Underwater Gliders: Novel Payloads for Monitoring Anthropogenic Inputs and Impacts

Daniel Hayes, Ehsan Abdi, and many more

Cyprus Subsea Consulting and Services C.S.C.S. Ltd
Who Are We?

• Based in Nicosia, Cyprus
• Founded 2012
• 6 employees + contractors
  • Oceanography
  • Ocean Engineering
  • Maritime Security
• Research Focus
Overview of activities

Research in Marine Science and Technology to advance observational capacity

Sales, rental, support, and operations through a global network of suppliers and experts

Real time data collection: from surface to full ocean depth
## Research Projects

**Gliders and advanced observing methods**

### H2020
- GROOM2 (Gliders for Research, Ocean Observation and Management II)
- TechOceanS (Technologies for Ocean Sensing)
- EU Marine Robots Transnational Access Grant, “Ecosystem profiling with ocean gliders”
- BRIDGES (Bringing together Research and Industry for the Development of Glider Environmental Services)

### NSF
- Development of a Carbon Dioxide Seaglider (University of Alaska Fairbanks)

### RIF Cyprus
- OS Aqua (Open Sea Aquaculture in the Eastern Mediterranean)
- STEAM (Sea Traffic Management in the Eastern Mediterranean)
- SMART CABLES (Smart Standardized Marine Sensor Cable Interface)

### Martera ERANET-cofund
- PIMEO-AI (Pollution Identification, Mapping, and Ecosystem Observation with AI-powered water quality USV)
- BioGlider: Autonomous Exploration and Monitoring of Marine Ecosystems
Areas of Expertise
Operations, maintenance, support, development, analysis

- **Autonomous Vehicles:** for ocean conditions, acoustic monitoring.
- **Fixed Buoys:** for ocean conditions and acoustic monitoring.
- **HF Radar (over the horizon):** for ship tracking, currents, waves.
- **Drifting and/or profiling buoys:** for search and rescue, currents.
- **Operational Oceanography:** for search and rescue, current prediction for pollution. Monitoring and forecasting of ocean in real time.
- **Ocean acoustics:** for quantifying noise levels, marine mammal presence and identification, ship detection, fish and bubble detection.
- **Remotely-Operated Vehicle (ROV):** for inspection, search and recovery.
Cyprus Subsea’s SIRMA™

- Smart Interoperable Real-time Maritime Assembly
- Variety of interchangeable modules
  - Processing modules
  - Protocol modules (RS-323, 485, 422, Ethernet, USB, CAN-bus)
  - Power modules (step-up, step-down, protection circuit)
  - Miscellaneous modules (ADC, memory, Real-time clock, etc.)
- Pressure tolerant
- Customizable connector/pin-out
Cyprus Subsea’s Glider Fleet

- FOUR Seagliders
- 1000 m rated
- CTD, DO, Fluorometers
- Rent as a service, with customizable payloads
Example 1: pCO2 (CH4 next)

- 4H-Jena (Contros) HydroC
- Seaglider with SIRMA
- Technical trials completed 11/21 (CY)
- Scientific trials 4/22 (AL)
Example 2: UVP6

- Akvaplan-Niva (Lional Camus) and CNRS-SU LOV (Marc Picheral)
- Seaglider with SIRMA cable
- Hydroptic UVP6
- Norwegian and Arctic technical trials 5/21, scientific trials 5/22

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Example 3: Passive and Active Acoustics

- **gListen**: hydrophone system designed for glider for passive acoustic monitoring
  - Seaglider with SIRMA
  - Technical and Scientific trials completed 6/21 (UK)

- **DeepEcho**: scientific echosounder designed for glider for detection of fish, plankton, bubbles
  - Seaglider with SIRMA
  - Technical trials completed 12/22 (CY)
  - Scientific trials 5/22 (Polar Front)
Passive Acoustics

- Seaglider with SIRMA inside glider
- Ocean Sonics icListen (Kayak next)
- Analyzes, transmits acoustic spectra
- Near-real-time event detection
Active Acoustics

- Kongsberg Simrad WBAT mini-ek80
- First scientific wide-band echosounder on glider
- Modified electronic boards to fit a pressure housing

*This experiment was jointly carried out with UCY*
Big Picture-Impact

- Biogeochemical, physical
- Depth / bathymetry features
- Zooplankton (optical/acoustic)
- Fish (larvae + juveniles)
- Gas release (natural, human)
- Ecosystem, behavioural studies (mammals + prey)
Conclusions

• Ocean gliders complement ocean monitoring of pollution inputs and impacts
  • High persistence, high resolution, quiet acoustically
  • Taking the sensors away from surface, down to 1000 m

• pCO2
  • Coastal carbon processes can be observed in 3-D over long periods. [input]

• UVP6
  • Ecosystem characteristics merged with biogeochemical [impact]

• Passive Acoustics
  • Impacts on marine mammals from noise and other pollution [input and impact]

• Active Acoustics
  • Characterize plankton communities and biomass [impact]
  • Characterize gas seeps [input]
Thank you

• Daniel Hayes, Managing Director, hayesdan@cyprus-subsea.com
• And the whole team!