

WAAM for CCS Monitoring

Active Acoustic CO₂ Leak Detection

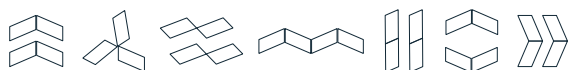
Michael Smith

Imenco Future Technologies



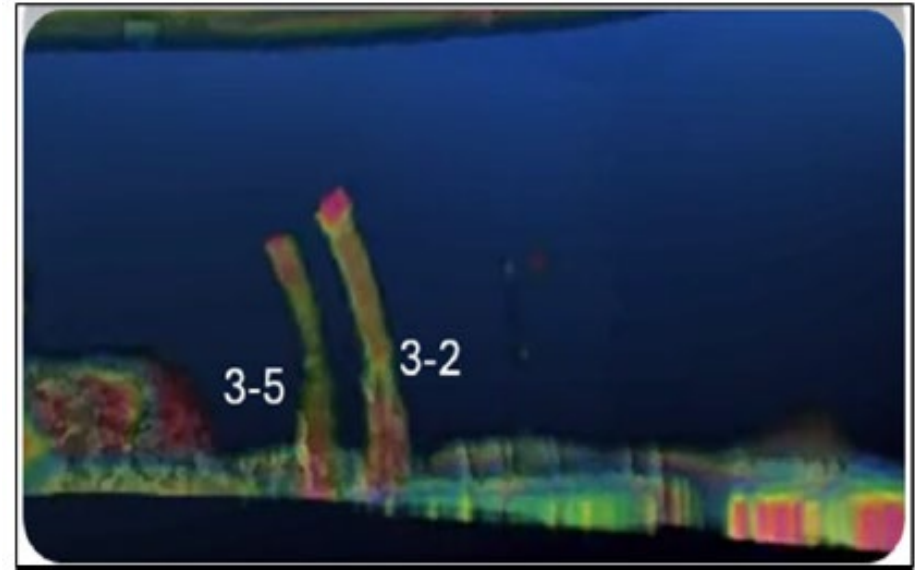
WAAM for CCS Monitoring

- **Wide-area Active Acoustic Monitoring for subsea CO₂ release detection**
- Field-deployed seabed active acoustic monitoring system
- Scans a defined area of the seabed and water column
- Detects, localizes, classifies, and supports quantification of subsea releases
- Applicable to CO₂ transport infrastructure, injection infrastructure, and seabed seepage/leakage
- Provides alarms, visualization, and operator response support

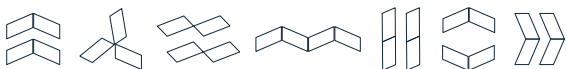


The CCS Release Detection Challenge SMART SOLUTIONS

- Has CO₂ reached the seabed or water column?
- Where is the release originating?
- How is the plume or seepage area developing over time?
- Is investigation, escalation, or corrective action required?
- Monitoring must support evidence-based operator response.



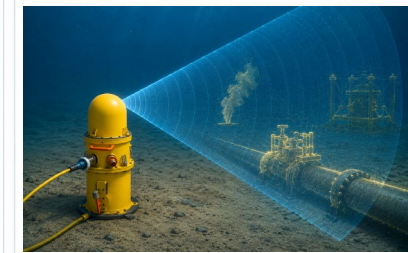
Example acoustic visualization of seabed-originating plume features

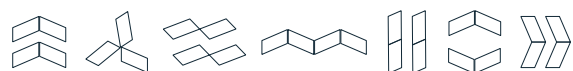


Why Active Acoustic Monitoring?

