Boost Applied munition detection through Smart data InTegration an AI workflows

Welcome to the BASTA Progress-Meeting

1st Year

If you don't want to be seen on Youtube don't switch on your camera

House keeping rules:

Please **mute** your microphone (unless you are speaking)
Turn off your camera (unless you are speaking)
Use the chat to ask questions
Raise your hand if you want to say something to everybody

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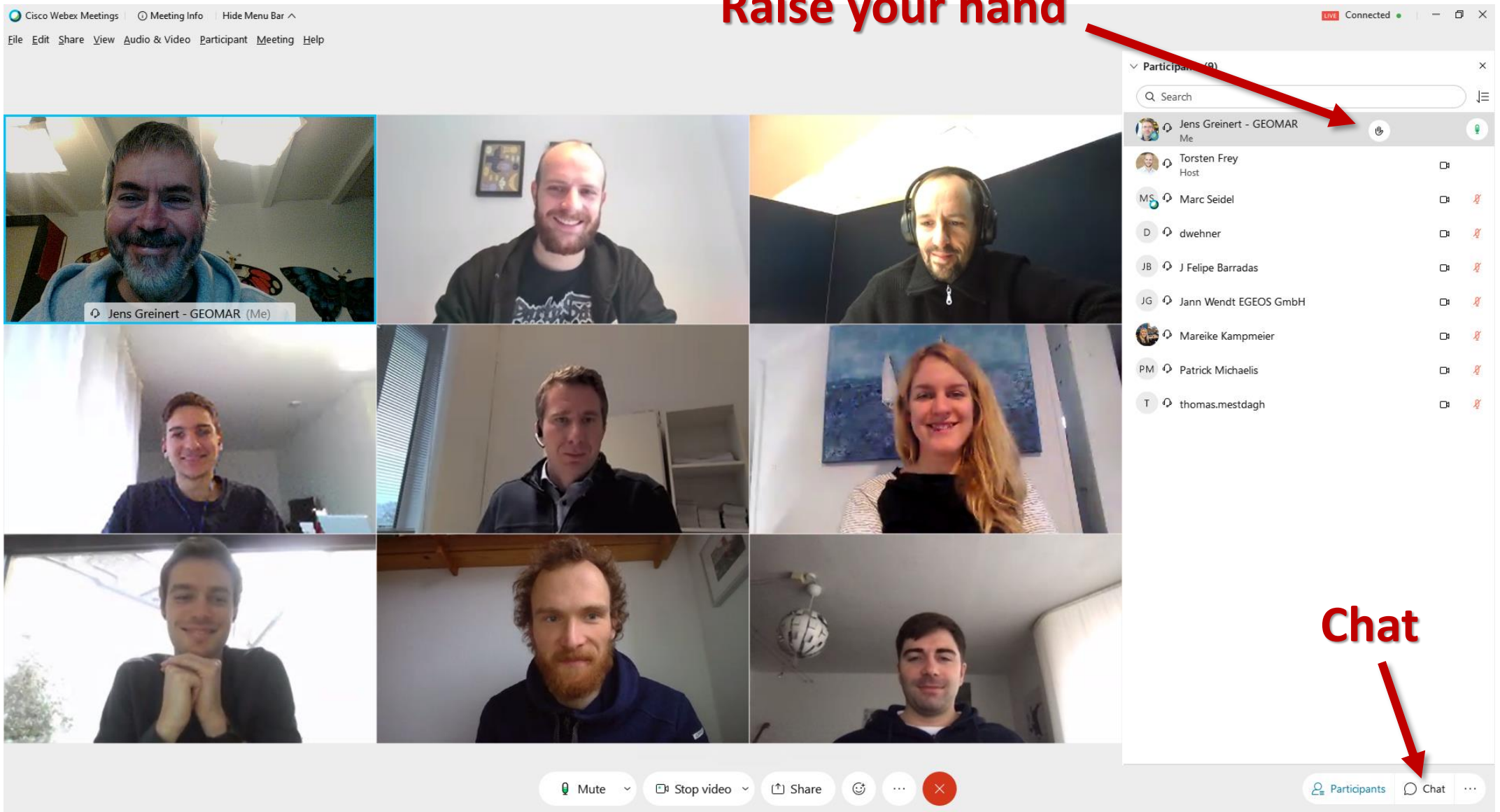
Grant Agreement No BASTA: 863702

Stakeholder Dialog BASTA – 16th Dec. 2020



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Boost Applied munition detection through Smart data InTegration an AI workflows

Where are we standing with respect to the project goals after one year?

Coordination: GEOMAR
Partners: VLIZ, G-tec, EGEOS
Duration: Dec 2019 – Nov 2022

Supporting Partners:
TenneT, DEME, Vattenfall, WWF, BSH,
Schleswig-Holstein Ministry – MELUND, NKT, SeaTerra,
WAS Wilhelmshaven, Norwegian Defense Research Establishment - FFI
Sensys, EGGERS

BASTA
Boost Applied munition detection through
Smart data inTegration and AI workflows

GEOMAR EGEOS VLIZ G-tec

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Boost Applied munition detection through Smart data InTegration an AI workflows

- Advance data acquisition through:
  - ultra-high-resolution **3D sub-bottom profiling**
  - intelligent **AUV-based magnetic** mapping
  - adaptive and **iterative survey approach**

- Foster sustainable use of survey and WW I/II archived data
  - within a **multi-sensor database**
  - with advanced data **processing of Big Data**
  - with **artificial intelligence** for detecting/identifying munition with uncertainty levels

- Discuss new tools, methods and workflows with stakeholders to formalize recommendations and quality definitions for industry actors and authorities

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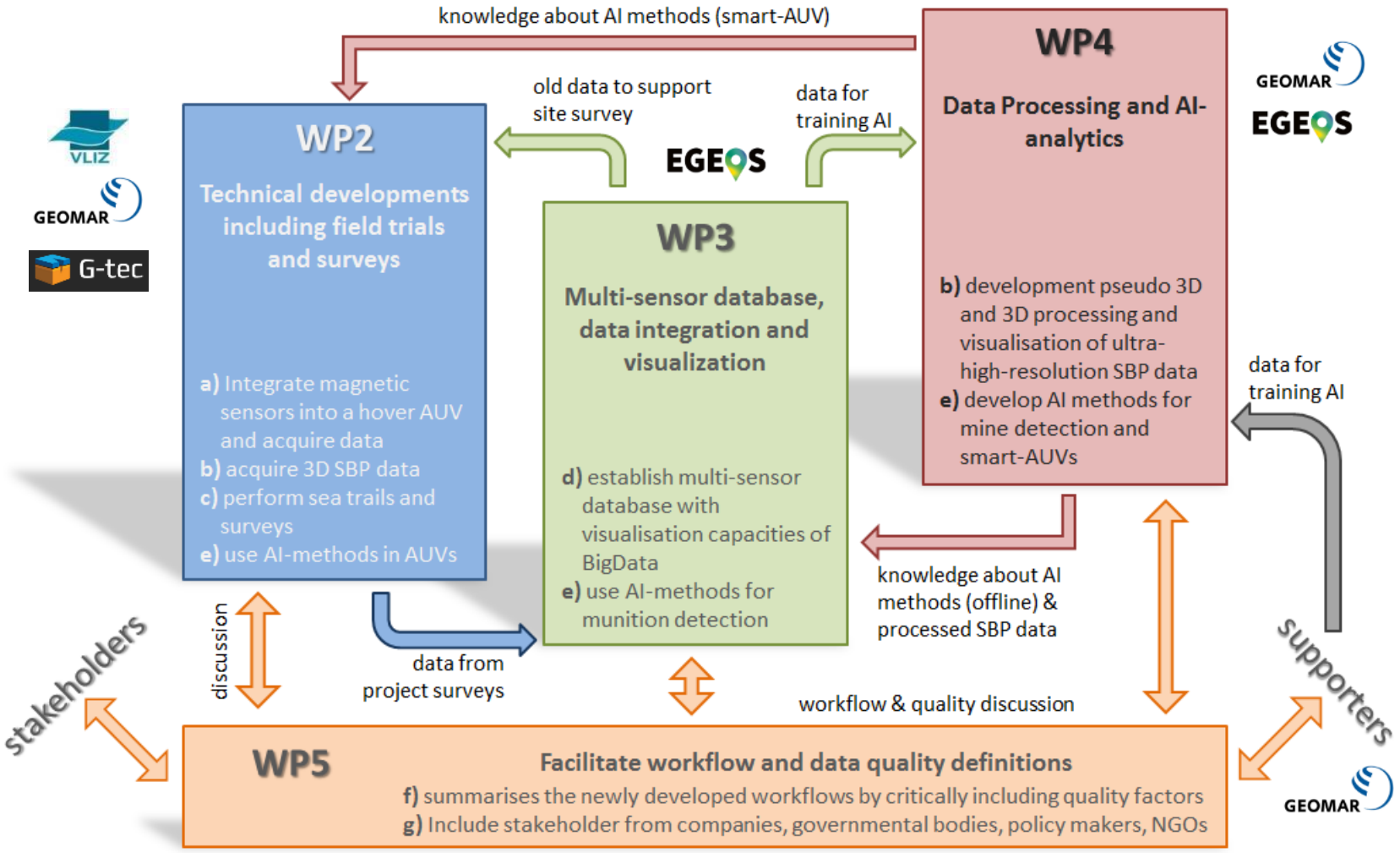
Boost Applied munition detection through Smart data InTegration an AI workflows



a) Integrate magnetic sensor into AUV
b) Acquire 3D SBP data
c) Perform sea trials
d) Establish multi-sensor data base
e) Use AI-methods for munition detection
f) Develop quality factors
g) Include stakeholders

