Standards
Industrial Vehicles and Exoskeletons

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ASTM Committee F45

National Institute of Standards and Technology (NIST)

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Agenda

Start Time	End Time	Topic	Speaker
9:00	9:20	Welcome/Overview/Introductions	Craig Schlenoff
9:20	9:30	IEEE WG Presentation - IEEE 1872 - CORA	Craig Schlenoff
9:30	9:40	IEEE WG Presentation - IEEE P1872.1 Robot Task Representation	Stephen Balakirsky
9:40	9:50	IEEE WG Presentation - IEEE P1872.2 - Autonomous Robotics	Veera Ragavan
9:50	10:00	IEEE SG Presentation – Verification of Autonomous Systems	Signe Redfield
10:00	10:10	IEEE WG Presentation - IEEE P2751 - 3D Map Data Representation	Francesco Amigoni
10:10	10:20	IEEE Ethics Efforts (P7007)	Edson Prestes
10:20	10:30	IEEE Ethics Efforts (P7008)	Laurence Devillers
10:30	10:40	BREAK	
10:40	10:50	ISO WG1 (Vocabulary and Characteristics)	Soon-Geul Lee
10:50	11:00	ISO WG3 (Industrial Safety)	Roberta Nelson Shea
11:00	11:10	ISO WG4 (Service Robots)	Seungbin Moon
11:10	11:20	ISO WF6 (Modularity)	Gurvinder Virk
11:20	11:40	RIA Efforts in Robot Standards	Carole Franklin
11:40	12:00	ASTM Efforts in Robot Standards	Roger Bostelman
12:00	12:20	OMG Efforts in Robot Standards	Koji Kamei
12:20	12:40	ASME Efforts in Robot Standards	Angel Guzman Rodriguez
12:40	13:40	LUNCH	

Standard Terminology Development

- **How does the group define terminology?**
  - Began with initial set of terms that seemed useful for test method development
  - Always begin with a defined term – in standards, Google, …
  - Now only define and add terms if test methods require them.
- **How do you define the following terms: robot, environment, pose?**

  ASTM F3200 terms
  - **robot cooperation,** n—information and action exchanges between multiple robots to ensure that their motions work effectively together to accomplish the task. ISO 8373
  - **environment map or environment model**, n—map or model that describes an environment with its distinguishable features. ISO 8373

    DISCUSSION—Examples are grid map, geometrical map, topological map, and so forth.
  - **pose**, n—position and orientation
  - *Others in the next slides*
- **How did you determine these definitions?**
  - Began with other standards, etc.
  - Change term/definition to fit standards developed within the committee

ASTM F45 Driverless Automatic Guided Industrial Vehicles

Performance of Automatic through Autonomous - Unmanned Ground Vehicles (A-UGVs)

- Began May 2014; 52 members; 10 countries

- F45.01 Environmental Effects
- F45.02 Docking and Navigation
- F45.03 Object Detection and Protection
- F45.04 Communication and Integration
- F45.90 Executive Subcommittee
- F45.91 Terminology

NIST site on vehicle standards activities (includes F45 and safety standards):

- https://www.nist.gov/el/intelligent-systems-division-73500/unmanned-ground-vehicles-research-and-standard-test-methods

F45 Terms

A-unmanned ground vehicle, A-UGV, n—automatic, automated or autonomous vehicle that operates while in contact with the ground without a human operator.

A-UGV system, A-UGVS, n—A-unmanned ground vehicle and all associated components, equipment, software, and communications necessary to make a fully functional system

ASTM F45 Standards and Work Items

Standards

- ASTM F3200-18 Standard Terminology for Driverless Automatic Guided Industrial Vehicles
- ASTM F3218-17 Standard Practice For Recording Environmental Effects for Utilization with A-UGV Test Methods
- ASTM F3244-17 Standard Test Method For Navigation: Defined Area
- ASTM F3265-17 Test Method for Grid-Video Obstacle Measurement
- ASTM F3327-18 Standard Practice for Recording the A-UGV Configuration

Work Items (in-progress)

- WK54431 - Standard Practice for Implementing Communications Impairments on A-UGV Systems
- WK54662 - Standard Practice for Capturing A-UGV Positions using Grid-Video Techniques
- WK54576 - (modifying ASTM F3218-17) Standard Practice for Recording Environmental Conditions for Utilization with A-UGV Test Methods
- WK57000 - Standard Test Method for Docking Driverless Automatic Guided Industrial Vehicles
- WK60390 - Standard Practice for Describing Stationary Obstacles Utilized within A-UGV Test Methods
- WK65141 - Standard Guide for Combining A-UGV Standards
- WK65139 - Standard Guide for A-UGV Capabilities

ASTM F48 Exoskeletons and Exosuits

Safety and Performance of Exoskeletons

- Began September 2017; 140 members; ? countries

- F48.01 Design and Manufacturing
- F48.02 Human Factors and Ergonomics
- F48.03 Task Performance and Environmental Considerations
- F48.04 Maintenance and Disposal
- F48.05 Security and Information Technology
- F48.90 Executive
- F48.91 Terminology

exoskeleton—wearable device that augments, enables, assists, and/or enhances physical activity through mechanical interaction with the body.

DISCUSSION—An exoskeleton may include rigid or soft components, or both (see exosuit).

ASTM F48 Standards and Work Items

Standards

- F3358-18 Standard Practice for Labeling and Information for Exoskeletons
- F3323-19 Standard Terminology for Exoskeletons and Exosuits (being revised – 39 terms currently balloted)

Work Items

- WK62649 Labeling and Information for Exoskeletons and Exosuits
- WK65346 Safety Considerations in Designing and Selecting Exoskeletons for Industrial, Medical and Military Applications
- WK65347 Utilization of Digital Human Modeling
- WK65587 Assessing System Training
- WK65295 Load Handling When Using an Exoskeleton
- WK65296 Recording Environmental Conditions for Utilization with Exoskeleton Test Methods
- WK67755 Exoskeleton Wearing, Care, and Maintenance Instructions