



# CRUSER • NEWS

Consortium for Robotics and Unmanned Systems Education and Research

FROM TECHNICAL TO ETHICAL...FROM CONCEPT GENERATION TO EXPERIMENTATION

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## CRUSER Mission Thread Design and Progress

by Lyla Englehorn, CRUSER Technical Writer

To meet our goal of “..from concept generation to experimentation”, CRUSER creates 24 month mission threads to align and focus our activities. Major aligned events starting in FY11 through FY13 include mission threads (see graphic on page 4) starting with concept generation workshops, developed in technical symposia, and demonstrated in field experimentation to test selected technologies. Using the mission thread concept CRUSER leadership designed an overarching program direction to guarantee tangible results for the second tenet of the program vision – from concept generation to experimentation.

Thread #1 began with the CRUSER Warfare Innovation Workshop (WIW) in September 2011. Four teams of NPS students, practicing engineers from Navy labs and industry, and visiting command representatives were asked to generate revolutionary concepts using rapidly evolving unmanned naval systems technologies. From these innovative concepts, the CRUSER leadership team chose five focus areas that warranted further investigation: 1) counter unmanned aerial vehicle (UAV), 2) information assurance, 3) intelligence surveillance and reconnaissance (ISR), 4) knowledge management/data management, and 5) non-kinetic strike.



*Pictured (l. to r.) FRONT ROW: J. Ma (NASA/JPL), O. Peralta (USMC), A. Sharif (SSC-PAC), J. Mason (USN), J. Kline (CRUSER) BACK ROW: A. Mclean (USN), C.Chen (Northrop Grumman), S. Kragelund (NPS), L. Payton (USMC), W. Chapman (USN)*

CRUSER then invited industry, Navy labs, and academic researchers to demonstrate technical capabilities related to the selected concepts at a three day CRUSER Technology Continuum in May 2012. Scheduled in conjunction with TENTH International Mine Warfare Symposium in Monterey, the CRUSER Technology Continuum “Unmanned Systems – The Way Ahead” was sponsored by NPS, ONR, the Program Executive Office, Littoral Combat Ships, OPNAV (N85), and CRUSER.



*Dr Timothy H Chung, CRUSER Director of Education and Research, and Students with Aerial Battle Bots*

Next, select presenters will be invited to participate in field experimentation of targeted technologies planned for April 2013. The results of Thread #1 will be presented at a Research Expo in Washington DC in June 2013.

As Thread #1 continues toward experimentation in April 2013, Thread #2 will begin this fall with the NWDC/CRUSER Warfare Innovation Workshop, “Advancing the Design of Undersea Warfare (DUSW),” scheduled for 17-20 September 2012 on the NPS campus. Participant recruiting is now underway. Please contact CRUSER Director of Concept Generation and Innovation Carol O’Neal ([cjoneal@nps.edu](mailto:cjoneal@nps.edu)) for more information on the DUSW WIW and participation details.

[HTTP://CRUSER.NPS.EDU](http://CRUSER.NPS.EDU)

## DIRECTOR'S CORNER

Robotics continues to inspire future generations of innovators, and this month highlights one of many robotics competitions that help foster these future engineers, scientists, entrepreneurs, policy and decision makers, and even hobbyists. Events such as MATE, RoboSub, RoboBoat, not to mention other challenges such as those from DARPA, provide opportunities for collaborative learning and discovery, both at the intra-team and inter-team levels. A key challenge is to capture these bright minds and their innovations and facilitate their transition into operational capabilities that can benefit society and Services alike. As CRUSER aims to help foster such opportunities, we encourage all members of our Community of Interest to take note, inspire others, and support such mechanisms for combining collaboration with friendly competition.

**Dr Timothy H Chung**  
**CRUSER Director, Education and Research**



## Far Eastern Federal University and Ozaukee/Oostburg High Schools Take the Top Spots at MATE Center's International Student ROV Competition

by Caroline Brown, PR for MATE and Jill Zande, Associate Director, & Competition Coordinator, MATE Center, VP of Education and Research, Marine Technology Society

More than 50 student teams from the U.S., Canada, Hong Kong, Macao, Taiwan, the UK, Russia, and Egypt participated in the Marine Advanced Technology Education (MATE) Center's 11th annual student underwater robotics competition, held last month in Orlando.

At MATE's remotely operated vehicle (ROV) contest, which took place at the YMCA Aquatic Center, students competed with ROVs that they designed and built to handle underwater tasks associated with the discovery and remediation of World War II shipwrecks.

