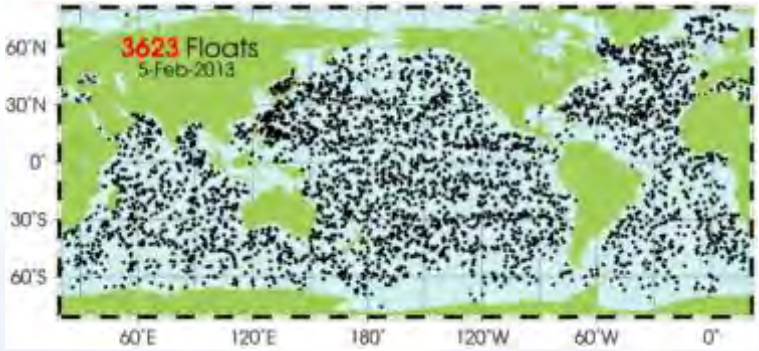
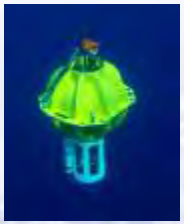
Expanded Capabilities of the Slocum Glider

Teledyne Webb Research



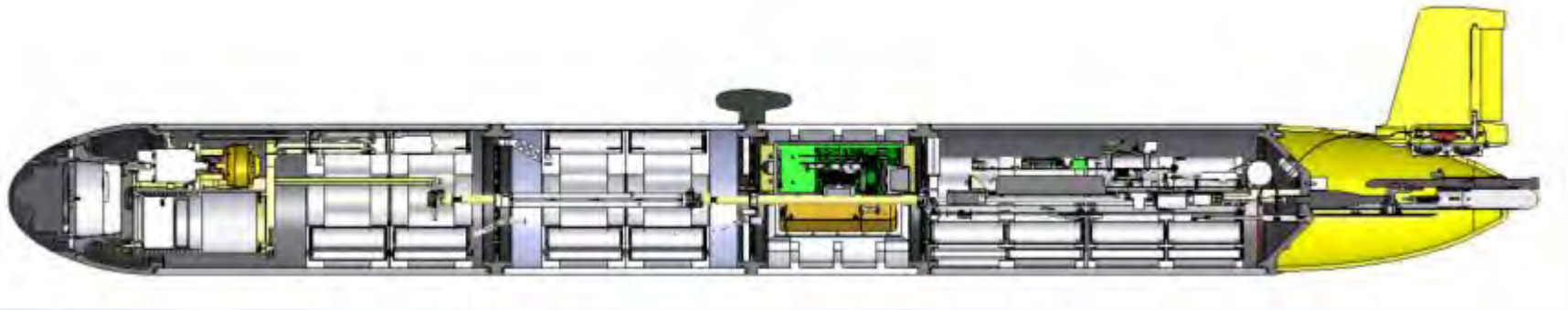
Long Endurance Worldwide Remote Sensing

- Low Frequency Sound Sources for Navigation and Tomography
- APEX Profiling floats, 2000 m and 6000 m depth operation
- Slocum Autonomous Underwater Gliders

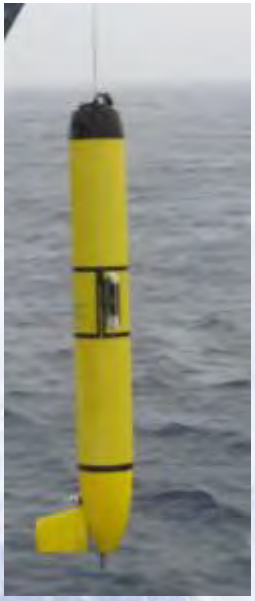


Teledyne Webb Research has a core focus and commitment to providing tools that better enable our understanding of the world's oceans.

Slocum G2 Glider



- 1000m Rated Vehicle
- Modular Architecture
- Expandable Design
- External Ballast
- Robust Design
- Lithium Primary Batteries
- Small and Large Vessel LARS



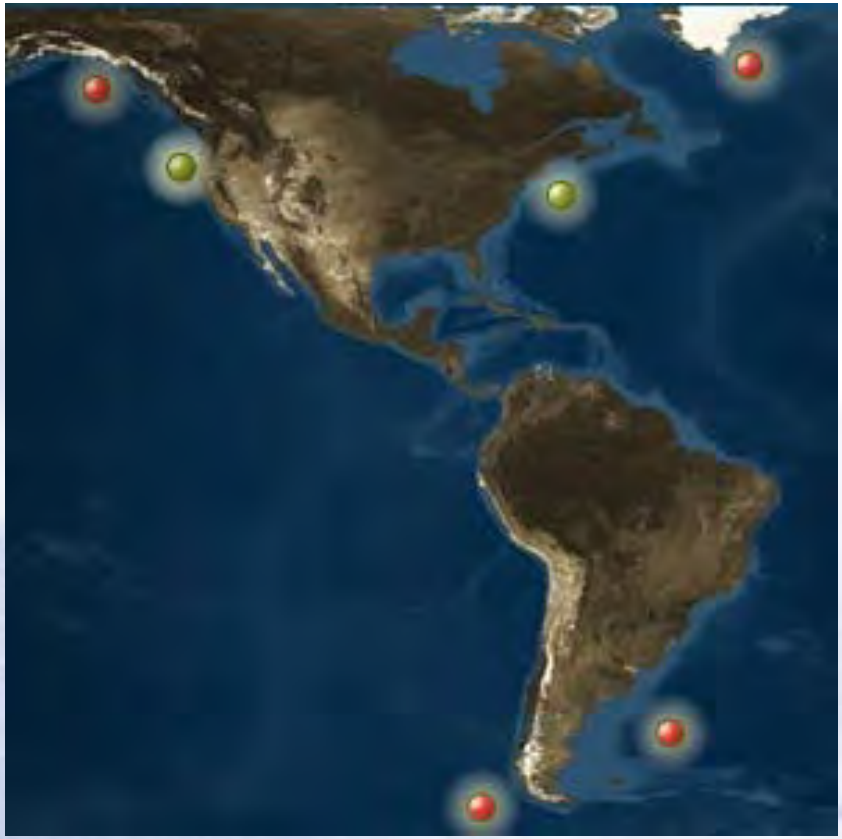
The LBS-G G2 Glider

Littoral Battlespace Sensing – Glider (LBS-G)

Deliver to US Navy 150 Gliders through 2015, additional 150 Gliders Sole Source as follow on.

