

Professional intelligent munitions assessment using 3D reconstructions and Bayesian Neural Networks (ProBaNNt)

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MarTERA Project Meeting
November 22, 2023

Project Overview

Partners

Coordination: GEOMAR

Partners: SeaTerra (GER), IO PAN (POL), OBR CTM (POL)

Duration: Oct 2021 – Sep 2024

Associated Partners:

Dresdner Sprengschule, north.io, MELUND,

Maritime Office in Gdynia

Funding:

Bundesministerium für Wirtschaft und Energie (GER)

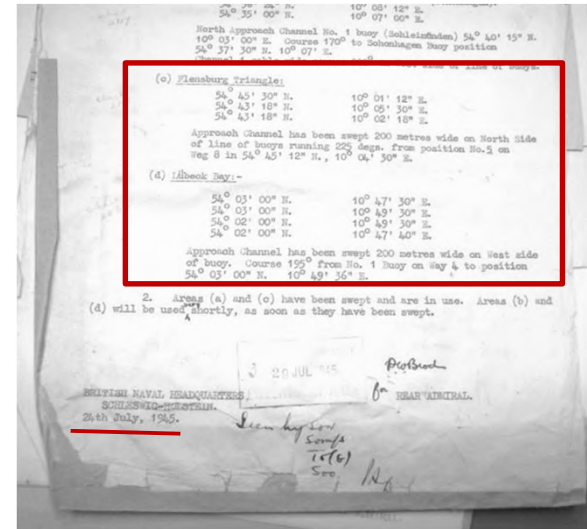


Background

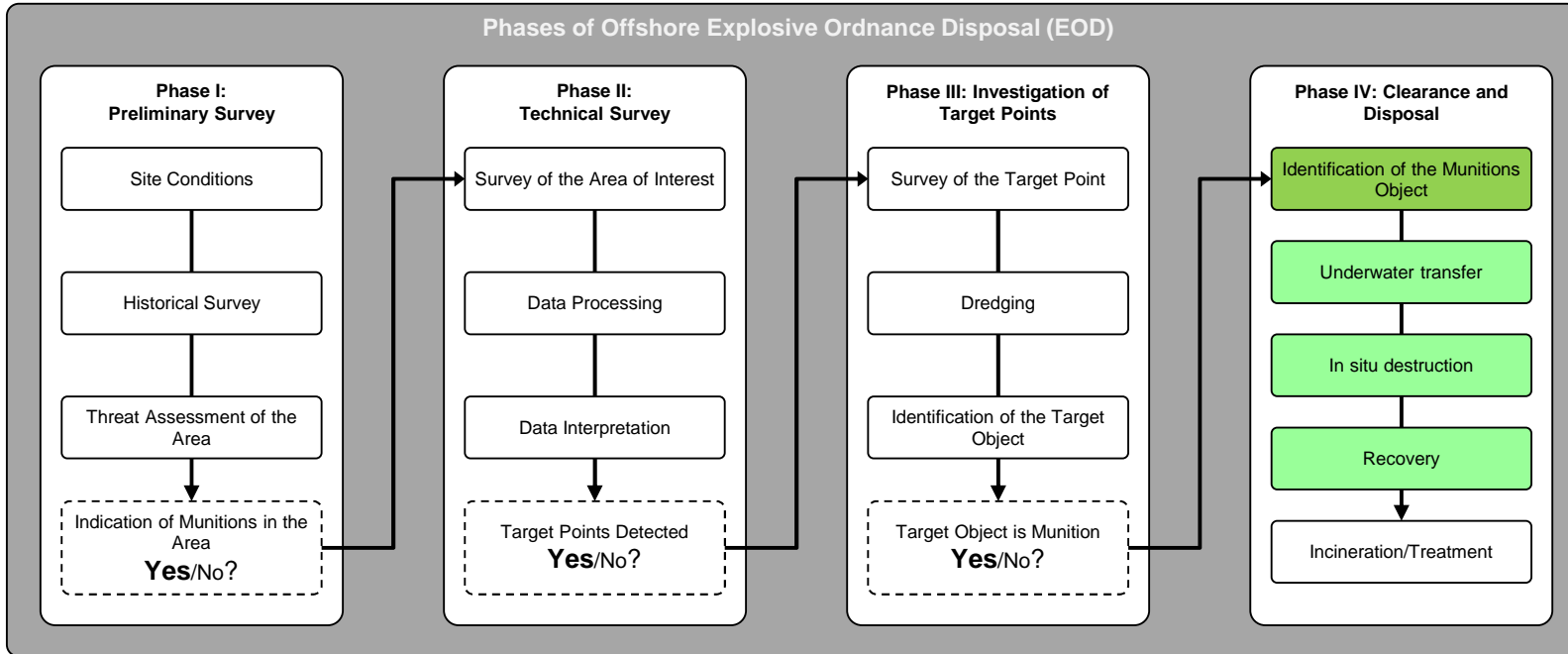
What are offshore UXO and EOD?

