

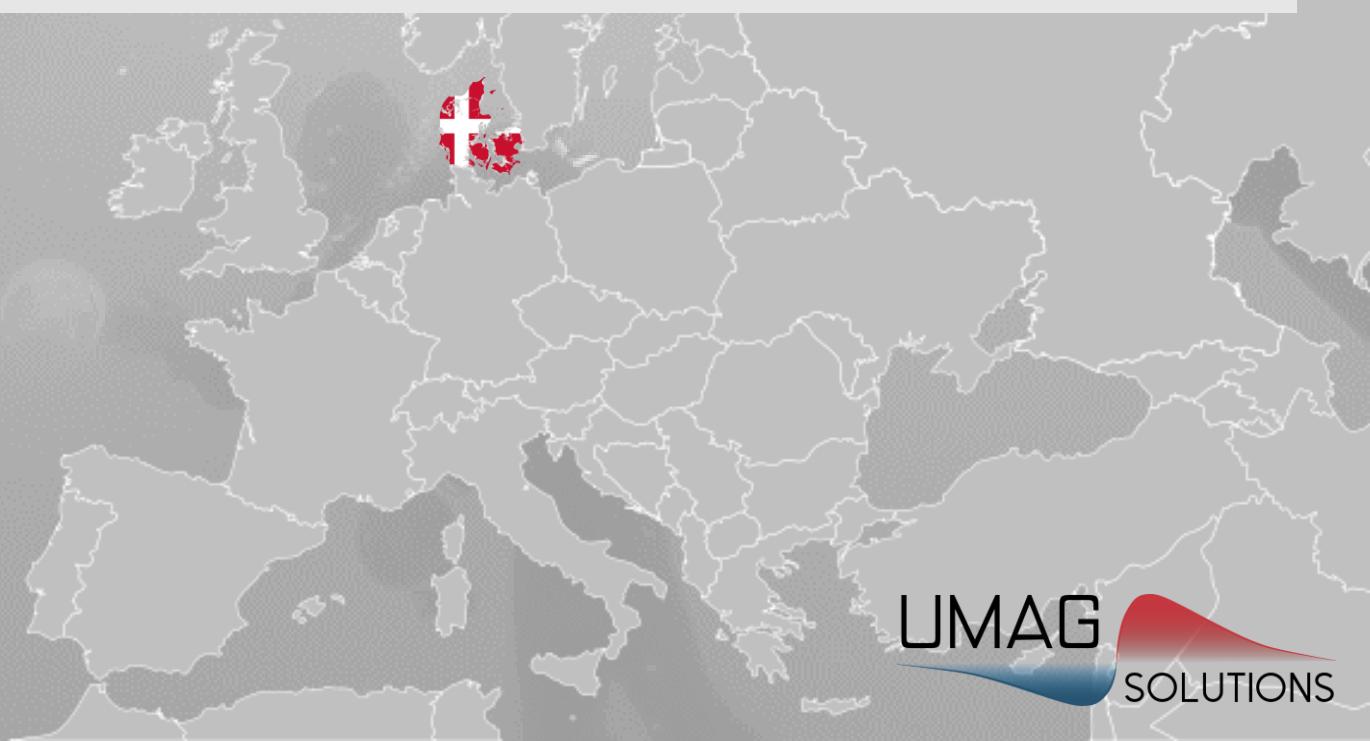
Advanced Mine Detection using Aerial Drone Magnetic Gradiometry

Arne Døssing Andreasen
CEO, Ph.D. Geophysics



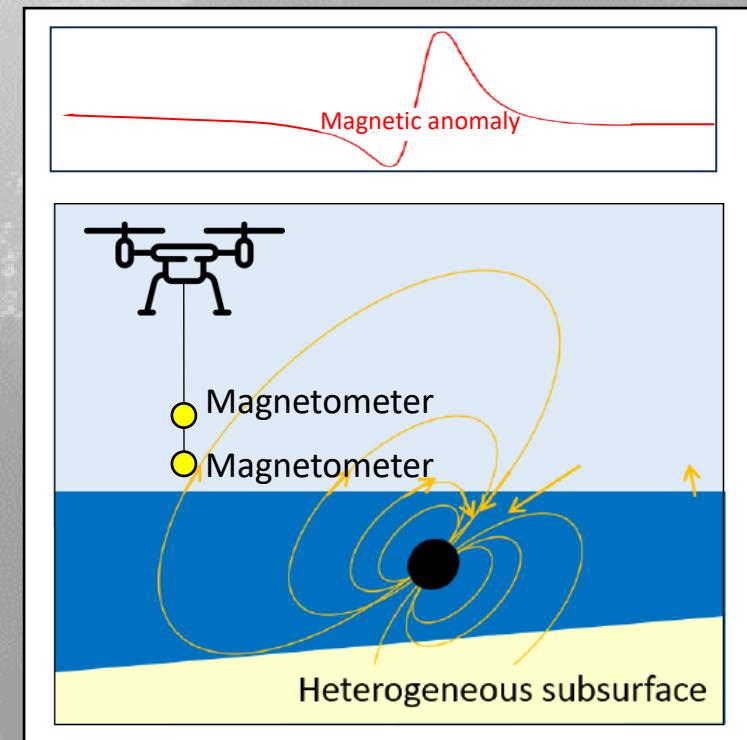
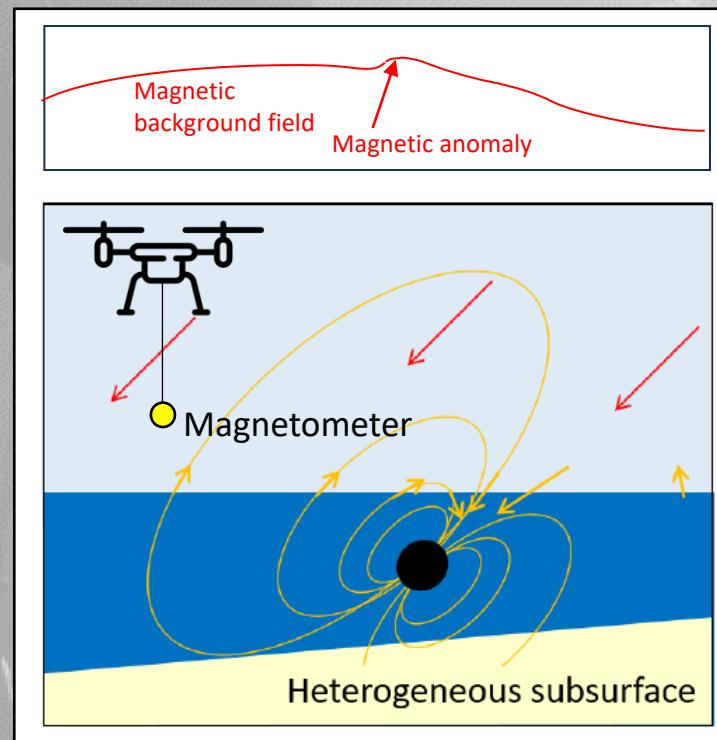
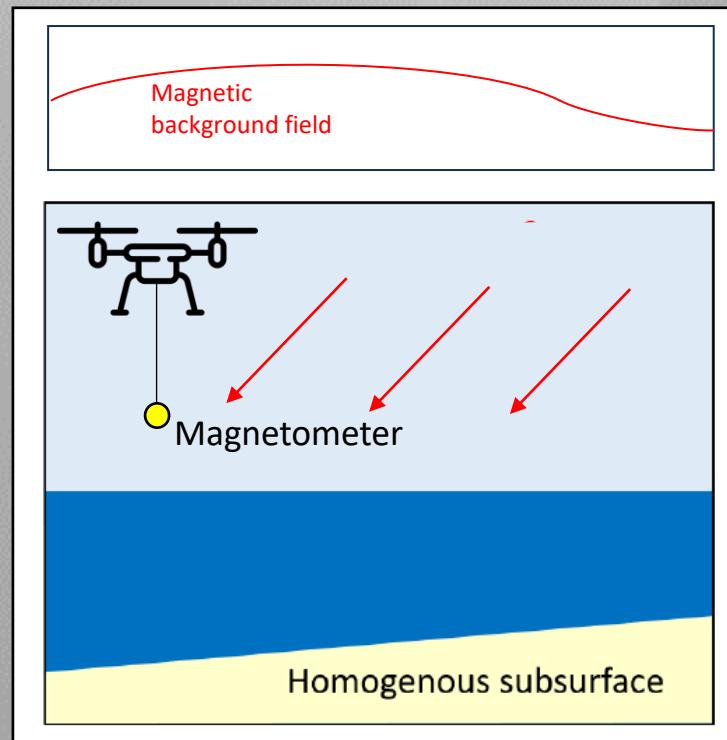
Aerial Drone Magnetic Solutions