- Sensors include a CTD and Beam Attenuation Meter
- Require both shallow water and open ocean functions for METOC, ASW, and MCM operations

Ocean Observation Initiative (OOI)



National Science Foundation

OOI Coastal Glider
24 Gliders 2012 - 2013

OOI Open Ocean
24 Gliders 2013 - 2014

Sensor Suites

Acoustic Modem
ADCP/DVL
Altimeter
Bathyphotometer (bioluminescence)
Beam Attenuation Meter
Optical Backscatter
Optical Attenuation
Oxygen
Conductivity, Temperature, Depth
Fish Tracking
Fluorometer
Hydrocarbon
Hydrophones
PAR sensor
Radiometer
Scattering Attenuation Meter
Spectrophotometer (red tide detection)
Turbulence

Modular 6 L Payload Bay
Nominally 3 – 6 kg air weight
Customized for a variety of acoustic, optic and chemical sensors

Science Bays can be stacked or stretched.

Modular Payloads

Increased Buoyancy Displacement

Shallow and Deep Pump (drop in replacements)

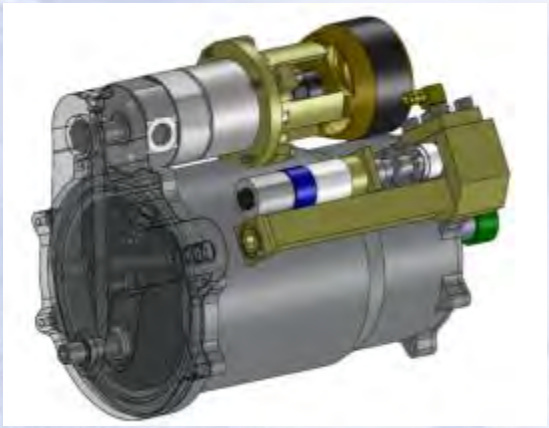
- Increased lung capacity from 460cc to 800cc (working on 1000cc)

Composite Hull (patented)

- Provides an additional 335 cc compressible drive

Advantages

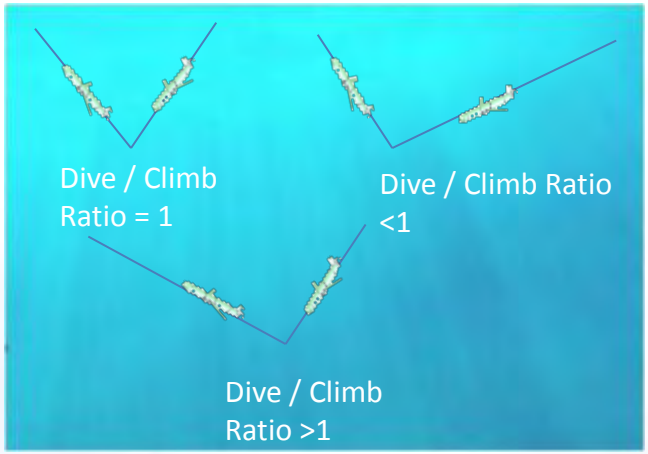
- Greater density range capability
- Greater speed capability

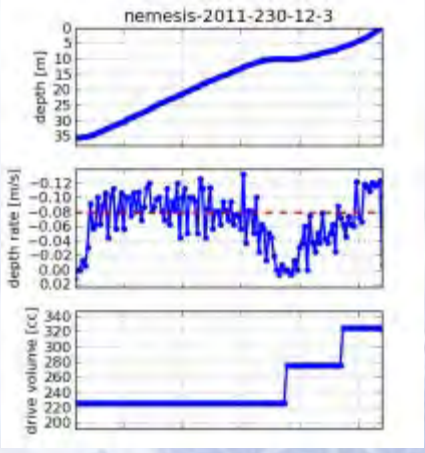


Software Advances

Optimize performance:

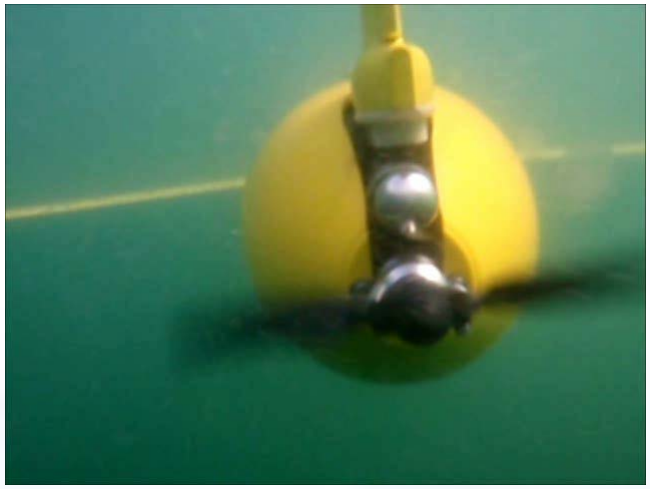
- Autoballast: adjusts to balance the dive/climb ratio within desired drive value.
- Speed Control: overrides Autoballast to maintain desired speed
- Low Power Mode: reduces processor cycle interval to manage energy usage

