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Object Detection Using NORBIT SONAR
Budapest, Hungary
Data collections on River Duna (Danube)

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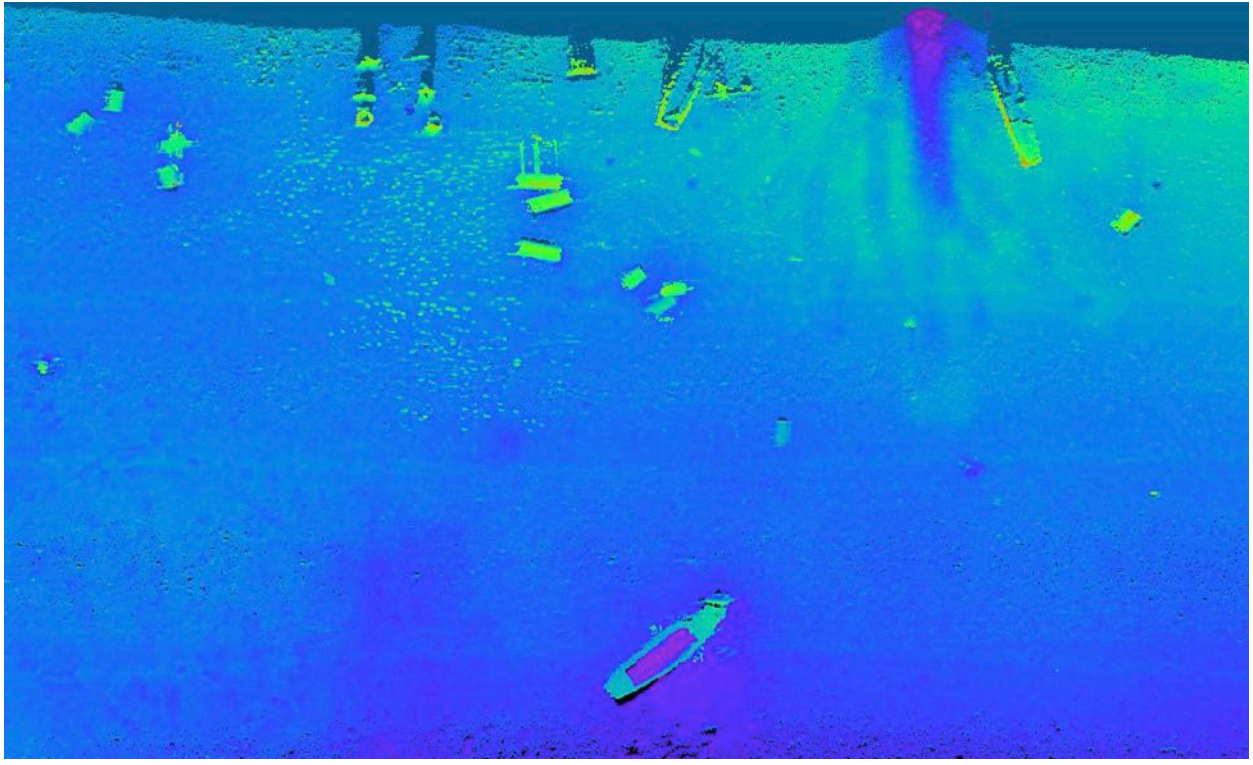


Detecting detailed objects underwater

Detecting objects underwater using multibeam echosounders presents a variety of challenges.

Typical digital terrain models made from bathymetry data incur a loss of resolution as a function of grid size which makes detailed object representation more difficult. Also, operational considerations include conflicting needs such as “real time” operator aided inspection vs. offline post processed inspection of data.

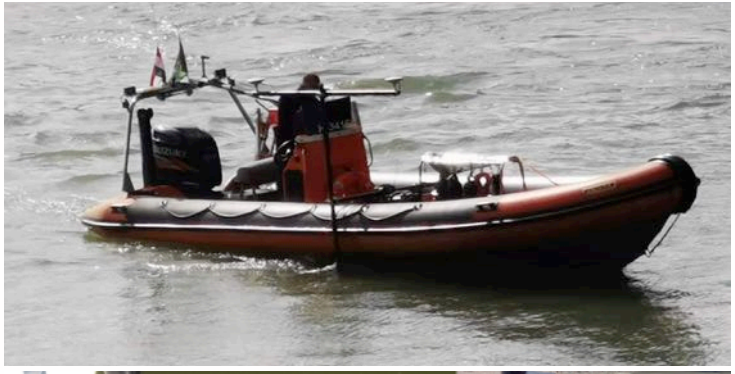
In this case study we highlight the benefits of using different approaches for imaging underwater targets. The applications for these techniques support:

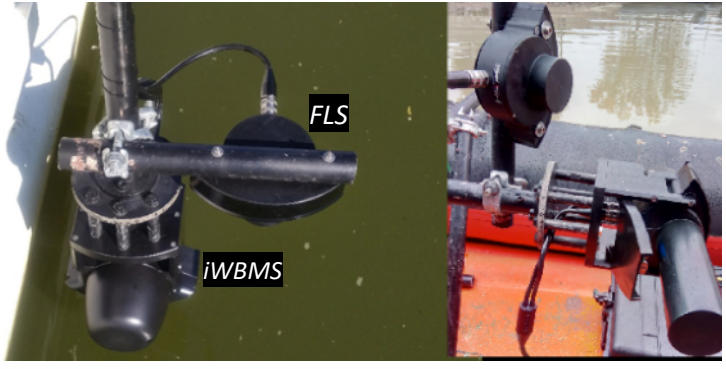
- Search and Recovery Operations
- Environmental/Biological/Ecological Assessment
- Navigational Support for vessels in shallow water

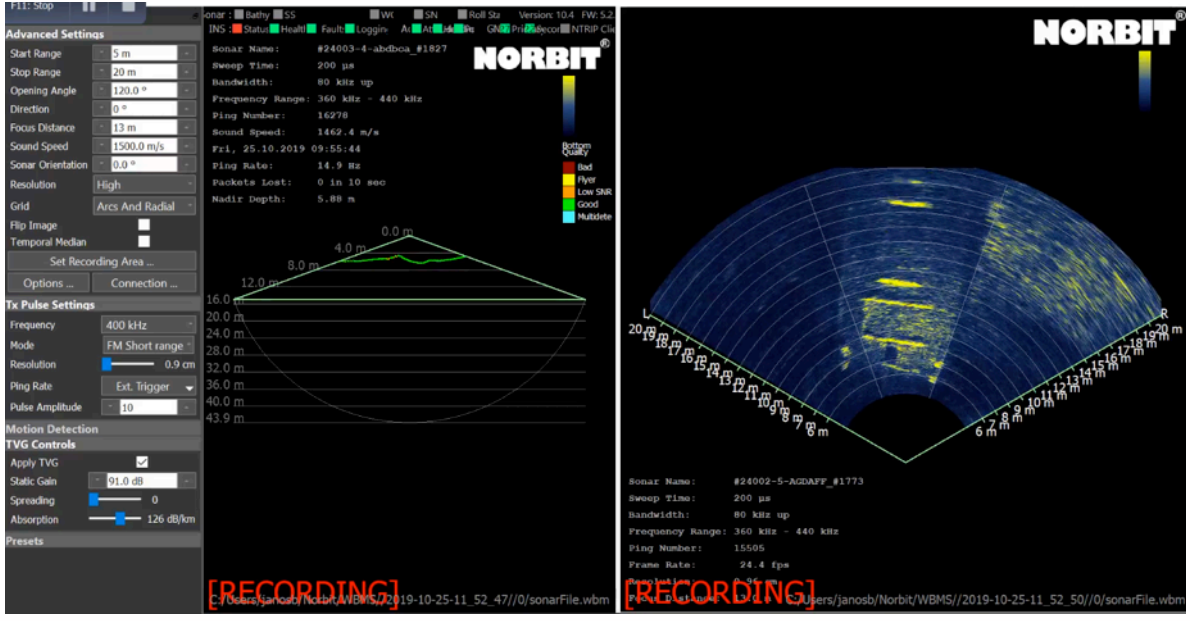
iWBMS for Mapping

WBMS FLS for Imaging

For this case study we chose a novel dual head sonar configuration consisting of a standard NORBIT FLS imaging sonar mounted with a NORBIT iWBMS mapping kit. Both sonar heads were connected to a single SIU topside and run from NORBIT GUI software (v10.4.X) simultaneously. The surveys were conducted from a RHIB vessel using a custom mounting arrangement made from inexpensive materials. RTK was provided via cellular network.

