Requirements and Initial Testing of an Inspection Class ROV as a Benthic Habitat Inspection Tool

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Outline

- Introduction
- Existing Tools for Benthic Mapping
- Using the Falcon ROV
- Challenges Faced
- Conclusions and Future Work

Introduction

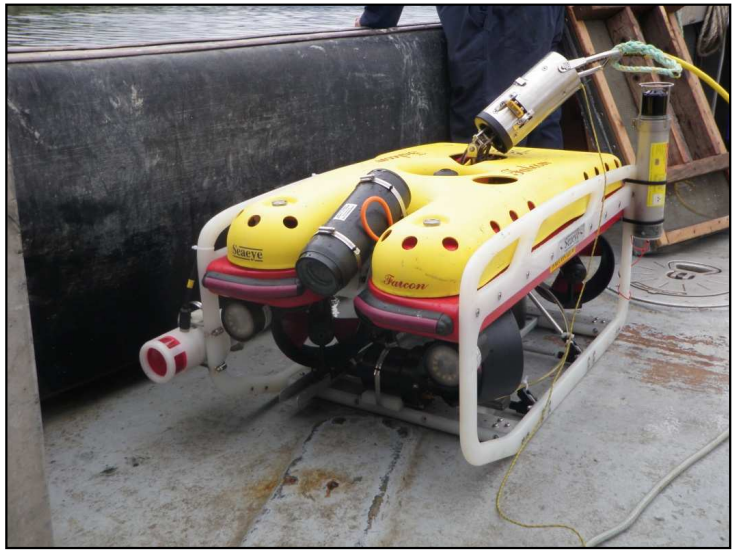
- **In 2010, the Autonomous Ocean Systems Lab at Memorial University acquired a Seaeye Falcon ROV**

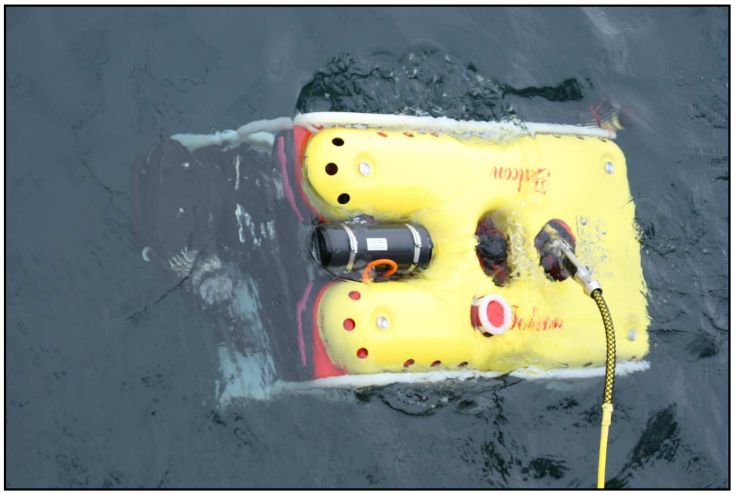
- **The Falcon ROV will be used by the lab to develop new autonomous control systems for underwater vehicles.**

- **In August, an invitation was made for the ROV to attend a research cruise in Northern Labrador on the MV What's Happening**

Seaeye Falcon ROV

Depth Rating	300m
Umbilical	500 m (fiber optic)
Payload capacity	14 kg
Primary Sensor	Colour Video Camera
Secondary Sensors	Rate Gyro Tilt Sensor Depth Sensor Scanning Sonar
Optional Tools	Hydraulic 5 function Manipulator

