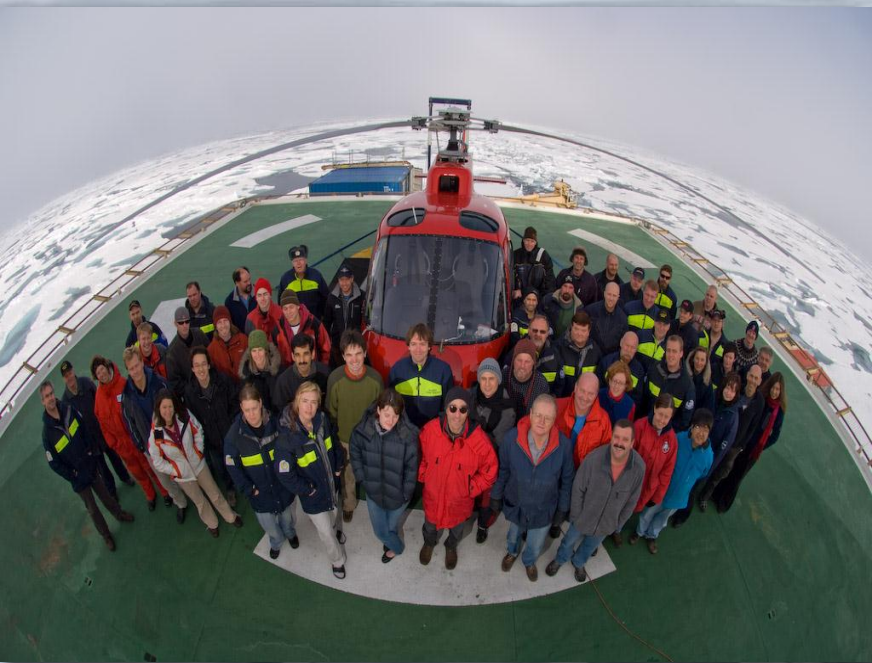
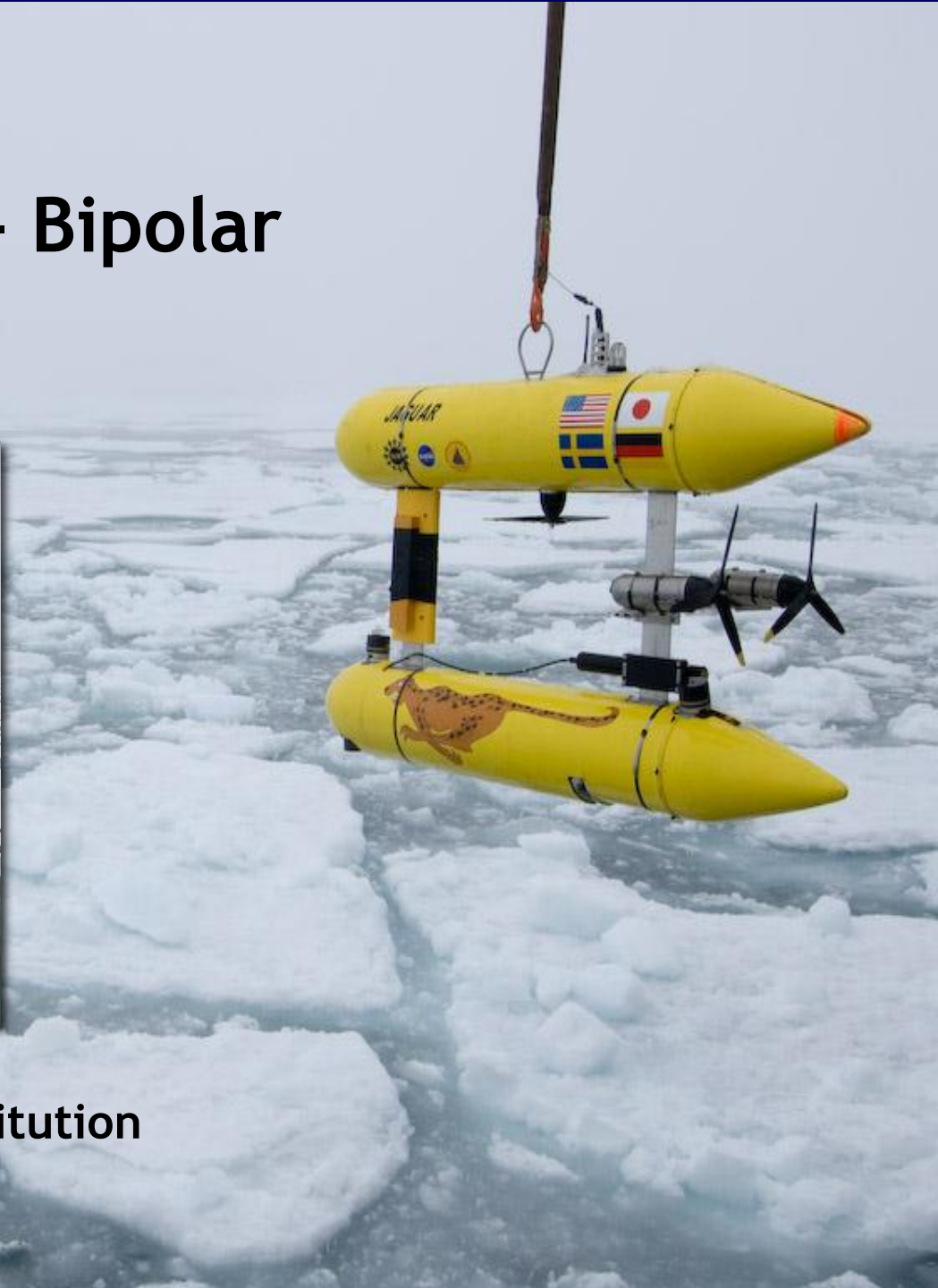


