SCOR/IAPSO WG #133: OCEANSCOPE

SUSTAINED OCEAN OBSERVATIONS FROM MERCHANT MARINE VESSELS

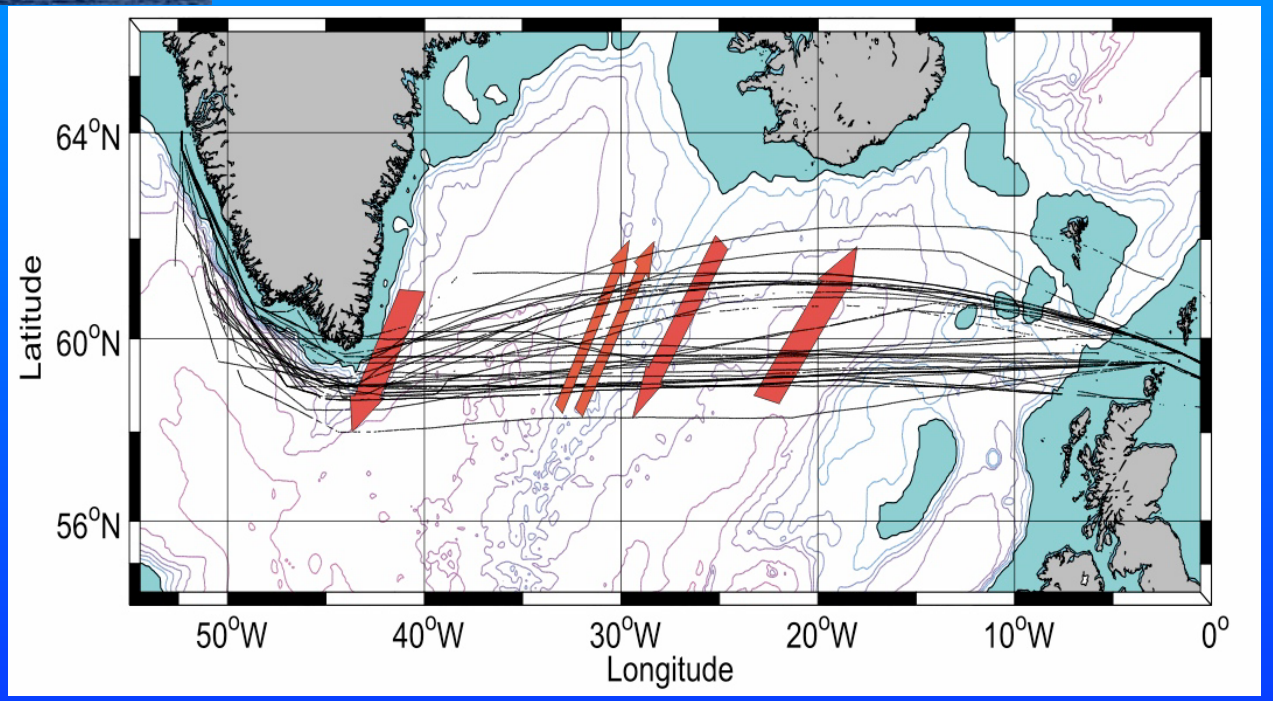
Vision statement: "In partnership with the merchant marine shipping industry we will develop an integrated approach to the observation of the global ocean on a regular and sustainable basis. This effort, entitled 'OceanScope' will equip commercial ships with fully automated unattended instrumentation to accurately measure and report upon both the currents and the physical, chemical and biological characteristics of the water column throughout the world ocean. These data will in time become a fundamental resource for studies of the climate and health of our planet."

Acoustic Remote Sensing

RAL Nuka Arctica

This ADCP operation discovered the existence of multiple currents along the Reykjanes ridge - discovered thanks to repeat sampling along a route between Denmark and Greenland.

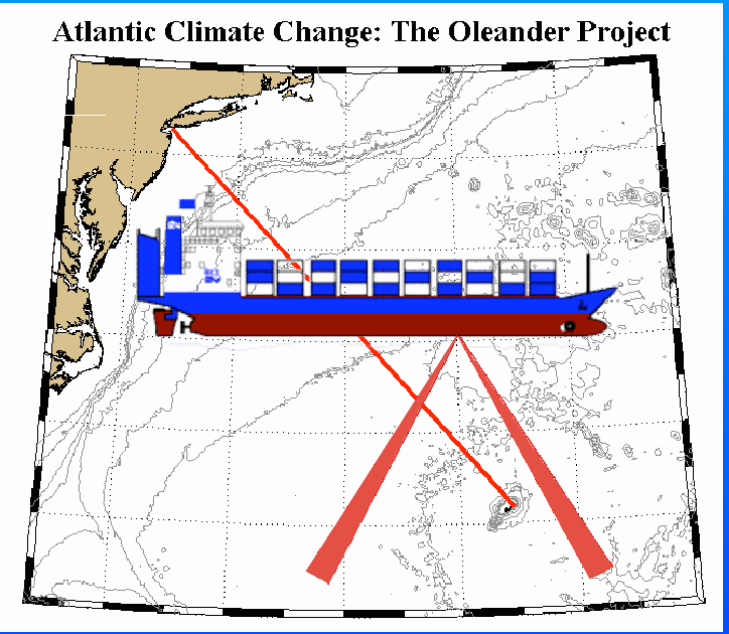
The ship is also equipped with TSG, XBT and total CO_2 systems. The DMI also releases balloons from a container.

