

**Possibilities of High Resolution Multibeam
and
Laser Scanning Technology
for
Engineering Support Inspections
under and above water line**

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NordPIANC, 01-03 September, Tallinn

**Possibilities of High Resolution Multibeam
and
Laser Scanning Technology**

Structure

- Meritaito Ltd past and today
- Multibeam survey
- Multibeam survey, new application
- Laser scanning
- Combination
- Supplementary inspections, traditional and modern
- Service package



Finnish Maritime Administration

Background of FMA

The Finnish Maritime Administration has been the national authority responsible for maritime safety, fairway maintenance, hydrography, winter traffic assistance, archipelago ferry services, marine traffic management and authority duties in pilotage.

The history of maritime authority in Finland dates back to 1696.

The Administration itself was established as a Finnish national institute in 1917, within two weeks of the declaration of independence.

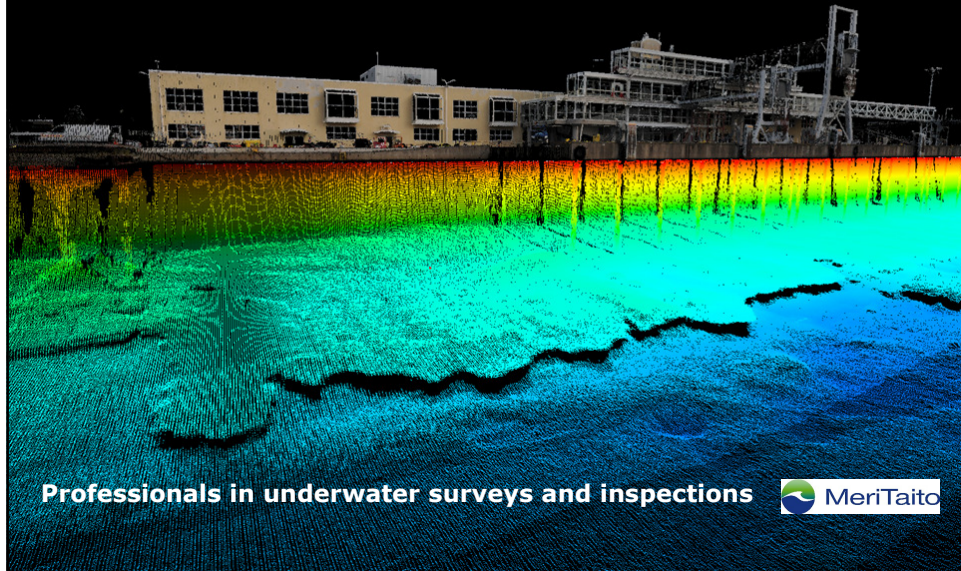


Meritaito

Finnish Maritime Administration were split into three elements from 1.1.2010:

- **Finnish Transport Agency**
 - Implementation of national traffic policy
 - To take care of traffic infrastructure by evaluating new practices and methods for that purpose
 - Developing frame to lead and purchase f.ex. hydrographic surveys of Finnish seas and inland waters
 - International co-operation (f.ex. IHO) and EU matters
- **Finnish Transport Safety Agency**
 - Transport safety matters
 - Ship inspections, manning, certifications
 - International co-operation and EU regulation
- **Meritaito Ltd**
 - Providing services and resources for fairway maintenance, planning, channel operations, hydrographic and underwater surveys
 - To ensure the availability of such an activities in Finland
 - To be an independent self sustaining company

**Meritaito Ltd. Established 2010. Our activities and background lays
in the basement of former Finnish Maritime Administration**



Professionals in underwater surveys and inspections



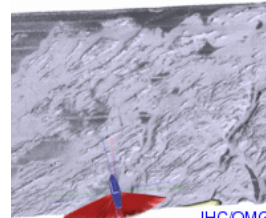
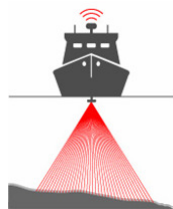
Meritaito Activities



Bottom bathymetry Multibeam surveys

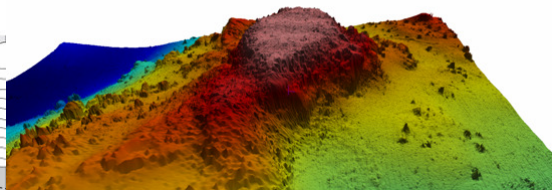
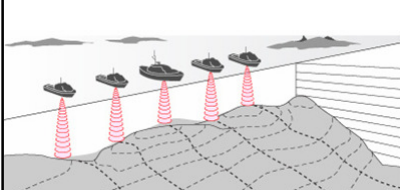
Multibeam Sonar

