Designation: ~~F3200 – 17a~~ F3200 – 17b

Standard Terminology for Driverless Automatic Guided Industrial Vehicles[1]

This standard is issued under the fixed designation F3200; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This terminology covers terms associated with unmanned (that is, driverless), ground (that is, land-based and in continuous contact with the ground), industrial vehicles. By providing a common and consistent lexicon, the purpose of this terminology is to facilitate communication between individuals who may be involved in the research, design, deployment, and use of unmanned ground vehicles, including but not limited to, for manufacturing, distribution, security, etc. The terminology covers terms used in performance test methods of automatic guided vehicles (AGVs), autonomous mobile robots, and all other driverless, ground vehicles. In addition, with increasingly intelligent vehicle systems with onboard equipment, robotics industry terms that are used in associated test methods and descriptions are also included.

1.2 For the terminology to be harmonious with the practices in the field, definitions have been drawn from the literature or other public sources when possible. When no definition is available, is similar but requires change for use within standards produced by Committee F45, or in dispute, a consensus-based approach will be used to resolve definitions and add them to the lexicon. The development of this terminology is taking place in close coordination with corresponding efforts in all Committee F45 subcommittees to ensure comprehensive and consistent coverage.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ANSI/ITSDF Standard:*[2]

ANSI/ITSDF B56.5 Safety Standard for Driverless, Automatic Guided Industrial Vehicles and Automated Functions of Manned Industrial Vehicles

2.2 *ISO Standard:*[3]

ISO 8373 Robots and Robotic Devices—Vocabulary

3. Terminology

3.1 *Definitions:*

A-UGV operator, *n*—person responsible for initiating and monitoring vehicle operation.

A-UGV technician, *n*—person(s) responsible for executing the test procedures under supervision of the test supervisor.

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

Ackermann steer, *n*—kinematic configuration for vehicles with pairs of wheels in which the front or rear wheels are pivoted to achieve steering.

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[1] This terminology is under the jurisdiction of ASTM Committee F45 on Driverless Automatic Guided Industrial Vehicles and is the direct responsibility of Subcommittee F45.91 on Terminology.

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[2] Available from Industrial Truck Standards Development Foundation, 1750 K St., NW, Suite 460, Washington, DC 20006, http://www.itsdf.org.

[3] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

DISCUSSION—

The pivot angles of each wheel within the pivoted set are calculated such that each wheel's axle intersects a common point. This common point serves as the instantaneous center of the vehicle's turning circle.

adaptive control, *n*—control scheme whereby the control system parameters are adjusted from conditions detected during the process.

aisle, *n*—in a facility, the passageway between locations where temporary or permanent obstructions may exist.

aisle, guide path clearance, *n*—minimum distance between fixed structures along the vehicle guide path or objects intentionally positioned in a designated area along the vehicle guide path and the rigid parts of the vehicle, the load, and trailers if towed. **ANSI/ITSDF B56.5**

ambient temperature, *n*—temperature of the atmosphere surrounding equipment.

automatic data capture, *n*—identification and direct collection of data into a computer system or other micro-processor-controlled device without using a keyboard (for example, technologies that support the function are: barcode, radio frequency data communication, radio frequency identification, and other emerging technologies).

DISCUSSION—

Other similar terms are *automatic data collection* or *automatic identification*.

axis of motion, *n*—axis along which the vehicle moves in translation or around which the vehicle moves in rotation.

barcode, *n*—system of printed patterns that represent alphanumeric data that are able to be optically read.

barcode reader, *n*—device used to read a barcode.

benchmarking, *v*—measurement process that can be used for comparison against established goals, operating targets, and performance expectations.

braking, *v*—any controlled or emergency means to slow or stop the vehicle. **ANSI/ITSDF B56.5**

bumper, physical, *n*—surface designed to absorb or withstand impact.

collision prevention, *n*—use of sensors to detect the presence of obstacles and, through the use of integrated controls, prevent a collision from occurring; *see also* **obstacle avoidance**.

