NATO OTAN

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NURC

PARTNERING FOR MARITIME INNOVATION

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Students AUV Competition a Great Success

University student competitions are a great way to foster interest in a field, to give students an opportunity to apply their learning in a real-world environment, to let employers find budding talent, and to just have a bit of fun.

Participant launching his team's AUV in NURC's harbour.

The Student Autonomous Underwater Challenge—Europe (SAUC-E) accomplishes all of these goals. The Centre is proud to have hosted this event for the past two years, which challenges teams of students to develop an autonomous underwater vehicle and test it in a series of realistic missions in NURC's harbour.

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2011 Winners

1st Place: University of Luebeck, Germany

2nd Place: University of Girona, Spain (2010 Champions)

3rd Place: DFKI Bremen, Germany

4th Place ENSTA Bretagne, France

Other Awards

Cooperation Award: Heriot-Watt University, United Kingdom

Engineering Award: University of Southampton and University of Birmingham, United Kingdom

Experimentation Award: University of West England, United Kingdom

Perseverance & Tenacity Award: ESIEA Paris, France

Best Use of Resources: ESIEA Paris, France

Teamwork Award: University of Cambridge, United Kingdom

Alliance Crew Rescues Passengers from Burning Pleasure Craft

On 1 August, the Centre's ship the NRV *Alliance* was conducting research operations off the coast of Italy near the port of Savona when the bridge crew noticed that a distant motor yacht was on fire. The *Alliance* crew quickly raised the alarm with the Italian Coast Guard and launched a Delta Fast Rescue Boat to offer immediate assistance to the passengers of the vessel, which was approximately five miles away. Six people—an Italian family of five and an Ecuadorian woman—were rescued. The rescued passengers were taken on board the *Alliance* where they received first aid and were then transferred to a Coast Guard tender.

The pleasure craft sank shortly after this picture was taken.

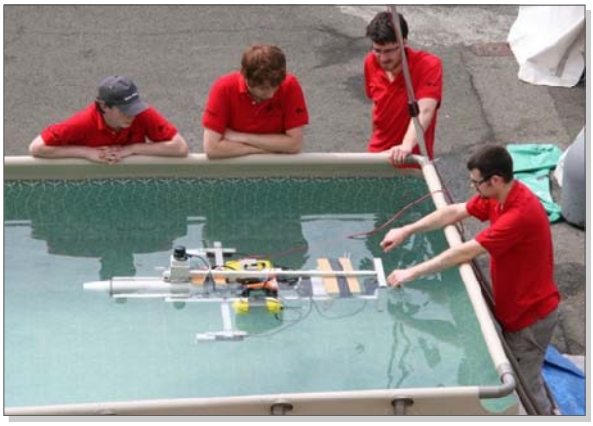
Because of the extent of the fire, the Italian Coast Guard denied the *Alliance*'s request to fight the fire. A few minutes later, the 18-metre motor yacht was consumed by flames and sank. According to Dr. Dirk Tielbuerger, Director of NURC, "We consider ourselves lucky that our ship, the *Alliance*, was on the scene at the right moment. Because of the vigilant and determined response of the crew, all were rescued and were able to return home uninjured".

After the rescue, it was back to work for the crew members, who were on the final day of an 11-day experiment to study how to mitigate the effects of sonar on marine mammals.

Crew members from the Alliance transport passengers to safety.

Student AUV Competition, continued

This year's event brought together 10 teams from universities throughout Europe to vie for a number of awards. University of Luebeck from Germany was the overall winner of the 6th SAUC-E competition. Teams were judged by an international panel of experts not only for a team's ability to complete missions with its AUV, but also for technical merit, craftsmanship, safety of design, as well as marketing and fund-raising efforts. Prizes for the first four teams were given in the amounts of €4000, €3000, €2000, and €1500. All of the other teams that entered received €1000. This money will be used to improve the teams' equipment for future competitions. According to NURC's Director, Dr. Dirk Tielbuerger, "All teams made important achievements that will help them continue their work in the future. Overall the whole event was a great success". NURC looks forward to hosting the SAUC-E competition again next year. More information about the event can be found at www.sauc-europe.org.



Students prepare their AUV for the competition.

NURC Hosts Remote Sensing Workshop

Over the past few decades, a number of conferences and workshops have been held on the use of high-frequency (HF) radar in ocean applications. On 10 – 13 October, NURC will give researchers another opportunity to share their work at the Third Workshop on Remote Ocean Sensing (ROS) 2011 at the Centre's facilities in La Spezia, Italy.