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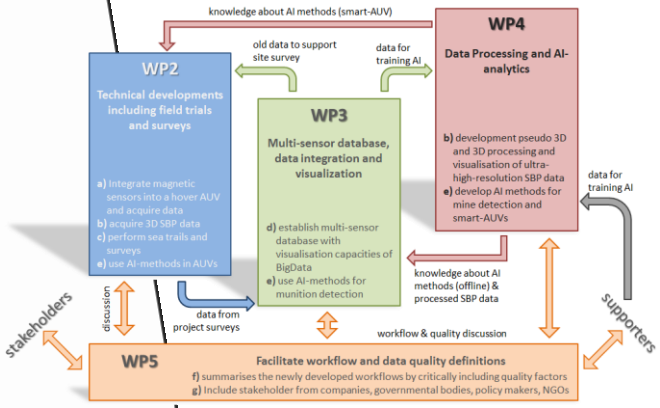
gh Smart data InTegration an AI workflows



a) Integrate magnetic sensor into AUV
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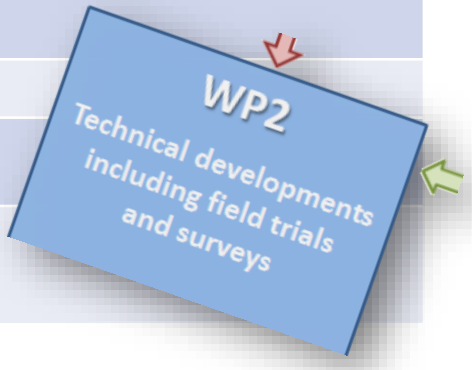
g) Include stakeholders

Milestones and deliverables: WP2 Technical developments including field trials and surveys

Milestones	Name	WP	Lead beneficiary	Means of verification	Due date	Description
MS6	Fieldwork Site A	2	GEOMAR	Cruise report OK	9	Ship-based and AUV-based high-res multibeam, side scan, towed camera and magnetometer tests at site A.
MS7	3D SBP developments; Phase 1	2	VLIZ	Technical report	18	Adaptation of SES-2000 Quattro for buried munition detection. Optimization of pseudo-3D approach (single transducer), ideally on autonomous vehicle/platform.
MS8	Magnetometer integration in AUV	2	GEOMAR	Technical report OK	18	Mechanical and electrical integration of magnetometers into AUV
MS9	Fieldwork Site B	2	VLIZ	Cruise report	20	Trials of 3D SBP and AUV-integrated magnetometer on test site B
MS10	SBP developments; Phase 2	2	VLIZ	Technical report	30	Final 3D-/pseudo-3D-sub-bottom profiling system
MS11	Smart AUV	2	GEOMAR	Technical report	30	Real-time data acquisition linked with ROS middleware for adaptive mapping based on magnetic readings; implementation of AI models in AUV software framework
MS12	Fieldwork Site C	2	VLIZ	Cruise report	32	Trial of all techniques on test site C

Deliverables	Name	WP	Lead beneficiary	Type / Dissemination level		Due date	Description
D2.1	Cruise reports	2.	GEOMAR & VLIZ	R	Public OK	10, 22, 34	Digital reports (pdf), English
D2.2	Technical description UHR 3D-SBP	2	VLIZ	R	Public	36	Digital report (pdf), English
D2.3	Technical description AUV Magnetics	2	GEOMAR	R	Public	36	Digital report (pdf), English



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Sea trials 2020

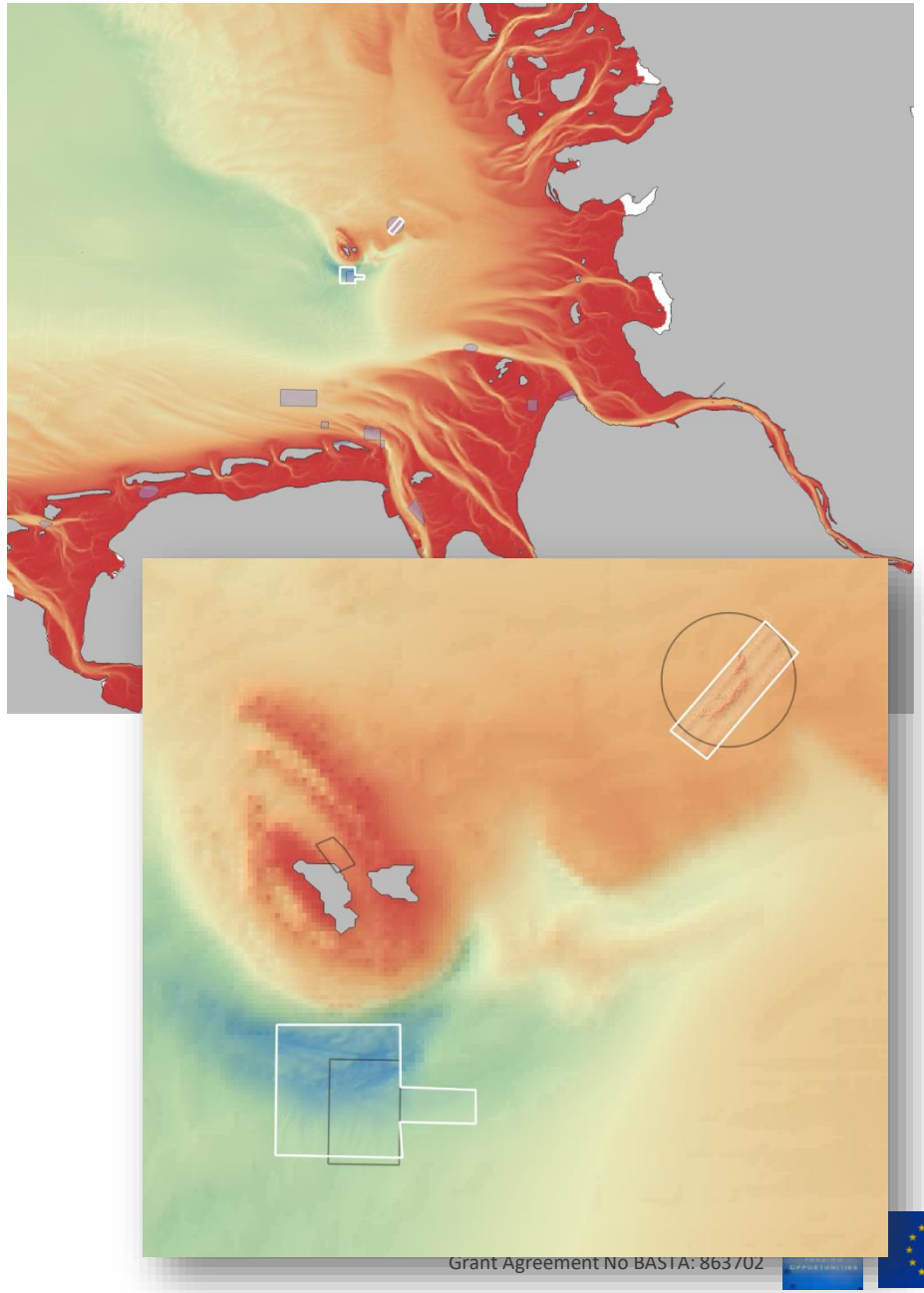
Mapping cruise North Sea (RV Belgica) -> *canceled*
Magnetic measurements with MagWing
3D SPB with Innomar Quattro
AUV with magnetic sensors
Water sampling

1) Test of equipment Kolberger Heide (RV Littorina) - June
Magnetic measurements with MagWing
3D SPB with Innomar Quattro
AUV with magnetic sensors

2) Mapping cruise in Lübeck Bay (RV Littorina) - June
MBES with RESON T50
3D SPB with Innomar Quattro

3) Mapping cruise around Helgoland (RV Littorina) - August
MBES with RESON T50
3D SPB with Innomar Quattro
Water sampling

4) Mapping cruise Baltic Sea (RV ALKOR) - November
MBES with RESON T50
AUV with magnetic sensors
Water sampling
Towed video



Cruise AL548

Environmental monitoring of the ‚TNT' pollution of the Baltic Sea

- Repeat the CTD sampling along the German Baltic Sea as done during POS530 (MineMoni-I)
- Detailed sampling around selected munition hot spots

