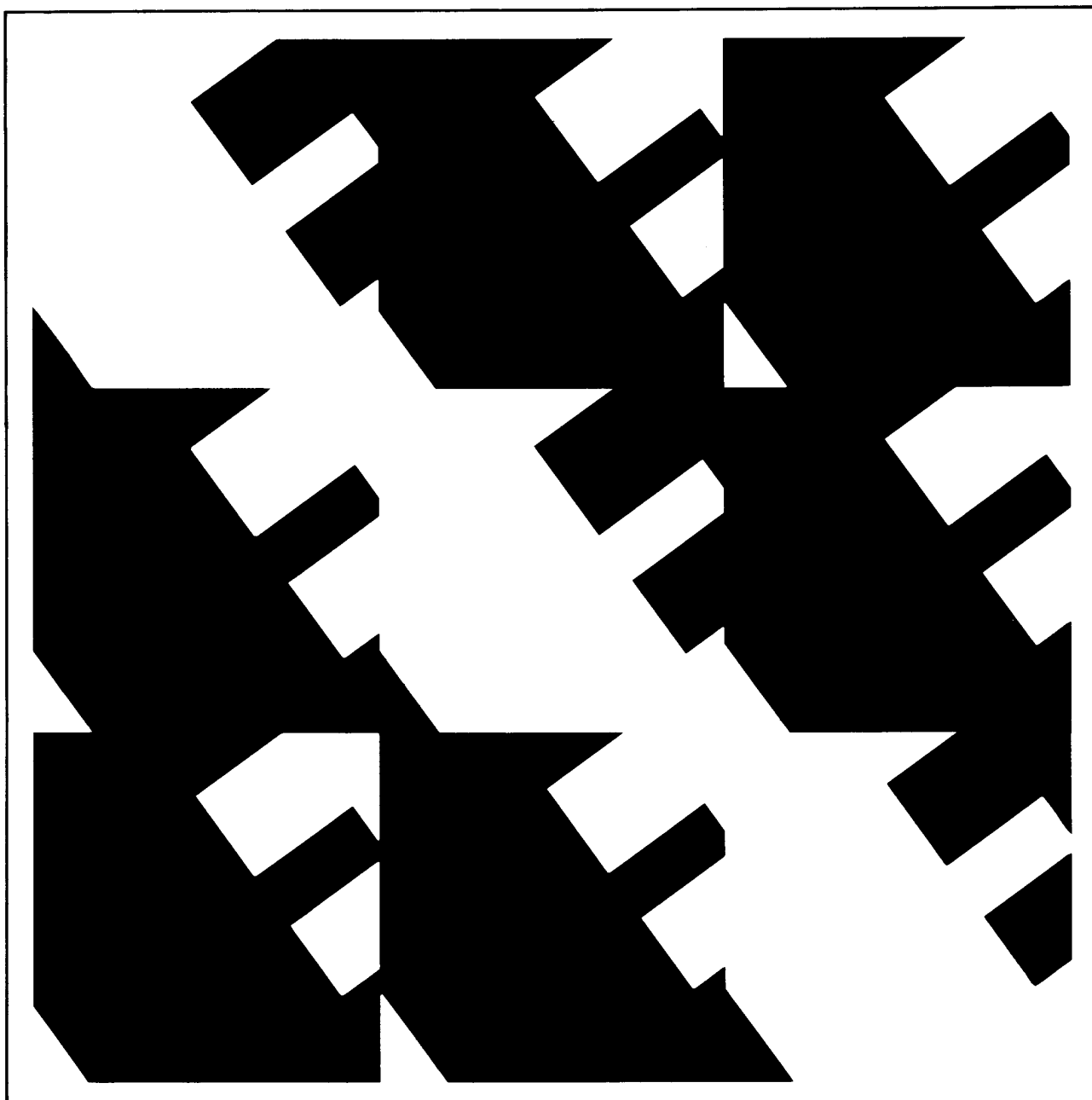


IEEE Standard Definitions of Navigation Aid Terms



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IEEE Standard Definitions of Navigation Aid Terms

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Guidance and Control Systems Panel of the
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Foreword

(This Foreword is not a part of IEEE Std 172-1983, IEEE Standard Definitions of Navigation Aid Terms.)