- Full bottom coverage to make 3D model
- more than 25000 survey points per second
- Meritaito Ltd has eight (8) units, SB7111, SB7101, SB8101 and SB7125
- 100 kHz-400 kHz



JHC/OMG

Animaatio: John Hughes Clarke,
Ocean Mapping Group



MeriTaito Multibeam Survey Vessels

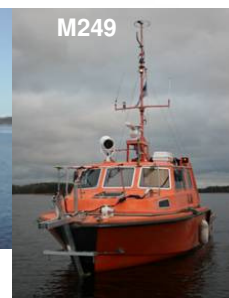
SeaBat 8101/7111/7101/7125



Mea Suunta



M620 & M640



M249



Mea Airisto



Mea Kaiku

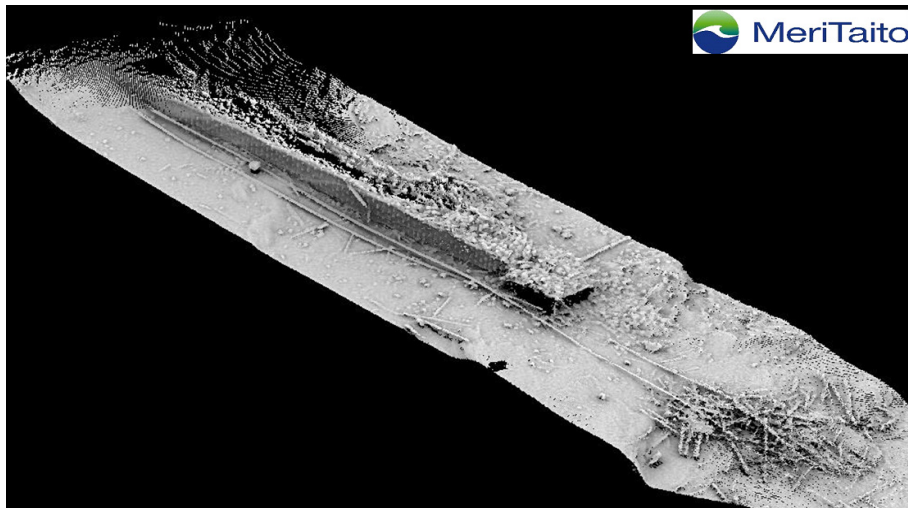


Keila-1,2,3 and 4

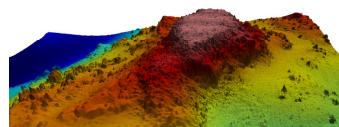
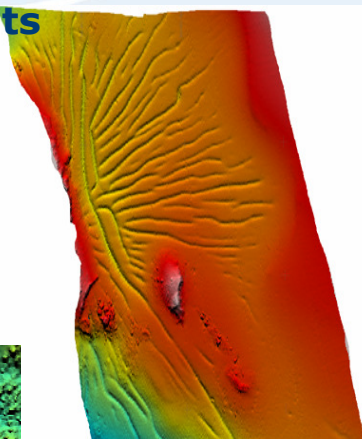
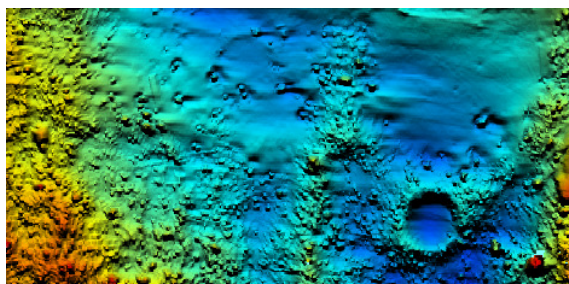
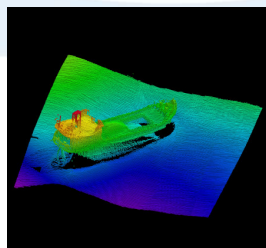