*Land- and Naval Mine Detection
Anti-Submarine Warfare (ASW)
Subsea Surveillance*

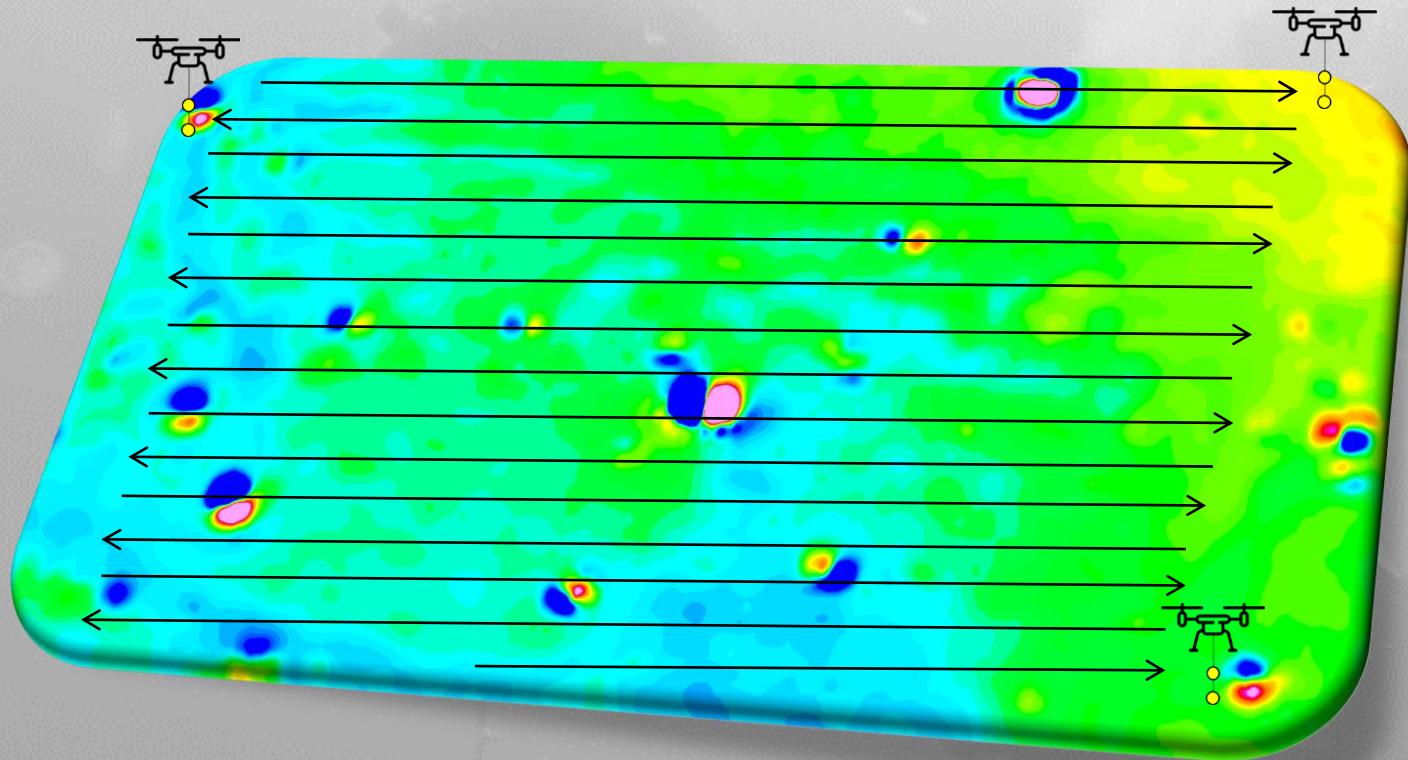


Magnetic Gradiometry?

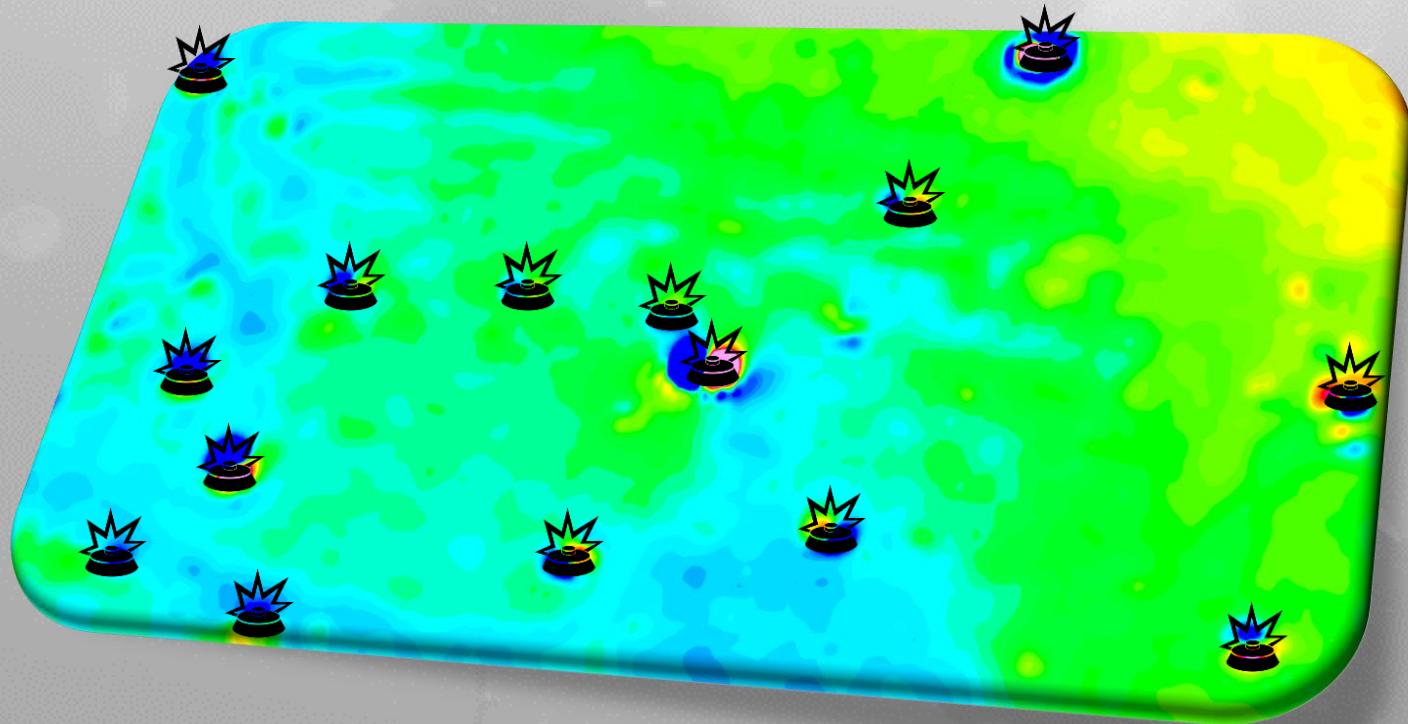
*Magnetic Gradiometry
highlights anomalies in
Earth's magnetic field*