This standard represents a revision of material contained in the previous edition of IEEE Std 172-1971.

The committee reviewed all of the terms, selected those which it considered appropriate, and deleted others. In preparation for this revision, the committee has included additional definitions relating to marine navigation, updated navigation equipment definitions, and included navigation terms where appropriate for completeness. This revision additionally encompasses suggestions and recommendations from a number of IEEE committees and panels who have contributed to this standard.

This standard was prepared by the Guidance and Control Panel of the IEEE Aerospace and Electronic Systems Society (AES). The following members have contributed to this standard:

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IEEE Standard

Definitions of Navigation Aid Terms

absolute altimeter. A device that measures altitude above local terrain. In its usual form it does this by measuring the time interval between transmission of a signal and the return of its echo, or by measuring the phase difference between the transmitting signal and the echo.

absolute delay (loran). The interval of time between the transmission of a signal from the master station and transmission of the next signal from the slave station.

accelerometer. A device that senses inertial reaction to measure linear or angular acceleration.

NOTE: In its simplest form, an accelerometer consists of a case-mounted spring and mass arrangement where displacement of the mass from its rest position relative to the case is proportional to the total non-gravitational acceleration experienced along the instrument's sensitive axes.

acoustical depth finder. *See:* echo sounder.

active homing guidance. A system of homing guidance wherein both the source of illuminating the target and the receiver for detecting the energy reflected from the target, as a result of illuminating the target, are carried within the vehicle.

ADF. *See:* automatic direction finder.

aerometeorograph. A self-recording instrument for the simultaneous recording of atmospheric pressure, temperature, and humidity.

AEW. Abbreviation for airborne early warning, describing an early-warning radar carried by an airborne or spaceborne vehicle.

aerophase (air operations). A name for a radio beacon.

AFCS. *See:* automatic flight-control system.

aid to navigation. *See:* navigational aid.

air data system. A set of aerodynamic and thermodynamic sensors, and a computer which provide flight parameters such as air speed, static pressure, air temperature, and Mach number.

air-derived navigation data. Data obtained from measurements made at an airborne vehicle.

air navigation. The navigation of aircraft.

airport surface-detection equipment (ASDE). A ground-based radar for observation of the positions of aircraft and other vehicles on the surface of an airport.

airport surveillance radar (ASR). A medium range (for example, 60 nmi) surveillance radar used to control aircraft in the vicinity of an airport.

airposition indicator (API). An airborne computing system which presents a continuous indication of the aircraft's position on the basis of aircraft heading, air speed, and elapsed time.

air-route surveillance radar (ARSR). A long range (for example, 200 nmi) surveillance radar used to control aircraft on airways beyond the coverage of airport surveillance radar (ASR).

air speed. The rate of motion of a vehicle relative to the air mass.

air-speed indicator. An instrument for measuring air speed.

Alford loop. A multi-element antenna, having approximately equal amplitude currents which are in phase and uniformly distributed along each of its peripheral elements, producing a substantially circular radiation pattern in the plan of polarization (originally developed as a four-element horizontally polarized VHF loop antenna).

alignment (inertial navigation equipment). The orientation of the measuring axes of the inertial components with respect to the coordinate system in which the equipment is used.

