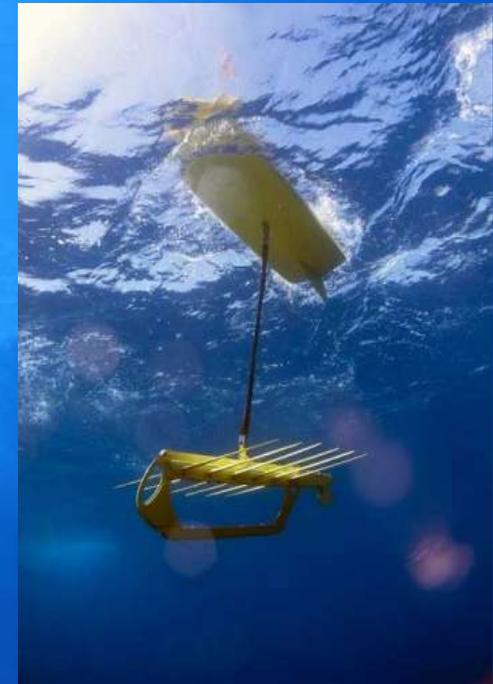
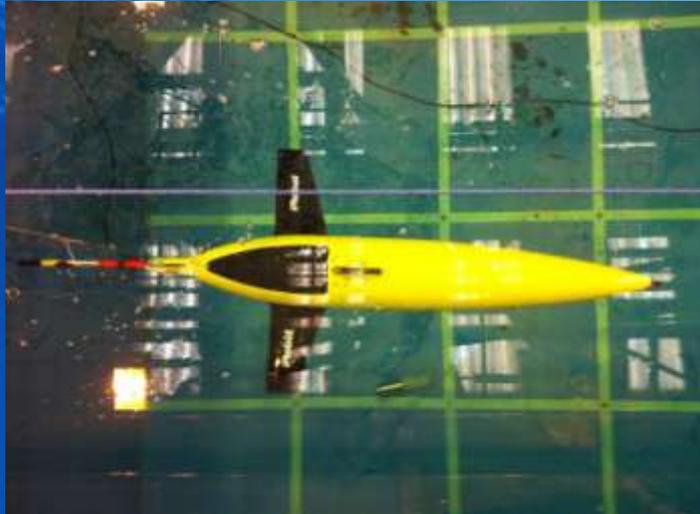


The Marine Autonomous and Robotic Systems (MARS) Facility at NOC



Steve McPhail November 2013

The MARS Vision



Our vision is that by 2016 we will be recognised as the world leader in the integrated provision of autonomous & robotic vehicles for marine science, with effective deployments, novel capabilities and strong partnerships.

MARS Fleet & Personnel

Underwater Gliders



- Teledyne Webb Slocum (1000m) x (4 + 10)
- Teledyne Webb Slocum (200m) x (4 + 6)
- Kongsberg Seagliders x (5 + 5)

AUVs



In-house developed:

- Autosub 3
- Autosub6000
- Autosub Long Range x (1 + 2)

ROV



6500m ISIS ROV
(based on WHOI's JASON)

USVs



Liquid Robotics Wave-glider
SV3 (awaiting delivery)

STAFF

19 with a mix of:

