Agenda Item No.

**AGENDA ITEM BRIEFING**

**Submitted by:** G. Kemble Bennett, Vice Chancellor and Dean of Engineering

 Director, Texas Engineering Experiment Station

**Subject:** Establishment of the Center for Robot-Assisted Search and Rescue (CRASAR)

**Proposed Board Action:**

Approves the establishment of the Center for Robot-Assisted Search and Rescue (CRASAR) within the Texas Engineering Experiment Station.

**Background Information:**

Robot-assisted search and rescue is an emerging sub-area in emergency response and in robotics. The need for rescue robotics or related technologies is cited in no less than 14 studies by the President’s National Science and Technology Council, National Academies, and the Defense Science Board. While the State of Texas, through the Texas Engineering Extension Service (TEEX), is a world leader in technology for emergency response, a strong academic research presence is missing in rescue robotics in Texas and in general. To further The Texas A&M University System’s competitive advantage in disaster response, to better leverage the academic faculty’s fundamental research in robotics, and to spur new industry, we propose that the Texas Engineering Experiment Station (TEES) host the Center for Robot-Assisted Search and Rescue (CRASAR), previously resident at the University of South Florida. With the hiring of Dr. Robin Murphy in the summer of 2008, the University of South Florida has transferred the CRASAR trademark to TEES. CRASAR will permit TEES researchers and partners to assist with actual responses, thereby applying the benefits of their research and expertise to the benefit of Texas, the nation, and the world while informing new, productive lines of research.

The concept paper for the Center for Robot-Assisted Search and Rescue was favorably received at the May 22, 2009 Board of Regents meeting. Following System guidelines, step two of the process requires developing a full-scale proposal for the new center, discussing key concerns. The attached proposal addresses the rationale for the center’s creation, its activities, its impact on the education and training of students, the sources and future expectations of financial support, its governance and advisory structure, and the mechanisms for periodic review.

**A&M System Funding or Other Financial Implications:**

No funding is expected to be requested from any TAMUS member. The Center for Robot-Assisted Search and Rescue will be funded through external grants, industry donations, or by agencies requesting expertise. The minimal administrative support needed will be provided by TEES through the Texas Center for Applied Technology (TCAT).

Agenda Item No.

**TEXAS ENGINEERING EXPERIMENT STATION**

Office of the Director

June 5, 2009

Members, Board of Regents

The Texas A&M University System

Subject: Establishment of the Center for Robot-Assisted Search and Rescue (CRASAR)

We recommend adoption of the following minute order:

 **“The Center for Robot-Assisted Search and Rescue, a TEES Center, is hereby established, reporting to the Vice Chancellor and Dean of Engineering and Director of TEES.”**

Respectfully submitted,

 G. Kemble Bennett

 Vice Chancellor and Dean of Engineering

 Director, Texas Engineering Experiment Station

**Approval Recommended: Approved for Legal Sufficiency:**

Michael D. McKinney Andrew L. Strong

Chancellor General Counsel

Frank B. Ashley III

Vice Chancellor for Academic Affairs

# ATTACHMENT TO ITEM

**Proposal**

**Center for Robot-Assisted Search and Rescue**

Texas Engineering Experiment Station

# 1. Rationale for establishing the Center for Robot-Assisted Search and Rescue (CRASAR)

## Introduction

Robot-assisted search and rescue is an emerging sub-area in emergency response and in robotics. The need for rescue robotics or related technologies is cited in no less than 14 studies by the President’s National Science and Technology Council, National Academies, and the Defense Science Board. While the State of Texas, through Texas A&M’s Texas Engineering Extension Service (TEEX), is a world leader in technology for emergency response, a strong academic research presence is missing in rescue robotics in Texas and in general. To further The Texas A&M University System’s competitive advantage in disaster response, to better leverage the academic faculty’s fundamental research in robotics, and to spur new industry, we propose that the Texas Engineering Experiment Station (TEES) host the *Center for Robot-Assisted Search and Rescue (CRASAR)*, previously resident at the University of South Florida. With the hiring of Dr. Robin Murphy in the summer of 2008, the University of South Florida has transferred the CRASAR trademark to TEES. CRASAR will permit TEES researchers and partners to assist with actual responses, thereby applying the benefits of their research and expertise to the benefit of Texas, the nation, and the world while informing new, productive lines of research.