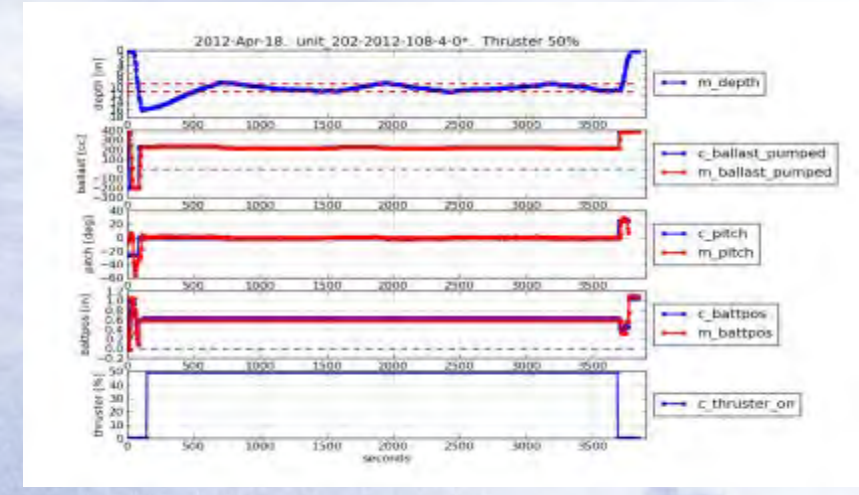




Hybrid Glider

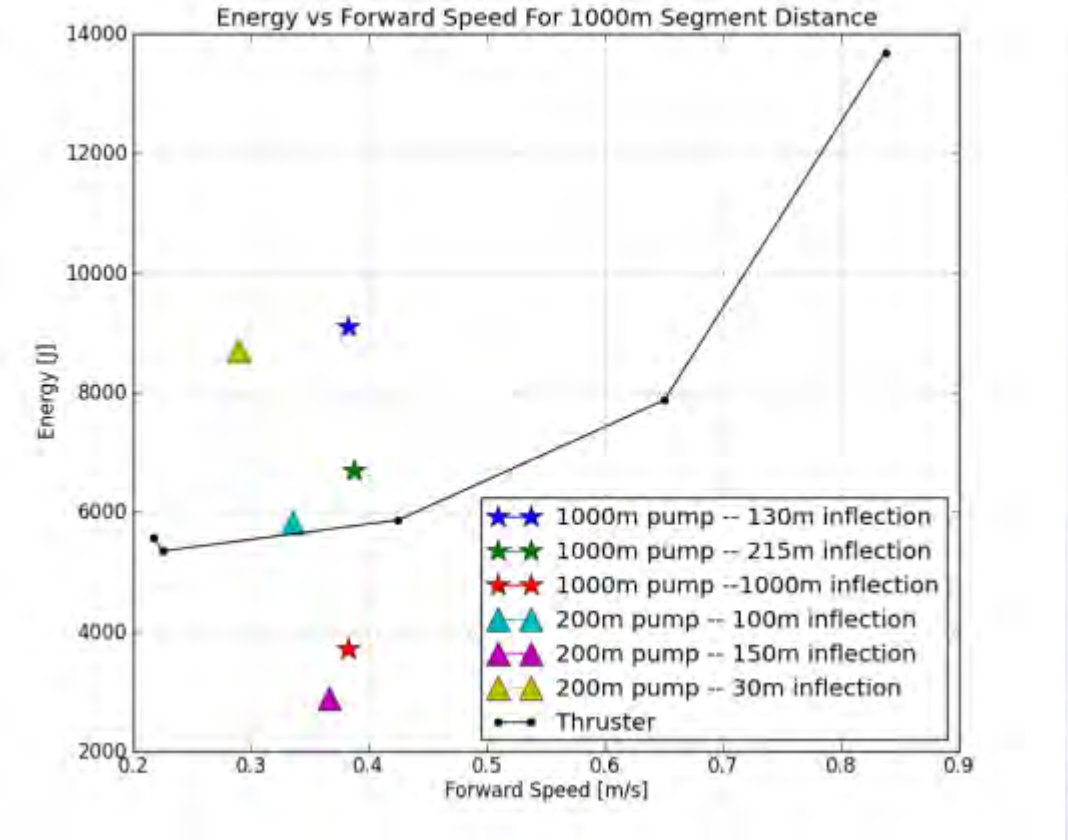
- Greater speed – up to 2.0 knots
- Increased vehicle capability using the standard mission construct
- Freshwater lens penetration for surfacing events





