



Designation: F3200 – 16

Standard Terminology for Driverless Automatic Guided Industrial Vehicles¹

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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

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

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.

Current edition approved Oct. 15, 2016. Published November 2016. DOI: 10.1520/F3200-16.

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

2.2 ISO Standard:³

ISO 8373 Robots and Robotic Devices—Vocabulary

3. Terminology

3.1 Definitions:

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

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.

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 microprocessor-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*.

barcode reader, *n*—device used to read a barcode; *see A-UGV system*.

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**

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*.

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>.

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.

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

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

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; *see* **A-UGV system**.

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.

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.

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**

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.

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

manual mode, manual control, manual operation, *n*—operating mode in which the complete vehicle is under control of an operator; *see* operator control unit (OCU).

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.

natural features, *n*—features in the environment that were not specifically installed to assist in A-UGV navigation.

navigation, *n*—deciding on and controlling the direction of travel derived from localization and the environment map; *see* **simultaneous localization and mapping (SLAM), localization**.

DISCUSSION—Navigation can include path planning for location-to-location travel and complete area coverage.

non-restricted area, *n*—area in which the A-UGV may operate and is shared with personnel.

normal operating conditions, *n*—range of conditions that can influence vehicle performance (such as electrical supply instability, electromagnetic fields) within which the performance of the vehicle specified by the manufacturer is valid.

DISCUSSION—This could also include environmental conditions, for example, temperature and humidity.

object, *n*—anything in the environment that may or may not be an obstacle.

object detection, *n*—use of sensors to identify the presence of an object.

obstacle, *n*—static or moving object or feature (on ground, wall, or ceiling) that obstructs the intended movement. **ISO 8373**

DISCUSSION—Ground obstacles include steps, holes, uneven terrain, and so forth.

obstacle avoidance, *n*—autonomously avoiding impact with obstacles (for example, stopping, driving around).