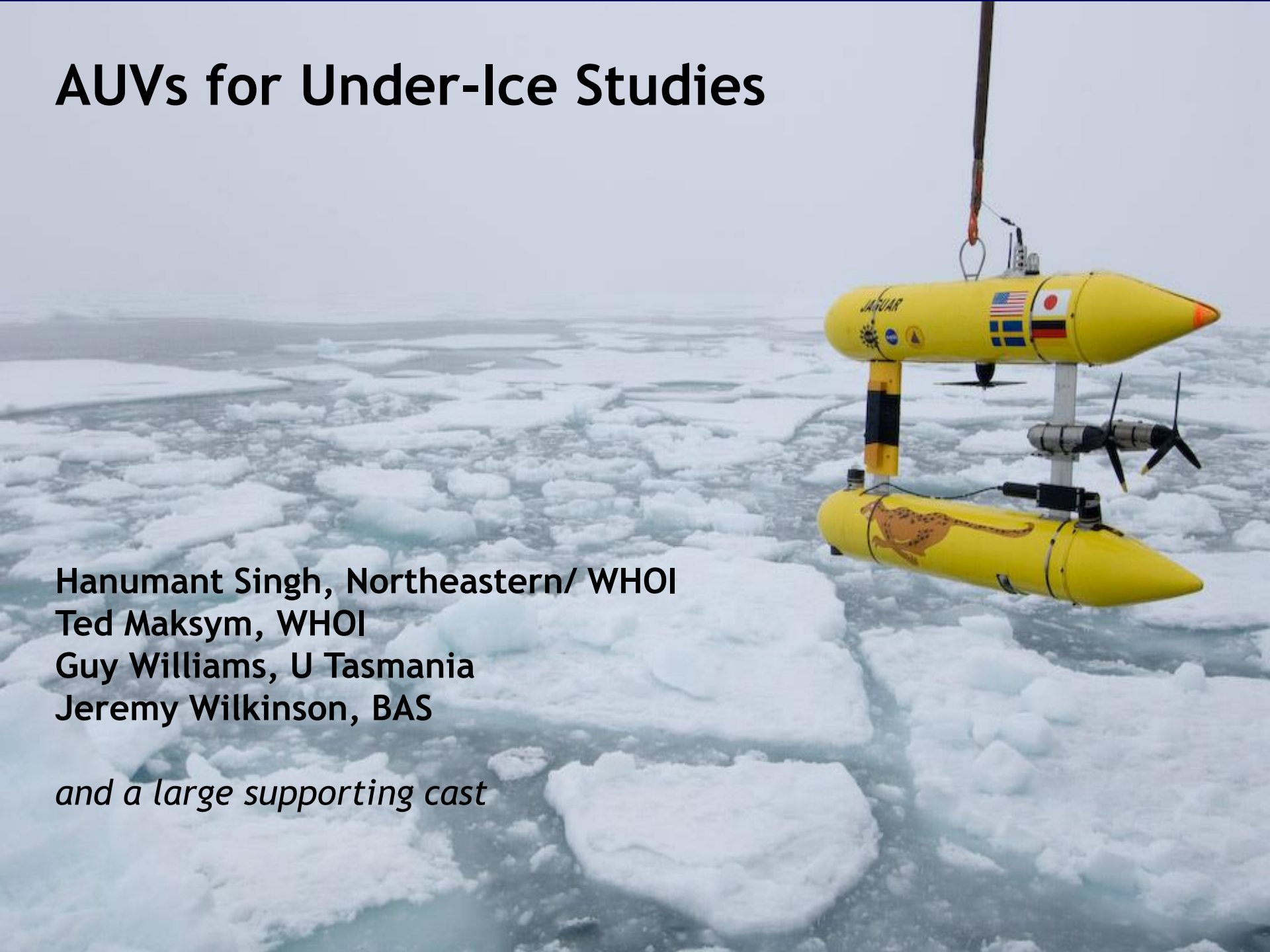
AUVs for Under-Ice Studies



Hanumant Singh, Northeastern/ WHOI
Ted Maksym, WHOI
Guy Williams, U Tasmania
Jeremy Wilkinson, BAS

