The next generation of Argo floats

Brian King

NOC, Southampton

Why do we need a next generation ?

To sustain Argo we need to reduce cost per profile

More cycles per float (developments of platforms and sensors)

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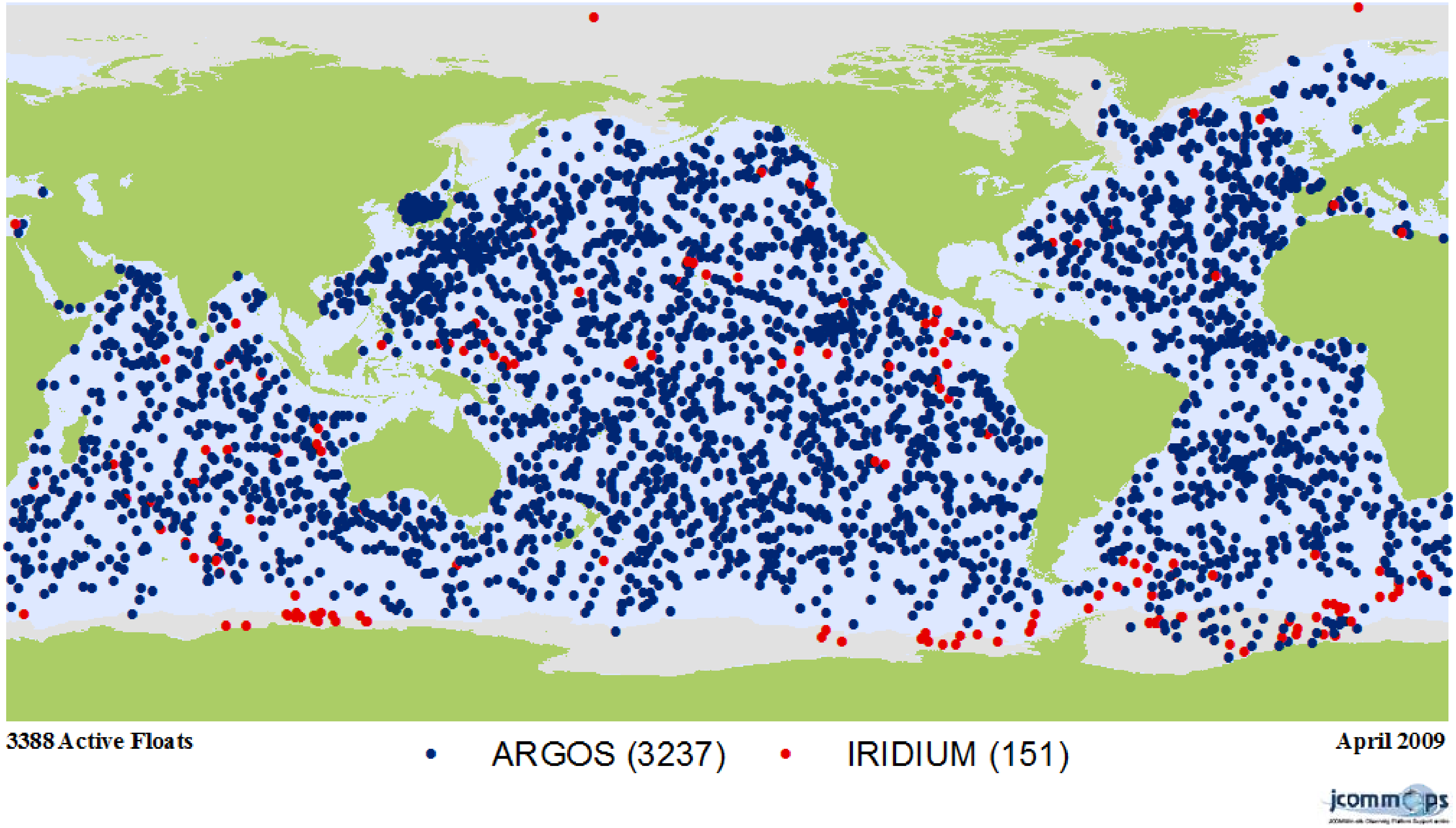
Incremental expansions

- Ice capability
- Avoid grounding
- Improved bandwidth & 2-way comms
  - Improved surface layer sampling
  - Improve vertical resolution