- Mechanical
- Electronics
- Software
- Systems

Marine Autonomous Systems

Capital Funding

- £3.5M in 2012-13
- £10M in 2013-15



**National Oceanography
Centre, Southampton**

UNIVERSITY OF SOUTHAMPTON AND
NATURAL ENVIRONMENT RESEARCH COUNCIL

www.noc.soton.ac.uk

AUTOSUB 6000

5.5 m, 0.9 m diameter 1800 kg

Launch And Recovery System
Has been fitted to many ships from 18.5 m upwards

Acoustic Telemetry and Tracking System

Lithium Polymer Rechargeable Batteries.
28 hour, 150 km

Precision Navigation
(FOG INS + DVL)
Drift <1 m per 1km

Collision Avoidance System

Pumped, Dual CTD
Also EH, DO, Turbidity
... + others

3 axis Magnetometer

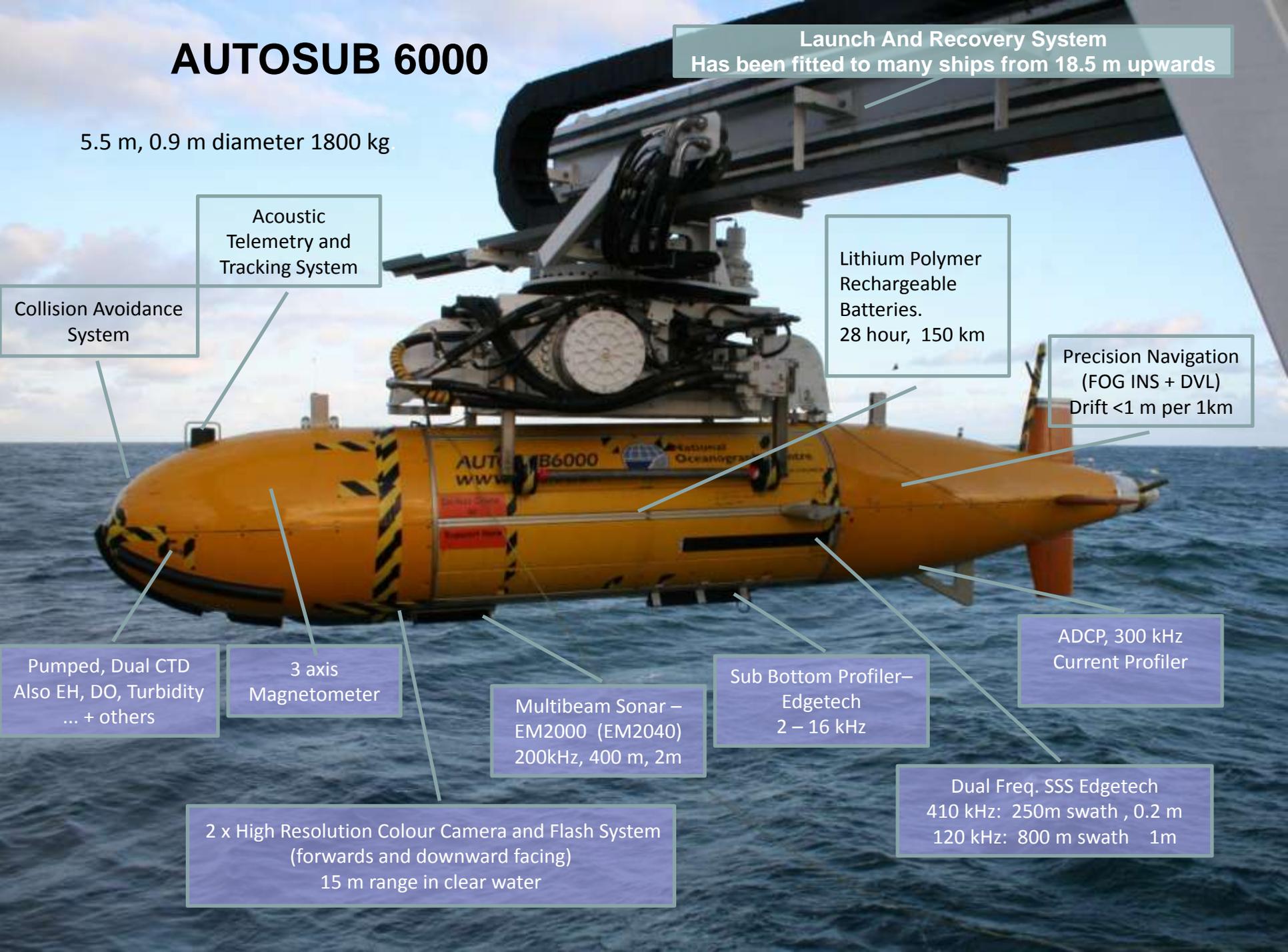
Multibeam Sonar –
EM2000 (EM2040)
200kHz, 400 m, 2m

Sub Bottom Profiler–
Edgetech
2 – 16 kHz

ADCP, 300 kHz
Current Profiler

2 x High Resolution Colour Camera and Flash System
(forwards and downward facing)
15 m range in clear water

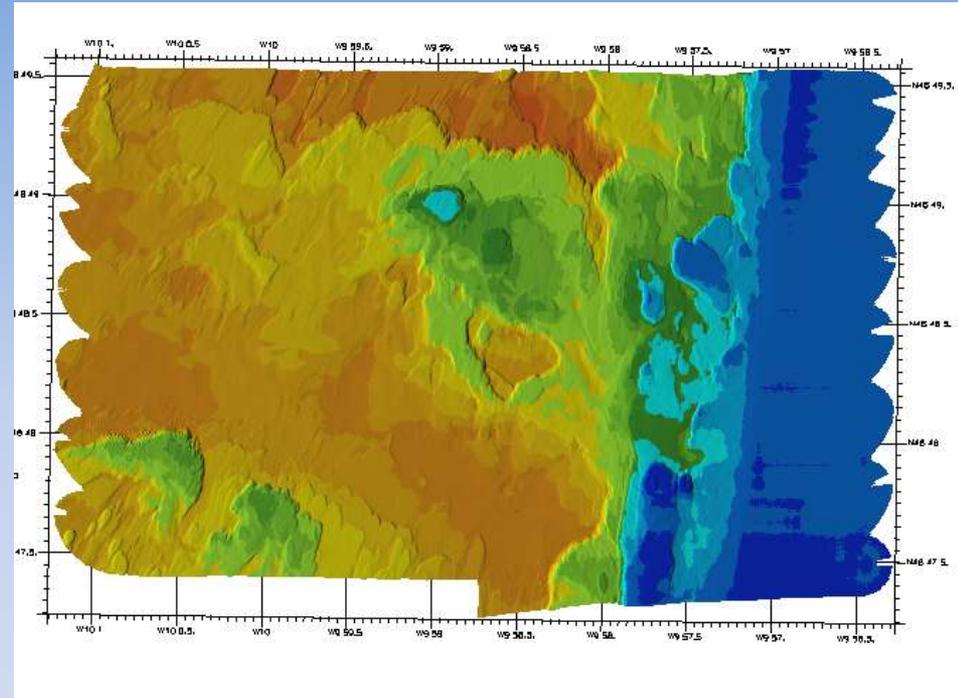
Dual Freq. SSS Edgetech
410 kHz: 250m swath , 0.2 m
120 kHz: 800 m swath 1m



