



Wireless Coastal Environmental Monitoring

Mark Rhodes
CTO – CSignum
[Stand Q390]



| Wireless Data Through Barriers



CSignum has achieved a significant technological first:
Send digital wireless signals through any medium

Other wireless communications techniques do not pass through the barrier from under the water to above the surface or through the ground

Patented electromagnetic field signalling (EMFS) uniquely travels through sea and fresh water, through soil, rock and across the air/water boundary

22 Patents in electromagnetic field-based communications and data transfer



| How Our Technology Works

Topside



EM Field

Saltwater, Freshwater, Soil, Rock, Concrete

**Below
the Surface**



- CSignum uses patented modulated electro-magnetic fields to achieve wireless communication
- CSignum is unique in communicating from the seabed to the beach, from ship hull to the deck, from riverbed to riverbank and below ground to the surface
- With EM field signaling (EMFS) there is no reflection at the water-to-air interface (as with optical and acoustic systems) allowing the signal to cross the boundary
- Data rates are suitable for bidirectional sensor data transfers at distances up to 50m. Longer ranges of 200m achieved with external antenna sets

The Internet of Underwater Things

- Bidirectional Data Transfer to Toppide devices
- Ship Hull & Propulsion Monitoring
- Coastal and River Environmental Monitoring
- Dual Use for Commercial & Defence

The Internet of Underground Things

- Through Ground Sensor Monitoring
- Sewers, Pipeline, Utilities & Soil Monitoring
- Industrial, Utilities & Mining Applications

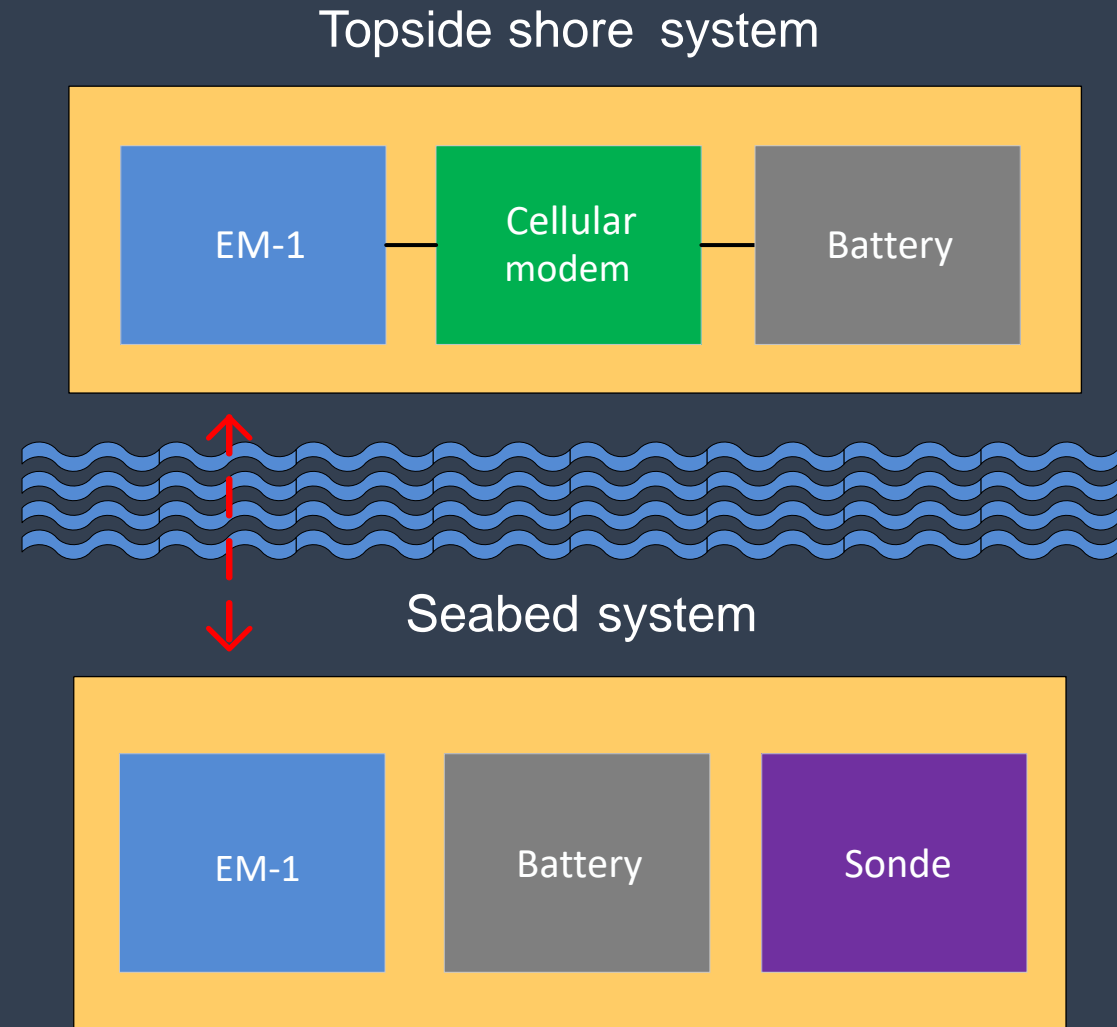
| Electromagnetic communications benefits



