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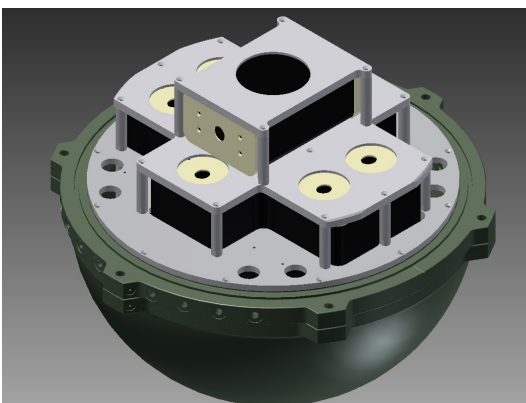
## NOC Autosub Long Range AUV Powered by Custom Power's Lithium Thionyl Chloride Battery Solution

### Introduction

The National Oceanography Centre (NOC) undertakes integrated ocean research and technology development from the coast to the deep ocean. It provides long-term marine science capability including: major facilities; sustained ocean observing, mapping and survey; data management, and scientific advice. Marine science national capability is provided to the Natural Environment Research Council (NERC) by NOC working in conjunction with their Delivery Partners.

National Oceanography Centre (NOC) is wholly owned by NERC and brings together the NERC-managed activity at Southampton's waterfront site and Liverpool's former Proudman Oceanographic Laboratory, creating the UK's leading institution for sea level science, coastal and deep ocean research and technology development.

Since 2001, Autosubs have brought back unique information from under floating ice, first from under sea ice in the Antarctic and Arctic, and later from under floating glacial ice in the Antarctic. In doing so, they have delivered the beginning of a new era for glaciologists and polar oceanographers. The first science application for Autosub Long Range (ALR) was the FASTNet (Fluxes Across Sloping Topography of the North East Atlantic) programme, a four year physical science research programme.



HEMISPHERE WITH BATTERY PACK FRAME

FASTNet's main aim is to construct a new paradigm of Ocean/Shelf exchange using novel observations and model techniques to resolve the key seasonal, inter annual and regional variation absent from existing knowledge.

ALR is capable of moving horizontally at up to 1.0m/sec, like a conventional AUV, and dive to 6000m. Five two month missions were planned, each covering in excess of 2500km.

In the longer term, the ALR's capability will enhance the NOC's increasing use of AUVs for oceanographic research.



## The Challenge

Historically, NOC have used alkaline and lithium polymer battery packs in AUV's but, with the ever increasing deployment demands on endurance, NOC required a fresh approach to power. Custom Power worked with NOC to develop a mission-critical lithium primary solution that increased the AUV's endurance whilst reducing the whole life cost. AUV deployment can be costly with limited deployment and recovery times so deploying for as long as possible can be essential.

	Primary Lithium	Alkaline
Operating Temperature Range	-55°C to +85°C	-20°C to +54°C
Energy Density	14.7 Wh/in <sup>3</sup> / 650 Wh/Kg	5.2 Wh/in <sup>3</sup> / 125 Wh/Kg
Nominal Voltage	3.9 V / 3.6 V	1.5 V
Watt Hours (for D size cell)	59.0	22.5
Advantages	<ul style="list-style-type: none"> <li>• Very high open circuit &amp; nominal load voltages</li> <li>• Lighter weight than alkaline (lower pack weight, easier field service, easier handling)</li> <li>• Internally fused</li> <li>• Lower "total" cost</li> </ul>	<ul style="list-style-type: none"> <li>• Low unit cost</li> <li>• Easier to transport</li> <li>• Easier to dispose</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>• Requires knowledge of appropriate safety and handling</li> </ul>	<ul style="list-style-type: none"> <li>• Limited temperature range</li> <li>• Short life cycle</li> <li>• Low power density per cell</li> <li>• Not hermetically sealed – potential leakage hazard</li> <li>• No internal safety fuse</li> </ul>

## The Solution

Custom Power's lithium primary solution offered a number of benefits over the existing alkaline solution such as greater endurance due to the increased energy density, weight saving, higher stable head voltage and a greater operating temperature range. These benefits are outlined in the table above.

Lithium batteries are already utilised with success in oceanographic applications including Autonomous Underwater Vehicles (AUV), pipeline Inspection, Seismic surveying, acoustic profilers, sonar devices, oceanographic buoys, sensing devices, GPS systems and memory storage.

Custom Power designed and manufactured battery packs, each containing 56 x lithium thionyl chloride D cells. These battery packs were then tested to meet UN Testing Criteria Part III 38.3 Rev 7, Clauses T1 – T5. The finished solution comprises of 10 x battery packs, in order to achieve NOC's required battery set specification of 25.2 Volts DC @ 152Ah. Each battery set will be constructed into a frame inside a pressure vessel by NOC with connections made to the Autosub.