and a large supporting cast

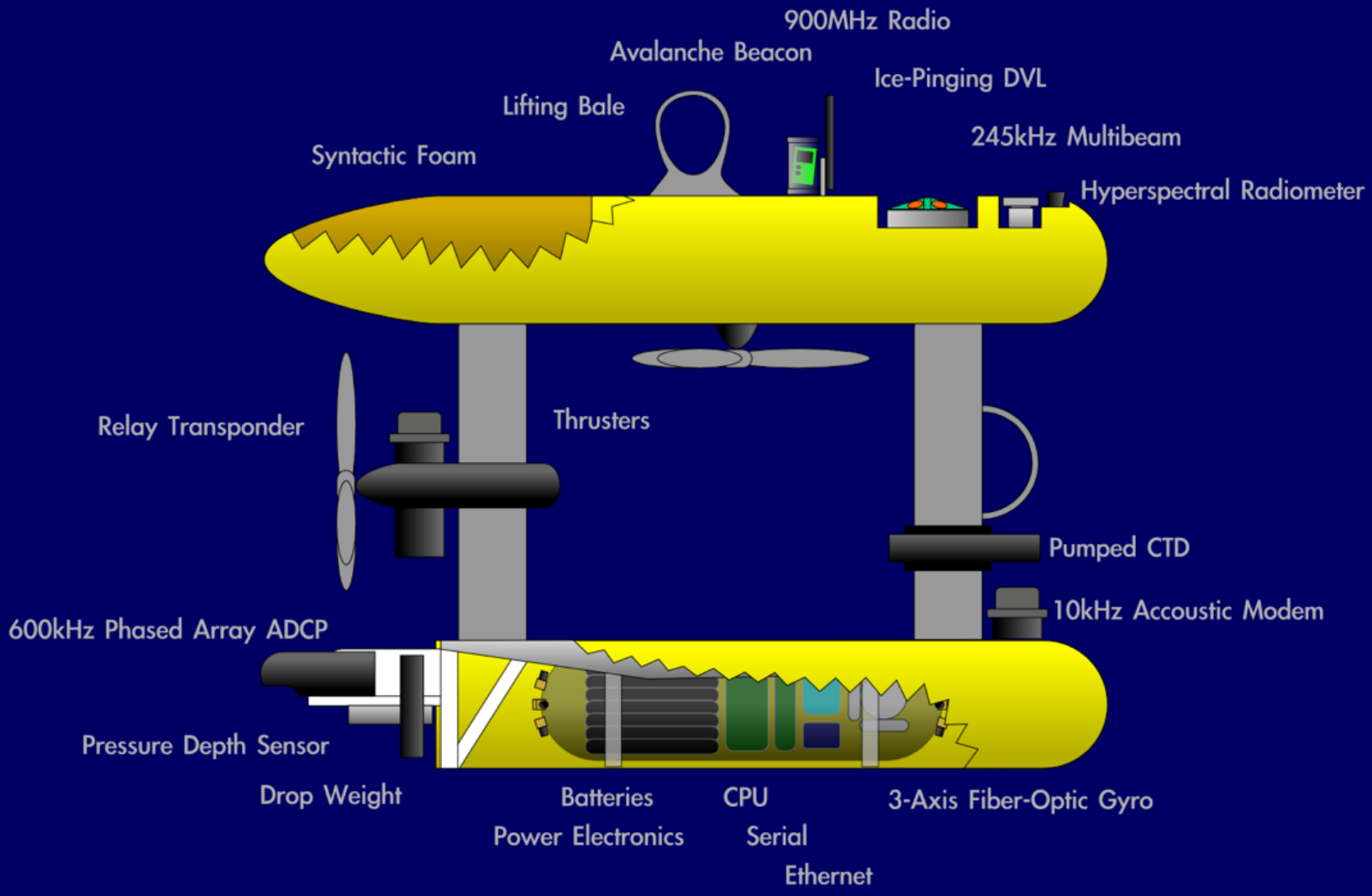
2007 Gakkel Ridge Expedition

***Science**: To study the geological, chemical, and biological characteristics of hydrothermal venting on the Gakkel Ridge.*

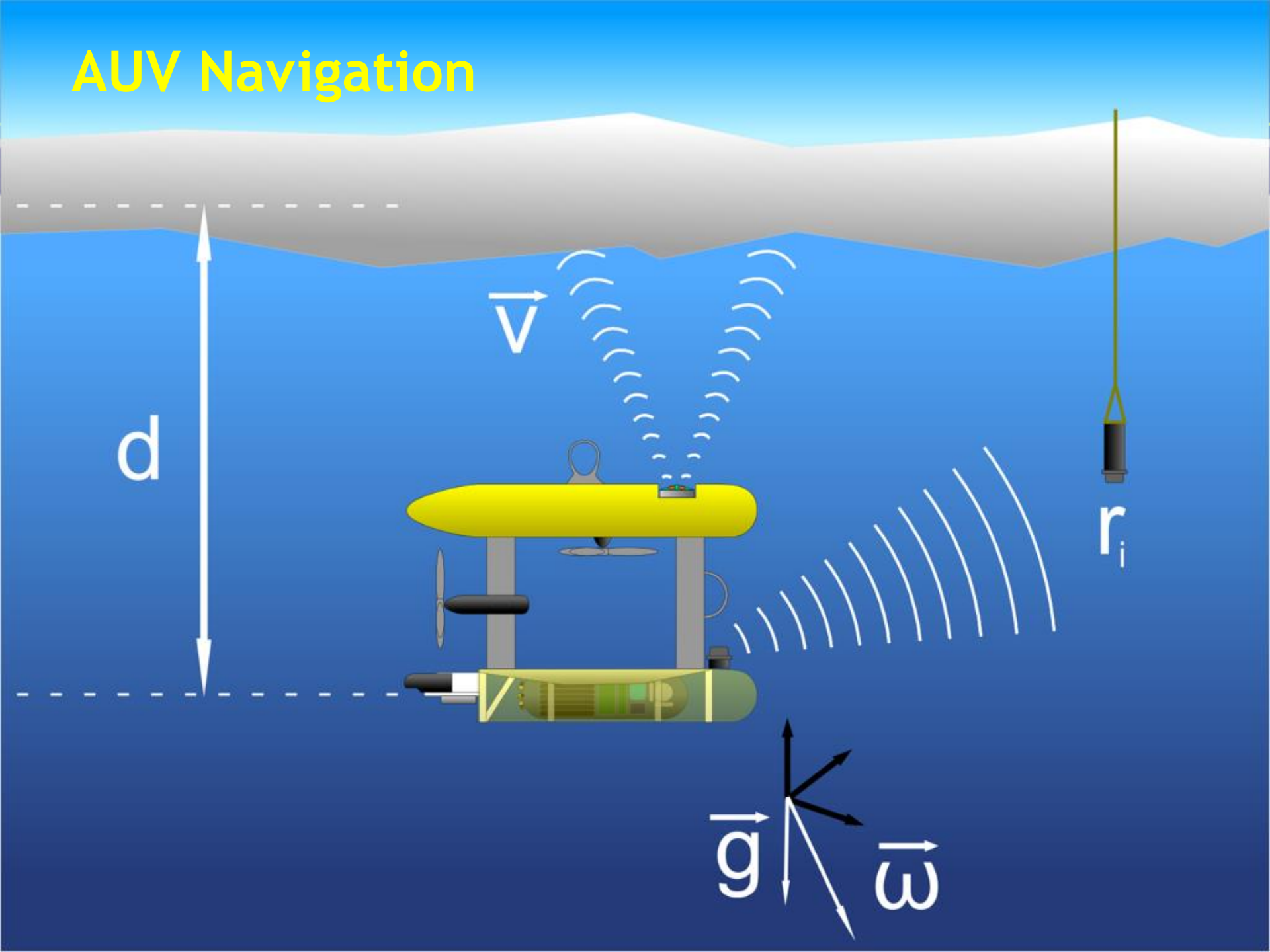
***Engineering**: To develop new technologies to enable deep-sea research in ice covered oceans.*

2017 PIPERS cruise Antarctica
2015 ONR Arctic Sea State Initiative
2014 Antarctic Invasive Crab Species
2013 Greenland Glacier Mapping
2013 Oil Spill Response Under-Ice
2012 Oil Spill response demonstration in Lake Huron
2012 Sea Ice Characterization Fram Strait
2012 Unmanned Aerial Survey, Qaanaaq, Greenland
2010 Icebell Sea Ice Mapping, BAS