NOTE: Inertial alignment refers to the result of either the process of bringing the measuring axis into a desired orientation or the computation of the angles between the measuring axis and the desired orientation with respect to the coordinate system in which the equipment is used. The initial alignment can be accomplished by the use of non-inertial sensors. *See also:* gyrocompass alignment and transfer alignment.

almanac. A periodic publication of astronomical data useful to a navigator.

altimeter. An instrument which determines the height of an object with respect to a fixed level, such as sea level. There are two common types: an aneroid, or barometric altimeter, and the radio, or radar altimeter.

altitude. (1) Angular distance above the horizon — the arc of a vertical circle between the horizon and a point on the celestial sphere. (2) Vertical distance above a given datum.

ambiguity (navigation). The condition obtained when navigation coordinates define more than one point, direction, line of position or surface of position.

anemometer. An instrument for measuring the speed of wind.

aneroid altimeter. *See:* barometric altimeter.

angle of attack. The angle between the mean chord or the wing and the line of flow of the air past the aircraft.

angle of climb. The angle between a climbing aircraft's flight path and the horizontal.

angle of cut (navigation). The angle at which two lines of position intersect. Also called **crossing angle**.

angle of descent. The angle between a descending aircraft's flight path and the horizontal.

angular deviation sensitivity. The ratio of change of course indication to the change of angular displacement from the course line.

angular width. *See:* course width.

A-N radio range. A radio range providing four radial lines of position identified aurally as a continuous tone resulting from the interleaving of equal amplitude A and N International Morse Code letters. The sense of deviation

from these lines is indicated by deterioration of the steady tone into audible A or N code signals.

antenna effect (radio direction finding). The presence of output signals having no directional information and caused by the directional array acting as simple nondirectional antenna; the effect is manifested by angular displacement of the nulls, or a broadening of the nulls.

apogee. That orbital point farthest from the earth, when the earth is the center of attraction.

apparent altitude. That sextant altitude corrected for reading and reference level inaccuracies.

apparent bearing (direction finding). A bearing from a direction-finder site to a target transmitter determined by averaging the readings made on a calibrated direction-finder test standard; the apparent bearing is then used in the calibration and adjustment of other direction finders at the same site.

apparent horizon. Visible horizon.

apparent vertical. The direction of the vector sum of the gravitational and all other accelerations.

approach navigation. Navigation during the time that the approach to a dock, runway, or other terminal facility is of immediate importance.

approach path. That portion of the flight path between the point at which the descent for landing is normally started and the point at which the aircraft touches down on the runway.

artificial horizon. (1) A device for indicating the horizontal, as bubble, gyroscope, pendulum, or the flat surface of a liquid. (2) A gyroscopic flight instrument that shows the pitching and banking attitudes of a vehicle with respect to a reference line horizon. Also called **gyro horizon**.

assumed position. A point at which a craft is assumed to be located.

astern. Bearing approximately 180° relative.

astrocompass. An instrument which, when oriented to the horizontal and the celestial sphere, indicates horizontal reference direction relative

to the earth. It is used to obtain true heading by reference to celestial bodies.

astro-inertial navigation equipment. *See:* celestial-inertial navigation equipment.

astronomical position. (1) A point on the earth where coordinates have been determined as a result of the observation of celestial bodies. (2) A point on the earth defined in terms of astronomical latitude and longitude.

astrotracker. An automatic sextant which has the ability to sight on and track selected stars throughout the day and night, providing heading and position data. The tracker may be optical or radiometric. Also known as **star tracker**.

A-trace (loran). The first (upper) trace on the scope display.

attitude. The position of a body as determined by the inclination of the axes to some frame of reference.

attitude control. Devices or system that automatically regulates and corrects attitude.

attitude-effect error (navigation). A manifestation of polarization error; an error in indicated bearing that is dependent upon the attitude of the vehicle with respect to the direction of signal propagation. *See:* heading effect error.

attitude and heading-reference system (AHRS). *See:* heading and attitude reference.

aural radio range. *See:* A-N radio range.

automatic chart-line follower. A device which automatically derives error signals proportional to the deviation of the position of a vehicle from a predetermined course line drawn on a chart.

automatic direction finder. A direction finder which automatically and continuously provides a measure of the direction of arrival of the received signal. Data are usually displayed visually.