About 200 active Iridium floats Jun 2010
Mainly APEX



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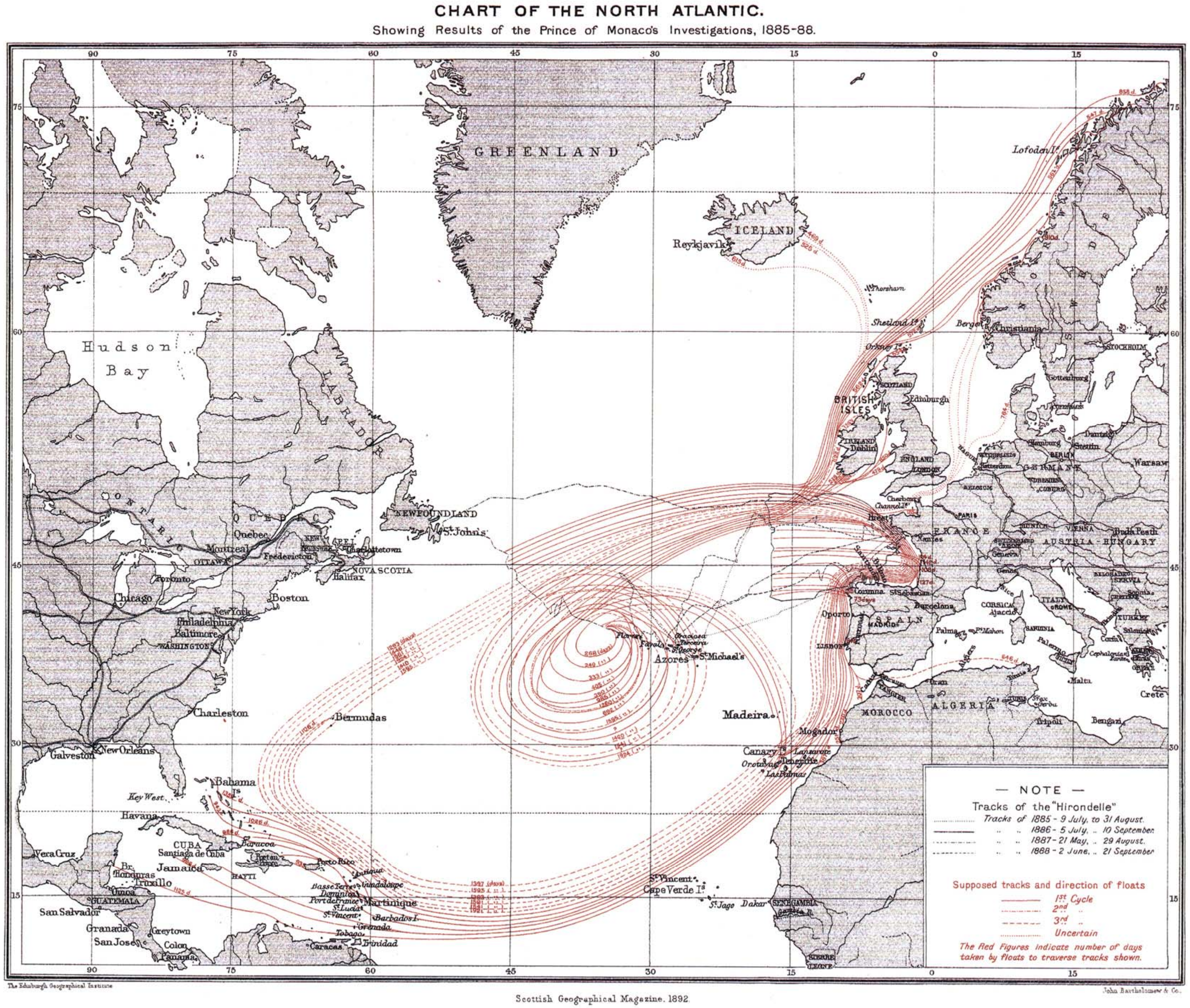
Major expansions
- Sensors
- Deep-ocean (platforms and sensors)
- Boundary currents (probably requires complementary technology such as gliders)

