THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

SUMMARY OF LECTURE/DISCUSSION

THE LORD LLOYD OF KILGERRAN PRIZE LECTURE

Held at the Royal Society, 3 October 2001

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In the Chair: **The Rt Hon The Lord Jenkin of Roding**, Chairman, The Foundation for Science and Technology

Speaker: **Nick Millard,** Project Director
Autosub Project: Southampton Oceanographic Centre

LORD JENKIN said that the Foundation was delighted to make the Lord Lloyd of Kilgerran award for the application of applied science and technology for the benefit of society to Nick Millard who had led the team which developed an innovative, autonomous submarine vehicle which could explore the oceans.

MR. MARGETTS, Chairman Of the Natural Environment Research Council, introducing Nick Millard, emphasised the length of time innovative technological projects took to come to fruition. This project had, in fact, started in 1985, but really took off in 1995 when the Southampton Oceanographic Centre was founded and Nick Millard selected to lead the project. Marine Sciences were a key component of the NERC's programmes, and the team effort of the NERC, Southampton University and the Centre, parallelled the team effort of Nick and his colleagues. The NERC's project was to understand Arctic Ocean environments, crucial to an understanding of global climate change. They also strongly supported the commercial application of projects, such as the contract with Halliburton on the use and development of the Autosub.

NICK MILLARD explained the need for autonomous underwater vessels (AUV's). The oceans covered most of the surface of the globe; they influenced climate and supported significant life and food chains. We must understand their behaviour. Ships were expensive, slow and limited in range. We needed something equivalent to space shuttles. AUV's were the answer.

The concept was developed and feasibility studies undertaken between 1988 and 1995. In 1996 the AUV was built and since then had been used for tests and had undertaken trips. Finally the contract with Halliburton had been formulated and signed. The key specifications for the AUV were speed, endurance, navigation, sensors, stability and telemetry. A vital factor in its design was the use of distributed systems. There were 14 subsystems, each with its own computer power and communication ability. This made incremental development and maintenance of systems easier. Dry cell batteries were used for power. Difficult problems encountered were designs for the launching and recovery and making pressure vessels which were both tough and light.

The science missions which the AUV had successfully undertaken were to estimate herring stocks in the North Sea, to map turbulence over sandbanks in the North Sea and off the West Coast of Scotland, measuring the thickness of ice and the density of krill beneath it, and examining the flow of water through the Sicilian straits.

Results included knowing that fish do not avoid ships, understanding the nature of bubbles in waves, and discovering that there was an increase in the number of krill under ice. A trip under an iceberg showed that conventional views about its underwater depth were wrong.

The major future project was exploration below the Arctic ice shelves. The NERC considered this of the highest imprtance and were funding a £5.86m programme. These ice shelves covered 10% of the ocean's area, contained 77% of the world's freshwater, and were little understood. The challenges were to be able to launch an AUV close to the shelves and retrieve it through moving holes in the sea ice, to increase its range, and make its navigation much more sensitive, and, because of the high risks involved, build a second AUV. SOC have achieved part of the vision, but Halliburton will play a vital role in developing seafloor surveying technology and techniques.

In the course of a short discussion PROFESSOR WOODS said that it should be realised that half the seabed was owned by coastal states and could not be explored without their authority. This was very inhibiting and time consuming. But he was able to say that there was a good prospect that UNESCO would obtain agreement on a new protocol, which would permit AUV's to carry out surveys in such areas for the purposes of ocean forecasting.

Because of the shortage of time, a number of issues, which those present would have wished to explore, could not be raised. Amongst these were:

- What were the benefits for the Centre and the NERC of the Halliburton contract? Was it simply their involvement in the research – subsea surveying – or were they undertaking further funding? Were they paying royalties for the use of the technology which had been developed?

- What international cooperation on the development had taken place? AUV's were so obviously important for scientific and other purposes that many states – e.g. USA and France – must be developing them.

- Given the ease, with which AUV's could be used for gathering valuable intelligence for military purposes, was not the assumption the UNESCO would be able to broker an agreement as suggested by Professor Woods over optimistic?

- Should not a better understanding of the sustainable fish resources of the ocean be the highest priority for future work? Knowledge about krill was only one aspect of this. Was there not scope for developing a much more widely based programme, involving international cooperation?

Sir Geoffrey Chipperfield KCB

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