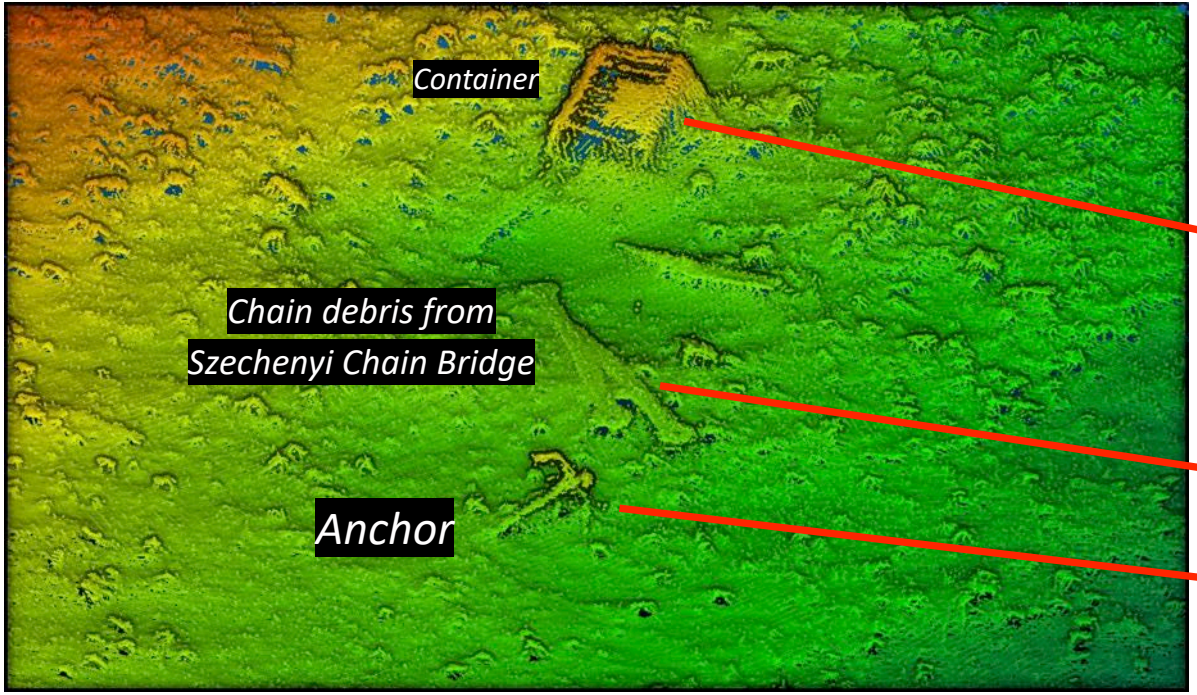




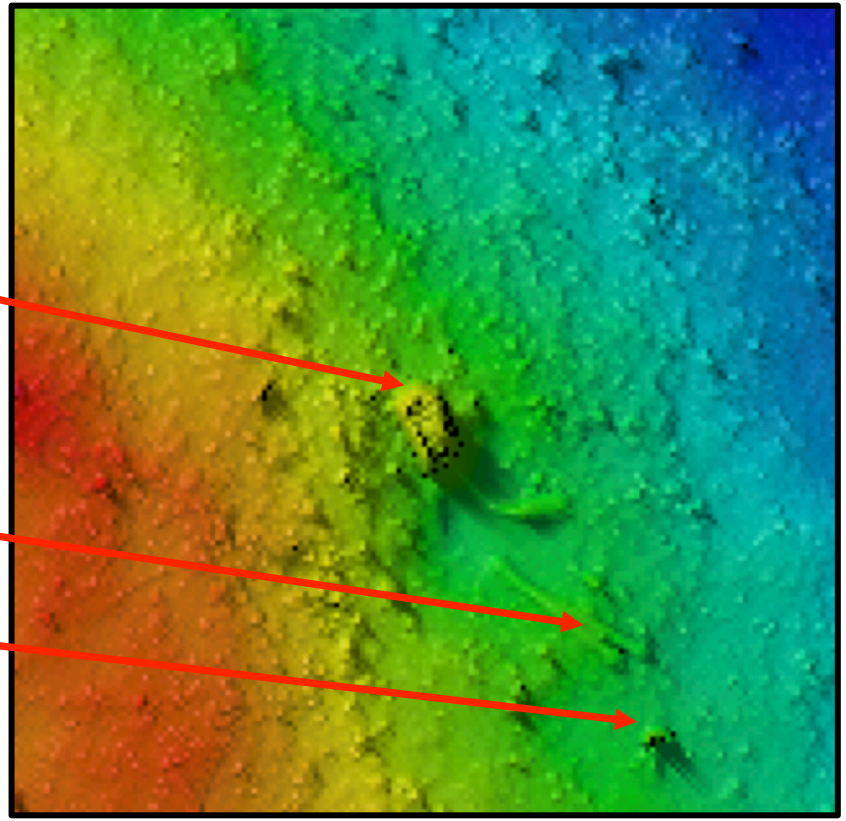


Dual Head System: iWBMS + FLS Real Time Capture

In this example we highlight the difference between a DTM and a Point Cloud representation of small and medium sized complex objects.