Increase our knowledge of munition occurrence in the working areas

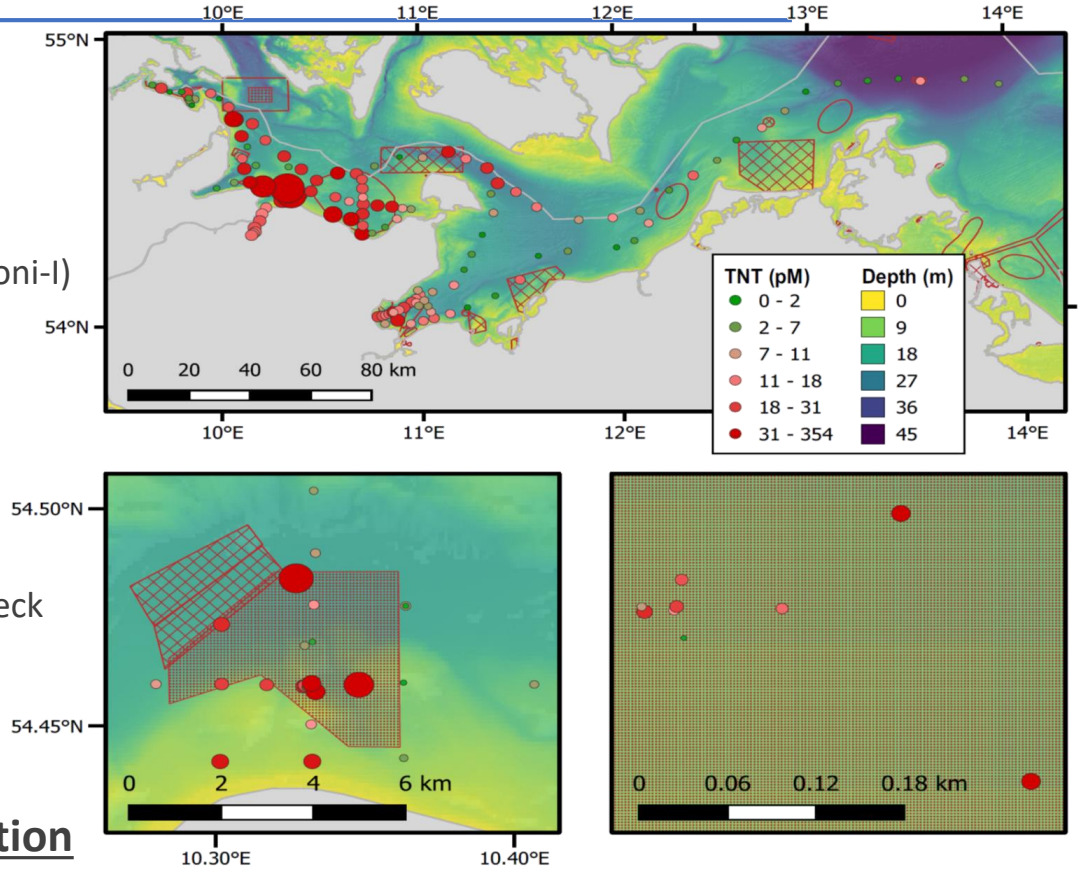
- Get better MBES date in Kolberger Heide
- Map Falshöft for the first time
- Extend maps in Lübeck Bay
- Perform additional surveys at the Kadetrinne, Trollegrund and a ship wreck area in Lübeck Bay
- Perform towed TV-CTD and AUV-based visual inspections
- Perform AUV-based magnetometer surveys

Test technology and workflows and survey approaches for UXO detection

- Test if parallel operations with two AUVs are feasible and if AUVs can be re-programmed to perform new surveys while in the water
- Test the magnetometer setup of the AUV, does it work and detects small magnetic objects with little noise

ExPloTect; testing of equipment

- The parallel running ExPloTect project aims at automating the analyses of explosive through a miniaturized water pre-concentration and successive mass spectrometer analyses. The aim was to use the very first demonstrator of this new device



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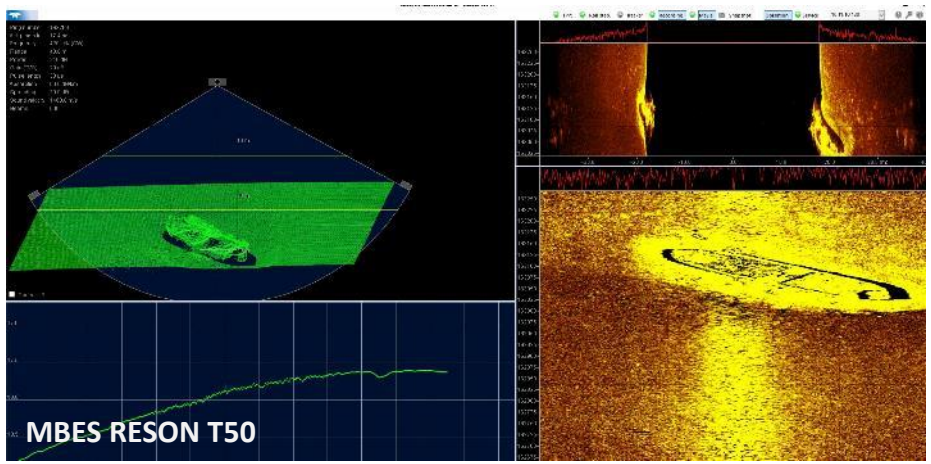
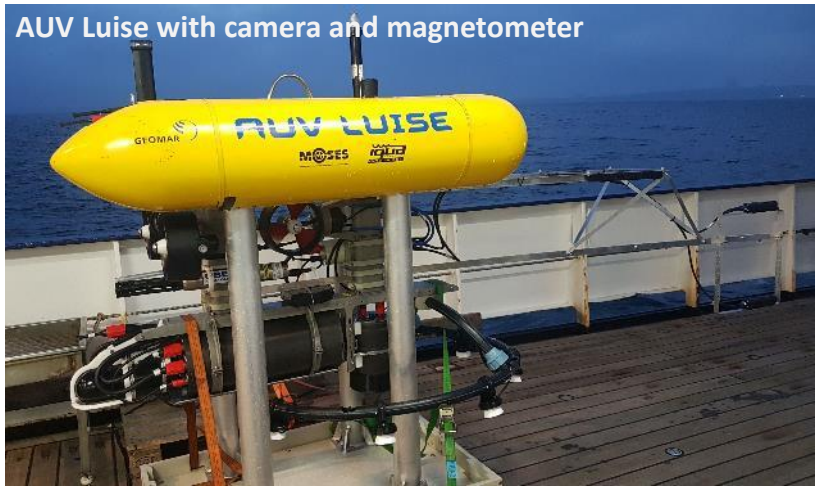
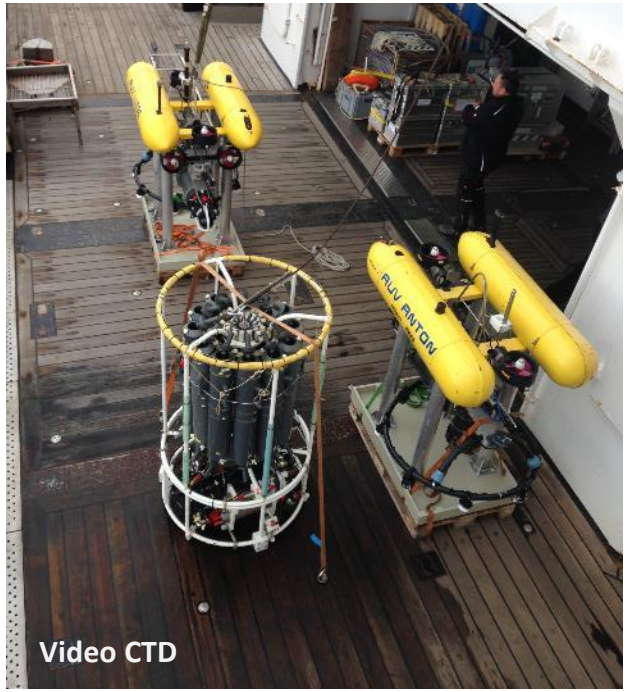
Cruise AL548