KEILA

Underwater structures and cables, Suomenlinna, Helsinki



Other results



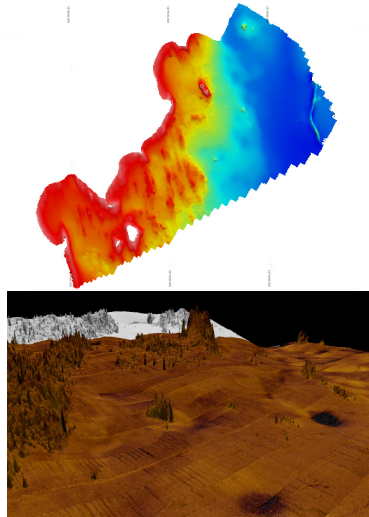
Multibeam survey technology, advantages

Compared to old fashion singlebeam soundings you get full coverage bottom information

Technical development has been fast, 10 years ago one sweep had 100 points, now there is 500 points

The resolution in shallow waters has developed accordingly and smaller targets can be located

All points have xyz-coordinates

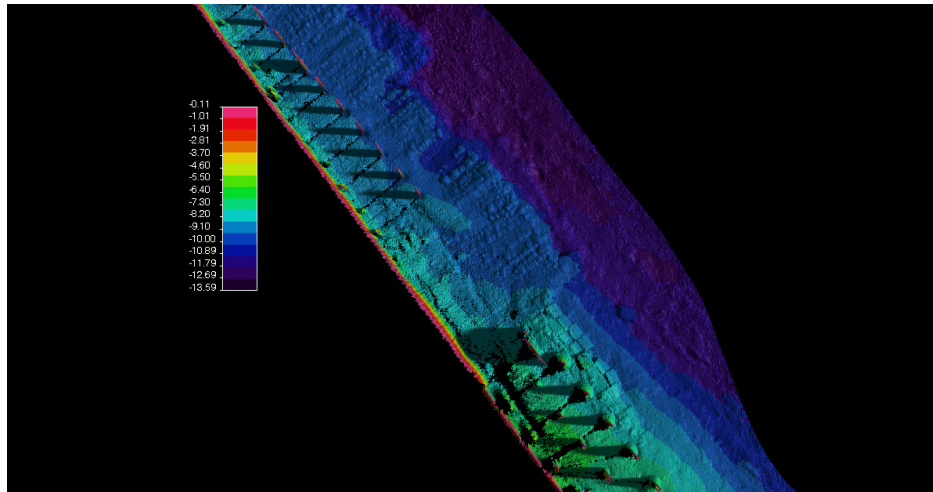


New application: Tilted MBES-sensor

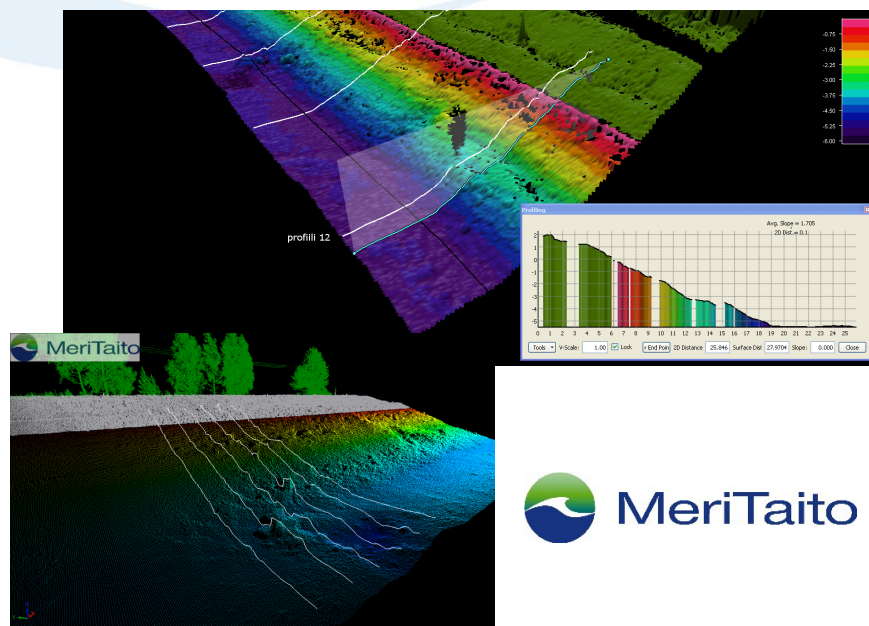
Meritaito surveyboat has sensor in 45 degree angle
It gives survey results up the water surface