Competitors included student teams representing middle schools, high schools, home schools, community colleges, universities, after-school clubs and outreach programs. They competed in either the RANGER or EXPLORER class, depending on the sophistication of their ROVs and the mission requirements.

### EXPLORER (Advanced) Class Winners

In the EXPLORER class, the overall first place winner was Far Eastern Federal University of Vladivostok, Russia. With 260 points out of 300 possible, the team also won the award for highest mission score.

As it did last year, Purdue University of West Lafayette, Ind. captured second place. The team was also recognized with the "Sharkpedo" award for innovation, originality and "thinking outside of the box," and team member Seth Baklor earned one of two EXPLORER class "Engineering MVP" prizes for the second year in a row.

Last year's first place winner Jesuit High School took third place this year. The Carmichael, Calif.-based team also won the award for best poster presentation.

### RANGER (Intermediate) Class Winners

Students from Ozaukee and Oostburg High Schools of Fredonia, Wis. combined to form a team that won overall first place in the RANGER (intermediate) class. The team also had the highest mission score, earning 300.1 points. (Their better-than-perfect score included bonus points.) Team member Eric Hartnett won one of three "Engineering MVP" awards in the RANGER class.

Second place went to Palos Verdes High School of Rancho Palos Verdes, Calif.

The Geneva School of Orlando, Fla. earned overall third place, as well as the award for top technical report.

### ROVs and World War II Shipwrecks

The competition encouraged students to think like entrepreneurs. They were asked to transform their teams into "companies" and respond to a

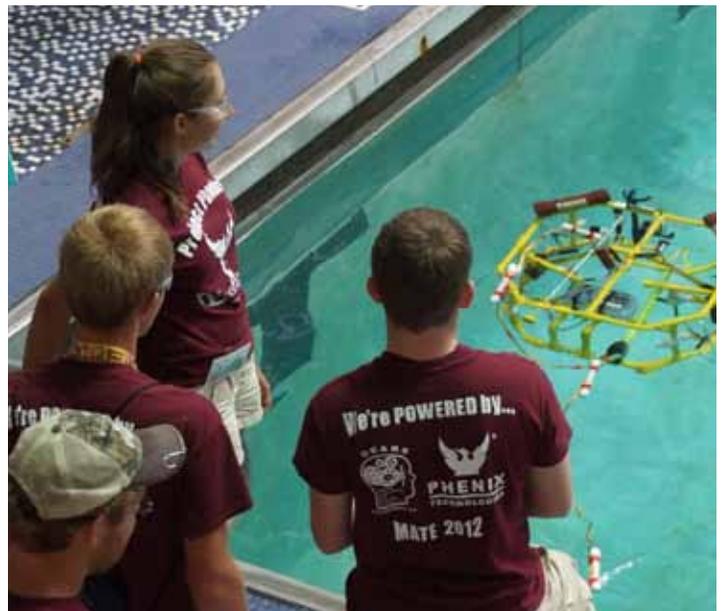
fictional RFP (request for proposal) for developing an ROV help with shipwreck documentation and remediation. During the process, the students developed the teamwork, creative thinking, and problem solving skills that make them competitive in today's global workplace.

During the event, teams piloted their ROVs to complete the mission tasks. They also prepared and presented an engineering report to a panel of volunteer judges and created a poster display aimed at the general public. Teams were evaluated on the design, construction, and performance of their ROVs; their ability to communicate what they learned; and how they put their knowledge to use in designing and building their ROV.

### About the MATE Center

Funded by the National Science Foundation and headquartered at Monterey Peninsula College in Monterey, Calif., MATE is a national program that works with educators and industry to improve marine technology education and expose students to science, technology, engineering, and math-related careers.

For more information about MATE, please visit [www.marinetech.org](http://www.marinetech.org). For more information about MATE's ROV competition, [www.materover.org](http://www.materover.org).



## Russian team wins first place at the world underwater robotics championship

The Far Eastern Federal University student team won the world championship in remotely operated vehicles at the 2012 MATE International ROV Competition, which was organized in Orlando, Florida, USA.



Each year, this competition attracts teams of specialists in underwater robototronics from all over the world. The FEFU team “Primorye Coast” competed with more than 20 teams from different countries including: USA, China, India, Great Britain, Egypt and others. The FEFU team has been taking part in these competitions, since 2008. In 2010, the team won first place for the first time. “Primorye Coast” consists of students of different specialties – from computer security to medical physics and interior design.