MBES RESON T50

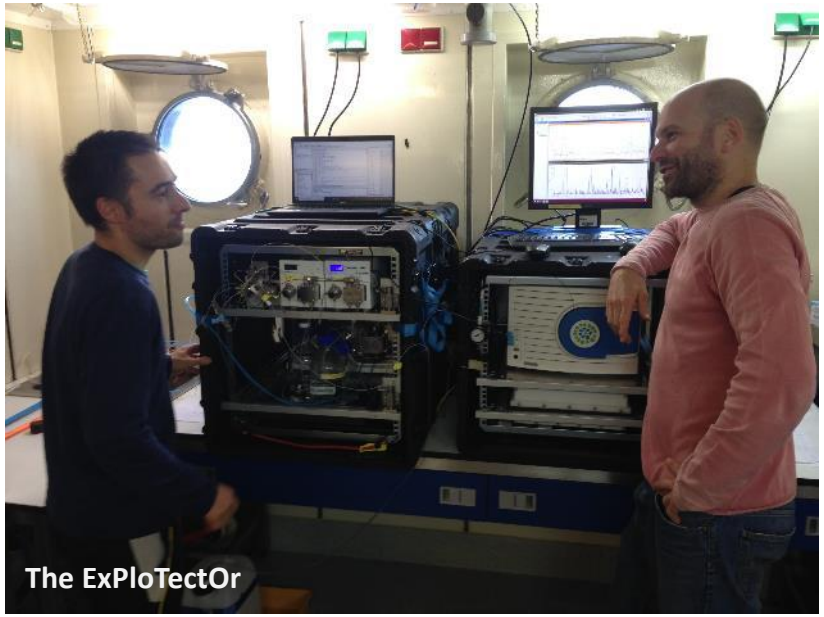


AUV Luise with camera and magnetometer


PC for photomosaiking

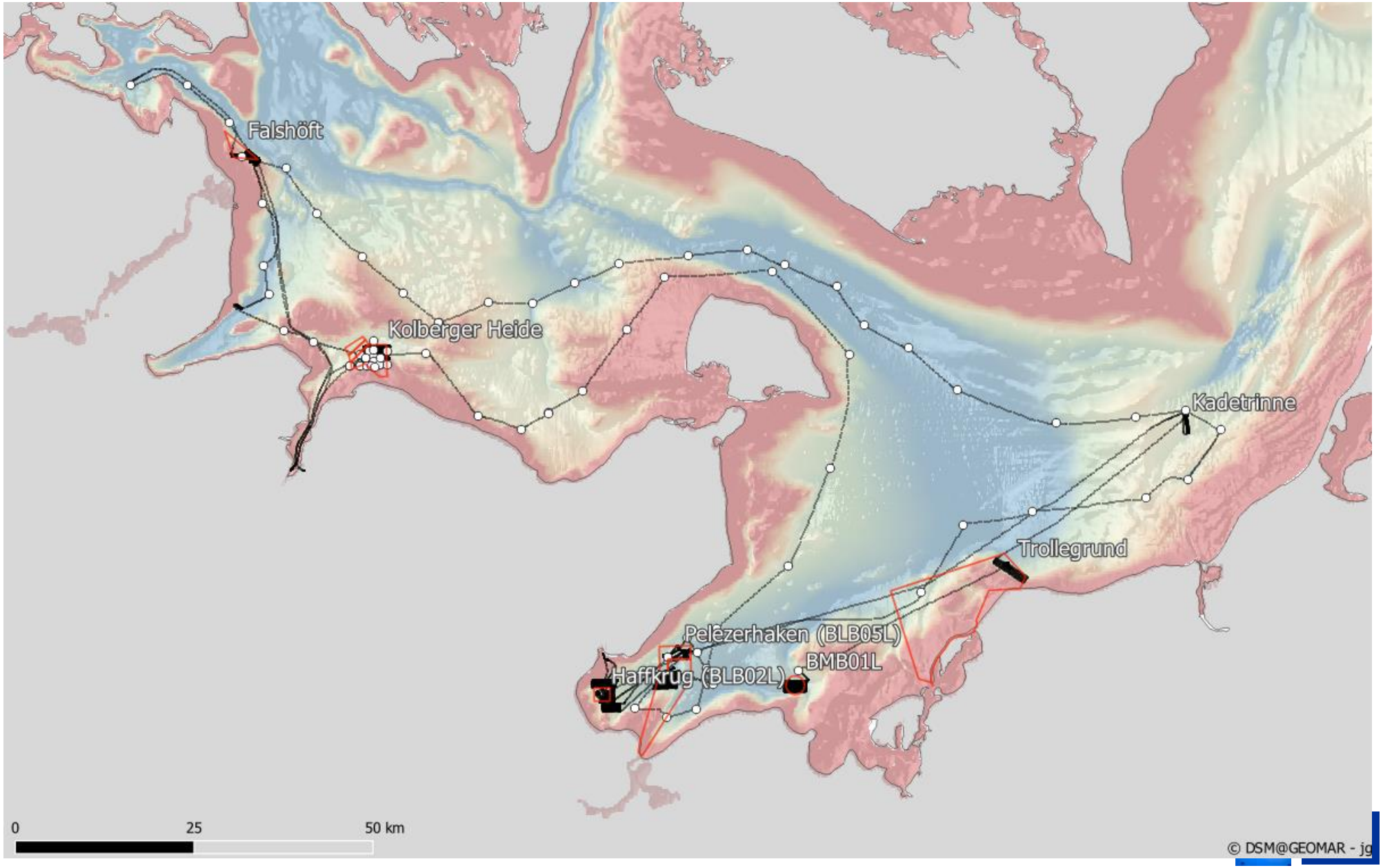


Video CTD


The ExPloTectOr

AUV Anton with camera

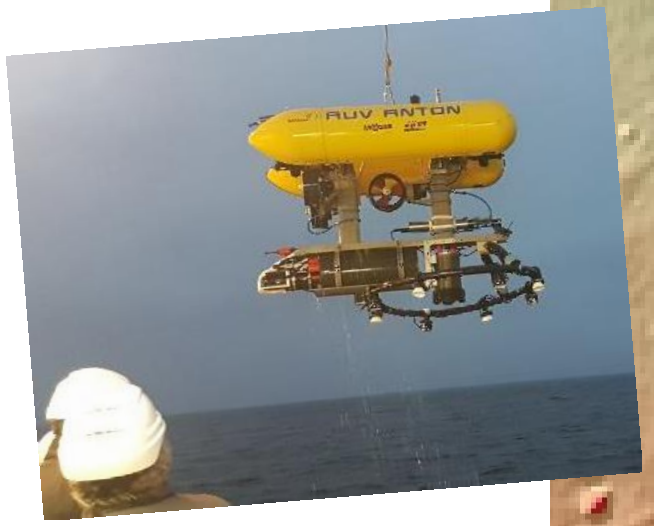
Cruise AL548



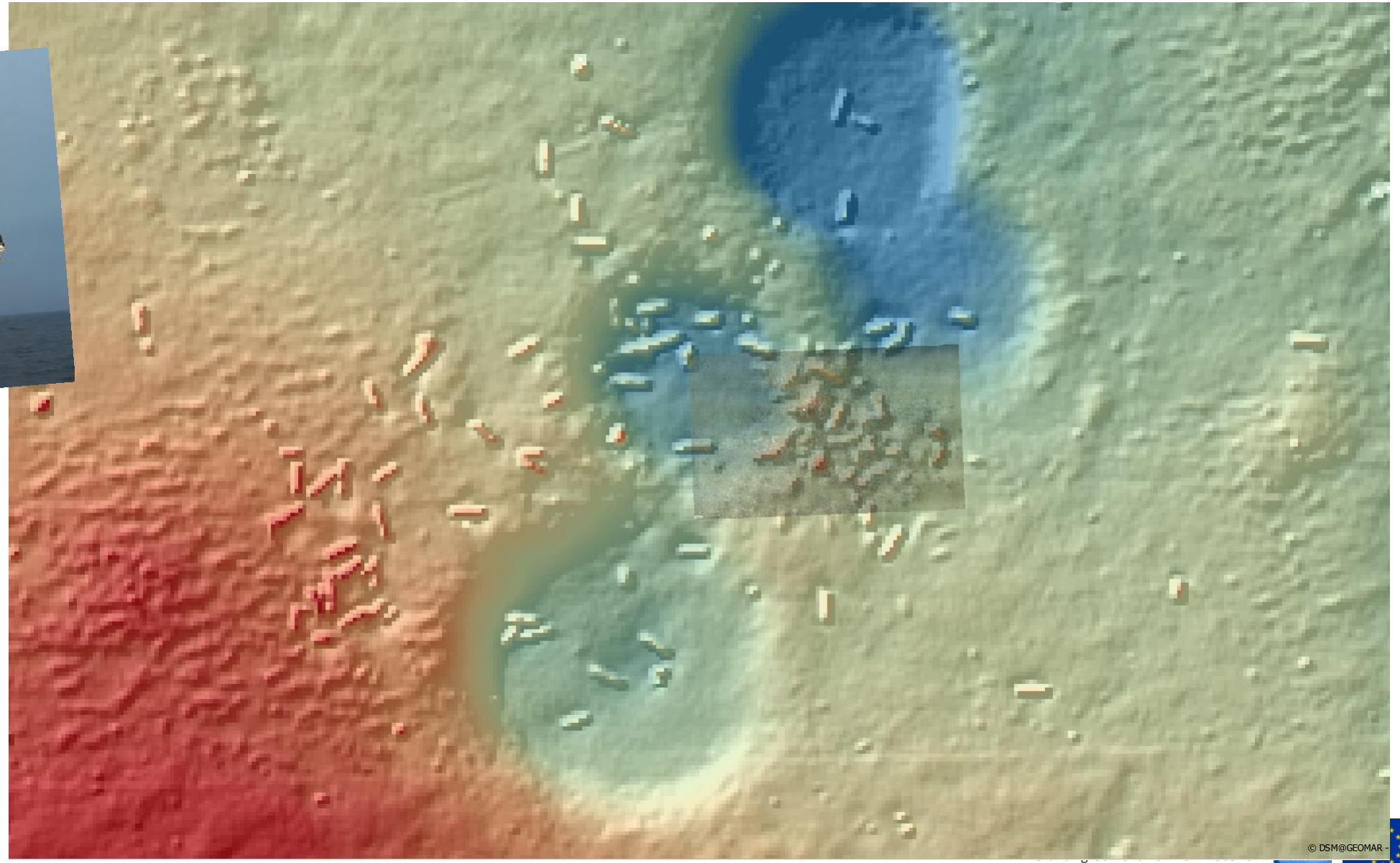
Stations

MBES:	**28.8 km²**
AUV Missions:	**36**
CTD-water:	**104**
TV-CTD:	**32**

Cruise AL548

