



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: FY14 and Beyond

by Dr Ray Buettner, NPS Associate Professor, CRUSER Director, buettner@nps.edu

Like many of you I have been watching the videos and looking at the photos of the X-47B landing on USS GEORGE H.W. BUSH – awesome! Seeing these autonomous drones doing what only our top pilots can do really forces one to re-think what warfare will be like in the future. The burning question in my mind, as a former wearer of gold wings, was...



(US Navy Photo) X-47B landing on USS HW Bush

Who gets to wear the cool leather jacket?

Luckily the SECNAV created CRUSER to ask more serious questions and to help the naval enterprise to stay on the cutting edge of this rapidly evolving domain.

This month began with a visit from Commander Stephen Martin, USN. The Commander is our ONR Program Manager and he enjoyed seeing some of the great things that have been going on under, or supported by, the CRUSER umbrella. His visit really kicked off the FY-14 planning cycle and I am happy to report that we should be ramping up to our fully funded level.

This means that CRUSER can expand both the number and sophistication of our educational efforts. We are looking at creating a series of top quality short pieces that can inform Flag and Line officers, as well as the rest of us, about the hard challenges that face the robotics and unmanned systems community. These “CRUSER Talks” will create dialogue around these challenges and serve as inspiration for exploring what the elements of PME (professional military education) should be in regards to this domain. As always we will explore the entire range of issues from ethical to legal with economics and organizational issues in the mix alongside the scientific, technical and engineering challenges.

We are considering sponsoring a peer reviewed academic journal to allow more formal exploration and discussion of appropriate topics, especially those that are interdisciplinary and/or more specifically focused on national security implications. This will allow our colleagues in the larger community to publish, not perish, while exploring issues of importance to defense community.

I will be asking for feedback and input at our next few CRUSER meetings so please join in and help us to shape the future!

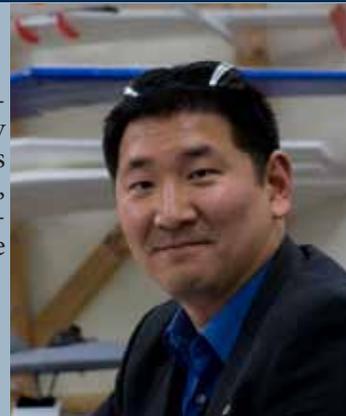
Additional Photos/Videos at: <http://www.navy.mil/>

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

DIRECTOR'S CORNER

Summer months not only bring a time for extending research efforts, conducting field experiments, and planning the next year's academic activities, but they also bring an opportunity to step back to observe the breadth and depth that is robotics and unmanned systems. As demonstrated in this issue, whether the research or education efforts are local or international, civilian- or defense-oriented, technological or tactical, the opportunities for expanding boundaries while finding synergies are plentiful. Our CRUSER members are encouraged to continue cross-pollinating, and we welcome opportunities to help facilitate such conversations!

Dr Timothy H. Chung
CRUSER Director, Education and Research



UAV Research at National University of Singapore

by Prof Ben M. Chen, Department of Electrical & Computer Engineering, National University of Singapore, bmchen@nus.edu.sg



The NUS UAV Research Team - Team GremLion of the DARPA UAVForge Challenge

The UAV Research Group at the National University of Singapore (NUS) has been working on various research projects related to defense technologies since 2003. The main focus is on unmanned rotorcraft systems and unconventional aircraft, and to explore the potentials of the next generation intelligent UAVs in various applications.

The team has successfully constructed a family of unmanned helicopters with payloads ranging from few grams to over ten kilograms, and identified the fairly comprehensive aerodynamics of these miniature rotorcraft systems. A highly efficient onboard and ground station software system has also been developed for carrying out fully autonomous flight tests and coordination of the unmanned systems. NUS UAV Team GremLion was selected as one of the top 12 teams (out of 134 entries worldwide) to the final fly-off at the DARPA UAVForge Challenge, held in May 2012, in Fort Stewart, Georgia, USA.

The team is currently working on projects related to navigation systems for indoor and foliage environments, vision-based navigation and motion coordination, micro aerial vehicles and unconventional aircraft. For more information on the research activities of the UAV Group at National University of Singapore, please visit the team website at: <http://uav.ece.nus.edu.sg/>



GremLion the UAV 40 gram micro aerial vehicle - K-Lion



HeLion and SheLion in formation



An unconventional aerial vehicle - U-Lion

IS THE UNMANNED GRASS TRULY GREENER ON THE CIVIL SIDE?

by Keven Gambold, Chief Operations Officer Unmanned Experts
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It has been an 'interesting' couple of years for Unmanned Experts (UMEX), a small team of ex-military UAS/RPAS operators who had spread their wings into the civilian sector. Initially a US-based company, personnel were hand-picked from retiring USAF, US Army, British Army and Royal Air Force to offer consultancy, training and managed services based on their substantial operational UAS expertise. The time seemed right to move into 'civi street': the rumors swirling around the uniformed crewrooms were ones of endless contracts, too few companies and a yearning need. This article is designed to give a 'peek behind the curtain' into the current civil UAS/RPAS scene.

From a CONUS-perspective, the culture shock was considerable: the far-reaching International Trade in Arms Regulations (ITAR) effectively prevents US-based firms from even discussing most UAS-based topics with non US-persons, especially when outside of the country. An enduring lack-of commitment by the Federal Aviation Authority (FAA), despite Congressional mandate to the contrary, has brought all commercial UAS operations in US airspace to a halt. If you read about a real-estate firm using unmanned aircraft to photograph properties, then that is likely illegal, and the FAA has prosecuted a number of such enterprises. This FAA reticence has been exacerbated by a set of knee-jerk State-sponsored Privacy legislations (40 out of 50 States have attempted to enact some form of restrictive regulations) which severely ham-strings Law Enforcement use of the platforms, and a number of UAVs currently sit on the shelves at Sheriff's offices across the Nation. The still substantial DoD market is justifiably competitive especially with Big Government suffering its own 'credit crunch'. Not much to rejoice about here.

