Autonomous Robotics Ltd

Efficient OBN Seismic Survey

Autonomous Robotics Ltd

- Autonomous Robotics Ltd (ARL) was set up in 2013 to develop autonomous systems
- Currently in the development phase of a Flying Node solution for OBN data collection
- Key Commercial Markets:-
  - Ocean Bottom Seismic
  - Underwater Environmental Data Collection

The Challenge of Acquiring Ocean Bottom Seismic

- Ocean Bottom Seismic provides excellent data quality but at relatively high cost.
- Today, deep-water OBS still relies upon ROV deployment of nodes
- Slow D&R rates of ROV deployment lead to lengthy & expensive surveys.
- Cabled nodes provide a cheaper alternative in shallow water. But with compromises on the positioning accuracy compared to ROV placed nodes.
- **How can we substantially reduce the cost of OBS without reducing the quality?**

Animation

- Flying Node Animation and Trials Video

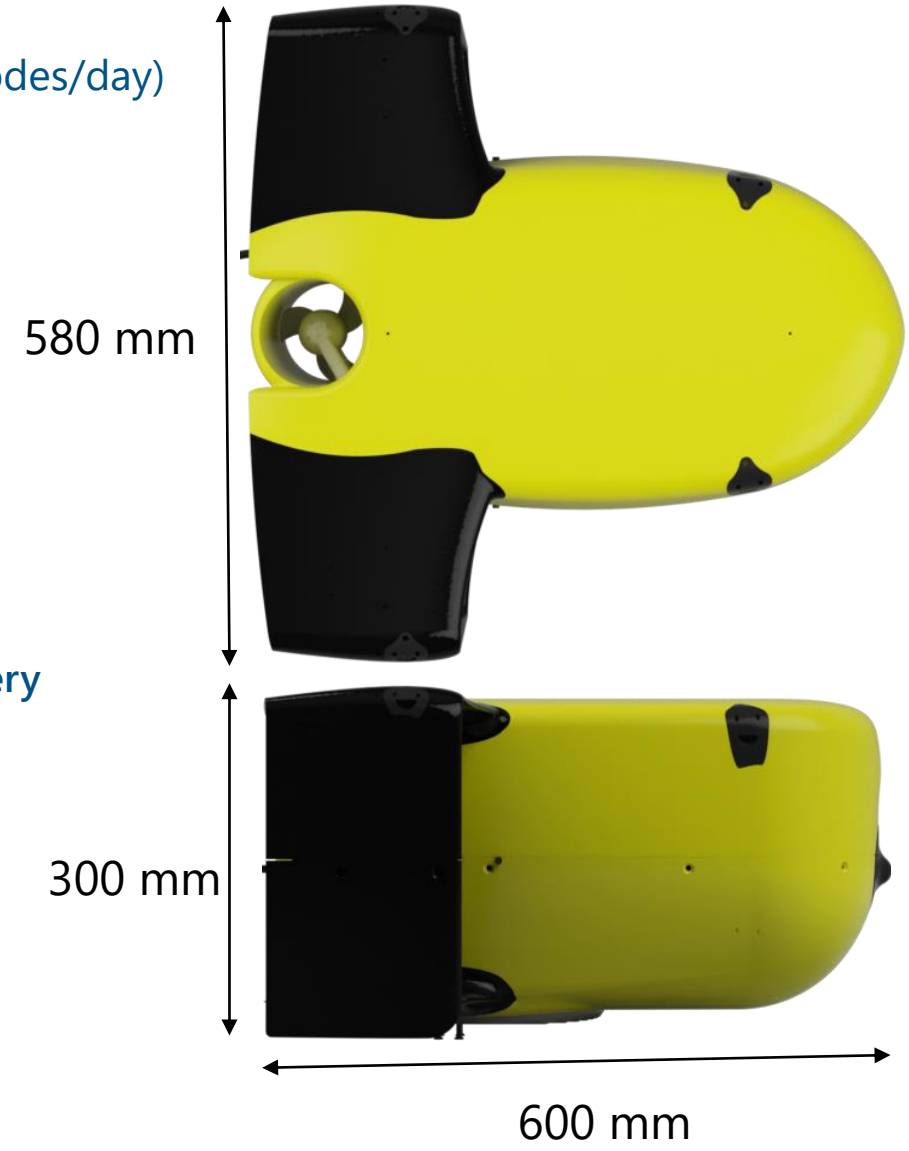
Key Features and Specifications - **Flying Node System**