- Wireless communications from submerged to air above surface – where client systems are usually located
- No reflections from surface, structures or seabed – shallow water
- Communicates through aeriated water in storm conditions
- Not affected by acoustic noise from piling etc.
- Communicates through ice
- Communicates through the seabed - can be buried
- Not affected by marine fouling of antenna
- Not affected by turbidity (as is optical)
- No known effect on marine life behaviour
- Short range signaling allows independent communication between spatially separated devices – similar to cellular phones

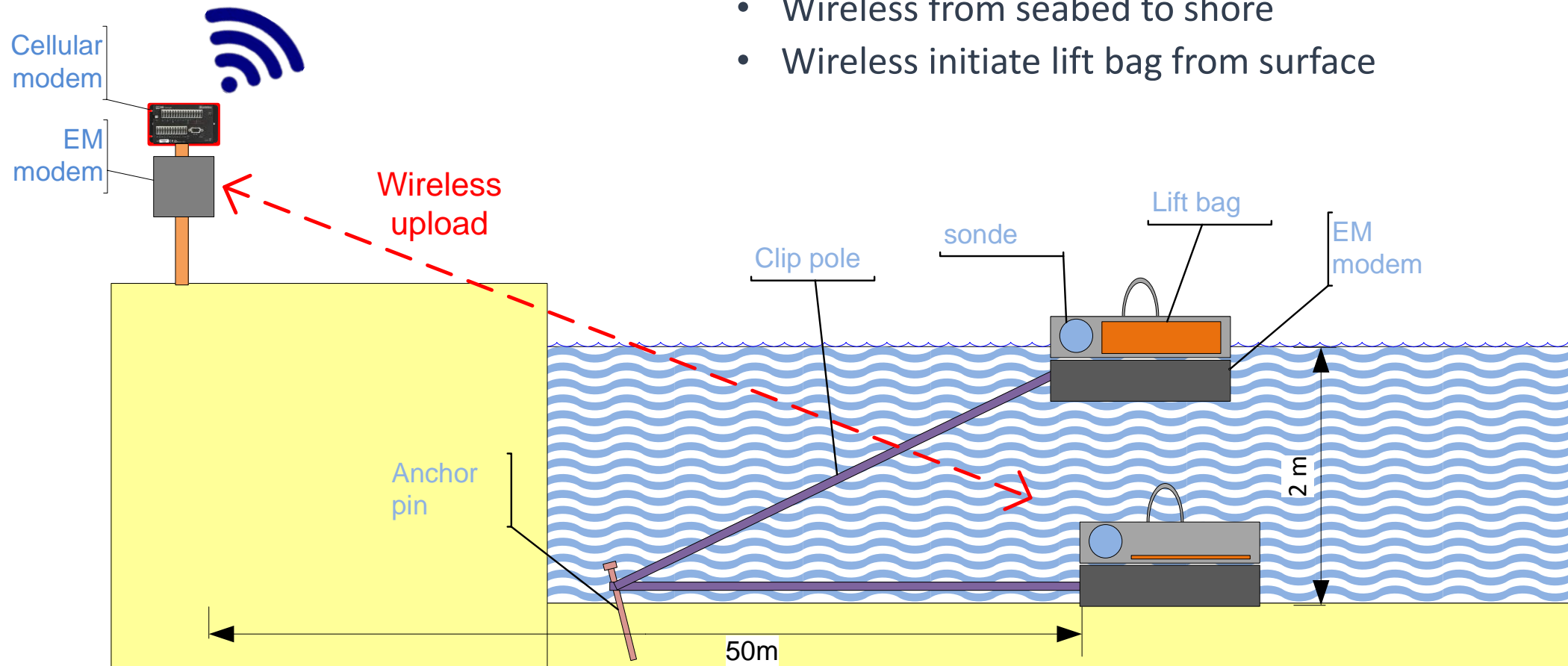
Online coastal environmental monitoring

- Modem and sonde deployed on seabed
- Sonde logs continuous data set (30 mins)
- Upload every hour to topside modem
- Topside uploads to cloud
- Seabed system recovered every 3 months for sonde calibration and battery swap
- CSignum provide full system solution
- Wireless link submerged to topside
- Flexible topside location
- No surface buoy
- Antennas can be buried



Online coastal environmental monitoring

- 1 Hour measure and publish to web
- Wireless from seabed to shore
- Wireless initiate lift bag from surface

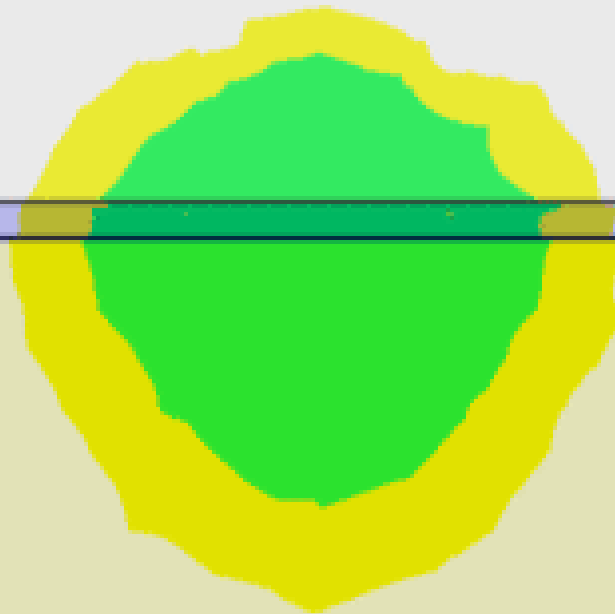


| Automated recovery system



Created using
SIMULIA CST Studio Suite®

B-Field [3.125]	
Orientation	Inside
Component	Abs
Frequency	3.125 kHz
Phase	0 °
Cross section	A
Cutplane at Y	0.000 m
Maximum on Plane (Plot)	1.39295 V.s/m ²
Maximum (Solver)	11.3282 V.s/m ²



- Finite Element analysis of communications range in complex environments
- Green shows operating range with recommended margin. Yellow reduced signal