Autosub6000

Much Greater *Efficiency* for a wide variety of survey mission types

High resolution imaging of erosional scours at 4000 m produced by sediment slumps – guiding assessment of risk of natural geo hazards

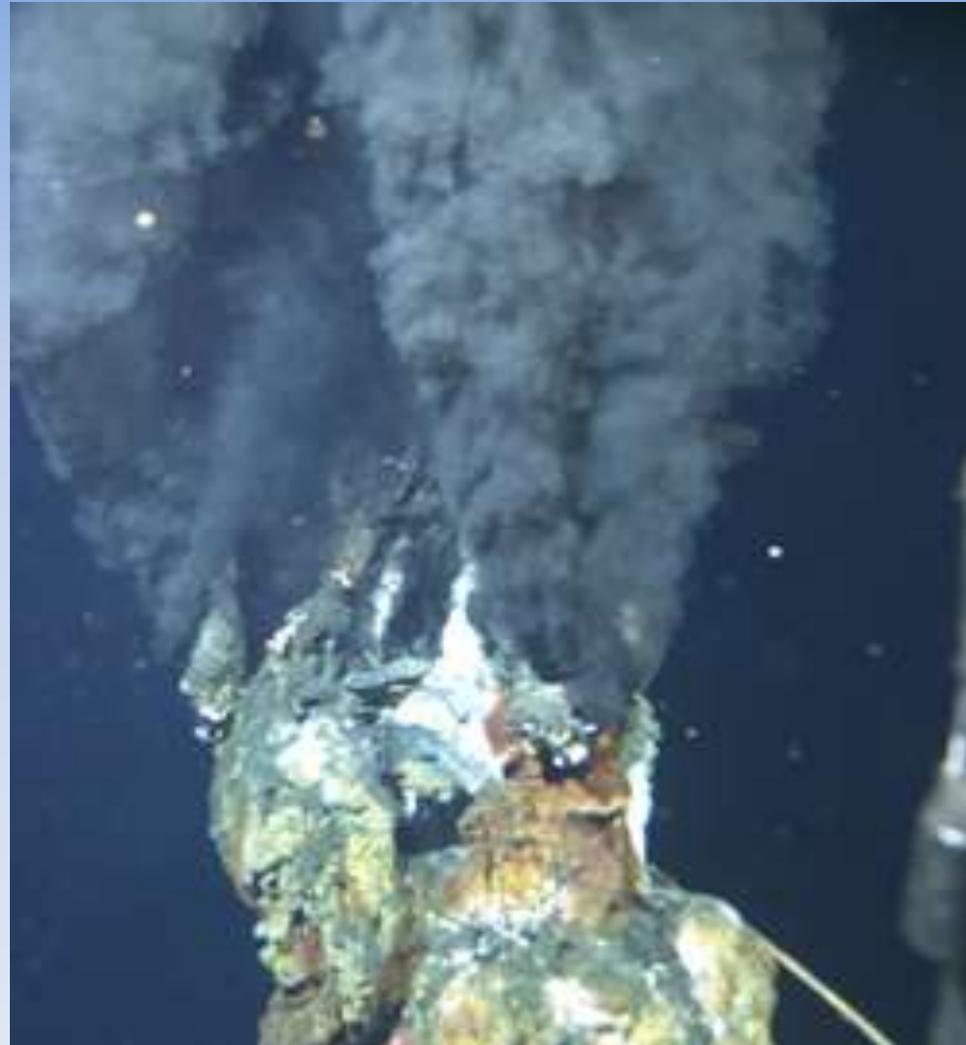


Autosub6000

Much Greater *Efficiency* for a wide variety of survey mission types

High resolution imaging of erosional scours at 4000 m produced by sediment slumps – guiding assessment of risk of natural geo hazards

Using Autosub6000 to help locate deepest yet discovered hydrothermal vent sites in Cayman trough



Autosub6000

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Using Autosub6000 to locate deepest yet discovered hydrothermal vent sites in Cayman trough

High resolution habitat mapping at 5000 m with sonar and photography (1/2 million photos)



