Bi-Annual Meeting
ASTM Committee F45
Meeting Minutes

Roger Bostelman, Chairman

ASTM Committee F45

National Institute of Standards and Technology

Gaithersburg, MD 20899

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August 17 & 18, 2016

(red text are meeting minutes)

Agenda

Wednesday, August 17		AML Building, Conference Room C106	
start	duration	event	presenter
8:00am	15	Bus pickup from Hilton	Bostelman
8:15am	20	Greetings, Agenda, Introductions	Bostelman
8:35am	10	NIST/Engineering Laboratory, Acting Deputy Director Greeting	Chin
8:45am	30	F45 Main Committee Status, ASTM Info-Roster Main.	Bostelman, Lively, Emanuel
9:15am	10	Coffee Break	
9:25am	150	F45-91 Terminology	Bostelman
11:55am	60	Lunch - NIST Cafeteria	
12:55pm	120	Test Method Demo's; Bus from Building 101 to Building 202	Bostelman, Norton
2:55pm	15	Coffee Break	
3:10pm	120	F45-02 Docking & Navigation	Roberts
5:10pm	20	Day 1 wrap-up and next day agenda	Bostelman
5:30pm		Adjourn	
6:30pm		Bus return to Hilton	
		Dinner - Paladar Latin Restaurant	

Agenda

Test Method Demonstrations

Start	Duration	Event	Presenter
12:55pm	15	Bus from Bldg. 101 to Bldg 202, Room 138	
1:10pm	90	Demonstrations:	
		Docking onboard equipment, with Comm. interrupts	Bostelman
		Navigation: Defined Spaces	Bostelman
		Obstacle avoidance	Norton
2:40pm	15	Bus from Bldg. 202 to AML Bldg. 215, Conf. Room C106	
2:55pm		Back for coffee break	

Agenda

Thursday, August 18		AML Building, Conference Room C106	
start	duration	event	presenter
8:00am	15	Bus pickup from Hilton	
8:15am	120	F45-03 Object Detection & Protection	Weiss
10:15am	10	Coffee Break	
10:25am	30	Presentation: Sharp Security Robot	Lewis
10:55am	90	F45-01 Environmental Effects	Lewis
12:25am	60	Lunch - NIST Cafeteria	
1:25pm	60	F45-04 Communication & Integration	Lichtenstein
2:25pm	10	Coffee Break	
2:35	60	F45-04 Communication & Integration	Lichtenstein
3:35pm	60	Final Wrap up discussion - Subcommittee Reports, Future works	All Chairmen
4:35pm		Adjourn	
		Bus return to Hilton	

Announcements

- Dinner sign-up:
  - Paladar Latin American Restaurant
  - 203 Crown Park Ave, Gaithersburg, MD 20878; (301) 330-4400
  - 6:30 PM
- Irv Lichtenstein, F45.04 Subcommittee Chairman
  - Potentially leaving position due to medical issues
  - Looking for replacement - current Deputy Subcommittee, 2017 Chairman

Introductions

- Name
- F45 member or guest
- Organization
- Job title/function – related to industrial vehicles

Greeting by Dr. Joannie Chin

NIST/Engineering Laboratory, Acting Deputy Director

ASTM Committee F45 Structure

Scope

The development of standardized nomenclature and definitions of terms, recommended practices, guides, test methods, specifications, and performance standards for driverless automatic guided industrial vehicles. The Committee will encourage research in this field and sponsor symposia, workshops, and publications to facilitate the development of such standards. The work of this Committee will be coordinated with other ASTM technical committees and other national and international organizations having mutual or related interests.