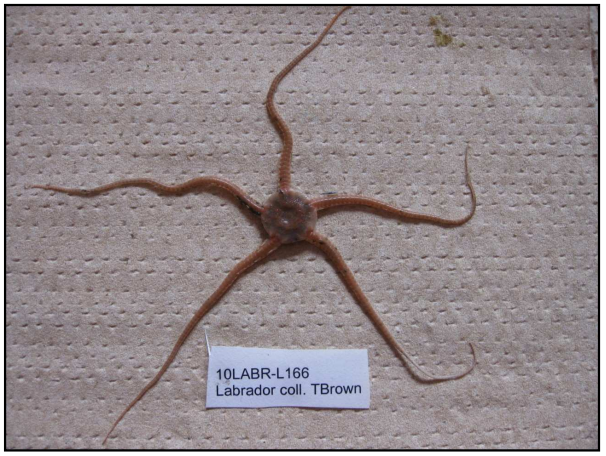




Existing Tools for Benthic Mapping

- Benthic habitat mapping of Okak bay in Northern Labrador has been ongoing fo several years
- Mapping is performed by “ground-truthing” previously obtained multibean backscatter data with box-cores and drop-camera inspections
- How can the Falcon ROV improve these activities, and what kind of ROV control performance is desired or necessary?

What are we looking for?



Requirements

- **Scientists must be able to identify and count species, thus video data must be slow moving, well lit, and low-altitude**
- **Due to changing bottom slope, light and camera must be able to be changed**
- **Accurate positioning of data is critical; presently, samples are interpolated to 5 m bins**

Advantages of an ROV

- **Variable speed and hovering allows detailed inspection of objects of interest**

- **High maneuverability means exploring into areas unreachable by larger ships (near shore) and areas that are difficult for drop cameras (shear walls or cliffs)**

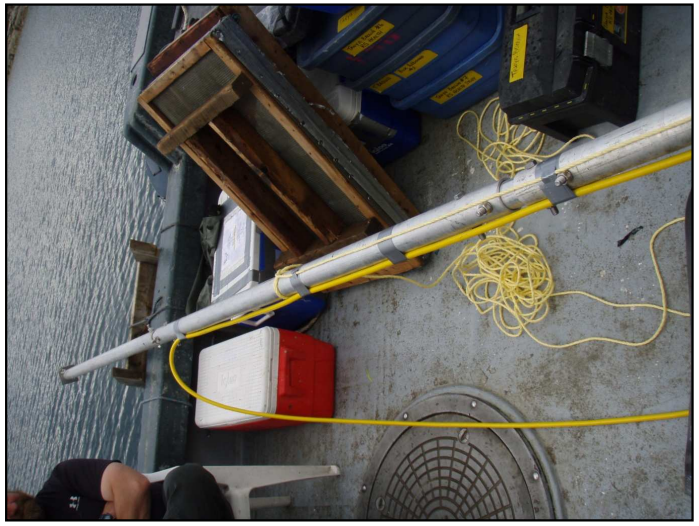
- **Manipulator allows sampling of uncommon species possibly missed in grab samples.**

Falcon ROV Challenges

- **Accurate subsea positioning is always a challenge**
- **Pitch and roll stability is affected by tether length, and optional tools**
- **Data synchronization and logging can be an issue, particularly if ROV console architecture is not “open”**