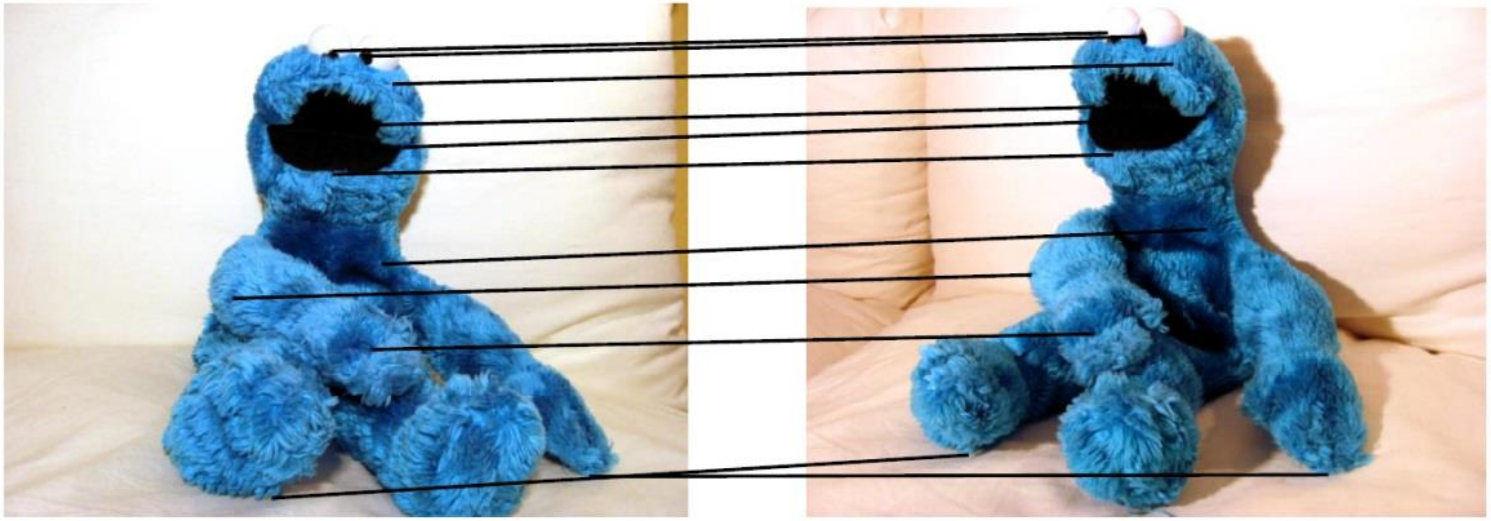


Photomosaiks and high res imagery for munition verification



Creating photomosaiks

Basic principle:
Identify clear/prominent features in several images



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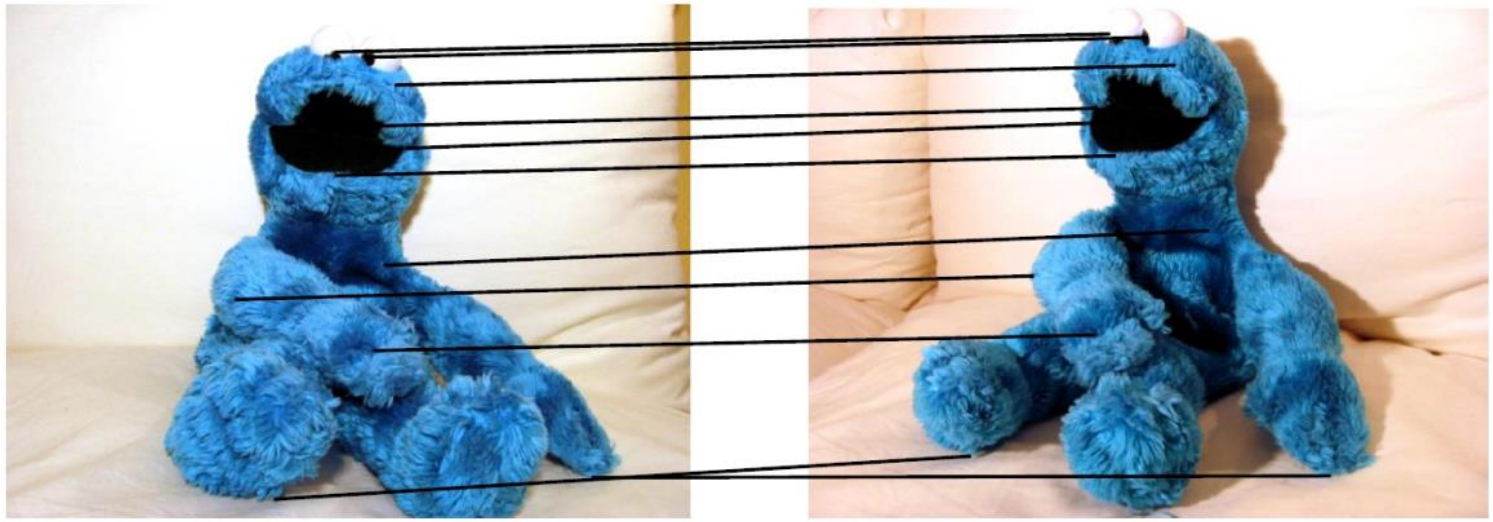
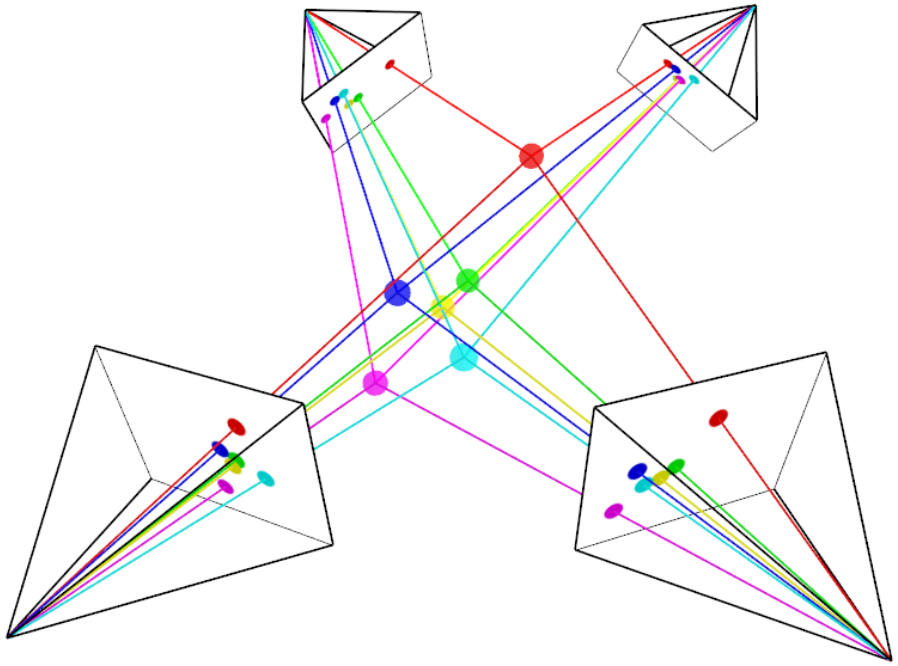
Creating photomosaiks

Compute camera motion and 3D coordinates from positions of features in images.