automatic flight control system (AFCS). An autopilot or automatic pilot. A system that controls the attitude, direction, and speed of a vehicle and directs it to travel along a selected course in response to manual or electronic commands. Stabilizes the dynamic response of the vehicle.

automatic track-follower. *See:* automatic chart-line follower.

automatic tracking. Tracking in which a system employs some feedback mechanisms, such as a servo or computer, to follow automatically some characteristic of a signal or target such as range, angle, Doppler frequency, or phase. *See also:* tracking, tracking radar.

autonavigator. Navigation equipment which includes means for coupling the output navigational data derived from the navigation sensors to the control system of the vehicle.

autopilot. *See:* automatic flight control system.

autopilot coupler (navigation). The means used to link the navigation system-receiver output to the automatic pilot.

azimuth. (1) The direction of a celestial point from a terrestrial point, expressed as the angle in the horizontal plane between a reference line and the horizontal projection of the line joining the two points.

NOTE: True North is usually but not always implied where no reference direction is stated.

(2) The angle between horizontal reference direction and the horizontal of the direction of bore-sight of the antenna.

(3) Bearing.

azimuth marks (markers). Calibration marks for azimuth.

back course (ILS). The course which is located on the opposite side of the localizer from the runway.

bank (navigation). Lateral inclination of an aircraft in flight. *See:* list.

barometric altimeter. Essentially an aneroid barometer, an instrument which determines atmospheric pressure and is graduated in feet above sea level.

barothermograph. An instrument which automatically records pressure and temperature.

baseline (navigation). The line joining the two points between which electrical phase or time is compared in determining navigation coordinates. For two ground stations, this is normally the great circle joining the two stations, and, in the case of a rotation collector system, it is the line joining the two sides of the collector.

baseline delay. The time interval needed for a signal from a loran master station to travel to the slave station.

basic repetition frequency (loran). The lowest pulse repetition frequency of each of the several sets of closely-spaced repetition frequencies employed.

basic repetition rate. *See:* **basic repetition frequency.**

bathythermograph. A recording thermometer for determining the temperature of the sea at various depths.

BDHI (bearing distance heading indicator). A display device which presents continuous references as to course and distance to destination.

beacon. (1) A fixed aid to navigation. (2) An unlighted aid to navigation. (3) Anything serving as a signal or conspicuous indication, either for guidance or warning. (4) In radar, a transponder used for replying to interrogations from a radar. *See:* **Examples.**

Examples of Beacons:

fan-marker beacon. A beacon that transmits vertical beam-horizontal cross section in the shape of a double convex lense.

homing beacon. A beacon that provides homing guidance.

identification beacon. A beacon that transmits coded signals to identify a geographic position.

landing beacon. A beacon used to guide aircraft in landing.

lighted beacon. A beacon that transmits signals by light waves (for example, light house).

marker or marker beacon. A radio beacon to designate a small area.

marker-radio beacon. A beacon that indicates specific location.

racon. *See:* **racon.**

radar beacon. *See:* **radar beacon.**

radio beacon. A beacon that transmits signals by only electromagnetic energy.

z-marker beacon. A vertical beam — horizontal cross section in the shape of a circle.

beam error (navigational systems using directionally propagated signals). The lateral or angular difference between the mean direction

of the actual course and the desired course direction.

NOTE: Sometimes called **course error.**

beam noise (navigational systems using directionally propagated signals). Extraneous disturbances tending to interfere with ideal system performance.

