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Technological developments for autonomous platforms in marginal ice zones as part of the COMPASS project

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BACKGROUND:

Autonomous vehicles (AUV) are ideal to survey regions close to ice shelves where it would be too dangerous for ships.

Using AUVs, the COMPASS project seeks to resolve the critical small-scale processes that drive exchange of water masses, heat and freshwater between Antarctic polynyas, ice shelf cavities, the continental shelf, and the open ocean.

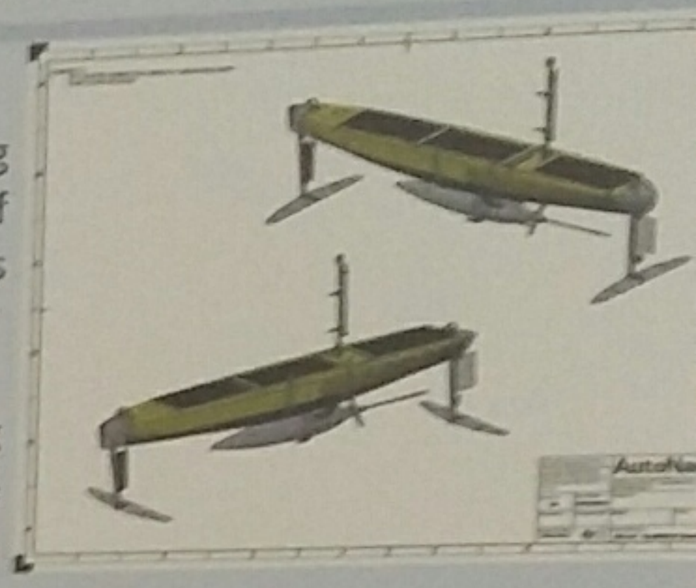
AUVs do not yet have the technological capability to ensure reliable, long term observations near ice.

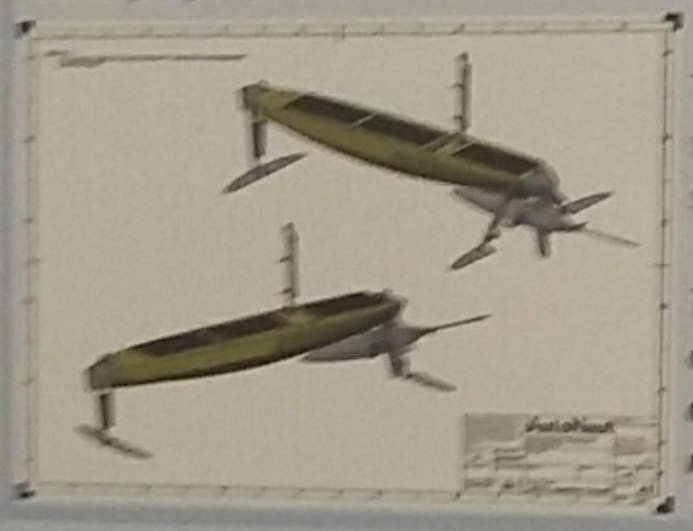
We present three innovations that address this limitation:

The "CLAW":

Ship availability is the largest constraint preventing long-endurance AUV missions. The logistics of arranging both deployment and recovery means AUVs are often deployed for a single cruise only.

The COMPASS team and Autonaut are developing the novel capability to deploy a Seaglider from the wave-propelled surface vehicle AutoNaut.





The Autonaut will rapidly transit to the study si saving glider battery and deploying months befo ships arrive on site.

This Autonaut CLAW will enable season-lo observation of remote regions while providi additional surface and meteorologic measurements.

Ice Avoidance:

During transit, the Autonaut must avoid obstacles:

- Ships can be tracked by AIS.
- Large icebergs and fast ice from remote sensing.
- Floating ice smaller than $1m^3$ will not cause damage.

We have no means of identifying intermediate sized obstacles. Colliding with ice larger than $1m^3$ would be equivalent to jogging into a brick wall.

We will use a small, low power, sensor such as the Gemini multibeam sonar to avoid obstacles within a 200m range. As both ice and the Autonaut primarly drift with surface currents, surface ice can be treated as a static object.

The sonar output will be processed in real-time on-board to provide instant instructions to the Autonaut.

Anti-ice coatings:

Long periods exposed to freezing winds and sea spray risk accumulation of ice on the Autonaut. This can jeopardize sensors and the vehicle's self-righting ability. We tested different anti-icing coatings for the Autonaut using a rotating rig and spray system in UEA's Roland von Glasow Air-Sea Ice Chamber. ***We tested bare metals, plastics, anti-fouling and hydrophobic coatings, for ice accretion rates and tensile strength.***