Autosub6000

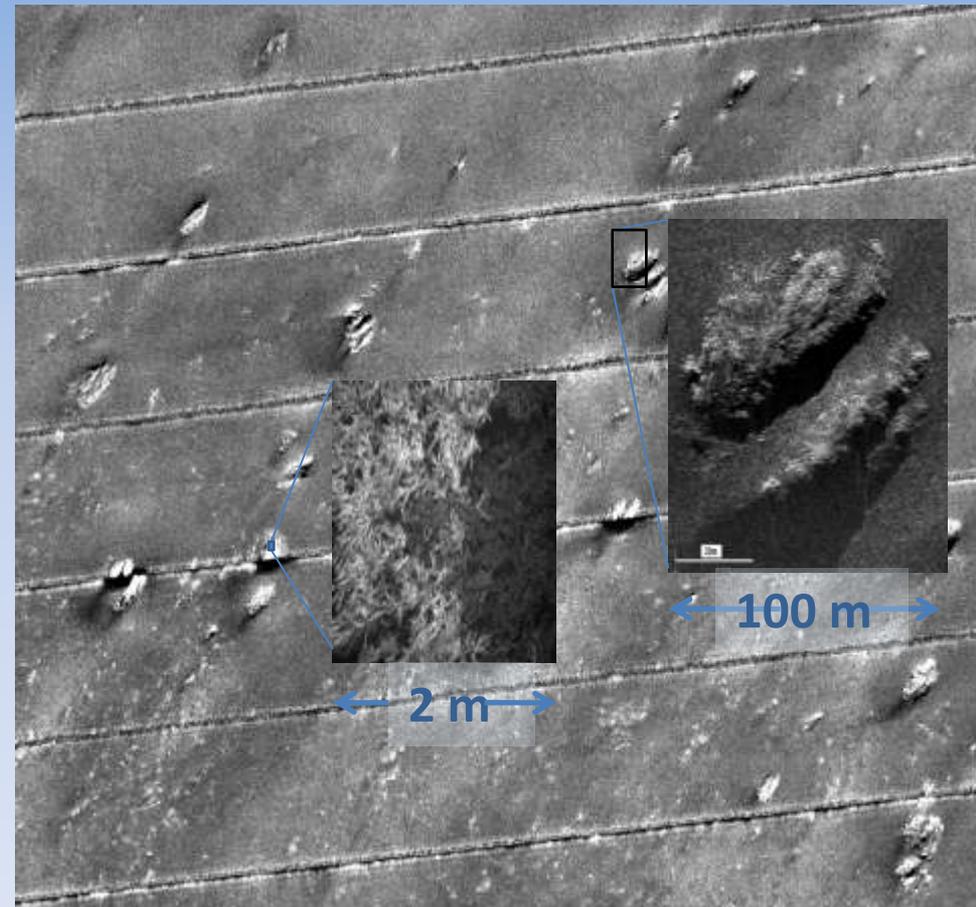
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High resolution imaging of erosional scours at 4000 m produced by sediment slumps – guiding assessment of risk of natural geo hazards

Using Autosub6000 to locate deepest yet discovered hydrothermal vent sites in Cayman trough

High resolution habitat mapping at 5000 m with sonar and photography (1/2 million photos),

Multi-resolution mapping of the fisheries protected zones on Rockall bank and Darwin cold coral mounds



AUTOSUB 3 : Launch for 1st Mission Under the Pine Island Glacier Ice Shelf



Ice shelf front is 5 km distant

7m long, 3600 kg
60 hour (400 km) endurance
5000 D cell batteries
1600 m depth limit
0.1% Navigation Accuracy