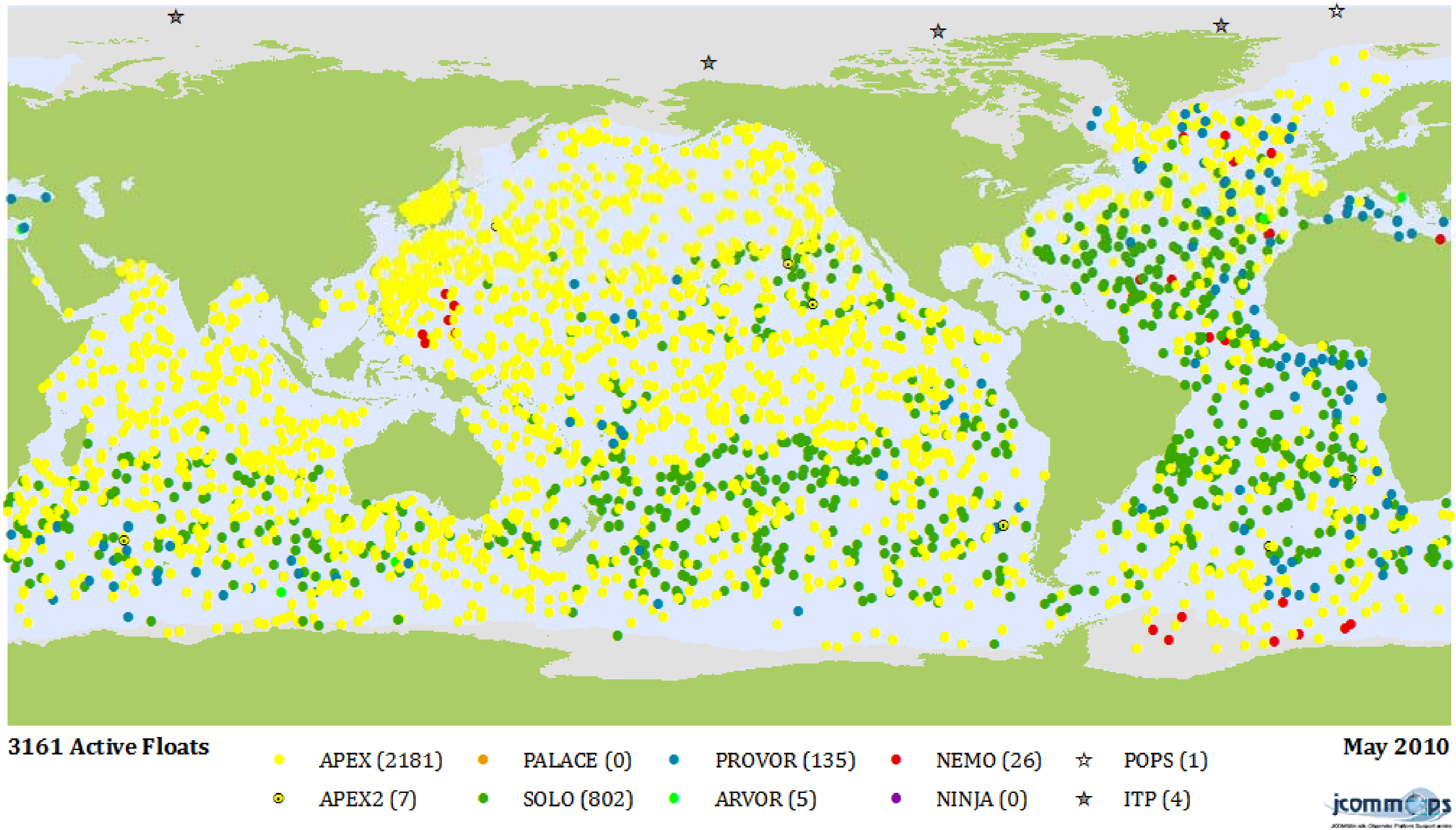


Carte des courants

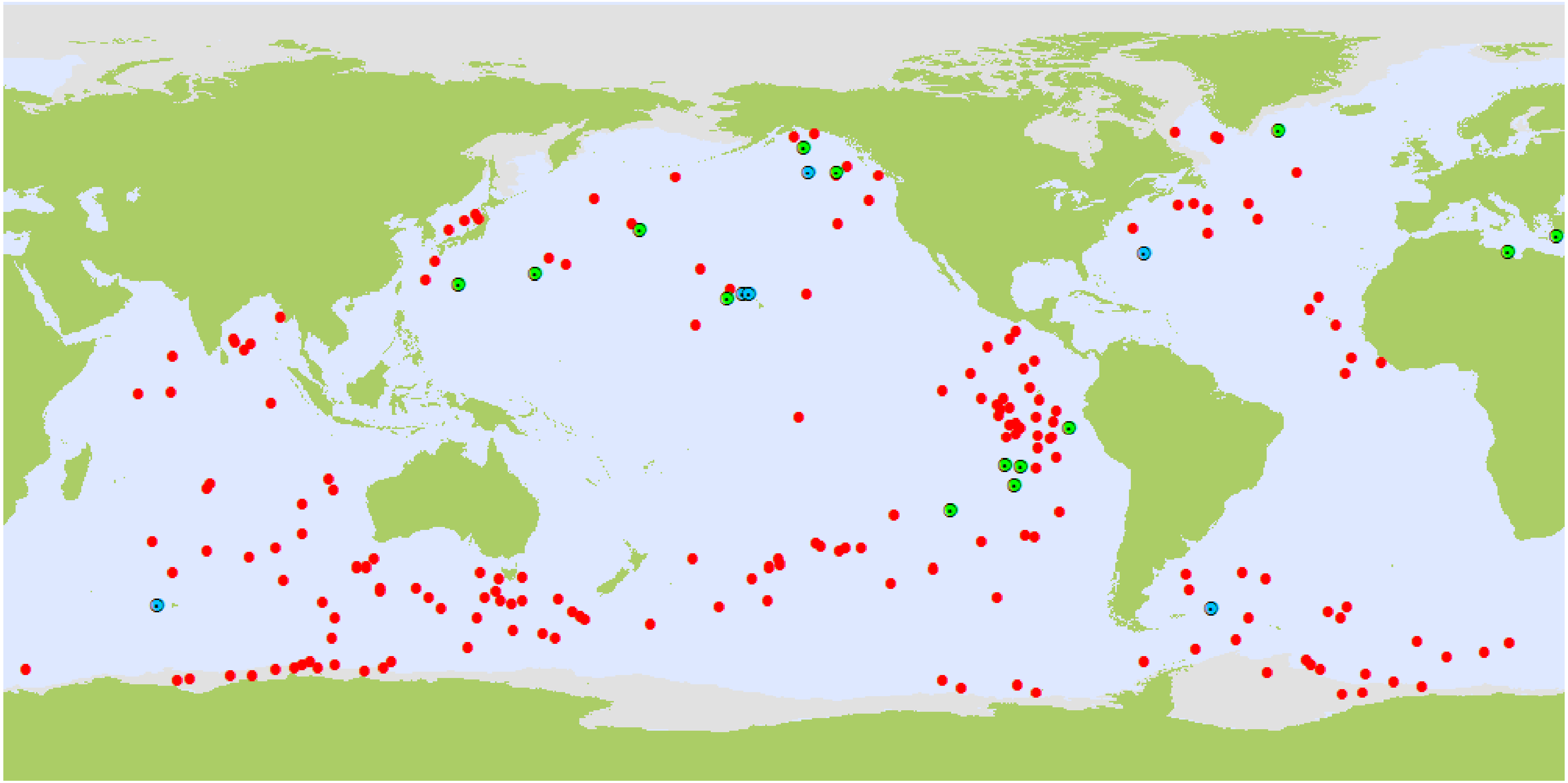
Prince Albert I, Nature 1898