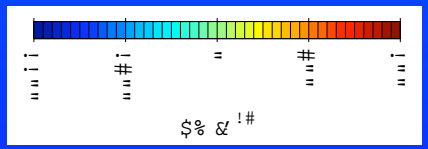


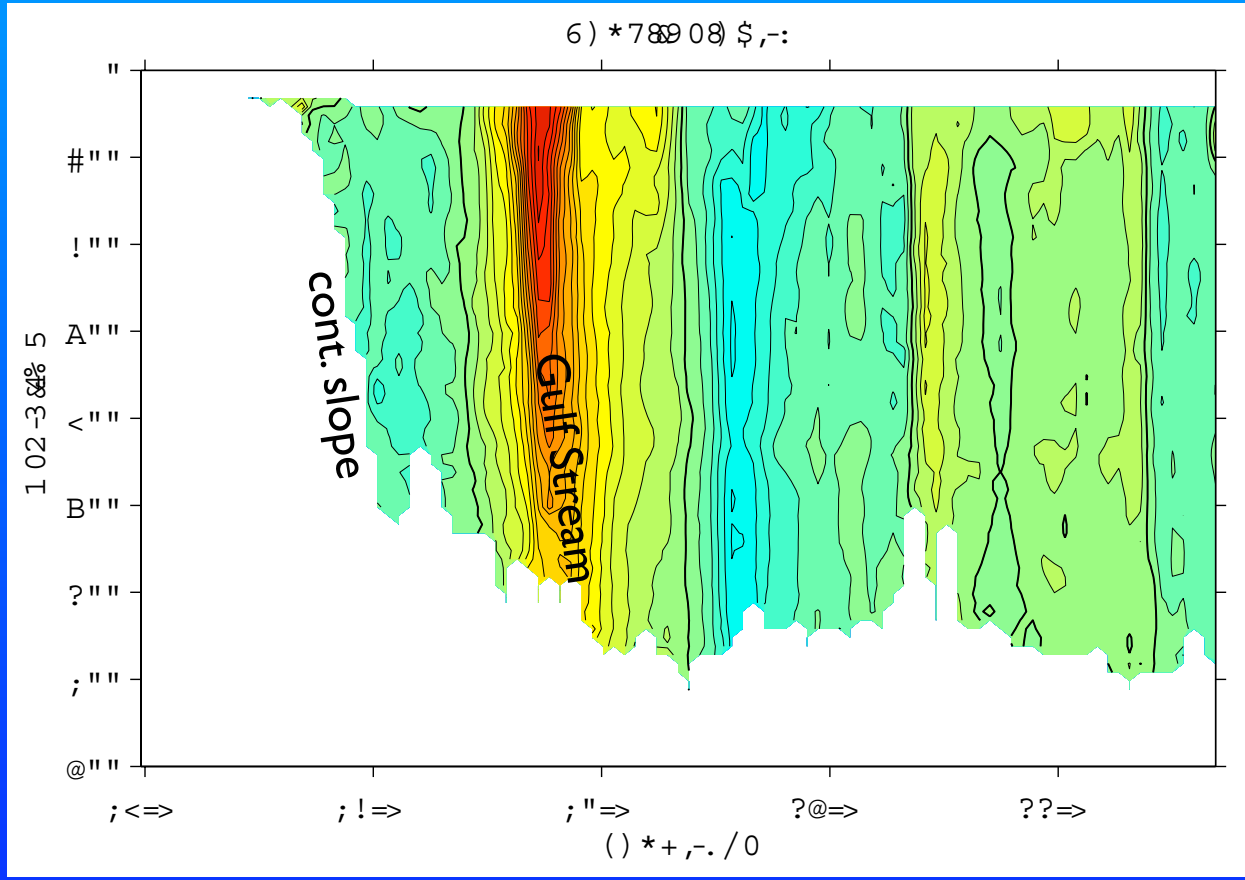
ADCP operated by the University of Bergen.

Acoustic Remote Sensing

The Oleander Project. The 75 kHz ADCP reaches to 600-800m depth. Data are uploaded by wireless internet while in port and can be served within days of collection. High resolution sampling in both vertical and horizontal.