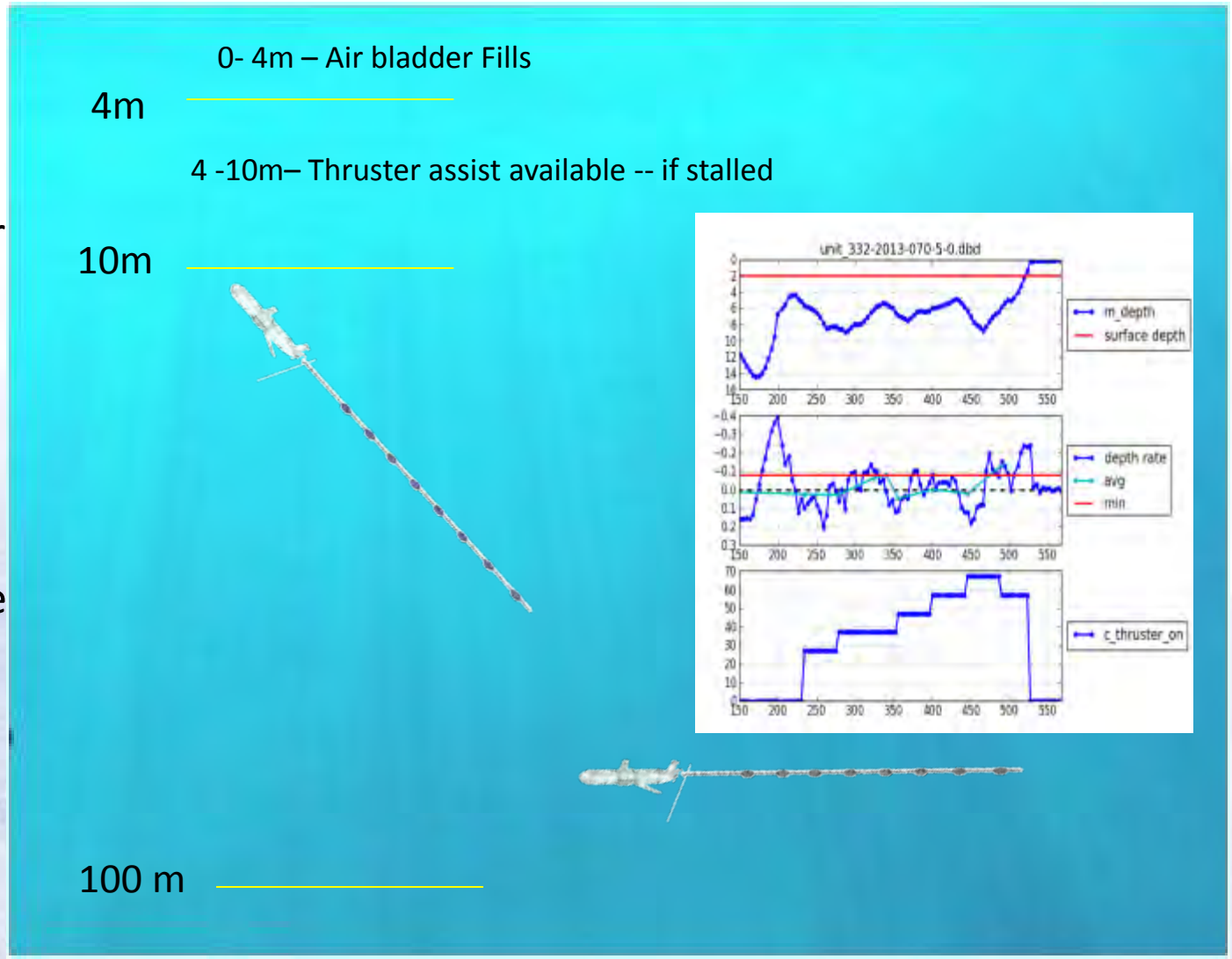
Thruster Performance

- Using a nominal glider speed of .35 m/sec
- Increased efficiency when flying in depths less than the optimized buoyancy pump range



Lens Penetration

- Ascent to surface standard buoyancy mode with speed control
- 1.5 liter Air Bladder turned on during ascent and bladder begins to inflate when at proper depth (~4 m)
- Thruster used for kick start to surface if stalled or ascent rate less than a threshold value.
- Provides up to an additional 1000 grams drive.



Depth, Density, & Speed

Optimized depth operations:

- Shallow family: 30, 50, 100, 200 meters (as shallow as 4 m water depth)
- Deep family: 350, 1000 meters

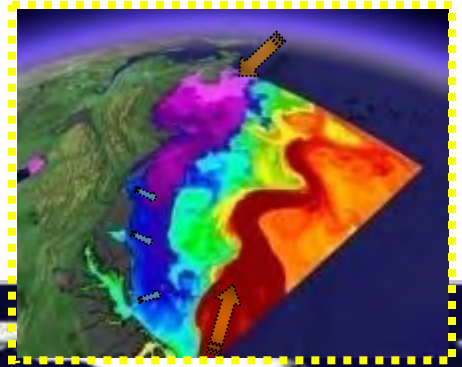
Density ranges:

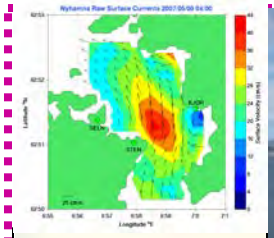
- 800 cc buoyancy: 12 kg/m³ available (reduced by 100 cc drive)
- Thruster: 17 kg/m³ available
- Combined: 29 kg/m³ available

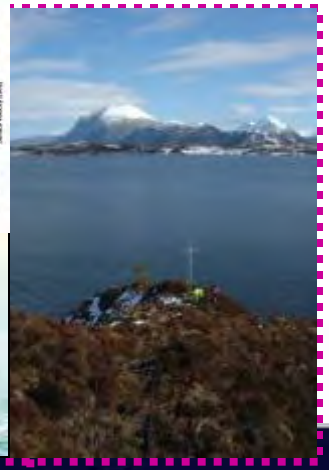
Speed:

- From buoyancy: up to 1 knot, dependant upon density and working depth, a function of pump speed and total displacement.
- From thruster: up to 2 knots (can be combined with buoyancy).
- Speed kills: your battery, that is.

The Challenge

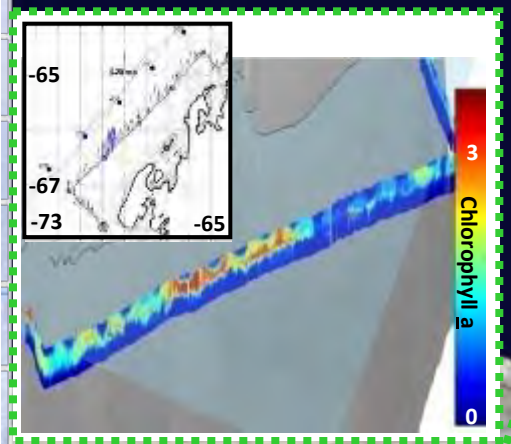






Challenger Expedition

International Consortium of Ocean Observing Labs (I-COOL)

