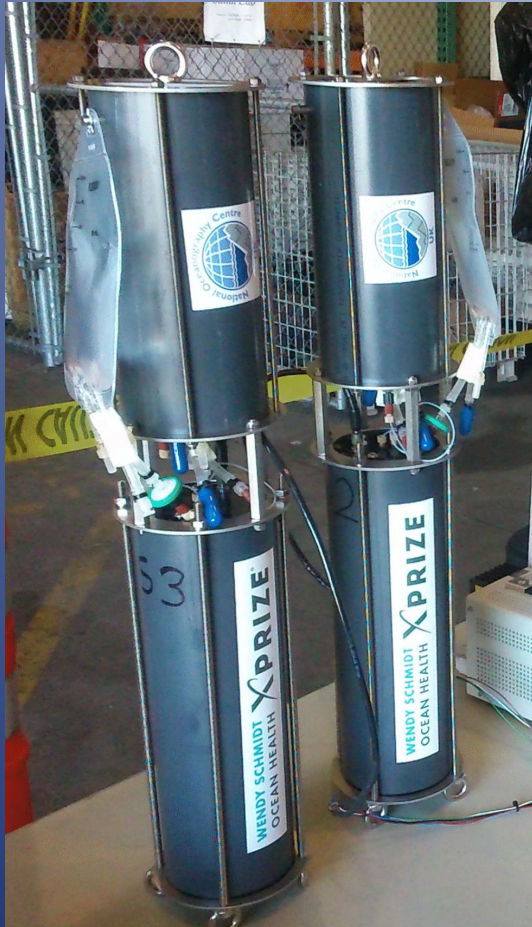
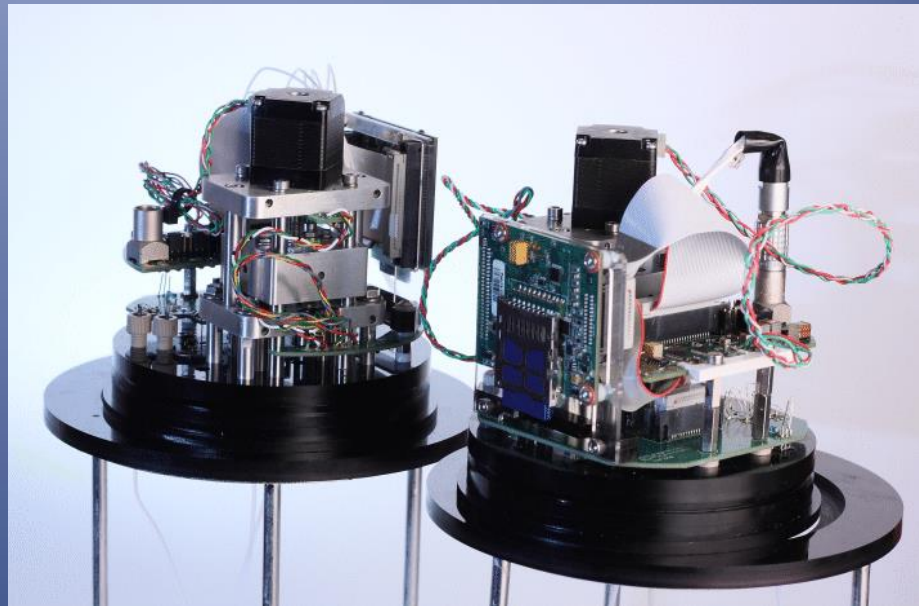


Development of microfluidic sensors for autonomous seawater measurements



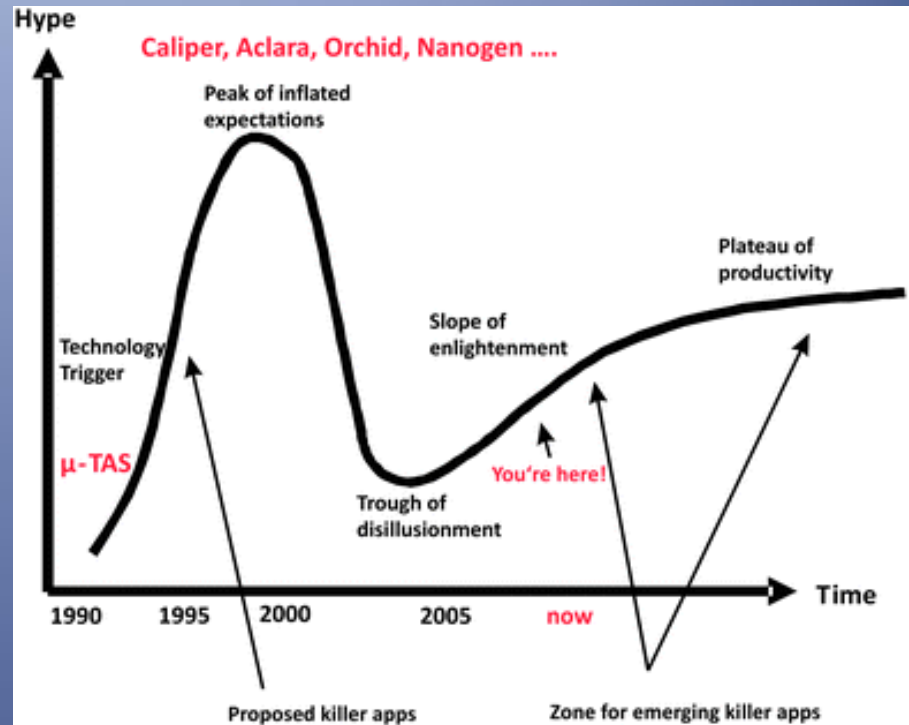
The oceans are undersampled both spatially and temporally