Drone Magnetic Gradiometry



Drone Magnetic Gradiometry



Drone Magnetic Gradiometry

Advantages to
UAV/Conventional Methods



Fast areal coverage (8 ha/hour) and easy deployment



Complete coverage: Beaches, rivers, surf zones, deeper waters, and low-visibility waters



Drifting / Moored / Bottom mines



Rocks versus mines



High positional accuracy



Real-time data



Man-power saving & Cost-efficient



Safe

Drone Magnetic Gradiometry

Advantages to
UAV/Conventional Methods



Ice-covered areas

Drone Magnetic Gradiometry

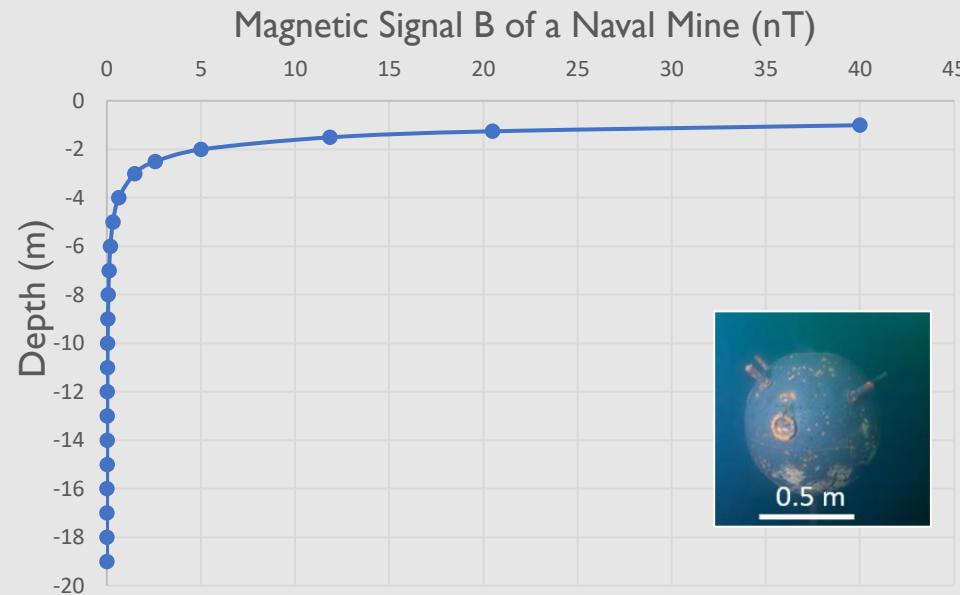
*Critical System
Parameters*

- ❖ System noise level
- ❖ System positioning accuracy

Drone Magnetic Gradiometry

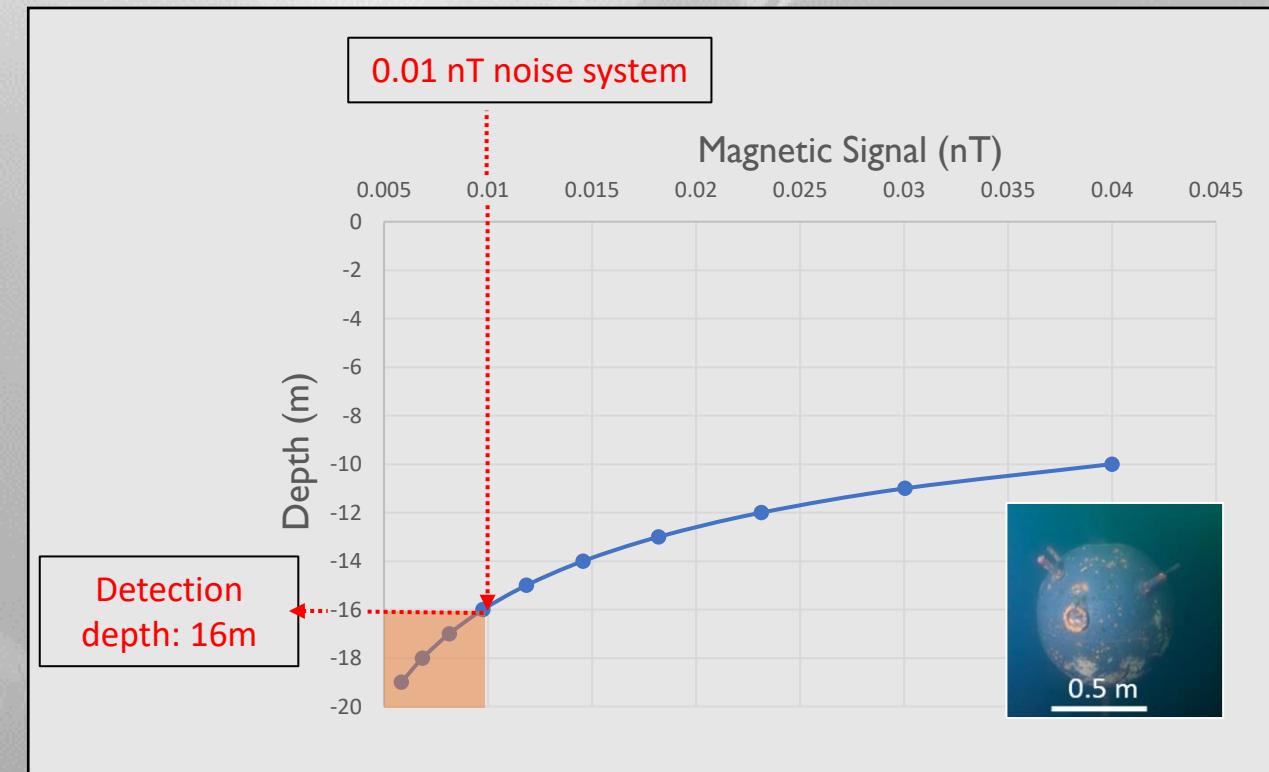
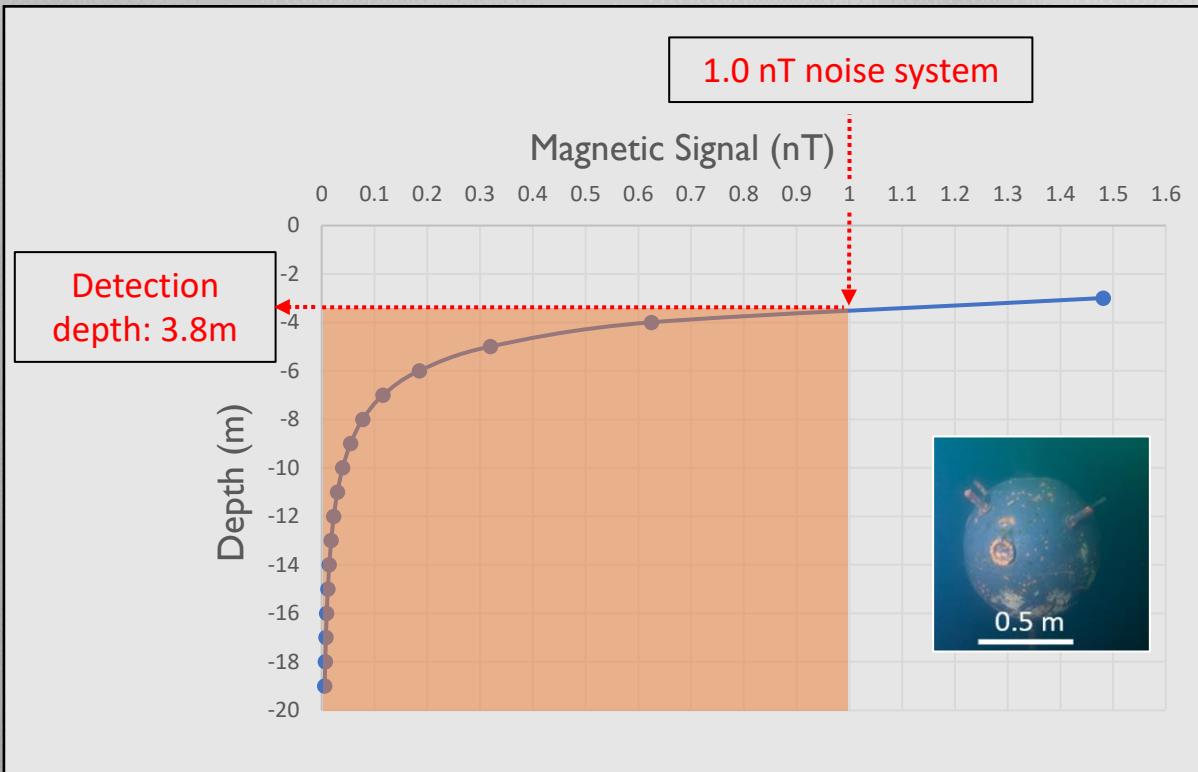
System Noise Level