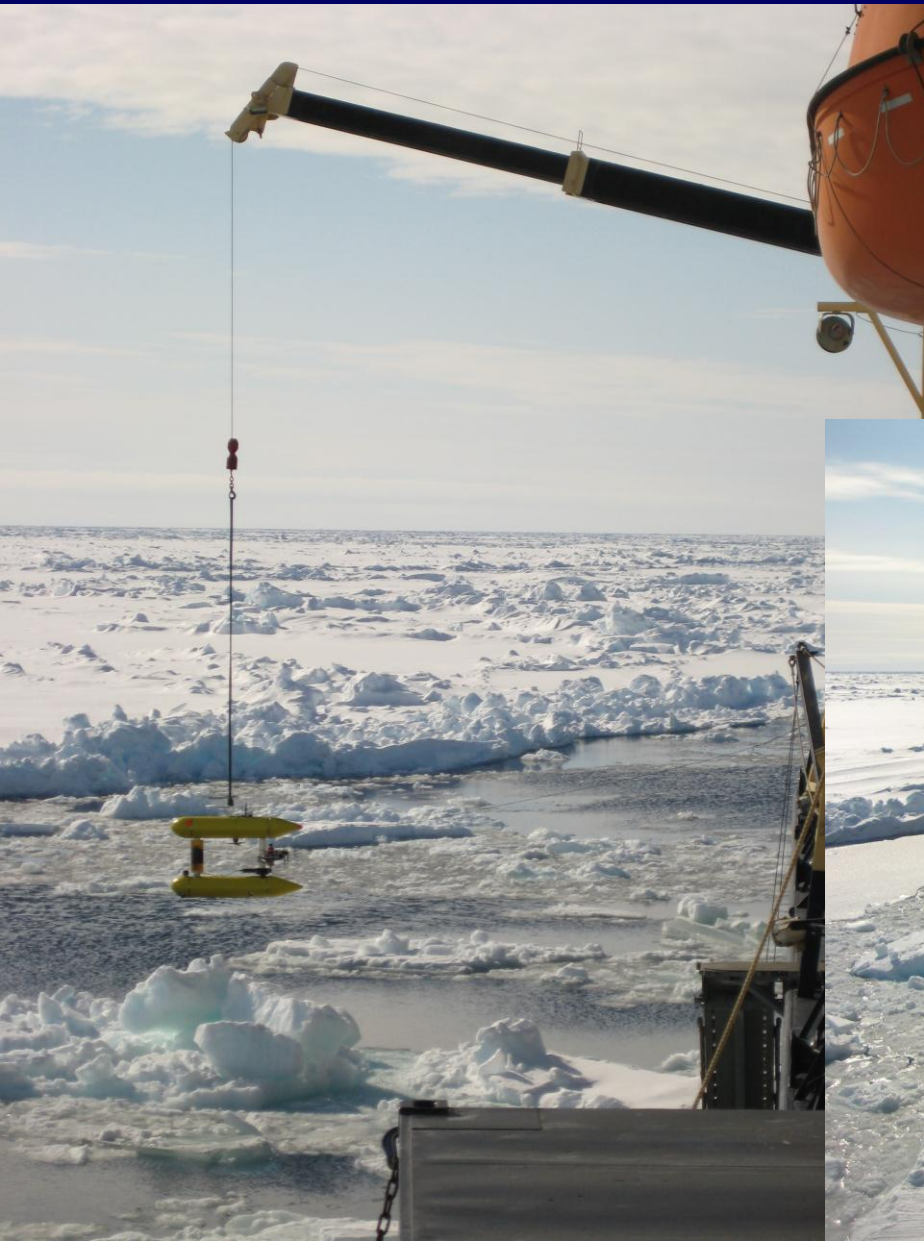
# Robot Exploration - Bipolar and Proud of it



Hanumant Singh\*  
Woods Hole Oceanographic Institution  
*\*and a large supporting cast*

