In this VI\textsuperscript{th} Issue you will find:

- **INFANTE diving in the Azores**
  - Page 2

- **The V\textsuperscript{th} FREESUB Workshop on I-AUV Control**
  - Page 4

- **Successful Sea Trials of Europe’s first Intervention AUV “ALIVE”**
  - Page 6

- **The Intervention AUV Simulator**
  - Page 4
**IST Sea Trials in the Azores**

Between July 31st and August 15th the Marine Robotics team of IST went to the island of Faial, in the Azores, to run sea trials with their INFANTE AUV. The goal was to test new AUV features and gain experience in performing AUV scientific missions while collecting valuable scientific data for the Department of Oceanography and Fisheries (DOP) of the University of the Azores, with whom IST has maintained close cooperation links over the past 7 years. The FREESUB Young Researchers Lionel Lapierre and Alex Alcocer involved in the IST team were there to tell us about the trials.

These trials were a great opportunity for the FREESUB young researchers to get involved in real AUV missions, as they had the chance to test some of their work, learn from “real life” experiments, and interact with a large number of people working in marine science and technology. The INFANTE AUV was equipped with a large number of sensors (including Navigation sensors) such as a Seatex Motion Reference Unit, a Sidescan Sonar, a profiler, 2 altimeters, a depth cell, and a Doppler Velocity Log. Among the INFANTE scientific payload a CTD (which records conductivity, temperature and depth data), a Fluorometer, and a Plankton Sampler should be mentioned.

During the first days, using a surface vessel and technology developed at IST, bathymetric data was acquired from different areas of ecological interest in order to build bathymetric maps and, in some cases, support their recognition as marine protected areas. Before INFANTE could take its first dive, a lot of preliminary work had to be done.
All the systems and equipment had to be checked and carefully tested in order to be able to guarantee a safe operation. First, the vehicle buoyancy was finely tuned on site using foam and weights to obtain a slightly positive buoyancy and compensate for all the new payloads. Extensive Hardware-in-the-loop simulations were carried out to guarantee the correct functioning of all electronic and mechanical devices. A big blackboard at the IST workshop, just a few meters away from sea, at the harbour of Horta, showed all the work plan for the following days: equipment tests, navigation and control architecture tests, mission control tests, acoustic communication tests and finally the scientific missions that had to be carefully planned in cooperation with the scientists from the University of the Azores. All together a quite notable exercise of project management.

It was an amazing bunch of work done by a relatively small group of people, and the working timetable was often pushed to the limit. However, as one of the team member likes to cite: "Teamwork is the fuel that allows common people to attain uncommon results", and this was another good example!

Lot of tests were performed, including depth control algorithms, trajectory tracking, and simple mission control tasks, all with outstanding operational support of DOP’s scientific team and vessels with respective crews. The GIB underwater positioning system, for which the Young Researcher Alex Alcocer was responsible, and that had been successfully tested just a few weeks before, did not perform well in the trials due to problems in accepting GPS differential corrections. A reminder that real work at sea goes well beyond neat diagrams on a board! During most of INFANTE operations, the scientific sensors were running and acquiring data that was at the end of each day given to the scientists of DOP.

Some of the tests were performed with an underwater video-camera attached to the AUV. In the picture we can see INFANTE diving with the camera. At the nose of the vehicle we can see a tube that directs the water flow to the Plankton Sampler. The other picture shows the AUV operating near the beautiful city of Horta (in the background). [AA]

If you want to learn more about the vehicles of IST please contact Prof. Pascoal (antonio@isr.ist.utl.pt) or visit http://dsor.isr.ist.utl.pt/
**The I-AUV Simulator: FREESUB is reaching high**

Work meeting on Simulator Integration at the CEA, Robotics & Interactive Systems Department, Control & Man-Machine Interface Laboratory in Fontenay-aux-Roses, France on December 15th 2003: The main scientific objective of Freesub is to develop modules and key technologies that can be implemented into Autonomous Underwater Vehicles for Intervention (I-AUV). The most intuitive and friendly manner for touching and testing such technologies is to integrate them into a numerical simulator. Now, Freesub is passing to its final stage and the integration of all the simulator modules is one of the main concern of the partners.

The common platform, VirtualRobot Simulator (VRS), is indeed a suitable solution for developing such an integrated simulator. The main advantage of this platform, is that each organisation could action to the same simulated environment of VRS via a comprehensive C programming interface.