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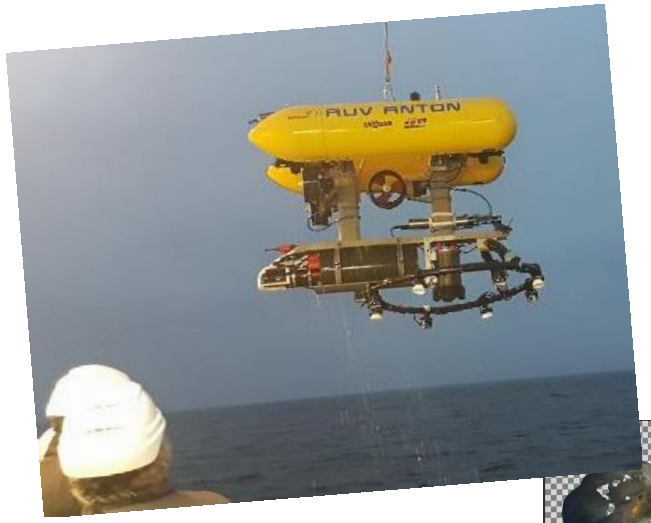
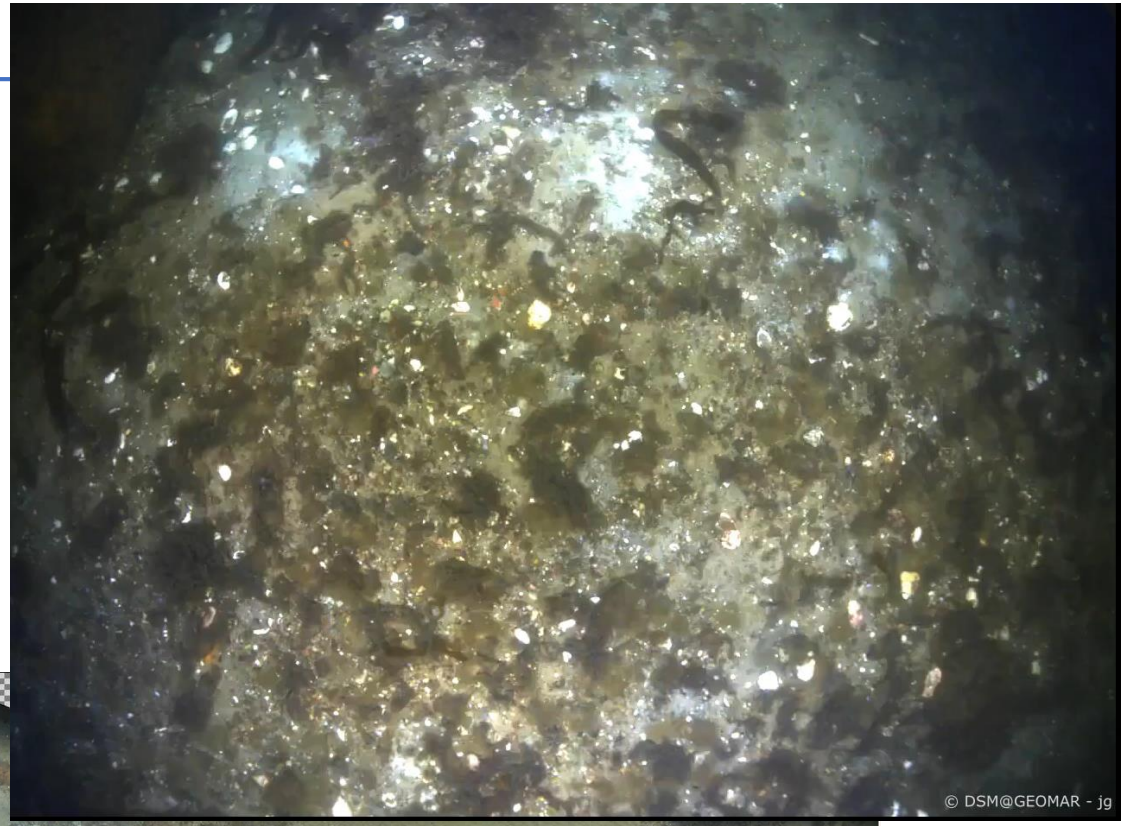
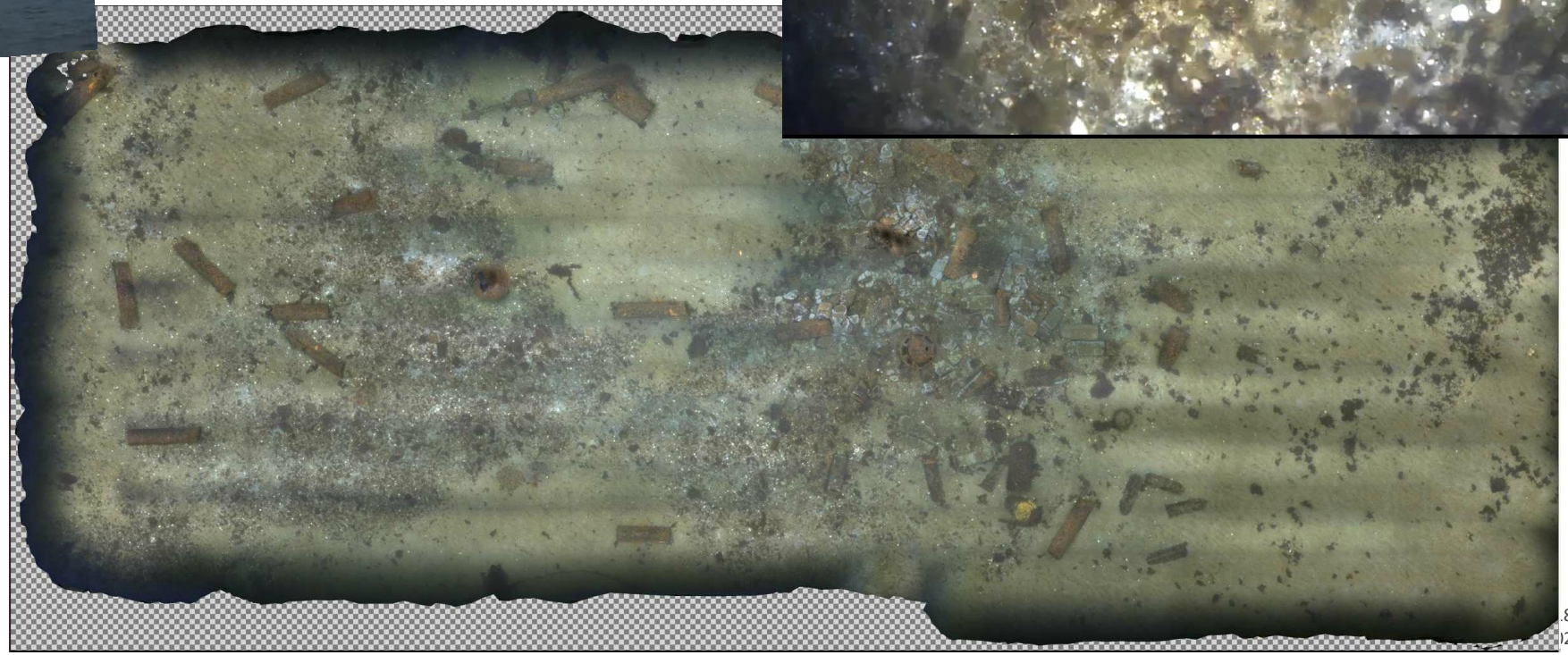
Creating photomosaiks

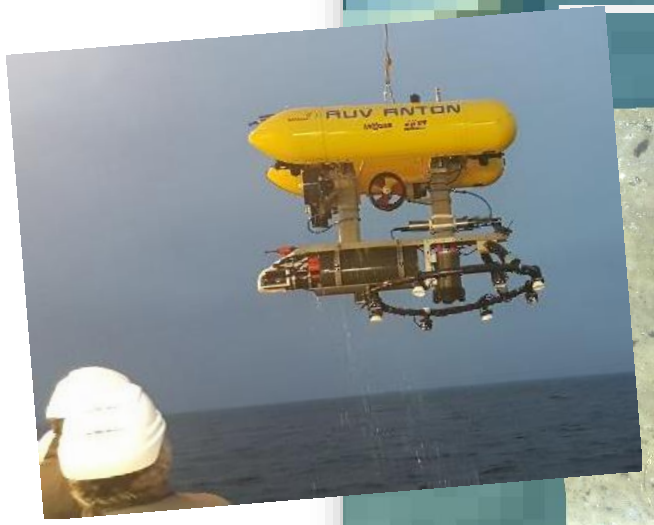


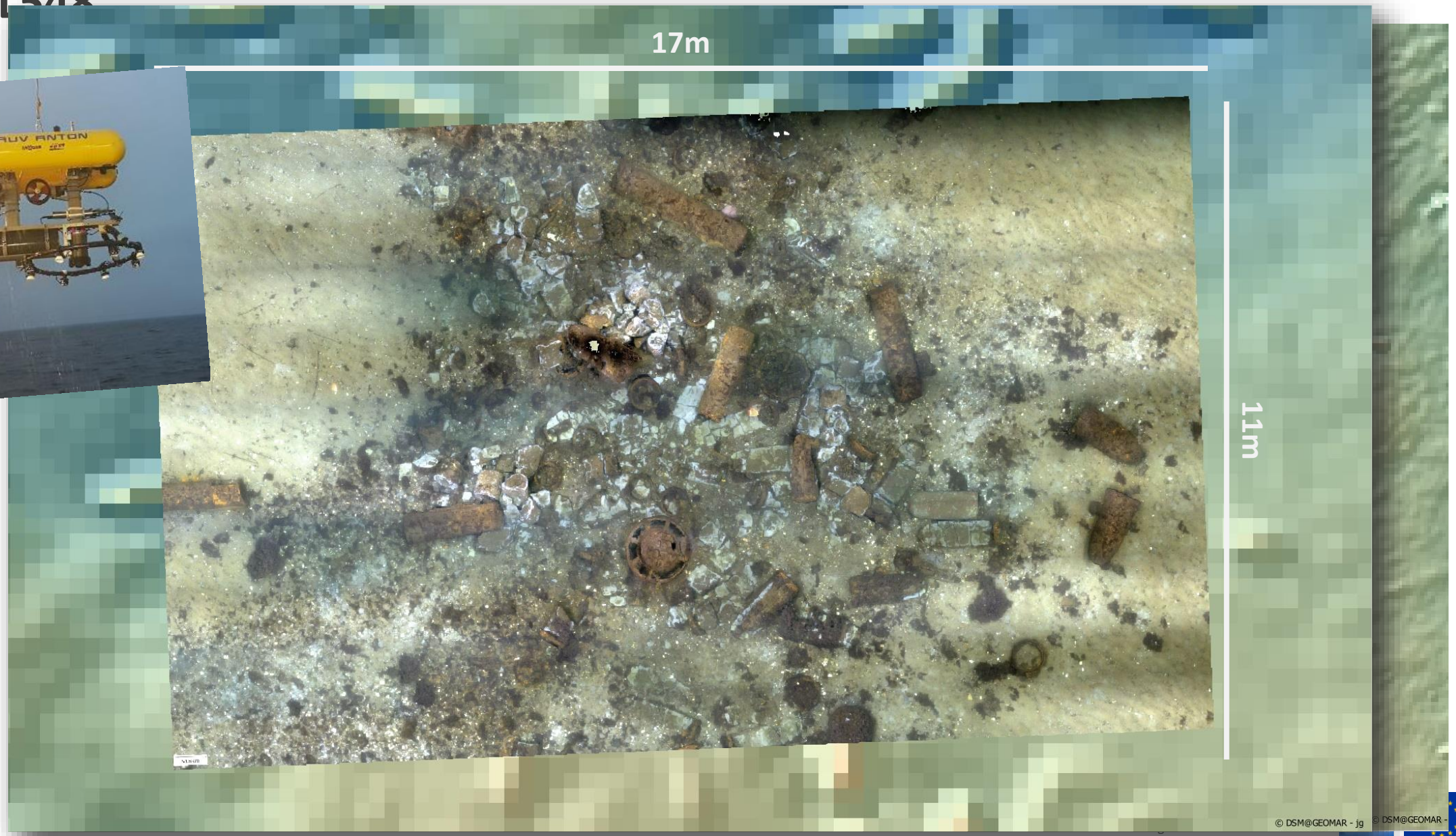




Photomosaiks and high res imagery for munition verification

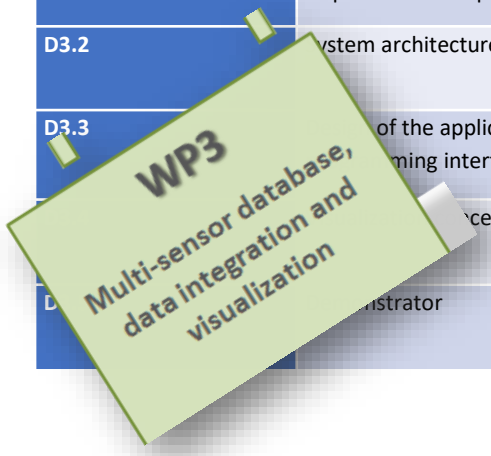
Cruise AL548





Milestones and deliverables: WP3 Multi-sensor database, data integration and visualization