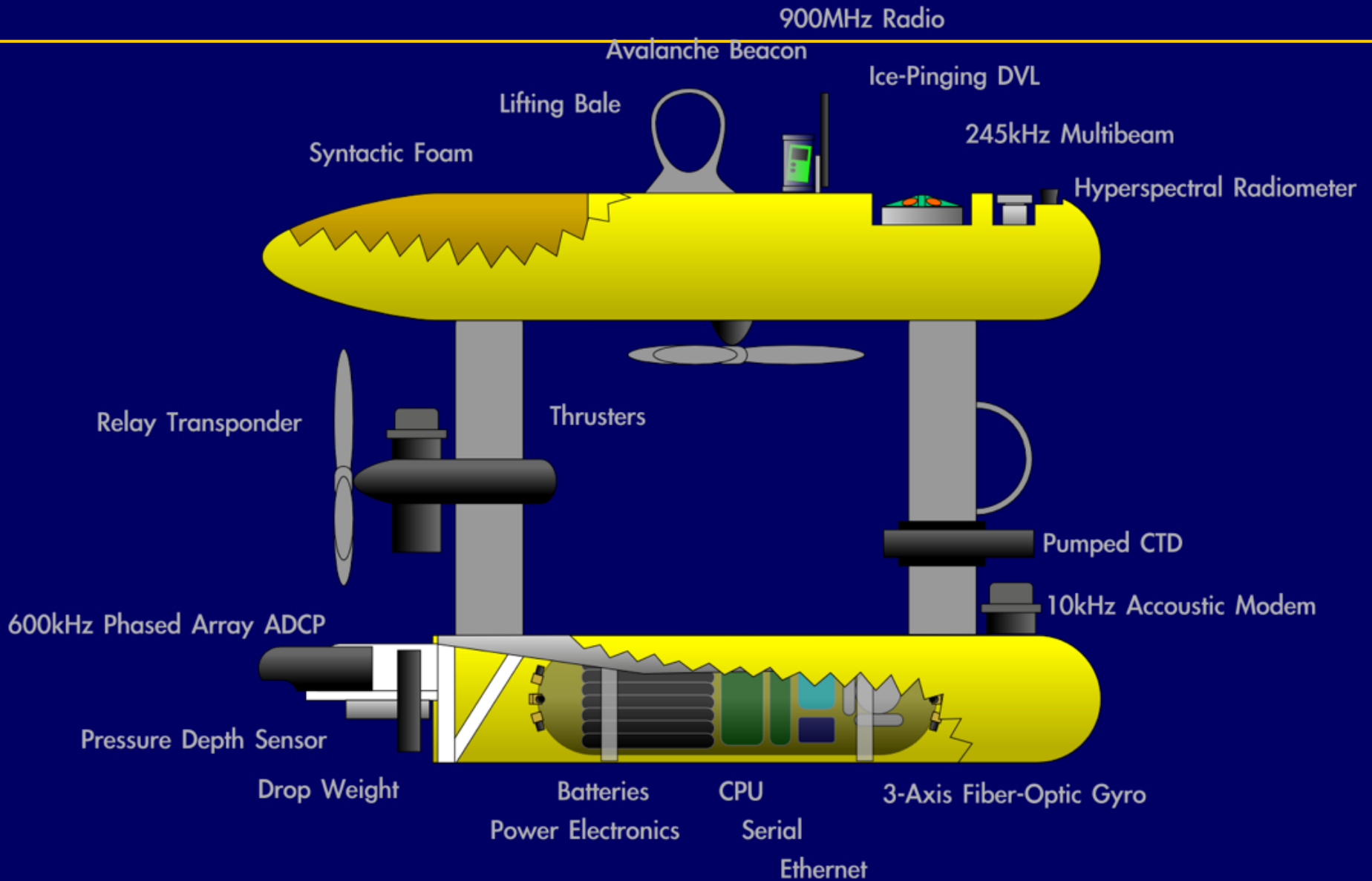


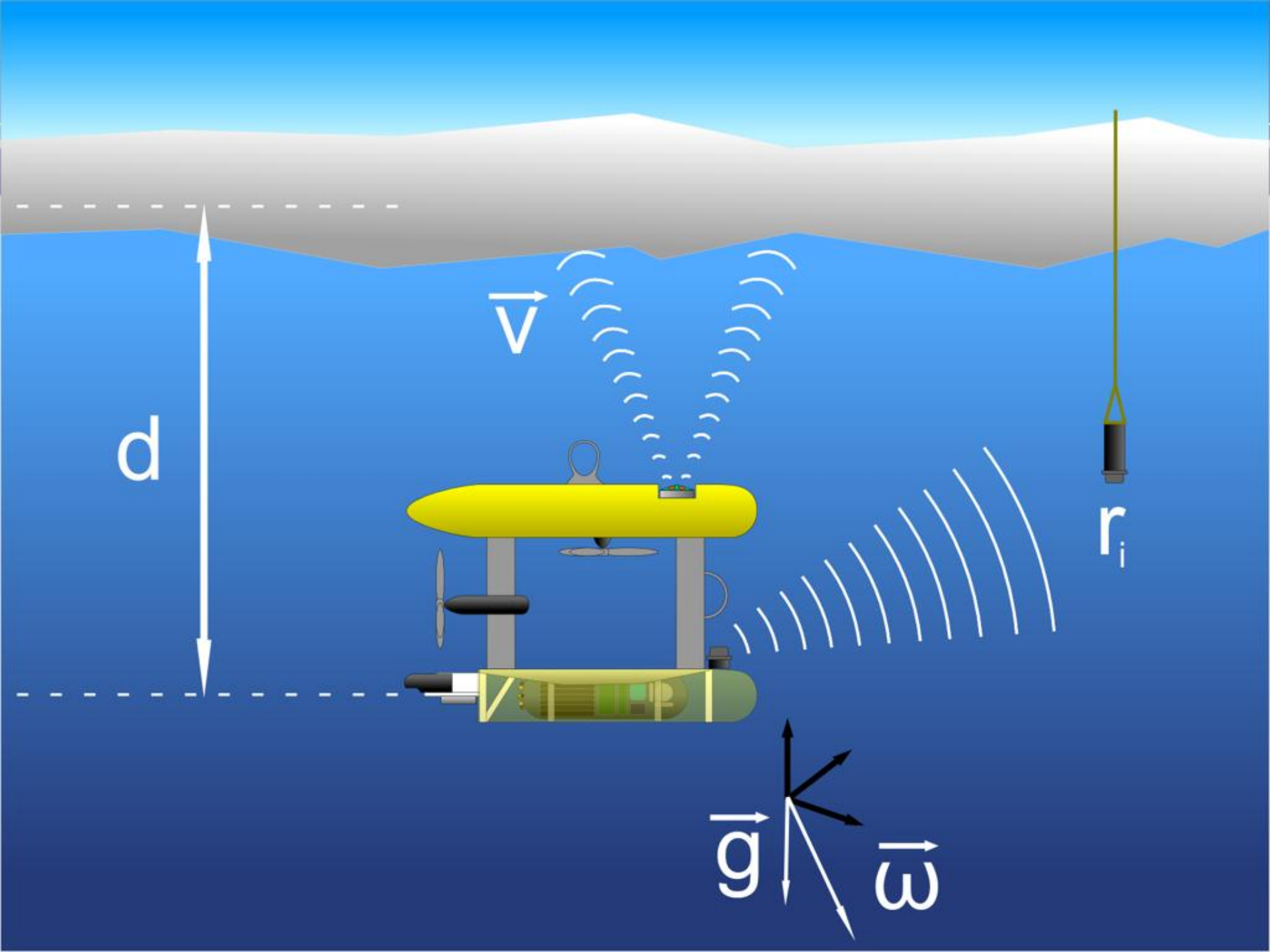
# Issues (Reference John Leonard)