$$B = \frac{\mu_0}{4\pi r^3} (3(\hat{r} \cdot m)\hat{r} - m)$$



Drone Magnetic Gradiometry

System
Noise Level



V2MAG™

*Worlds most sensitive Drone
Magnetic Gradiometry solution*

Magnetic Gradiometry

Magnetic UAV Solution

V2MAG™ NOA Military Ed.



Military UAV magnetic turnkey solution with unrivaled UXO / mine detection capabilities, real-time data, and computer-assisted target analysis



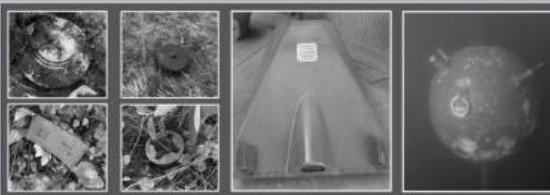
UMAG  SOLUTIONS

Magnetic Gradiometry

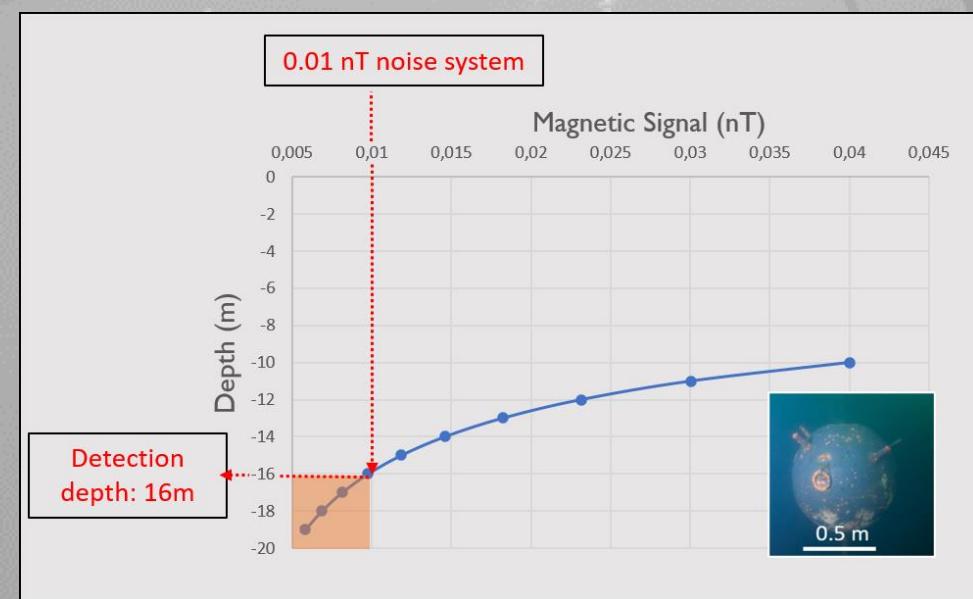
Magnetic UAV Solution **V2MAG™ NOA** Military Ed.



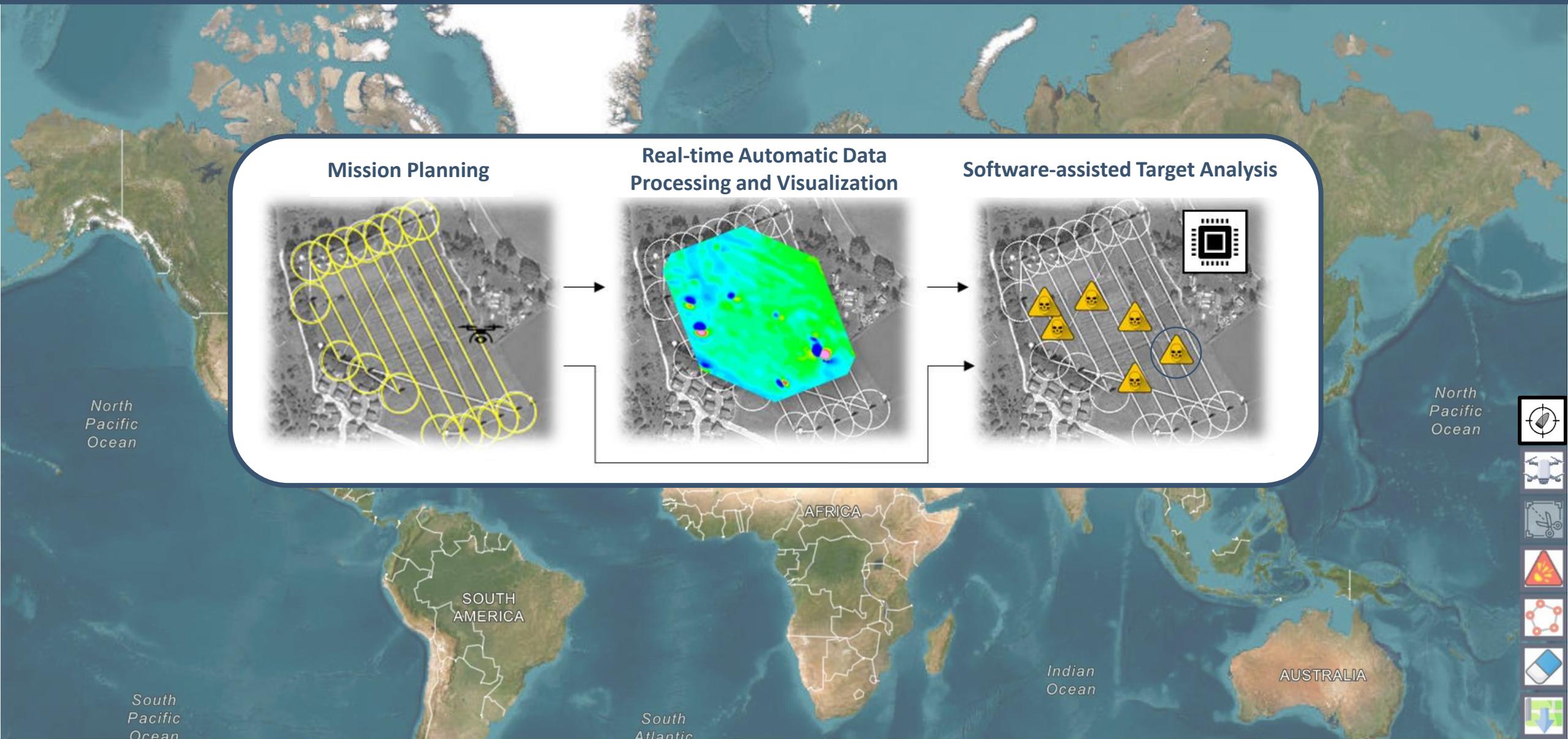
Military UAV magnetic turnkey solution with unrivaled UXO / mine detection capabilities, real-time data, and computer-assisted target analysis