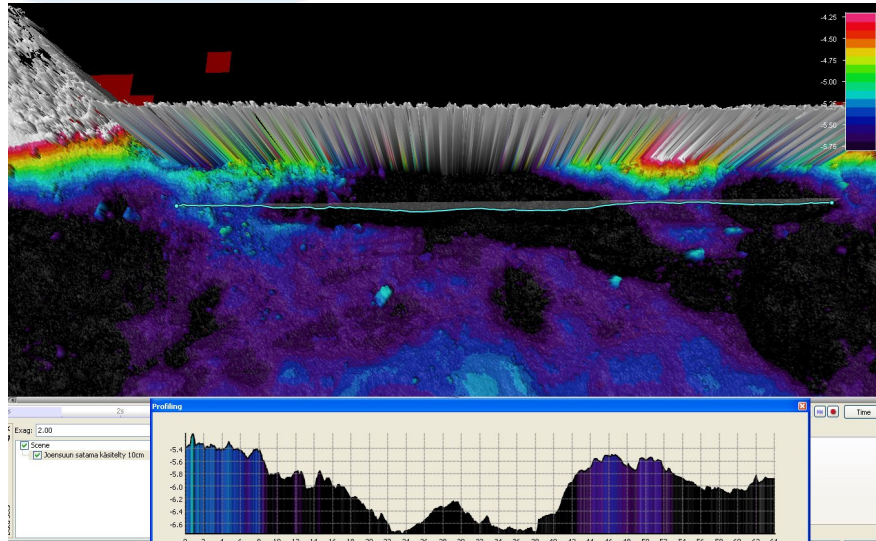
Scouring protection and dock structure in Port of Turku



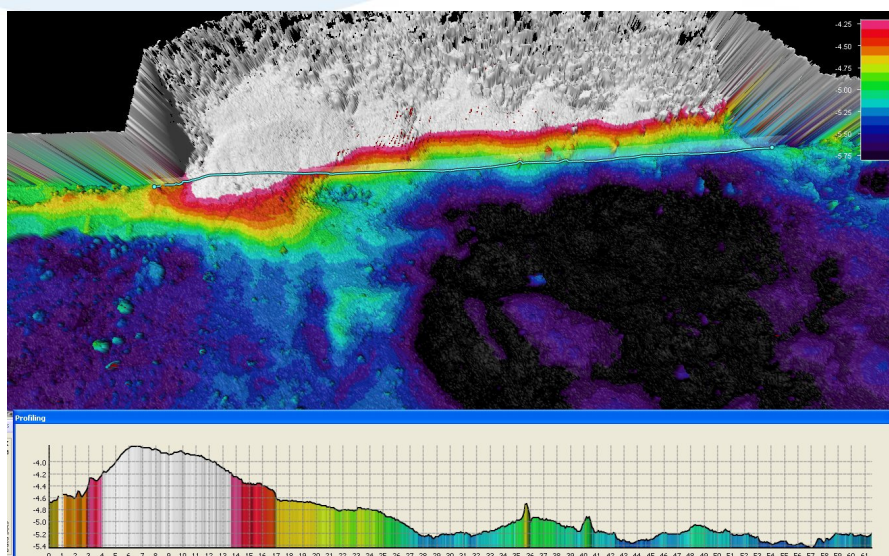
Inspection of canal slope, Saimaa canal, damages



Port of Joensuu, section of the berth



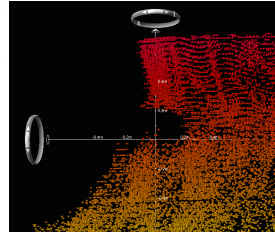
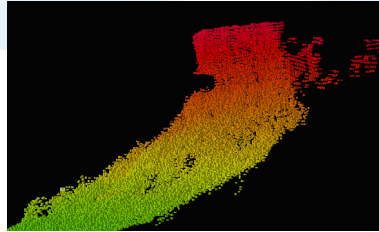
Port of Joensuu, section of the slope





MeriTaito

Damage in stone wall, Suomenlinna



MeriTaito

Tilted Multibeam sensor

- **New high resolution MBES sensors in 400 kHz up to 500 survey points in one sweep gives better information of the sea bed than the earlier MBES equipments**
- **Tilting the sensor gives information up to the water surface**
- **This introduce new possibility to survey properly harbour structures and other underwater civil engineering targets**
- **Visibility in water does not effect to the study**
- **All results are 3D point clouds and are compatible to the modern planning softwares for designing and planning purposes**