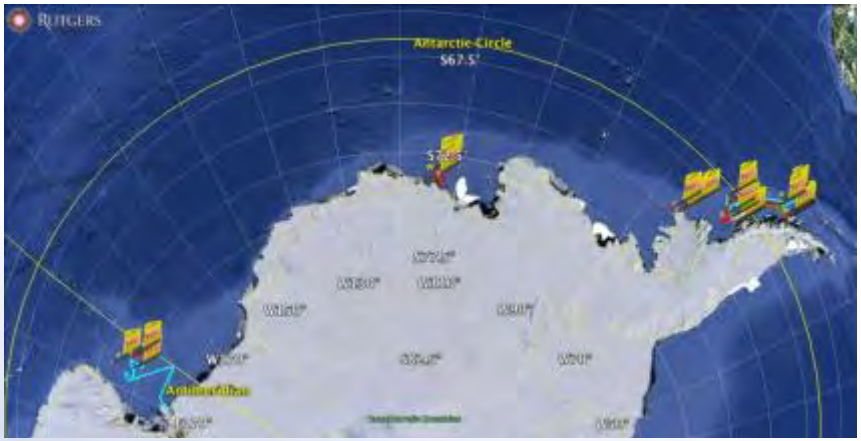


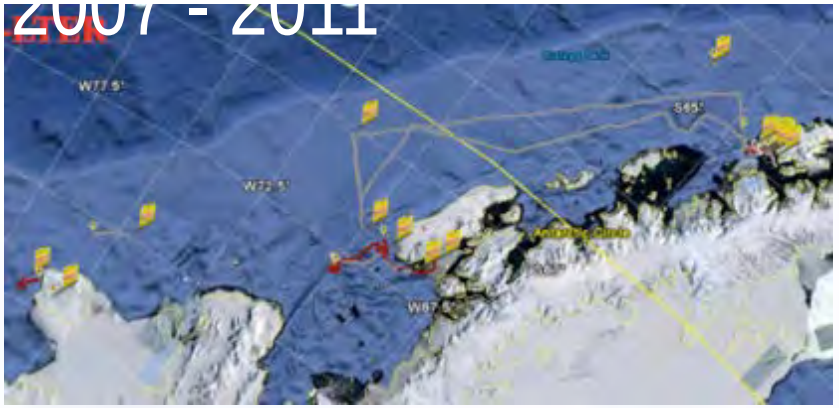
Focus on the extreme missions:

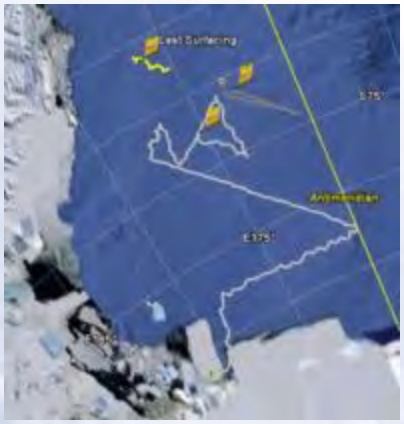
1) poles, 2) urbanized shelves, 3) long duration

