Committee F45 Meeting Minutes

Roger Bostelman

Chairman, ASTM Committee F45

Julia Moynihan

ASTM Staff Manager

March 6, 2017

F45.90 Executive Subcommittee Meeting

Roger Bostelman

Chairman, ASTM Committee F45

Julia Moynihan

ASTM Staff Manager

February 1, 2017

Administrative

1. Committee attendance
   - Bostelman, Weiss, Roberts in attendance for this meeting; Norton also participated
2. Agenda
3. Committee/Subcommittee Status
   a. Membership
   b. Officers
   c. Ballots
4. New Business
   a. Future test methods
5. Other Business

ASTM Committee F45

	Wednesday 02/01/2017 A	Thursday 02/02/2017 A
7:00 AM		
8:00 AM		
8:30 AM	F45.90 Executive Subcommittee Meeting (Closed Meeting for Officers) (0)	F45.03 Object Detection and Protection (0)
9:00 AM		
9:45 AM	F45 ASTM Sponsored Coffee Break (0)	
10:00 AM		F45 ASTM Sponsored Coffee Break (0)
10:15 AM	F45.91 Terminology (0)	F45.04 Communication and Integration (0)
11:00 AM		
12:00 PM		
1:00 PM		F45 Main Committee (0)
2:00 PM	F45.01 Environmental Effects (0)	
2:30 PM		
3:00 PM		
3:00 PM	F45.02 Docking and Navigation (0)	
4:00 PM		
5:00 PM		

Committee Status

- 51 F45 Members

- Officers Status
  - Irv Lichtenstein, F45.04 Subcommittee Chairman
    - Potentially leaving position due to medical issues
    - Looking for replacement - current Deputy Subcommittee, 2017 Chairman
  - Vacant recording secretary
  - Other Status?

New Business

- List of potential standards to develop
  - Request proposals?
  - Where should they be placed?
- Do we need/can we add this statement? "Results of this test do not reflect all vehicles from this manufacturer."
  - Consensus was that this will not be added to documents.

Ballots

F45 Closed Ballots and Closing Reports

| RETURN TO MYBALLOTS | SUBSCRIBE TO CLOSING REPORTS TRACKER |

To view the ballot items documents, click on the ballot designation link, below. To view a Closing Report (PDF format) for a ballot, depress the adjacent "Closing Report" button. Closed Ballot Items are available for e-ballots only.

Letter Ballot	Closing Report		Issue Date	Closing Report Posted ⬇
F45 (16-04)	WEB VIEW	PDF	December 2, 2016	January 3, 2017
F45.04 (16-01)	WEB VIEW	PDF	December 1, 2016	January 3, 2017
F45.02 (16-01)	WEB VIEW	PDF	November 11, 2016	December 13, 2016
F45 (16-03)	WEB VIEW	PDF	August 31, 2016	October 3, 2016
F45 (16-02)	WEB VIEW	PDF	June 29, 2016	August 3, 2016
F45.01 (16-01)	WEB VIEW	PDF	June 28, 2016	July 29, 2016
F45 (16-01)	WEB VIEW	PDF	May 5, 2016	June 6, 2016

Committee F45 Ballots

	Ballot	Issue Date	Closing Date	Committee Description	Status
(02, 04)	F45 (17-01)	Jan 05, 2017	Feb 05, 2017	Driverless Automatic Guided Industrial Vehicles	Submitted
	F45.03 (17-01)	Jan 05, 2017	Feb 05, 2017	Object Detection and Protection	Submitted

Standards Updates – F45 Driverless Vehicles

- **ASTM F45** meeting to be held in Norfolk February 1 & 2

- **F3200-16 Standard Terminology for Driverless Automatic Guided Industrial Vehicles** (68 terms)