- ✓ Vertical Gradiometry solution
- ✓ Two top-quality Quantum Magnetometers
- ✓ Real-time cm-level (5-8 cm) 3D positioning
- ✓ GPS jamming/spoofing resistance
- ✓ Drone agnostic (minimum 5 kg payload capacity)
- ✓ Weather resistant (wind and rain)
- ✓ Minimum noise system (0.01 nT in raw data)



UMagMission™ End-to-End Operation Software



V2MAG™



SWECO
Global Marine

FUGRO

COWI

amprion

SCOTTISHPOWER

UXO Offshore Services

tennet

UXO Control

RAMBOLL

**VIKINGESKIBS
MUSEET**

Ørsted



*Commercial
Track Record*

SWISS ARMY
Victorinox

**wessex
archaeology**

SCHOLLENBERGER
KAMPFMittelBERGUNG

Boskalis

BY&HAVN

SEA



*Sold to European
Defense 2024*



*Operated by Ukrainian STSS
for land- and naval mine
detection*

Oleksii Reznikov
@oleksiireznikov

The Ministry of Defense of Denmark has provided 6 drones for mine scanning as part of their aid package for Ukraine. These drones are used for non-technical inspection of territories, including water bodies, for explosive ordnance. It is the latest innovative approach to inspecting territories. I'm grateful to our Danish friends and especially to my colleagues [@mfMorten](#) and [@troelslundp](#)!

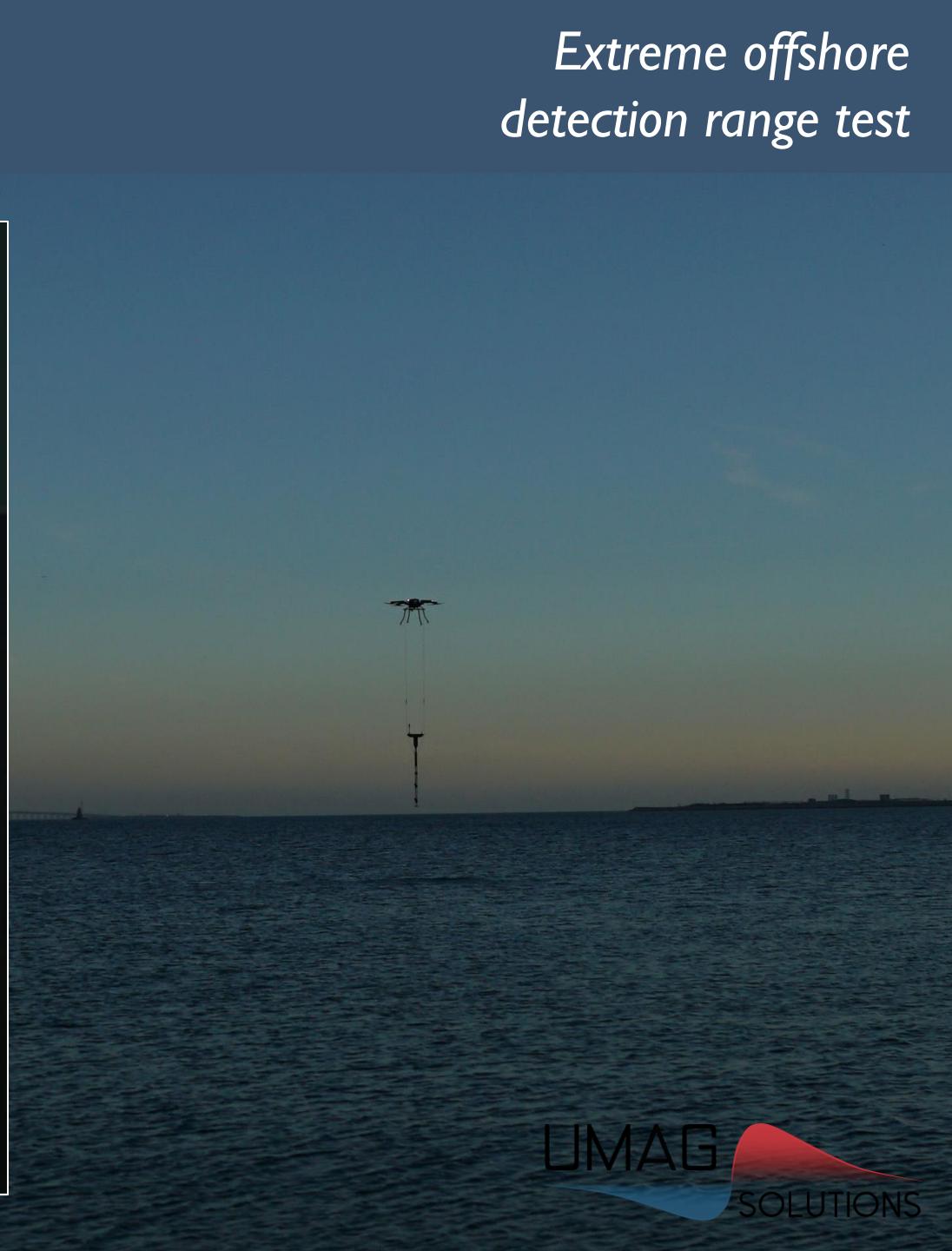


2:46 PM · Jul 14, 2023 · 535.9K Views

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Extreme offshore
detection range test