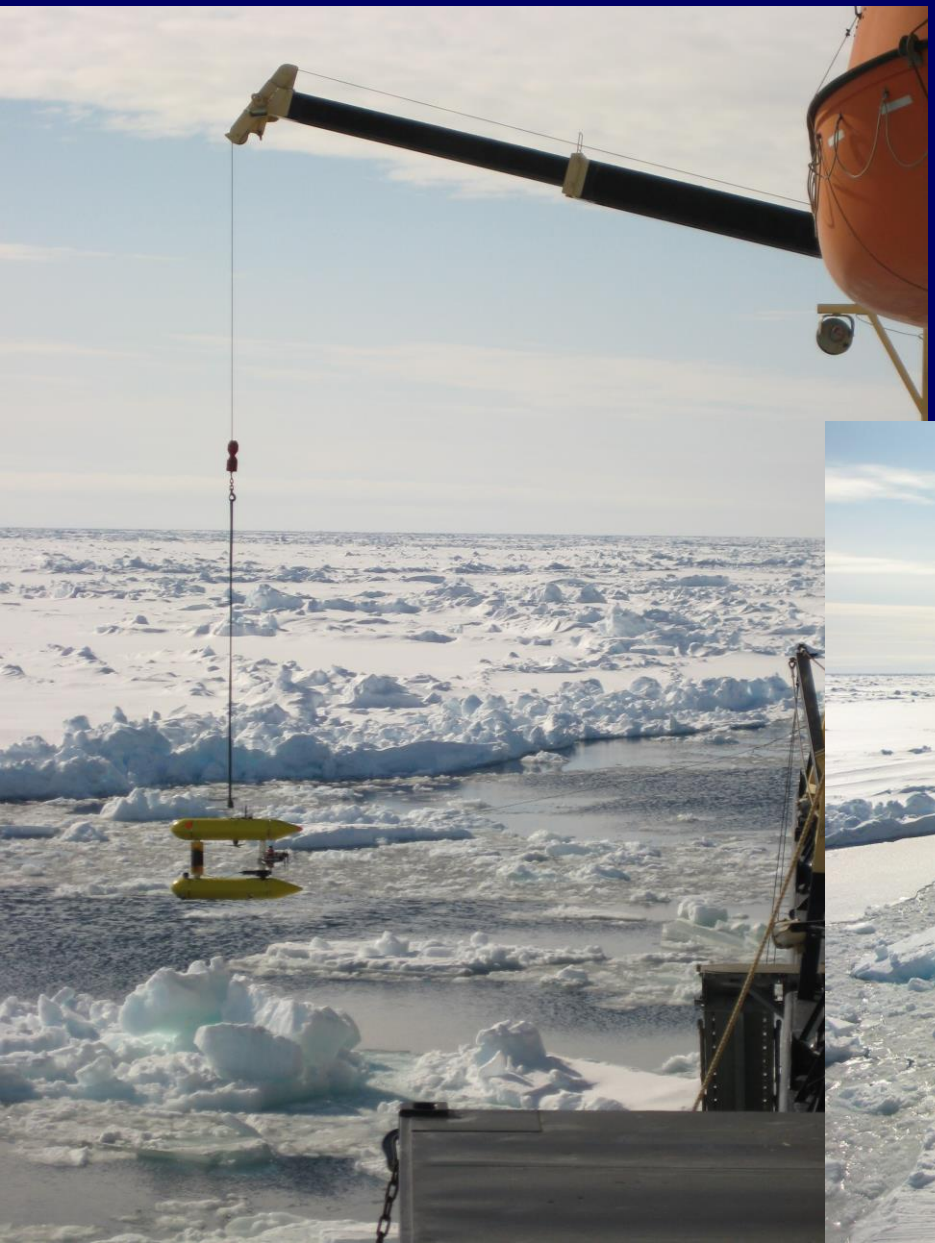
The Jaguar AUV



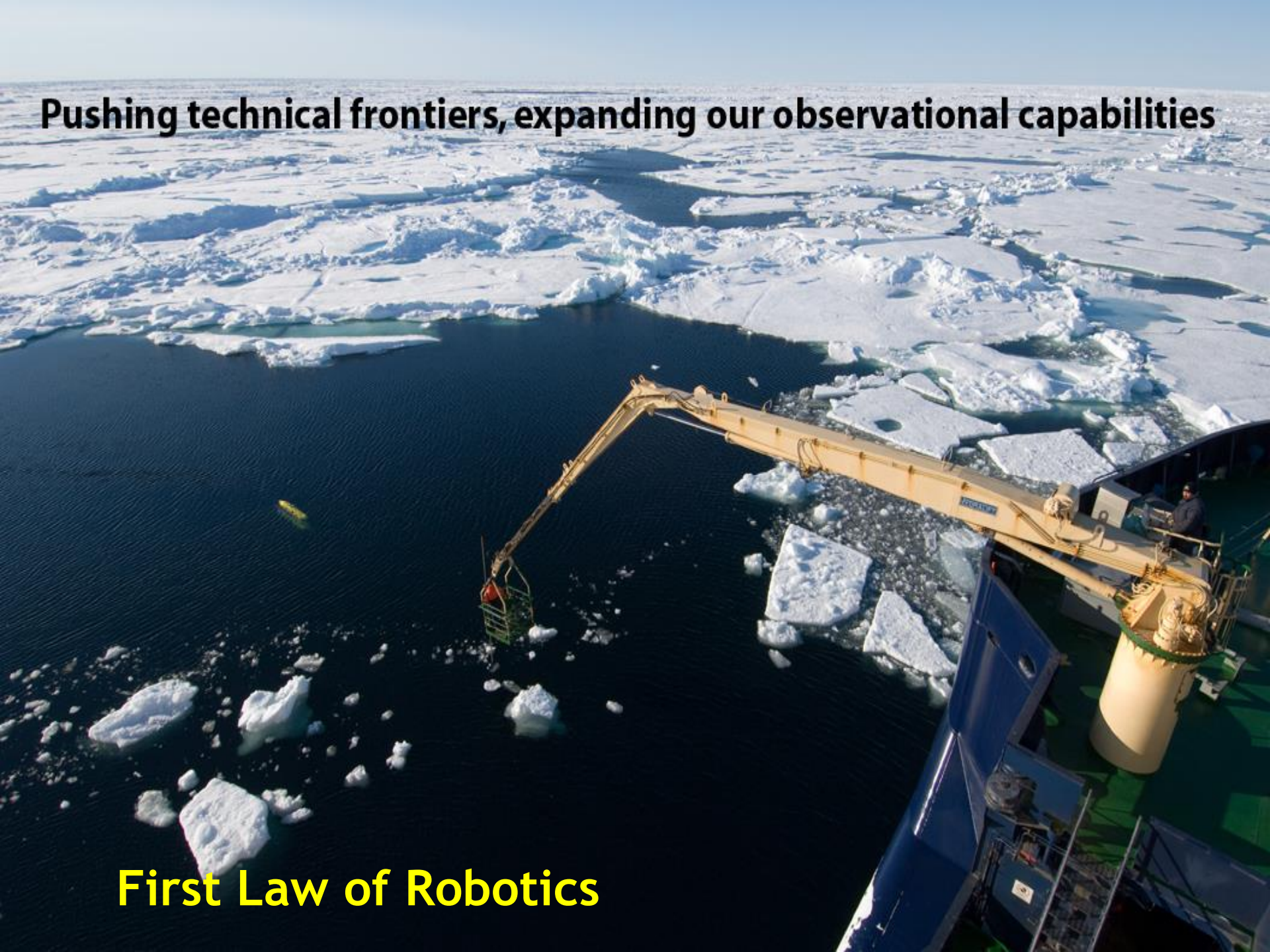
AUV Navigation



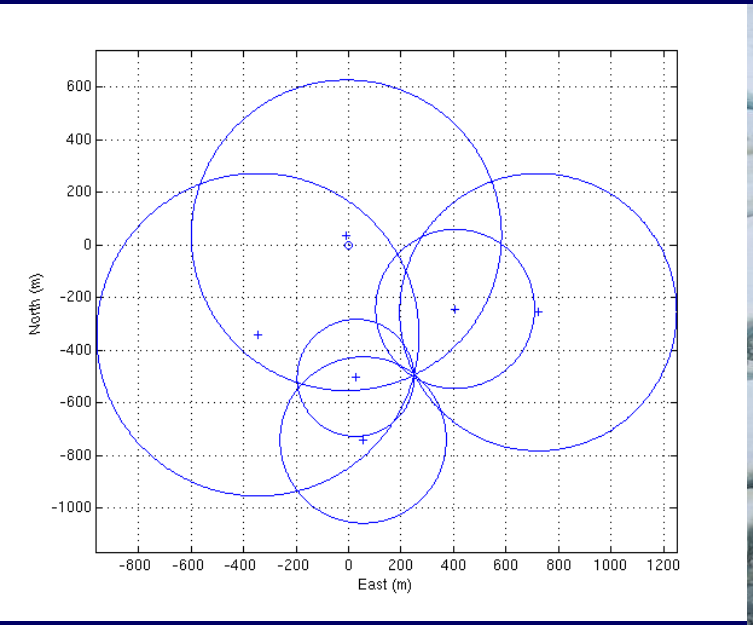
Issues: Good and Not so Good



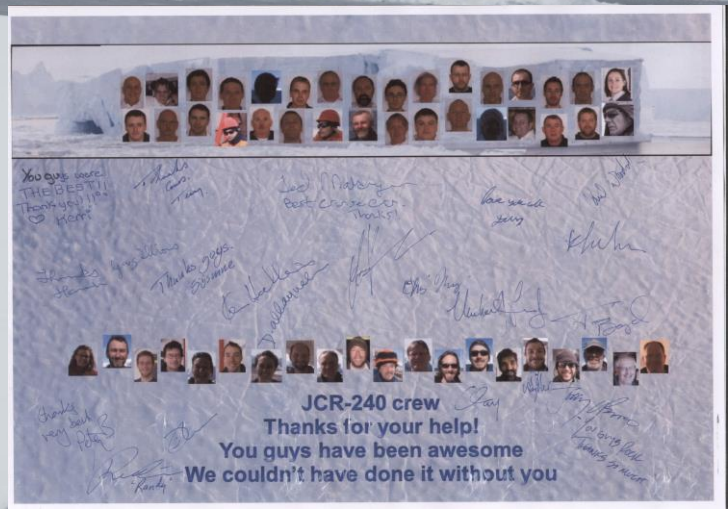
Platforms
Underwater Communications
Under-ice Navigation
Movement of Ice
Acoustically quiet
Minimal Wave Motion


Pushing technical frontiers, expanding our observational capabilities
First Law of Robotics