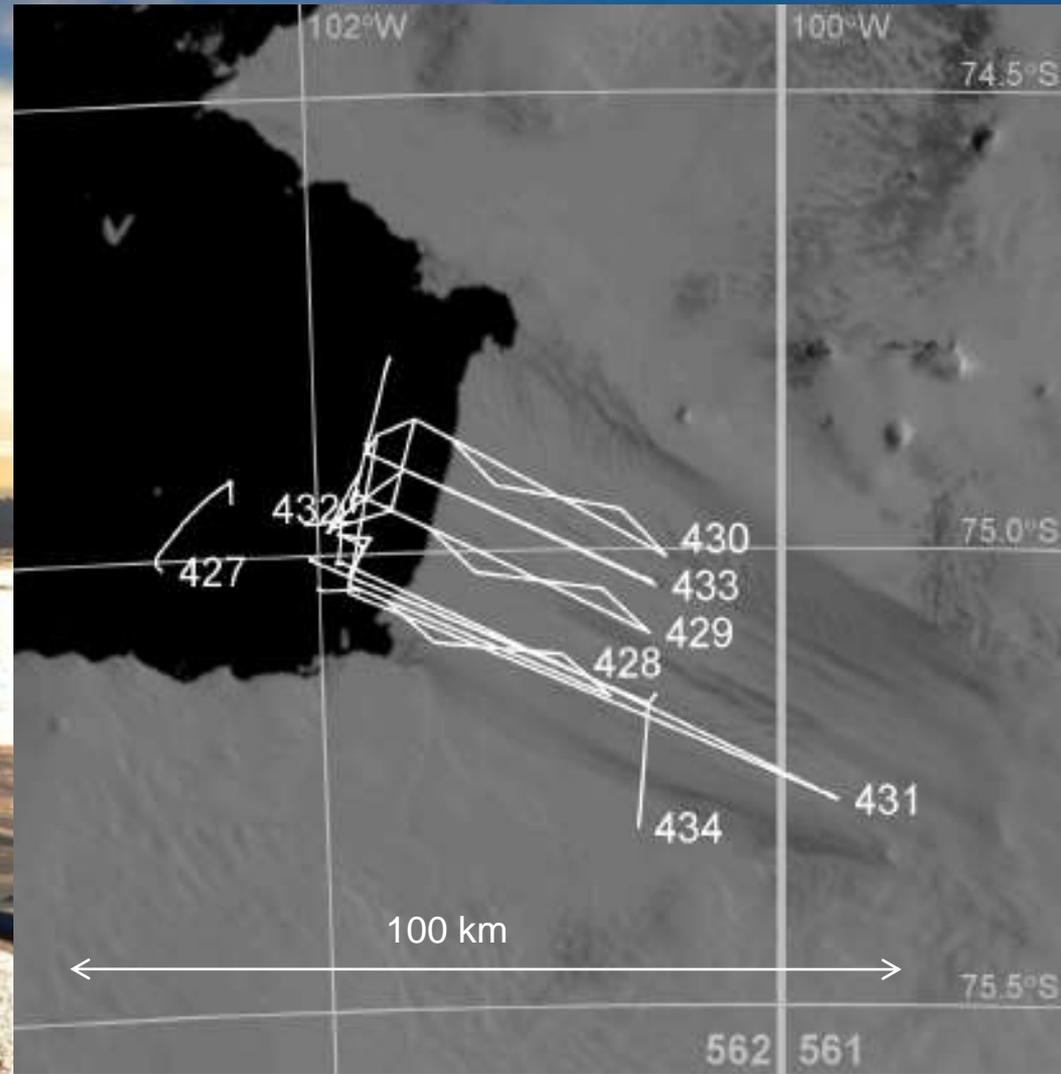


THE AUTOSUB3 Pine Island Glacier Ice shelf Campaign On the N B Palmer : - Summary

8 missions (2 test)