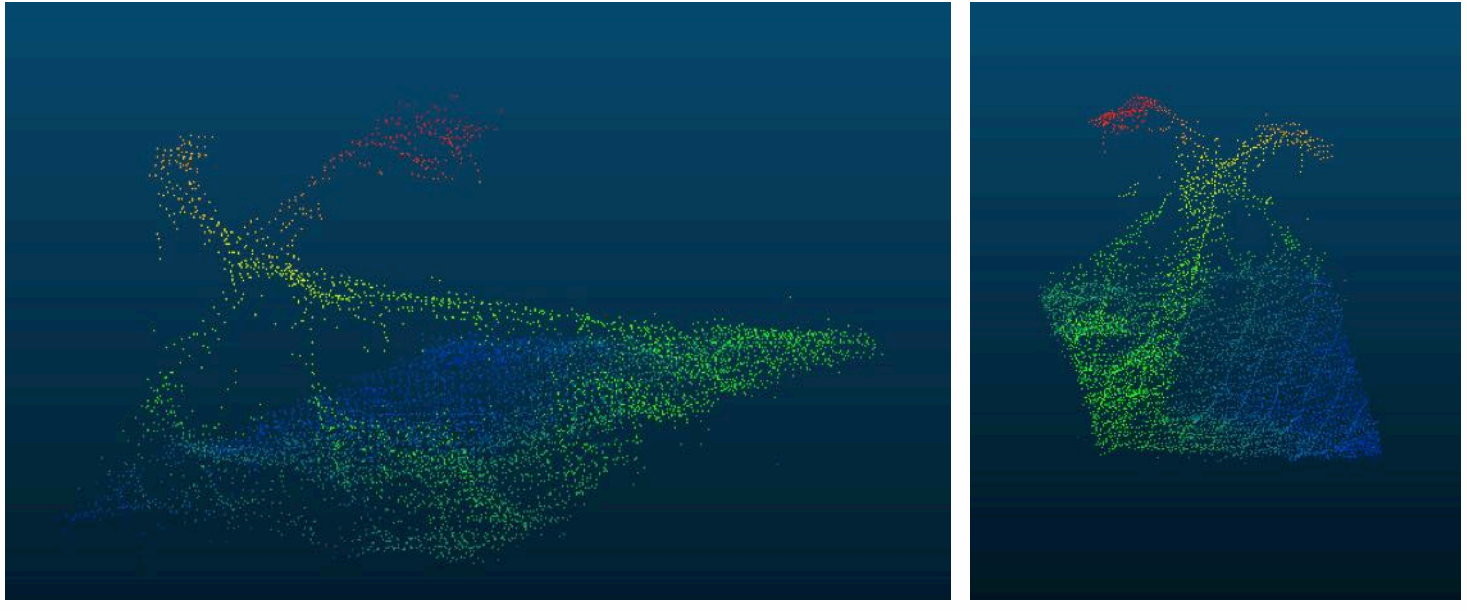


Full resolution processed point cloud viewed at olblique angle



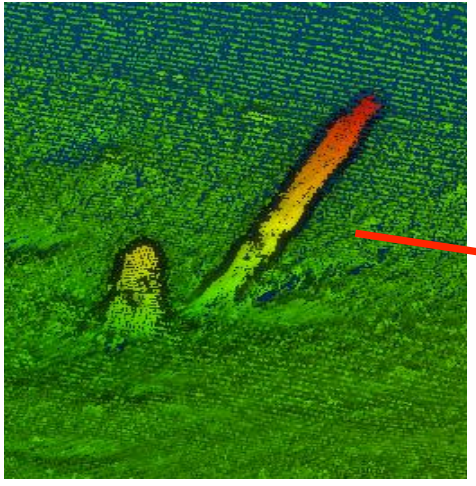
Standard DTM model 25cm grid size

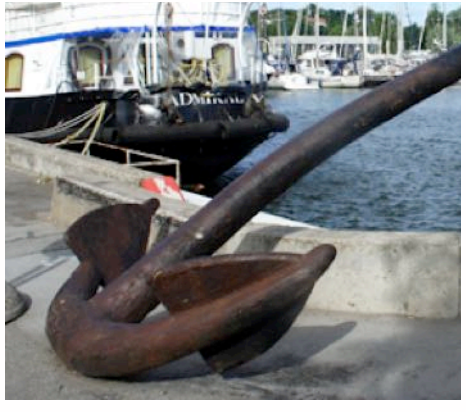
Full resolution point clouds typically preserve the complex structure of small objects as shown below:



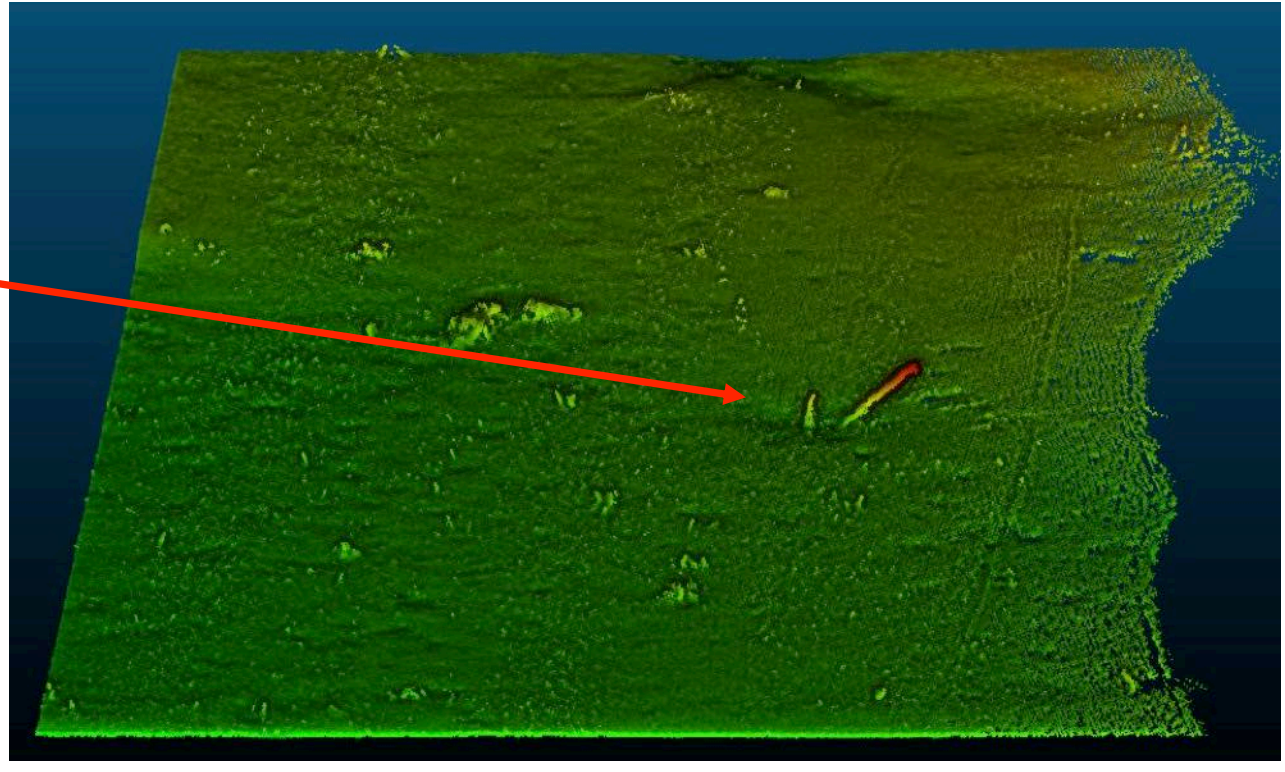
Point cloud Sample using minimally processed data

Similar type anchor photo





Similar type anchor photo



Kedge-Admiralty type anchor shown in processed full resolution point cloud, shading and illumination applied

Environmental Assessment: Industrial drums (contents unknown)

Processed Point Cloud Representation

Public images of dumped drums

These storage drums were located near a popular fishing location. Full resolution point cloud data allows divers to have the maximum level of detail required to plan and support safe inspection and recovery.