This year, the theme of the competition was the research of sunken World War II vessels. For the participants, there was a simulated event in which the fuel materials of the sunken vessels were an environmental threat that had to be neutralized. The teams were challenged with the development of methods for the secure fuel extraction.

At the core of the equipment, developed by the FEFU team, are bionic principles, and the “skeleton” of the equipment resembles the anatomy of sea creatures. The apparatus can withstand water pressure up to the depth of 6 meters and is fitted with video cameras, transmitting the whole picture of the ocean floor to the pilot.



Several technical elements were specially created for this device, for example, components for the engine are made out of plastic with the

help of a 3-D printer. “For many years already we’ve taken part in these competitions, and year by year the tasks get more difficult and interesting. For us, the competition is the climax of our work: all team members worked to create the apparatus. However, the completion of the devise is only half of the success. Only an clear and harmonious team work during the competitions can lead to the victory” said the leader of the team, Specialist of the FEFU Department of students’ scientific research work, Mr. Sergey Moon.

There is a stereotype that robotics engineering is a job for men, but there is also a girl on FEFU’s team. “I am very happy to have a chance to take part in such a competition in the USA and to win together with my team. This has been a unique experience that I would like to repeat next year as well”, said Ms. Angelina Borovskaya, 4th-year student of the FEFU School of Engineering.

The Marine Advanced Technology Education Center (MATE Center) is the organizer of MATE ROV Competition 2012 and other international competitions on underwater robotics.

### About FEFU

*Far Eastern Federal University is one of the federal universities forming elite Russian higher education. FEFU was established under a Russian presidential decree in October 2009 on the basis of four leading universities of the Far East, which have a history of more than 120 years of scholarship. FEFU’s development strategy includes the creation of an internationally recognized science and education center to represent Russia in Asia-Pacific region. The university’s priority development programs focus on “World ocean resources,” “Energy resources and energy-saving technologies,” “Nano-systems and nano-materials industry,” “Transportation and logistics,” “Russia’s interaction with APR countries,” and “Biomedicine.”*

*The unique educational environment that is being created on Russky Island (Vladivostok) will provide students and the people of Primorsky Krai with ideal opportunities for studying and making the most of their creative potential. The new FEFU campus will open its doors immediately after the completion of the APEC Summit, to be hosted here in September 2012.*

## CRUSER News Contributions

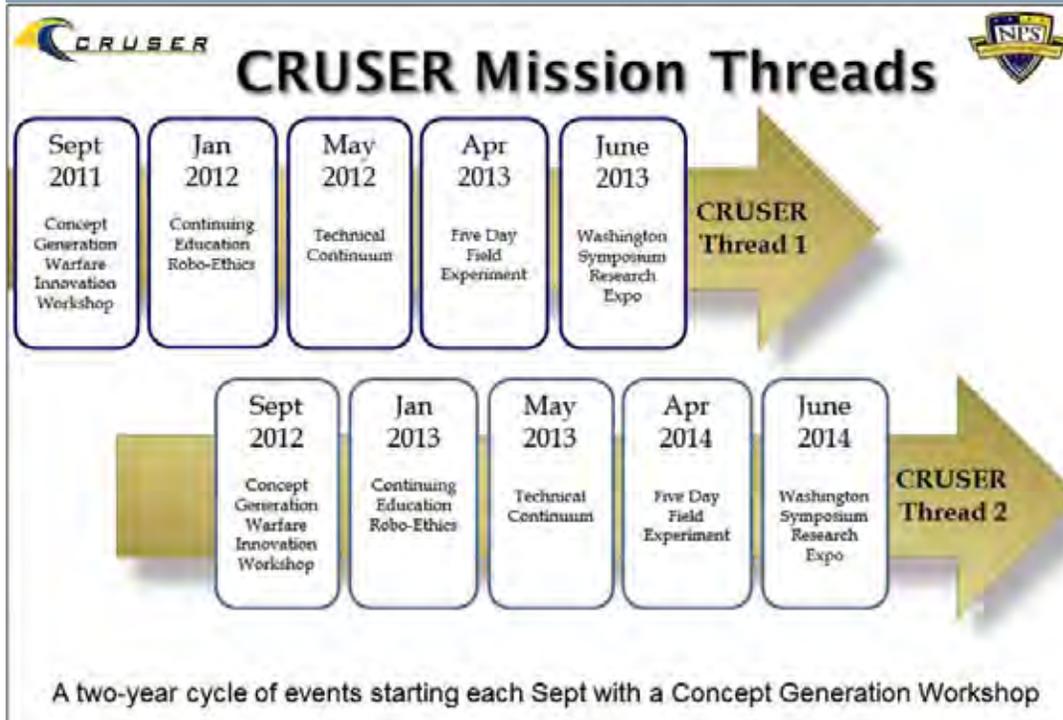
Short articles of 300-400 words are needed for future CRUSER News. Please contact Lisa Trawick at [cruser@nps.edu](mailto:cruser@nps.edu) for additional information