In contrast to the previous workshops, ROS 2011 will be dedicated solely to remote sensing of the ocean using HF radar and its applications. This workshop will focus on retrieval of information such as surface currents, waves, and winds as well as ship detection. Furthermore, ROS 2011 will address the use of retrieved information in other applications, for example environmental modelling. For more information about the workshop, visit www.nurc.nato.int/ROS.

New Books from NURC Scientists

Many years have passed with few or no new significant textbooks on the topic of underwater acoustics, but thanks to current and former NURC scientists a new book and an updated edition have been recently published.

The book *Passive Acoustic Monitoring of Cetaceans*, written by NURC scientist Walter Zimmer, has just been published by Cambridge University Press. This book covers topics related to the acoustic non-invasive study of marine mammals, from basic underwater acoustics to the modelling, simulation, and practical aspects of the passive acoustic monitoring systems. Walter Zimmer has spent the past 10 years at NURC studying marine mammals as part of the Marine Mammal Risk Mitigation programme (see "Sirena Continues to Call", p. 3).

Finn B. Jensen has spent most of his professional life at the Centre, formerly as a senior scientist and currently as emeritus scientist. His book *Computational Ocean Acoustics*, co-authored with William Kuperman, Michael Porter and Henrik Schmidt, has been recently released in its second edition. This edition features more than 200 new pages with updates on signal processing for sonar applications, ray methods, wavenumber integration techniques, 3-D scattering and reverberation, parabolic equation modelling, target scattering, and finite-element technique. Kuperman, Porter, and Schmidt have spent one or more tours of duty at NURC.

Sharing our Work Locally

This September, scientists all over Europe will participate in Researchers' Night 2011. The aim of this programme, sponsored by the European Commission, is to share scientific and technological innovations with the public and to introduce scientists and their research to the communities that they work and live within.

NURC scientists will participate in the nearby town of Lerici, which is one of 11 cities in Italy hosting this event. Dr. John Potter will give a presentation called "Sailing and ice: the passions and the adventures of a scientist", and Cdr. Enrico Antonino will give a presentation "Italy, why Antarctica?" These presentations, along with other presentations from local scientists, will take place in the Lerici Castle, 23 September, 5 pm – 8 pm. During the day, there will be information booths set up and scientists will be on hand to talk to students and locals who are interested in learning more about marine biology, alternative energy, and climate change. NURC is glad to have this opportunity to connect with the local community.

Sirena Calls Again

Since 1999, NURC scientists and engineers, along with personnel from partnering organizations, have gone to sea to gather data on whales in the Mediterranean. This year's sea trail, where researchers continue to learn how to mitigate the effects of sonar on marine mammals, is called SIRENA '11. (Sirena is a mythical mermaid who lures sailors with her hypnotic voice.) The first phase of this data-gathering mission took place from 22 July to 1 August in the Ligurian Sea aboard the NRV *Alliance*.

NURC began its Marine Mammal Risk Mitigation programme with the intent of taking a proactive approach to ensure that NATO maritime forces could use active sonar during operations while mitigating the risk to marine mammals, most specifically whales. This long-term effort has included the development of:

- A marine mammal database to understand the population distribution and density in areas that NATO operates within
- Technologies to enable the use of sonar while mitigating risk to marine mammals
- Guidelines and protocols that NATO personnel can use when conducting their operations

It has also resulted in a new book written by NURC scientist Dr. Walter Zimmer: *Passive Acoustic Monitoring of Cetaceans*. (See "New Books from NURC Scientists", p. 2).

The success of the Marine Mammal Risk Mitigation programme is largely dependent on the cooperation of and collaboration with national and international organizations. SIRENA '11 is no exception with participation from the *Centro Interdiscipinare di Bioacustica e Ricerche Ambientali (CIBRA),* University of Pavia, Italy, as well as the Bundeswehr Technical Centre for Ships and Naval Weapons, Maritime Technology and Research Department for Underwater Acoustic and Marine Geophysics, Kiel, Germany. CIBRA collaborated in the collection and analysis of acoustic data as well as providing both equipment and support personnel. The Bundeswehr contributed acoustic buoys, a new towed array that it has developed, and support personnel. Also, universities and non-governmental organizations from various NATO nations participated with their expertise and time, primarily helping with visual observations.