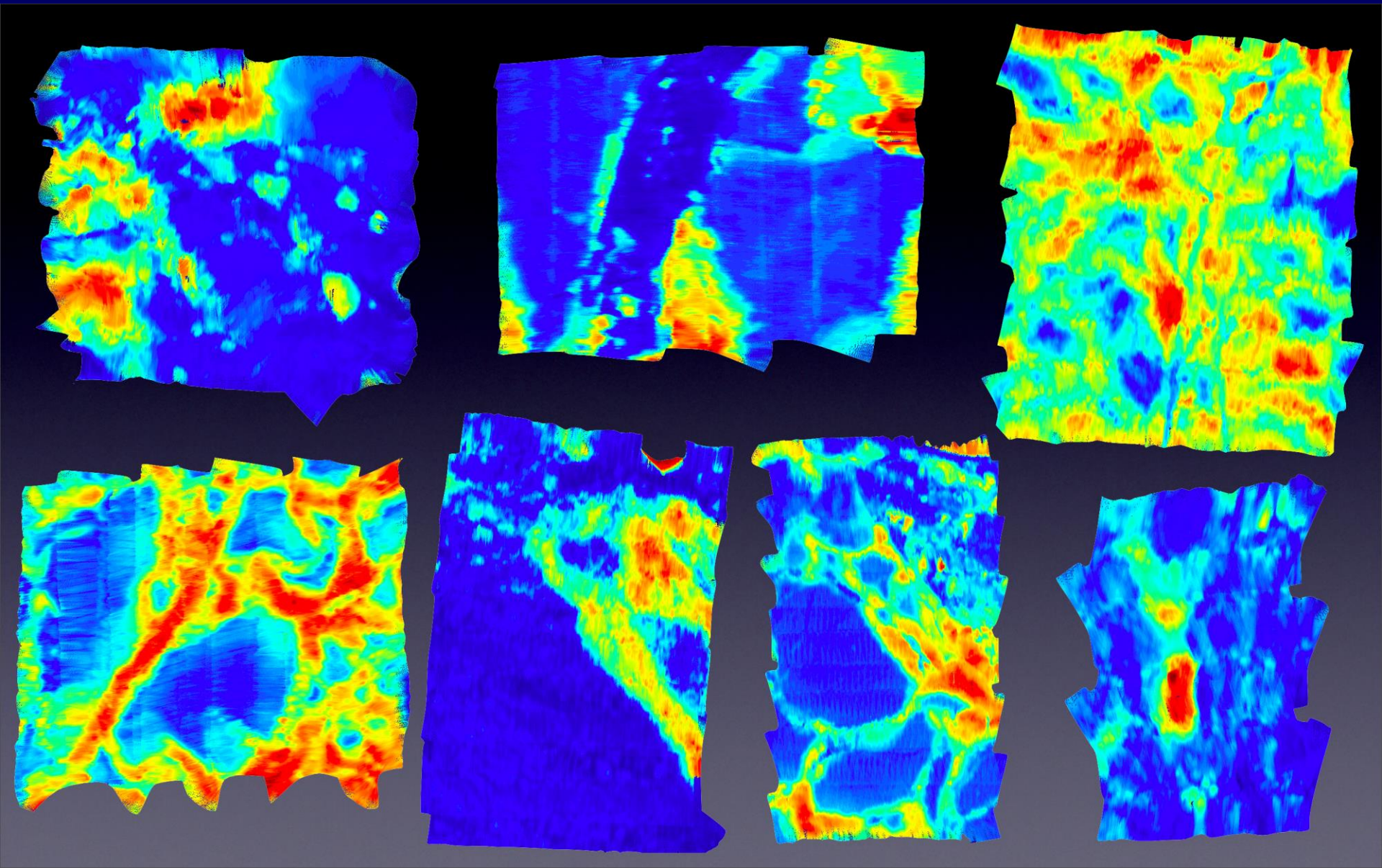
Second Law of Robotics



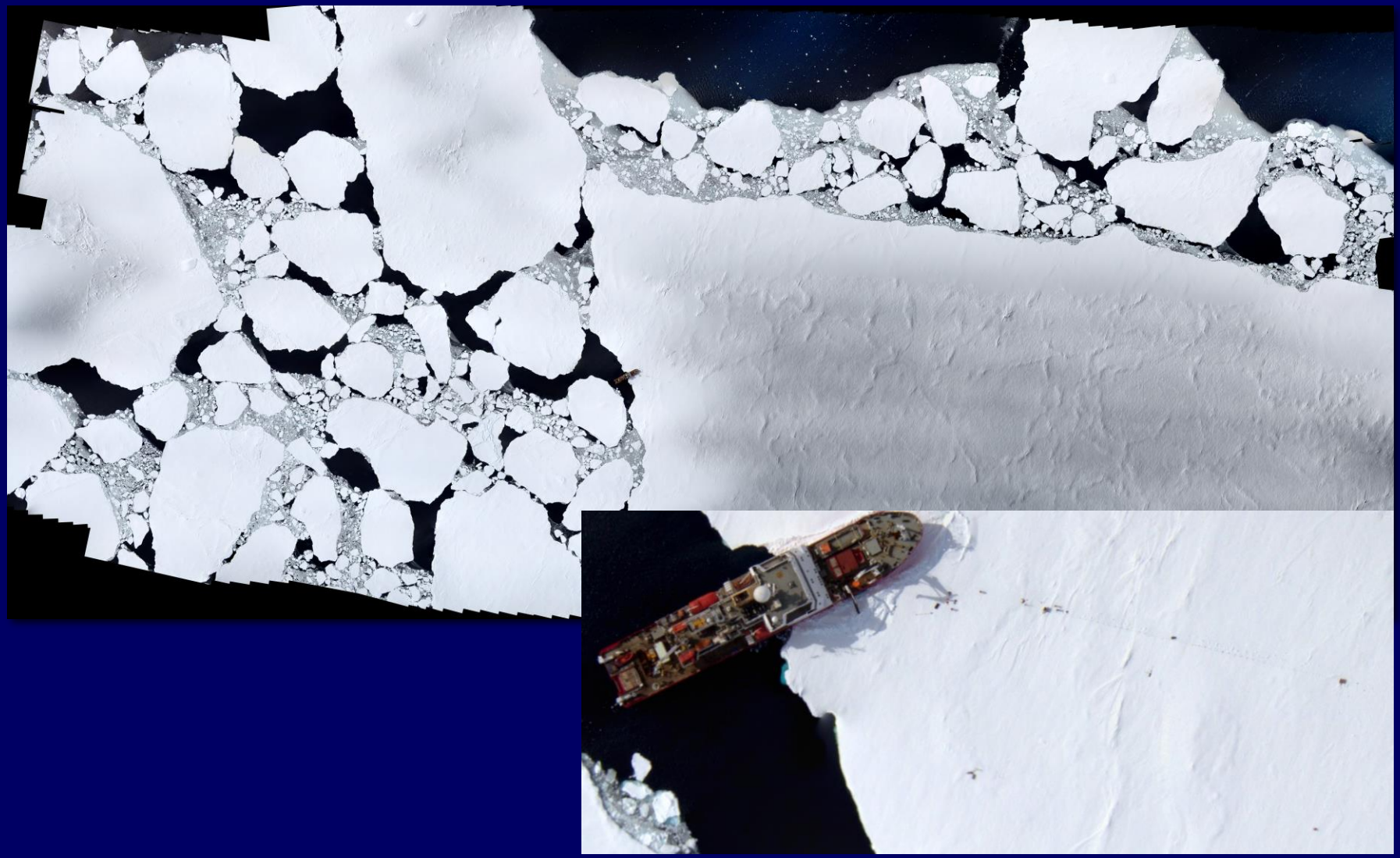
2010 The IceBell Antarctic Experiment



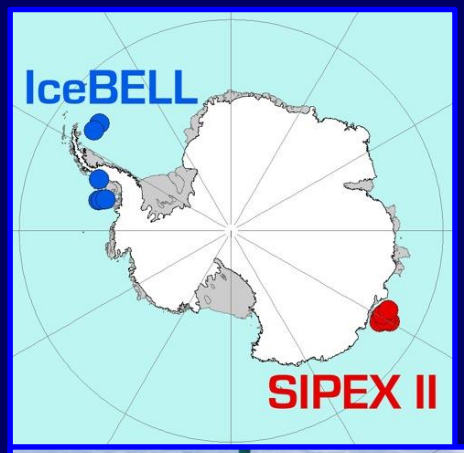
Multibeam Mapping using SLAM (10cm res, 500mx500m)

