



ASTM International
Committee on Homeland Security Applications;
Operational Equipment; Robots (E54.08.01)
June 24-25 (Tue-Wed), 2008, Denver, CO

PRE MEETINGS**LOCATION**

Tue 09:00 pm Room 606 (or lobby bar if room closed)

TOPIC: SWRI data logger capture around hotel scenarios

Tue 12:00 pm (lunch) Hotel restaurant

TOPIC: Mobility: SWRI tasks, Logistics: Robot configuration as tested

Tue 2:00 pm Room 606

TOPIC: Power: Penn State, SWRI Packbot with data logger, fuel cell, etc.

- Introductions all around
- Objective (Adam Jacoff, NIST and Karl/Chris, Penn State APL)
 - Figure-8 endurance test
 - Constant temperature, X laps to drained, Y bench cycles, Z laps to drained
 - Other variables for this proposed test?
 - Extreme temperature testing
 - Other test apparatuses? carpeted incline plane pattern? inclined treadmill?
 - Discussion
- Alternative batteries: MIL 2590 lithium rechargeable (self limiting issues?)
- SWRI data logger (Bill McBride, SWRI)
 - Current and voltage, open source, matchbook size, self powered,
 - 1KHz, 12bits, 24hr of storage
 - Show data plots and video of samples captures at hotel

(last 15 minutes)

- Fuel cells for robots update
 - Bill Siddall, Adaptive Materials?
 - Chip Allgrove, Jadoo Power?
- TARDEC experience (Sony Gargies)?

Tue 4:00 pm Room 606

TOPIC: Sensors: Next steps e.g. visual pointing? two way audio? 3D imaging?

Tue 7:00 pm (dinner) Rally at hotel bar

TOPIC: Planning for following day's meeting

MAIN MEETING **LOCATION**

Wed 8:00 - 11:00 am Mineral B

TOPIC: E54.08.01 Subcommittee Meeting

- Common Issues (ASTM content requirements, etc.)
- Scheduled Events (Document Schedule, Response Robot Exercises)
- Working Group Status Reports
 - 15 min Intro (Terminology, Logistics, HRI)
 - 30 min Sensors
 - 10 min Energy
 - 30 min Radio Comms
 - 15 min Mobility
 - 15 min Manipulation
 - 30 min Safety
 - 20 min Throwable robot brainstorming for test methods (Scout demo)

Wed 11:00 - 12:30 pm Mineral B

TOPIC: E54 Main Committee Meeting

Wed 12:30 (lunch) Hotel restaurant

TOPIC: Planning the rest of the day's discussions

Wed 1:30 - 5:00 pm Room 639

TOPIC: E54.08.01 Working group discussions and brainstorming

- Radio Comms, Data logging, Throwable robots, Other???

Energy Meeting Notes:

Apparatuses:

- Figure-8 is okay, especially if it fits into temperature chambers PSU-ARL is apparently bigger than figure-8 (SWRI's is 10x9x8ft tall).
- Various terrains to use:
 - Flat flooring
 - 15° continuous pitch/roll
 - Stepfield pallets (geometric hills, diagonal hills, and flats)
 - Small gravel (sand could be considered, but is difficult to specify and deal with)
- Inclined treadmill tests would be good to remove the human operator element, plus it will certainly fit into a temperature chamber.

Cycling batteries:

- PSU-ARL characterizes a set of three batteries to be good and similarly conditioned.
- Run all three batteries back to back to back in the given robot in the given apparatus.
- Take the average of the three profiles as the bench-top depletion profile (accounts for warm-up of robot)
- Run on bench with average profile until battery's energy capacity is below 80% of rated capacity, and report the number of cycles it took to get there.
- Put batteries back into robot and run back to back to back in apparatus again to get an actual distance for responders to see effects of battery depletion.

