



CRUSER • NEWS

Consortium for Robotics and Unmanned Systems Education and Research

FROM TECHNICAL TO ETHICAL FROM CONCEPT GENERATION TO EXPERIMENTATION



NAVAL
POSTGRADUATE
SCHOOL

INSIDE THIS ISSUE

4K ALOFT

Mr Jeff Weekley

DIRECTOR'S CORNER

Dr Timothy H Chung

NPS SYSTEMS ENGINEERING CAPSTONE PROJECTS

UUV DUAL PURPOSE

Mr Antoine Martin

CRUSER WARFARE INNOVATION WORKSHOP

Ms Lyla Englehorn

ROBOETHICS

Mr Mark Dankel

STUDENT RESEARCH

Mr Carl Thibault, UNB

ISRTC

Mr Russ Keller

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OF INTEREST**

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4k Video Aloft

by Jeff Weekley

In cooperation with the Naval Research Lab's Scientific Development Squadron ONE (VXS-1) and CineGrid, the Naval Postgraduate School demonstrated the capture and streaming of 4K video (3840x2160 at 60 frames per second) from the USN Airship MZ-3A during the week of 22- 28 August 2011. The experiment took place near the Naval Air Station Pax River and in the Annapolis, MD metropolitan area. Four use cases will be examined: coastal observation around the Chesapeake Bay and near Ocean City, MD; observation of submersibles and semi-submersibles (SPFS) under foliage canopy; remote observation of the Calvert Cliffs Nuclear Power Plant facility during a safety exercise, and overflight of metropolitan areas to include the United States Naval Academy in Annapolis and Danville, VA. Additionally, the airship made surveys of the Southern Maryland area in the wake of Hurricane Irene to help Maryland Emergency Management with damage assessment. The imagery from the Airship was captured using the JPEG2000 standard and transmitted over the Global Lambda Integrated Facility (GLIF) from the Naval Postgraduate School to other facilities around the world, including Cinemateca at the Museum of Modern Art in Rio de Janeiro, UCSD's California Institute for Telecommunications and Information Technology (Calit2) and CineGrid Amsterdam.

4K, at 3840 x 2160 pixels, doubles the 1080p high-definition television standard in both the vertical and horizontal dimensions; has 2.5 times the frame rate of conventional digital cinema and supports full 12-bit color sampling. The imagery was compressed using NTT Advanced Technology JPEG2000 Real-time Codec and sent via the Global Lambda Integrated Facility (GLIF) 10gbps network through NPS' CENIC connection. The imagery will be made available to NPS researchers upon request to assess its value in Intelligence, Surveillance, and Reconnaissance (ISR) programs; stereoscopic 3D reconstruction; inclusion

in hyper-spectral imagery; and for various computer vision techniques.



The US Navy Airship MZ-3A helps assess storm damage on its return to Pax River Naval Air Station after Hurricane Irene. Aboard is NPS Remote Sensing Center's Operations Manager, Jean Feirerra.

CRUSER News Contributions

Short articles of about 200-300 words are needed for future CRUSER News'. Please contact Lisa Trawick at cruser@nps.edu for additional information

DIRECTOR'S CORNER

As unmanned systems research lies at the intersection of numerous disciplines, conversations between players lead not only to sharing of information but also to forging of professional relationships which can be leveraged throughout their careers. A number of CRUSER events, such as the Innovation Workshops, are designed to foster such interactions with the aim of bridging different skill sets, disciplines, and communities.

Dr Timothy H Chung
CRUSER Director Education & Research



NPS Systems Engineering Capstone Projects completes NAVAIR DL MSSE Program for graduating Cohort #4

NPS has an extensive distant learning program with graduate degrees in Systems Engineering, Systems Analysis, and Business Administration. Students in these programs complete their degree by completing a capstone project in lieu of an individual thesis. These projects are frequently sponsored by DoD organizations who provide the issue for study. The following two projects are examples from the NPS Masters of Systems Engineering distant learning program.

Pirate Mother Ship Warning and Reporting System (PMSW&RS)

The Pirate Mother Ship Warning and Reporting System (PMSW&RS) analysis identifies a suitable and effective combination of unmanned aerial systems land launched from regional main operating bases (MOB) or commercial airfields to provide persistent intelligence, surveillance, reconnaissance, and tracking of Pirate Mother Ships that are prowling the shipping lanes for commercial vessels transiting across the Horn of Africa (HOA). The analysis developed a systems concept, the context, and a requirements hierarchy to support mission objectives. Architectural baselines were developed to identify key design characteristics and to provide insight into the value system design, analysis, modeling, and research efforts. Mission modeling using IBM Rational Rhapsody toolset, OMOE analysis, and CAIV analysis confirm that the highest value solution uses the LEMV.