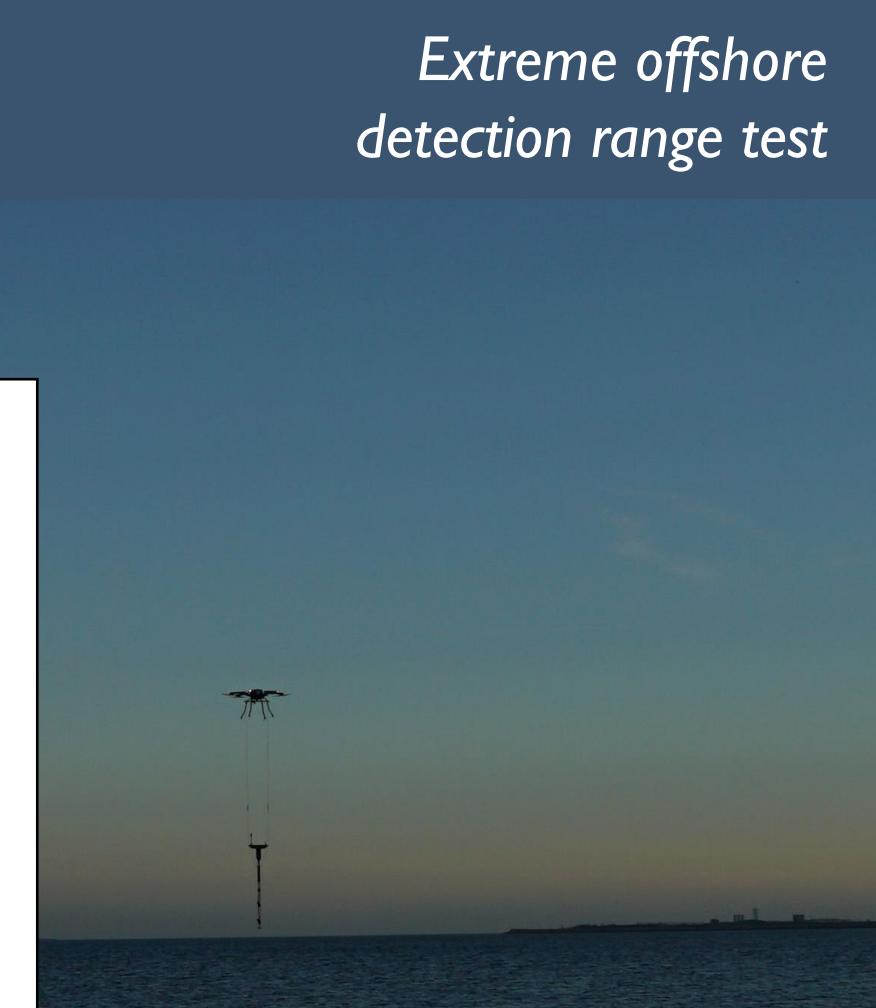
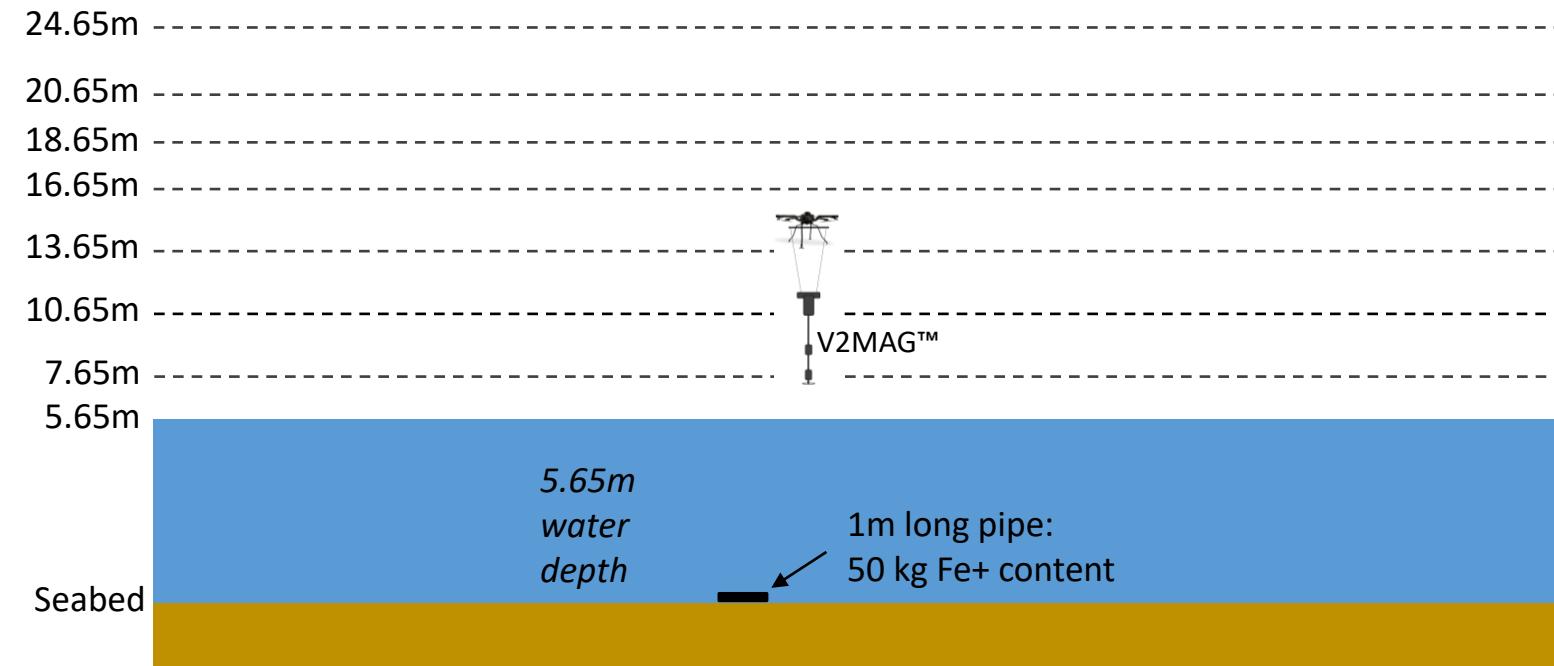


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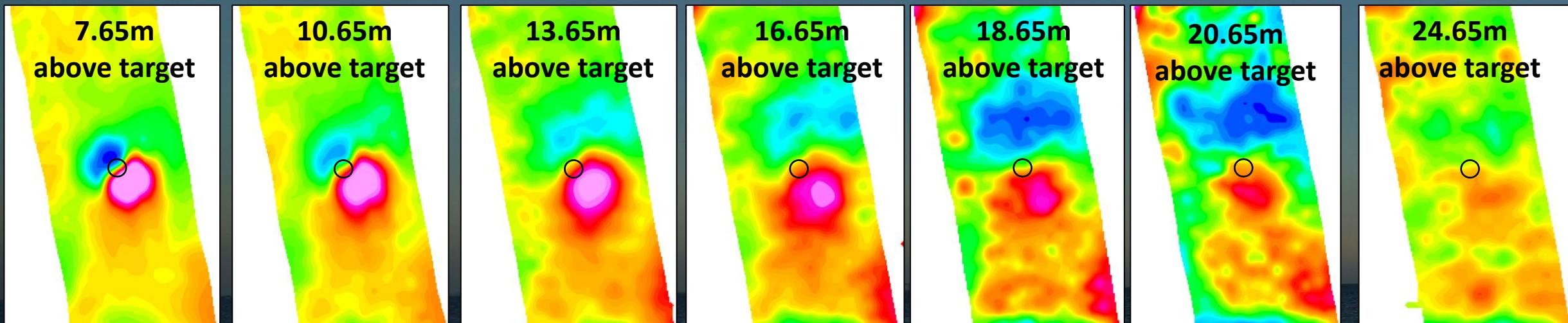
Extreme offshore
detection range test