CRASAR is the robotics equivalent of the teams of civil engineers who comb earthquake sites and meteorologists who chase tornadoes. The data collected from actual events is extremely valuable; however, few groups have the expertise to examine earthquakes or measure tornadoes. Likewise, with rescue robotics field data is critical. Beginning with the 9-11 World Trade Center disaster, CRASAR has participated in 11 incidents in the U.S. and Germany, and over 30 exercises in the U.S., Japan, South Africa, and the UK. CRASAR was the first with ground rescue robots (World Trade Center), small aerial vehicles (Hurricane Katrina), and marine vehicles (Hurricane Wilma). To date, 60 high quality scientific publications and book chapters have been produced. CRASAR is the only group in the world that maintains a cache of rescue robots with trained academic experts from across the country and Japan on stand-by to assist with a disaster.

Texas A&M Engineering has already been requested to participate in disasters due to the existing CRASAR reputation and brand. Unfortunately, the resulting media coverage and publications cannot brand with CRASAR without the center designation by the System. With its work at the University of South Florida, CRASAR has established name recognition world-wide. The combination of the A&M System and CRASAR will amplify research credibility of an already recognized and respected response organization. With the research expertise within TEES and the response mission within TEEX, the ability to use the CRASAR brand will increase opportunities for the A&M System to be requested to participate in similar situations.

CRASAR will build intellectual capacity through multi-disciplinary connections. While CRASAR is focused on the Department of Computer Science and Engineering, TEES’ Texas Center for Applied Technology (TCAT), and TEEX, it is expected to leverage the critical mass in both “end use research” of rescue robots (captured by faculty specializing in geotechnical, structural, coastal, and nuclear disasters) with “robot-centric research” across multiple engineering departments. These connections will create new research directions, attract external funding, benefit society, and foster general excellence.

## Mission, Goals, Objectives, and Milestones

CRASAR’s mission is to improve disaster preparedness, prevention, response, and recovery through the development and adoption of robots and related technologies. Its goal is to create a “community of practice” for rescue robots that motivates fundamental research, supports technology transfer, and educates students, response professionals, and the public.

The primary objectives are:

* Deploy field research teams to local and international disasters to insert and/or observe the use of robots, produce detailed technical after action reports, and create a corpus of data.
* Promote and guide research on search and rescue to produce innovations in robot design, human robot interaction, and enabling technology and to validate that new designs are effective and operationally relevant for the entire range of crisis response challenges.
* Serve as a focal point for the transfer of technology to the response community, including the certification and training of human-robot systems.
* Educate (a) students on search and rescue topics through multi-disciplinary, hands-on pedagogy, (b) response professionals about the utility and safe operation of robotic systems, and (c) the general public about the contributions of rescue robotics to science and society.

Milestones in each of the three initial program areas described in Sec. 2 will be established in collaboration with the Advisory Board described in Sec. 4. As other sponsors engage the Center, they will also contribute to the development of milestones for the programs in which they participate.

## Faculty Experience and Expertise

The unique expertise and experience of engineering faculty and the relationship with TEEX are critical to the proposed center. Texas A&M already has a large critical mass of over 50 faculty working in areas related to emergency response, as shown by the recent preliminary submission for an NSF Science and Technology Integrative Center, with 20 of those in the Department of Computer Science and Engineering. Centers already active in areas that would benefit from interactions with CRASAR includes: the Hazards Reduction and Recovery Center (Architecture), Institute for Science, Technology and Public Policy (Bush School), and the Integrative Center for Homeland Security (Bush School). In addition to these groups in the Colleges of Architecture, Bush School, Engineering, and Science already working together, Emergency Informatics intersects with Agriculture, Business, Geosciences, and Veterinary Medicine and Biomedical Sciences.

The key faculty member is Dr. Robin Murphy, proposed Director, who is the Raytheon Professor of Computer Science and Engineering. Dr. Murphy is the foremost expert in rescue robotics, having participated in the majority of incidents where land, air, or sea robots were used, and is the only academician to be awarded the Association for Unmanned Vehicle Systems International Foundation’s Al Aube Outstanding Contributor Award. She serves on numerous defense and scientific boards, including the Defense Science Board.

Dr. Murphy will serve to attract and engage faculty and research programs as needed. For example, for a bridge collapse, the coastal engineering expertise at A&M would be tapped. For rapid survey of a large geographical area, aerospace engineering expertise would be involved.

# 2. Initial Activities and Impact on Education and Training of Students

CRASAR potential activities will be an expansion of previous efforts spanning *deployment, research and technology transfer*, and *education*. Although limited to rescue robotics, these activities will contribute to the larger, overarching research theme of emergency informatics. CRASAR could serve as a model for other emergency response technology research areas.