1675 floats released, 226 returned

AIC: Floats by model

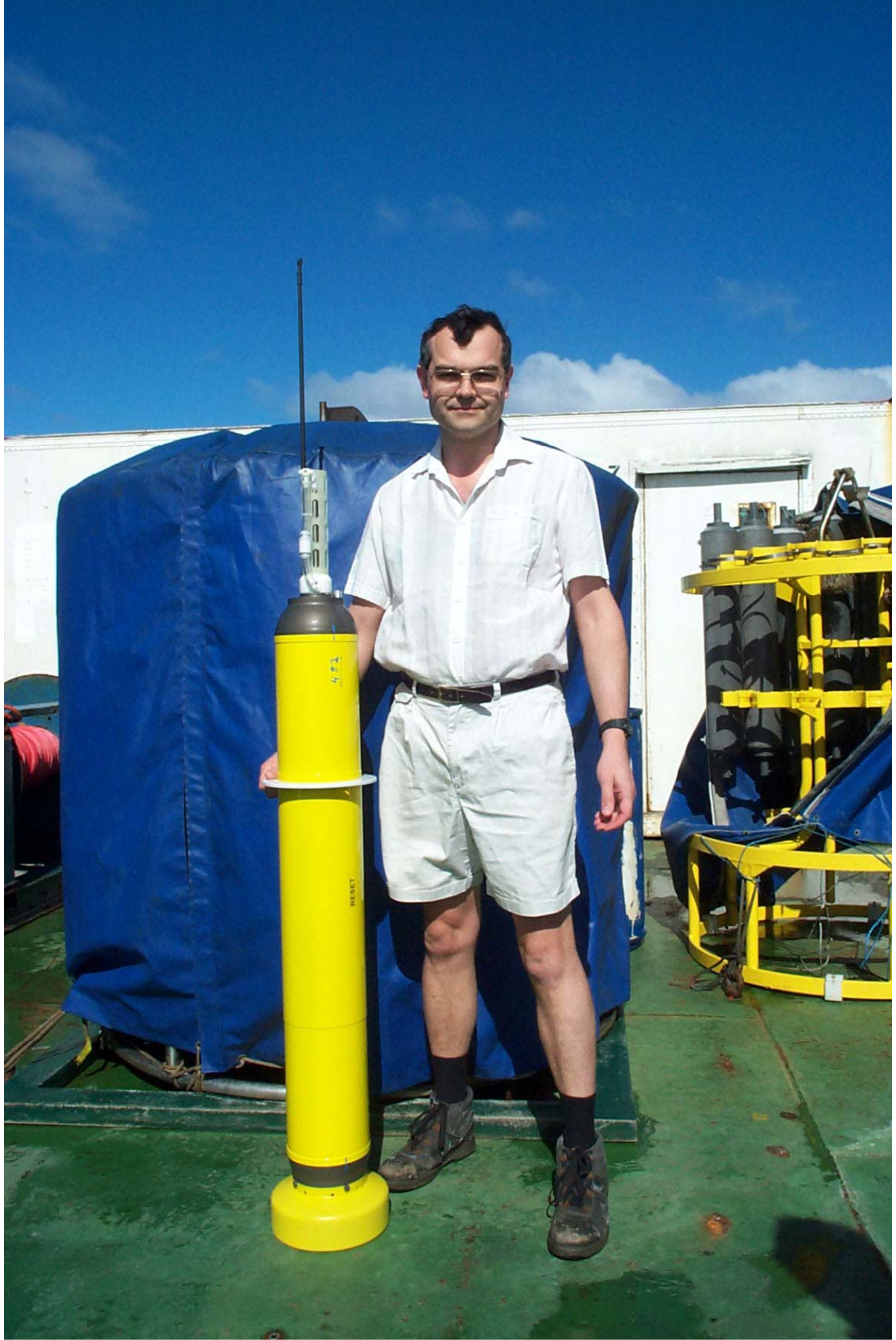


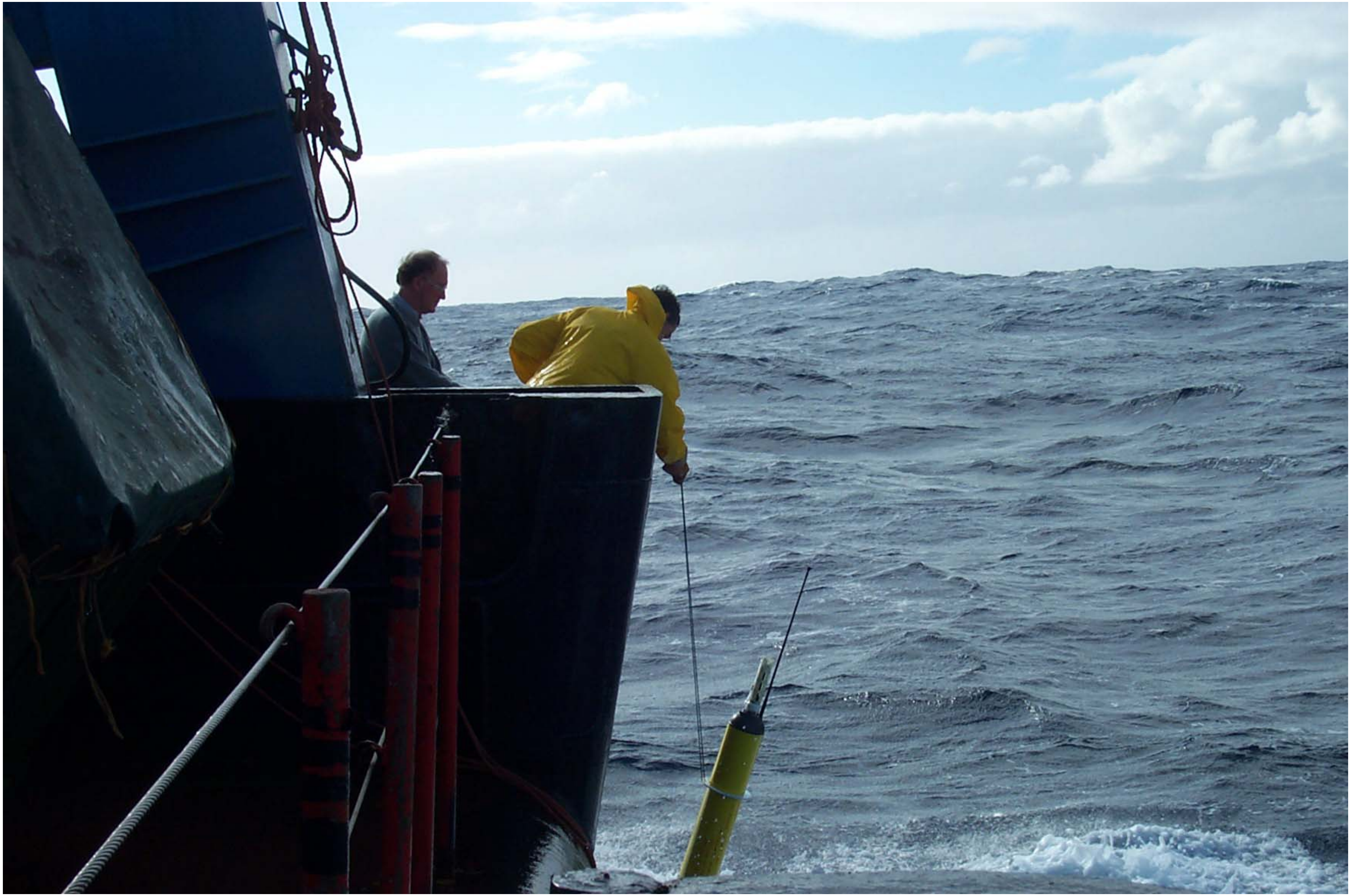
AIC: Extra sensors