Milestones	Name	WP	Lead beneficiary	Means of verification	Due date	Description
MS13	Data platform	3	GEOMAR	Upload of datasets is possible OK	3	The data platform is established, and project beneficiaries and associated organisation can upload datasets
MS14	Data compiled	3	GEOMAR	Initial number of useful datasets are available	6 OK	Uploaded datasets are verified and can be used for further steps
MS15	Database structure	3	EGEOS	Draft of database structure OK	9	A generalized draft of a database structure reflecting the requirements of quality metrics and AI is available
MS16	Data Base alpha version	3	EGEOS	First version (Alpha) in established	18	First version (Alpha) of the application including backend for quality metrics and AI is available for testing of main functionalities.
MS17	Data Base beta version	3	EGEOS	Second version (Beta) established	30	Second version (Beta) of the application including backend for quality metrics and AI is available with all planned functionalities.
MS18	Demonstrator	3	EGEOS	Demonstrator	36	Demonstrator is available that includes all functionalities, implemented visualization concept and fixes of known bugs.
Deliverables	Name	WP	Lead beneficiary	Type / Dissemination level	Due date	Description (including format and language)
D3.1	System use cases and requirement compiled	3	EGEOS	R Public OK	9	Description of scenarios and use cases as well as architecture and system requirements; Technical document; Digital report (pdf), English
D3.2	ystem architecture	3	EGEOS	R Confidential	12	Analysis of requirements and derivation of design principles and high-level architecture; Technical document; Digital report (pdf), English
D3.3	of the application ming interface	3	EGEOS	R Public	24	Design of the application programming interface based on the analysis and concepts in the prior deliverables; Technical document; Digital report (pdf), English
	cept	3	EGEOS	R Public	34	Understanding of complex datasets is a key point in transferring data into information; Technical document; Digital report (pdf), English
	nstrator	3	EGEOS	DEM Confidential	36	Demonstrator is available that includes all functionalities, implemented visualization concept and fixes of known bugs. Software



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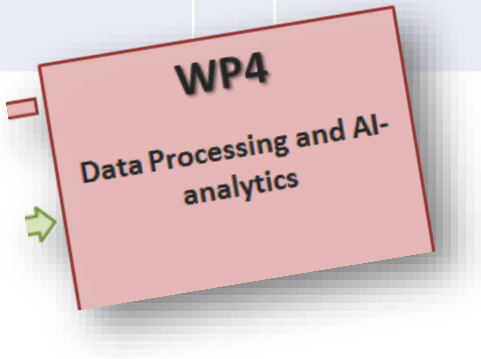
Milestones and deliverables: WP4 Data Processing and AI-analytics

Milestones	Name	WP	Lead beneficiary	Means of verification		Due date	Description
MS19	Data compilation	4	GEOMAR	Data in database		6	First data of supporting partners available
MS20	SBP processing – alpha*	4	VLIZ	Workflow and test data set reported		18	SBP processing in alpha-version running
MS21	AUV-magnetic processing - alpha	4	G-tec	Workflow and test data set reported		18	AUV-based magnetic data processing in alpha-version running
MS22	AI - alpha	4	GEOMAR	Workflow and first results reported		20	Various AI algorithms tested and test-wise implemented in data base and AUV
*Alpha = first working version							
Deliverables	Name	WP	Lead beneficiary	Type / Dissemination level		Due date	Description
D4.1	Processed Data of field campaigns created	4	GEOMAR	DATA	Confidential	**12,** 24, 36	Data are compiled from partners to train AI methods. The data itself are partly confidential or have been made public by the providers already (BSH)
D4.2	SBP processing routines and workflows	4	VLIZ	R	Confidential	36	Processing and visualisation workflows described, integration of resulting data into Database (WP3) shown; Digital report (pdf), English
D4.3	AUV-magnetic processing description	4	GEOMAR	R	Confidential	36	Processing AUV-based magnetic data described, integration of resulting data into Database (WP3) shown; Digital report (pdf), English
D4.4	AI method description and software tools	4	GEOMAR	R	Confidential	36	Description of the workflows and used algorithms described, integration of resulting data into Database (WP3) shown; Digital report (pdf), English