**Deployment activities**

CRASAR will *deploy field research teams to local and international disasters to insert and/or observe the use of robots, produce detailed technical after action reports, and create a corpus of data*. As noted earlier, CRASAR has assisted with eleven incidents by inserting state of the art robots. From a research perspective, this not only confirms research outcomes, it also offers the opportunity to identify new research topics by collecting multi-disciplinary data spanning hardware, software, and cognitive engineering from these responses for the scientific community. For example, CRASAR members have documented performance issues that had not been encountered by military uses of robots and created new protocols specifically for responders. CRASAR will be *available to federal and international agencies*, extending Texas A&M’s expertise, influence, attractiveness to industry, and competitive advantage.

**Research and technology transfer activities**

CRASAR will facilitate *attracting external funding*. The establishment of CRASAR at TEES gives the faculty a competitive advantage, as it is proof to sponsors of research with a clear transfer to the “real world” and the potential to make a visible difference during a crisis. CRASAR has obtained over $1M in funding to date from NSF for equipment, workshops, and studies and has been part of research grants totaling over $6M from NSF, ONR, DARPA, and the Mine Safety and Health Administration. CRASAR will increase competitiveness on large center grants ($20M) from DHS and NSF involving emergency informatics. CRASAR will use its unique expertise to *advise and assist agencies in developing roadmaps for the development and integration of robots*. For example, CRASAR participated in a 2007 workshop that identified FAA restrictions that were hobbling research in unmanned aerial vehicles for disaster response. That workshop led to a 2008 workshop and the formation of an advisory group to the FAA (which Dr. Murphy co-chairs). CRASAR will produce *an annual rescue robotics technology review*. The review is not intended to substitute for the scientific articles that will be produced by members from deployments and field exercises, but rather will synthesize and abstract those findings. This is expected to be of immense benefit to industry and can be leveraged by the Texas Center for Applied Technology (TCAT). CRASAR will engage and facilitate Texas A&M faculty and student involvement in multi-disciplinary field research through *quarterly field exercises* and *annual seminars*. Through funding from the National Science Foundation, CRASAR has held numerous field exercises, exposing over 100 faculty and 50 graduate students to field research and the rescue robotics domain (and resulting in one Ph.D. thesis on conducting exercises). CRASAR also founded and assists with the annual IEEE Workshop on Safety Security Rescue Robotics.

**Educational activities**

CRASAR will work with TEES and TEEX to *create professional courses and certificate programs in rescue robotics*. Such courses would supplement training programs at TEEX, but also can serve as graduate minors or specialized programs for engineers, city managers, and others at the master’s level. The courses can also attract industry. CRASAR comes to TEES with an established 2-hour awareness class and 10-hour introductory course for rescue robotics (1.5 Continuing Education Units), through funding from the Florida High Tech Corridor. Over 400 responders have taken a CRASAR course. CRASAR will also continue to *create K-12 outreach programs and teacher training events*, taking advantage of the public’s interest in science with a clear societal impact. CRASAR has been included in several children’s books and two museum exhibits as well as been featured in numerous cable science programs.

# 3. Sources and Future Expectations of Financial Support

CRASAR is cost-effective, as it would neither request nor require any additional financial support. As described above, CRASAR has historically been funded through external grants, industry donations, or by agencies requesting expertise. The minimal administrative support needed will be provided by TEES through TCAT.

# 4. Governance and Advisory Structure

CRASAR will be led by a *Director* who will be appointed by, and report to, the *Vice Chancellor and Dean of Engineering and Director of the Texas Engineering Experiment Station.*

CRASAR’s Director will be Dr. Robin Murphy, Raytheon Professor of Computer Science and Engineering. As described above, Dr. Murphy is the foremost expert in rescue robotics. The Director is responsible for the activities of the center and will coordinate deployment decisions.

The Advisory Board will consist of a representative from the Texas Engineering Experiment Station, the US&R Division of the Texas Engineering Extension Service, and the Texas Center for Applied Technology, currently Bob McKee and Cindy Wall respectively. The Advisory Board will oversee activities, bring existing CRASAR operational procedures into compliance with TEES and TEEX, and identify funding and fielding opportunities. In particular, TEES will provide general oversight and assist with the engagement of and networking with faculty and students, TEEX will advise on field worthiness of CRASAR team and equipment and deployments, and TCAT will advise on involving industry and assist with the distribution of lessons learned.

# 5. Mechanisms for Periodic Review

The Director will meet monthly with the *Advisory Board* described above and will provide an annual written report, providing a mechanism for periodic review. Each sponsor of a CRASAR program will also conduct its own periodic reviews to ensure that CRASAR is delivering a valuable return on the sponsor’s investment.