- ASTM F45 has 5 drafts that have been balloted, one per subcommittee

- ASTM F45 documents balloted at committee ("C") and Subcommittee ("S"):
  - F45.01 - WK54576 Standard Practice for **Recording Environmental Effects** for Utilization with A-UGV Test Methods – (C – did not pass ballot; 2 negatives to review)
  - F45.02 - WK48955 Test Method for **Navigation: Defined Space** for Driverless Automatic Guided Industrial Vehicles (C - under ballot until Feb 5)
  - F45.03 - WK54662 Test Method for **Grid-Video Obstacle Measurement** (S- under ballot until Feb 5)
  - F45.04 - WK54431 Standard Practice for Testing Data **Communications Interruption** for A-UGVs (C- under ballot until Feb 5)
  - F45.91 - WK56744 Revision of **Terminology** (C - Passed ballot with approx. 20 additional terms added to F3200-16; 8 negatives to review)

- New Work Items
  - WK57000 Test Method for **Docking**
  - Proposals for all sub-committees to be discussed at Norfolk meeting

Proposed F45 Test Methods
Red text were agreed upon as next working documents to develop

- 01 Environmental Effects
  - Lighting (continuous and transition) affecting A-UGV sensors
    - Sunlight/high intensity light affecting vehicle functionality - highest priority issue at Aug 2014 mtg
  - Surfaces, etc. – see next slide

- 02 Navigation
  - Multiple defined spaces
  - Navigate without defined spaces – able to get there along any path
  - Vehicle stability

- 02 Docking – see next slide
  - Docking – **new work item**
  - Move to a docking location from any location in space
  - Docking a robot arm/onboard equipment to a precise location – *demo'ed at NIST, August 2015, 2016*

- 03 Obstacle avoidance – see next slide
  - Obstacles in the navigation path – *demo'ed at NIST, August 2015, 2016*
  - Negative obstacles - *August 2015, 2016*
    - Example from rescue robots
      https://drive.google.com/open?id=0B76PMngYDE1dNEFTMmFVWUhwMVk
  - Combine navigation and docking with obstacle avoidance
  - Interference between two vehicles (passing or crossing)
  - Avoiding another vehicle or object
  - Sensor interference between two passing vehicles
  - Performance measurement of sensors
  - General grid-video to characterize vehicle performance
  - Obstacle avoidance performance

- 04 Communication and Integration
  - Forced GPS interrupts – August 2016
  - Addition of equipment, sensors, algorithms – August 2015
    - Autonomous/manually reconfigurable
    - Assistance: Sensors (e.g., RFID) or specific factory clothes worn by workers
  - Given the type of AGV <u>power system</u>, such as AC or DC, low-V or high-V, lead-acid/sealed-lead acid batteries/hydrogen fuel cell, etc. and given payload, daily-use, system longevity, environmental effects:
    - mean time between failures/maintenance (MTBF/M)?
    - mean time between battery charge?
  - Synchronization among vehicles
    - Wait to pick up load
    - Not cause congestion
  - Reduced dependence on operators

- 91 Terminology
  - add/harmonize with other F45 document terms

From Aug 2016 meeting at NIST

- 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
  - Many vehicles – possible fit to all areas? Where should it reside?
  - Standards usage guide - Where should it reside?

- *It was not discussed during the meeting where these documents would reside.*

Next F45 Web-Ex meetings

- F45.01 - 3rd Friday/month, 10 AM – 12 Noon   next: 17 Mar
- F45.02 - 2nd Wednesday/month from 2-4 PM   next: 8 Mar
- F45.03 - 3rd Wednesday/month from 11-1 PM   next: 15 Mar
- F45.04 - 1st Wed/month, 1-3 PM   next: ~~1~~ 7 Mar
- F45.91 - 1st Monday/month from 11-1 PM   next: 6 Mar

F45 Main Committee and .01 through .04 Subcommittees

Roger Bostelman, F45 Chairman, F45.91 Chairman

Malcolm Roberts, F45.02 Chairman

Mitchell Weiss, F45.03 Chairman

(Roger covered meetings for F45.01 and F45.04)