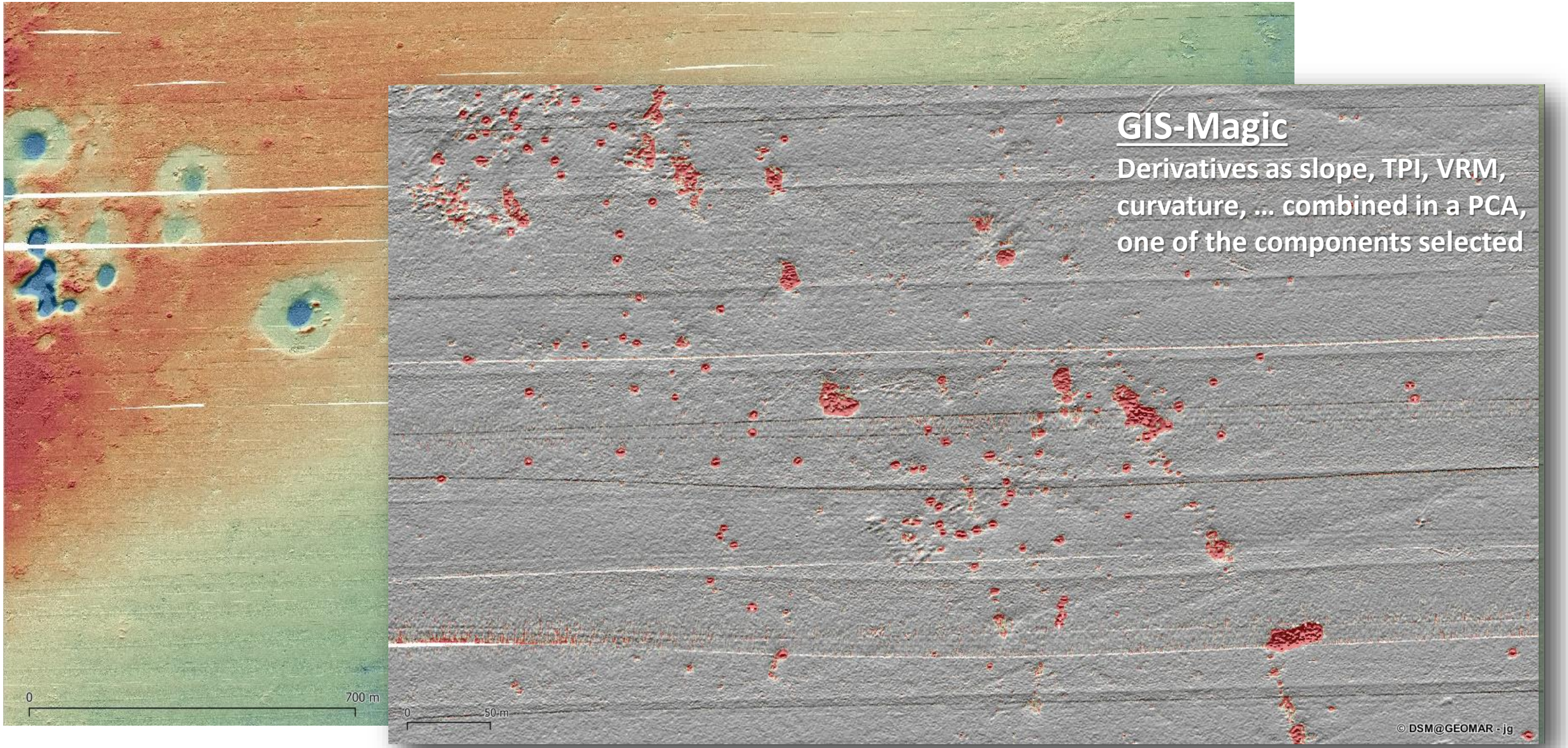
OK

OK

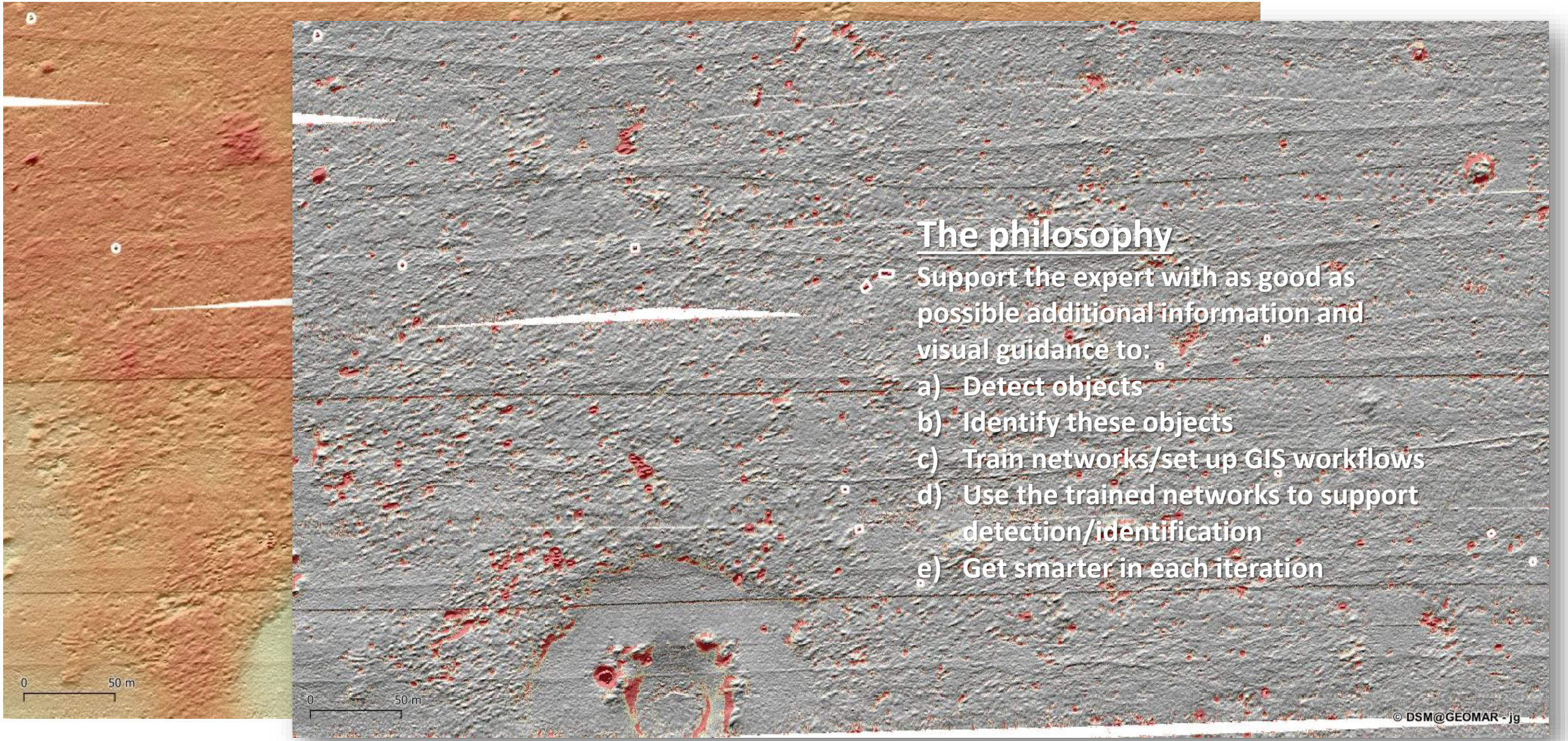


Data Processing and AI analytics

Data Processing and AI analytics



Data Processing and AI analytics



The philosophy

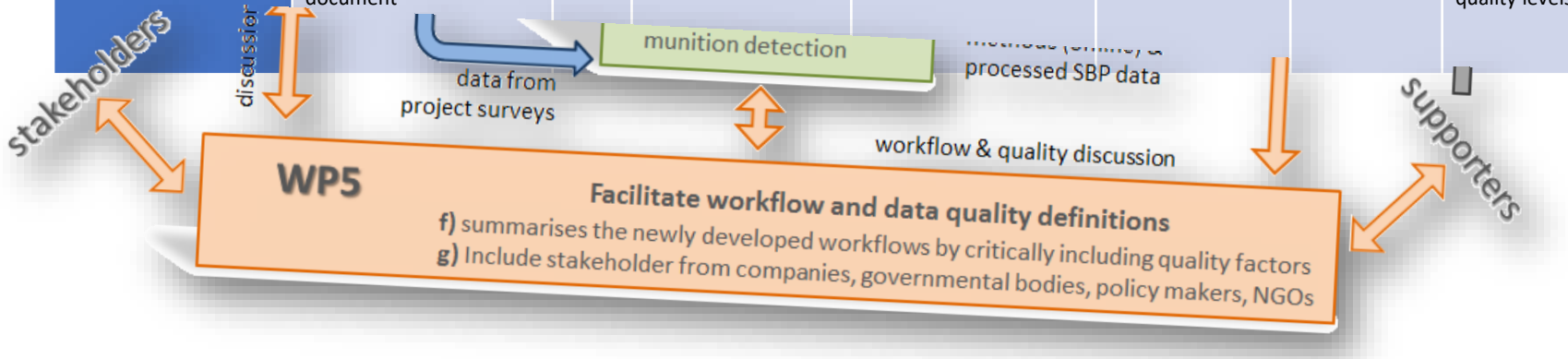
Support the expert with as good as possible additional information and visual guidance to:

a) Detect objects
b) Identify these objects
c) Train networks/set up GIS workflows
d) Use the trained networks to support detection/identification
e) Get smarter in each iteration

Milestones and deliverables: WP5 Facilitate workflow and data quality definitions

Milestones	Name	WP	Lead beneficiary	Means of verification	Due date	Description
MS23	Preliminary Quality factors defined	5	GEOMAR	List of quality factors with threshold values and cut-off criteria OK	6	A preliminary list of quality factors is required before the first fieldwork campaign takes place.
MS24	Preliminary workflow established	5	GEOMAR	Description and graphical depiction of workflow available to stakeholders	9 OK	The workflow of data acquisition and handling as agreed upon by the project partners.
MS25	Data quality described per dataset	5	GEOMAR	Quality factors and preliminary quality metrics available to stakeholders	12	The data quality requirements as agreed upon by the project partners.
MS26	Workflow and quality factor verification 1	5	GEOMAR	Documented annotations to workflow and quality requirements	22	Results of Tasks 5.1 and 5.2 are verified by stakeholder workshops and field campaigns. The results are specified and amended.
MS27	Workflow and quality factor verification 2	5	GEOMAR	Documented annotations to workflow and quality requirements	34	Results of Tasks 5.1 and 5.2 are verified by stakeholder workshops and field campaigns. The results are specified and amended.

Deliverables	Name	WP	Lead beneficiary	Type / Dissemination level		Due date	Description (including format and language)
D5.1	Best-practice workflow	5	GEOMAR	R	Public	36	A workflow describing the process of data acquisition and handling as a flow chart (Guideline document), Digital report (pdf), English
D5.2	Quality requirement document	5	GEOMAR	R	Public	36	A glossary of quality requirements and a description of these requirements for different quality levels (Guideline document), Digital report (pdf), English



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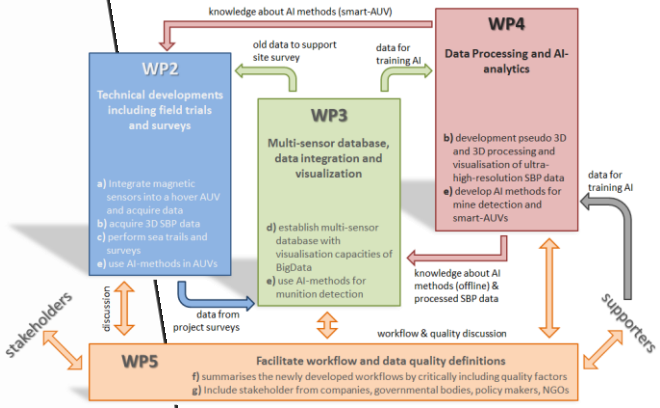

a) Integrate magnetic sensor into AUV
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Other activities

BASTA & ExPloTect members secured additional funding

- **ProBaNNt** - Professional intelligent munitions assessment using 3D reconstructions and Bayesian Neural Networks (MarTerra - BMWi)
- **AMMOTRACe** - Marine AMMunitiOn dump site exploration by surface- and underwater-based laser mass spectrometric TRACing technologyultra-high-resolution (MarTerra - BMWi)
- **UnLowDet** - Laserinduzierte Unterwasser Low-Order-Detonation zur effizienten Entschärfung von Kampfmitteln im Meer (BMWi)

.. are in the process of fine tuning the re-submission of a very good reviewed proposal

- **CONMAR** - CONcepts for conventional MArine Munition Remediation in the German North and Baltic Sea (DAM Mission proposal in Protection and sustainable use of marine areas)

.. preparing for submission of other proposals

- **CLEAR** - CrawLer based Environmentally friendly Ammunition Removal
- **¡DIGA M_2E_4!** - DIGitalisation of Archives on Marine Munition for Exploration, Eradication, public Education and Enlightenment

.. are part of the JPIO Action ‘Munitions in the Seas’

- help establishing a European Knowledge Hub

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Other activities

Kiel Munition Clearance Week addresses these challenges across oceans and disciplines

The Kiel Munition Clearance Week wants to inform and propel these efforts by creating a shared perspective on the challenge that will bring together the latest scientific research, industry best practice, navy expertise, technical innovation as well as economic and political considerations.

Five immersive days of stakeholder engagement

Panel debates; Technology showcases; Roundtables & Project meeting; Public side events; In-Person & Digital Participation

The event addresses the whole spectra of pressing issues in legacy munition clearance

Research environment; Environmental & Societal Impacts; Detection & Identification Solutions; Remediation Solution
Stakeholder Roles & Responsibilities; Legal Aspects; Funding Options

www.MunitionClearanceWeek.org

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