Background

How did the UXO end up in the sea?



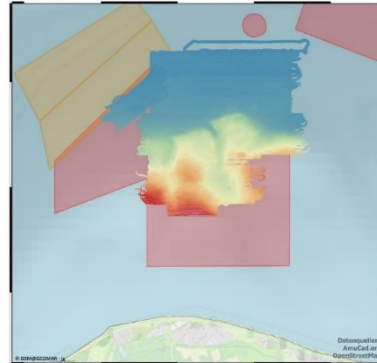
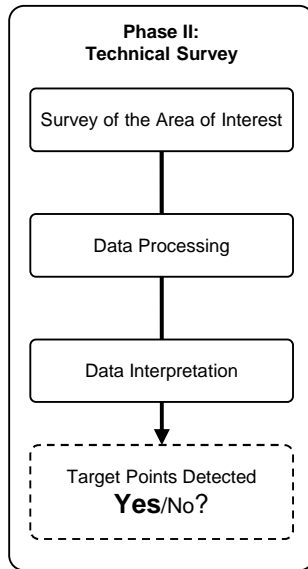
What is Offshore Explosive Ordnance Disposal (EOD)?



Frey (2020)

Background

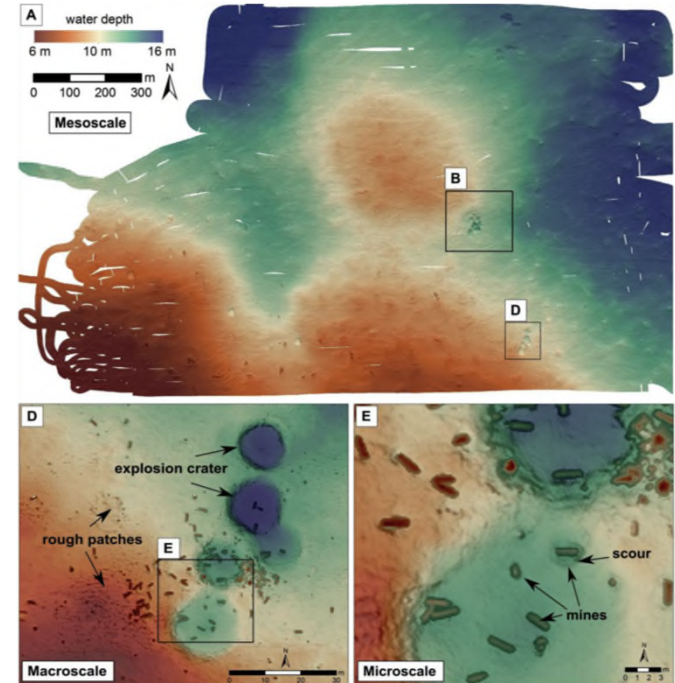
What happens before ProBaNNt?