commissioning, *v*—sequence of actions of setting up and checking the A-UGVS followed by the verification of the A-UGV functions after installation.

configuration, *n*—all hardware, software, and settings needed to operate the A-UGV as specified.

controls and **control system,** *n*—hardware and software required to operate A-UGVs and communicate with the environment (equipment and users); *see also* **integrated systems and controls**.

cycle, *n*—single execution of a task program.

cycle time, *n*—time required to perform the cycle.

defined areas, *n*—space constrained by test method boundaries for A-unmanned ground vehicle (A-UGV) operation.

differential steer, *n*—kinematic configuration for vehicles with two drive wheels in which steering is achieved solely via varying wheel speeds and the wheels are not able to pivot; *see* **skid steer**.

distance accuracy, *n*—difference between a command distance and the attained distance over a set of points.

dock, *n*—target location where the A-UGV interacts with another object.

docking, *v*—arrival and act of stopping at a position relative to another object.

drift, *n*—movement from the designated hold point because of the system's inability to maintain a fixed position.

echo, *n*—time elapsed between signal emission and reception that is used to determine target position in a sensor.

emergency stop, *n*—vehicle stop, not part of normal operation, that requires operator action to restart; also known as E-stop.

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.

exteroceptive sensor or **external state sensor,** *n*—mobile platform sensor intended to measure the state of a vehicle's environment or interaction of the vehicle with its environment.

DISCUSSION—

Examples are global positioning system (GPS), vision sensor, distance sensor, force sensor, tactile sensor, and acoustic sensor.

guidepath, *n*—intended path for an A-UGV used with automatic or automated guidance.

human-machine interaction, *n*—information and action exchanges between human and A-UGV to perform a task by means of a user interface.

integration, *n*—act of combining an A-UGV with other software or hardware, or both.

intended path, *n*—heading of a vehicle at a given instant in time dictated by the control logic, recognizing that the heading is a dynamic property and can change at any instant in time depending on conditions in the operating environment (for example, the decision to allow a vehicle to pass another vehicle or to navigate around an obstacle); *see***path deviation**. **ANSI/ITSDF B56.5**

interlock, *v*,*n*—method to limit or prevent the operation of machine functions under specified conditions.

joystick, *n*—manually controlled input device whose variable positions and orientations or applied forces are measured and result in commands to the vehicle control system.

landmark, *n*—artificial or natural object identifiable on the environment map used for localization of the A-UGV.

layout, *n*—graphical representation of the environment and A-UGV functional space.

load, rated, *n*—load stated by the manufacturer that can be applied to the A-UGV under defined operating conditions.

load-bearing surface, *n*—actual area of material in contact with and supporting a unit load.

local operator, *n*—operator within reach of the vehicle, its control, or safety devices. **ANSI/ITSDF B56.5**

localization, *n*—ability of the A-UGV to determine its pose within an environment map.

main direction of travel, *n*—forward movement of the vehicle, including turns, unless otherwise specified and agreed to by the user and system supplier.

ANSI/ITSDF B56.5

manipulator, *n*—automatically controlled, reprogrammable, multipurpose device, programmable in multiple axes that can be either fixed in place or mobile for use in industrial automation applications.

manual mode, manual control, manual operation, *n*—operating mode in which the complete vehicle is under control of an operator.

manufacturer, *n*—company or organization responsible for the vehicle system to be installed and integrated into the environment where it will be operating.

mapping or **map building** or **map generation,** *n*—constructing the environment map to describe the environment with its geometrical and detectable features, landmarks, and obstacles. **ISO 8373**

master-slave control, *n*—control method in which the motion of a primary device (master) is reproduced on secondary devices (slaves). **ISO 8373**

DISCUSSION—

Master-slave control is typically used for manual control.

maximum force or **maximum thrust,** *n*—force (thrust), excluding any inertial effect, that can be continuously applied by or to the mobile platform without causing any permanent damage to the vehicle.

maximum moment or **maximum torque,** *n*—moment (torque) excluding any inertial effect that can be continuously applied by or to the mobile platform without causing any permanent damage to the vehicle.