided Tools and Services (Section 3.5) utilise the same set of open architecture features that are accessible to third-party modules. The SDK includes full interface descriptions (ICD), system diagrams as well as example code and facilitates software development within the SeeTrack framework and architecture without demanding in-depth and low-level technical knowledge.

3.5 Tools and Services

SeeTrack's architecture employs a service oriented architecture (SOA) approach. In this approach, all system components are separate modules capable of being easily replaced with third-party equivalents using the SeeTrack SDK. The figure below provides a breakdown of the major components in SeeTrack.



SeeTrack's Logical Data Model

To easily allow third-party software integration that is capable of full integration with core components SeeTrack introduces the concept of Tools and Services. Tools are software modules that provide a user interface, while Services run in the background and provide data processing functionality:

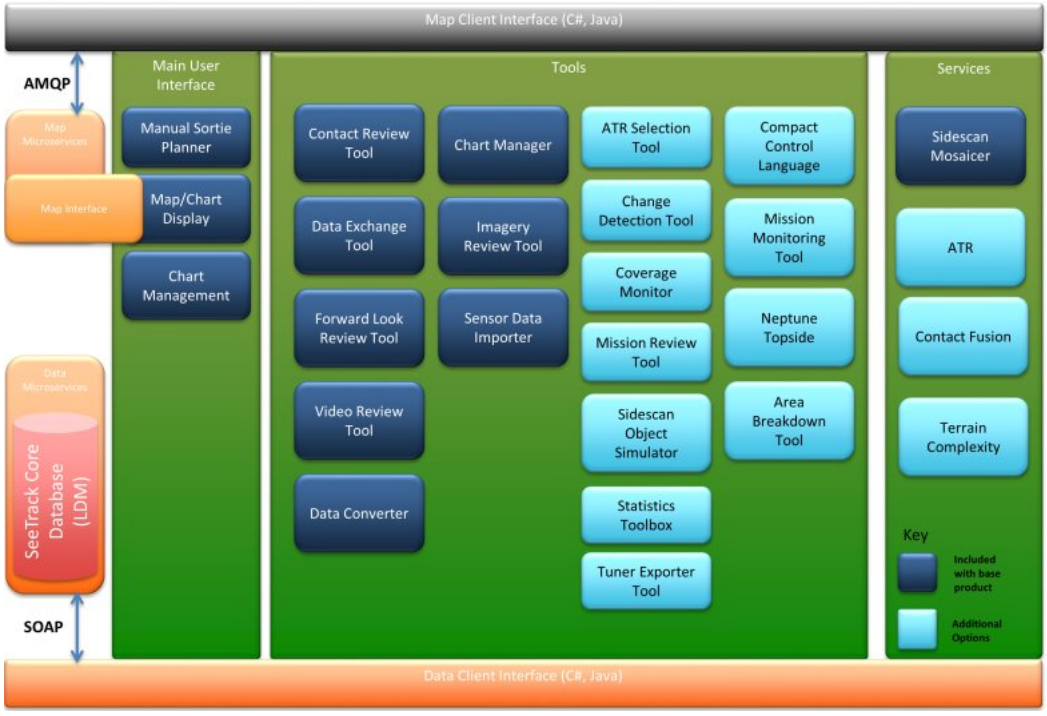
- Tools – This set of modules provides extensions to the core functionality that requires interaction with the user. Examples include the Imagery Review Tool, Video Review Tool and Sortie Planner Tool. The tools are launched from the Main UI and appear as separate windows. The SeeTrack SDK encompasses a SeeTrack tool template to facilitate straightforward development of 3rd party tools.
- Services – This set of modules provides functionality that does not require user interaction. These software processes run in the background and examples include data processing tasks like Automatic Target Recognition (ATR) and image Mosaicing. The SeeTrack SDK encompasses a SeeTrack service template to facilitate straightforward development of 3rd party tools.

3.6 Integration with SeeByte Products

SeeTrack's Tools and Services architecture is designed to allow the simple integration of new functionality. In addition to providing this interface to customers it is also designed to allow simple integration of other SeeByte products to further enhance the operator experience. Some examples of products that can be easily integrated with SeeTrack include:

- SeeByte Automatic Target Recognition (ATR) System
- Neptune Multi-Vehicle payload control architecture
- Automated Breakdown Tool for campaign planning

These products use a combination of tools and services to integrate seamlessly with SeeTrack. For more information about any of these or other SeeTrack compatible products please contact SeeByte.