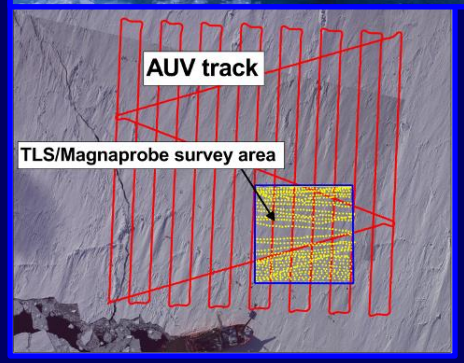


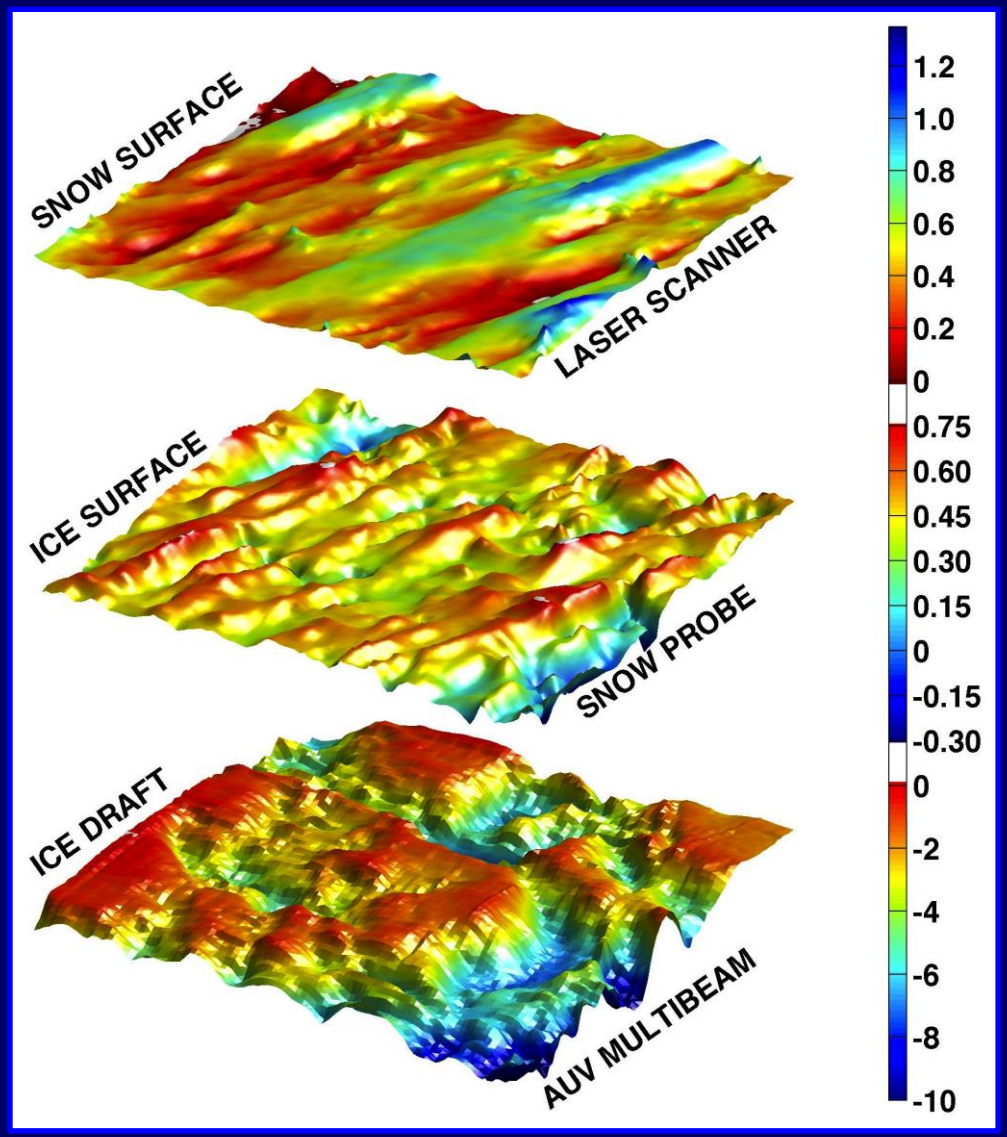
Otter Overflight Mosaic



2012 Sipex II Expedition with AAD

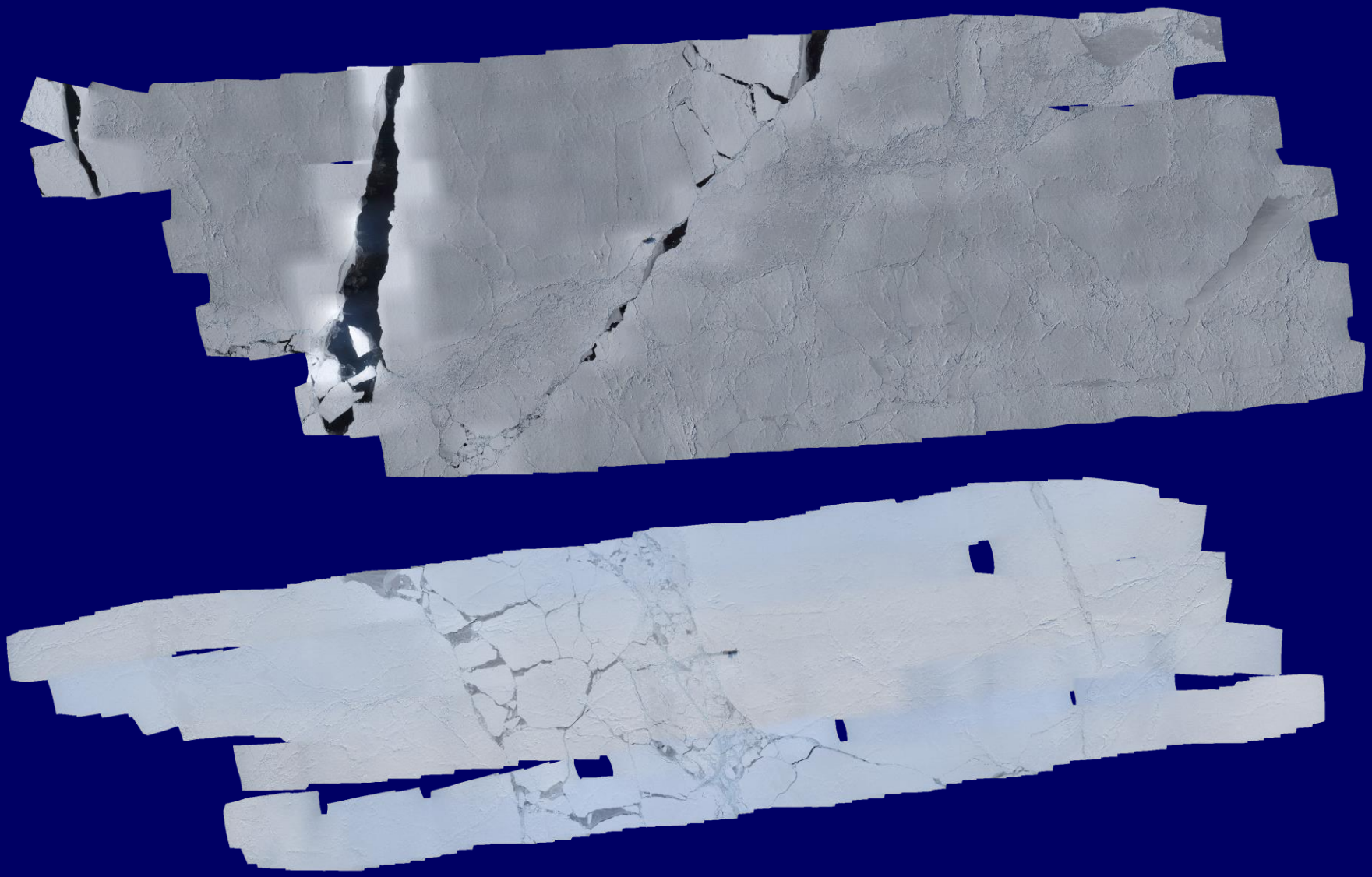






Mapping with Drones

R/V Lance (Wilkinson et al)



What's the Future ?