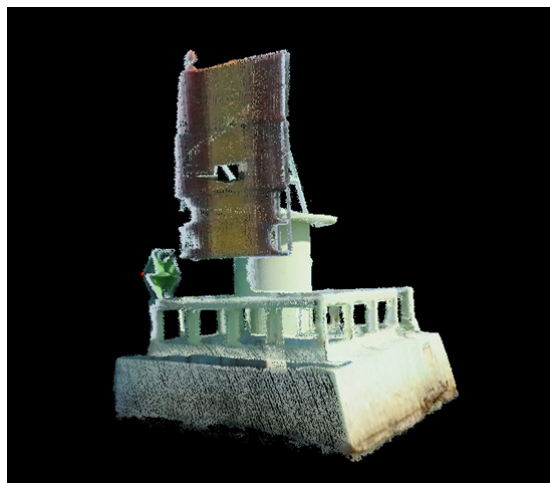
MeriTaito

Laserscanning

- **Riegl VZ-400 3D-laser scanner**
 - **125000 points/second**
 - **multiple targets**



Storhästen leading mark



Laser scanning technology, advantages

Point cloud is very accurate, internal accuracy is in millimeters

Mobile scanning allows measurement done simultaneously with multibeam survey

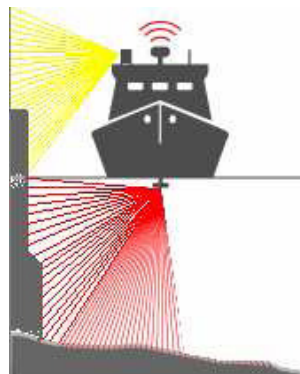
Static scanning gives you also colours for each scanning points

All scanning points have xyz-coordinates

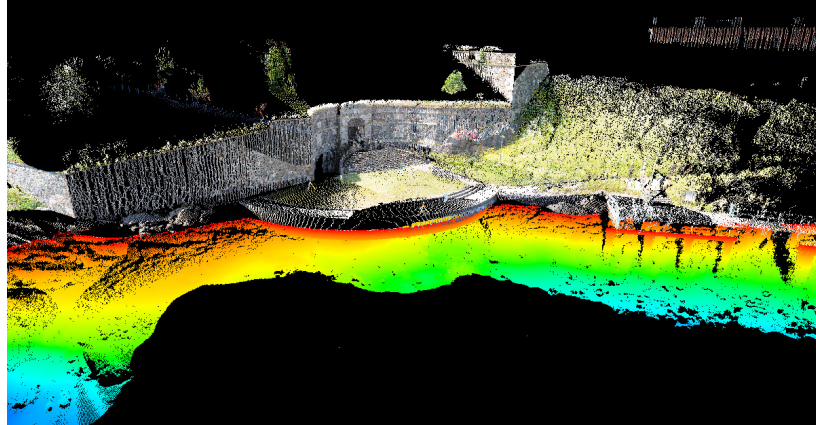


Multibeam survey and laser scanning simultaneously gives you total information

- Survey result can be done by combining multibeam and laser scanning point clouds
 - better resolution
 - no gap between point clouds
- This gives a possibility to take laser scanner as a part of modern hydrographic survey system
 - positioning- and motion sensors work normally with both instruments
 - RTK or VRS positioning



Multibeam survey and laser scanning simultaneously gives you total information Suomenlinna, Kings Gate



Other Site Investigations in Harbours

ROV and Diving inspection

- Remote operated underwater vehicle
- Realtime still- ja videorecording
- Manipulator
- MeriTaito Ltd has two different size of ROVs (150m, 4,5 kg ja 500m, 50 kg)
- Meritaito has several professional divers for different kind of diving works





MeriTaito

Traditional methods: Diving and ROV inspections

Diving is widely used in Finland to inspect dock structures

- **Advantage is that skilled inspection diver has good skills to estimate structure in situ**
- **Diving inspection is time consuming and rather expensive. Results are drawings and written text on paper.**
- **Bad underwater visibility lower the accuracy of the inspection**

ROV-inspections have more rare.