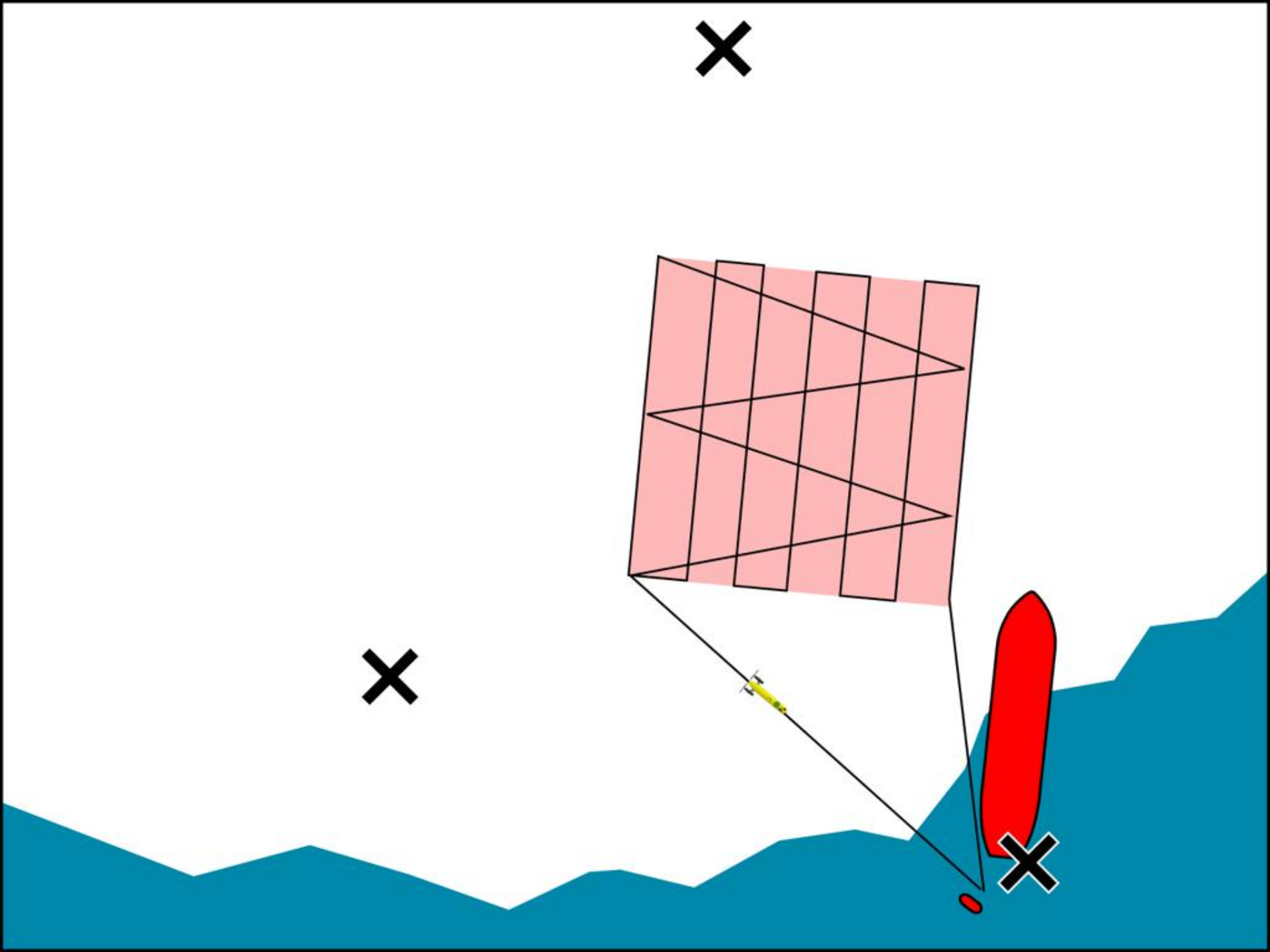


Platforms  
Underwater Communications  
Under-ice Navigation  
Movement of Ice









**Pushing technical frontiers, expanding our observational capabilities**



# Vehicle Recovery

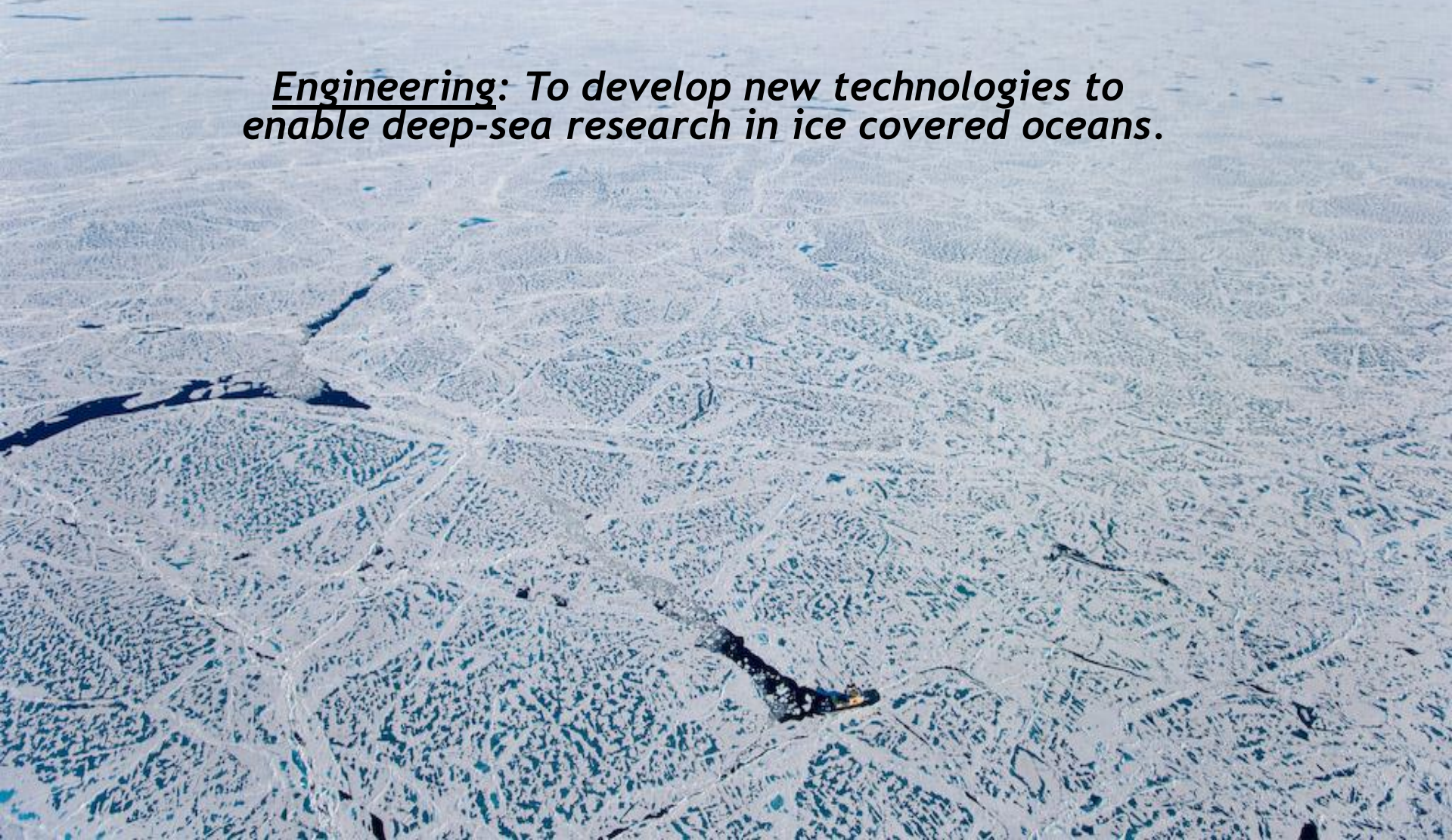
---

**CLICK HERE FOR PUMA RECOVERY VIDEO:**  
<http://www.who.edu/page.do?pid=116876&cid=88273&article=158669&tid=5122>

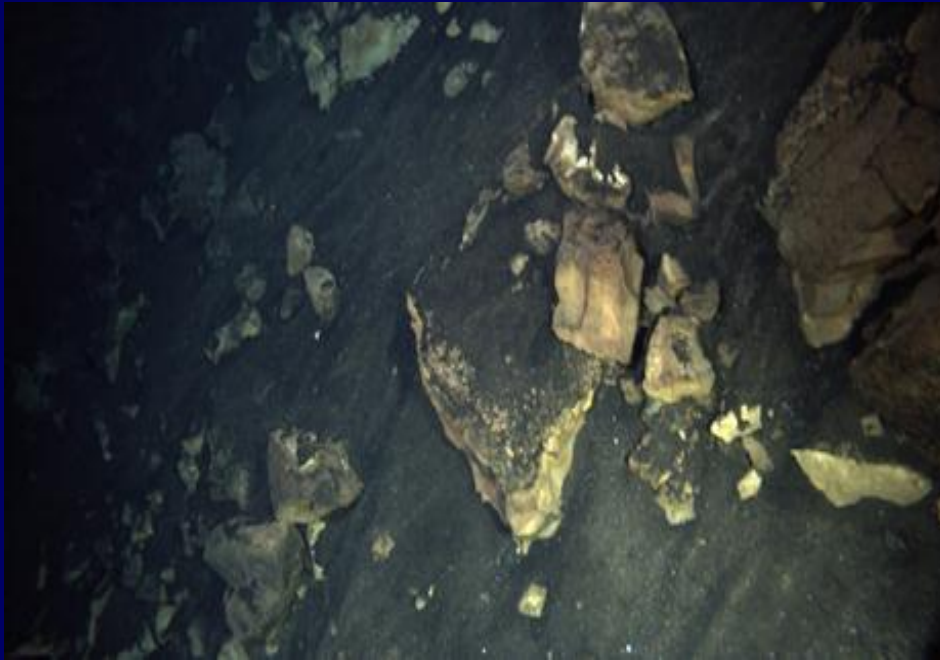
# 2007 Gakkel Ridge Expedition

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

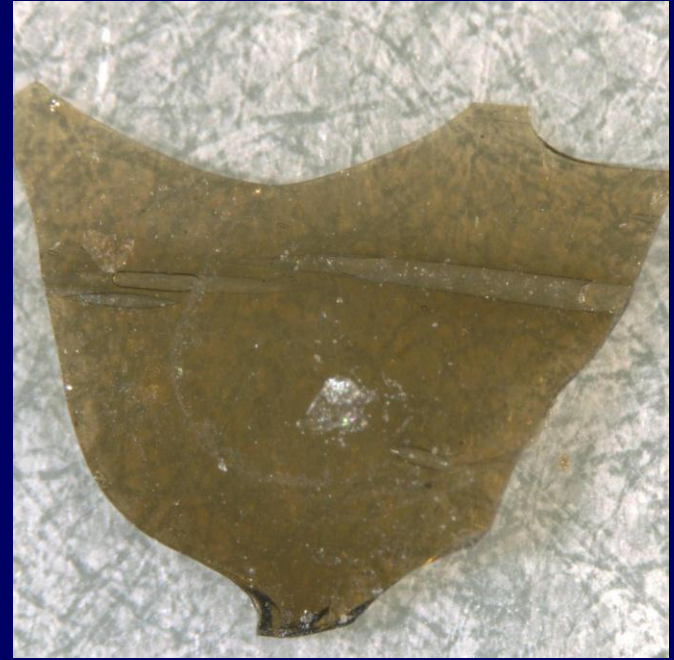
**Engineering:** *To develop new technologies to enable deep-sea research in ice covered oceans.*



