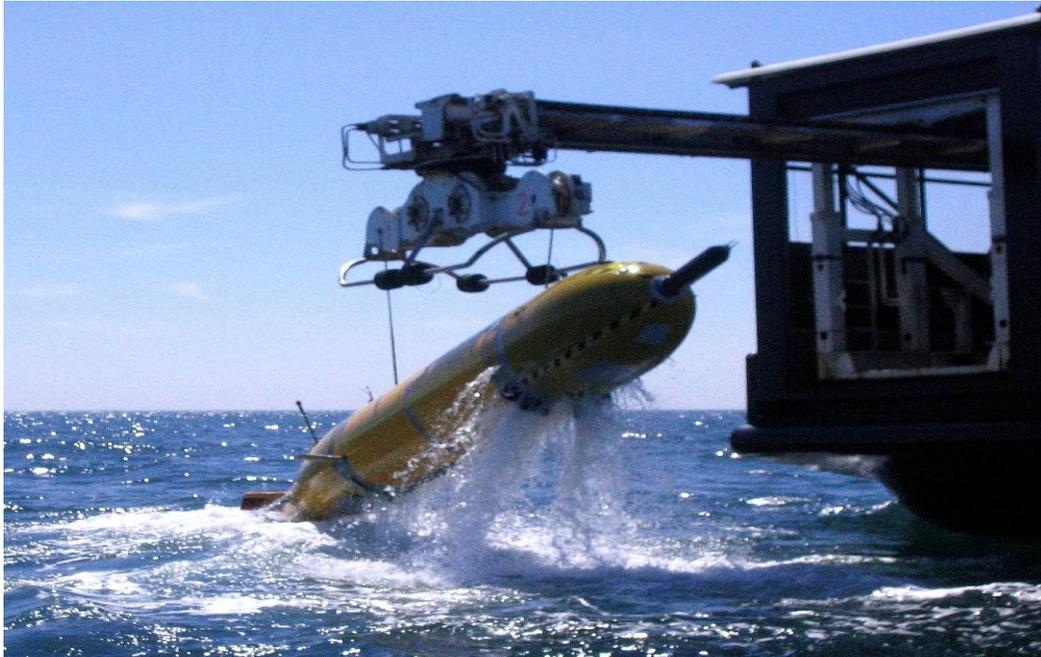


¹Autosub6000 - a leap forward in capability: A long range and deep diving AUV

²Steve McPhail. 5th January 2007



With an ultimate range up to 1000 km, a maximum operating depth of 6000 m, and a generous payload capacity of 0.5 m³, Autosub6000 will be one of the world's most capable deep diving science Autonomous Underwater Vehicle (AUV). It is scheduled for deep water trials on the RRS Discovery in September 2007, after which it will be available for science missions. We encourage proposals for the use of Autosub6000 from 2008 onwards. We envisage its use in a wide variety of missions, for example : overflow and exchanges across sills, abyssal circulation + mixing, Southern Ocean mixing processes, ocean ridge, marine census, canyons and sea-mounts, ocean margins benthic communities, gas hydrate surveys.

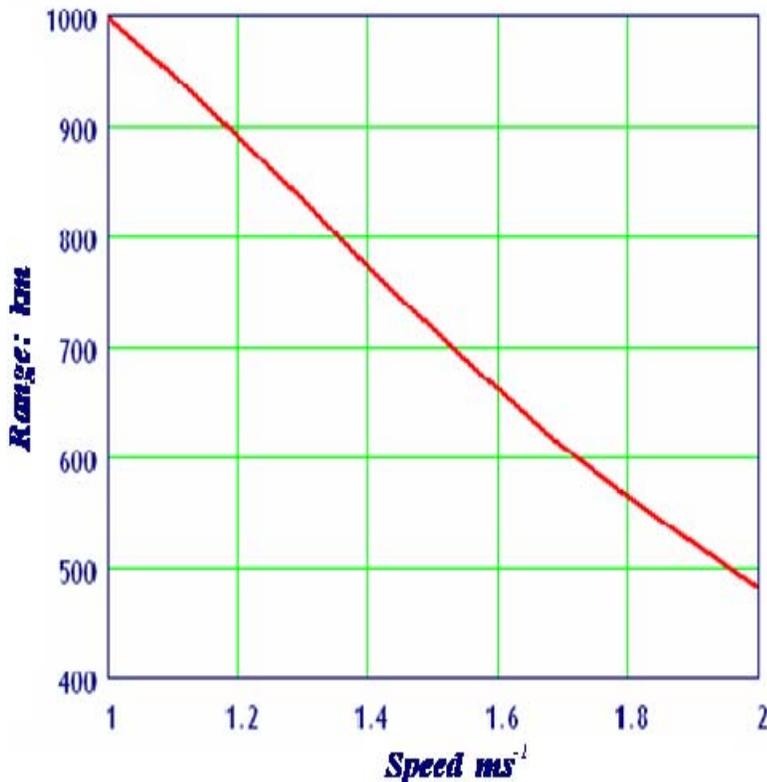
Autosub6000 is the latest 6000 m rated version of the Autosub AUV series, which has been used extensively for ocean science during the last 10 years, including work under ice operations in the Arctic and Antarctic. The design of the nose and tail sections, including the navigation and control systems, are substantially inherited from the tried and tested Autosub3. The main difference is the depth rating (6000m rather than 1600m), and the energy system (Lithium Polymer rechargeable batteries rather than primary manganese alkaline cells).