- F45-01 Environmental Effects
- F45-02 Docking & Navigation
- F45-03 Object Detection & Protection
- F45-04 Communication & Integration
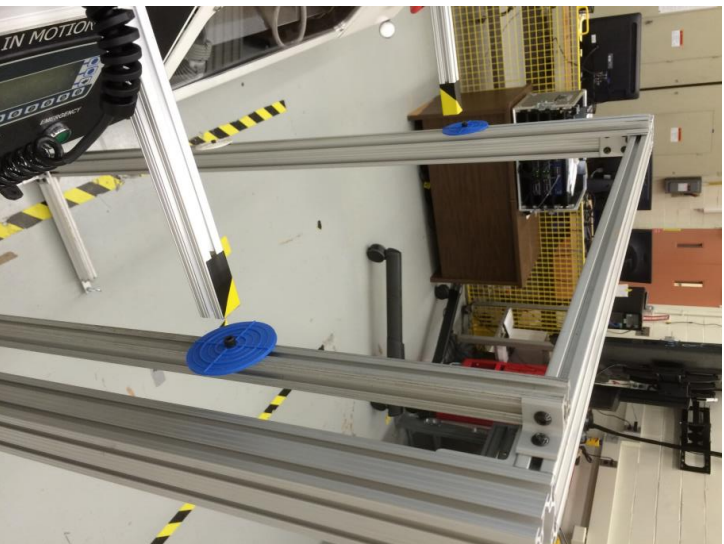- F45-91 Terminology

F45 Status

- Established May 2014
- Approximately 55 members
- Third face-to-face committee meeting
  - August 2015 – NIST, Gaithersburg, MD
  - April 2016 – Modex Atlanta, GA
  - August 2016 – NIST, Gaithersburg, MD
- Monthly Subcommittee E-meetings
- 5 Working Documents – 2 have been balloted
  - F45.01: WK54576 - Standard Practice for Recording Environmental Effects for Utilization with A-UGV Test Methods
    - *balloted through F45.01*
  - F45.02: WK48955 - Standard Test Method for Navigation : Defined Space
  - F45.03: WK54662 - Standard Test Method for Grid-Video Obstacle Measurement
  - F45.04: WK54431 - Standard Test Method for A-UGV Communication and Integration
  - F45.91: WK48954 - Standard Terminology for Driverless Automatic Guided Industrial Vehicles
    - *ballot 16-01 (~135 terms) and ballot 16-02 (Scope and 6 terms)*
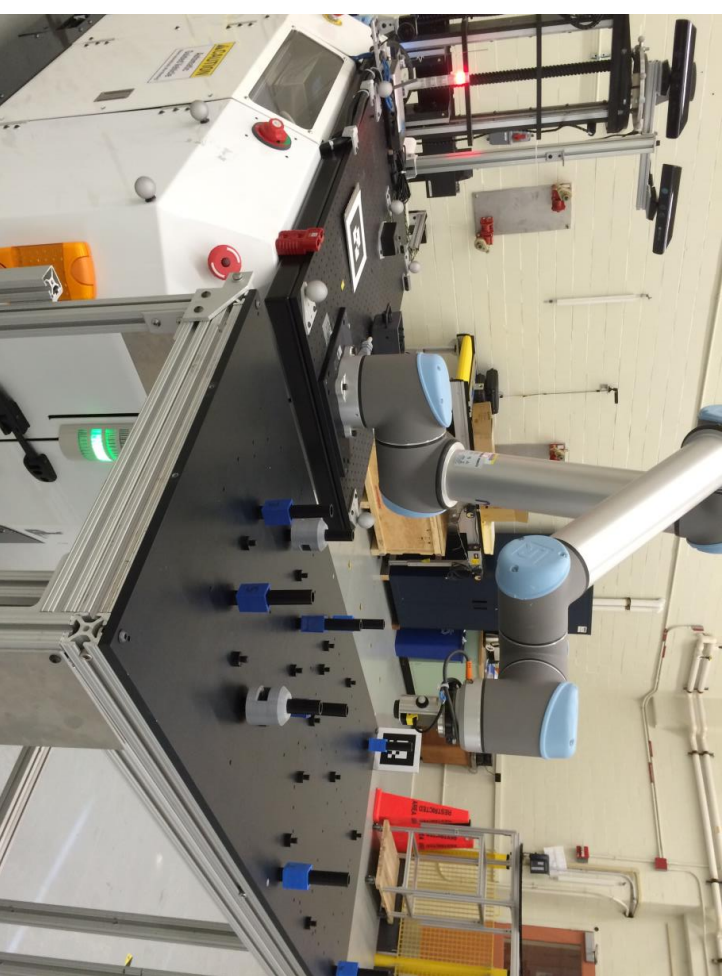
Demonstrations

- Docking with onboard equipment; with Comm. interrupts
  - A video was shown of an Automatic-UGV docking with a test apparatus.
  - A demonstration was provided of an Automatic-UGV with onboard robot docking with an apparatus from a variety of positions and orientations.
  - During the demonstration, the communication link was interrupted (removed) between the vehicle controller and the wireless router.
- Navigation: defined spaces
  - A demonstration was provided of an Autonomous-UGV navigating through three of the test spaces as described in WK48955.
- Obstacle avoidance
  - The navigation demonstration included the addition of Umass-Lowells concept of standard obstacles within the defined space.
  - Additionally, a change in the environmental setup as shown with a light directly shining on the vehicle.