SYSTEM

- Deployment & Recovery rates of at least 50 nodes / hour (1,200 nodes/day)
- Positioning accuracy similar to ROV deployed nodes
- Ability to deploy multiple receiver rows in a single vessel pass
- Maximum sea state: **Sea State 5**
- Maximum surface current: **3 knots**

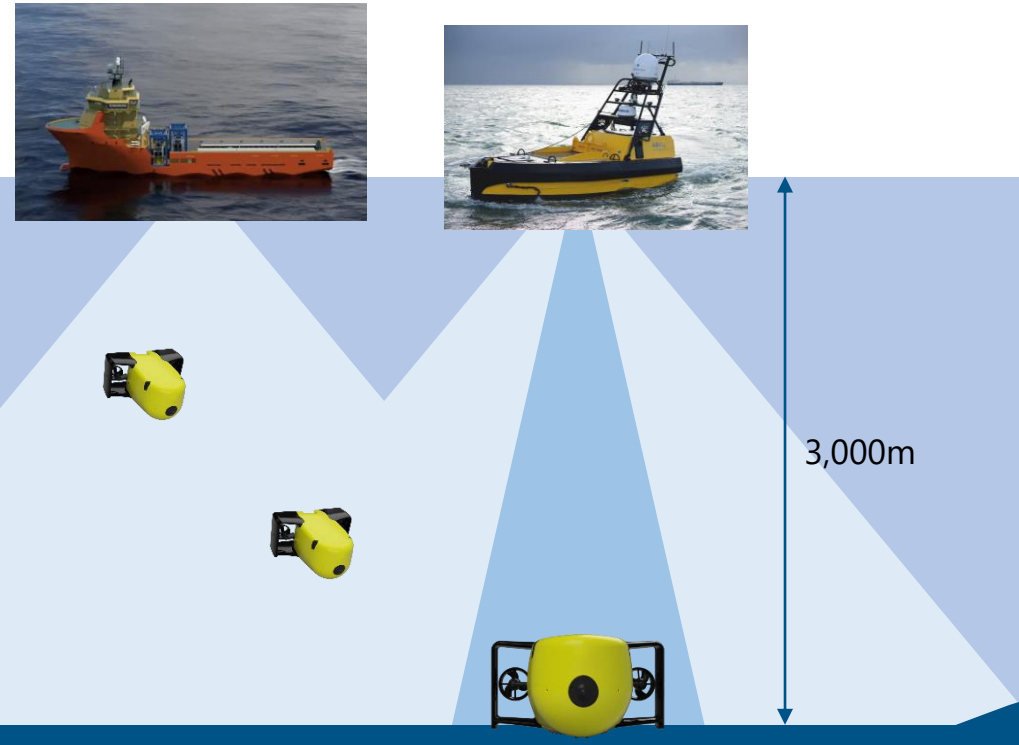
NODE

- Weigh in air: **35kg**
- Weight in water: **Heavy on seabed, neutral during deployment/recovery**
- Seismic sensors: **3 x geophone, 1 x hydrophone**
- Maximum seabed current: **1 knot**
- Maximum recording duration: **60 days (at 3,000m depth)**
- **Dimensions:** L = 600, W = 580, H = 300 mm



