Call for Robots and Operators to Practice Standard Test Methods for Response Robots

Robot Test Facility, National Institute of Standards and Technology, Gaithersburg, MD

The National Institute of Standards and Technology (NIST), with sponsorship from the Department of Homeland Security (DHS) Science and Technology (S&T) Directorate Office of Standards, is developing a suite of ***DHS-NIST-ASTM International Standard Test Methods for Response Robots*** to quantitatively evaluate the performance of robots for emergency response applications. These standard test methods measure robot capabilities in **mobility, manipulation, energy, sensing, radio communication, operator proficiency, logistics, and safety** to provide a point of comparison for a variety of robot sizes and configurations prior to testing in more realistic scenarios. They address ground, aerial, and aquatic systems for emergency response and military applications. Statistically significant robot performance data captured within these standard test methods measure incremental system improvements, highlight break-through capabilities, guide purchasing and deployment decisions, and support training with measures of operator proficiency. More than forty test methods are under development with apparatuses, procedures, and performance metrics. They are being standardized through the ASTM International standards committee on Homeland Security Applications; Operational Equipment; Robots (E54.08.01).

We rely heavily on support from emergency responders and soldiers, robot developers, and test administrators from across the country and around the world to advise on robot capability requirements, help validate robot test methods, and set priorities for future standards. We are very appreciative of the efforts from each of these communities thus far. Such participation ensures that these standard test methods help robot developers more quickly and successfully address the needs of emergency responders and soldiers operating in hazardous environments.

ASTM International Standards Committee on Homeland Security Applications; Operational Equipment; Robots (E54.08.01)
May 28-29-30, 2014
(Wednesday 1:00 pm - 5:00 pm; Thursday 9:00 am - 5:00 pm; Friday 9:00 am - 3:00 pm)

The goal of this meeting is to review the entire suite of standard test methods under development. It is open to all who are interested, and given our proximity to Washington we expect civilian and military robotics program managers from around the area will attend. We will discuss each sub-suite of test methods throughout the three days, and intersperse robot demonstrations provided by participating robot developers and emergency responders during frequent breaks and lunches served in the building. Recent Use-Cases and reports from field deployments will also be presented as examples of how the standards development process works for response robots.

To Participate: Pre-registration is essential to gain access to NIST. You do not need to be an ASTM member. Please register at the ASTM website: http://meetingsprod.astm.org/AttendeeMeetingRegistration.aspx?EventId=2524&MeetingId=85918. See the attached map for driving directions, including on the NIST campus.

To Bring Robots for Practice or Demonstration: In addition to following the instructions above, please email RobotTest-Methods@nist.gov which meeting days you expect to come, the make/model robot and related tools you plan to bring. You may practice in any available test method throughout the meeting days and highlight your robot's capabilities within the test methods during breaks and lunches. We can secure equipment overnight if helpful.

Adam Jacoff
Intelligent Systems Division, Engineering Laboratory
National Institute of Standards and Technology
RobotTestMethods@nist.gov | 301-975-4235
http://www.nist.gov/el/isd/ks/upload/DHS_NIST_ASTM_Robot_Test_Methods-2.pdf

Standard Test Methods For Response Robots

ASTM International Standards Committee on Homeland Security Applications;
Operational Equipment; Robots (E54.08.01)

Status: Standard (ASTM ###), Balloting (B), Validating (V), Prototyping (P)

Mobility: Confined Area Terrains

- Continuous Pitch/Roll Ramps (ASTM E2826-11)
- Crossing Pitch/Roll Ramps (ASTM E2827-11)
- Symmetric Stepfields (ASTM E2828-11)
- Gravel (Balloting)
- Sand (Balloting)
- Mud (Prototyping)

Mobility: Confined Area Obstacles

- Gaps (ASTM E2801-11)
- Hurdles (ASTM E2802-11)
- Hurdles with Culvert (Validating)
- Inclined Planes (ASTM E2803-11)
- Stairs/Landings (ASTM E2804-11)
- Vertical Insertion/Retrieval Stack with Drops (Validating)

Safety and Durability

- Lost Communications and/or Power Behaviours (Balloting)
- Water Fording - IP## (Validating)
- Washdown/Decontamination - IPX#3 of 8 (WK33262)
- Immersion - IPX7 of 8 (Prototyping)
- Throw Distance (Validating)

Small Unmanned Aerial Systems
(Initially for Vertical Takeoff and Landing, FAA Group I, <2 kg, 30 knots, frangible)

- Maneuvering Tasks: Station-Keeping: Horizontal and Vertical (Validating)
- Endurance/Power: Endurance: Path Following (Validating)
- Safety: Impact Forces (Prototyping)
- Safety: Lost Control/Communications/Power Behaviours (Prototyping)

Manipulator Dexterity

- Strength at Reach (Balloting)
- Inspection (Balloting)
- Retrieving/Inserting Objects (Validating)
- Pushing/Pulling/Rotating Forces (Validating)
- Door Opening and Traversal (WK27852)
- Tools Deployment: Disruptor Aiming (Validating)
- Tools Deployment: Breaking/Boring (Validating)

