

NOAA Research/Office of Ocean Exploration
Travel Report for November 12-20, 2005

Traveler: Justin Manley

Destination: United Kingdom, Southampton, Oxford and London.

Purpose: Meet with UK R&D community to discuss technology and ocean science issues

Objectives:

1. Gain knowledge on UK R&D funding systems
2. Meet individuals involved in AUV development, and ocean exploration in UK
3. Identify new developments in subsea technology
4. Learn more about risk evaluation of AUVs and high tech programs

Preparation:

1. Applied for and was awarded a bursary (fellowship) to travel to the UK and investigate policy and program management issues in advanced marine technology. Coordinated with my host at the National Oceanography Centre (Dr. Ken Collins) to arrange travel and meetings in the UK
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Participants:

Various from across the UK ocean science and technology community.

Background:

Autosub Under Ice was a £5.86 million (~\$12M) program to explore the marine environment beneath floating ice shelves using an Autonomous Underwater Vehicle. Funded by the [Natural Environment Research Council](#) (similar to the U.S. NSF), the program brought together oceanographers, geologists, glaciologists, biologists and engineers from fourteen UK institutions to investigate the role of sub-ice shelf processes in the climate system. See <http://www.soc.soton.ac.uk/aiui/aiui.html> for more. A sub-component of this program was the collaborative autosub science in extreme environments (CASEE) project. Click on the "CASEE Web Site" link in the AUI page. CASEE included an opportunity for researchers to request travel funds for international exchange.

I wrote a proposal (which was funded by NERC) to visit the UK twice to develop a greater understanding of how their agencies and researchers pursue the development and deployment of advanced technologies such as AUVs. I was particularly interested in the role of risk management, which is a fundamental concept to the UK R&D efforts I was familiar with. By Learning more about U.K. programs and comparing that to efforts in the United States my goal is to write a concept paper on "the role of risk in unmanned vehicle development and deployment." I plan to make my second visit to the UK (also sponsored by the CASEE bursary) to present this paper at OCEANS 2007 in Aberdeen Scotland in June 2007.

This trip report provides a synopsis of the day-to-day activities and a summary of the key ideas or conversations that came out of the many meetings I had in the UK.

Trip Synopsis:

Daily Activities

Monday November 13, 2006: I arrived in the UK and travelled to Southampton. I checked in at the National Oceanography Centre (NOC) with Dr. Ken Collins and obtained my visitor credentials. In my conversations with Ken I learned about the structure of the UK Fiscal year and how their research community often runs into "odd" spending patterns late in the year. I had a very productive discussion with Martin Marsters who is a member of the outreach team at NOC. We discussed OE and its programs and I introduced him to our website, especially the lesson plans. We also had a good discussion about how to use "telepresence" in education and outreach. Martin gave me a copy of a DVD produced by the "SERPENT" program which teams ocean scientists with commercial ROV operators. The results seem to be of some value and certainly represent an efficient use of resources. I concluded my day's research activities by watching the "Gadget Show" on television in the evening. Consumer technology interests in the UK seem to be identical to those in the U.S. Not a major surprise.

Tuesday November 14, 2006: My first meeting was with Jon Adams a Professor of Marine Archaeology at the University of Southampton. I described OE, its programs and in particular the Phaedra expedition of 2006. Jon had good insights about the technology demands of archaeology and interdisciplinary exploration. He was interested in the results of some of our technology demonstrations, especially the imaging of the wreck of the *Paul Palmer* in the Stellwagen Bank National Marine Sanctuary. I also invited Jon to contribute to the Marine Technology Society **Journal** (I am the Editor and always on the lookout for a good paper).

I had lunch and an extended meeting with Gwyn Griffiths who leads the autosub team at NOC. I provided him with updates on AUV activity in the U.S. and NOAA. He helped me understand the existing funding regime in UK ocean sciences and introduced me to Oceans 2025, which is a combined vision/proposal from the major UK oceanographic programs. The overall concept was intriguing and the concepts within his technology development work program (particularly improved reliability of AUVs, a 5000km range AUV and air deployed conventional AUVs) also sounded exciting. Funding decisions are anticipated soon and Gwyn promised to send me detailed information on his technology work program once its funding level is determined. We also discussed how Autosub 3 was transitioned from a technology effort into an operational asset now available to the UK science community.

In the afternoon I met with Steve McPhail to get an update on the development of Autosub 6000. The core technology developments are valuable but it is fundamentally an evolution of the existing design. Once ready for testing and operations, in early 2008, this asset will be of great interest to Bram Murton, an oceanographer I met at NOC. Bram has some exciting ideas about technology, including low cost deep ROV approaches and his own ideas on a hybrid ROV. We also discussed the possibility of a joint AUV based expedition to the Cayman Trench. It might be possible to coordinate Autosub 6000 and Sentry (WHOI's new AUV) for an expedition to explore this deep water just off the U.S. Coast. I showed Bram the OE website and described how he could go about submitting a proposal for the 2008 cycle. This holds great promise for a collaborative exploration using the latest tools from both the UK and US.