Temperature issues:

- Need to run tests in temp extremes -20°C (0°F), 20°C (68°F), 50°C (120°F)
- Need to similarly adjust bench-top profile to account for temperature extremes
- So the bench-top profile needs to represent the in-robot AND in-environment profile

Notes:

- Cycling to completely depleted in the robot gives a worst case use scenario from the battery perspective.
- Actual usage profiles like prematurely charging batteries is not included in this test, as we've chosen to reflect the worst case scenario by depleting fully each time.
- Use treadmill test to see if impact of pressure, humidity for ground robots is greater than noise (maybe not on batteries, but on motors?)

Initial robot candidates (by increasing size):

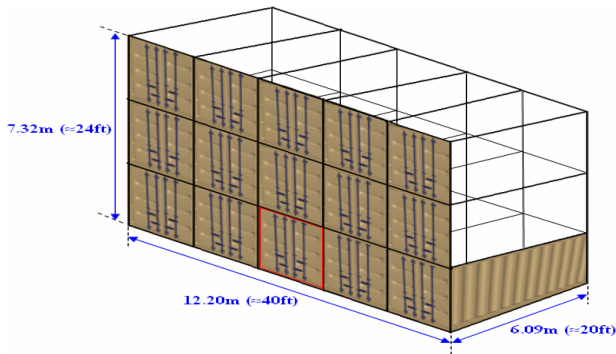
- VGTV-Extreme (tethered, small size) at least on treadmill first
- Dragon Runner (original batteries, MIL2590)
- Packbot (original batteries, MIL2590)
- Talon (original batteries, MIL2590)
- Telex with manipulator???
- F6A with manipulator???

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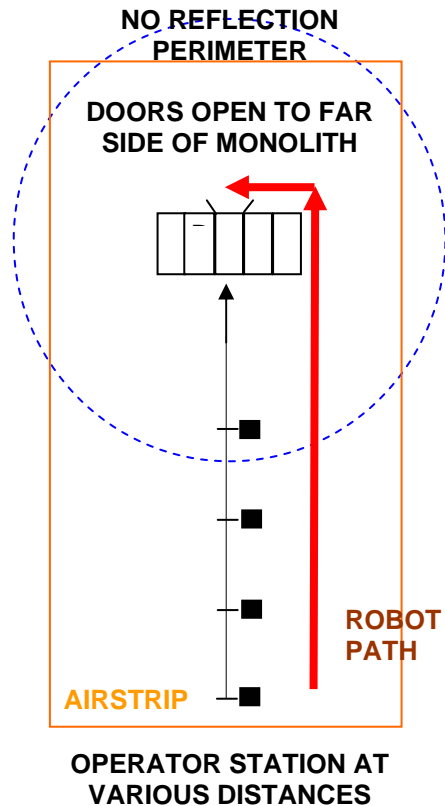
Radio Comms Meeting Notes:

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- The ISO container monolith (40wide x 20deep x 24ft tall using 8x8x20ft containers stacked 5 wide x 3 tall) is looking good, still needs to be tested to see if nominal 20ft signal bend around both sides and over the top is sufficient. Could go to taller and wider <gulp>. Doors will be closed for non-line-of-sight test method. We'll explore container penetration by closing the doors with the robot inside to attenuate the signal as well.
- Ground the monolith electrically!
- We'll seek to setup the monolith this summer to explore the test method prior to Disaster City. Potential locations: SWRI, MD or CO... but the likeliest place will be the Riverside Airstrip near Disaster City, so that it is all setup for the November 17-21 exercise.
- Full spectrum EMI testing must be done, in a chamber, to establish EMI/EMV
- Spectrum analyzer is essential to capture background during any outdoor test.
- Can we specify a ceiling for noise in the target spectrum for a "good" test?
- Could use 2.4GHz phones as structured noise during a different comms test.
- Receiver signal filtering is an issue and may be a key performance driver, according to robot manufacturers.
- All test layouts should have clearly delineated areas for human observers that are NOT near or in line with transmitter/receiver on either end.
- All humans on test site need to be aware that cell phone and voice radio comms could affect the test!
- Weather station measurements of temp, humidity, precipitation should be taken at test time. Some limits might be considered to invalidate the test environment.