Organic Kill Chain System

The Organic Kill Chain System analysis identifies the optimal configuration of unmanned aerial systems launched from an independently steaming U.S. Navy Arleigh-Burke class destroyer in international waters to provide persistent intelligence, surveillance, reconnaissance, and targeting for a strike against a high value individual located in a nominal coastal area. The analysis developed the family of systems concept, context, and requirements hierarchy to support mission goals. Architectural baselines were developed to identify key design characteristics and to provide insight into the value system design, analysis, modeling,

and research efforts. Mission modeling using Boeing's AFNES toolset, OMOE analysis, and CAIV analysis confirm that the highest value solution uses either the ScanEagle UAS, the Integrator STUAS, or a mix of both to meet capability thresholds.

For additional information about either theses - please contact Dr Richard Millar at rcmillar@nps.edu or Dr Rama Gehris at rdgehris@nps.edu who were the instructors for this capstone course.

UUV will double as offensive and defensive tool in undersea warfare

by Antoine Martin

Autonomous Underwater Vehicles have been used for mine countermeasure survey with good results, using sonars to map the seafloor and water body for moored and surface mines. Mine Disposal Vehicles are tethered Unmanned Undersea Vehicle which deploy an explosive by the mine or explode themselves next to the mine, thereby neutralizing it. As autonomy increases and CPU become faster and smaller, MDV are becoming untethered. UUV will therefore be able to deploy explosives and position themselves at precise locations, thanks to cheaper and smaller inertial measurement units. The bridge to have UUV turn their role from counter mining to become mines will be met. UUV could therefore become the ultimate smart mine, able to covertly and quietly reach their programmed target, while not responding to traditional mine-sweeping measures such as magnetic or contact detonation. There are also concepts to have UUV deploy mines underwater, instead of using submarines or boats. In any case, we are moving towards a functional merge of UUV doubling as counter mine or mine. While the technological hurdles of sonar data processing and autonomous behavior poses the largest obstacle to making this capability a reality – besides ethical debates -, this technological prowess would present an undeniably superior tool to the ones who possesses it, whether used as a threat or actually.

Antoine Martin, a business consultant and principal of Unmanned Vehicles Systems Consulting LLC, can be reached at Antoine.Martin@UVS-Consulting.com

CRUSER Warfare Innovation Workshop

By Lyla Englehorn

The Navy Warfare Development Command (NWDC) and CRUSER recently co-sponsored a Warfare Innovation Workshop (WIW) from 19 – 22 September 2011 at NPS. This workshop was in direct support to the Secretary of the Navy (SECNAV) directive that CRUSER support the development of a concept for unmanned systems to be applied in a naval operation. The analyzed results of the CRUSER WIW 2011 will serve as a basis for future CRUSER research, symposia, and experimentation. This WIW leveraged the innovation lessons learned in previous workshops and was designed specifically to support concept development for unmanned systems. Participants were asked to generate revolutionary concepts using rapidly evolving unmanned naval systems technologies.

The specific directive given to participants was: Within the framework of a near peer scenario, generate ideas and concepts for employing unmanned systems in dangerous and dirty environments to accomplish specific missions. Additionally, the WIW design team stressed that proposed solutions should emphasize current or programmed systems where incremental or evolutionary technical changes could have revolutionary operational effects.

Targeted participants included NPS students and faculty currently participating in some aspect of unmanned naval systems education (class work or thesis research), but recruitment was open to all students, services and nationalities as participant diversity has proved to be a force multiplier in supporting innovation in past WIW efforts. Additionally, young SYSCOM engineers and selected engineers from industry were also invited to participate.

This final report details the concepts generated by all four teams. From these innovative concepts, the CRUSER leadership team chose several concepts and will invite industry and navy labs to investigate the technical requirements to take these concepts off the page. Once these select concepts are explored in a three day CRUSER UxS Technical Symposium in Spring 2012, they will move to the final

Thesis Topics from DoD Organizations
Does your DoD Organization have potential graduate thesis topics related to unmanned systems they would like NPS students to research? <https://wiki.nps.edu/display/CRUSER/Potential+Thesis+Topics>

experimentation phase of development with the results briefed at the federal level sometime in Spring 2013.

Please contact Lyla Englehorn at laengleh@nps.edu if you would like to receive a copy of the CRUSER WIW Final Report.