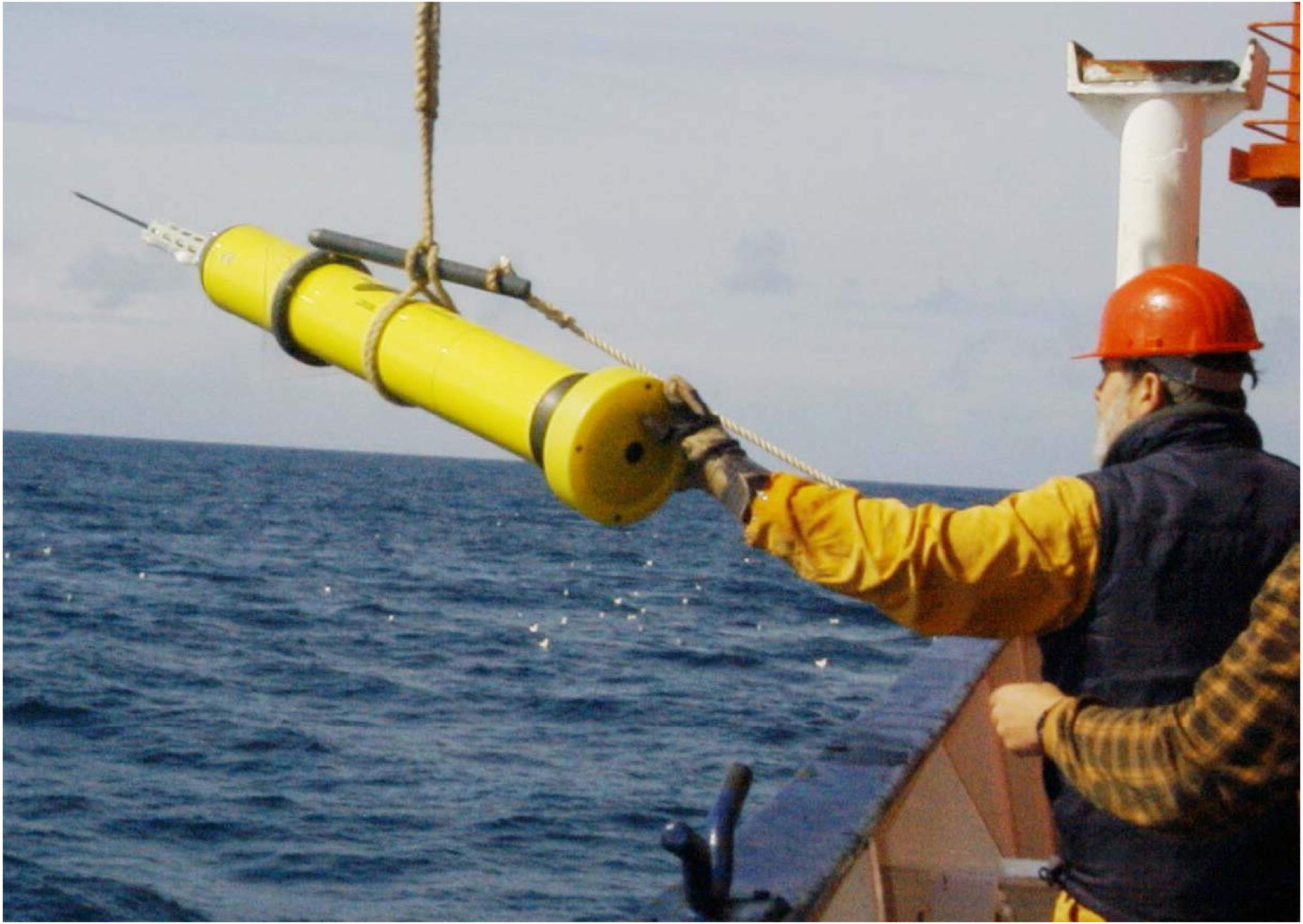


BIO Argo (201) **May 2010**

• Dissolved Oxygen (197) • Bio-optics (14) • Nitrates (6)