**STUDENT CORNER**

**STUDENTS:** LT Dylan B. Ross, USN and LT Jimmy A. Harmon, USN

**TITLE:** NEW NAVY FIGHTING MACHINE IN THE SOUTH CHINA SEA

**ABSTRACT:** This research examined naval surface forces of the People’s Republic of China (PRC) and the United States (U.S.) through the perspective of Captain Wayne P. Hughes, Jr., USN (ret.) missile salvo equation in order to demonstrate how American surface combatants can defeat PRC anti-access area denial (A2AD) measures in the South China Sea (SCS). Hughes’ equation reveals that advantages for American surface forces are obtained by increasing fleet numbers, counter-targeting (CT), and increased scouting. This thesis advocates fleet growth as articulated in Hughes’ New Navy Fighting Machine (NNFM) study. Comparisons of the NNFM, the U.S. fleet, and the PRC fleet demonstrate both the disparity facing the American surface forces, and the near parity obtained in the NNFM. CT through unmanned surface vehicles (USVs), and naval obscurants provide American surface forces increased staying power and tactical advantage. Scouting and communications networking through a theater wide constellation of airships provide the American fleet with persistent situational awareness of the battle space, tactical communications with subsurface forces, and improved emissions control (EMCON) measures for surface forces. The distributive properties of the NNFM, combined with this study’s CT and scouting findings, offer American surface combatants success over the PRC Navy in the SCS scenario.



**Does your DoD Organization have a potential thesis topic for NPS Students?**

**Please contact us at [CRUSER@nps.edu](mailto:CRUSER@nps.edu) for details about how to submit your organization’s topic.**

*CRUSER Mission Threads For details about CRUSER Mission Threads, please see the article on page 1*

**3D Metrics Workshop**

by Dr Paul McManamon and Fred Webber, Research Scientist, University of Dayton Research Institute

While accepted criteria exist to judge the quality of two dimensional imagery, there are no equivalent methods of judging the quality of three dimensional imagery, which is generated by ladars. Standardized quality evaluations are essential for both acquisitions and quantifying advancements in research. Our eye sees in two dimensions, so we are used to two dimensional imagery. Some traits of imagery are the same: both 2D and 3D imagery can have color or grey scale. Ladar adds a range dimension as well as the usual angle/angle information, while stereo vision adds range to the usual horizontal / vertical information.

To address this technical need, the University of Dayton hosted a 3D Metrics workshop at the Ladar and Optical Communications Institute, LOCI on May 31, 2012. The purpose of the workshop was to generate a plan to develop community accepted 3D metrics, standards to judge 3D image quality, for use with ladar sensors, and for use with other methods of generating 3D imagery (such as stereo imaging). The meeting was widely attended by government and contractor personnel. The National Geospatial Agency (NGA), the National Reconnaissance Office (NRO), Naval Research Laboratory (NRL), the National Institute of Standards and Technology (NIST), the Air Force Research Laboratory (AFRL), the

Army’s Night Visions and Electronics Sensors Directorate (NVESD), the Aeronautical Systems Wing (ASC/WI), and the National Air and Space Intelligence Center (NASIC) were government participants.

The workshop concluded there are two types of required metrics, engineering metrics that specify specifications for 3D sensors, and how to measure those specifications, and information level metrics, such as NIIRs, the National Imagery Interpretability Rating Scale. A NIIRs rating can tell a user if the quality of the image is good enough to accomplish a certain task, such as identifying a truck. Both of these levels of metrics will require modeling and laboratory testing.

To address these issues, agencies took specific action items to facilitate this development. For example: 1.) NGA will take action to get release of a NIIRs related article. 2.) Multiple government agencies will write down what they would like to see in terms of metrics (at one or both levels).

Dr. Paul McManamon, chair of the LOCI tech council, chaired the conference. Dr. McManamon is a former Chief Scientist for AFRL Sensors Directorate and an IEEE Fellow. He may be reached at [pmmcmanamon1@udayton.edu](mailto:pmmcmanamon1@udayton.edu). LOCI webpage: <http://www.loci-ud.com/>