Pursuing the spirit of integration, during 15th December 2003 a one day meeting was organised in Fontenay-aux-Roses, France. The major objective was to build the first common simulation environment, which includes various models (the sea-bed, the AUV, the docking panel) from different partners of FREESUB. The first step was to convert the sea-bed in suitable format and then, to integrate it with the models of the I-AUV and of the docking panel within VRS. Because of the efficient collaboration between Young Researchers from CEA and University of Southampton, before end of the day, the first common simulation environment was brought into reality.
Thus, the first objective, integration of the simulation environment was successfully solved. Furthermore, another topic of the workshop agenda, the development of an interaction mechanism between control blocks of the simulator was touched. In this sense, the Young Researchers have quickly evaluated the potential of a programming tool developed by CEA for building a communications interface between applications based on TCP/IP protocol. The results were quite promising, but, before starting the implementation, the young researchers convened to look further into a formalism for describing the interaction between control blocks (a set of macro commands), and thus, the agenda of the next workshop for integration was already sketched. Finally, the development of a mission control block, capable to manage the interaction mechanism between all control blocks of the simulation was envisaged. [MB]

If you want to learn more about the telemanipulation systems of the CEA please contact Dr. Gravez (philippe.gravez@cea.fr) or visit http://www.cea.fr

FREESUB Land: Who is working where in FREESUB?

Please contact the coordinator or visit FREESUB’s homepage under www.freesub.soton.ac.uk for open vacancies.
The Dawn of the Intervention AUV:
Successful Sea Trials of Europe’s first Intervention AUV “ALIVE”
October 23rd to 29th, 2003, Mediterranean Sea near Bandol, France. Development teams from Cybernetix, IFREMER, the JRC, Heriot-Watt University and HITEC-FRAMNÆS assist to the final sea trials of Europe’s first Intervention AUV “ALIVE”.
The objective of these trials was to autonomously dock the vehicle to a pre-installed ROV-Panel and to execute there an automatic intervention with the hydraulic 7-function manipulator arm.

On October 27th, 2003, after a successful launching of the I-AUV from IFREMER’s research vessel “EUROPE”, ALIVE dived down to the sub-sea target while regularly sending telemetry data to the surface. After a transit of 10 minutes to the seabed and the following approach to the target, the crew on the second vessel “CUPIDON” which controlled the observation ROV confirmed the successful docking and telemanipulatorat of ALIVE on the Panel, setting a successful end to this 3 year research project which was financed by the European Commission under the GROWTH programme.
**A strong partnership** between the five organizations working in the ALIVE project, with Cybernetix as project coordinator, was the factor of success for this endeavor:

Since three of the partners, namely JRC, IFREMER and Cybernetix, are on the same time part of the FREESUB Research Training Network, Young Researchers of FREESUB also profited from the experiences during the ALIVE development. The project showed the feasibility of autonomous sub-sea intervention and thus pushes open the doors to new applications in many fields of the exploration and exploitation of the deep-sea.

While the objective of this project was mainly oriented on interventions that can be found in the offshore oil and gas industry, many other types of missions are imaginable, like i.e. the autonomous sampling for maritime research, fast interventions in the case of accidents like the “Prestige” oil tanker or the recovery of black boxes from airplane wrecks. The open-frame design of the ALIVE allows the integration of various sensors and actuators. The future will show, if the partners common vision towards autonomous deep-sea intervention will become reality. [PW]
I-AUV Control Workshop in Marseilles

Researchers of FREESUB met on October 20th and 21st for the 5th Workshop on I-AUV Control in Marseilles.

The guidance and control of an AUV for Intervention differs in many ways to the control systems of Remote Operated Vehicles. Such a system has to overtake, in some parts of the mission, the role of the human operator on the surface. While Mission Management Systems for AUVs for Survey have achieved a mature state, such systems for Intervention AUVs are still under development.

It was the subject of this last Workshop of the Research Training Network to set up a control structure appropriate to this ambitious task and to “marry” the control of an AUV with the functions of a telemanipulation system - a process transforming an AUV into an Intervention AUV.

Besides the technical presentations the occasion was used to discuss on the future of the FREESUB network. During the last three years a strong partnership between the consortium members was built, allowing Young Researchers from all over Europe to gain valuable experience in AUV technology. The participants agreed that the FREESUB network must go beyond its finishing date, which will be in September 2004. [PW]
NEW MEMBERS IN THE TEAM

Florian OSZWALD: Florian is the newest member in the FREESUB team since he joined the IST in Portugal on the 1st of November, 2003. He is of German nationality and studied at the University of Hanover where he graduated in Mechanical Engineering.

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http://www.cordis.lu/improving/

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