- **Advantage is that you can operate ROV from surface and it is not so manual labor**
- **To make proper study you need undervater positioning system and good steering ability for ROV (more expensive equipments)**
- **Bad underwater visibility common in harbour areas has same effect than to the diving work**



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New possibility to make supplementary inspections

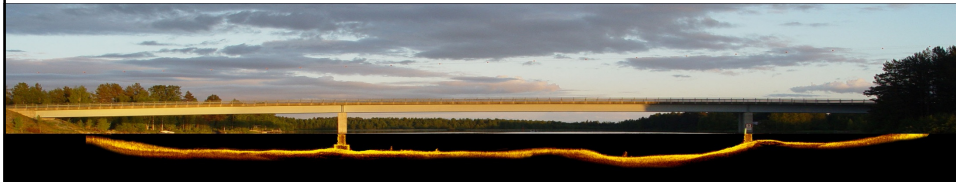
New technology gives new possibilities to makes supplementary inspections

Next I will introduce a combination of Multibeam Surveys and Scanning underwater sonar

VRT Vesirakennetutkimus Ltd



- VRT Vesirakennetutkimus Ltd is a company specialised in underwater examination and inspection. We offer a high quality inspection of a wide range of underwater facilities.
 - All inspections , results and repair recommendations are performed by specialized civil engineers.
 - VRT offers an all-encompassing control of 3D material. We have at our disposal the necessary equipment to gather a point cloud data of any structure under or over the water level.
 - The point cloud data will be connected to a coordinate system after which it may be transferred into a three dimensional model.
 - We master a large variety of programmes aimed at handling point cloud data and building information models (BIM).