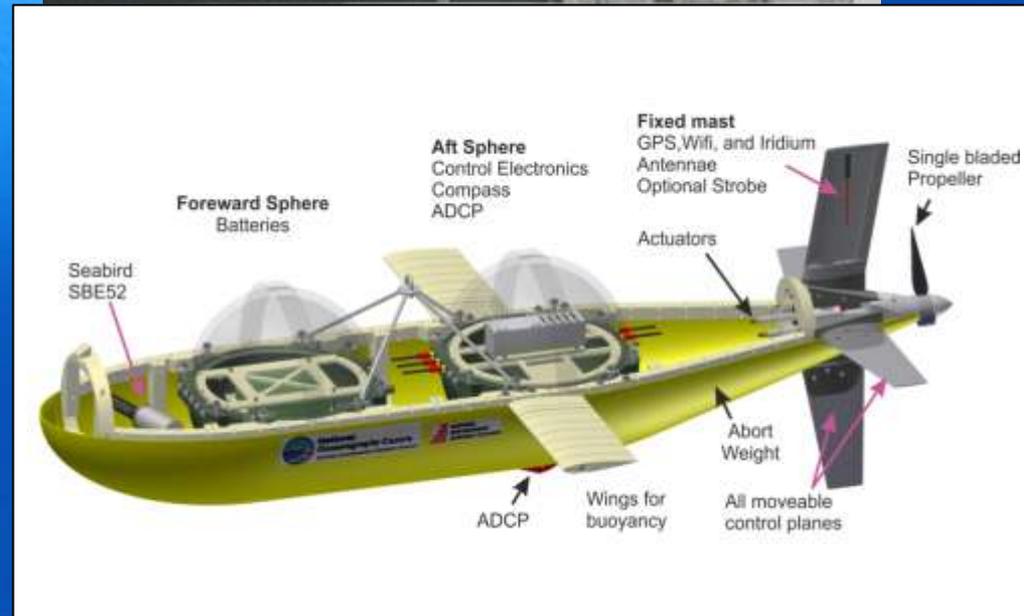
Longest 60 km

Total 4 days and 510 km run
under the ice shelf



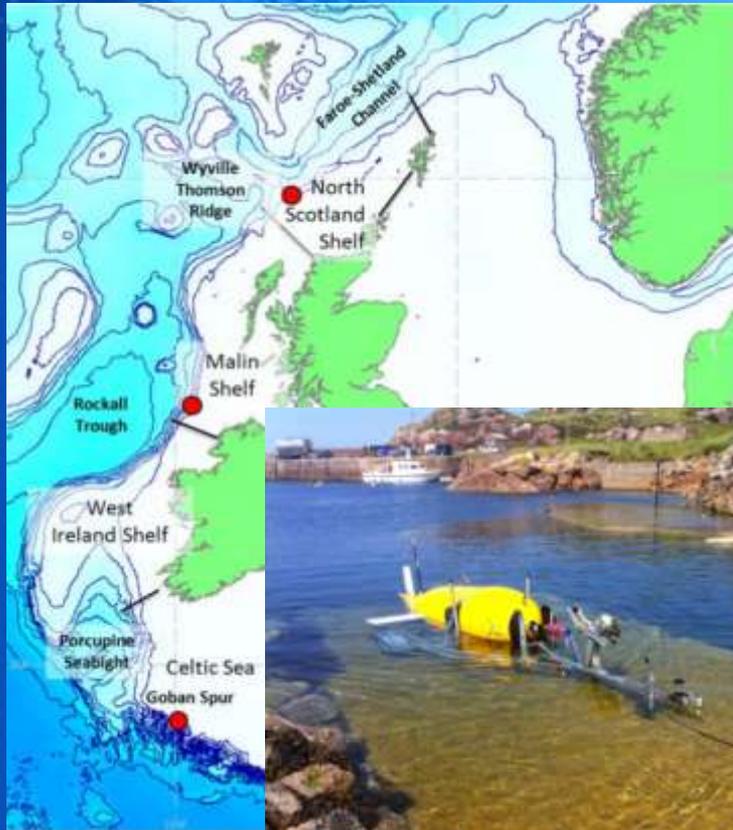
Autosub Long Range

Mass	600 kg
Maximum Depth	6000 m
Maximum Range	6000 km, 6 months (up to!)
Speed range	0.35 to 1.0 ms ⁻¹
On-board energy	30 kW hrs (primary lithium)
Flight Modes	Depth, Altitude, Profiling
Communications	Iridium & WiFi at surface
Standard Payload	CTD (SBE 52), 300 kHz ADCP



ALR 1st Science Campaign

FASTNEt: Fluxes Across Sloping Topography of the North East Atlantic



Mission Outline

- 5 missions planned (primarily Malin Shelf)
- 1000 km (1 month) typical
- 1400 m water depths
- 1st Mission July 2013

Science Payload

- Rockland Microrider-6000 turbulence probe
- Up and down facing 600kHz ADCPs
- SBE-52 pumped CTD
- Chlorophyll and Turbidity Sensors.

Malin Shelf: 800M



1st Science Campaign for Autosub Long Range. Shore launch from Donegal.

104 km
i

CARRICKFIN BAY

Gortnasate

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2012 TerraMetrics
© 2012 Google

