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)

USVs
- Liquid Robotics Wave-glider SV3 (awaiting delivery)

Staff
- 19 with a mix of:
  - Mechanical
  - Electronics
  - Software
  - Systems

ROV
- 6500m ISIS ROV (based on WHOI’s JASON)

Marine Autonomous Systems
Capital Funding
- £3.5M in 2012-13
- £10M in 2013-15

www.noc.soton.ac.uk
AUTOSUB 6000

- 5.5 m, 0.9 m diameter 1800 kg

**Collision Avoidance System**

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

**Sub Bottom Profiler – Edgetech**
- 2 – 16 kHz

**Acoustic Telemetry and Tracking System**

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

**Lithium Polymer Rechargeable Batteries**
- 28 hour, 150 km

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

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

**3 axis Magnetometer**

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

**ADCP, 300 kHz Current Profiler**

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

**Multibeam Sonar – Edgetech**
- 200kHz, 400 m, 2m

**Sub Bottom Profiler – Edgetech**
- 2 – 16 kHz
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

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 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

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 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.
1\textsuperscript{st} Science Campaign for Autosub Long Range. Shore launch from Donegal.