| EM-1 and EM-2



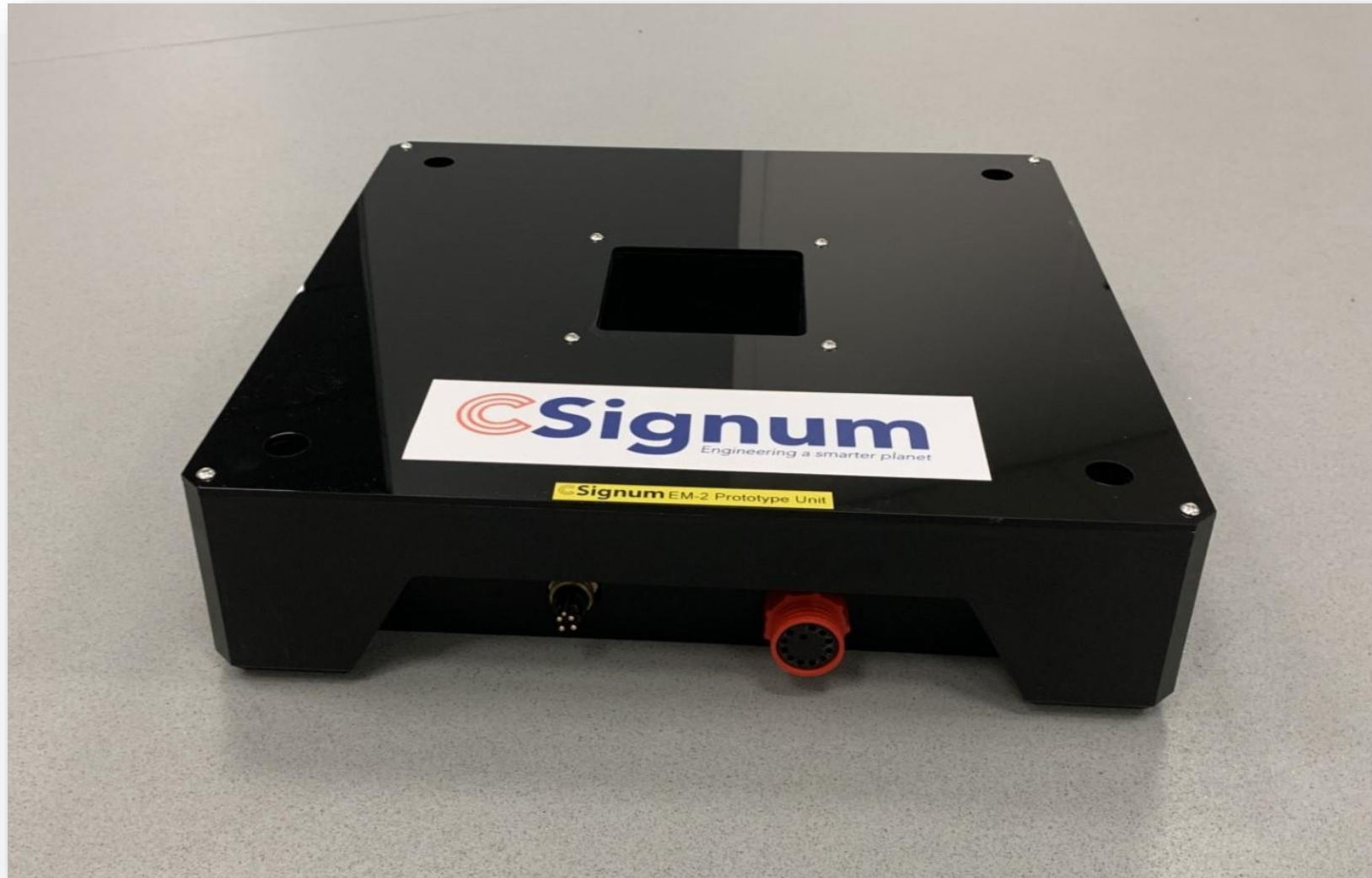
EM-1



EM-2

- Omnidirectional Antenna
- Ultra-low Power
- Networking Capability
- Shallow Water Housing
- Extended Endurance
- Increased Data Rates
- Remote lift bag solution for recovery