PROVOR & ARVOR

SOLO II & SOLO

SOLO -> SOLO II developments

SOLO-II Profiling Float

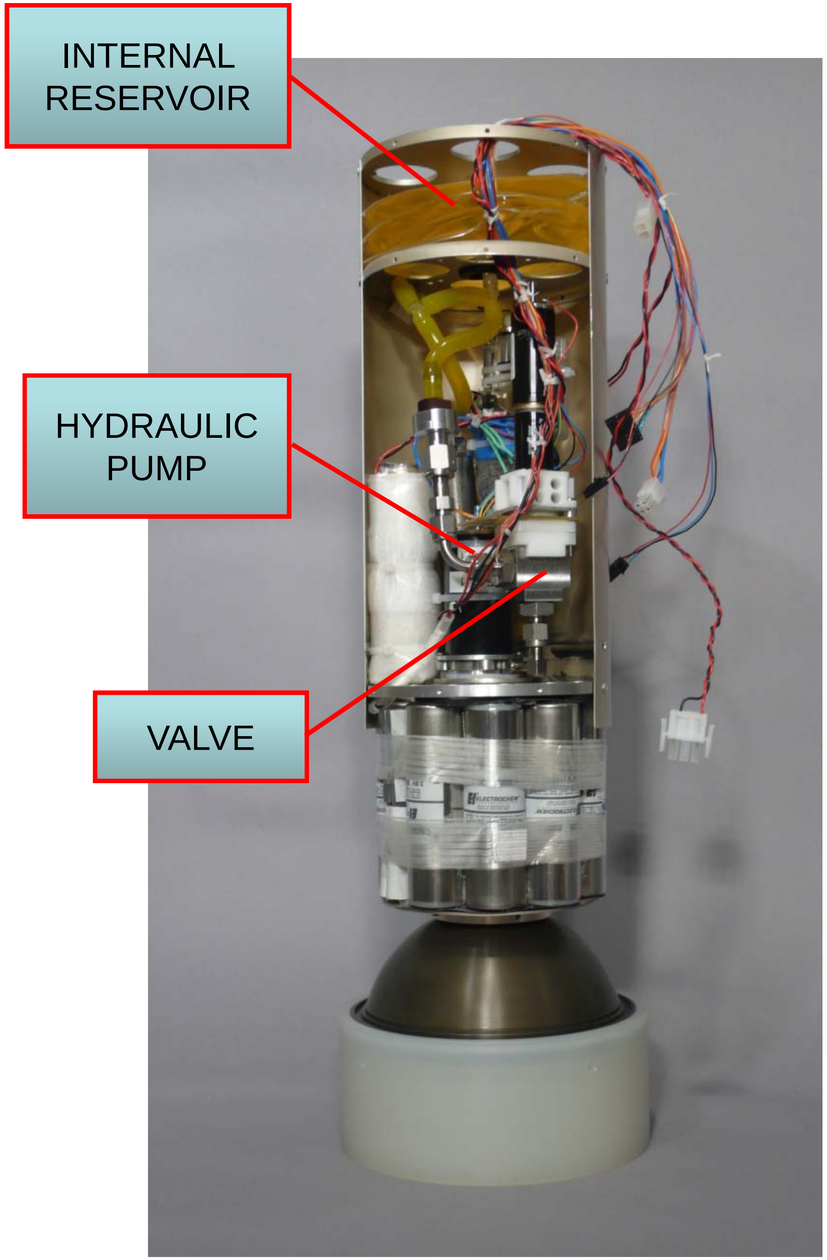
DESIGN ACCOMPLISHMENTS AND CAPABILITES:

- Smaller and lighter (energy-efficient, easier to ship/deploy)
- 70% reduction in packing volume
- Reduced labor for assembly
- No high pressure ballasting required
- 2000 m profiles anywhere
- Long life (~6 years)
- No air bladder
- Reciprocating pump (same as Spray glider)
- Scalable (in length, batteries, sensors), increased payload
- Pumping system adaptable for deep-ocean profiling
- Bi-directional “seek” capable.
- Waste and non-degradable product reduced by over 50%

SOLO-II vs. SOLO

SOLO/SOLO II comparison:

	SOLO-I	SOLO-II
# of dive cycles	~180	~200
Energy (kJ)/dive w/SBE-41cp	22.5	10.3
Max depth (dBar)	2300	2300
Ocean coverage @ Max depth	~50%	100%
Telemetry	ARGOS	Iridium
CTD	SBE 41cp	SBE 41cp
Surface time (hr)	12	0.25
Mass (kg)	30.4	18.6
Main pressure-case length (in)	41	26
Seek capability	Bidirectional	Bidirectional



SOLO-II internal view

SOLO-II presently has 2 systems (passive and active) for removal of air bubbles.