# What did we Find?



*Pyroclastic deposit on country rock ejecta*



*Limu o Pele (Pele's Seaweed)*

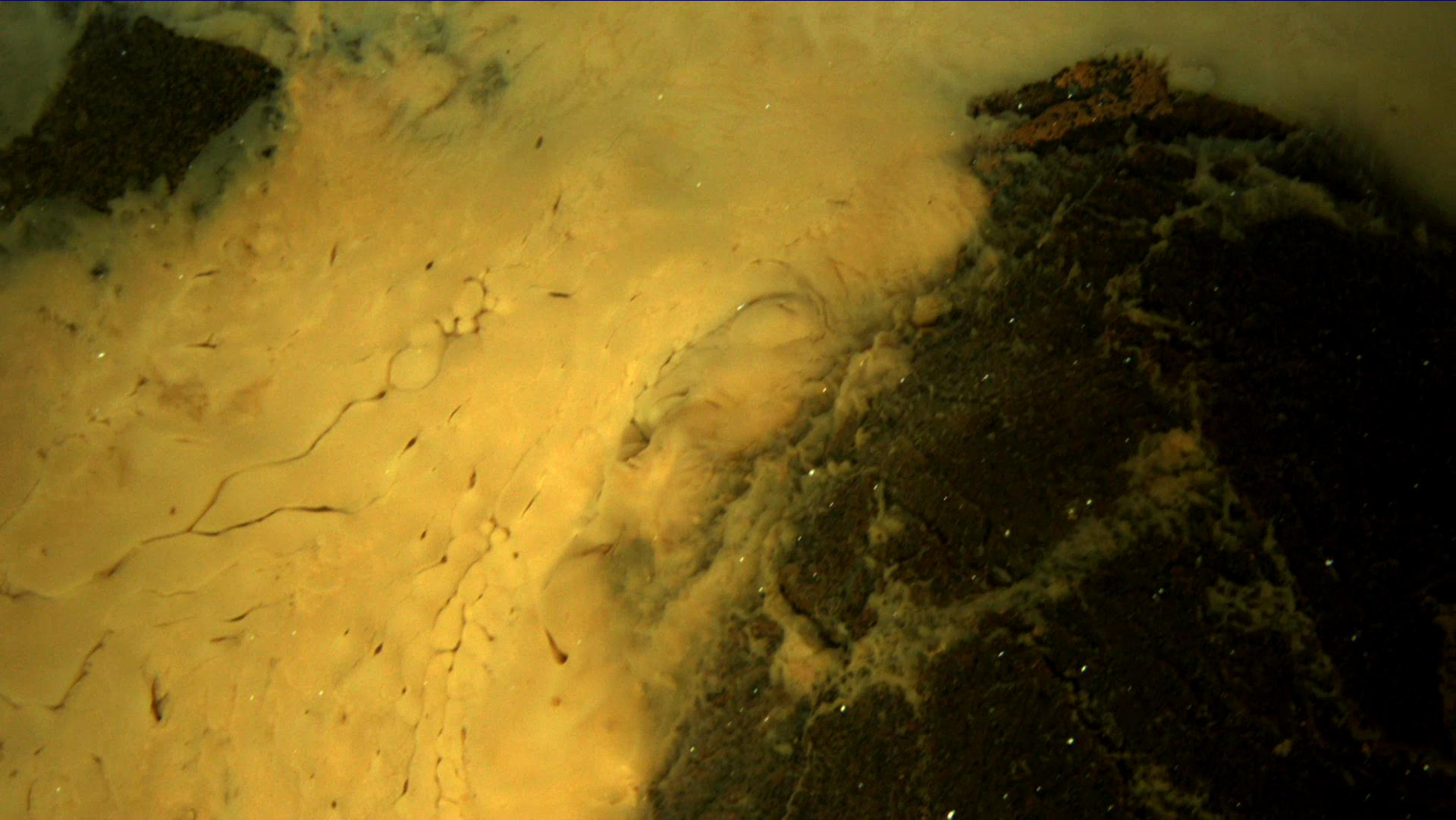
Magma must contain  $> 13.5\%$   $\text{CO}_2$  for pyroclastic eruption at 4 km water depth