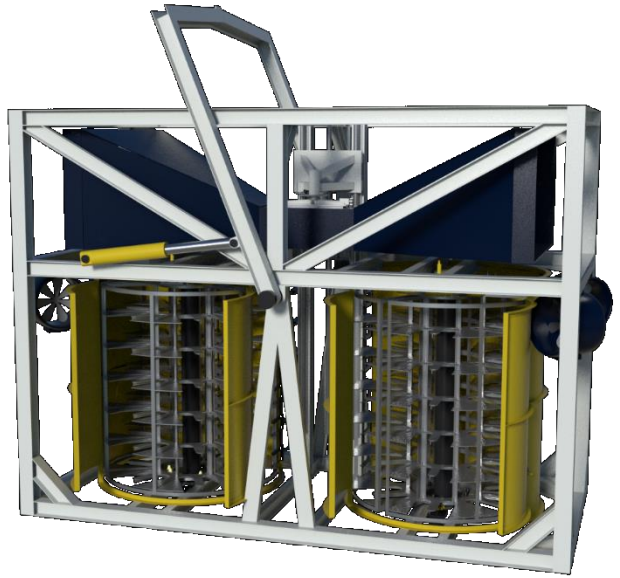
Technology Overview - **Positioning the Flying Nodes**

- Two Ultra Short Baseline (USBL) acoustic positioning systems utilised:
- One on the node vessel, a second on the Unmanned Surface Vessel (USV)
- USV is positioned over the nodes as they touchdown to provide good positioning accuracy
- Similar system been trialled for pipeline touchdown monitoring
- Match positioning accuracy of ROV deployed nodes



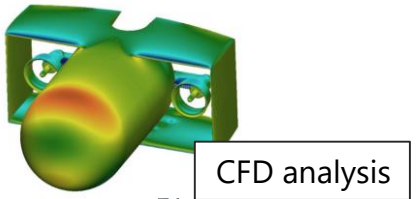
Technology Overview - **Deployment & Recovery**

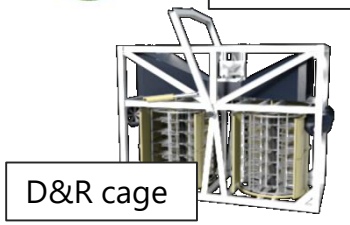
- Concept for the deployment & recovery system developed which enables a 50 nodes/hour deployment & recovery rate using a dual deployment/recovery system.
- A cage, similar to an ROV garage, with dual carousel storage sorts nodes subsea simplifying deck handling operations.
- Allows use of proven ROV Launch and Recovery System (LARS) technology

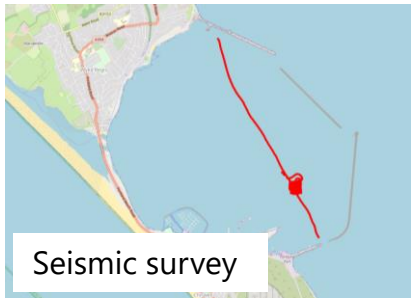


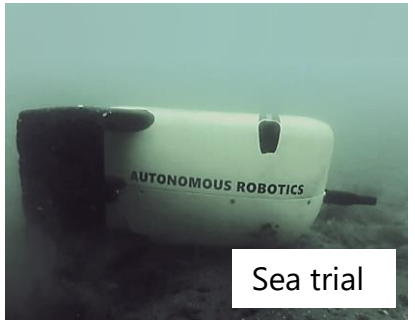
Technology Readiness

- Survey modelling developed, demonstrating the economic benefits of using Flying Nodes.
- Requirements and concept of operations for the system derived from this modelling.
- Feasible concepts developed for all parts of the system, including:
  - Accurate navigation for a large number of nodes
  - Deployment & Recovery
  - Deck handling systems and node storage
- Prototype node built to demonstrate Flying Node concept.
- Demonstrated autonomous flight of node during sea trials with node landing and taking off from seabed.
- Performed a seismic field trial which successfully demonstrated the nodes' ability to acquire high quality OBN seismic data.


CFD analysis


D&R cage


Seismic survey



Sea trial

Summary

Autonomous Robotics Ltd

- Flying Node solution for efficient Ocean Bottom Seismic acquisition
- Proof of Concept stage completed
- The key advantages of Flying Nodes are:
  - Reduction in survey costs – less than half the cost of ROV deployed nodes
  - Excellent positioning accuracy and data quality.
  - Operation in water depths up to 3,000m
- Nine patents filed protecting the technology