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Monterey, California: Naval Postgraduate School

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Issue 36 Feb 2014

From Technical to Ethical...From Concept Generation to Experimentation

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TRUFAST: Intelligent Replan Support for the Mine Countermeasures Domain

by Bob Marinier and John Sauter, Soar Technology, Inc. (SoarTech), bob.marinier@soartech.com

Current Mine Countermeasures (MCM) operations require a great deal of staff expertise and time. The Navy's MCM decision support system, Mine Warfare and Environmental Decision Aids Library (MEDAL), provides some support to address these issues but it lacks direct support for replanning. As a result current planning cycles require a full day with much of that time spent dealing with asset issues as reported in the Navy's casualty report system, CASREP. Current planning tools offer little help to inexperienced operators. They are mostly passive, leaving tasks of issue detection, option generation, and option evaluation entirely up to the operator. Ideally a decision aid would apply expert MCM knowledge in understanding the situation, equipment status, and other factors and generating appropriate recommendations. The tool needs to build trust with users by explaining how it arrived at those recommendations and the certainty of its conclusions so users can make decisions quickly, confidently, and effectively.

To address these issues SoarTech is developing TRUFAST (Transparent Reasoning under Uncertainty For Anti-mine Systems in real-Time), a replan support system for helping mine countermeasures (MCM) staff quickly generate high-quality responses to asset readiness issues. It generates and evaluates options for responding to issues as they arise.

- Detects MCM-relevant issues
- Generates options for responding to issues
- Evaluates options using expert-heuristics encoded in human behavior models
- Explains issues, options, evaluations, and uncertainty, supporting appropriate trust
- Provides user with ultimate control via mixed-initiative interaction
- Automatically adapts feedback and interaction based on the user's level of expertise in MCM operations
- Supports authorability: Experts can build the knowledge used in the system

TRUFAST's approach to dealing with problems is inspired by how experts deal with problems. Thus, the options and heuristics it uses are familiar to users. Operators learn to trust TRUFAST because the system can explain the reasons for its recommendations and its confidence levels in terms that users understand.

The operator will always know things the system does not, and different users will have different preferences about how they like to

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Director's Corner

Ms Lyla Englehorn, CRUSER Director of Concept Generation

National Robotics Week is just around the corner, and CRUSER is jumping right in! The CRUSER Technical Continuum (TechCon) is scheduled midweek, Tuesday and Wednesday 8-9 April 2014. We are bringing the event "into the light," so look for the giant white event tent on the lawn out on The Quad. Drop in whenever you are able to catch some presentations that promise to cover quite a breadth of topics. CRUSER's 4th Annual "Robots in the Roses" Research Fair is scheduled for Thursday afternoon, 10 April 2014. This event will again be held on The Quad and Spruance Plaza and promises to have something of interest for everyone. Finally, CRUSER's next event in our Robo-Ethics continuing education series is scheduled for Monday 24 March 2014. The panel will be live in San Diego at TACTRAGRUPAC, but will be available at multiple sites via VTC – including NPS! The NPS remote audience will be upstairs in Reed Hall (Bldg 301 next to the library).

For future planning, our next Warfare Innovation Workshop will be held during NPS Enrichment Week in September 2014. Stand by for details!

For more information on all of these upcoming events, contact Lyla Englehorn (laengleh@nps.edu) or 831-656-2615.

CRUSER Librarian's Corner

20YY: Preparing for War in the Robotic Age
https://www.hsdl.org/?view&did=748605

"Over the past several decades, the United States has been an aggressive first mover in a war-fighting regime centered on guided munitions and integrated battle networks. These innovations have allowed U.S. forces to operate relatively uncontested in space, in the air, and on and under the sea, and to dominate conventional force-on-force land combat. For a variety of reasons -- the geopolitics of rising powers, the global diffusion of technology and counter-reactions by its adversaries chief among them -- the preeminence enjoyed by the United States in this regime is starting to erode. As a result, U.S. defense strategists and force planners are confronted by a rapidly approaching future in which guided munitions and battle networking technologies have proliferated widely and are employed by both state and non-state actors across the full range of military operations. While senior force planners and policymakers at the Pentagon, White House and Capitol Hill increasingly recognize the potential challenges and costs of operating against adversaries with such sophisticated weapons, much remains to be done to prepare the U.S. military for fighting against adversaries capable of firing dense, accurate salvos of guided munitions." by Robert O. Work and Shawn Brimley