Magmatic foam accumulates at top of a large, long-lived, crustal magma chamber

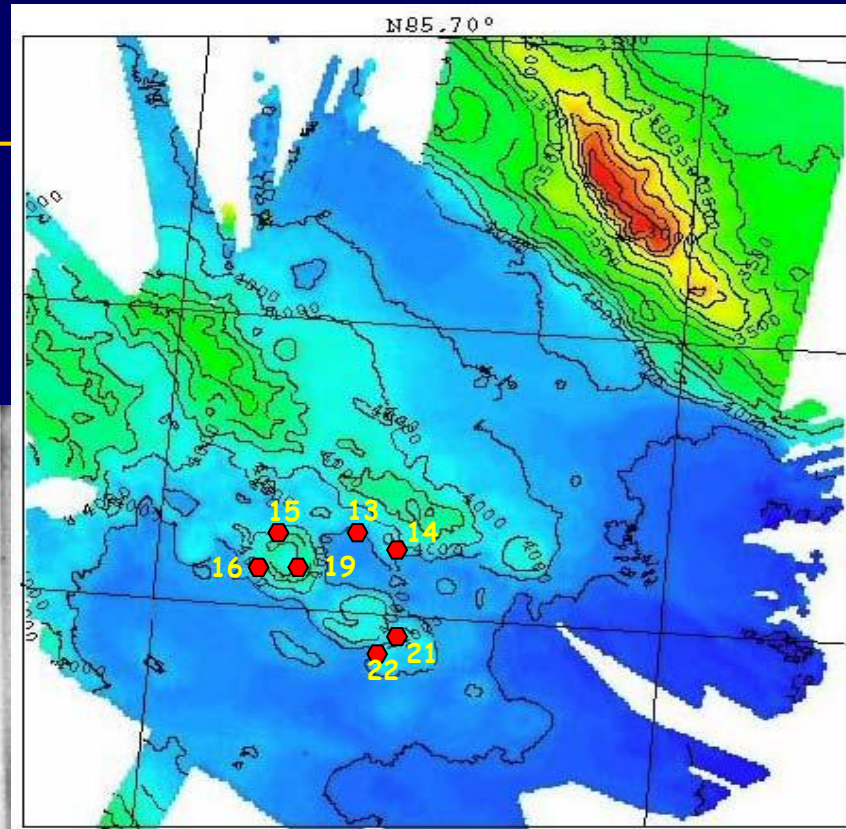
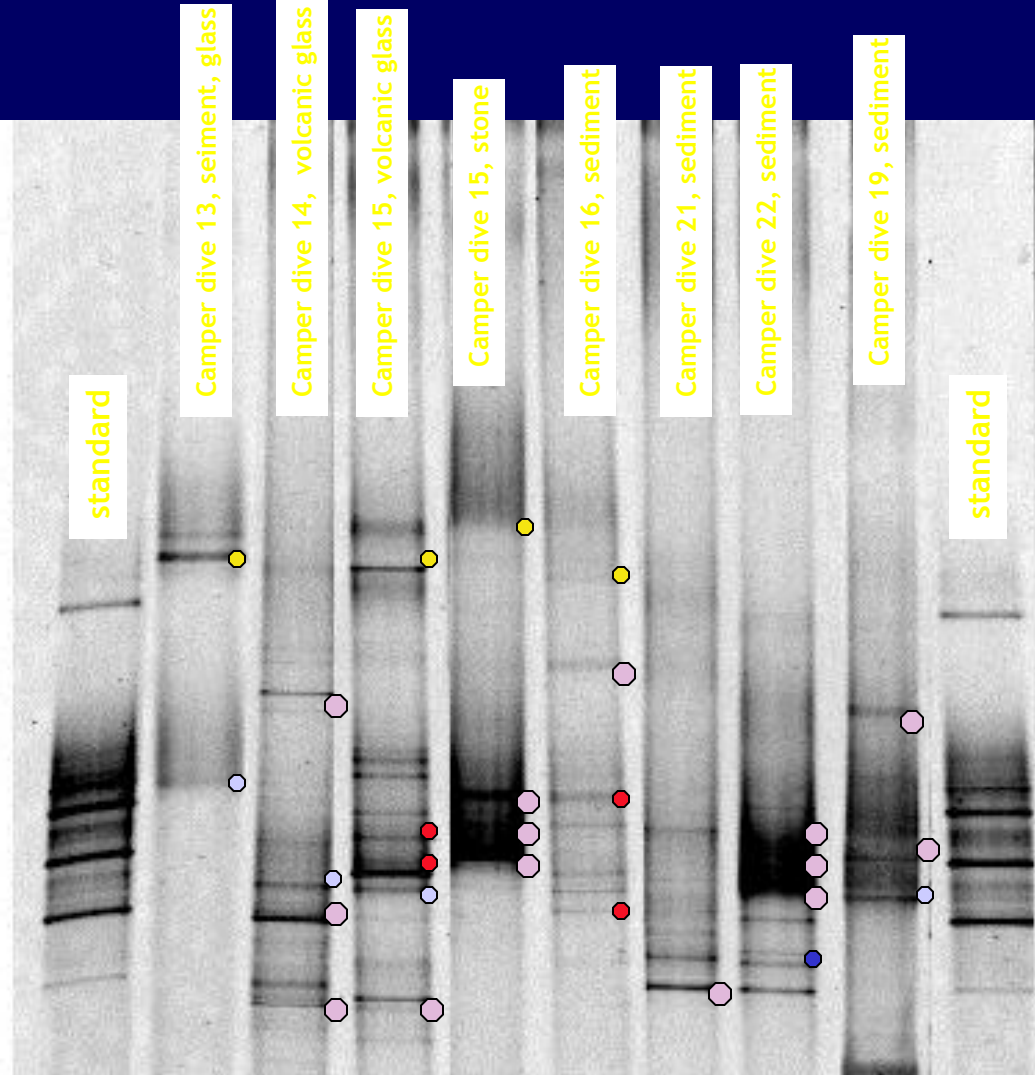
Impulse velocities 100 - 300 m/s, with a jet that extends 400 - 3800 m above seafloor

*(Head and Wilson, 2003)*

# What did we Find?



# Characterization of the Prokaryotic Diversity



DNA of 16 S rRNA  
gene

related to:

- Gamma-proteobacteria
- Alpha-proteobacteria
- Bacteroidetes
- Delta-proteobacteria
- unknown bacteria

# 2010 Invasive Species Cruise

The  
Economist

## Climate change Claws!

### Crabs are invading the shallow waters of the Southern Ocean

Mar 3rd 2011 | PALMER, ANTARCTICA | from the print edition

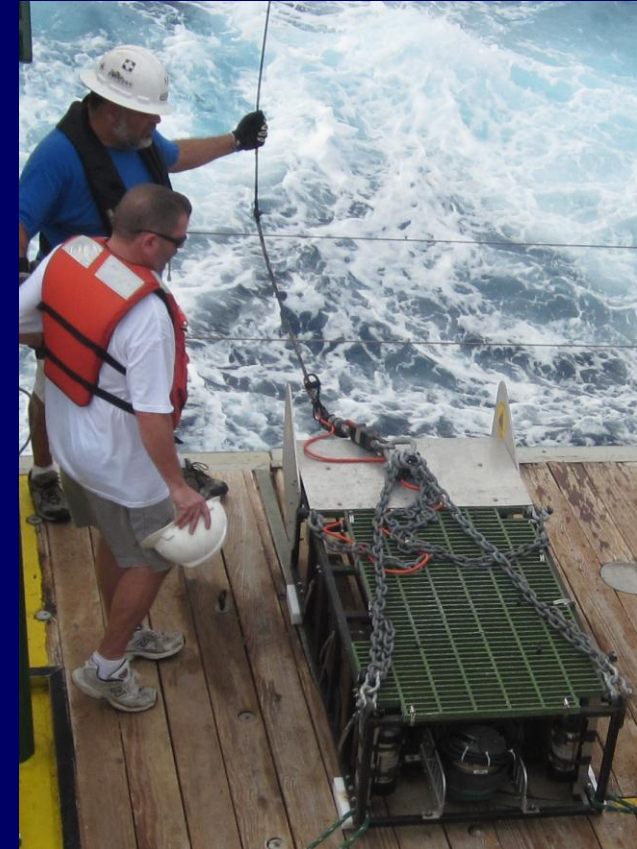
ANTARCTICA is a peculiar place. For instance, unlike those in most parts of the planet, the ocean depths around it are warmer, at 5°C or so, than the shallows near the coast. Here, the temperature hovers around 0°C and can drop to -2°C. As a consequence, the animals of the Antarctic continental shelf have been free for millions of years from the attentions of predators, such as crabs and sharks, that cannot cope with the cold. The result is an unusual bunch of sea lilies, brittle stars, giant ribbon worms and molluscs that are armoured only with thin, soft shells.

But not, perhaps, for much longer—for crabs are on the march. In the past few years several groups of researchers have spotted king crabs on the continental slope of Antarctica. This slope, which connects the deep ocean with the continental shelf, and whose waters have an average temperature of between 1°C and 5°C, is a marginal habitat for king crabs. They die when the temperature drops below 1°C because they are then unable to process magnesium ions. In small quantities, these ions are needed for energy metabolism. Too many, though, act as a narcotic that eventually kills the animal. Worryingly for sea-lily lovers, the latest research suggests the crabs may be creeping up the slope.