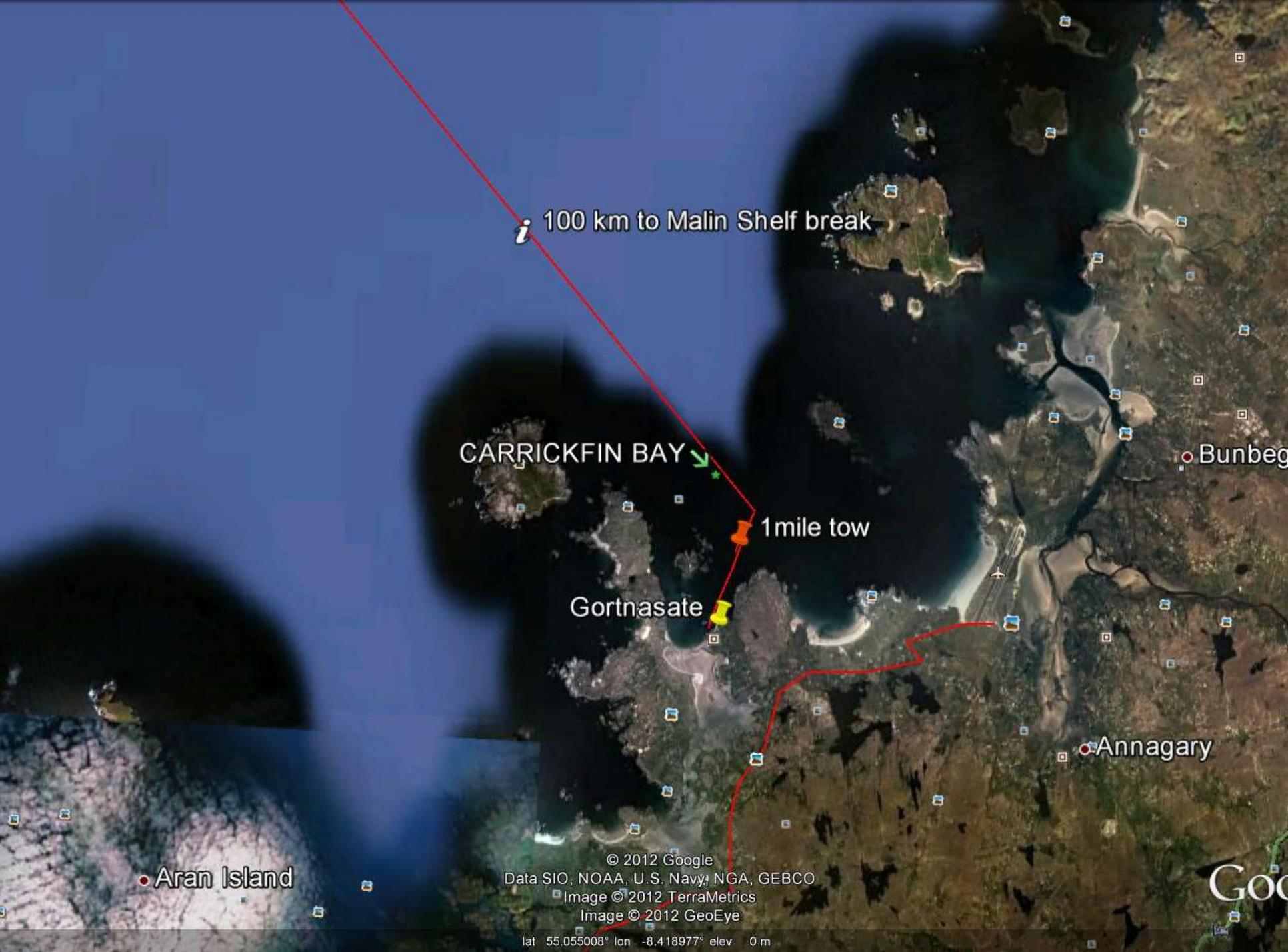
Google earth

lat 55.384502° lon -9.181466° elev -104 m

Eye alt: 149.07 km



Donegal



i 100 km to Malin Shelf break

CARRICKFIN BAY

1 mile tow

Gortnasate

Bunbeg

Annagary

Aran Island

© 2012 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2012 TerraMetrics
Image © 2012 GeoEye