ISO SHIPPING CONTAINER MONOLITH
 (15) 8X8X20 FT STACKED THREE HIGH
 40FT WIDE X 20FT DEEP X 24 FT TALL
 WITH DOORS ON FAR SIDE FROM
 OPERATOR CONTROL UNIT (SOME
 OPEN, SOME CLOSED)



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Sensors Meeting Notes:

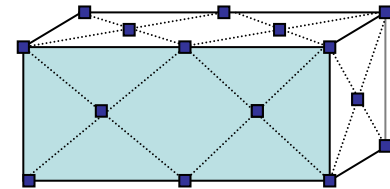
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Two-way audio:

- Two way audio, push to talk, listen always (can help identify track/wheel slippage and make/maintain contact with victims). Potentially full duplex?
- Bonus points for directional discrimination, even stereo microphones to two ears (though there may be a safety issues associated with covered ears on responders during general searching, could be beneficial once near a victim)
- Microphones and speakers need to be depth rated to 1 atmosphere.
- Frequency response tests could be used for general test method
- Speech intelligibility standards -- McDonalds drive through test! – may require a panels of listeners, but is language specific. See NIOSH tests for this.

Video/Image pointing (directed perception or special awareness):

- More than field of view, can you look at and focus in on particular targets, and how quickly (think structural engineer needing to look at top and bottom of supports for cracks, etc.)
- 8x8x20ft ISO container with various flooring (flat, pitch/roll, stepfields), targets in all corners and floor/wall/ceiling centers (see graphic: nodes are target locations).
- Robot placed at center initially with door closed behind (dark), or randomized start positions inside.
- Robots with independent pan/tilt/zoom should do well in time. Robots with body-mounted cameras need to steer and drive to corners to see targets, and may only be able to identify the low targets. Not bad performance, just limited.
- Targets might need to be identified in order with a time limit.
- Targets might be timed (lighted?) on/off to isolate awareness issues along with speed/accuracy of pointing (robots with fixed cameras on uneven floors will be slower).
- Hang the robot from the center to mimic vertical insertion.
- Mapping element requires establishing robot orientation during identification.
- Targets can be rows of tumbling E's with smallest as crack size
- Targets need to start moving toward SHAPES such as mannequin parts (hand, foot, leg, head, baby doll) or identifiable objects (door knobs, keyboard, stapler, telephone (with number to read), office door numbers or nameplates, dentist office stuff for hazmat area). Almost any recognizable items: wristwatch, shoes.
- Irregular target patterns, not the corners and centers, might be better.
- Smaller scale version is an option for more confined space analysis (culvert size?)



Hazmat sensing:

- *Requirement #73 Sensing -- Hazmat -- Hazard Detection.*
 - *Metric: Scale 1-5.*
 - *Description:*
 - 1 = ph + O₂, LEL, CO, H₂s, RAD; 2=+WMD and TIC detection;
 - 3 = +WMD and TIC classification;
 - 4 = +Tentative WMD and TIC identification;
 - 5 = +WMD and TIC sampling.
 - Detection capabilities must meet current capabilities as documented in industry standards.



- Combustible gas (methane or other) sensors as part of the mandatory “chassis” on every robot? Set to 10% of problem level. A hit could drive shutdown decisions. Additional sensors are also welcome.
- Small robots will, of course, have a problem with a mandatory payload, may be exempt.

A/C line detection:

- *Requirement #103 Operating Environment -- Electrified Environment.*
 - *Metric: Yes/No.*
 - *Description: Concern is interacting with a voltage source and tethered back to operator.*
- Tethered robots should be isolated from operator control units in case the robot makes contact, should be included in UL certificates.
- Responders already have “Hot Stick” that makes an audible tone, maybe it can be incorporated into the chassis?