"Future of Unmanned Aviation in the U.S. Economy: Safety and Privacy Considerations."
HSDL compilation of the parts: https://www.hsdl.org/?view&did=748453 (full version not yet available)

Interim Report on the Department of Justice's Use and Support of Unmanned Aircraft Systems
http://www.justice.gov/oig/reports/2013/a1337.pdf

China's Military Unmanned Aerial Vehicle Industry
http://origin.www.uscc.gov/sites/default/files/Research/China's%20Military%20UAV%20Industry_14%20June%202013.pdf

Unmanned Air Systems: The Future of Air & Sea Power?
http://www.ifri.org/downloads/fs49rogers.pdf

Homeland Security Digital Library - Unmanned Systems Topic: Documents are added continually
https://www.hsdl.org/?collection/cluster&id=2556

Short articles of 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

CRUSER Monthly Meetings

Mon 24 Feb, 1200-1250 (PST)
Mon 17 Mar, 1200-1250 (PST)
Root 272, VTC, or dial-in 831-656-6685
contact us at cruser@nps.edu for the passcode

Upcoming CRUSER Sponsored Events

http://CRUSER.nps.edu for additional information on these events and the opportunity to participate remotely

Robo-Ethics: A Naval Commander's Perspective

San Diego 2014 (TACTRAGRUPAC): 24 March 2014

A panel discussion by leading thinkers with diverse perspectives, Robo-Ethics 2014 will be held on Monday 24 March 2014 in San Diego CA. Panelists to include an operator, a policy-maker, a lawyer, a roboticist, and a philosopher will be asked for their guidance on ethical dilemmas embedded in a South China Sea scenario in the year 2024 involving regional unrest and a diverse set of stakeholders. In this scenario, unmanned and manned systems will be deployed and engaged in response to escalating political tensions, and fictional warfighters will be faced with sometimes ambiguous command and control decisions at each phase of operations. The panelists will each be given an opportunity to respond to the scenario, then a moderator will facilitate a discussion of these responses. DoD stakeholders throughout the San Diego region will be invited to attend the event, and we plan to make the session available remotely to an audience on the NPS campus in Monterey as well as a remote audience in Washington DC. The moderator will take audience questions to incorporate into the discussion, as well as Tweets and other input from social media channels.

POC: Lyla Englehorn, Research Associate, laengleh@nps.edu
CRUSER Director of Concept Generation

CRUSER TechCon 2014: 8-9 April 2014

This annual event gives NPS Faculty an opportunity to explore selected concepts developed during the September Warfare Innovation Workshop 2013 in support of our 3rd Innovation Thread - "Distributing Future Naval Air and Surface Forces" and the March 2013 Warfare Innovation Workshop "Advancing Undersea Warfare." Presentations will allow faculty to showcase how a concept can be taken to experimentation.

Abstracts are due 15 Mar 14 to Lisa, cruser@nps.edu
Details: http://www.nps.edu/Academics/Centers/CRUSER/events/IndividualEvents/TechCon_2014_04.html

4th Annual Robots in the Roses: 10 April 2014

CRUSER's annual event at NPS that features NPS Faculty and DoD Labs showcasing their researching which gives them an opportunity to recruit NPS Students to complete graduate-level thesis research in support of their projects. Robots in the Roses also features a STEM activity for K-12 students making it a great opportunity for children to attend a learn more about the unmanned systems and robotics.