Docking with onboard equipment; with Comm. interrupts Demo Setup

Automatic-UGV docking with a test apparatus that simulates a two point roller-table dock

Docking an Automatic-UGV with onboard robot with a test apparatus.

Navigation/Obstacle Avoidance Demo Setup

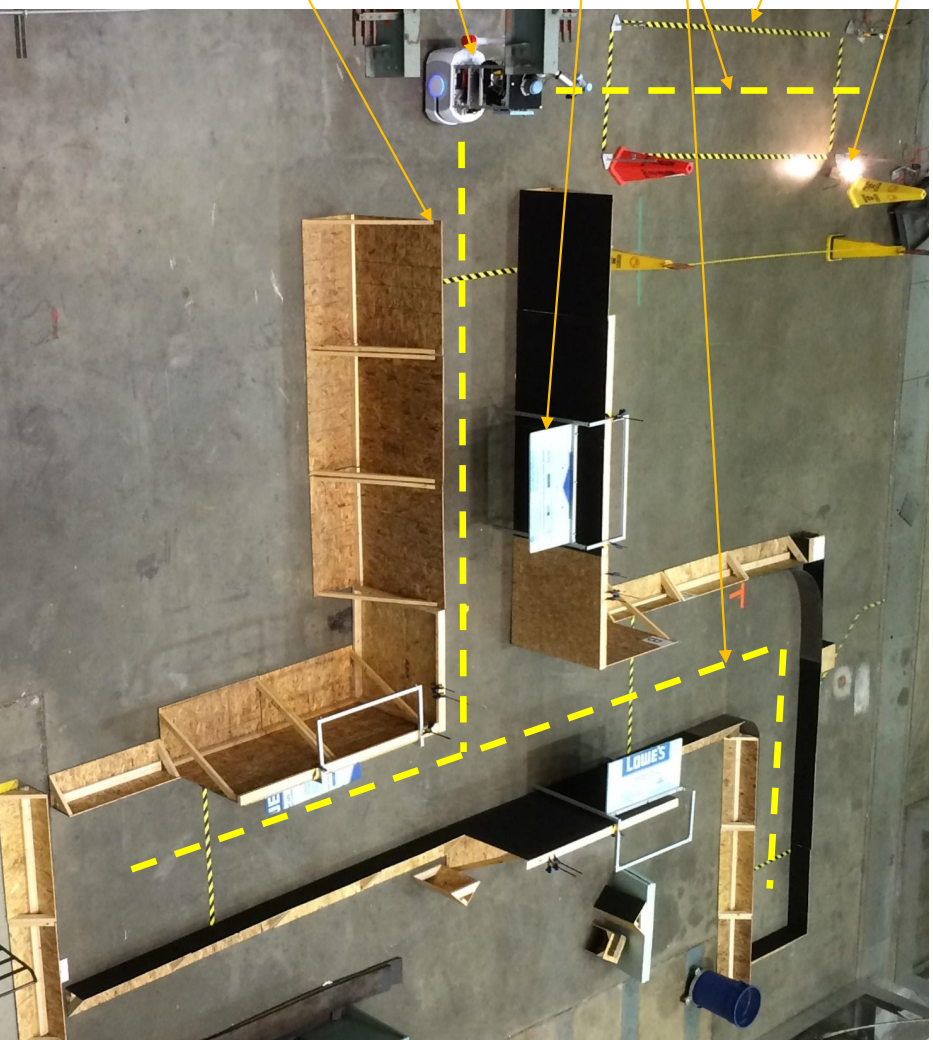Light setup as change to environment (i.e., shining towards A-UGV)

Virtual defined space

A-UGV paths

Obstacles

Autonomous-UGV

Barrier defined spaces

ASTM Info-Roster Main

- Julia Moynihan, ASTM Technical Manager, provided an update on the membership. Membership requests were also made and sign-up sheets provided for requests to join each of the subcommittees.