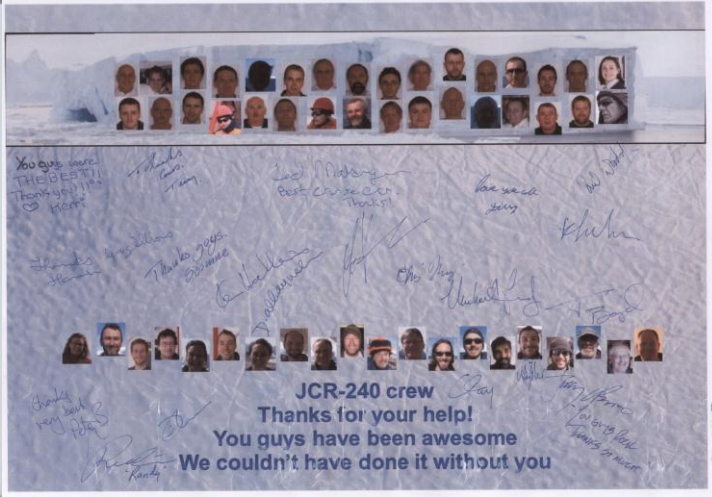


Peek-a-boo. I see you

0 Like 118



# 2010 The IceBell Antarctic Experiment



# Components of IceBell (A NERC/BAS Funded Project)









# Why measure ice thickness with AUVs?

We know neither how much ice there is, nor how it's changing.

In Antarctica, the large influence of snow confuses remote (aerial or satellite) measurements.

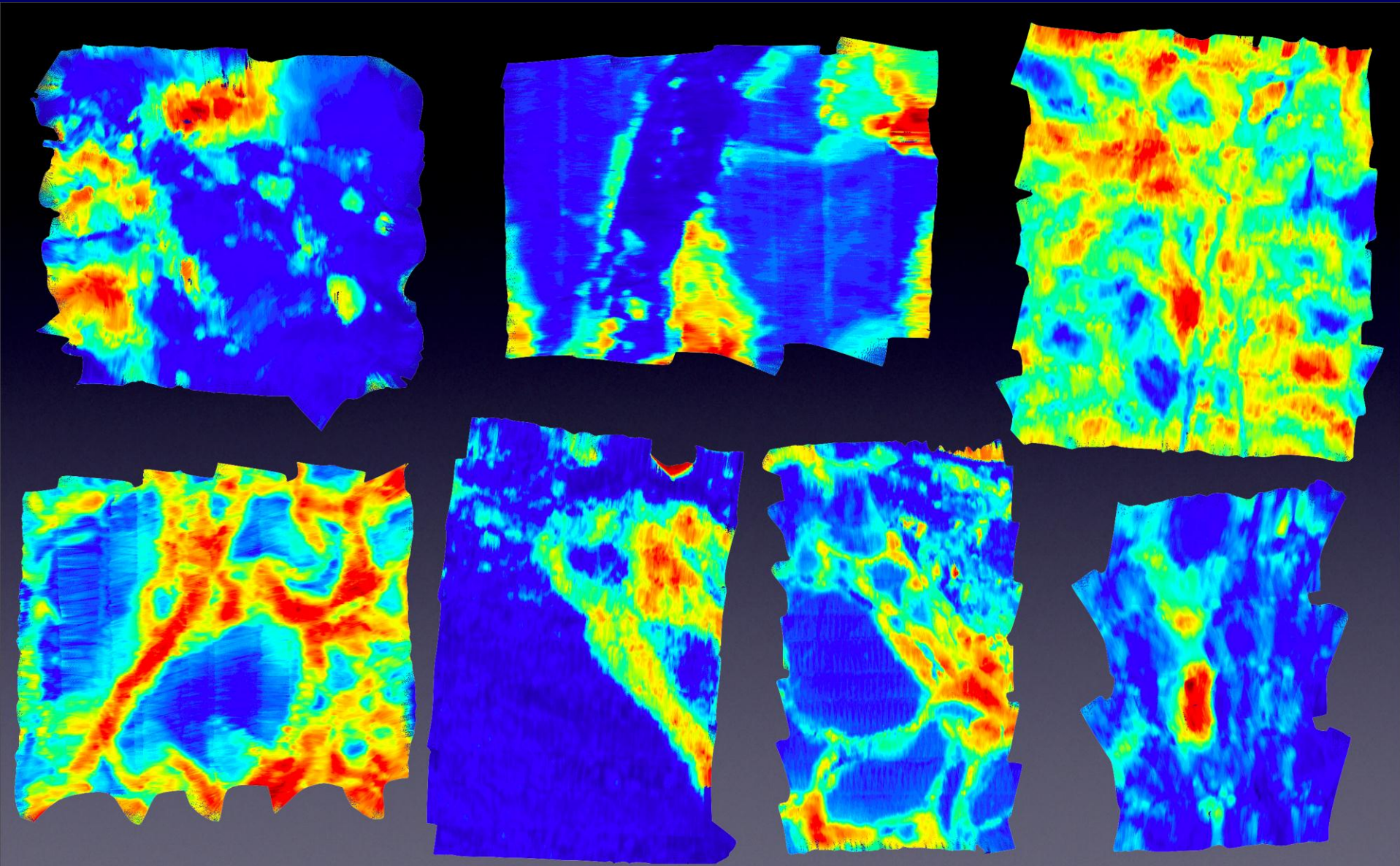
The only way to validate remote measurements is "by hand."

AUVs are the safest and best tools for under-ice science.