SOLO-II, Prototype #1 UPDATE

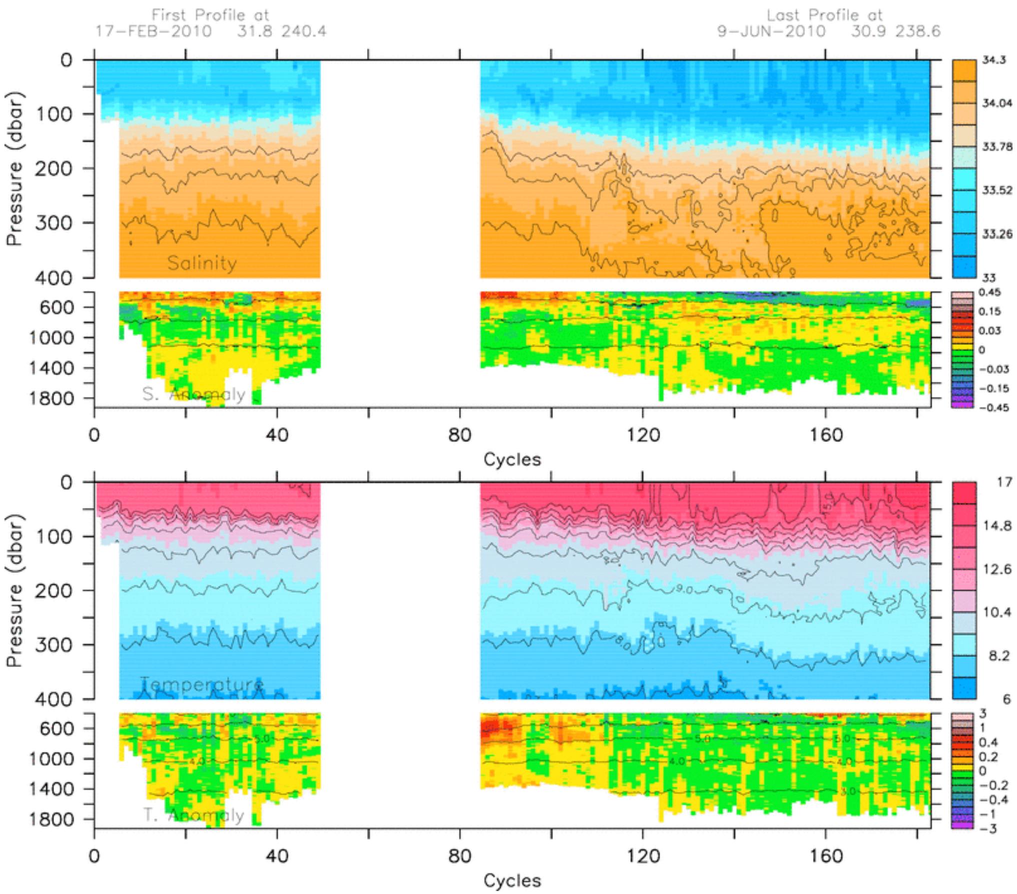
- First deployment Sep 2009, recovered
- Second deployment 17 Feb near San Diego
- Completed >150 cycles (presently daily)
- Some dives >1700 dbar (oil remaining in bladder)
- Returning good 2-dbar data

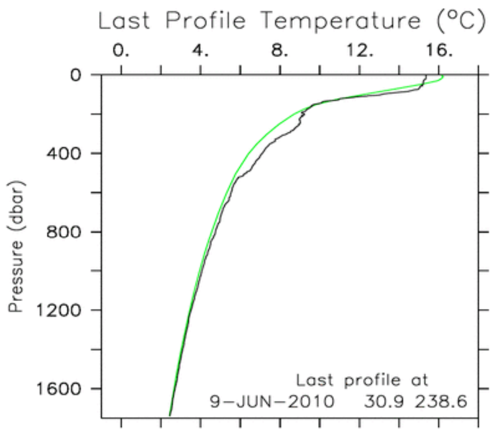
•Using < 10 kJ per cycle

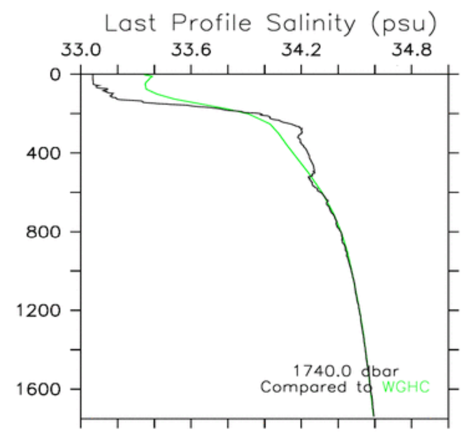
Plans

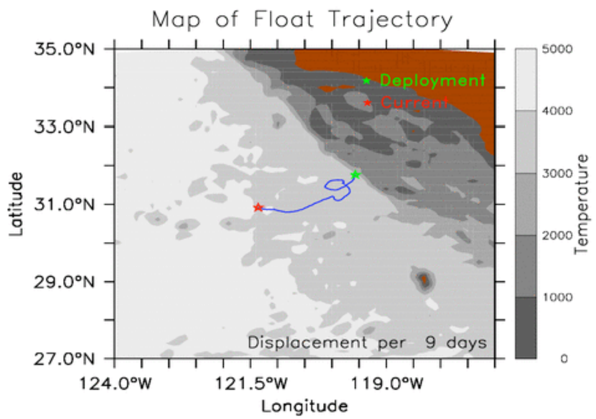
- Deploy S-II Prototype #2 with modifications near San Diego
- Deploy remaining S-II prototypes in mid-Pacific; new antenna, accelerated cycling by August 2010
- 1st production run:
  - •25 SOLO-II floats by 4th quarter 2010; equatorial pacific deployment
  - •2 SOLO-II floats in end of 2010; Bay of Bengal
  - •10 SOLO-II floats in 4th quarter; Atlantic

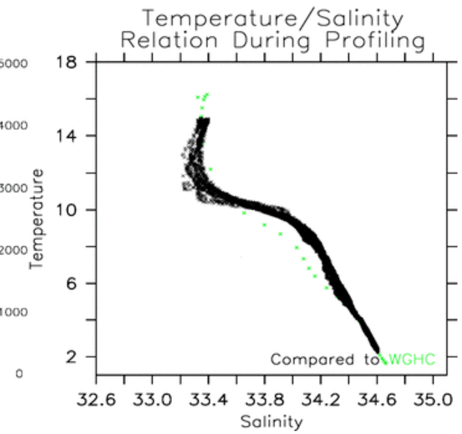
•Redesign S-II for deep operation.