Spatial Coverage (100m – 1000km)

Temporal Coverage (Hours – Years)

Sensor Resolution (cm – km)

Platform Navigation (cm – km)

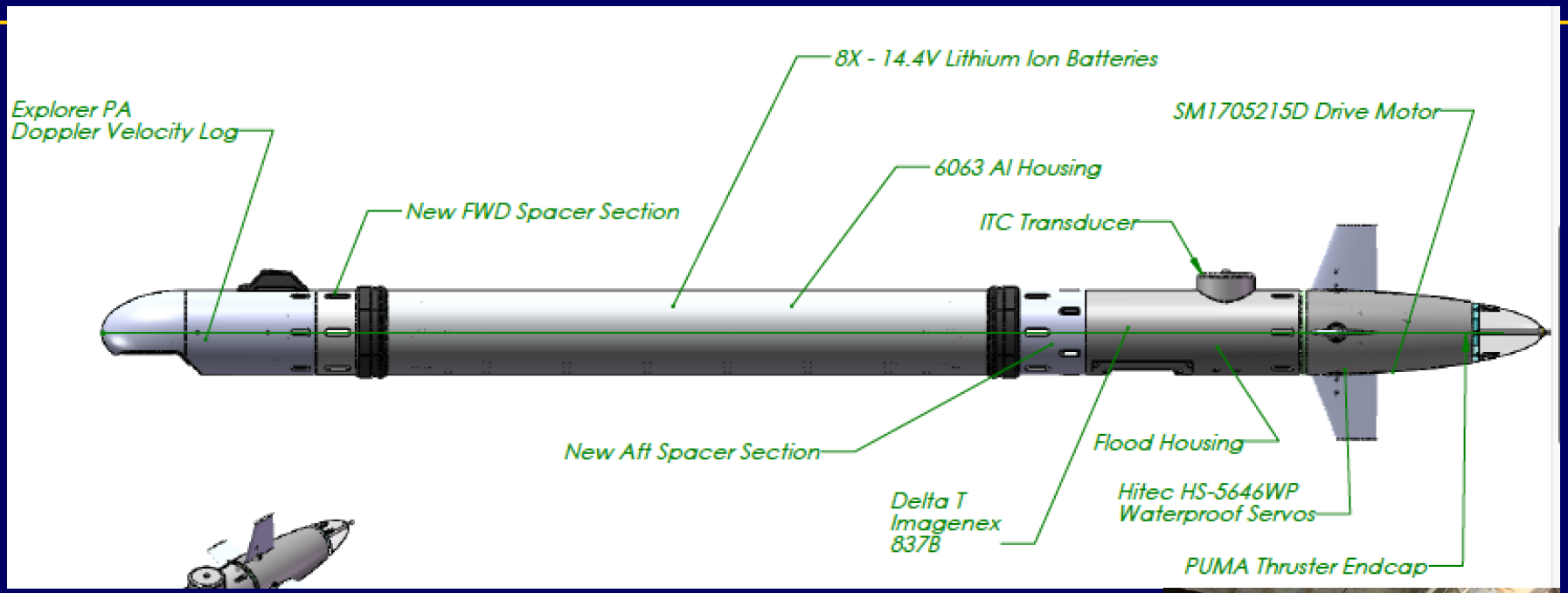
Manipulation and Sampling (sessile/motile)