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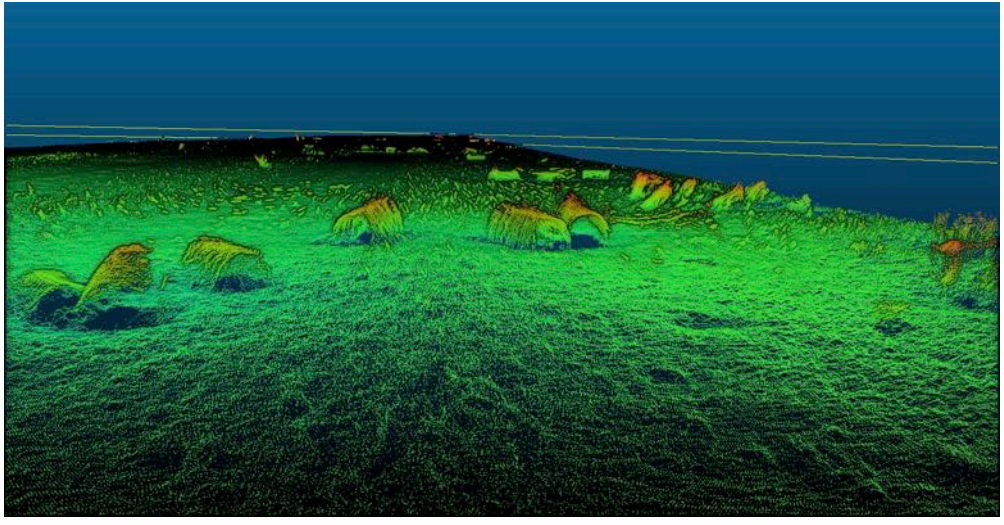
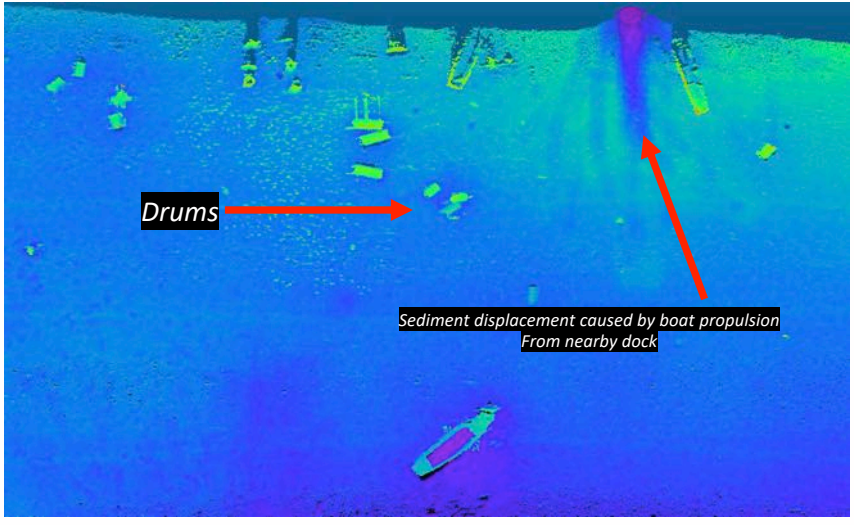
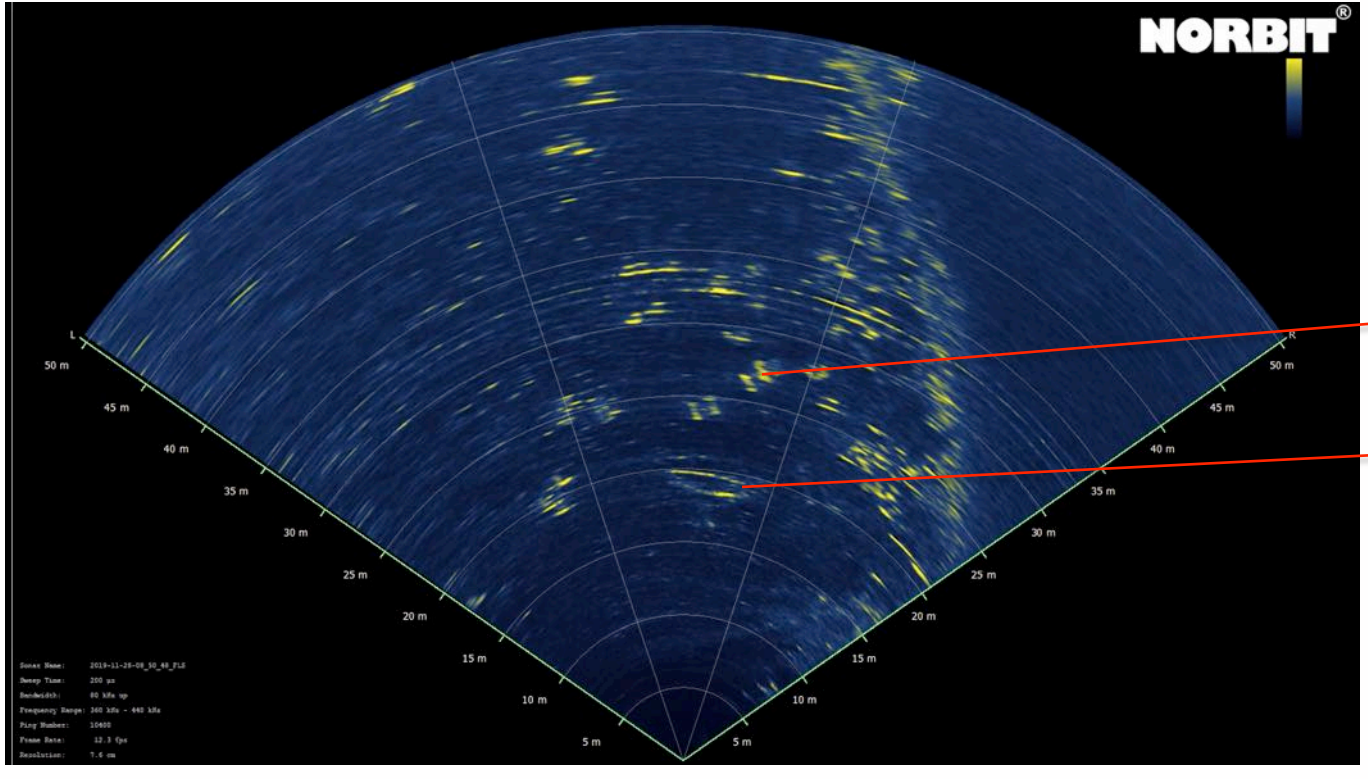
Additional Views of drums in riverbed





Drums in riverbed with FLS

Forward Looking SONAR (FLS) images also provide a unique representation of objects ahead of the vessel.