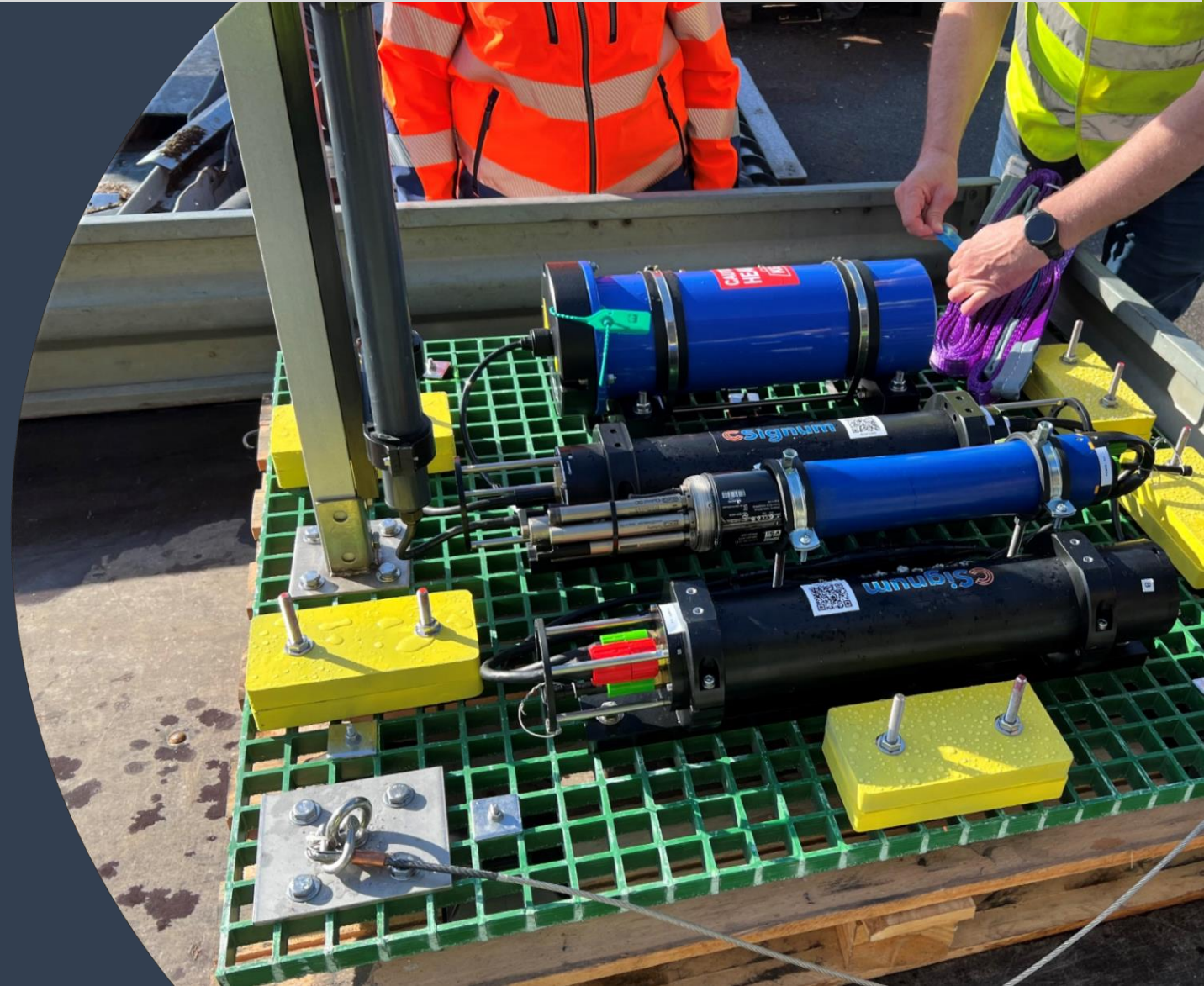
- EM-1 - shipping today, a powerful solution for trials and initial deployments
- EM-2 - compact shallow water monitoring solution released mid 2024
- A significant reduction in capital installation and operational expense vs wired solutions



| Coastal Wireless Monitoring: Ørsted