Julia Moynihan, ASTM Staff Manager

February 2, 2017

Administrative

<u>Committee Membership:</u>

- F45   51
- F45.01   22
- F45.02   22
- F45.03   22
- F45.04   25
- F45.91   24

<u>Feb 1,2, Norfolk, VA Meeting attendance:</u>

1. Roger Bostelman
2. Mitchell Weiss
3. Malcolm Roberts
4. Bob Holmberg
5. Matt LaFary
6. Mark Hollebeek
7. Adam Norton
8. Chris Merther
9. Ron Brown
10. Ed Rothke
11. Julia Moynihan

Cross-standards

- Roger asked two E54.09 Response Robots committee members (Ann Virts and Kenny Kimble) to please review all F45 documents and provide potentially useful information to F45 with regards to duplication of standards, lessons that can be learned, and any other useful information. Roger met with Ann and Kenny on 1/24/17 to discuss their findings. The following is a brief summary:

  They initially provided a general statement: We're "writing clear standards".

- 01
  - Known frictions of surfaces – Andy Moore, SwRI
  - Dynamic range test – determines when vehicles are blinded – Kam Saidi

- 02
  - Sustained speed test – *E2829 – 11 Standard Test Method for Evaluating Emergency Response Robot Capabilities: Mobility: Maneuvering Tasks: Sustained Speed*

- 03
  - "forest" of obstacles that shrink the path (side-to-side and along path) and force robot to meander through
  - Negative obstacles – rail test; soft material next to path allows footprint of off-path navigation
    - https://drive.google.com/open?id=0B76PMngYDE1dNEFTMmFVWUhwMVk
  - Best configuration - *ASTM WK55681 New Practice for Response Robot Capabilities: Logistics: Identifying and Reporting the Configuration of a Response Robot System*

- 04
  - Communication capabilities (limits of comm) – being done in E54.09

- In addition, Roger passed around paper copies of all E54.09 standards for all participants to review at the meeting.

F45.01 summary

- Ballot returned 67.8%, just shy of necessary 68% vote response required for the document to move forward. As a result, further changes can be made and the document will be reballoted to both the sub and main committees when additional changes are made.
  - Resolved Johannsson's and Hollebeek's negative comments
    - Persuasive: will use unit's from ASTM circular letter ballot – SI (imperial = informative)
    - Persuasive: will remove precision and bias section
  - Will also include Hollebeek's suggestions
    - 255 4.5.4 Air Velocity/Direction: refer to Figure 1 (a and b) for direction – either record the actual measurement or classify them into one of the following as an example:
      - 256   0 mph – (e.g., calm) *(do this for all)*
    - 4.1.6 Spectrum: identify colors and approximate wavelengths (and remove the wavelengths and colors – wavelengths too broad, colors not useful)

- New business – potential document inclusions:
  - Boundaries: Not considered an environmental effect that fits into the current Env Eff practice scope.
  - Documenting boundaries are important to capture, tabled until later.
  - Roger requested additional help from the committee members to provide references to specific environmental effects parameters (e.g., surface roughness, lighting, etc.) and/or test methods to measure these parameters. He passed a sign-up sheet around. Julia will provide the list.

- Adam Norton, UMass-Lowell:
  - showed a video of two sensors (Kinects) pointed at each another (external emission) during a navigation test
  - showed a video of the sensor detecting and the robot avoiding obstacles inserted into the navigation test.

- Ed Rothke, GMI:
  - provided an example of transitions of vehicles moving cold equipment (refrigerators) - carrying cold equipment and condensation from the equipment affecting the floor surface
  - mentioned 'floor resistance' vs. 'static electricity on floors' as a possible environmental effect to add to the document

F45.02 summary

- Reviewed 16-01 ballot
  - F45.02 (16-01) 1 Items Ballot close date 12-13-16
    - Further comment from Bob Holmberg received at the meeting. Many errors with misaligned text and diagrams. Agreed to reject the current document to enable a further ballot with improved structure and cross-referencing.
- New Standard and Reinstatement Work Items (Not Currently on Ballot - i.e., Docking)
  - Key guidance to final document proposed:
    - Test will confirm (or fail) stopping within repeatability area of docking location
    - Docking location area to be based upon location accuracy and separation of fiducial marks
    - Degrees to replace mrads in specification
    - Do not use 'natural' in feature description
    - Improve scope definition to include level floor only.
    - Docking location as 4-dof; x,y,z,heading
    - Consider a 'Usage Guide'.