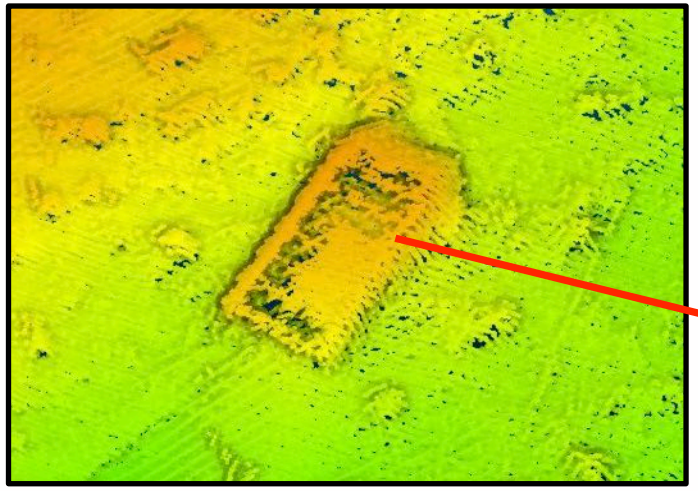


Drums

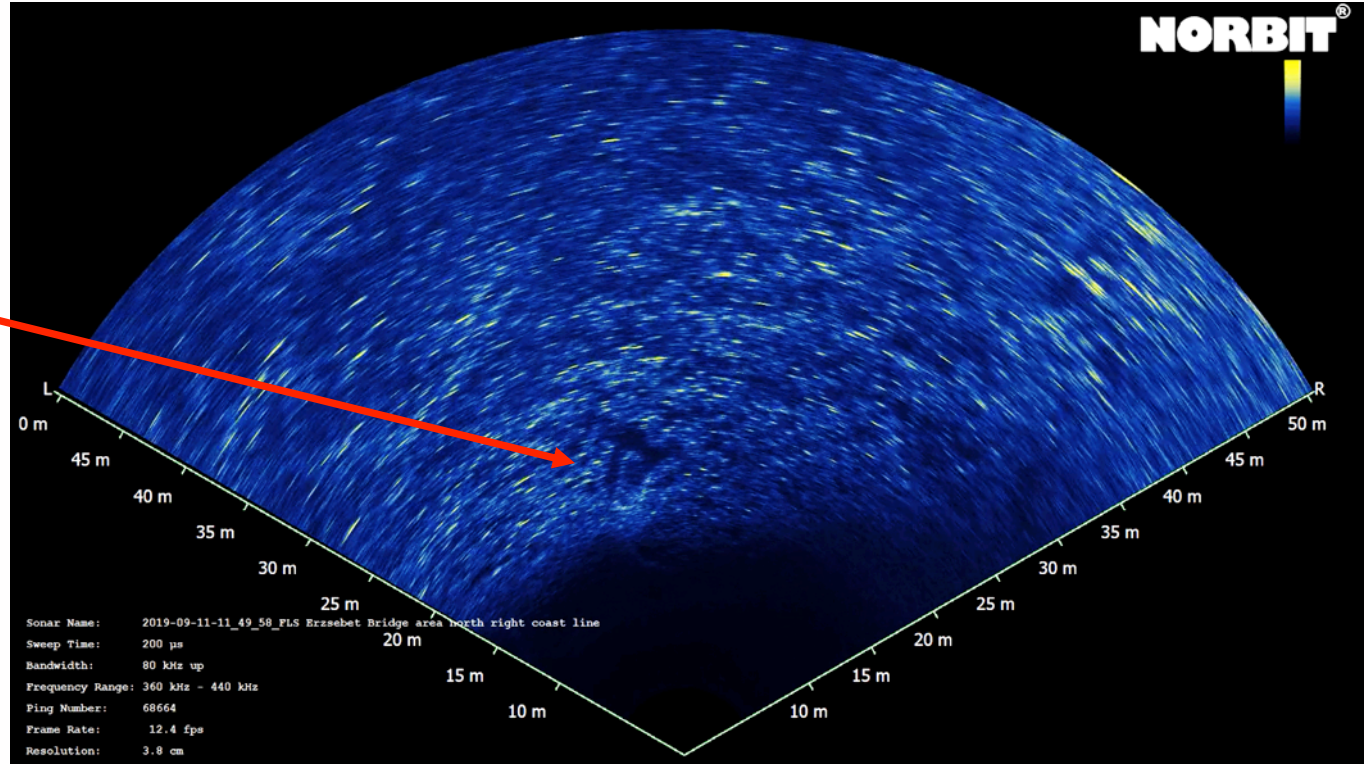
Shipwreck

FLS video snapshot

Lost containers, unknown contents



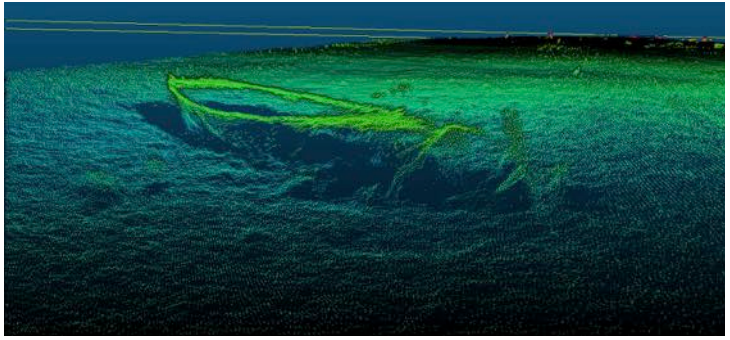
Full resolution point cloud of container

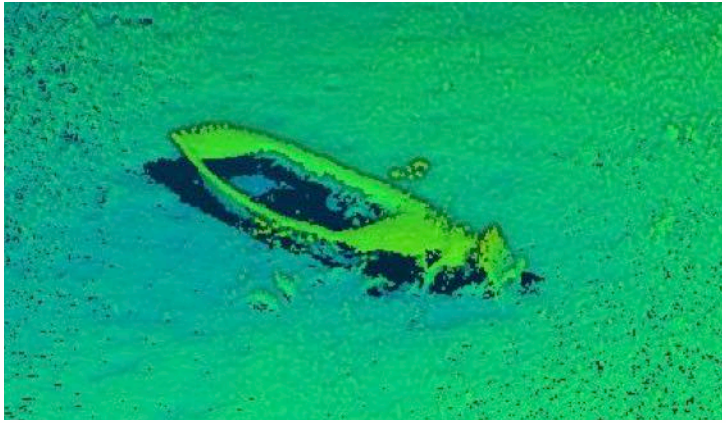


FLS video snapshot of storage container from initial inspection

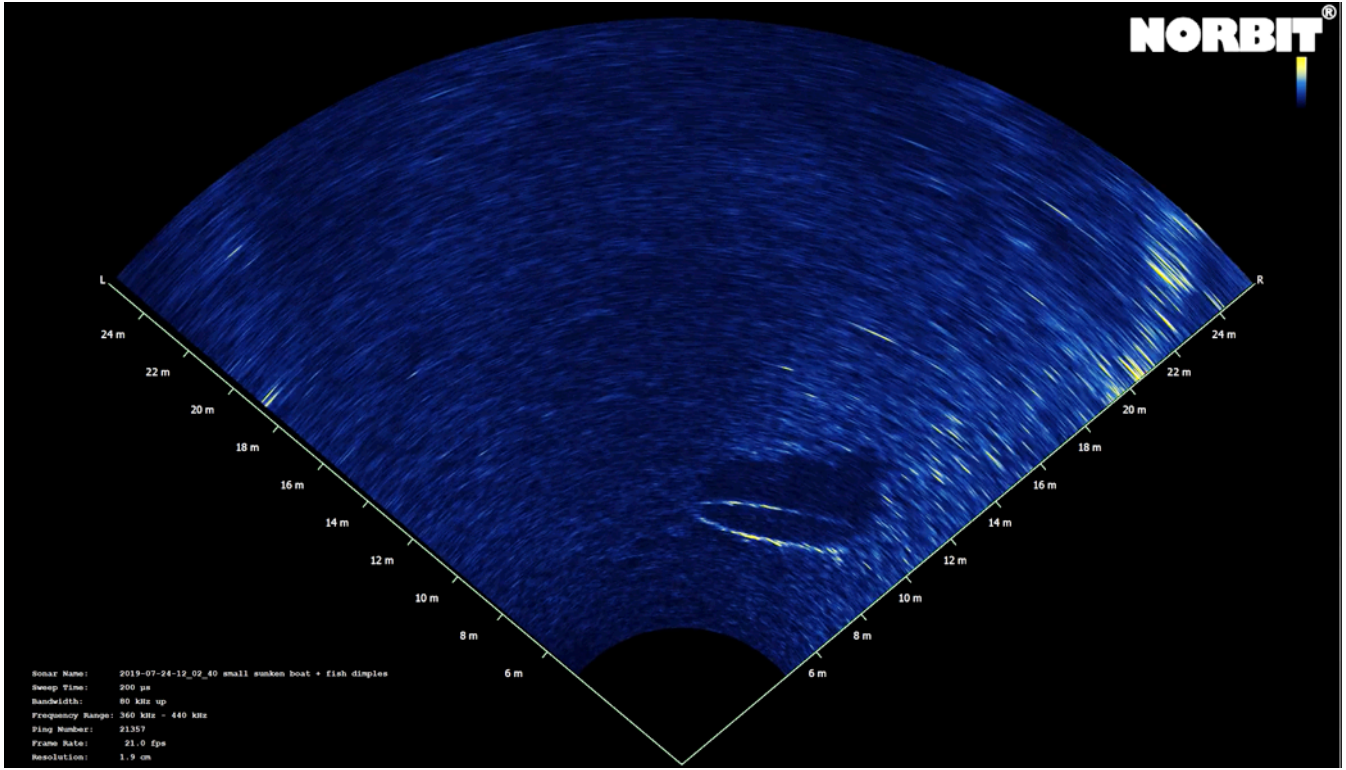
Lost shipping containers present a unique challenge for recovery. This container was inspected as a potential store for WWII ammunition. Understanding the detailed orientation of the structure, how it lays, and the distribution of debris surrounding it is critical for safe recovery efforts.