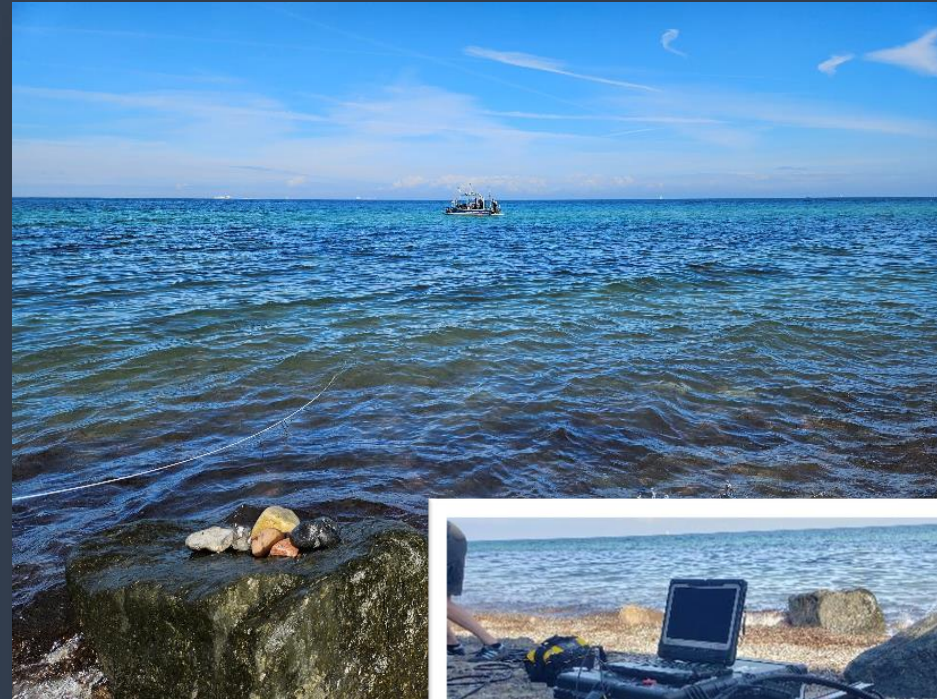


- Environmental monitoring around offshore wind turbines
- Maintenance of cabled sensor systems is complex in offshore environments
- Monitoring of anchors for floating wind turbines
- Deployed pilot system harbour in Denmark
- Water quality sonde measurements communicated from the seabed directly to the quayside



