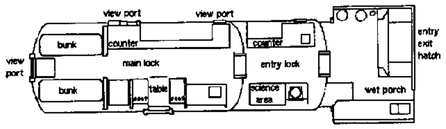
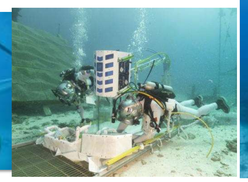
Student Projects in Support of NASA's Extreme Environment Mission Operations (NEEMO) Program

Carolyn E. Newton, Victoria C. Barkley, Ashley E. Hollis-Bussey, Holly Abernethy, Dr. Jason P. Kring (Faculty Advisor)
Embry-Riddle Aeronautical University

What is NEEMO?

This was the 19th rotation of a crew comprising astronauts from the European Space Agency, the Canadian Space Agency, and NASA. Astronauts-in-training use this facility called "Aquarius," residing 50 feet below the surface of the Atlantic, approximately 6 miles offshore from Key Largo. The astronauts live inside this habitat for 6-7 days to simulate living in space. They also perform simulated Extra Vehicular Activities (EVAs) by completing maintenance tasks in the area surrounding the living quarters.





Future Projects

The students who participated in NEEMO 19 are planning new tests for mission 20:

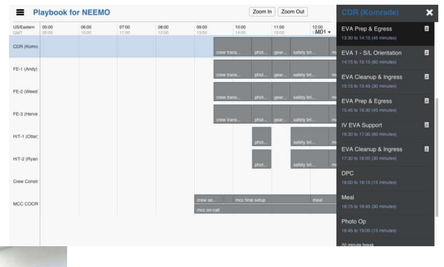
Engineering: Students are working on developing a second, two-story structure (CORAL 2). CORAL 2 will be sent to the astronauts in pieces which they will assemble in multiple simulated EVAs.

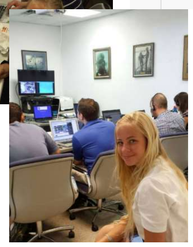
Human Factors: Students will be testing out different training methods for instructing the astronauts on the CORAL 2 assembly. Planned off-nominal situations will occur during construction, to encourage innovation practices learned during the training. The students are also organizing a communication study by simulating a delay and transfer of information through two stations rather than one.

Computational Math: The next step for the Eco-Dolphin is to provide live-visual feedback to astronauts in the Aquarius habitat during the next NEEMO crew rotation. Current goals are to provide the NEEMO crew with full ability to manipulate the vessel from their station in Aquarius. The dolphin will be released and and retrieved from the wet-deck.

Mission Operations- Human Factors & Commercial Space Operations

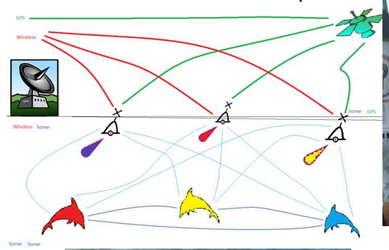
Students from these majors focused on mission operations throughout the NEEMO 19 mission. They observed communication between the crew and mission control center in Key West through the application developed by NASA employees from the AMES Research Center. This was a web-based, mobile application that scheduled all crew activities actively. This application, called Playbook, was capable of being altered by mission control personnel or the crew in the Aquarius facility. It would display all activities by degree of importance and urgency. The entire crew described it as "simple," and applauded its contribution to the success of the mission.

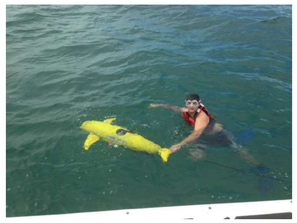


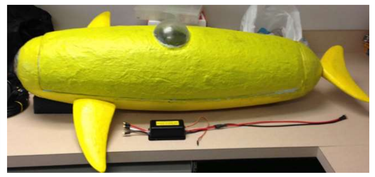


Eco-Dolphin- Computational Mathematics

The Computational Mathematics program at ERAU sent a group of 5 undergraduate students and 2 graduate students to NEEMO in support of their Eco-Dolphin project. The autonomous vehicle was built to be controlled from an operator at a location above the surface. It uses fin-like structures similar to that of a dolphin to steer according to input from the on-deck operator. Students had tested this vessel in the lab and in a local fresh-water river. This was the first time the students had tested the vessel in open water with unpredictable flow patterns and harsh fluctuations in water levels. Another concern was the salinity of the water. The dolphin performed just as well under these conditions and was able to communicate to the on-deck operator.

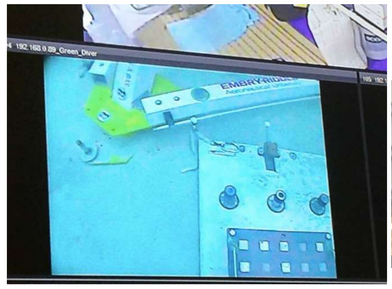


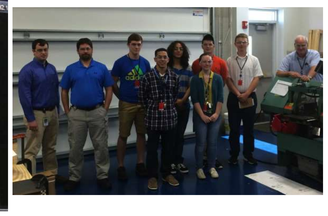




Teledyne Oil & Gas CORAL Structure- Engineering

Students from ERAU partnered with Teledyne Oil and Gas in Daytona Beach to design a structure called the Collaborative Oceanic Reliability Analysis Lab (CORAL). Participating students came from Aerospace and Mechanical Engineering disciplines at ERAU. Using graphical design software, these students worked with employees at Teledyne to build a 3-D mock-up of a structure to test cables and other materials used by the company. After the design was complete, these students constructed their design using tools and materials from the Teledyne facility in Daytona.





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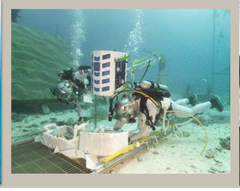

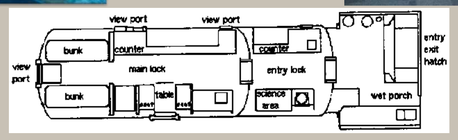

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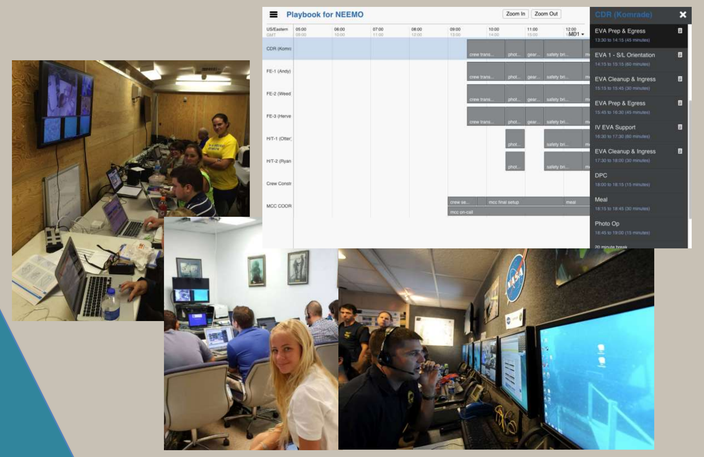

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