SeeTrack System Architecture with Tools and Services

4 HOW TO INTEGRATE WITH SEETRACK

4.1 New Sensor

Integrating a new sensor with SeeTrack is easy due to the Open Architecture design and the available Software Development Kit allowing integration with the core data model. The first step in integrating a new sensor into the system is to ensure that that sensor type is supported by the Logical Data Model (see Section 3.3). The set of currently supported sensor types encompasses navigation sensor, sidescan sonar, video, environmental data sensor and forward-looking sonar.

To import data from the new sensor, the SeeTrack SDK provides a low-level access interface to the sensor data importer framework. 3rd party developers are required to code a small dedicated parser library for the new sensor and simply register it with SeeTrack v4. The sensor data are then pushed to the SeeTrack LDM thereby making it available to all SeeTrack clients and operators.

4.2 New UMS Platform

Like adding a new sensor, adding a new Unmanned Marine System to SeeTrack takes advantage of the Open Architecture design and SDK. There are a number of components to this integration; registration of an asset type, mission plan export, vehicle data import and third party software integration.

As discussed earlier one of SeeTrack's benefits is its ability to plan missions generically and to export those missions to any UMS asset in the fleet. This is accomplished via a mission plan adapter which is coded and registered with SeeTrack by 3rd party developers in the form of a small dedicated library . In essence, a standard format SeeTrack mission plan must be imported, parsed and exported to the proprietary UMS mission file required for the asset.

Once the mission has been exported to the new UMS asset and the mission completed, the next SeeTrack integration step is to create a data importer for that UMS mission data, as discussed in the previous section.

Finally, SeeTrack also provides the ability to launch external software tools associated with the new UMS asset. These could include mission monitoring tools or data post processing services to create metadata from the mission data. This will be discussed in the next section.

4.3 Third Party Processing Chain

In addition to writing tools using the SDK, SeeTrack provides the ability to easily launch third party tools. A good example of this would be to start an external specialist software tool to perform data post processing. In this instance a SeeTrack adapter tool or library would be created to wrap and manage the process first by passing data to and starting the external tool and then by importing the result back in to the SeeTrack data model. In this way operators can easily use existing data processing tools within the SeeTrack environment. This third party application functionality can also be used to start UMS mission monitoring tools, again keeping the entire mission planning, monitoring, and data management cycle within a single process.

4.4 Custom visualisation

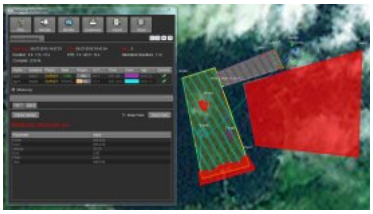
The SeeTrack SDK also includes a powerful interface for interaction with the SeeTrack world map display. Clients are offered a wide range of options for customisation of various aspects of mission management including mission planning, monitoring and analysis.

5 CONCLUSION

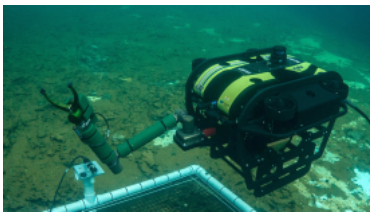
SeeTrack is designed to maximise the capabilities of heterogeneous Unmanned Maritime Systems. This smart software solution provides users with the capability to rapidly plan a mission, gather data, and integrate it into one layered image of the maritime space with greater speed and fewer errors. SeeTrack consolidates inputs from various sensor feeds to provide a comprehensive picture of the situation. It provides a common interface for the UMS and their sensors to allow users to easily view information in a single real-time display, enabling more reliable and efficient decision making. By using an open-architecture framework users are able to operate many different UMS platforms from a single system.

SeeTrack's modular approach allows individual modules to be substituted and changed according to the user's requirements. By using a Logical Data Model, where the data architecture feeds relevant information into each module, SeeTrack is able to provide fully compatible integration with data management systems. Finally, the data model allows structured interaction and standardised data to be passed easily both within SeeTrack and externally to other data management systems.

SeeByte Software Solutions



Neptune provides a payload control architecture, goal based mission planning, and real-time autonomy engine for Unmanned Maritime Systems (UMS) to plan and execute well known patterns of behaviour.



CoPilot is the world's most advanced, easy-to-use, plug-and play software that makes piloting any ROV a much simpler task.

SeeByte has created a variety of product offerings to help manage MCM assets, ultimately providing situational awareness across all assets and within the battlespace for MCM and EOD Operators.

For more information please contact SeeByte at sales@seebyte.com