Global network of sensors that can measure seawater properties continuously



Why Lab-on Chip /Microfluidics?

- Mass manufacturing capabilities leading to cost reduction
- Reagent based systems: low fluid volume and reagent consumption. Low power requirements
- Ability to design compact systems with complex microfluidic geometries



The Gardner hype cycle model for microfluidics.
From H Becker *Lab Chip*, 2009
DOI: 10.1039/b911553f
Focus

Lab-on Chip and microfluidics using colorimetric methods

Provides us with the ability to measure a range of nutrients such as:

Nitrate / Nitrite

Phosphate

Iron

Manganese

Ammonium

And also the carbonate chemistry of the oceans:

pH.

TA

DIC

A field-deployable sensor for automated in-situ spectrophotometric pH measurements

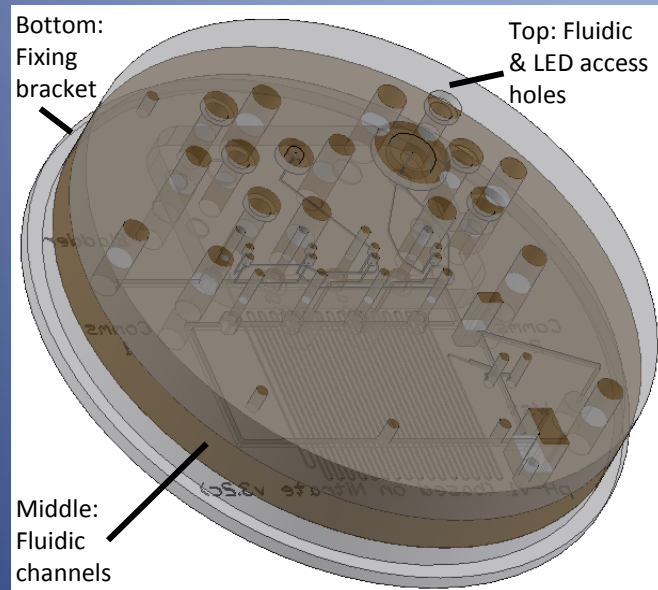


Figure 1 Three layered microfluidic chip

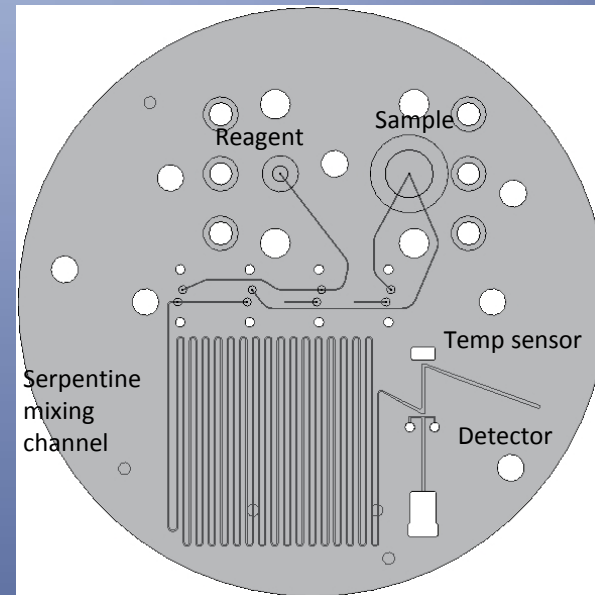


Figure 2 Detail of microfluidic middle layer section

- Measurement based on the formation of a concentration gradient measured by a two wavelength LED
 - Total concentration of indicator and pH is calculated and plotted to derive a perturbation free pH sample

Macronutrient cycles

Christchurch harbour, UK



Nitrate Sensor On Kongsberg Glider



Current and future work

- pH system currently being tested at the Wendy Schmidt XPrize Phase 3 in Seattle for one month coastal trials
- Preparations for further nitrate glider deployments
- Deployments in the Arctic and Greenland



Acknowledgements

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