V2MAG™



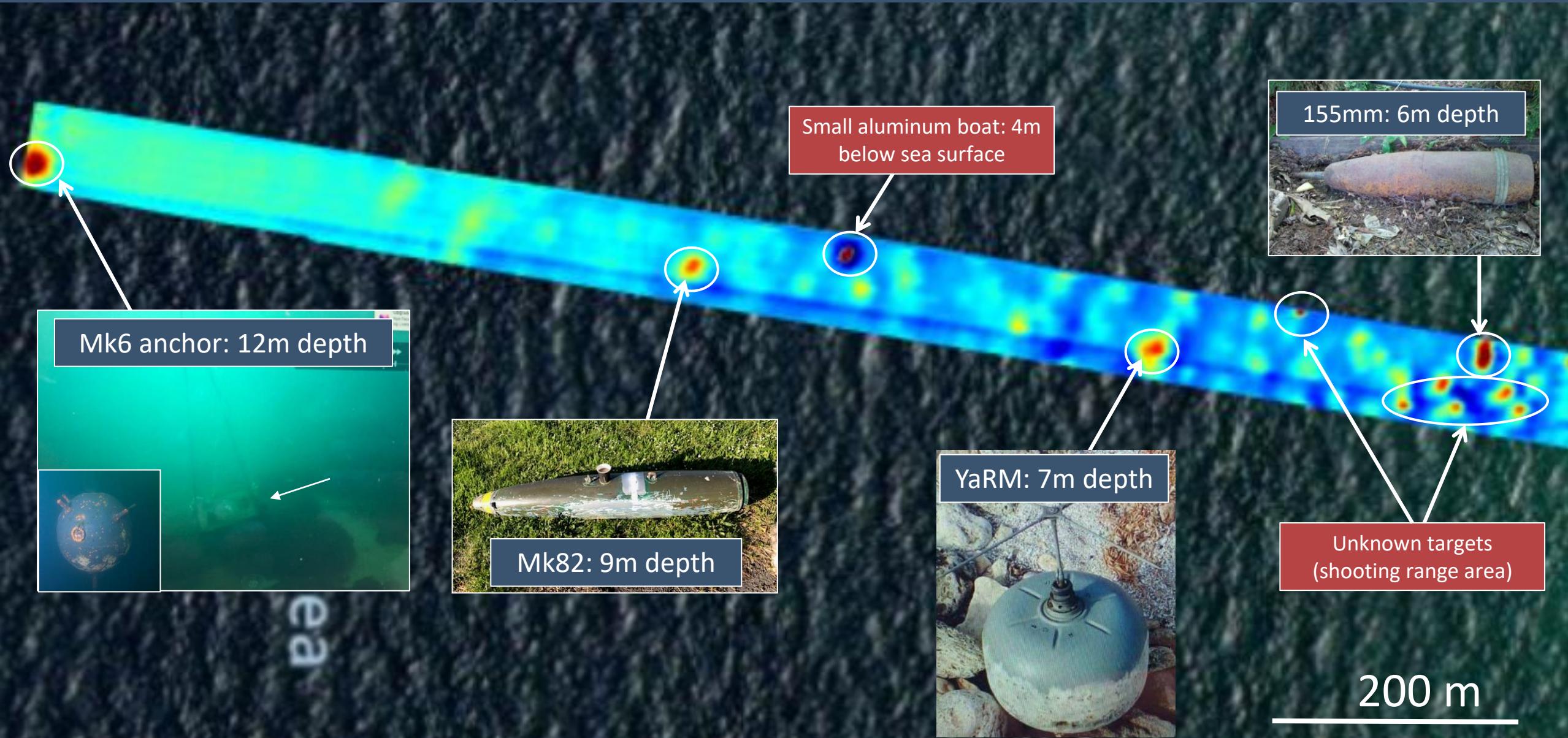
Extreme offshore
detection range test

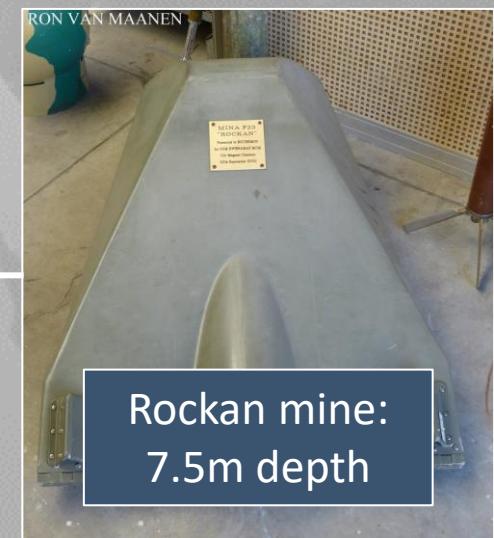
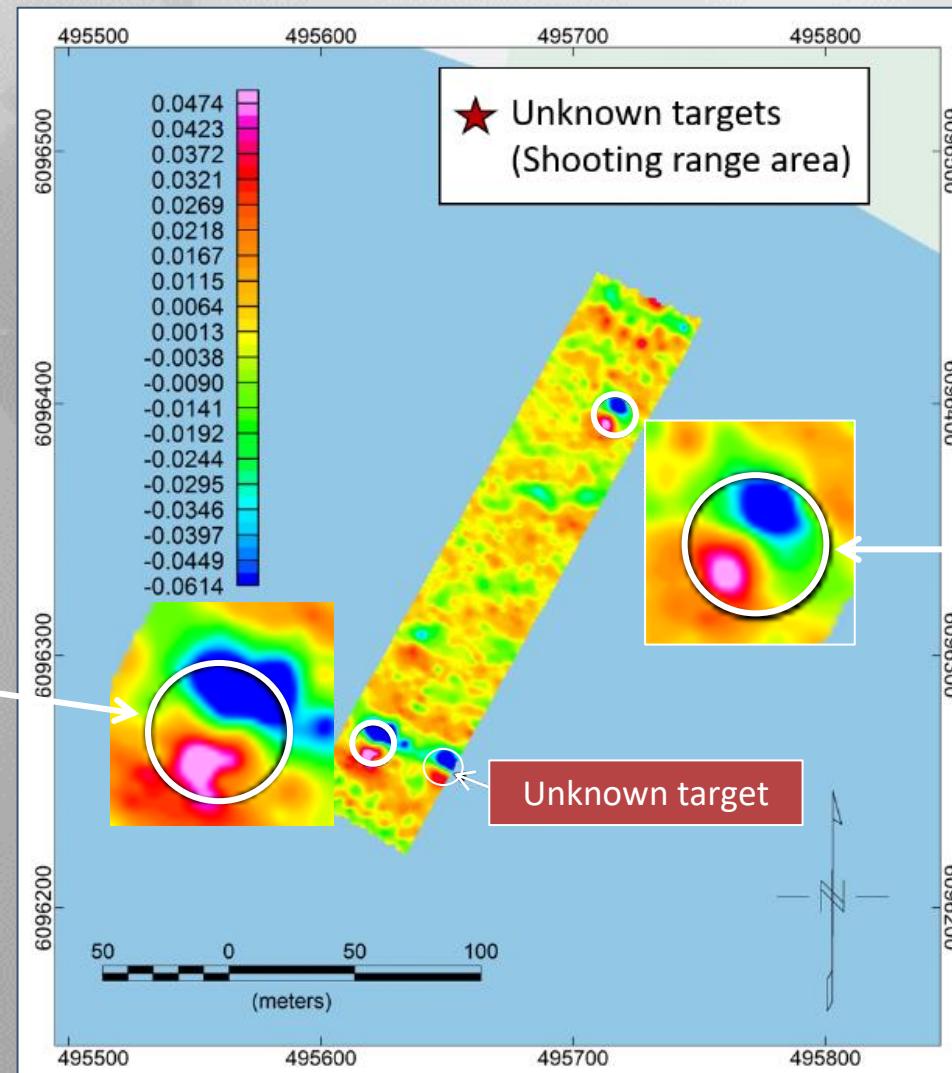