Kampmeier et al. 2020, CSR



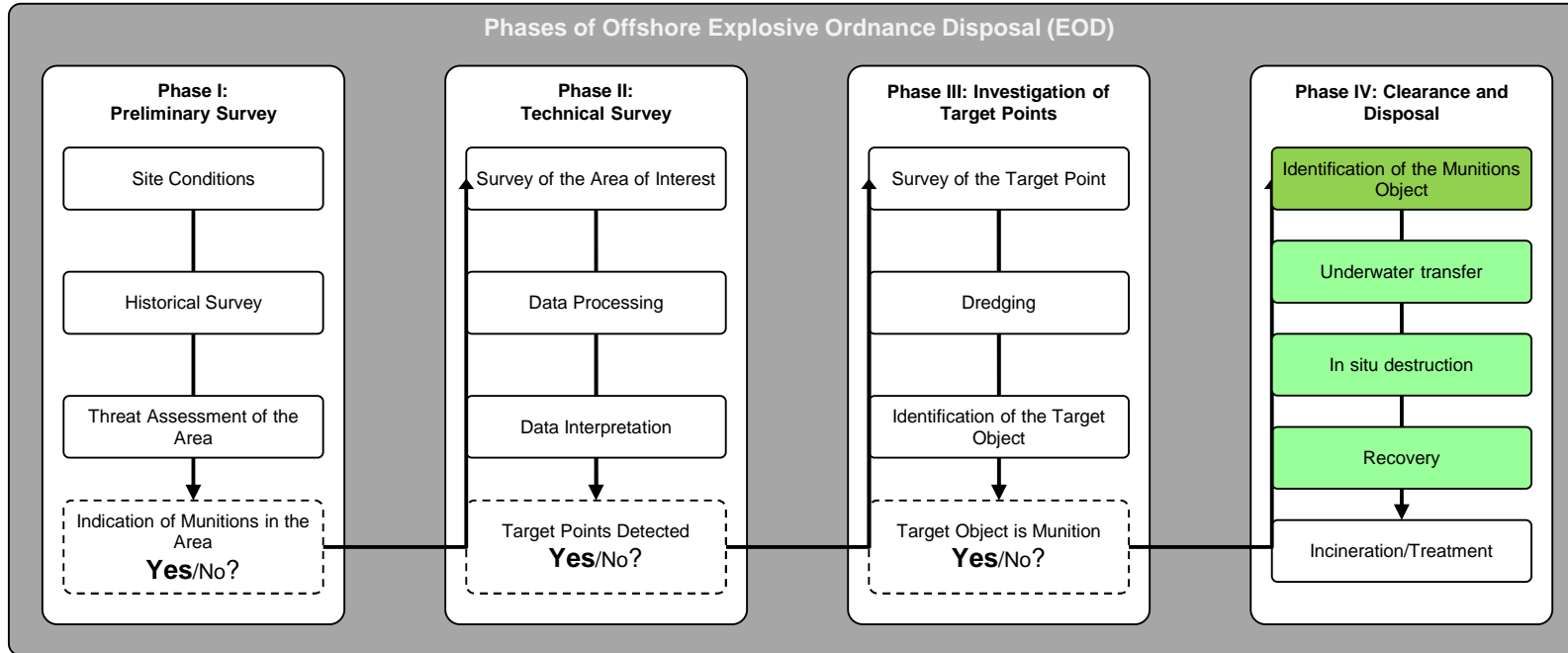
<https://doi.org/10.1016/j.csr.2020.104108>



ProBaNNt Results

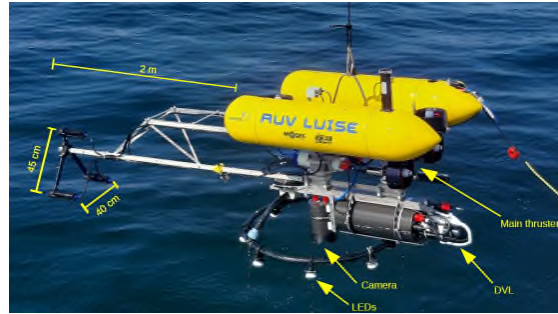
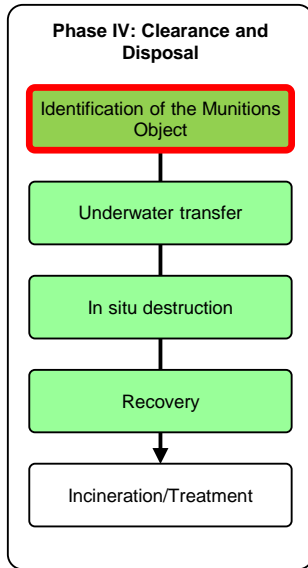
How do we improve object detection and EOD decision making

ProBaNNt's Contribution to EOD

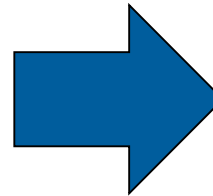


Frey (2020)