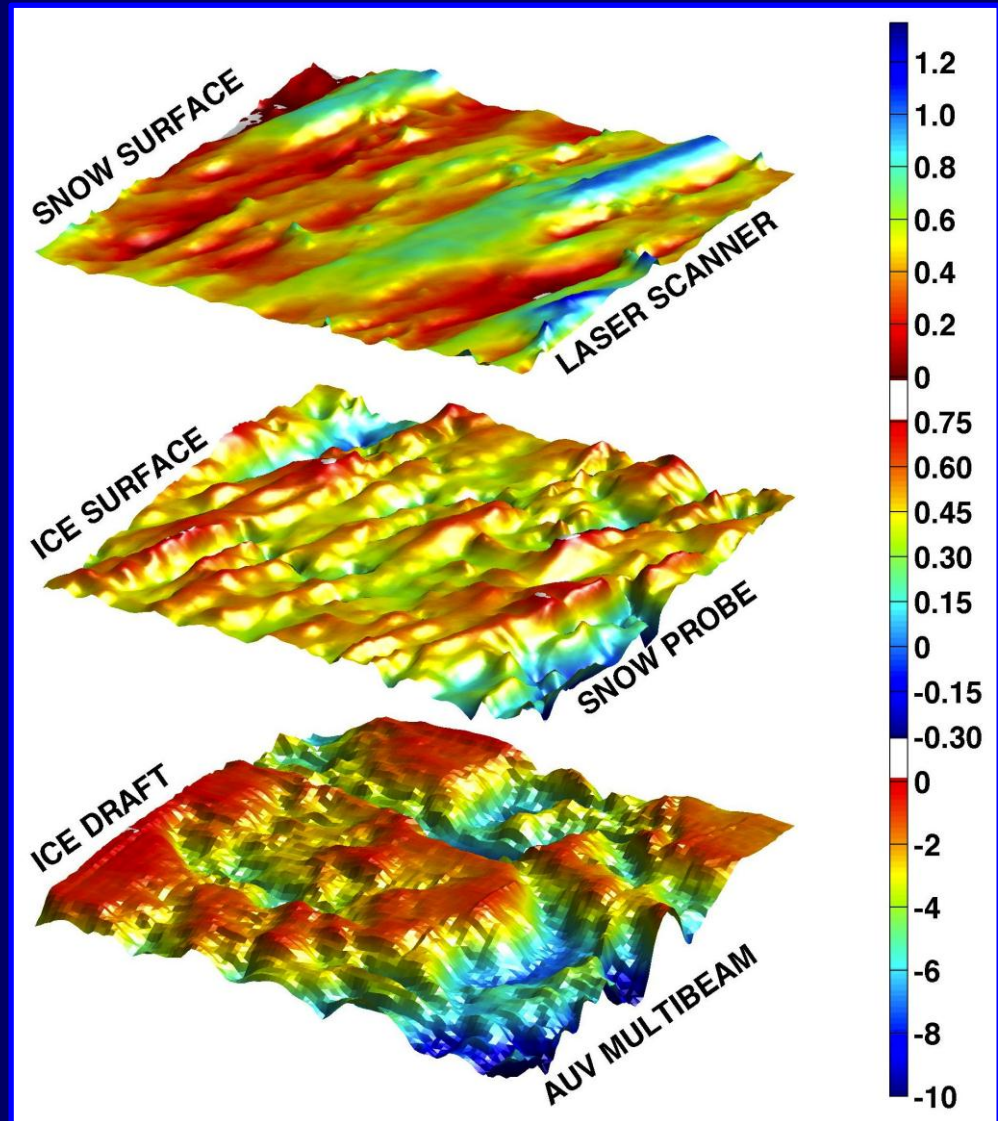
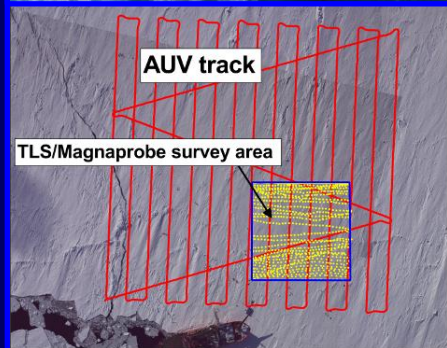
## Survey Area:

- 25 meter AUV depth
- 25 meter trackline spacing
- 90 degree multibeam field of view
- 50% overlap trackline-to-trackline



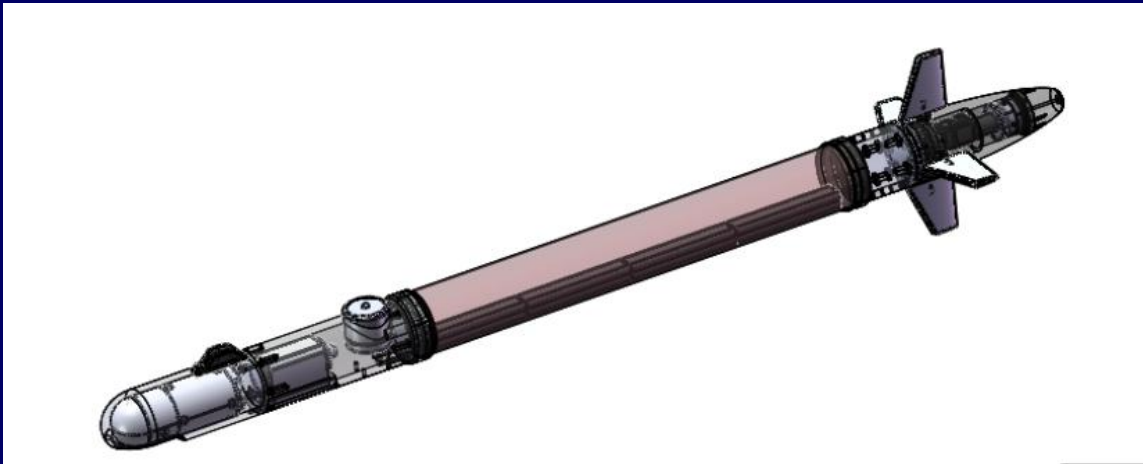
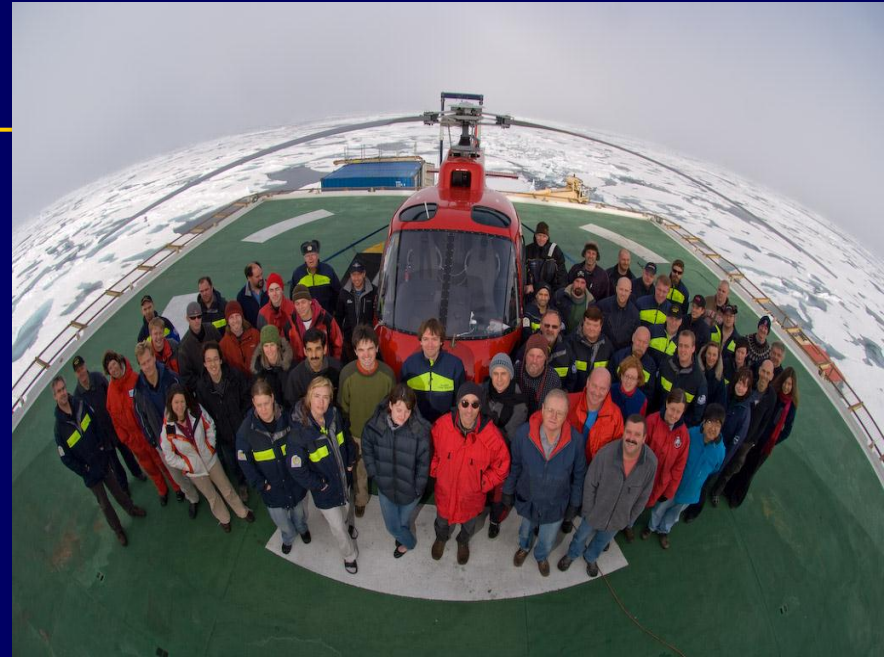


# 2012 Sipex II Expedition with AAD



# Upcoming Cruises

2013 BSEE Oil Spill Characterization  
2013 Invasive Species  
2014 Sipex III AAD Sea Ice Mechanics



Chris Murphy, Clayton Kunz,  
Peter Kimball, Derya  
Akkayanak, Jeff Kaeli,  
Fiamma Straneo, Sarah  
Das, Al Plueddeman, Ryan  
Eustice(U Mich),  
Rob Sohn, Susan Humphris,  
Ted Maksym, Jeremy  
Wilkinson (SAMS), Milica  
Stojanovic (NEU), Guy  
Williams (ACEARC)

Thanks to ONR, NSF, NOAA,  
BAS, NASA, Censsis ERC, AAD  
and Private Sponsors