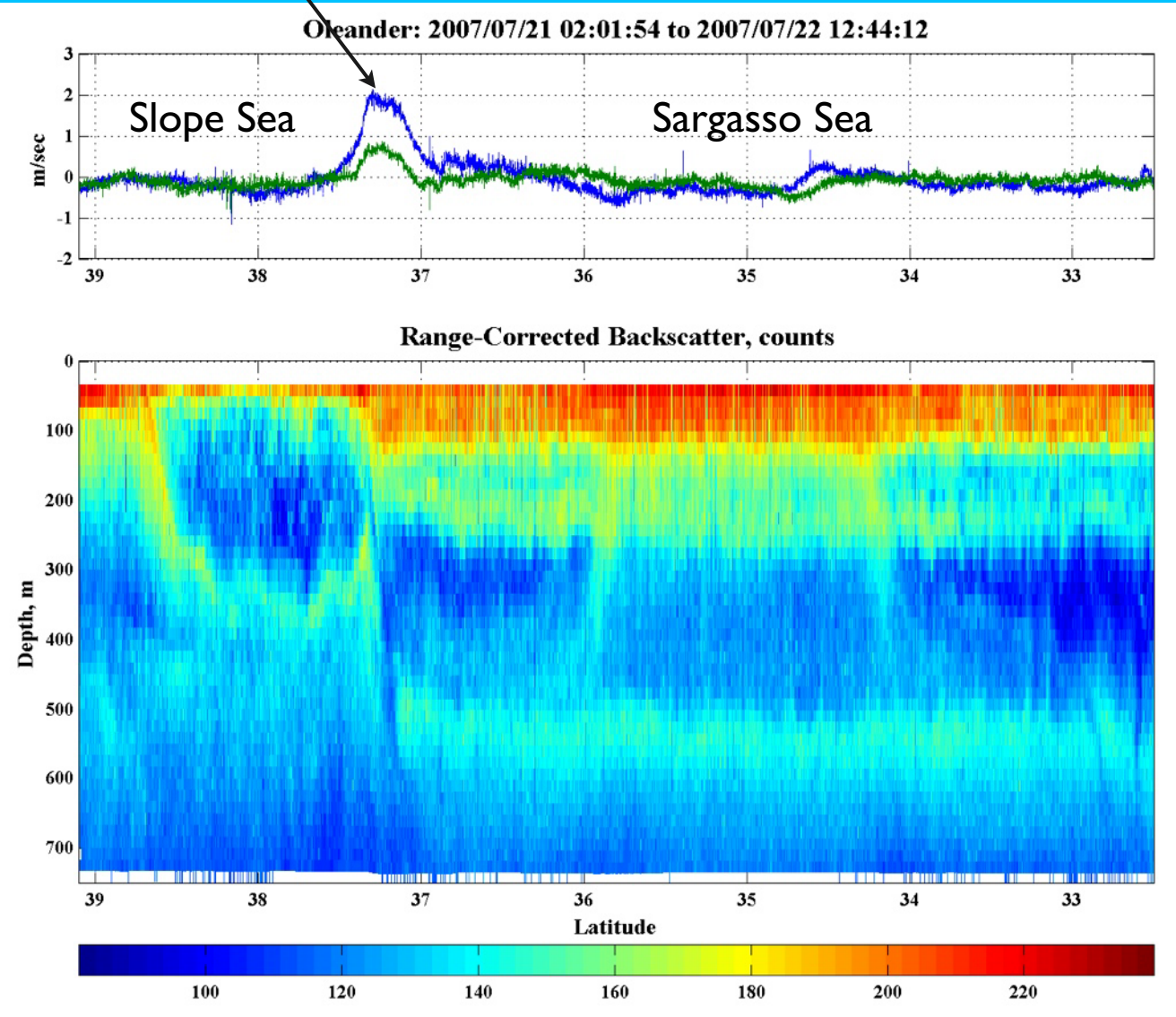






Acoustic Remote Sensing

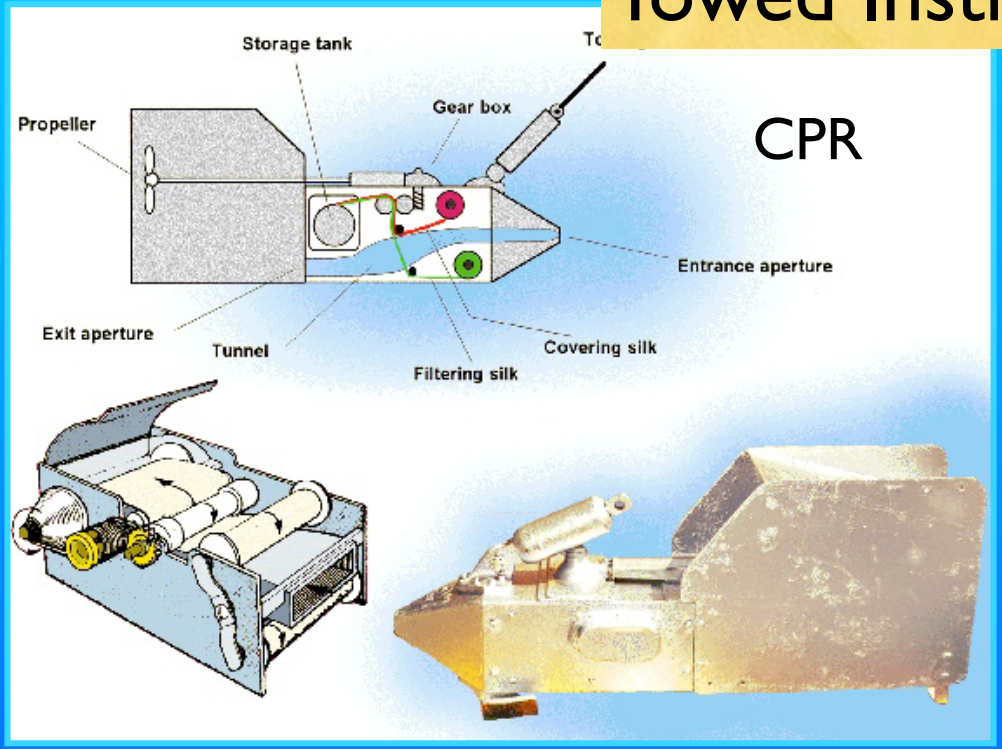
The Gulf Stream



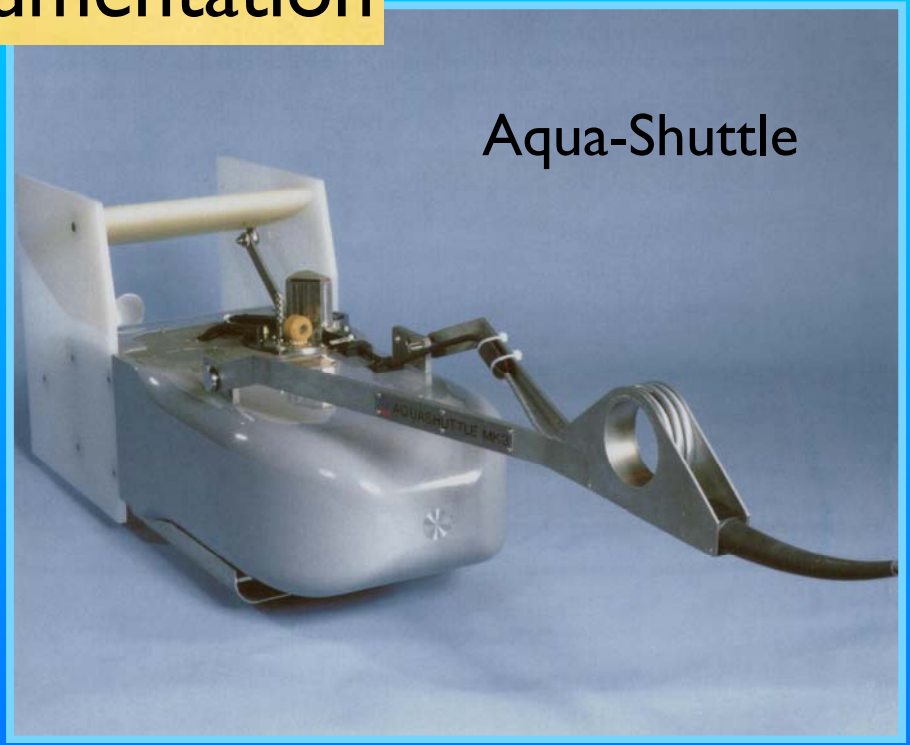
Acoustic backscatter strength along an Oleander transect between the shelfbreak and Bermuda.
Top: currents.
Bottom: intensity.
Note strong returns at certain depths and multiple layers of diurnal cycling. Why the low returns in the Slope Sea, etc?