Human-System Interaction

- Maneuvering Tasks: Sustained Speed (ASTM E2829-11)
- Maneuvering Tasks: Towing Grasped/Hitched Sleds (ASTM E2830-11)
- Maneuvering Tasks: Post/Hole Slaloms (Balloting)
- Navigation Tasks: Hallway Labyrinths with Complex Terrain (WK33260)
- Search Tasks: Random Mazes with Complex Terrain (ASTM 2857-12)
- Search Tasks: Underbody Inspection (Validating)
- Pan-Tilt-Zoom Tasks (Balloting)
- Operator Interface Constraints: PPE; Posture; Lighting (Prototyping)
- Operator Interface Indicators: Low Battery; Robot Tilt (Prototyping)

Small Unmanned Underwater Systems and ROVs

- Maneuvering Tasks: Sustained Speed (Prototyping)
- Maneuvering Tasks: Station-Keeping in a Current (Prototyping)
- Manipulation: Cutting Ropes and Rods (Prototyping)
- Manipulation: Lifting and Placing Tasks (Prototyping)
- Sensors: Sonar Resolution (Prototyping)
- Safety: Lost Communications and/or Power Behaviours (Prototyping)

Radio Communications

- Line-of-Sight range (ASTM E2854-12)
- Non-Line-of-Sight Range (ASTM E2855-12)
- Structure Penetration Environment (Prototyping)
- Urban Canyon Environment (Prototyping)
- Interference Signal Environment (Prototyping)

Energy/Power

- Endurance: Continuous Pitch/Roll Ramp Terrain (Balloting)
- Peak Power: Stairs/Landings (Prototyping)

Sensors

- Video Acuity, Resolution, and Field of View (ASTM E2566-08) (Re-Balloting)
- Video Dynamic Range (Balloting)
- Video Color Acuity (Validating)
- Video Latency (Validating)
- Audio Speech Intelligibility Two-Way (WK34435)
- Audio Spectrum Response Tones Two-Way (Prototyping)
- Mapping Spatial Resolution (Prototyping)
- Mapping of Hallway Labyrinths with Complex Terrain (2D/3D) (Prototyping)
- Mapping of Sparse Feature Environments (Prototyping)

Terminology and Logistics

- Search Terminology for Urban Search and Rescue Robotic Operations (ASTM E2521-07A)
- Standard Terminology for Federal/State/Local Bomb Squads (Prototyping)
- Standard Practice for Configuration Identification and Cache Packaging (ASTM E2592-07) (Re-Balloting)
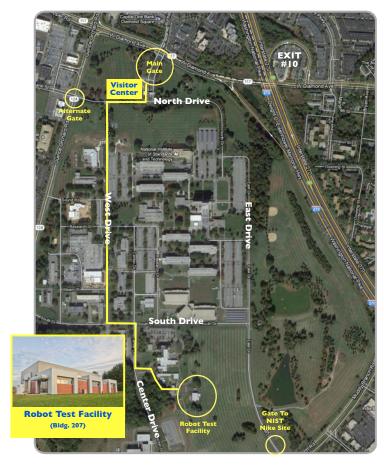
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Directions to NIST's Robot Test Facility
Gaithersburg, MD 20899

From Dulles International Airport (IAD) *45-60 Min.*
- Dulles Access Road toward Washington
- Exit onto I-495 toward Bethesda/Baltimore
- Exit onto I-270 North toward Frederick (left lanes)
- Exit #10 West Diamond Ave. / Clopper Road (MD-117)
- Right at the first traffic signal onto West Diamond Ave.
- Left at the next traffic signal into NIST's Visitor Center

From Reagan National Airport (DCA) *45-60 Min.*
- George Washington (GW) Parkway North toward Maryland. (This road is confusing with several merges and forks. So when in doubt, stay right along the Potomac River until the following exit.)
- Exit onto I-495 toward Bethesda/Baltimore
- Exit onto I-270 North toward Frederick (left lanes)
- Exit #10 West Diamond Ave. / Clopper Road (MD-117)
- Right at the first traffic signal onto West Diamond Ave.
- Left at the next traffic signal into NIST's Visitor Center

From Baltimore Washington Int'l Airport (BWI) *60-75 Min.*
- I-195 West
- Exit onto I-95 South toward Washington
- Exit onto I-495 West toward Silver Spring
- Exit onto I-270 North toward Frederick
- Exit #10 West Diamond Ave. / Clopper Road (MD-117)
- Right at the first traffic signal onto West Diamond Ave.
- Left at the next traffic signal into NIST's Visitor Center

NIST Campus
All visitors must enter the Visitor Center at the main gate on the first day of visit to pick up a badge (your name must already be in the system) and show the badge and photo ID to enter/exit any NIST Gate during visit.

From NIST's Main Gate:
- Right on North Drive
- Left on West Drive to end
- Left on South Drive
- Right on Center Drive
- Left into first driveway/road (unmarked)
- Follow road to right toward tall brick tower
- Robot Test Facility is at top of hill
- Park anywhere except circular driveway (maintain fire access)
- Call x70777 from phone at door for entry (or 301-975-3418)