Small sunken boat





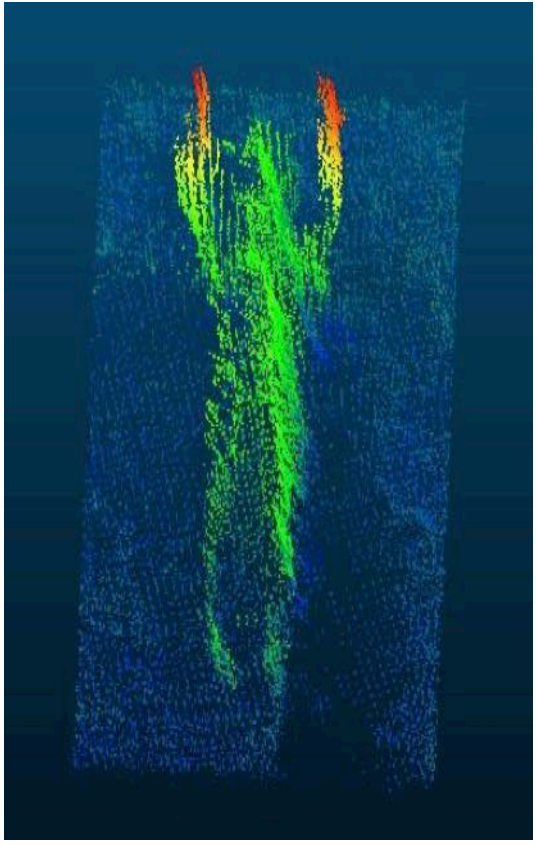
Point cloud, small boat



FLS video snapshot

Shipwrecks are a classic target for representing underwater structure and detailed objects. In this example we see a small fishing boat imaged using both mapping and imaging sonar modes.

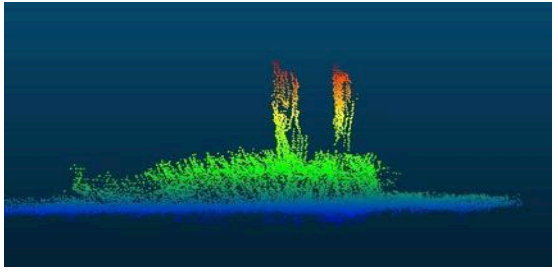
Mannequin Imaging

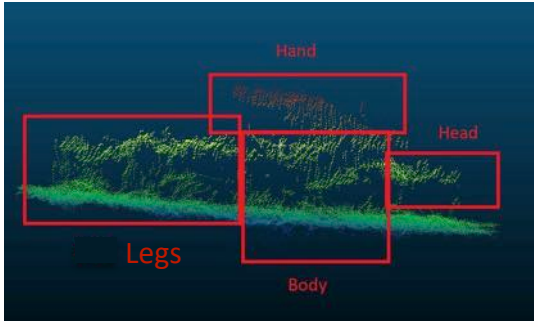


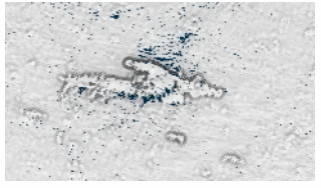
Mannequin use for imaging of human forms underwater

Search and recovery in maritime operations includes the location and identification of human forms. In this example we experiment with detection of human forms in the mapping data.

Orientation – Arms raised
Water depth: 1.6 – 1.8 meters
Underwater visibility: 0 – 30cm



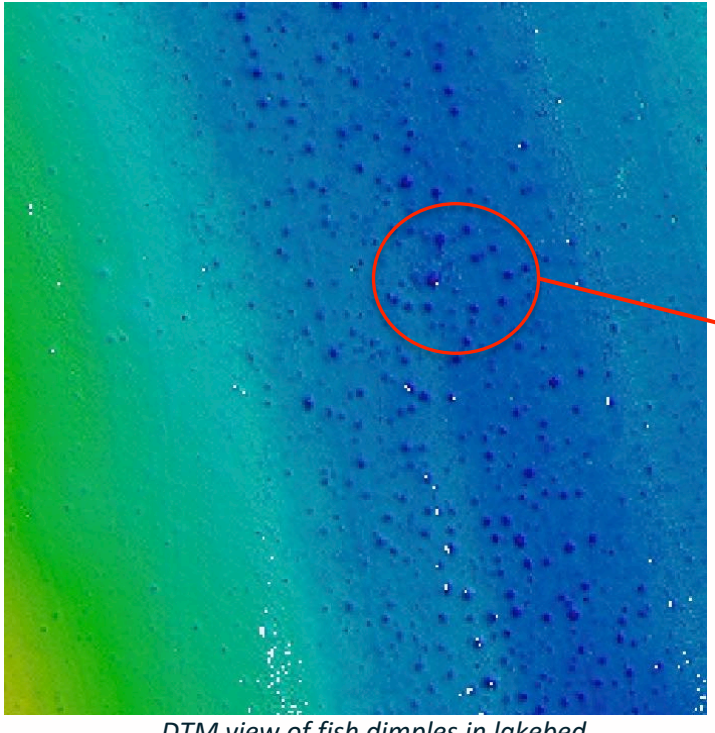




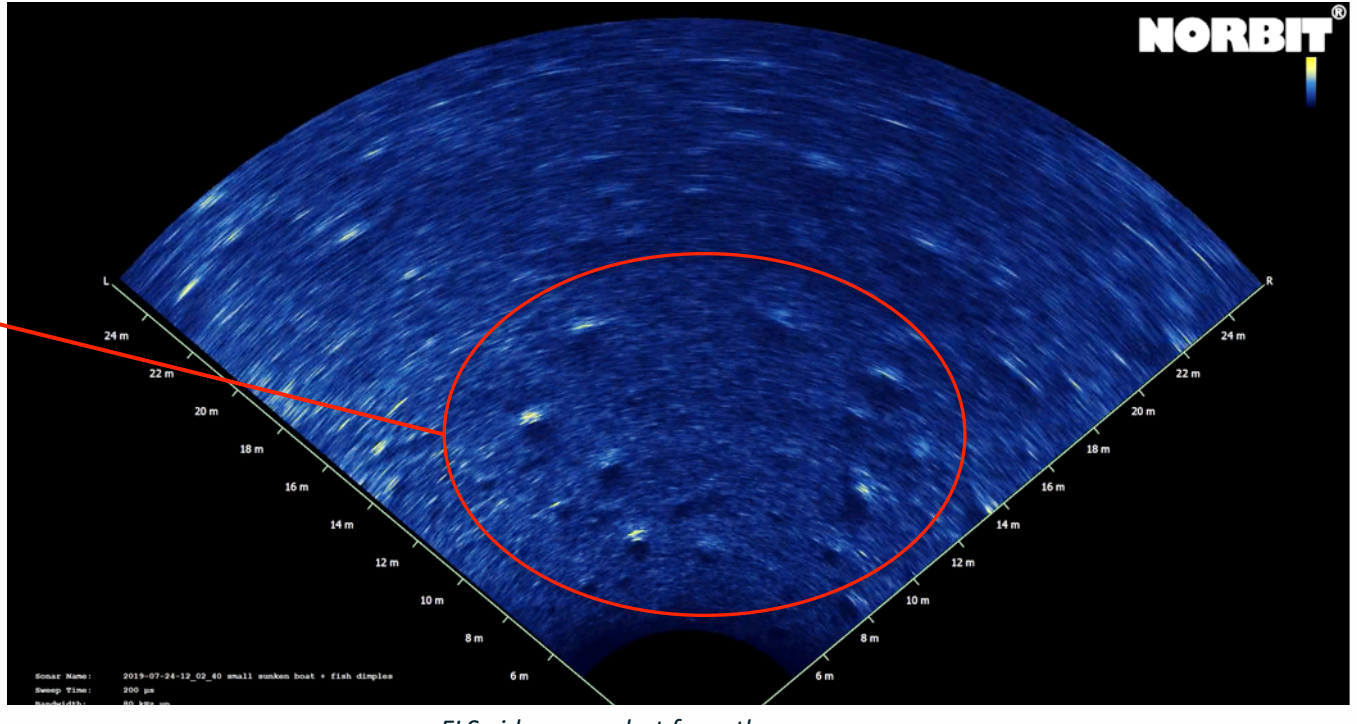
Human dummy target (mannequin) laying sideways on the riverbed, also using 700kHz with side scan imagery enabled. Multidetect mode provides enhanced detection around the target enabling better information about its structure.