Roboethics: Rhetoric vs Reality A Symposium for the Warfighter

by Mark Dankel

On Wednesday and Thursday, **25-26 January 2012**, ONR, N2/N6 and CRUSER will sponsor a 2-day symposium comprised of four, separate, 2-hour panels focused on cultural, legal and ethical issues affecting policy governing design and utilization of robotic defense technologies. The goal is to differentiate between rhetoric and reality with regard to risks, opportunities and obligations involving unmanned, remotely operated, and autonomous robotic systems, platforms and weapons. Each panel is designed as a stand-alone so Pentagon uniformed and civilian personnel may attend those most appropriate for their professional interest(s). The format for all panels is the same: 3 panelists will each have twenty minutes to present their perspective(s) on the panel focus area. Following the formal presentations a moderated discussion between panelists and symposium attendees will continue for 60 minutes.

- Panel One – Robot Rhetoric: Revolution or Evolution?**
- Panel Two – Rules of War: The Law of Armed Conflict**
- Panel Three – Reciprocity: Worth Killing For vs. Worth Dying For**
- Panel Four – Praise and Blame: Moral Agency and the Ambiguity of Accountability in Robotics**



Pictures by MC1 Rubio



STUDENT RESEARCH: IN-PROGRESS

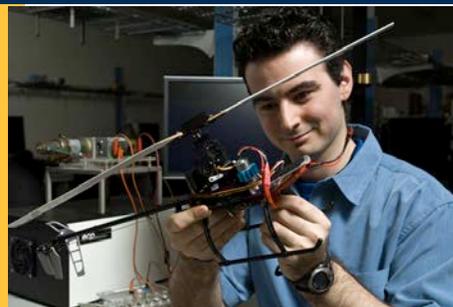
**CARL THIBAUT, PHD CANDIDATE
COBRA (COLLABORATION BASED ROBOTICS AND AUTOMATION)
UNIVERSITY OF NEW BRUNSWICK.**

COBRA has expanded into a group of six graduate students who are making huge advances in the area of unmanned vehicle research. Carl has been researching unmanned air vehicles as part of his work with COBRA. So far, most vehicles are remotely controlled, but Carl hopes that his work will one day lead to these vehicles being completely autonomous.

“Right now, we hear a lot about robots and drones that are being used in Afghanistan and different places around the world. However, they’re all essentially remotely piloted, so someone is sitting behind a computer screen, flying it like a video game.”

“Our work is trying to take that to the next level in the sense that, rather than having to fly the vehicle, the people can just focus on controlling the camera, as the aircraft will be able to do more and more by itself.”

Full Article at <https://wiki.nps.edu/display/CRUSER/CRUSER+News+Articles>



To learn more about
COBRA and this group of
student researchers

<http://www.ece.unb.ca/COBRA/>

Intelligence, Surveillance and Reconnaissance Technology Consortium (ISRTC)

by Russ Keller

The Space and Naval Warfare Systems Center Pacific (SSC-P) has announced its intention to sponsor an enterprise between it and a consortium of private industry, academia and non-profit organizations having skills/capabilities anywhere within the autonomous/unmanned systems domain (space, air, land, sea, undersea) across a wide swath of technology disciplines (platforms, power and energy systems, sensors, processing/exploitation/dissemination systems, ground control stations, etc.). SSC-P is framing the opportunity as a multi-year, multi-million dollar effort that would be executed across a wide array of technology development/prototyping projects.

The Intelligence, Surveillance and Reconnaissance Technology Consortium (ISRTC), formed at the request of the Office of the Secretary of Defense’s ISR Task Force, intends to submit a Letter of Intent to provide the consortium partner for SSC-P. The ISRTC is reaching out to various businesses and academic research institutions to ask them to consider joining their consortium to pursue this opportunity. This opportunity is open to all CRUSER member organizations.

The ISRTC is an unincorporated, member-driven, member-governed consortium, organized under flexible and adaptable Articles of Collaboration that permits it to align its technology committee structure and tailor its concept of operations as necessary to maximize the value proposition both for the government and for individual members. The business affairs for the ISRTC are managed by ATI, the leader in creating customized OT consortia that connect purpose-built industry-academia teams with specific government customer requirements.

If you are interested in learning more, an information paper that provides additional details regarding the ISRTC is available at the ISRTC’s web site (<http://isr.ati.org>), or you can contact Russ Keller at ATI (russ.keller@ati.org).

An informational paper & application are available at <https://wiki.nps.edu/display/CRUSER/CRUSER+News+Articles>

CRUSER News Blog

Subscribe to the RSS Feed to keep up to date with CRUSER related news articles on the CRUSER Blog at <https://wiki.nps.edu/display/CRUSER/Welcome+to+CRUSER>

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<https://wiki.nps.edu/display/CRUSER/>

Submit your events:

http://www.nps.edu/Research/cruser/cruser_EventSub_Form.html

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COORDINATION GROUP**

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