Size, Expense, Risk Tolerance etc

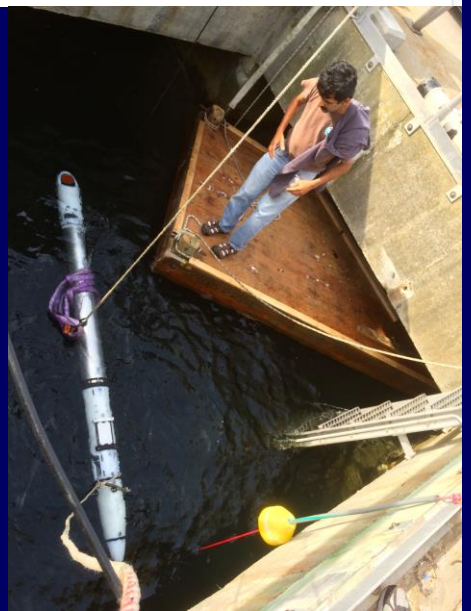
Hybridization

ASVs

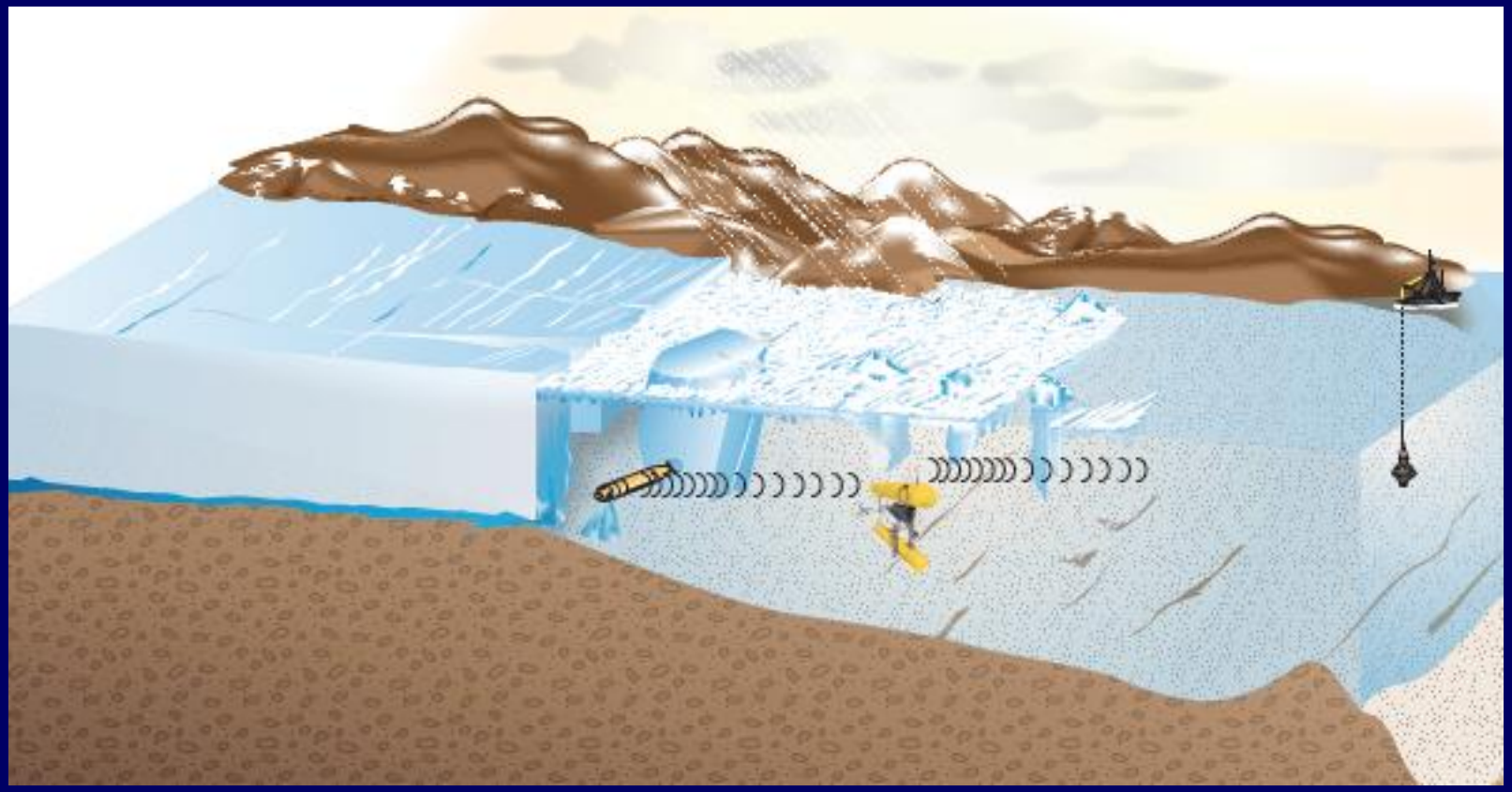
Where are we going – Seabed 125



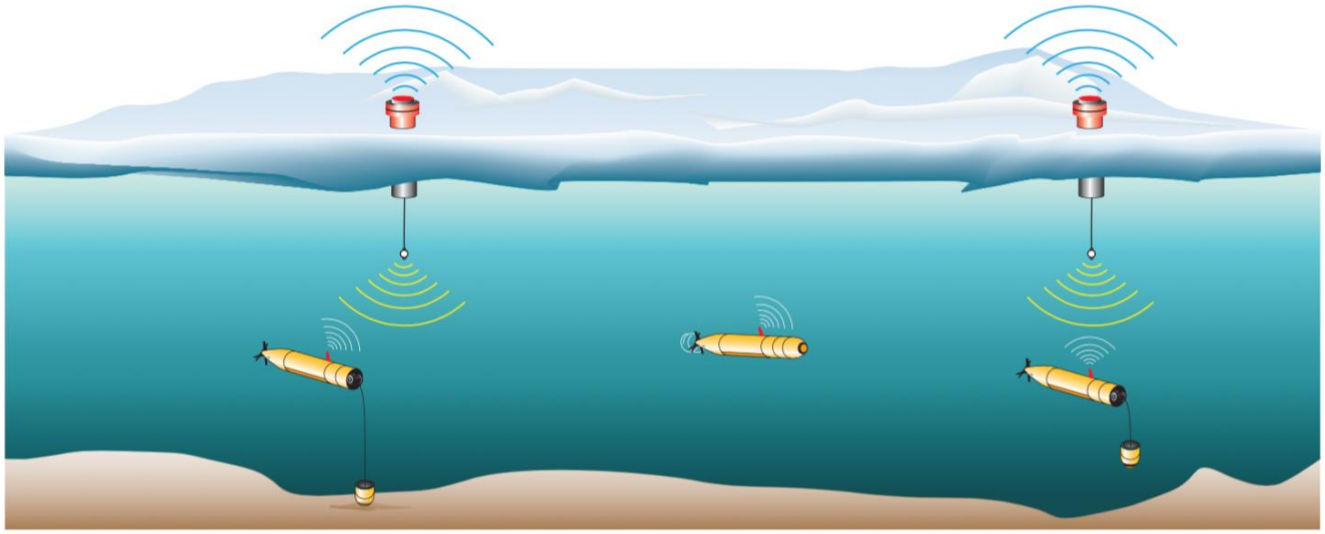
- Cost per bit of informaton
- Reliability
- Simplicity (can a sea –ice person operate it)

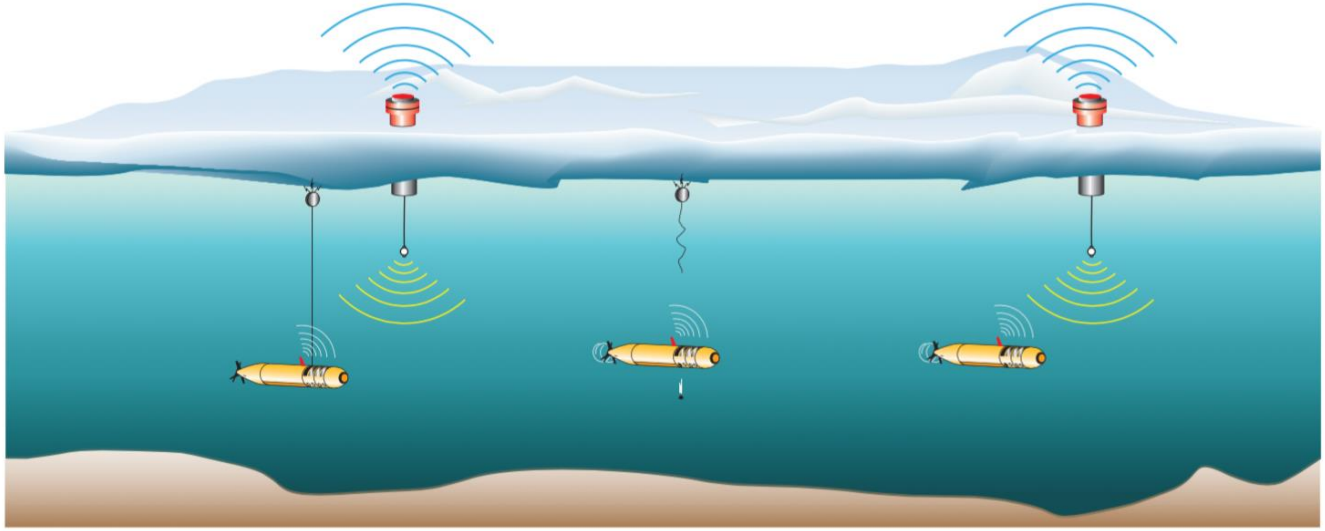


Multi-vehicle Deployments (Autonomy?)



Over-Wintering AUV





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