¹ Autosub6000 was developed within the Underwater Systems Laboratory at the National Oceanography Centre, Southampton, with funding from the UK Natural Environment Research Council.

² Contact Steve McPhail, head of the Autosub6000 project, sdm@noc.soton.ac.uk, for further information.

Specifications for Autosub6000

Dimensions	5.5 m long, 0.9 m diameter
Mass	2000 kg (Dry), 2800 kg (Wet).
Range, endurance	1000 km at 1 m/s (8.6 days). 400 km at 1.6 m/s. (2.9 days). <i>The 2007 version will have 50% of this range.</i>
Depth capability	6000 m maximum.
Navigation	0.1% of distance travelled since last GPS or USBL fix.
Telemetry and Tracking	Linkquest TrackLink 10000 USBL and bidirectional telemetry system.
Control Modes	Constant depth, constant altitude (5 to 200m), profiling.
Recharge time	5 hours from fully exhausted lithium polymer battery pack.
Standard Sensor Suite	300 kHz RDI Workhorse ADCP. Fitting of Seabird 911 CTD be requested from NMFD. There are plans to fit a Multibeam system by August 2008.
Payload Capacity	Similar to Autosub3. Large (0.5 m ³) volumes free in the nose area for payloads.
Power for sensors	Up to 250 Watts at 48 volt.
Data Handling	100 M bit s ⁻¹ TP Ethernet .200 G byte data storage. IEEE 802.11g WiFi for data download.
Shipping	One standard 20 foot shipping containers. Launch and recovery gantry.



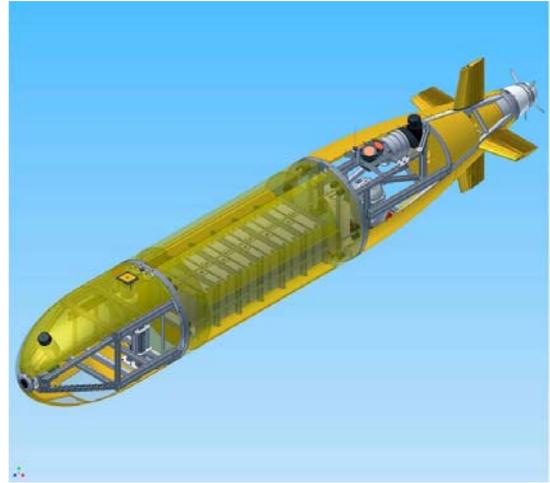
Range versus Speed prediction for Autosub6000, with the maximum load of 12 batteries (the 2007 version will have 6 batteries). This prediction includes no contingency, and is for a minimal sensor suit.

Lithium Polymer Pressure Balanced Batteries.

Autosub6000 combines a high depth capability with long range. We achieved these (usually mutually exclusive) characteristics by developing pressure balanced lithium polymer battery technology, eliminating the need for expensive and bulky pressure resistant housings.



Within the each battery box are 405 Kokam Lithium Polymer cells, storing a total of 18 M joule of energy.



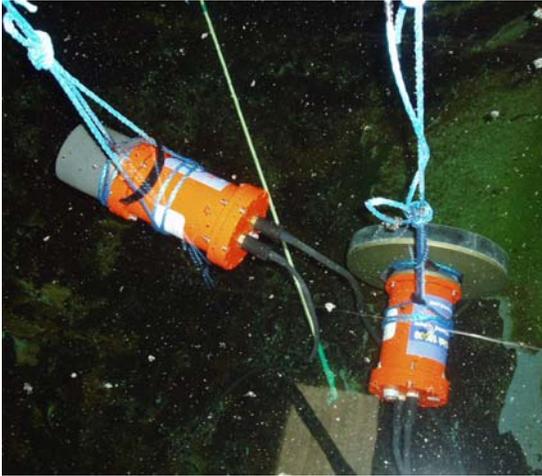
Up to 12 battery packs can be fitted within slots in the syntactic foam which make up the centre section of the vehicle.

Navigation



A titanium tube housing –the Inertial Navigation Unit (IXSEA-PHINS), a 300 kHz RDI ADCP, and a high performance Thales GPS receiver. We are developing navigation algorithms, involving processing of imaging or multibeam data, which, for area survey missions in deep water, will maintain GPS quality accuracy over periods of several days.

Tracking and telemetry



A combined Ultra Short Baseline and bi-directional acoustic messaging system, the Linkquest10000, will be used for tracking from the mother ship, and for health monitoring, navigation, and control. Normally, once the vehicle has descended to operating depth, and system health has been checked via the acoustic telemetry link, then the AUV can operate in fully autonomous mode, with the ship free to carry out other science operations.

What the performance means in terms of area survey:

Autosub 6000 will revolutionise the efficiency of deep sea surveys. As an example: For a 500 km, 3 day mission, the vehicle will be able to survey areas as shown.

L (side of box) = $[R \cdot s]^{1/2}$ Where L is side of the box, R is the vehicle Range, and s is the line spacing.

Photography 1 mm resolution, 2 m Track spacing 1.0 km side box, 1 km² 

Bathymetry 1m resolution, 100 m line spacing 7 km side box, 50 km² 

Chemical plume survey 1km line spacing, 22 km box, 500km² 