C. Flagg, SUNY

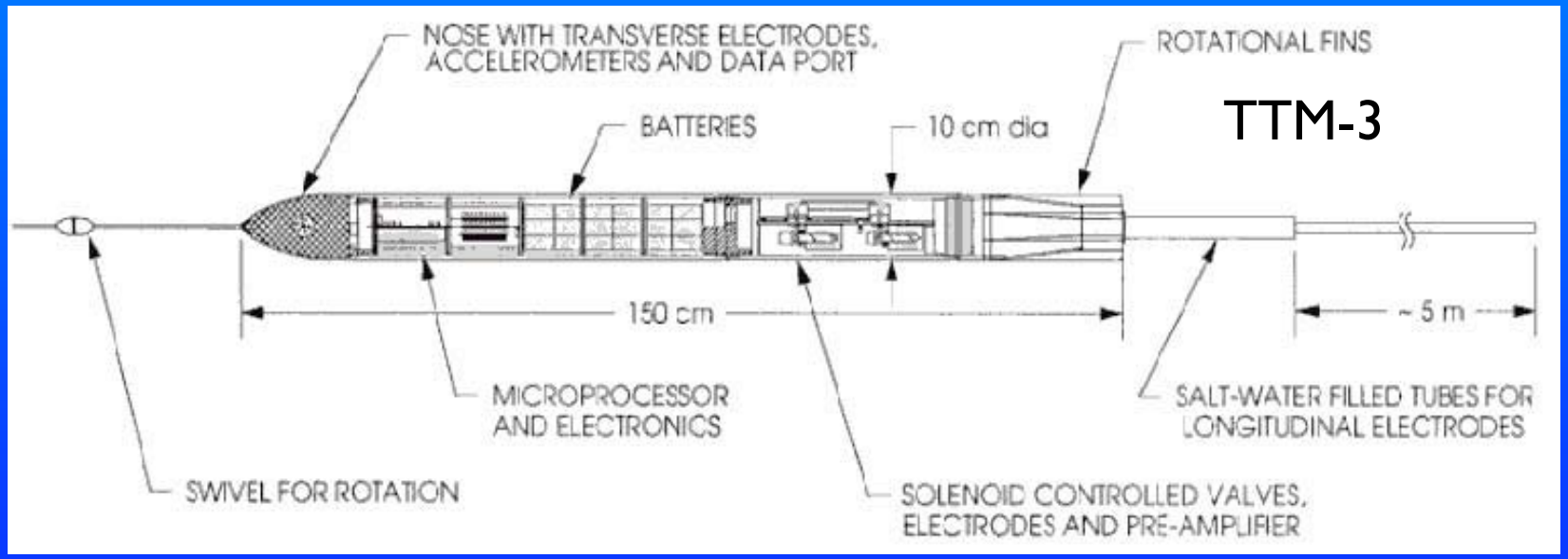
Towed Instrumentation



CPR

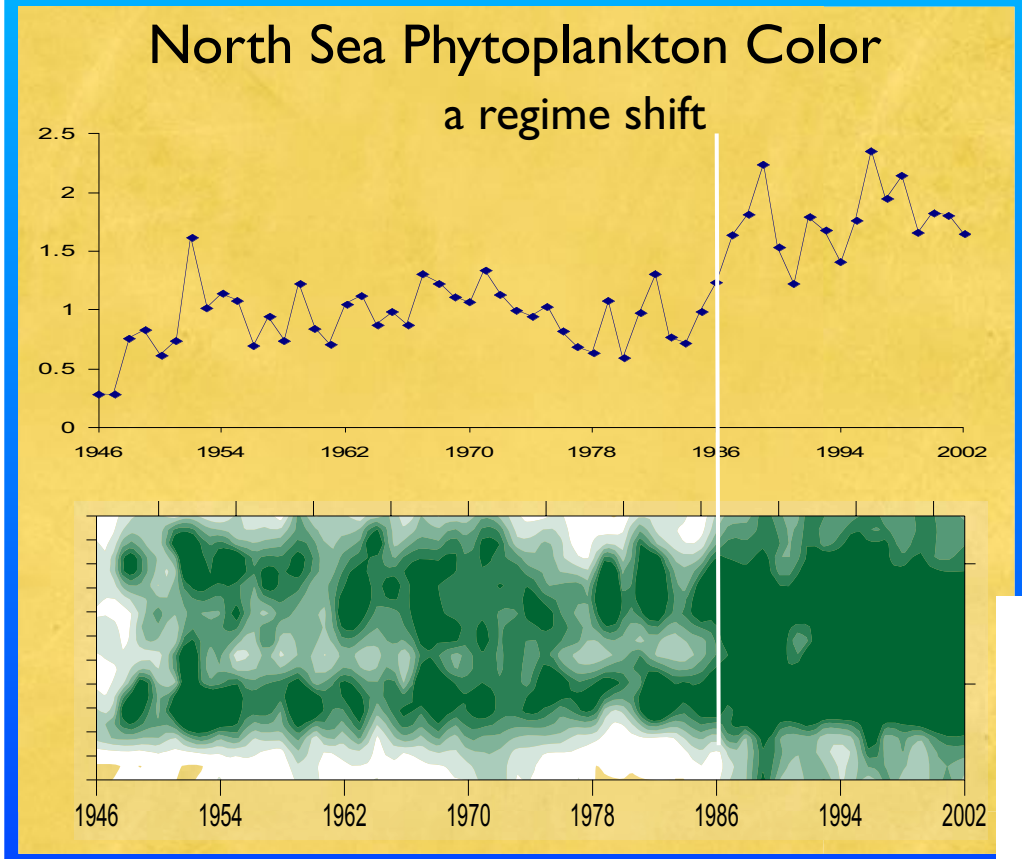


Aqua-Shuttle

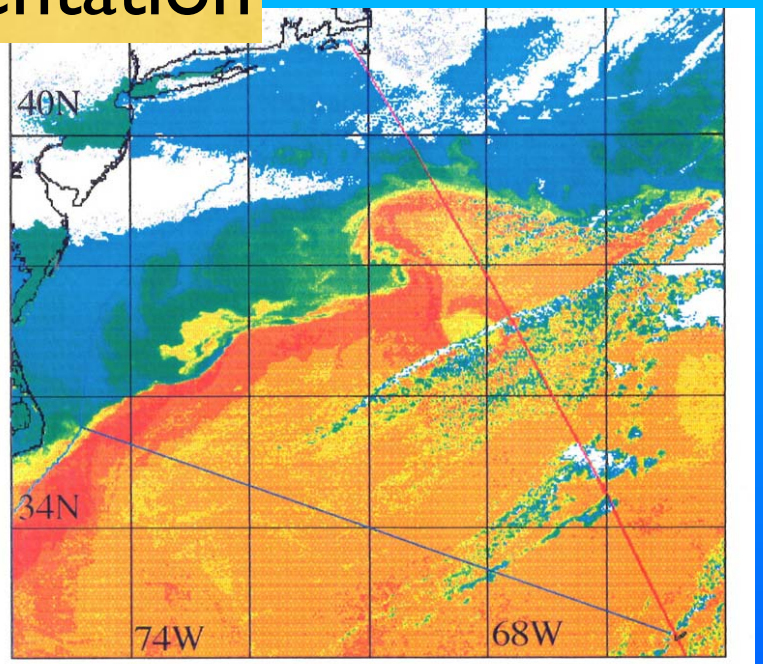


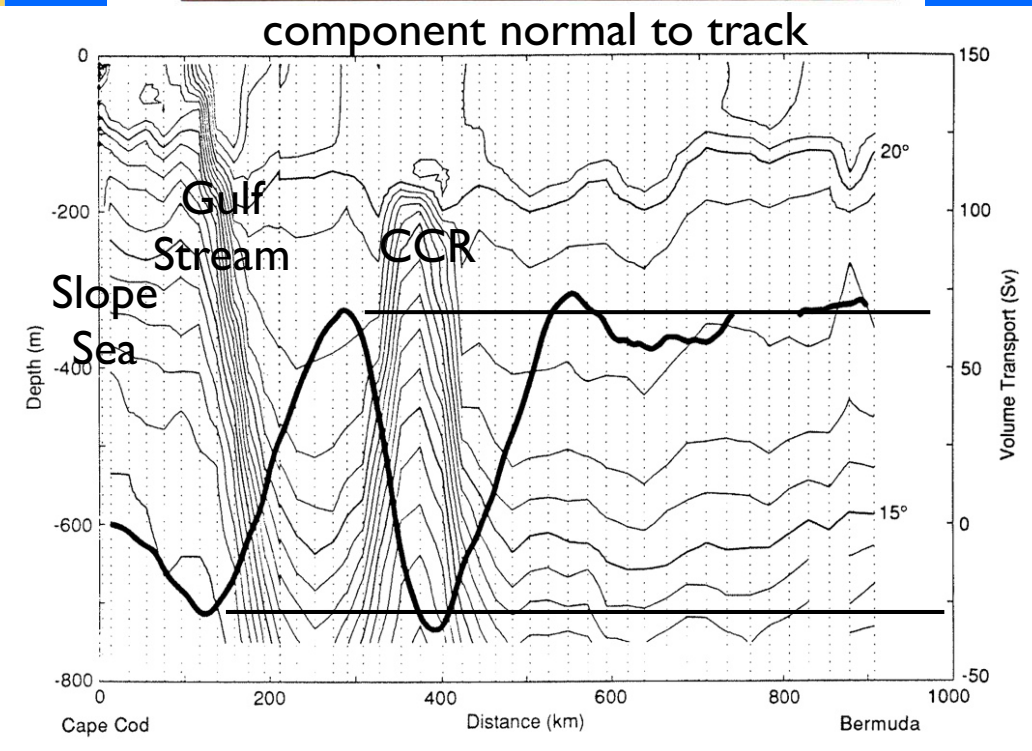