lat 55.055008° lon -8.418977° elev 0 m

Go

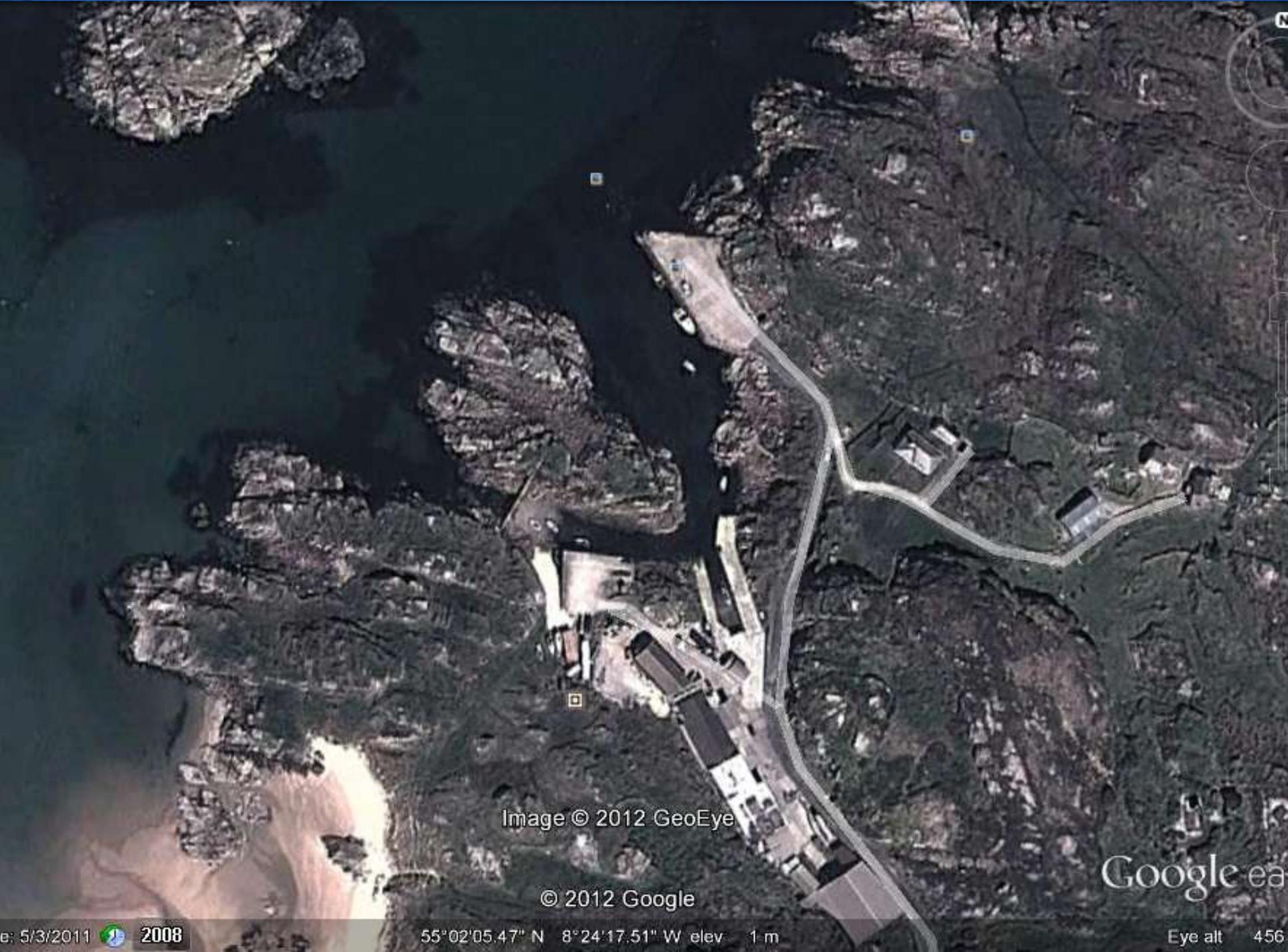


Image © 2012 GeoEye

© 2012 Google

Google Earth

5/3/2011 2008

55°02'05.47" N 8°24'17.51" W elev 1 m

Eye alt 456





White boat

YAMAHA

AUV LR

WINNER TRAILERS

Roller Coaster

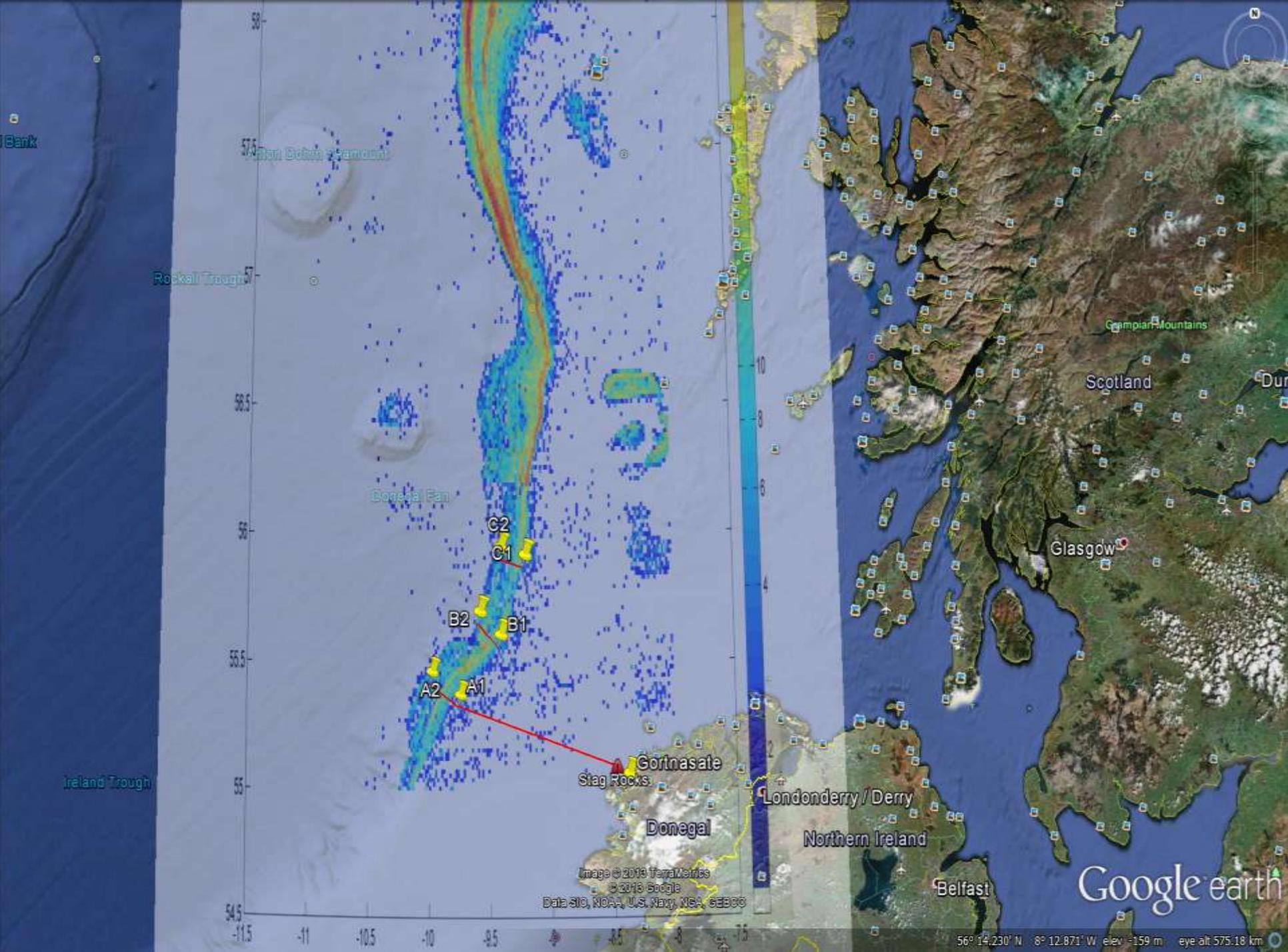












Rockall Trough

Bonessa Fan

Ireland Trough

C2

C1

B2

B1

A2

A1

Gortnasale
Stag Rocks

Donegal

Londonderry / Derry

Northern Ireland

Belfast

Scotland

Glasgow

Giant's Mountains

Image © 2013 TerraMetrics
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

56° 14.230' N 8° 12.871' W elev: -159 m eye alt: 575.18 km