POC: Lyla Englehorn, Research Associate, laengleh@nps.edu
CRUSER Director of Concept Generation

STUDENT CORNER

Student: Zhifeng Lim

Title: The Rise of Robots and the Implications for Military Organizations

Curriculum: Systems Engineering

Link to Completed Thesis: http://calhoun.nps.edu/public/handle/10945/37662

Abstract:

This thesis explores the reasons for the inevitability of the extensive use of robots in military organizations, projects the adoption timeframe for robots in military organizations, proposes how robots might evolve, assesses the impact of robots on military organizations and suggests the way forward for military organizations to facilitate the adoption of robots. Macro environmental trends suggest that the use of robots is the way forward for military organizations. The thesis projects that the adoption rate of robots will pick up from this point forward and will reach market saturation in a matter of decades. The use of robots has physical, functional, and behavioral implications for military organizations, and their increasing numbers will affect how militaries are organized and alter the existing organizational processes in the long term. Military organizations will benefit from a better understanding of the impact of robots and the resulting challenges. Taking the necessary steps to mitigate the challenges and facilitate the evolutionary transition for the military organizations will allow these organizations to reap the benefits of robots and to operate effectively in the changing macro environment.

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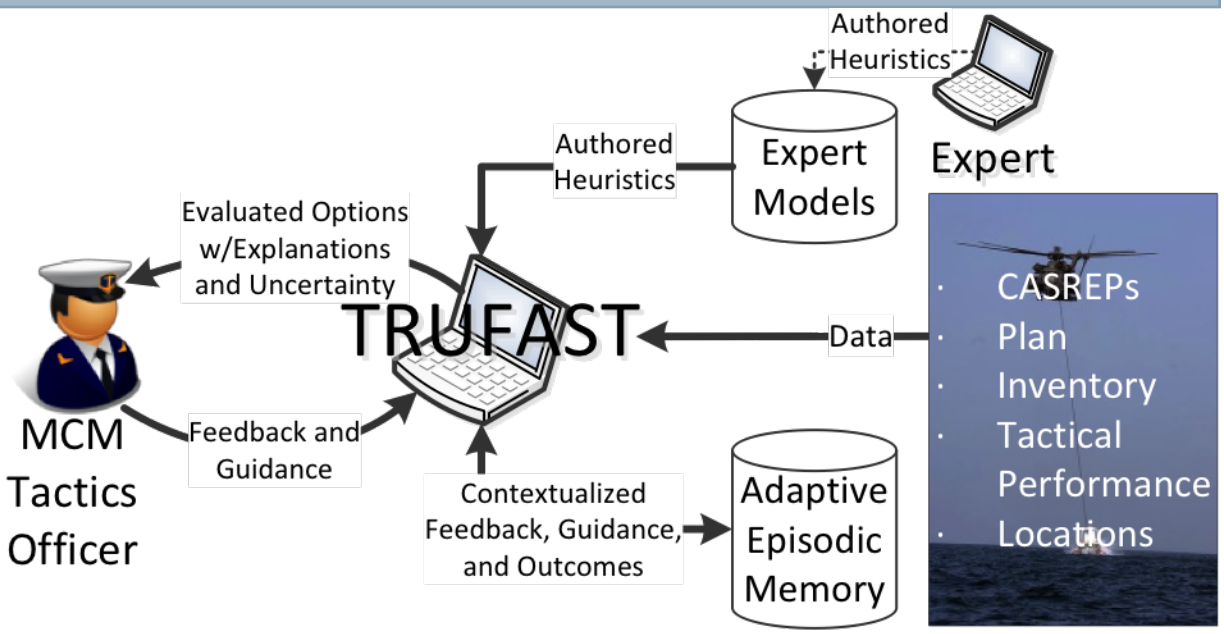

solve problems. TRUFAST addresses these issues by providing the user with control over the option generation and evaluation process via mixed-initiative interaction: the user is able to guide the system to interesting parts of the space, and override TRUFAST's evaluations. TRUFAST remembers user-provided feedback and guidance, along with the relevant context. When working through a new situation, TRUFAST retrieves feedback and guidance from similar past situations, relieving the operator from having to repeatedly fix the same issue time and time again.

TRUFAST is implemented as a new set of SOA services integrating seamlessly with the user's current workflow. It integrates with MEDAL and CASREP gaining access to the most current information, without introducing new data entry burdens on the user. TRUFAST is built on the proven Soar cognitive architecture which has been successfully deployed in a number of training and decision support aids. SoarTech is currently working with different potential transition targets for this system.

CRUSER's New Website is now Live

We're still at **http://CRUSER.nps.edu**, but check our new site for information on our monthly meetings, CRUSER sponsored events, CRUSER community-wide calendar items, Completed Research, other Resources, and much more.