Fish and Fish “dimples”

In this example we see shallow structures created by fish burrowing into the sediment of a lakebed. This behavior creates “dimples” which are easily detected using FLS or iWBMS modes. Analysis of these structures could help assess population density and activity.

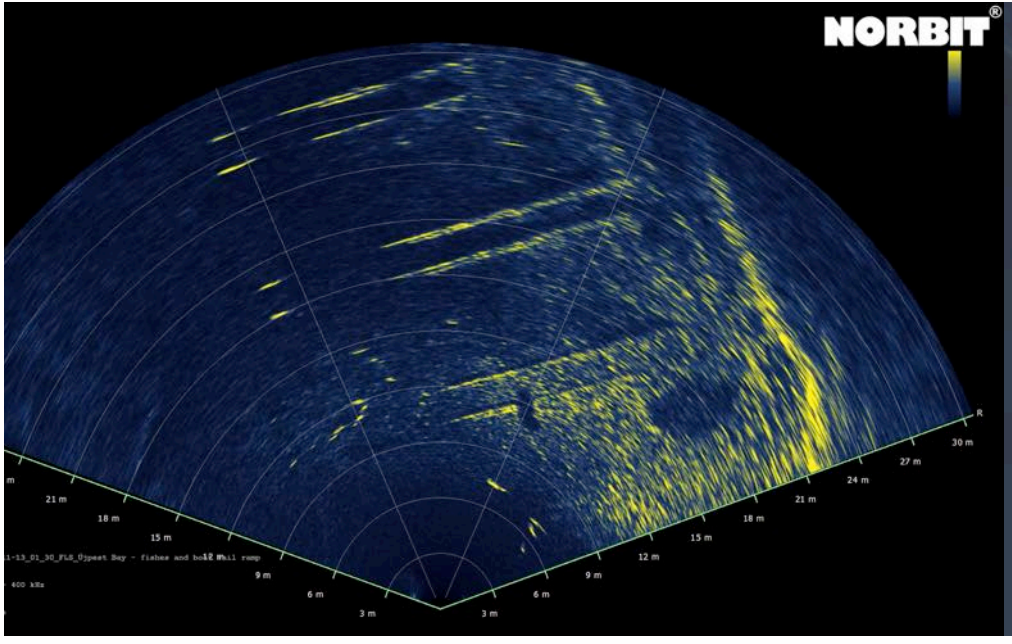


DTM view of fish dimples in lakebed



FLS video snapshot from the same area

In this example an FLS is used to maneuver around complex underwater structures in very shallow water (1-2m max). By Combining Google images with real time FLS an operator can easily navigate a reasonable path through a dense obstacle field. This example shows boat launch ramps from a decommissioned shipyard which is sometimes used for illegal dumping of waste and is located near residential fishing areas.