- WAAM actively scans the monitored volume
- Does not depend on release producing detectable sound
- Provides area coverage, not just point measurement
- Operates independent of light, visibility, turbidity and surface weather
- Builds acoustic volumes for detection, localization and plume visualization

Comparison of subsea leak detection approaches

Point Sensor	Passive Acoustic Monitoring	Wide-area Active Acoustic Monitoring
		
- Local measurement - Single location - High sensitivity at point of placement	- Listens for acoustic emissions - Area influenced by source sound - No active interrogation	- Active scan of defined area - Seabed and water-column coverage - Detection, localization, and plume visualization
 Coverage: Point	 Listening area	 Wide-area scan
 Method: Local sensing	 Passive listening	 Active acoustic scanning
 Output: Detection at point	 Acoustic event indication	 Detection and localization



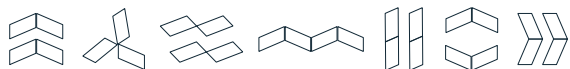
CCS Deployment Applications

Monitoring Locations

- ▀ Transport:
 - ▀ pipelines, jumpers and connection points
- ▀ Facilities:
 - ▀ Injection wellheads, templates, manifolds
- ▀ Seabed:
 - ▀ Legacy wells, pockmarks, seepage pathways

Monitoring Modes

- ▀ Baseline or investigation campaigns
- ▀ Permanent injection monitoring
- ▀ Post-Injection surveillance
- ▀ Event Response Support



Monitoring Outputs

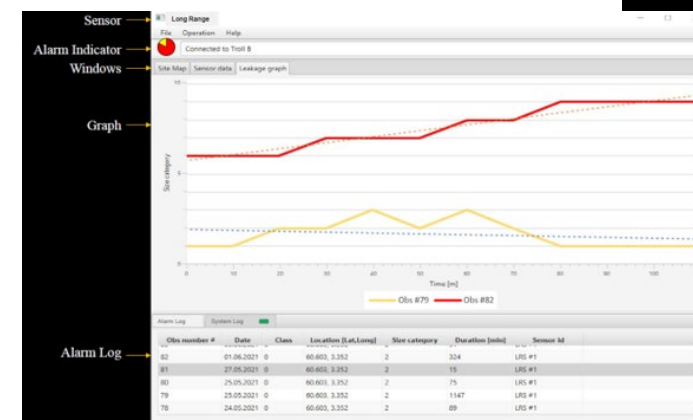
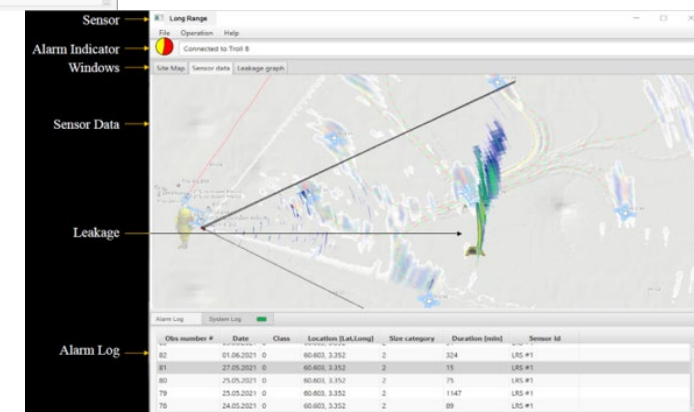
Monitoring Outputs

- Detection of subsea release anomalies
- Localization of release origin or area of interest
- Classification support for CO₂-relevant targets
- Plume visualization and development over time
- Alarm and event outputs for operator response

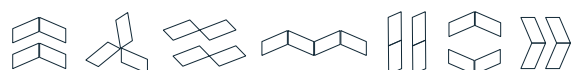


Release location in monitored area

Plume visualization and spatial development



Severity trend and alarm history



Readiness for CCS Monitoring

Field-deployed

- Permanent and temporary subsea integrity monitoring applications

CO₂ relevance

- Active acoustic detection of seabed and water-column release features

CCS deployment ready

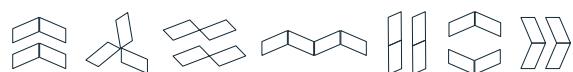
- Standard WAAM architecture configured for the monitoring objective



Permanent Installation



Temporary stand-alone deployment



Questions?

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