Identification of Munitions Objects – Photogrammetry

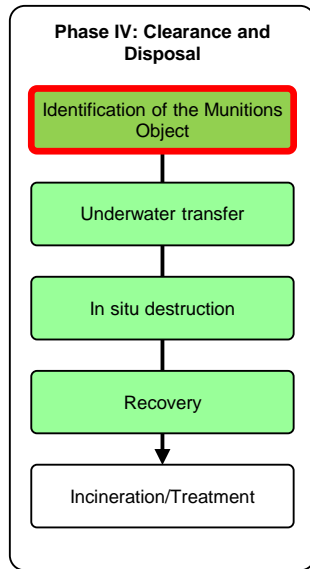


Images from AUV Luise of UXO Pile

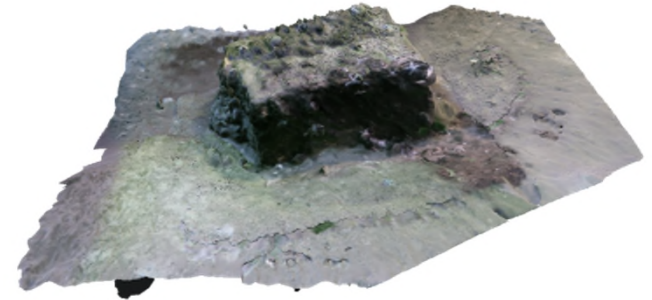


Photomosaic of UXO Pile

Identification of Munitions Objects – Photogrammetry



Saab Seaeye Falcon ROV (IO PAN)

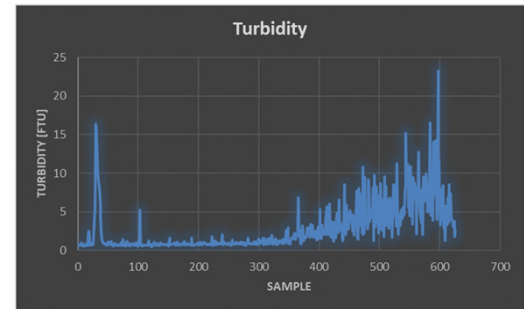
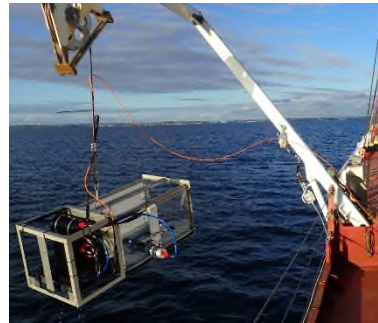
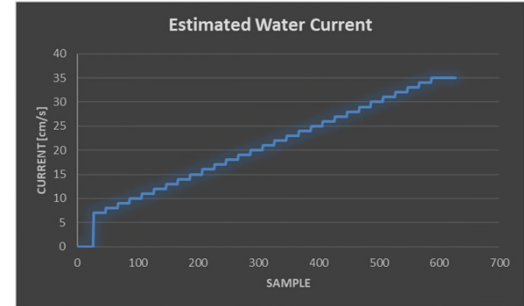
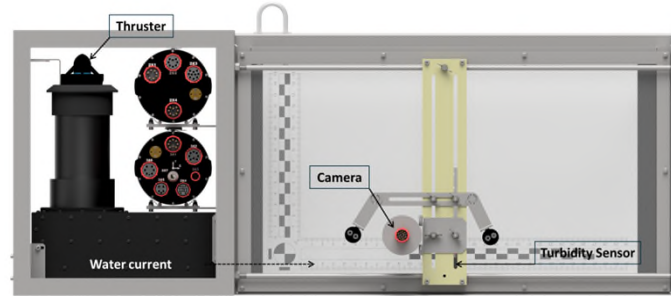
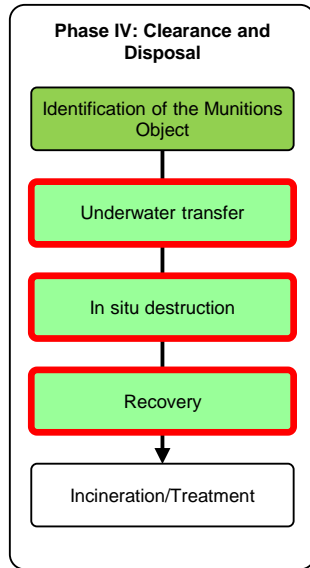