F45.03 summary

1. No previous minutes to review

2. Reviewed Membership report. 35 voting members, +2 non-voting. More added during after meeting.

3. Reviewed F45.03 initial ballots. No negatives, but numerous comments. Discussion on some of the language and figures and captions. Corrections being made for re-balloting. One negative received.

4. General discussion on next efforts. Top contenders: generalized Grid-Video performance test method, obstacle detector characterization standardization, obstacle avoidance maneuver performance test method.

5. Next video/teleconference meeting, Wednesday, March 15th, 11 am Eastern.

F45.04 summary

- Reviewed document with Weiss suggestions that will appear as negative on ballot:
  - Rework document- Subcommittee ballot has several issues that were not corrected during pre-ballot stage

- Replacement for Irv Lichtenstein as F45.04 Subcommittee Chairman
  - Bob Holmberg, GoogleX, volunteered for this position

- Proposed Next Test Methods
  - Forced GPS interrupts, suggested during the August 2016 meeting, is mentioned in the current 04 document scope as non-inclusive to the document.
  - However, it was suggested that forced GPS or other navigation interrupts be a potential A-UGV integration document topic.

F45.91 summary

Reviewed terminology to consider harmonizing terms within F45.01 through F45.04 documents and suggested that these two terms from within F45.02 will be added to F3200-16:

- Modified during the meeting:
    - **defined areas**, n— space constrained by test method boundaries for ~~navigation areas with limited~~ A-unmanned ground vehicle (A-UGV) ~~clearance.~~ operation
        - ~~3.2.1.1 Discussion—Defined areas of A-UGV navigation have limited clearance for A-UGV traversal or can also have unstructured environments or both. Typical defined areas are cordoned-off vehicle paths whereas unstructured areas change vehicle paths with typical product or equipment flow through facilities.~~

- To be modified during webex meetings:
    - **task**, n—sequence of movements and measurements that comprise one repetition of n repetitions that form a complete test.
        - 3.2.5.1 Discussion—For example, one of the tasks is defined as when the entire A-UGV traverses from the specified start location to the goal location (Points A, B, or C in FIGS 1-4) and back to the end goal (start).
    - <u>Also, the group suggested to define and add these terms to F3200-16:</u>
    - **Trial -**
    - **Test -**
    - **Set -**
    - **Repetition –** one maneuver from start to goal   *(this was an initial suggestion for definition)*

Additional Documents for consideration

- Usage guide for standards developed within F45
- Vehicle configuration practice

Cross F45 standards issues

- Harmonize similar language across all F45 standards where appropriate
- Standardize test forms language – Julia will check with ASTM on policy
  - Initial findings were:
    - test forms included within standards can be replicated
    - Spreadsheet used for test form fill can be used and may be an additional fee for use with a standard. The spreadsheet may reside on the ASTM website.

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Future F45 Web-Ex meetings

Future Bi-Annual (F-to-F) Meetings

- ~~Event Name: June 2017 Committee Week~~
  ~~Dates: Wednesday, June 14th 2017 - Thursday, June 15th 2017~~
  ~~Location: Sheraton Centre Toronto; Toronto, ON CA~~

- Event Name: July 2017 Meeting
  Dates: July 10th week (days to be determined)
  Location: National Institute of Standards and Technology, Gaithersburg, MD US
  - The change was made so that demonstrations can occur as part of the meeting.
  - Also, it was suggested that future summer meetings be held at NIST, UMass-Lowell, or user facilities for the benefit of committee members and December meetings coincide with date and location of ASTM Committee Weeks.

- Event Name: December 2017 Committee Week
  Dates: Wednesday, December 6th 2017 - Thursday, December 7th 2017
  Location: Sheraton New Orleans; New Orleans, LA US

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