TTM-3

Towed Instrumentation



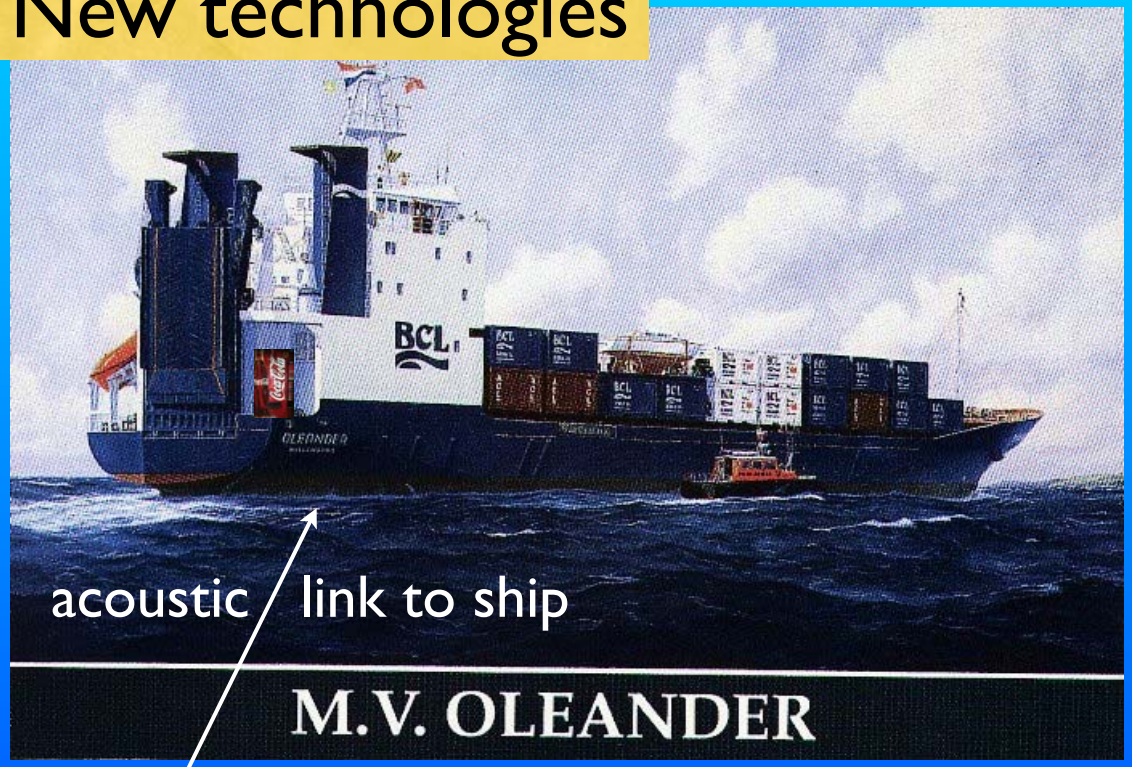
Adapted from C. Reid, SAHFOS





Adapted from T. Sanford, APL/UW

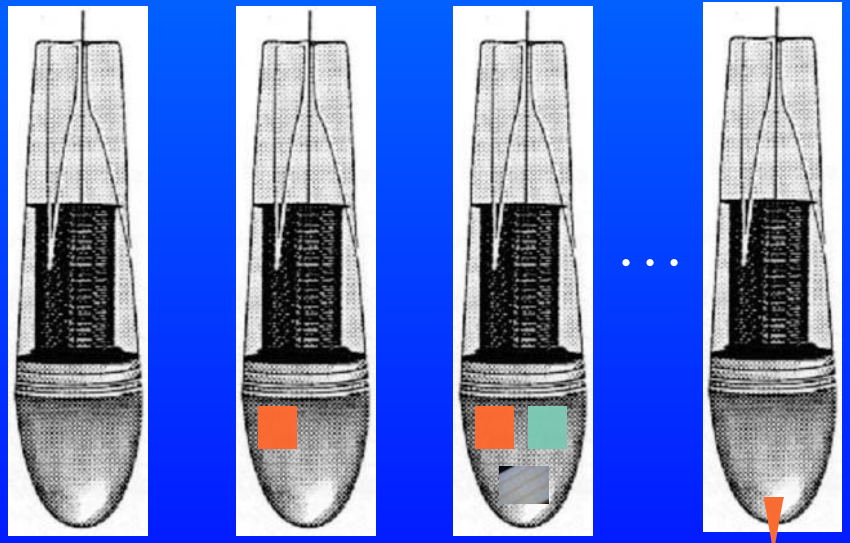
New technologies



schedule or radio command:

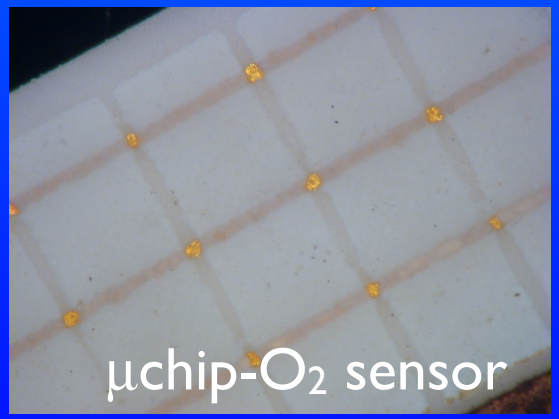
T

TSO_2

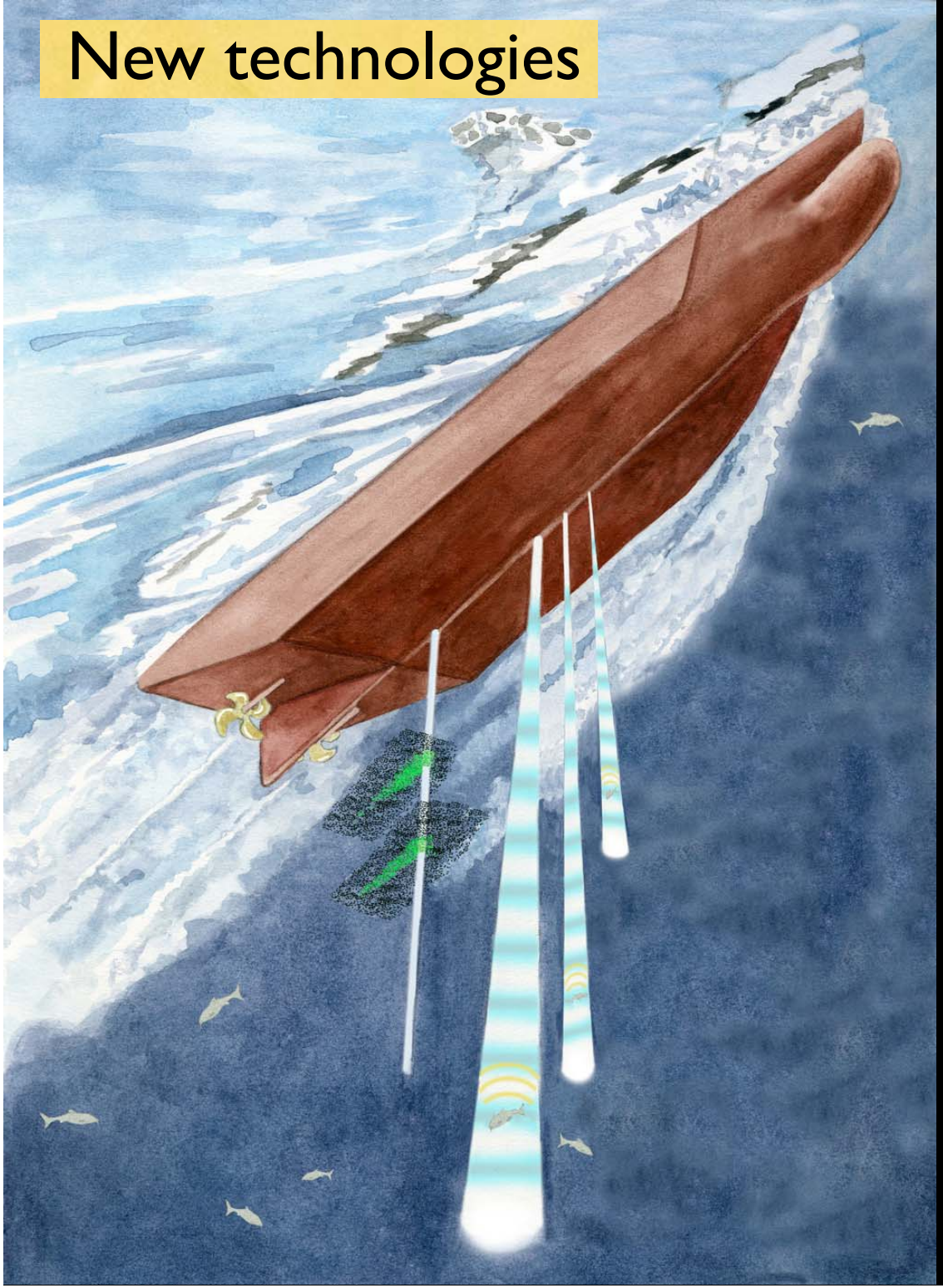


T TS TSO_2 µ-probe

Standardized probes with chips to address different questions:

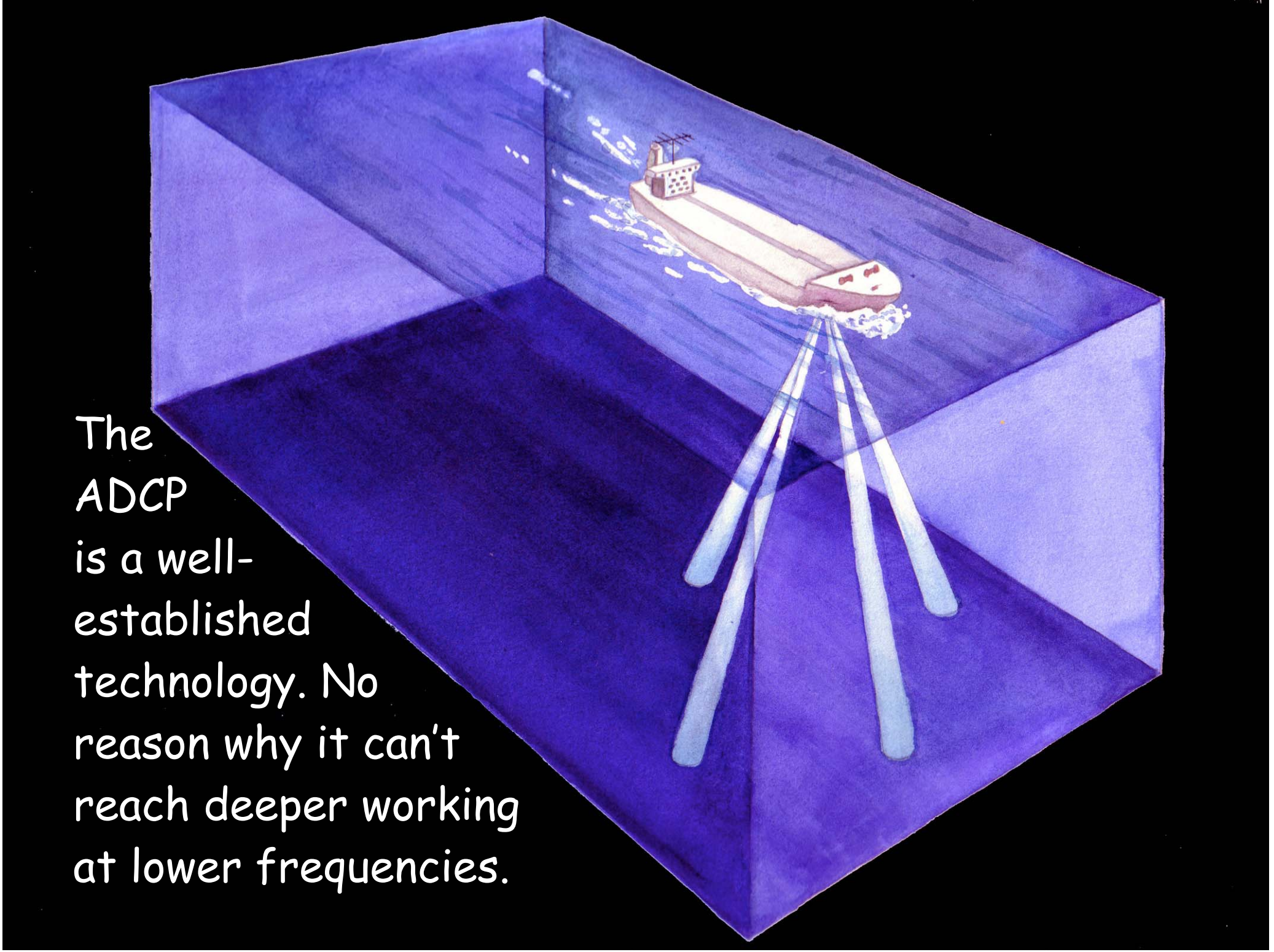


New technologies

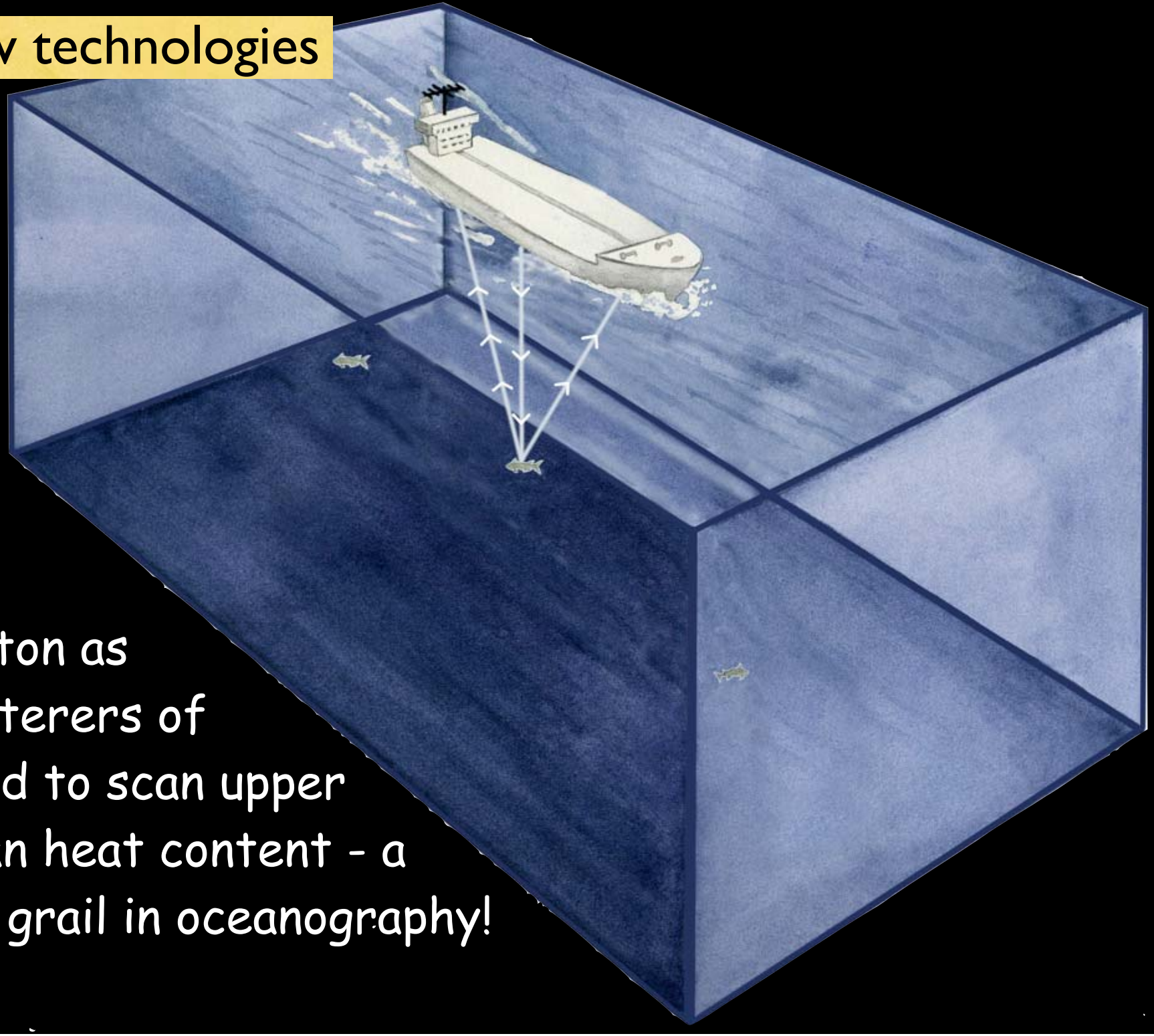


An underwater view of a MM vessel. It can be equipped to scan the ocean for plankton and nekton of various sizes.

By working at multiple frequencies, one can measure 'biomass' across a size spectrum. Repeat sampling can give insight into joint spatial and temporal variability.

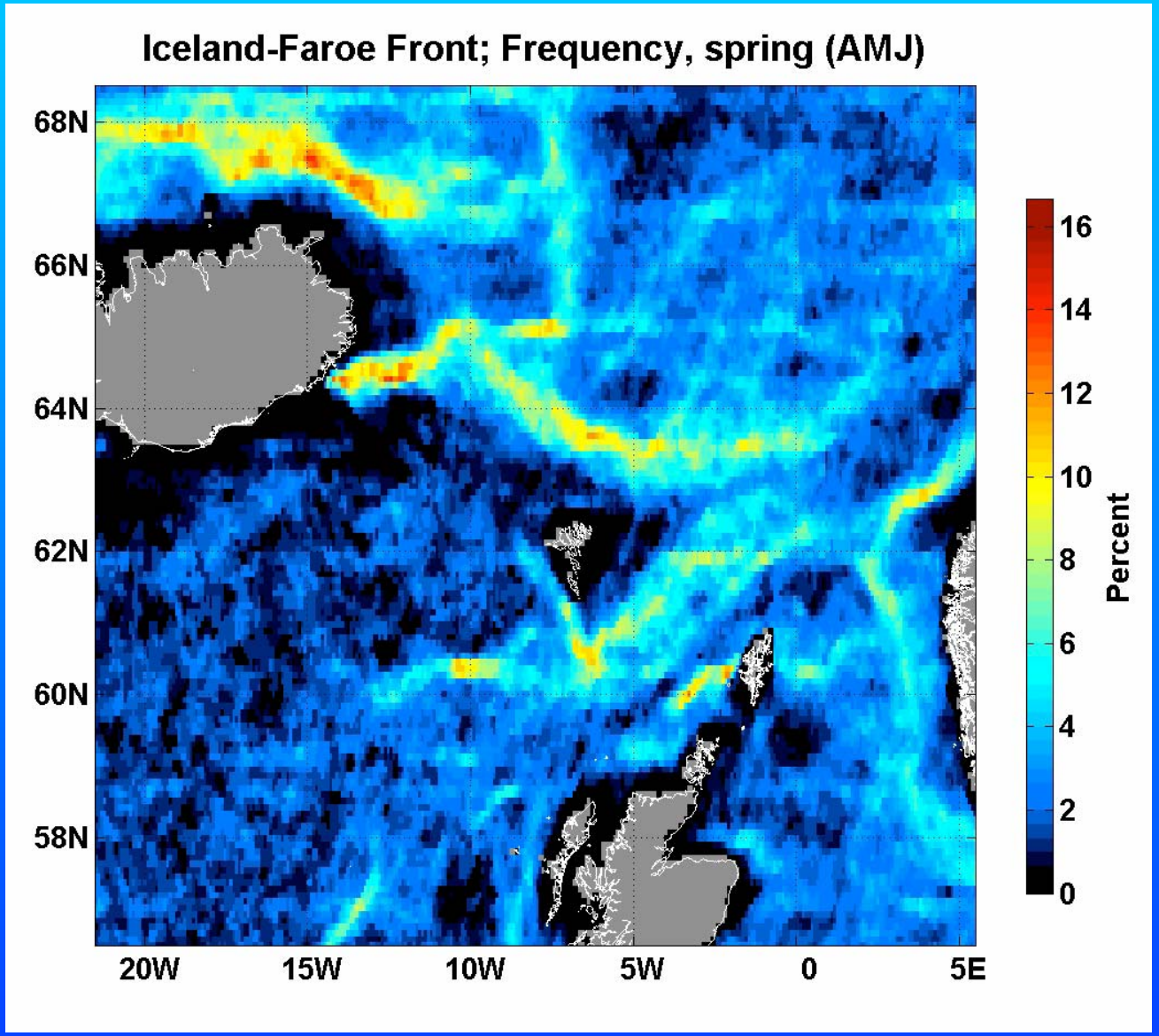

The ADCP is a well-established technology. No reason why it can't reach deeper working at lower frequencies.