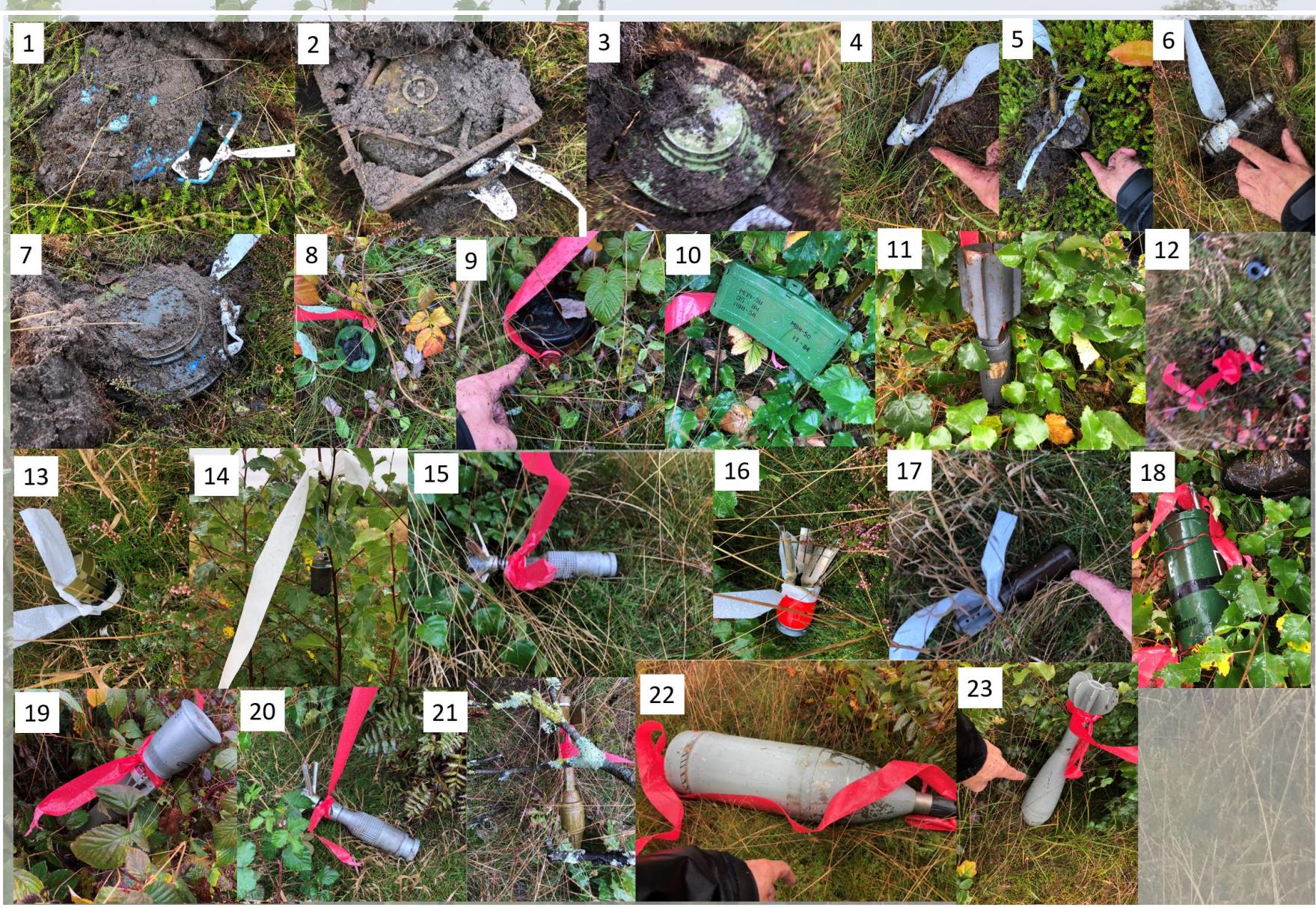
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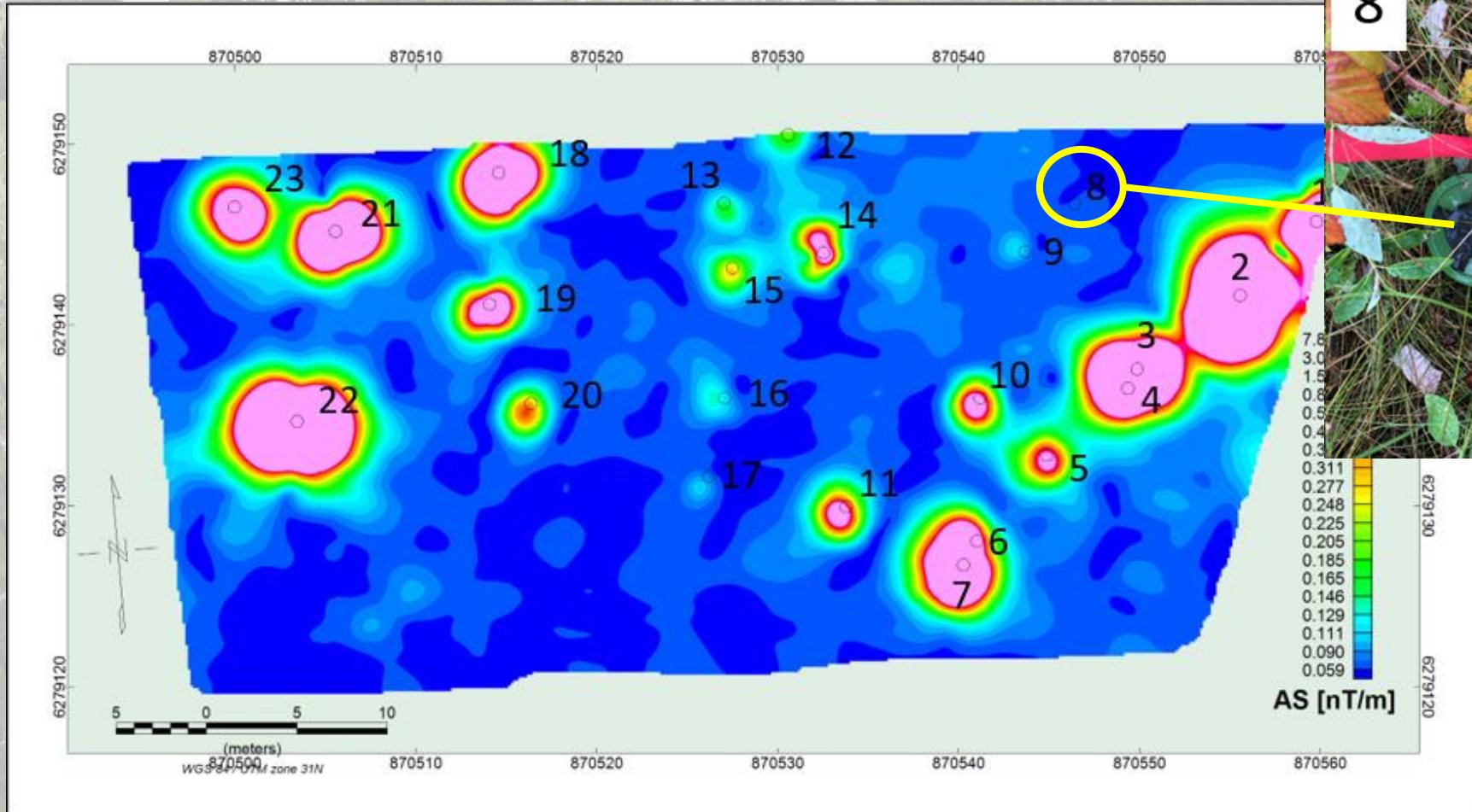


Real targets offshore detection
range test – Baltic Sea







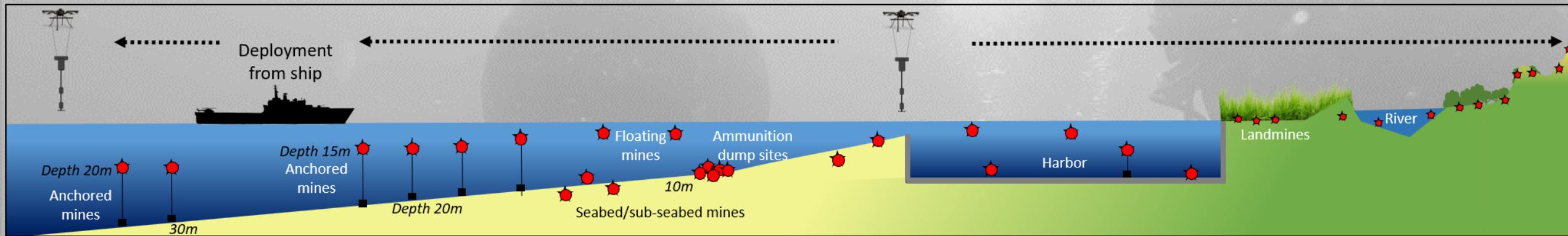


Survey altitude 2m above terrain (lower sensor-to-ground distance)

V2MAG™



One Solution for Onshore
& Offshore Mine Detection



V2MAG™ Reports

Documentation

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V2Mag Drone Magnetic Gradiometer
Onshore UXO Demonstration
Surface Anti-personnel Mines, Anti-tank Munition, and Grenades

V2Mag Drone Magnetic Gradiometer
Offshore UXO Demonstration
Rockan sea mine, Anti-invasion mine, MK82 bomb

V2Mag Drone Magnetic Gradiometer
Onshore UXO Demonstration
Buried Anti-personnel Mines, Anti-tank Munition, and Grenades

V2Mag Drone Magnetic Gradiometer
Surrogate Item Trial (SIT)
A Multi-Altitude and Multi-Target SIT Demonstration
North Sea Geological Background Condition

V2Mag Drone Magnetic Gradiometer
Onshore UXO Demonstration
Modern Warfare UXO in areas with dense grass and vegetation: Anti-personnel Mines, IEDs, Anti-tank Munition, Small Artillery Shells, and Grenades

V2MAG™ Drone Magnetic Gradiometry System
Onshore Archaeology Demonstration

V2MAG™ Drone Magnetic Gradiometry System
Offshore Surrogate Item Trial

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Military UAV magnetic turnkey solution with unrivaled UXO / mine detection capabilities, real-time data, and computer-assisted target analysis



Arne Døssing Andreasen
ada@umagsolutions.com

Drone Magnetic Gradiometry

*System Positioning
Accuracy*

