ASTM E54.08.01 Task Group on Robotics – January 2008 Committee Week Report

The ASTM Homeland Security Applications Operational Equipment Task Group on Urban Search and Rescue Robot Performance Standards met on January 30th, 2008 in Tampa Florida as part of the ASTM Committee Week. The meeting was led by Elena Messina, Task Group Chair, and included presentations by several of the Working Group Chairs, as well as valuable discussions with attending members representing the responder community.

Working Group Reports

Elena briefed the group on the status of overall work in the Task Group (TG). Within the **Logistics Working Group**, E2592-07 Standard Practice for Evaluating Cache Packaged Weight and Volume of Robots for Urban Search and Rescue was approved. This work item was submitted by Elena on behalf of Bob McKee and Billy Parker (Texas Task Force 1), with input from several other members.

In the **Terminology Working Group**, there has been some ongoing discussion regarding the scope of the next set of standard terminology submitted for balloting by Hui-Min Huang. Negative votes during balloting indicate that some terms may be more generally applicable to E54, not just robot-specific. E54.92, the Terminology Subcommittee, has been inactive. Kathleen Higgins, Chair of E54, will work with Timothy Brooke, Staff Manager, to resolve how to proceed.

John Evans, Chair of the **Sensors Working Group**, gave an update on WK10336 (Standard Test Method for Evaluating Visual Acuity of Video Sensing for Robots for Urban Search and Rescue). The standard was approved during the most recent ballot. John has some minor edits to make prior to publication of this standard. He and the responders in attendance had some discussion about which sensors to tackle in the next iteration. Three-dimensional (e.g., LADAR) and acoustic sensors may be considered.

Galen Koepke, co-Chair of the **Communications Working Group**, discussed WK14437 (Evaluating the Performance of Radio (Wireless) Communication Links used for the Control and Telemetry Systems on Urban Search and Rescue Robots). He and Kate Remley (co-Chair), are close to completing the first draft the test method, covering both line-of-sight and beyond line-of-sight. One open item is whether to include in the initial test method a checklist item regarding whether the wireless communication protocol has some form of security. The draft will be circulated to Task Group members in the coming weeks for comment prior to balloting.

Adam Jacoff, co-Chair of the **Mobility Working Group**, presented status on WK15347 (Practice for Evaluating Ground Mobility of Robots for Urban Search and Rescue Applications). This Practice covers several types of mobility tests, including step, gap, stairs, step fields, and inclined planes. Discussion touched upon the types of flooring material and geometries used in the tests (for instance, should wet carpet be used for the inclined plane test? What should the proportions of the stairs be?) as well as the necessary or minimum number of repetitions of the test to obtain valid data. Adam also presented 2 manipulator-oriented test methods: directed perception and manipulator dexterity. At issue is how exhaustive either of these tests need to be in order to capture representative and fair data. The sentiment of the attendees was that a time limit could be placed on the execution of the test, rather than allowing an unlimited amount of time to complete as much as possible. The manipulator dexterity test method will be redesigned to have

a 4-unit grid, rather than the previous 9 units.[1] This will reduce the complexity as well as the execution time.

The Chair of the **Human-System Interaction Working Group** (Sal Schipani) was unable to attend. Adam presented an update on the situational awareness test method (known as WK11331 - Standard Test Method for Evaluating the Usability of the Human-robot Interface for Robots for Urban Search and Rescue). Responders voiced their belief that the test method should emphasize exhaustive search of the maze, rather than fastest traversal. A differing number of stickers (e.g., hazardous material labels) should be placed within the maze, and complete search should be assigned to the robot operator. The time required to complete the search and the percentage of stickers correctly identified and localized should be noted. The feedback will be conveyed to the Chair.

The **Power Working Group** has been activated, with Chris Rogan and Jim Kozlowski of Pennsylvania State University's Applied Research Laboratory taking the lead. Chris and Jim were not able to attend this meeting, so Adam gave a brief update on where the initial test methods stand. An endurance test method had been piloted at Disaster City in 2007. This test method is being expanded to more adequately test battery characteristics. In the envisioned test method, ground robots perform endurance test method (which involves traversing a figure 8 with rolling and pitching flooring) with new batteries. Then, deplete batteries over xxx cycles at a known rate yyy (bench-top) and repeat the endurance test method. The two different results will allow computation of the degradation in battery performance.

Mark Micire, of the University of Massachusetts-Lowell and American Standard Robotics is now Chair of the **Safety & Operating Environment Working Group**. He introduced himself and briefly described some of the existing standards that he is researching. Basic concepts, such as whether a robot has to be deemed intrinsically safe or not prior to inserting it into a mission need to be determined. Some new schemes for testing whether a robot is "explosive proof" will likely be tried at the next robot exercise.

Other Business

Adam Jacoff discussed a new effort underway on micro aerial vehicles for applications other than US&R within DHS and the National Institute of Justice. NIST has been working with the program sponsors to apply and refine the aerial test methods that have been partially developed for the US&R project. The new test methods will likely reside in the ASTM F38 Unmanned Aerial Vehicles Committee. It is expected that the test methods will be relevant and useful for US&R as well and the E54 and F38 Committees will collaborate.

NIST and DHS are planning on hosting another robot exercise at Disaster City in May, 2008. The exercise will be an opportunity to experiment with robots of various types within realistic training scenarios. Test methods under development will be available for responders and robot developers to evaluate and critique.

Kathleen Higgins and Philip Mattson (Chair of E54.08) presented Elena with a Distinguished Service Award recognizing her participation that led to the development of the E2592 Standard.

[1] Test methods are not described in this document. See reports and presentations available on the project web site http://www.isd.mel.nist.gov/US&R_Robot_Standards for more information