FLS capture approaching boat ramp

Boat ramp from Google Earth

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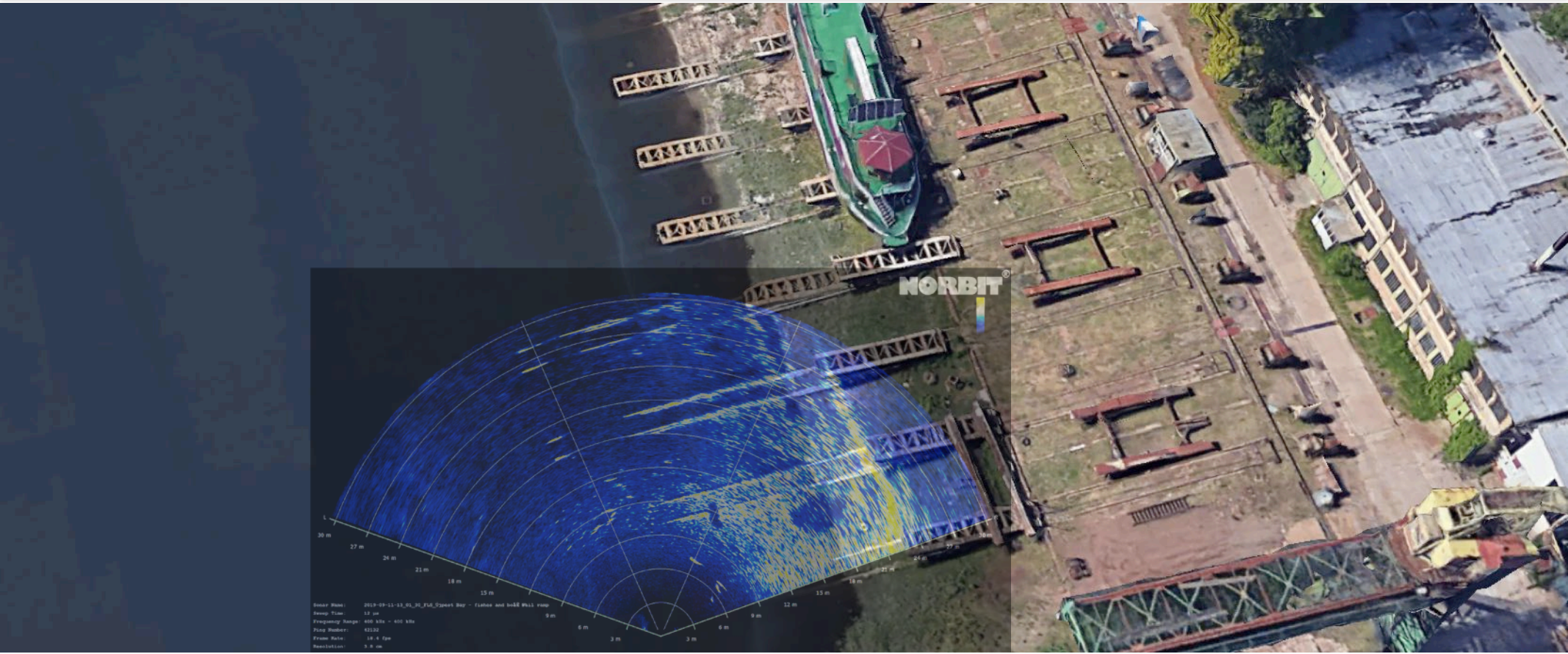
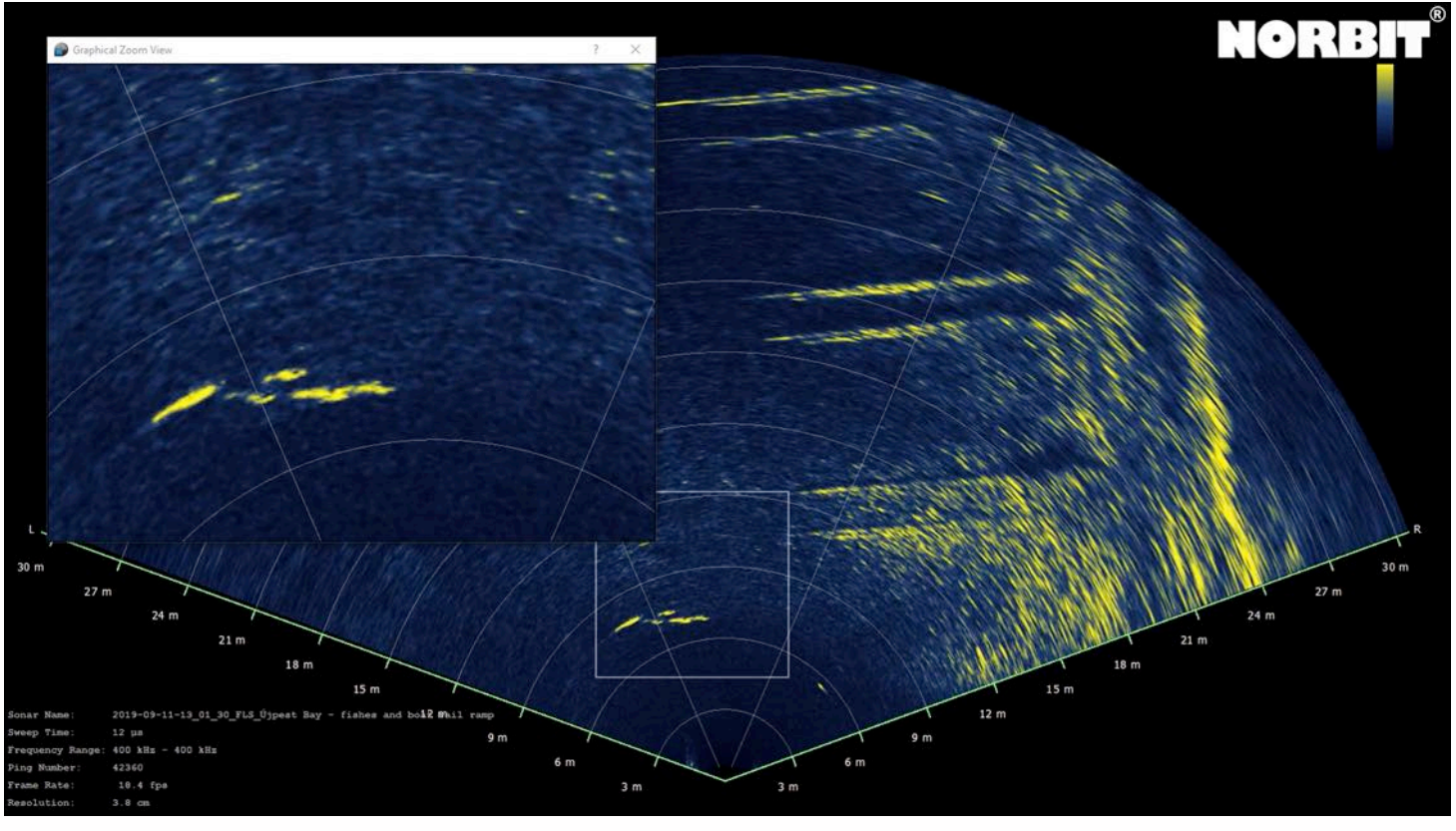
Fusing Imagery – FLS and Satellite Images

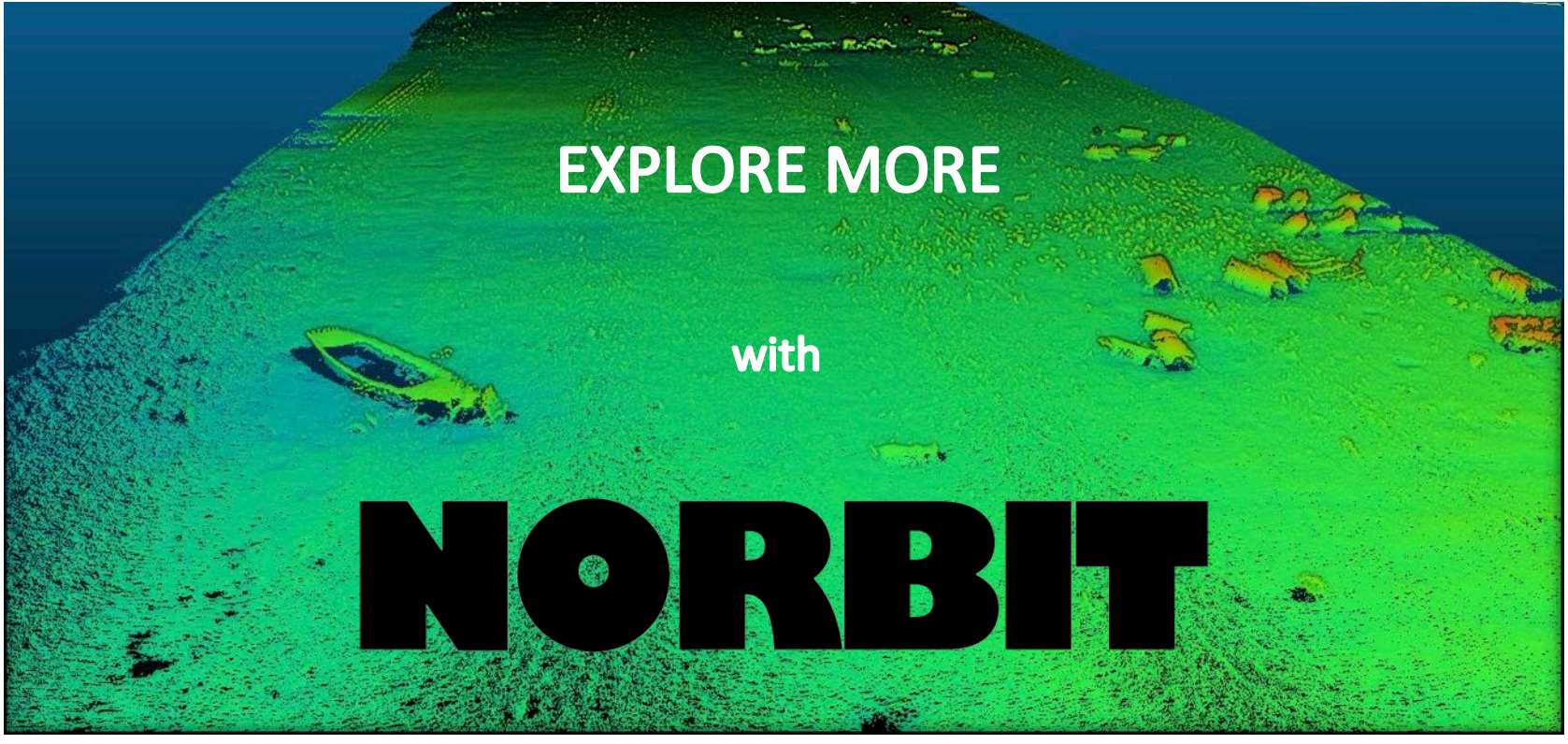


FLS video snapshot fused into Google Earth view from same area

Forward Looking SONAR (FLS) images also provides a unique way to catch fish during operational down time.



FLS video snapshot with zoom from swimming fish near the boat ramp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