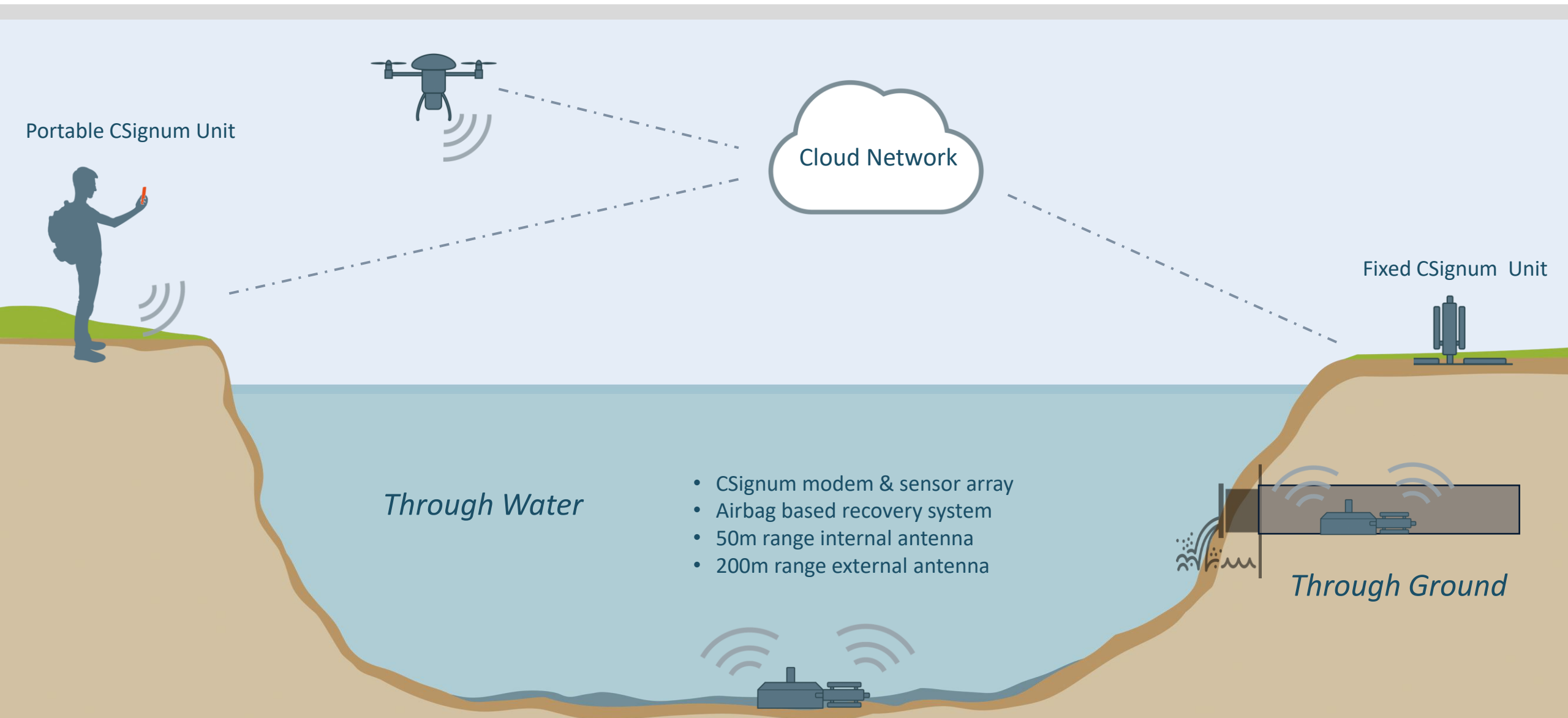
| Baltic Deployment - Surf Zone to Shore

IOW Leibniz Institute for Baltic Sea Research Warnemünde



- EM-1 with external loop antenna
- Extended range up to 200 meters
- Sensor data from seabed to beach or clifftop
- Connect to LTE or satellite services

| Underwater Sensor Monitoring applications





| Breaking through the Barriers

Experience live demonstrations of our EM technology; enabling data transmission from underwater to an external receiver and back, without relying on traditional methods [Stand Q390]