- Additionally, Julia provided information on dealing with negative votes.

F45.91 Presentation

- Scope:
  - Definitively includes only unmanned ground vehicles
    - "unmanned (i.e., driverless), ..." mirrors the B56.5 title so that F45 includes AGVs
    - "ground (i.e., land-based and in continuous contact with the ground), industrial vehicles"
- Terms/Definitions
  - Include a generic set of terms to include all types of ground industrial (i.e., not home service vehicles – lawn mower, carpet sweeper, etc.)
  - Key terms include three types of intelligence: automatic (AGV), automated (mobile robots), and autonomous (some mobile robots)
    - **A-unmanned ground vehicle, A-UGV,** *n*—vehicle that operates while in contact with the ground without a human operator; *see* automatic-UGV, automated-UGV, and autonomous-UGV.

Meeting Goal:
- Resolve negative votes

The following slides are notes from each of the subcommittee and main meetings.

F45.01 Meeting Notes

- Dave Lewis, F45.01 Subcommittee Chairman, presented the Sharp outdoor security A-UGV.
- Ballot to Main now, resolve negatives at February 2017 meeting or prior
- Test methods for environmental effects
  - Prioritized list
    - Surface measurement – description of conditions
    - Temperature
    - Lighting
    - Methods for defining transitions
- Outdoor robot considerations
  - Negative obstacle – not a navigation point
- Visual acuity test method – E.54 human readable, machine readable
  - i.e., light and dark conditions – detect objects or humans under certain conditions
  - QR code use??
- Add perforations and voids/grates
- Air velocity

F45.02 Meeting Notes

- Check height of physical boundaries
- Multiple defined spaces
  - Does orientation of each configuration matter? Only for future multiple defined spaces
- Next: Roger to work with Malcolm on developing 'Precision and Bias' section

F45.03 Meeting Notes

- Ballot mid Sept.
- Distance to stop? Needed – yes; does it need to stop?
- Potential interpretation to obstacles entering the vehicle path within the stop zone
  - B56.5 interpretation
- 9.12 not success, but some other word
  - "If, after the A-UGV collides with the test piece, it comes to a stop on its own due to the detection of the test piece, then the repetition (trial) is a <u>success</u>. Important change"
- Stop zone – provide another word for 'stop zone' to minimize B56.5 association.
- Start point and start line confusion; consistent 'goal', 'end', 'repetition', etc.
- Future – add negative obstacles

F45.04 Meeting Notes

- Turn into a practice instead of test method
  - Post-meeting point: Rename work item to match document scope, e.g., "Practice for Testing Data Communications Interruption for A-UGVs"
- Take out ping, etc. and test interruptions
- Change the drawing: "wireless router" to "comm. infrastructure"
- Remove failure and replace with intended performance
- Add forced GPS interrupts

F45.91 Meeting Notes

- 45 negatives from Ballot F45 (16-01) were reviewed and resolved
- Item 001 (Title/Scope) on F45 (16-02) received one negative and the subcommittee decided to put this item in addition to five other terms that received negatives onto a letter ballot for adjudication.
- The terms considered persuasive were removed from ballot and will be either re-balloted or removed from the document completely.
- Meeting Dates to Resolve Remaining Negatives; 1 PM to 3 PM EST on:
  - Sept 8, Thurs
  - Sept 19, Mon
  - Oct 4, Tues
  - Oct 17, Mon
  - Nov 1, Tues
- Ballot resolved terms

Wrap-Up Discussion Meeting Notes

- Main
  - Include videos in standards? – include a link (e.g., NIST link)
  - Full committee meeting – Feb 1,2 in Norfolk, VA
  - Next web ex meetings:
    - F45.01 - 3rd Friday/month, 10 AM – 12 Noon   16 Sept
    - F45.02 - 2nd Wednesday/month from 11-1 PM   14 Sept
    - F45.03 - 3rd Wednesday/month from 11-1 PM   21 Sept
    - F45.04 - 1st Wed/month, 1-3 PM   7 Sept
    - F45.91 - *1st Monday/month from 11-1 PM*   - not setup yet
- ASTM to setup a Webex training session on Precision and Bias
- What sub-committee should these be added to or create a new sub-com.?
  - Configurations – hardware and software
  - Battery life test method
  - Sensing arms or other overhanging obstacles