IOOS INTEGRATED OCEAN OBSERVING SYSTEM

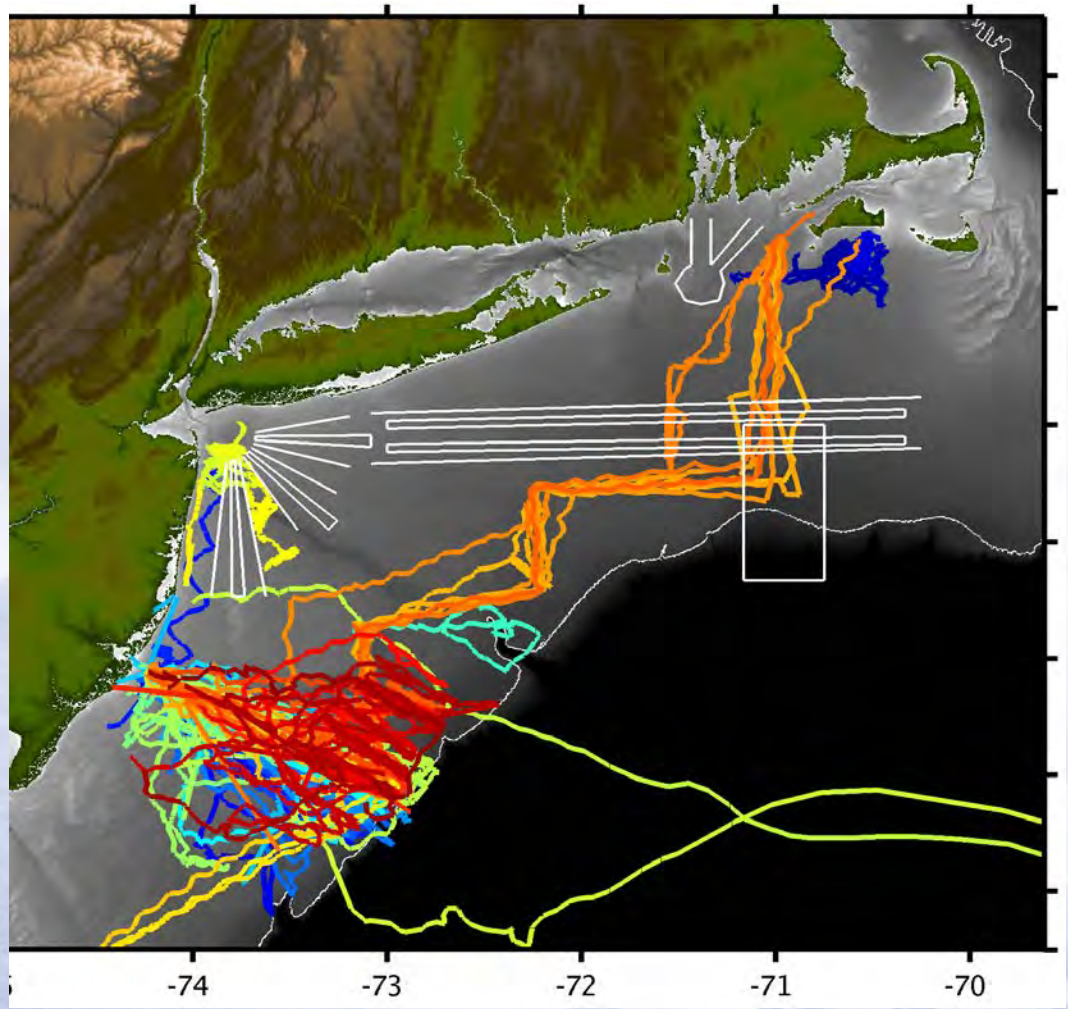
Remote Harsh Environments

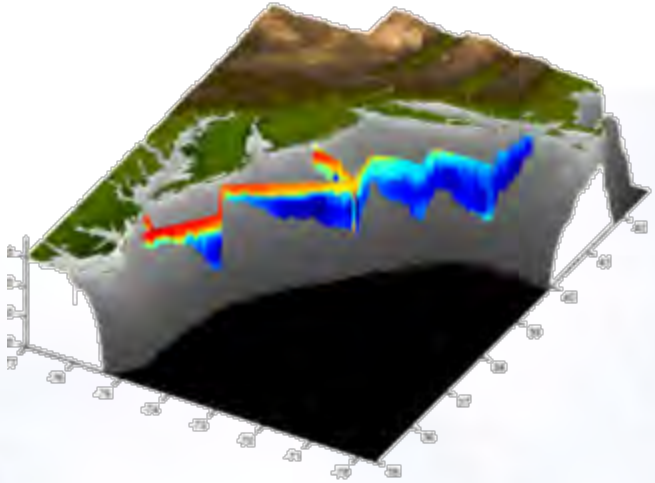


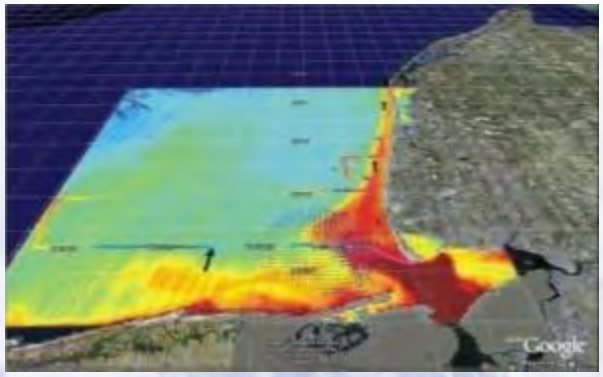




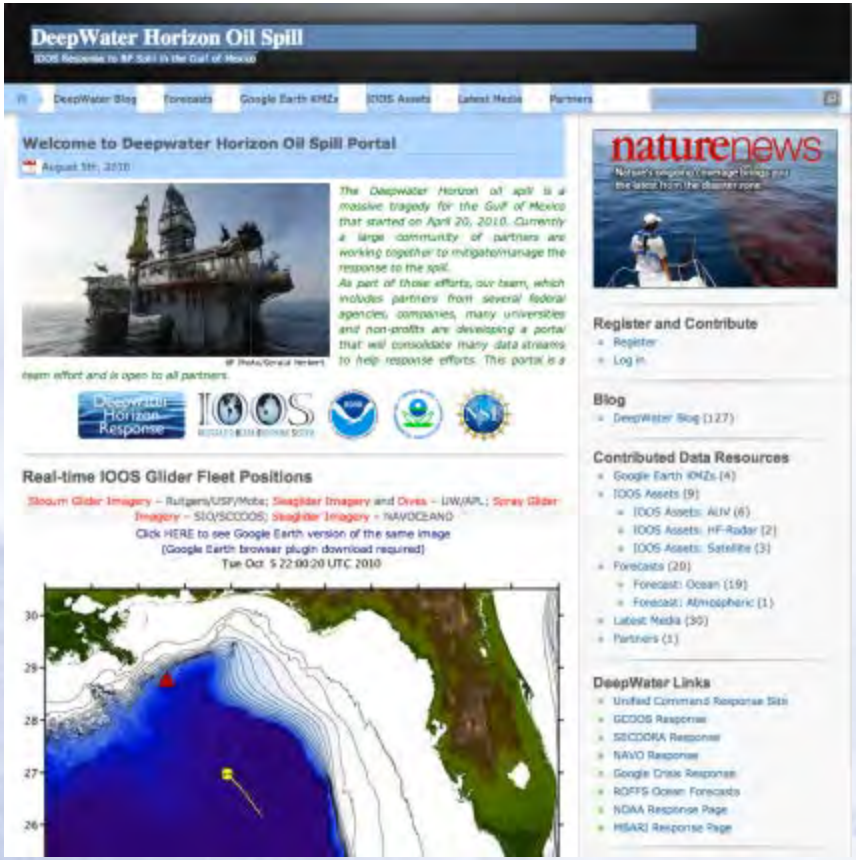
Coastal Operations

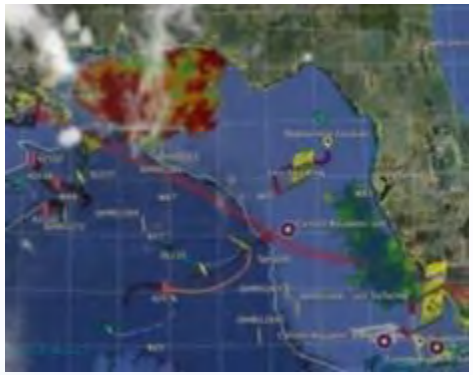