So 'change or die' became the watchword, and UMEX started new companies in both England and Australia, where the respective CAA and CASA aerospace agencies have positively embraced UAS integration efforts (the UK currently has nearly 300 registered civilian commercial operators). Outside of the Missile Technology Control Regime (MTCR limits data exchange on larger platforms i.e. 500kgs over 300km) there are few restrictions on providing international UAS services. Note that European or International airspace integration is woefully behind also, but some countries have 'gone it alone' to considerable success.

Unmanned Experts UK Ltd, drawing on over 25,000 hours of cutting-edge UAS operations and instruction, produced a comprehensive set of ground school courses ranging from one-day Career Workshops to 4-week UAS Maintenance Courses. Accreditation is an oft used, but little understood, concept but UMEX Courses are approved by George Mason University for CEUs, we are tied to Southampton University and have recently agreed a roadmap for accreditation from Lincoln University, both in the UK. Since then, UMEX has run courses in the UK, US (for ASPRS amongst others) and Singapore with more planned for Turkey, the Middle East, India and Africa.

There is a growing demand for Consultancy and Managed Services in far-flung places as the utility of inexpensive SUAS comes to bear on a number of industries: open-cast mine mapping in Australia, anti-poacher patrols in Namibia, oil platform security in Iraq and search (& rescue) operations in Canada to name a few. An undercurrent of 'good' stories is emerging across the globe to show the true potential that UAS could bring to everyday lives. UMEX is fielding requests from an ever diversifying client base, and the future looks much brighter.

Bottom Line: the civil market is coming to life and the grass is sprouting, but in the US there's more watering required.

Upcoming CRUSER Monthly Meetings

Wed 17 July 2013, 1200-1250 (PDT)

Root 272, VTC, or dial-in 831-656-6685

Wed 21 Aug 2013, 1200-1250 (PDT)

Root 242, VTC, or dial-in 831-656-6681

contact us at cruser@nps.edu for the passcode

Short articles of 300-500 words for CRUSER News are always welcome - cruser@nps.edu

- Unmanned Systems/Robotics research
- New Program/Systems/Projects
- Other aspect of Unmanned Systems/Robotics

STUDENT CORNER**STUDENT:** LT Timothy S Stevens, USN**TITLE:** Analysis of Nondeterministic Search Patterns for Minimization of UAV Counter-Targeting**CURRICULUM:** Operations Research**FULL THESIS:** <http://calhoun.nps.edu/public/handle/10945/32905>

ABSTRACT: In an attempt to mitigate the expanding counter-UAV capabilities of adversary countries developed in response to the United States' increased reliance on these platforms, we apply a nondeterministic search pattern to a finite area searcher. By implementing a Levy distribution on search leg lengths we analyze the trade-offs between efficiency and evasiveness of the searcher, comparing the expected time to target detection for a given set of Levy parameters to a probabilistic time to counter-targeting based on intelligence driven enemy capability. The culmination of this thesis is the development of a robust simulation tool, capable of modeling various parameters on both searcher and search area, the output of which is a quantifiable estimate on the probability of mission success.

**Does your DoD Organization have a potential thesis topic for NPS Students?
Contact us at CRUSER@nps.edu**

CRUSER Librarian's Corner**Unmanned Aircraft and the Human Element: Public Perceptions and First Responder Concerns:**

Project Team: Joe Eyerman, Clark Letterman, Wayne Pitts, John Holloway, Ken Hinkle, Katrina Ladd, Susan Mitchell, S. Cornelia Kaydos-Daniels (RTI International); David Schanzer (Duke University)

Unmanned Aircraft Systems (UAS) are a relatively mature technology currently used for military and homeland security purposes that are quickly being developed for transition to public safety, first responder, and commercial applications in the United States. Although currently closely regulated by the Federal Aviation Administration (FAA), UAS are expected to be cleared for wider use in the continental United States (CONUS) following the congressional mandate that FAA establish guidelines for use within U.S. national airspace by 2015.

RTI International began a research program in 2012 dedicated to understanding the social, behavioral, and policy factors associated with UAS technology. This research brief includes the preliminary findings of the first two pilot surveys of a non-representative group of police chiefs in Ohio, USA, and the general population of the United States.*

For survey results and a report on developing trends in the general population and law enforcement community, please review the report, available in full at <http://sites.duke.edu/ihss/files/2013/06/UAS-Research-Brief.pdf>

For additional research conducted by the Institute for Homeland Security Solutions, please visit the IHSS website. (<http://sites.duke.edu/ihss/>)

Media Inquiries should be directed to Joe Eyerman (RTI International): eyerman@rti.org

*Surveys conducted in March 2013.

The Institute for Homeland Security Solutions (IHSS) was established in 2008 to expand the resources available to the Department of Homeland Security and other agencies to conduct social science research in support of the national homeland security mission. IHSS conducts applied social science research that seeks to improve detection, analysis, and understanding of homeland security threats and enhance response and recovery. IHSS is administered by RTI International in cooperation with Duke University, the University of North Carolina at Chapel Hill, and the North Carolina Military Foundation. IHSS is federally funded and coordinates its research activities with the DHS Science and Technology Directorate, Resilient Systems Division.

The July 2013 issue of SeaPower : The Official Publication of the Navy League of the United States is a special report on Unmanned Systems: http://www.seapower-digital.com/seapower/july_2013#pg1

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