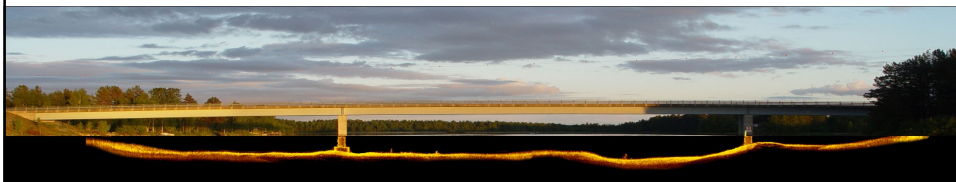


VRT Vesirakennetutkimus Ltd

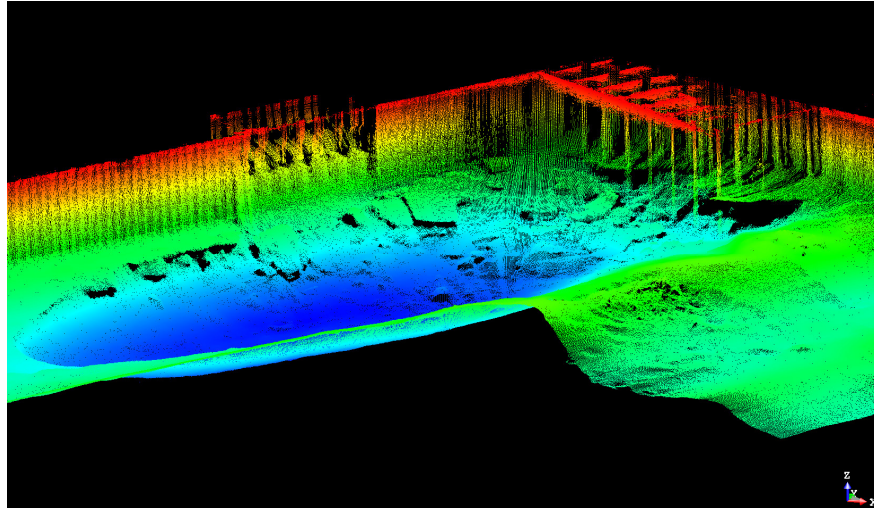


◦ Scanning sonar

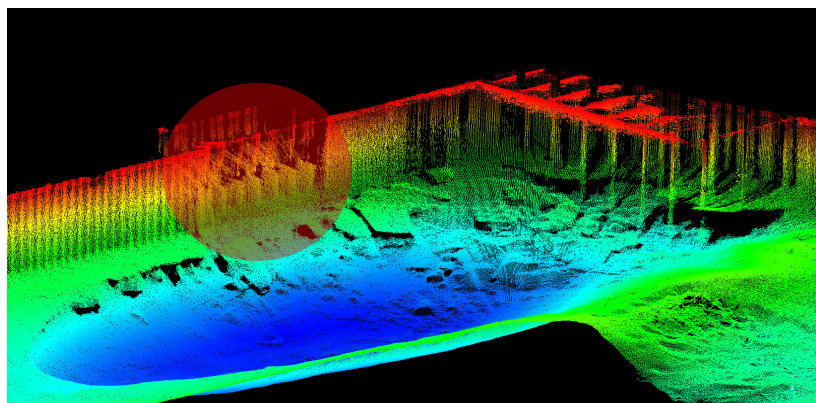
- Operating frequency from 600-1500 kHz
- Most accurate method for inspecting underwater structures
- The examined structures could be anything from piers, bridges, power plants, dams or shoreline barriers to riverbeds
- Equipment is also suitable for directing diver, locating missing persons or objects.
- The work may be performed on a platform appropriate for the environment in question, for instance using a barge, a crane or working on ice
- Able to detect and define possible deviations and changes in the underwater structure or the surrounding area also in murky waters or in a fast current
- The result is an accurate 3D point cloud data or a 2D photographic rendering of the underwater structure



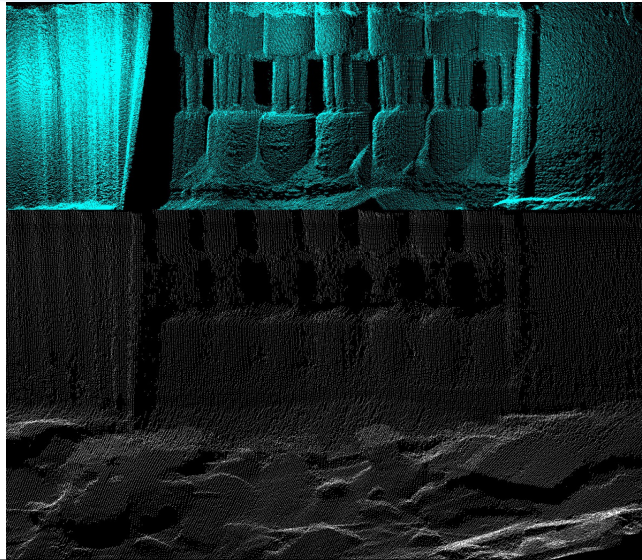
Multibeam survey in Sörnäinen berth in Helsinki