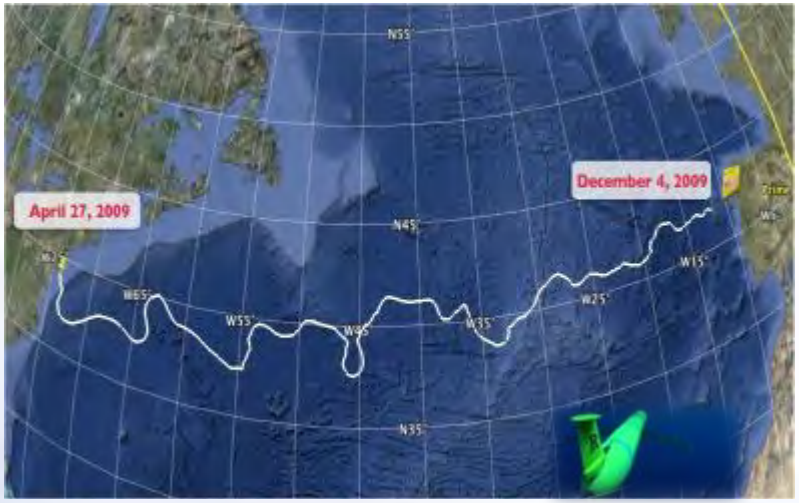
Deepwater Horizon – Oil Spill

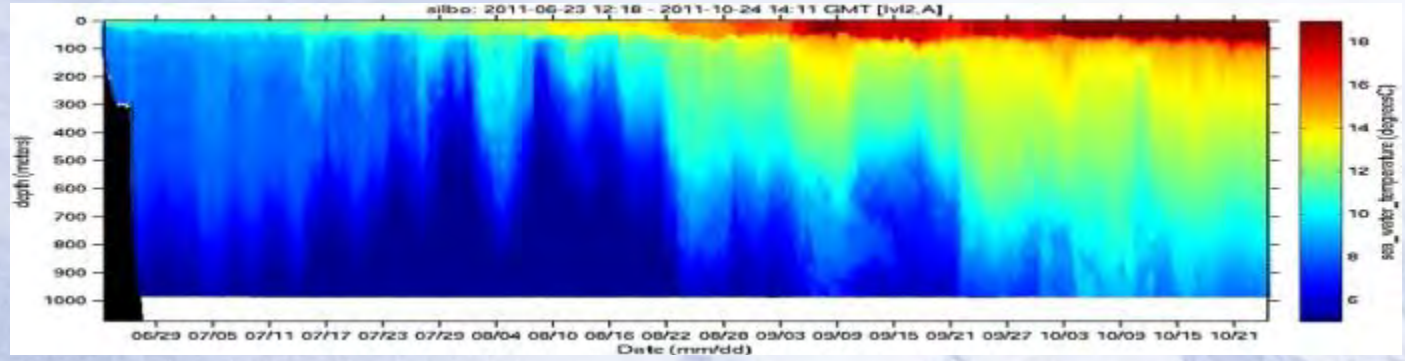


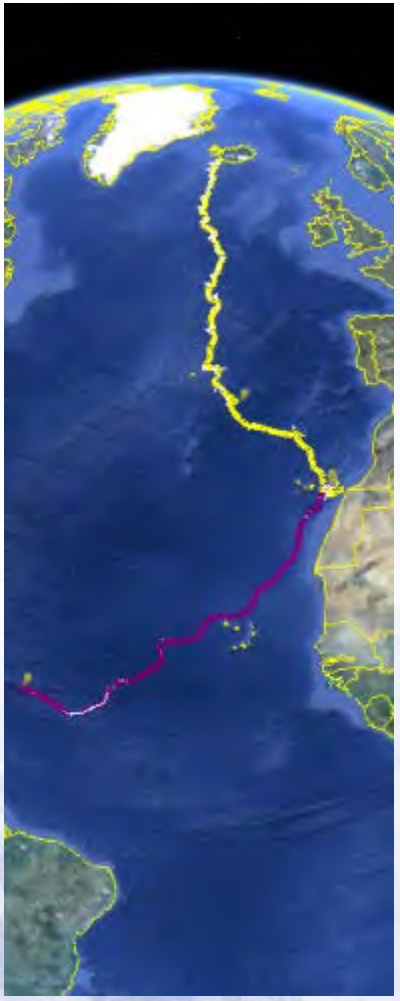


Glider	# Deployed	Tot Days	Tot Dist (km)
RU21	1	35	607
RU23	5	87	1582
UD 134	3	51	1111.5
Bass	3	31	552
Waldo	4	74	1476
Sam	2	39	677
TOTALS:	**18**	**317**	**6005.5**