Muniton Box at Lübeck Bay

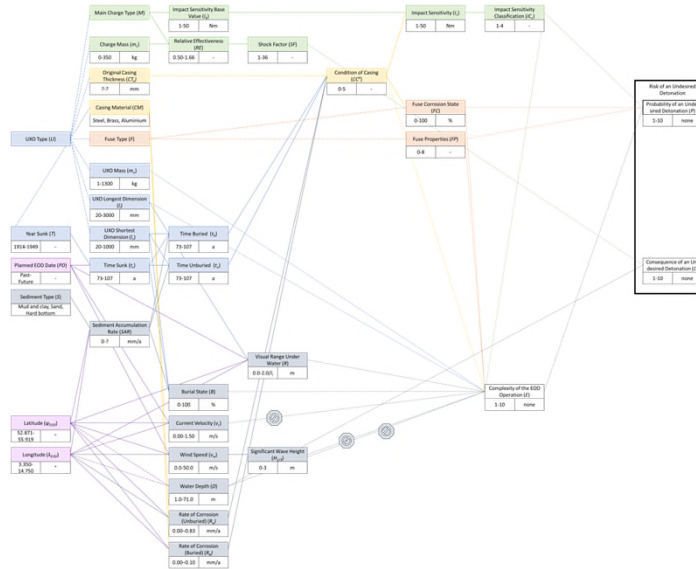
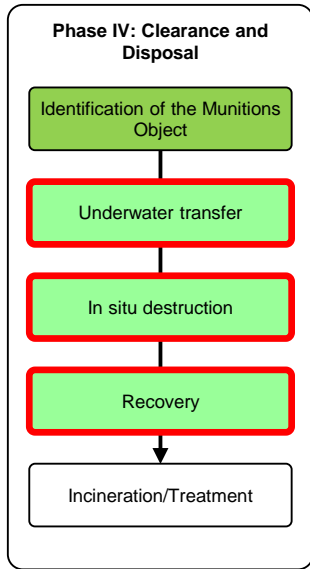


Ground Mine in Kolberger Heide
(<https://probannt-munition.eu/results/>)

Identification of Munitions Objects – Sediment Mobility



Identification of Munitions Objects – Risk Assessment

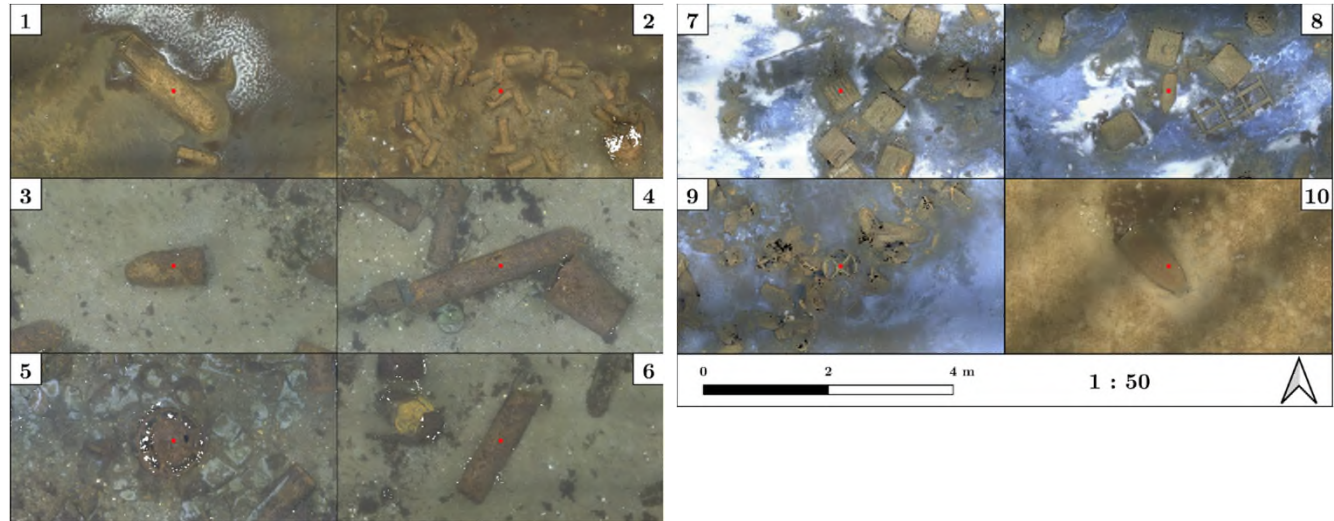
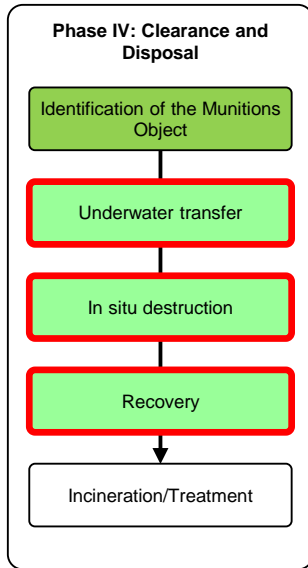