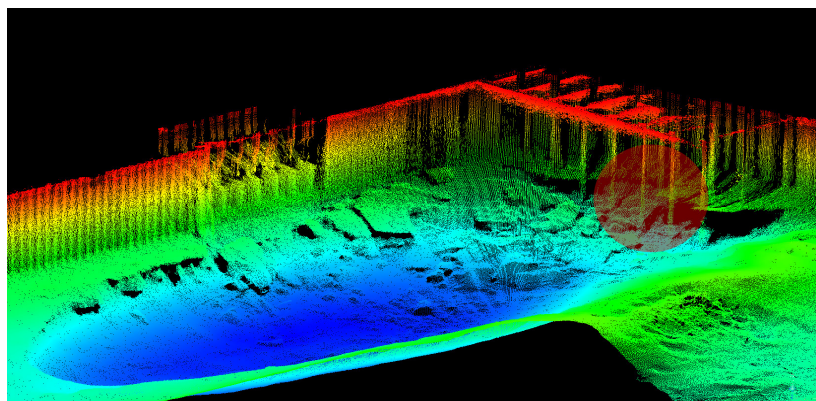
Point of interest 1



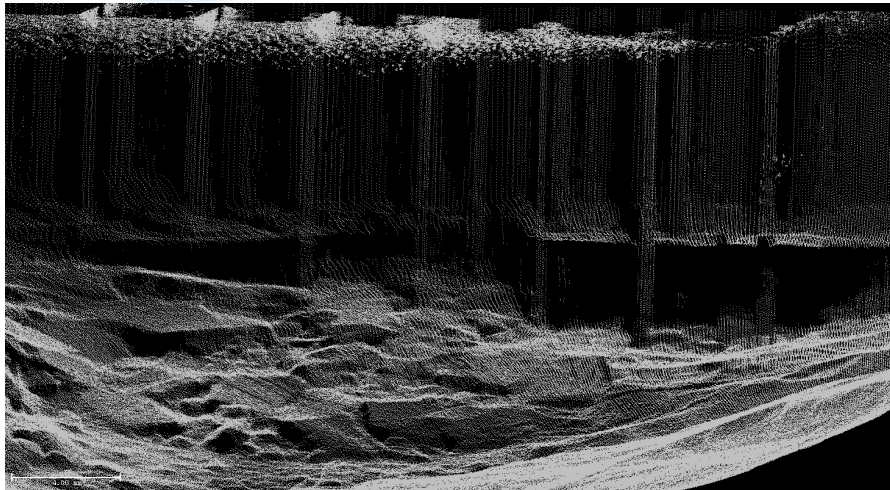
Multibeam data and scanning sonar data



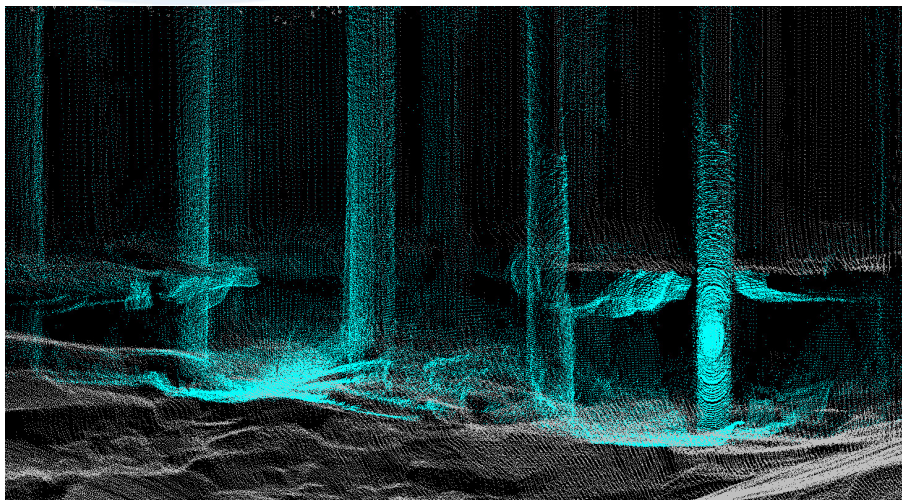
Point of interest 2



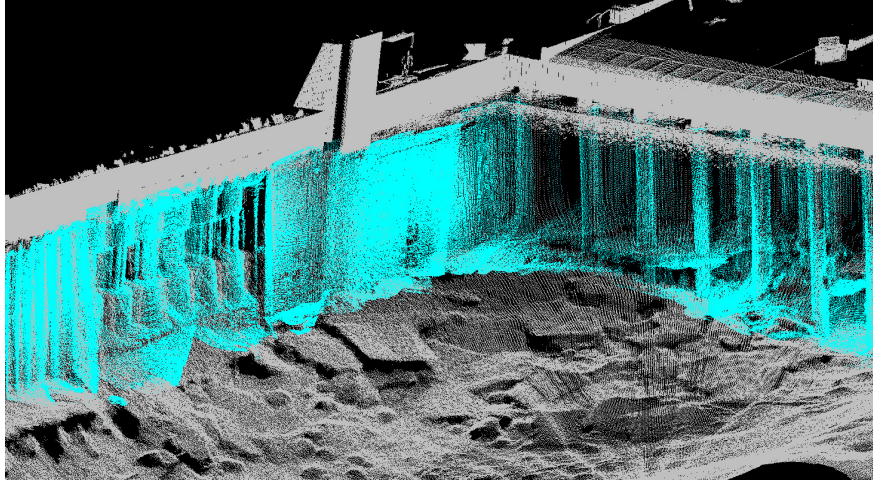
Multibeam data of the area



Scanning sonar data of the piles



Overall picture of the area with both methods and laser scanning of the upper structure



Method and service provided

- **MBES gives a good picture of the situation and structures under the water**
- **MBES 3D point cloud gives excellent information about the critical areas for closer examinations and planning**
- **At the same time mobile laser scanner gives you almost photograph quality picture in 3D above water structures**
- **Closer inspections with scanning sonar gives more detailed information about damages, also in 3D point cloud**
- **All this information in digital form can be modelled and it is usable in modern planning softwares for further maintenance planning and design**

Possibilities of High Resolution Multibeam and Laser Scanning Technology

Structure

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- Multibeam survey, new application
- Laser scanning
- Combination
- Supplementary inspections, traditional and modern
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Meritaito Supports Better Civil Engineering Under and Above the Water Line



Thank You For Your Interest