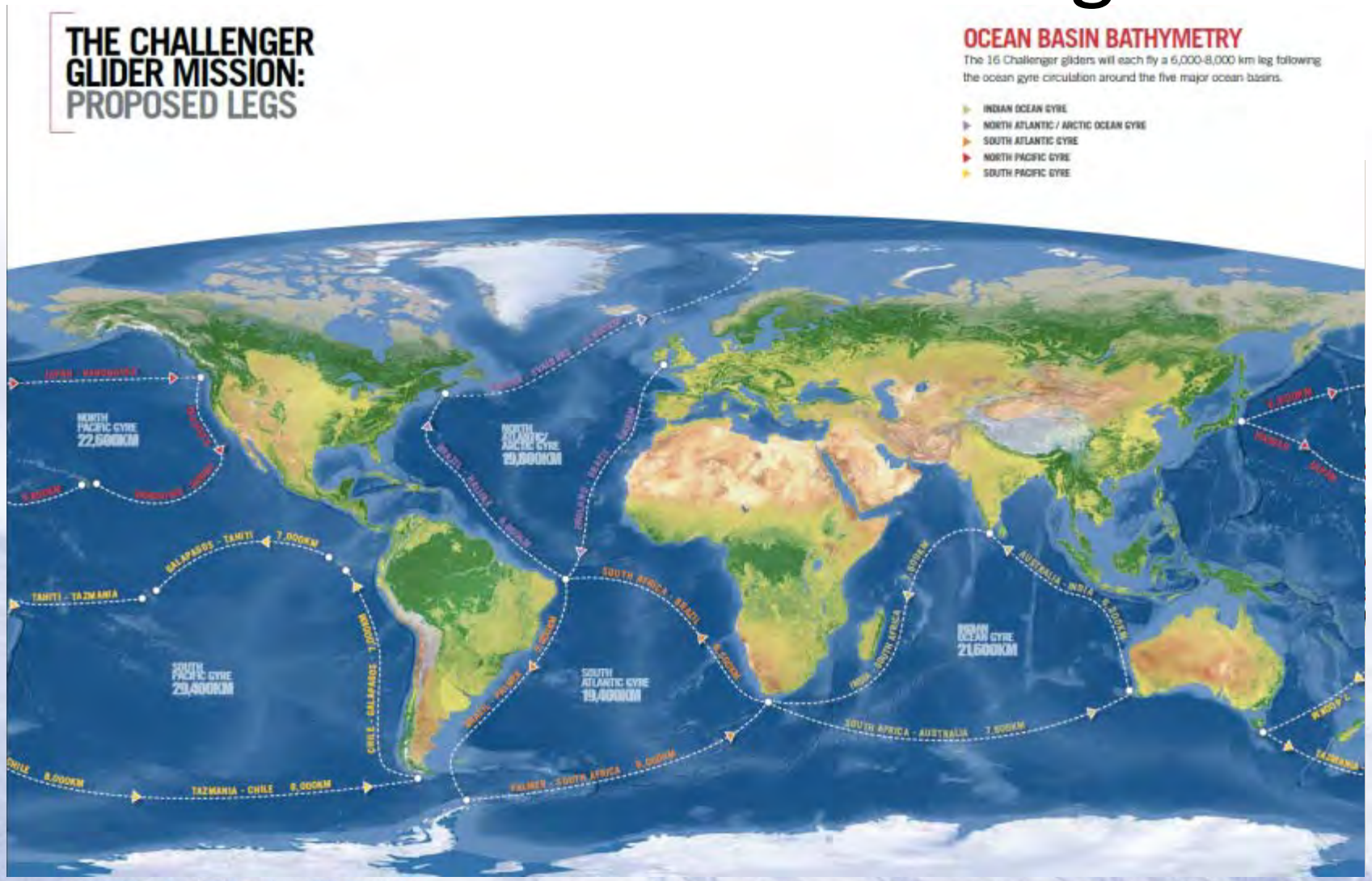
Ocean Basin Transects





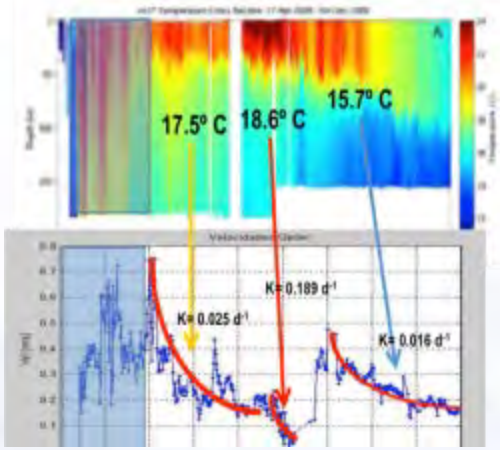


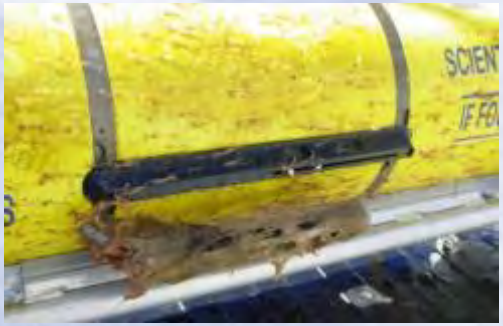
Trans-Oceanic Crossings



Biofouling

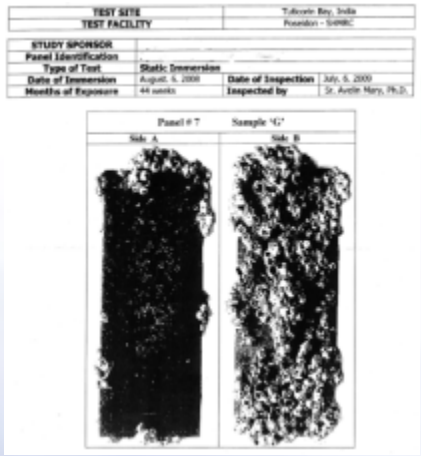

INVESTIGAD

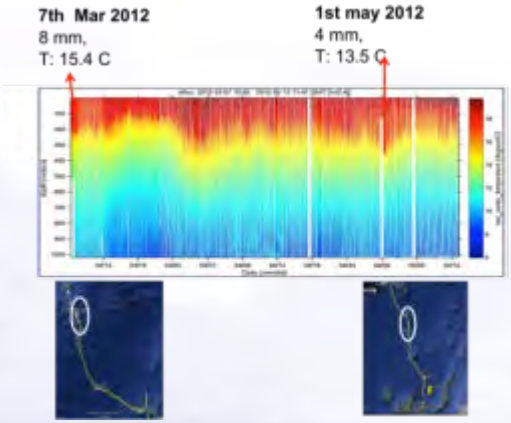

17.5° C
18.6° C
15.7° C
K= 0.025 d-1
K= 0.189 d-1
K= 0.016 d-1

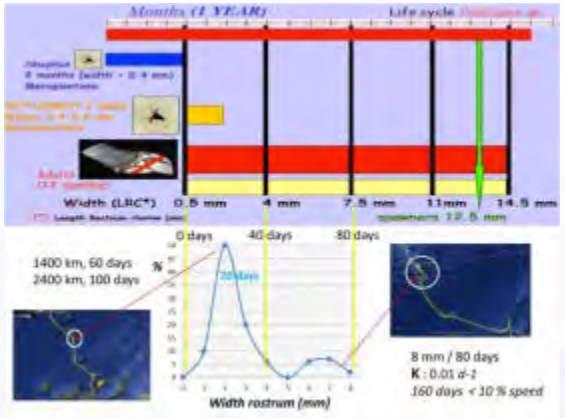


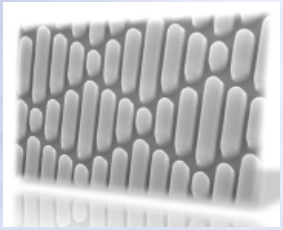

WRC
SLOCUM
ELECTRIC

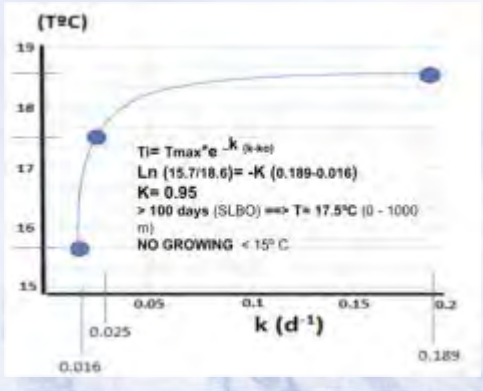
Antifouling

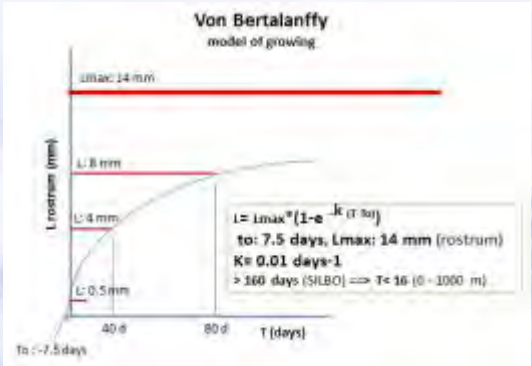












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