New technologies



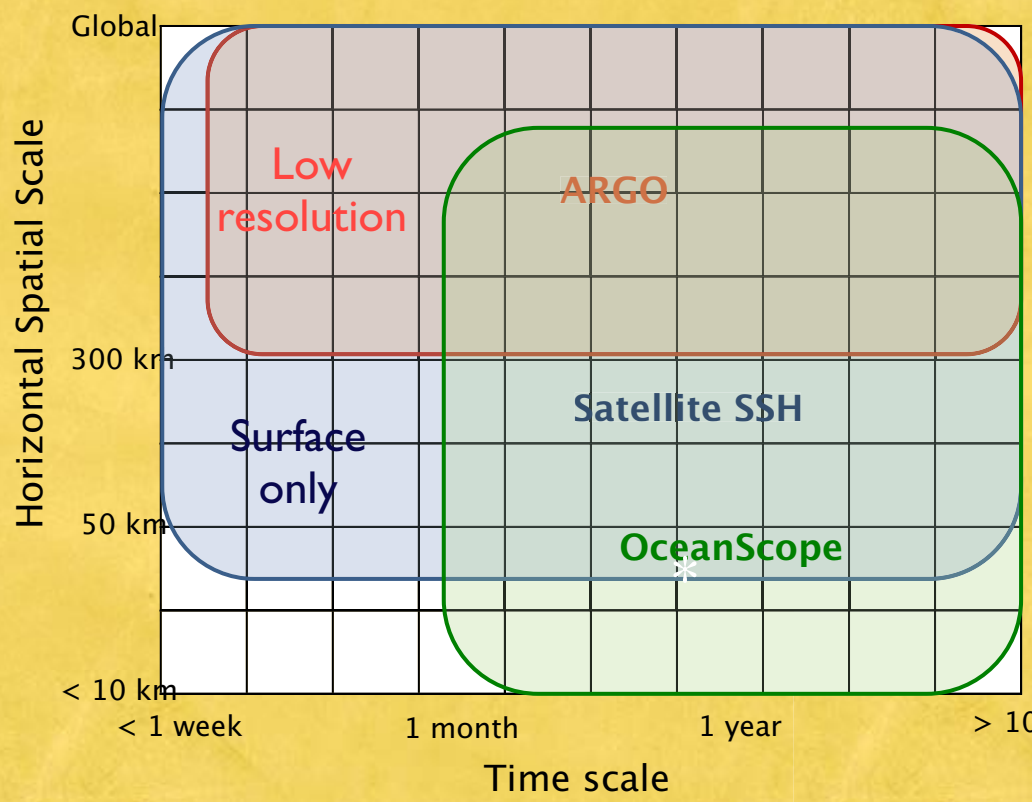
Nekton as scatterers of sound to scan upper ocean heat content - a holy grail in oceanography!

Thermal fronts reflect density gradients and thus currents. We can anticipate related patterns in-situ water properties, plankton and nekton. But we lack the tools to study and quantify these patterns and trends on a systematic basis. Note fine-structure in the ocean!



Igor Belkin

Data Resolution in space and time



Include meso-scale and even submesoscale phenomena

Sustained long-term observation (such as monitoring meridional heat transport)

Note: Does not show vertical sampling!

Adapted from K. Kim, SNU, Korea

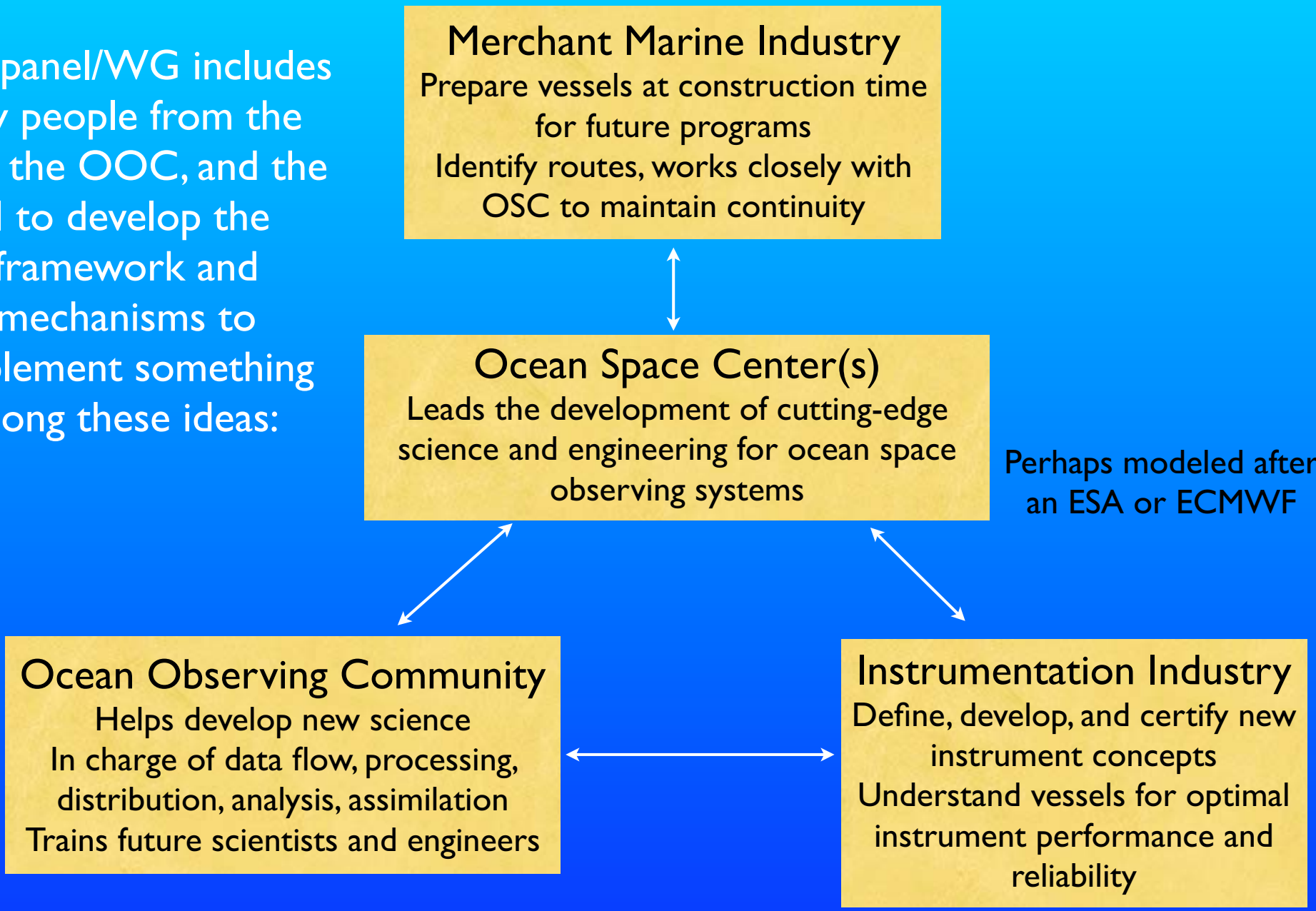
Continuous acoustic/optic remote and towed sampling in the horizontal will accurately resolve and span the most energetic scales in the ocean, from the submeso- to basinwide- scales, a factor 10^3 range.

Terms of References

We are drafting these for April 12-14 WG meeting

The Scientific Basis
Routes - Coverage
Vessels and their characteristics
Technologies (acoustic, flow-through, probes, towed)
Communications (satellite and in-port)
Data handling and management
Legal-Organization Issues (EEZ)
Phasing In OceanScope
Industrial Partnerships
Capacity Building and Outreach

The panel/WG includes key people from the MM, the OOC, and the II to develop the framework and mechanisms to implement something along these ideas:



Perhaps modeled after an ESA or ECMWF

SUMMARY

The key point here is to recognize that the MM is an available global resource for probing the interior of the ocean on a repeat and regular basis - the domain that has been and continues to be very difficult to access, especially at high resolution to resolve the fine-structure we are only dimly aware of, and at a repeat rate in order for the mean fields and their variability to emerge a quantitatively useful way.

Fundamental to the OceanScope paradigm is repeat and regular sampling. The data shall be freely available, timely and accurate.