Wednesday November 15, 2006: My primary activity today was a long visit with Mike Webb of NERC. Mike is the senior program manager over the Autosub Under Ice program and other NOC efforts. On my part I shared information about NOAA in general and ocean exploration in particular. The *Okeanos Explorer* and ROV were of great interest to Mike, as was the HROV project at WHOI. A primary conversation topic was the possibility of including *O. Explorer* in the international barter system developing amongst ship operators. Currently NSF participates but NOAA is not effectively engaged. In concept we might be able to swap time on our vessel for other ships operated by the barter participants. Thus we might see the cost savings of keeping the vessel in one region but also be able to use other ships and tools to explore wider regions of the ocean. I assured Mike I would bring this concept back to OE for discussion. We also discussed developing strong collaborations amongst our ROV operators and technology suites. I will make sure we invite representatives from the UK community to our planned technology workshop that will discuss our ROV payload plans. The other core concept I took away was that the funding base and outlook in the UK is much different from that in NOAA. NERC sponsors research programs for five years at a time. Once funds are awarded and committed they are quite stable. This allows large bodies of work (e.g. Autosub Under Ice at over \$10M) to be conceived and executed. While the burden of justification is higher than OE's peer review panel the stability and results speak for themselves. The Autosub program truly explored an unknown region with the latest technology. It incurred great risk (even the loss of one AUV) but yielded exceptional data. Obviously the Government funding mechanisms are different but these lessons are worth considering as OE develops programs and sees its budget stabilize.

Thursday November 16, 2006: I opened my day with a meeting with Colin Day and Geraint West both of whom are engaged in the operations side at NOC. Once again I described the *O. Explorer* and ROV. We discussed the barter system and including their representatives in the OE ROV/technology workshop. We also discussed the Cayman Trench idea and its possible logistics. Much will depend upon the trials of Autosub 6000. A strong discussion and excellent contacts with the UK vessel operations community.

Later in the day I travelled to Oxford. I met with Paul Newman who was a post-Doc at MIT while I ran the AUV Lab there. Paul is now a Fellow of New College (similar to tenured faculty) where he teaches engineering. He conducts most his research in robotics. In addition to learning about the fascinating history of Oxford and the quirks of its education system I also saw further impacts of the UK R&D approach. Paul described how he just finished a series of proposals that would provide funding for three to six years of his work. As a researcher he appreciates the stability and duration of the funding. This is especially true for his technology development efforts. We also discussed the idea of an undersea "grand challenge" to spur the development of undersea robotics. Paul pointed out that the cost of entry is much higher than the land version (where an automobile and laptop are all on needs). It is unclear if that means the prize must be larger or if it will simply exclude the amateurs from such an event.

Friday November 17, 2006: I met with Ian Gallet executive director of the Society for Underwater Technology. In addition to discussing ways SUT and the Marine Technology Society might collaborate we also discussed the legal and policy efforts his society is leading in the UK. A working group there is attempting to develop updated legal studies of AUVs and eventually hopes to develop a code of "best practices" for the operation of AUVs. Both of these efforts are intended to help those who actually use AUVs manage their liability as they use ever greater numbers of AUVs offshore. This discussion was followed by a visit to the Leviathan Facility, specialty underwriters for Lloyds of London. Leviathan exclusively works in the area of marine equipment and have written policies on many AUVs. I met with Simon Edwards who founded the group. Simon described the critical importance of the crew and vessel experience in AUV operations. All of the claims Leviathan has paid out have been a result of launch and recovery incidents. While they have not found themselves in a liability situation (e.g. an AUV surfacing under a jet ski injuring the rider) but Simon assured me he was concerned about this incident. From his perspective it is a matter of when not if and that only such an incident will initiate the legal events required to truly understand the liability regime for AUVs. He encouraged me to work with Ian Gallett on the code of best practices and suggested that development and use of such a code would help AUV operators manage their risks more effectively.

Saturday and Sunday November 18-19, 2006: I spent the weekend visiting a friend at the University of Birmingham who is completing a Ph.D. in advanced techniques for data visualization. Staying the Saturday night significantly reduced my air travel costs and allowed me to see a Rugby Game. Definitely in the spirit of international exchange. I spent Sunday travelling back to Boston.

Key Contacts:

All of the individual meetings described above can be considered key contacts. For further information or contact information please see Justin.

Reference Materials:

These are materials were collected on this trip and are retained by Justin

1. SERPENT Program DVD
2. An overview of the Oceans 2025 initiative proposed to NERC.
3. Industry publications from the Society for Underwater Technology including two issues of their Journal and a magazine on underwater vehicles.