The primary tasks of SIRENA '11 are to gather visual and acoustic data on marine mammal distribution, particularly for deep-diving whales that seem more vulnerable to problems associated with sonar, and to compare passive acoustic monitoring technologies that can help locate and identify marine mammals. SIRENA '11 used a wide variety of technologies to "listen" for the signature sounds of marine mammals, including hydrophones that are:

- Towed behind the ship (NURC's, the Bundeswehr's, and CIBRA's towed arrays)
- Mounted on four different types of moored buoys (NURC's HYDRA buoys and the commercially available C-POD, T-POD, and EAR buoys)
- Carried onboard an autonomous deep water glider (Slocum)

The glider—a type of autonomous underwater vehicle (AUV)—is a new approach to monitoring in the deep ocean and is being explored as a possible means of persistent monitoring of marine mammals. Gliders use a buoyancy engine that has minimal power requirements, allowing them to stay at-sea for longer periods of time than propeller-powered AUVs. The Slocum glider can dive up to 1000 metres. When it surfaces, it sends data via satellite anywhere in the world. A fleet of gliders could offer a less expensive means of monitoring whale distribution and densities than ship-based monitoring, and because it could be done year-round, it could provide more accurate data.

Deep-diving marine mammals, such as this Cuvier's beaked whale, are more sensitive to active sonar operations.

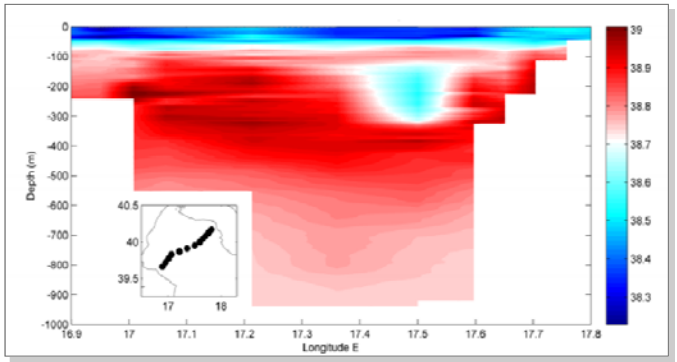
Data from the July phase is starting to be analyzed and incorporated into the marine mammal database. The final two phases of SIRENA '11 will take place in October and December of this year.

For more information on NURC's Marine Mammal Risk Mitigation programme, visit http://solmar.nurc.nato.int/.

Creating a Clear Picture from a Sea of Data

NATO militaries assess the environment prior to and during operations to help develop a strategy and determine the risks and likelihood of success, but because the marine environment is dynamic and cannot be observed directly, getting an accurate assessment is difficult.
A team of scientists at the Centre is trying to help NATO navies create a clearer "picture" of the underwater environment as part of the Recognized Environmental Picture (REP) project. This multifaceted project collects meteorological and oceanographic data in the waters near shore and builds ocean forecasting models to support NATO operations. For the past three years and again this year, scientists from the Centre will go to sea with partnering agencies to gather more data. From this sea of data, scientists hope to create a clearer picture of the environment NATO navies operate within.

REP11 conducted its first at-sea trial from 13 to 24 August in the Gulf of Taranto, northeast Ionian Sea. The focus of this trial was on oceanographic measurements and modelling of the following properties: conductivity, temperature, salinity, optical attenuation, wave height, surface current, and sea surface temperature. Instruments used during the trial included full-depth moorings, upward-looking acoustic Doppler current profilers, surface current and temperature drifters, a wave rider buoy, and a meteorological station buoy. In addition to these fixed instruments, data was also gathered from instruments onboard the NRV Alliance and from three Slocum gliders deployed throughout the 12-day sea trial. Seismic surveys were also conducted to obtain detailed bathymetry and information on the composition of the seafloor. These data will be useful in the next phase of the REP 11 sea trial, when acoustic measurements will be the focus.



Physical properties of the ocean, such as salinity, can affect sonar predictions. This graph shows a pool of low-salinity water observed during the REP11 sea trial.

The wealth of data collected in REP11, and in the previous three years of at-sea investigations, feeds into a cycle of improved understanding of the underwater environment: Scientists develop models for ocean forecasting and sonar predictions; models are tested against known conditions to measure all of the uncertainties and errors in the forecasts; and from these uncertainties, changes are made to data gathering to improve the model.

Three Slocum gliders were used to gather data throughout the experiment.

To make these models usable by NATO personnel in an operational environment, tactical planning aids are also being developed at the Centre. For example, the MSTPA (Multi-static Tactical Planning Aid), a tool developed a number of years ago for antisubmarine warfare, is being updated to provide a way to visualize the meteorological and sonar forecasts including the inherent uncertainties. With this project, scientists hope to give NATO personnel better tools to make tactical and strategic decisions in a complex marine environment.

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