## The Benefits

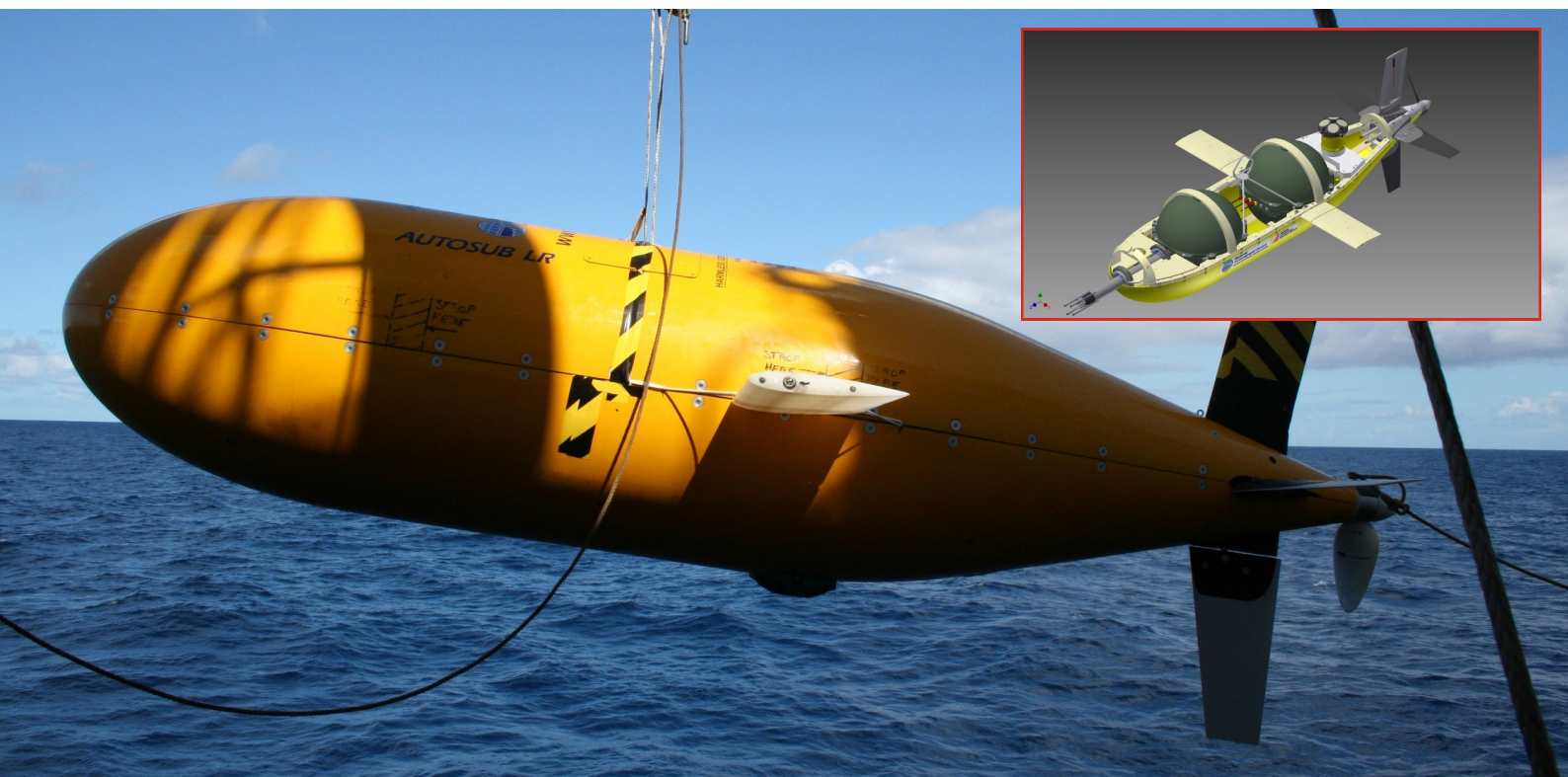
**Greater Endurance:** By working with NOC closely to understand the power requirements and application, Custom Power suggested a primary lithium thionyl chloride battery cell. This type of cell would offer the most reliable endurance possible and allow NOC to maximise the data collection.

**Cost effective:** Custom Power's strong existing relationships with key quality cell manufacturers tailored with inhouse design and engineering support means they can deliver complex projects whilst keeping costs within budget.

**Total Solution:** Custom Power offers the full solution from design concept to recycling of depleted batteries . In this project, NOC wanted all design, build and UN testing to be carried out by one contractor and Custom Power was able to offer this.

**Tried and Tested:** Custom Power has been building battery packs for over 30 years for many applications. Our track record of building battery packs for critical and subsea applications made us the obvious choice for this project.

Custom Power and NOC have a long successful trading history so it was only natural to be involved in the selection process for a battery supplier.



## About Custom Power

Custom Power is a specialist supplier of custom built lithium battery packs, COTS battery modules, portable power and energy storage systems for industrial, medical, autonomous and defence applications. Designed for high reliability in the most demanding environments, for sectors as diverse as energy, oceanography and robotics. Custom design and battery pack assembly from a UK based battery pack manufacturer with over 30 years experience.

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