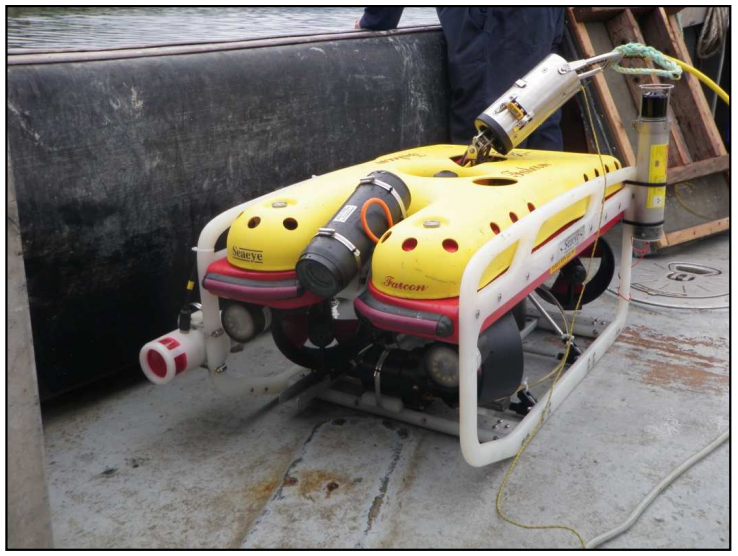
Positioning

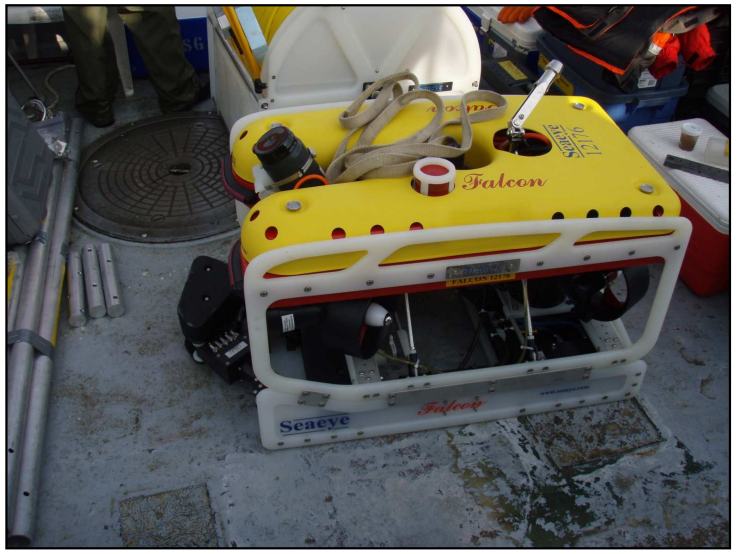
- An Ultra-Short Baseline (USBL) system was used, which required no fixed beacons, and gave ship-relative position
- Used with both pole-mounting and free-hanging deployment
- Results were very promising, although it was shown that further testing and calibration was necessary



Stability

- Due to large number of deployments, we were able to operate the Falcon with and without the manipulator sled
- Without manipulator, performance and control was significantly improved
- Better “auto-pilots” could greatly improve data quality

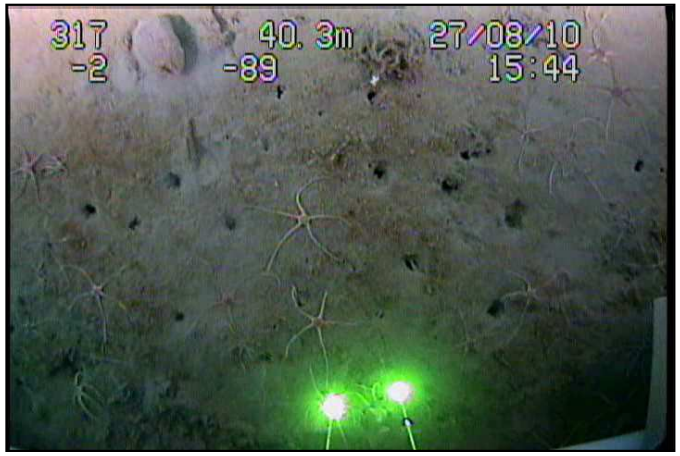




Data Synchronization

- Using an NTP server, all computers were synchronized to GPS time, providing a common baseline
- Video was recorded with time-coding for synchronization
- USBL data was also time synchronized

What did we find?



Sampling with Manipulator

Conclusions & Future Work

- **The Falcon ROV performed extremely well as a benthic habitat mapping tool (ie. scientists were pleased)**

- **Much was learned about the operational constraints, and limitations of the system**

- **Improvements to the ROV are planned, using custom control systems, improved and additional sensors**

Highlights

Questions?