NOTE: Beam noise is the aggregate effect of bends, scalloping, roughness, etc.

bearing. (1) The horizontal direction of one terrestrial point from another, expressed as the angle in the horizontal plane between a reference line and the horizontal projection of the line joining two points. (2) **Azimuth.** A bearing is often designated as **true**, **magnetic**, **compass**, **grid**, or **relative** and is dependent upon the reference direction.

bearing error curve. (1) (**DF equipment**). A plot of the instrumental bearing errors versus either indicated or correct bearing. (2) (in **DF installations**). A plot of the combined instrumental bearing error (of the equipment) and site error versus indicated bearings.

bearing offset, indicated (DF installations). The mean different between the indicated and apparent bearings of a number of signal sources, the sources being, for the most part, uniformly distributed in azimuth.

bearing reciprocal. *See:* **reciprocal bearing.**

bearing sensitivity, DF. The minimum field-strength input to a direction-finder system to obtain repeatable bearings within the bearing accuracy of the system.

bend. A departure of the course line from the desired direction at such a rate that it can be followed by the vehicle.

bend amplitude (navigation). The measured maximum amount of course deviation due to bend; measurement is made from the nominal or bend-free position of the course.

bend frequency (navigation). The frequency at which the course-indicator oscillates when the vehicle track is straight and the course contains bends; bend frequency is a function of the vehicle velocity.

bend-reduction factor (navigation). The ratio of bend amplitude existing before the introduction of bend-reducing features to that existing afterward.

binnacle. The stand in which a compass is mounted (marine navigation).

binocular. An optical instrument for use with both eyes simultaneously.

blinking (pulse systems). A method of providing information by modifying the signal at its source so that the signal presentation on the display at the receiver alternately appears and disappears, for example, in **loran**, blinking is used to indicate that the signals of a pair of stations are out of synchronization.

blip. A deflection, or a spot of contrasting luminescence on a radar display caused by the presence of a target.

blur (null-type DF systems). The output (including noise) at the bearing of minimum response expressed as a percentage of the output at the bearing of maximum response.

boresighting. The process of aligning or determining the angle of the electrical or mechanical axes of a navigation system to a set of vehicle reference axes. Usually accomplished by an optical procedure.

boundary marker (ILS). A radio-transmitting station near the approach end of the landing runway, which provides a fix on the localizer course.

B-trace (loran). The second (lower) trace on the scope display.

buoy. A floating object, other than a lightship, moored or anchored to the bottom of the sea, which is an aid to navigation.

Examples of Buoys:

buoys classified to location: channel, mid-channel, turning, fairway, bifurcation, junction, sea.

combination buoy. A buoy that has more than one means of conveying intelligence.

danger or hazard buoy. Classified as: obstruction, wreck, telegraph, cable, fish net, dredging.

lighted buoy. A buoy with a light that has characteristics for detection and identification.

radio-beacon buoy. A buoy equipped with a marker-radio beacon.

sonobuoy. A buoy that automatically transmits a signal when triggered by an underwater-sound signal.

sound buoy. A buoy equipped with a characteristic sound signal.

CADF. *See:* commutated-antenna direction finder.

calibration marks. Indications superimposed on a display to provide a numerical scale of the parameters displayed.

carrier-controlled approach system (CCA). An aircraft-carrier radar system providing information by which aircraft approaches may be directed by way of radio communication.

CCA. *See:* carrier-controlled approach system.

ceilometer. An instrument for measuring the height of clouds.

celestial-inertial navigation equipment. An equipment employing both celestial and inertial sensors. Also **astro-inertial navigation equipment** and **stellar-inertial navigation equipment**.

celestial fix. A position fix established by observation of celestial bodies.

celestial navigation. Navigation with the aid of celestial bodies. Applied principally to the measurement of the attitudes of a celestial body.

centerline. The locus of the points equidistant from two reference points or lines, as the perpendicular bisector of the baseline of a hyperbolic system of navigation, such as **loran**.

CEP. *See:* circular probable error.

chain. A network of similar stations operating as a group for determination of position or for furnishing navigational information.

challenge. To cause an interrogator to transmit a signal which puts a transponder into operation.

chart. A map intended primarily for navigation use.

chart-comparison unit. A device for the simultaneous viewing of a navigational chart in such a manner that one appears superimposed upon the other.

check point. *See:* way point.