Future activities for SOLO II

- Deploy 4 more SOLO-II prototypes by August 2010
- Deploy 25 SOLO-II floats in Eq. Pacific (+ 12 in Atlantic and Bay of Bengal), late 2010
- Complete the transition from SOLO-I to SOLO-II production, 2011
- Increase maximum profiles to 400 dives
- Dual telemetry system capability (Iridium and Argos III)
- 90% biodegradable
- Redesign SOLO-II for deep ocean profiling.

APEX developments

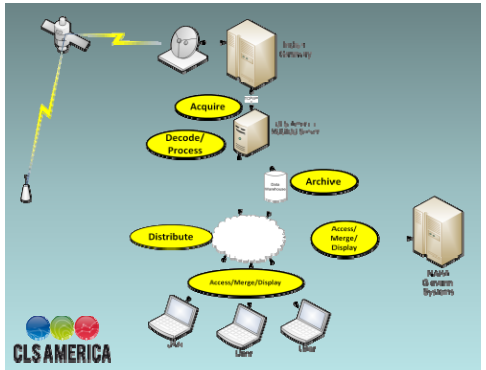
FY09 NOPP BAA

Development, Assessment and Commercialization of a Biogeochemical Profiling Float for Calibration and Validation of Ocean Color and Ocean Carbon Studies

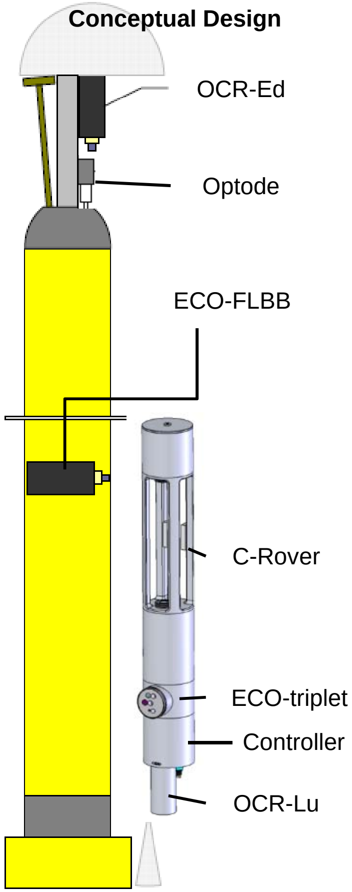
Emmanuel Boss (University of Maine)

OBJECTIVES:

- Integration of high precision bio-optical sensors (both active and passive) onto profiling floats
- Deployments of floats in interesting dynamic ocean regimes to demonstrate the efficacy of autonomous and sustainable technology for
  - a.) the calibration and product validation of orbiting ocean color radiometers
  - b.) investigations of the dynamics of carbon in the upper ocean.



Goals:
- Novel integration of optical sensor packages to APEX profiling floats.
- Rigorous evaluation of the capabilities and limitations of profiling floats for biogeochemical observations, including a thorough analysis of the uncertainties of float based measurements.
- Development of adaptive profiling regimes to capitalize on events
- Development of software for display and dissemination of data.
- Development of a novel web tool that will provide NASA's products.



ACCOMPLISHMENTS:

Completed integration design of bio-optical instrument package (C-Rover, ECO-Triplet, OCR-504 Lu, OCR-504 Ed)

Preliminary mechanical design of instrumentation implementation on floats

Developed & implementation of a rigorous testing of optical sensors before deployment (pressure cycle simulations)

Made modifications to the current float firmware to support the successful deployment of at least one optical sensor.

Preliminary biogeochemical profiler interface definition.

Shore-side data capacity requirements are being scaled and web-based data access tools are being evaluated

Hired a postdoc for the project (Dr. G. Gerbi) to assist with deployments, evaluations, data processing and science interpretations.

APEX (Teledyne Webb) developments

Bio sensors: Oxygen +

- Multiple optical sensors -
  - Radiometer, Fluorescence, Carbon (U. Maine)
  - Nitrate (UW, MBARI)
  - First deployment late 2010

APEX (Teledyne Webb) developments

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6000m float under development

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6000m float under development

Planning stage
- Iridium short burst data
- Acoustic detection/avoidance of ice or grounding

PROVOR -> ARVOR developments

PROVOR (NKE) developments

PROVOR will remain as major platform for additional sensors, larger payloads, etc.

Talk by Patrice Brault.

ARVOR (NKE) developments

Will replace PROVOR as ‘standard’ Argo float (2000m)
- 250 cycles, lighter (20kg), cheaper

Present ARVOR experience
- 2 test floats have achieved 240 (2-day) cycles
- CP CTD, 2000 metres, 98 levels

ARVOR (NKE) developments

Will replace PROVOR as ‘standard’ Argo float (2000m)

- 250 cycles, lighter (20kg), cheaper

Present ARVOR experience

- 2 test floats have achieved 240 (2-day) cycles
  - Equivalent to > 6 years of 10-day cycles
- CP CTD, 2000 metres, 98 levels

Under development

- Iridium and Argos-3
  - Reduction of surface time, 2-way comms;
  - Possibility of updating mission, including for float recovery
  - Most likely to be used in marginal seas
- With Ifremer: 3500m capability

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