EOD RA Model:

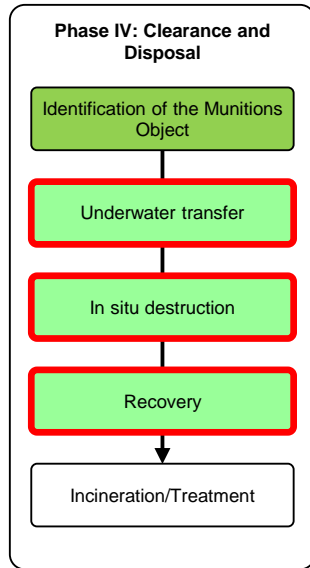
- 8 UXO Factors
- 7 Charge Factors
- 3 Ignition Chain Factors
- 3 Casing Factors
- 3 Planning Factors
- 11 Environmental Factors

- 3 Model Output Factors
 - Probability of Undesired Detonation (UD)
 - Consequence of UD
 - Complexity of EOD

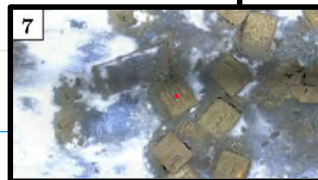
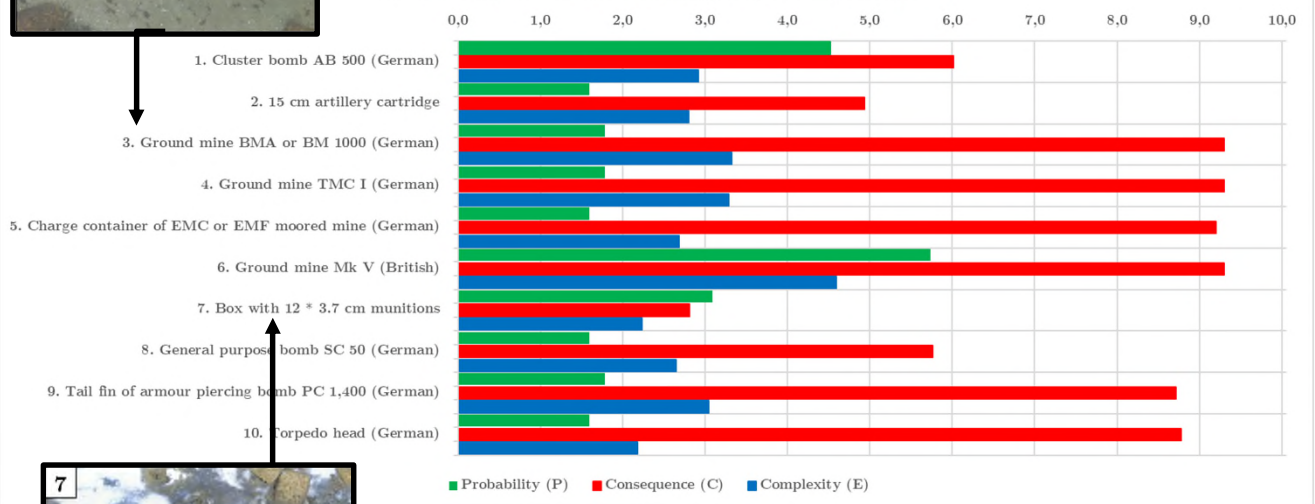
Identification of Munitions Objects – Risk Assessment



Identification of Munitions Objects – Risk Assessment



Model Outputs of the Planning Layout Application



Summary

Summary

What did we achieve and what is left to do?

Achievements:

- Successfully produced 3D models of numerous objects
- Critical Shear Stress Device built and tested
- EOD Risk Assessment Model established
- EOD Database established
- High frequency sonar data collected in lab



Thank you for your attention!

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