PNT Terms & Definitions

accuracy

Source C

The accuracy of an estimated or measured position of a craft (vehicle, aircraft, or vessel) at a given time is the degree of conformance of that position with the true position, velocity and/or time of the craft. Since accuracy is a statistical measure of performance, a statement of navigation system accuracy is meaningless unless it includes a statement of the uncertainty in position that applies.

atypical error

Source A

The accuracy of an estimated or measured position of a craft (vehicle, aircraft, or vessel) at a given time is the degree of conformance of that position with the true position, velocity and/or time of the craft. Since accuracy is a statistical measure of performance, a statement of navigation system accuracy is meaningless unless it includes a statement of the uncertainty in position that applies.

alternative PNT service

Source B

A PNT service that has the capability to operate completely independent of, or in conjunction with, other PNT services. Multiple, varied PNT services used in combination may provide enhanced security, resilience, assurance, accuracy, availability, and integrity. An alternative PNT service allows a user to transition from the primary source of PNT signals in the event of a disruption or manipulation.

augmentation

Source B

Any system that provides users of PNT signals with additional information that enables users to obtain enhanced performance when compared to the un-augmented signals from a primary PNT service alone. These improvements include improved accuracy, availability, integrity, and reliability, and independent integrity monitoring and alerting capabilities for critical applications. Augmentation systems inherently rely on a primary PNT service to operate.

availability

Source C

The availability of a navigation system is the percentage of time that the services of the system are usable by the navigator. Availability is an indication of the ability of the system to provide usable service within the specified coverage area. Signal availability is the percentage of time that navigation signals transmitted from external sources are available for use. It is a function of both the physical characteristics of the environment and the technical capabilities of the transmitter facilities.

common mode

Source A

Common mode threat/failure refers to the case in which two or more PNT UE systems (or PNT sources), while appearing independent, in fact have a common dependence that makes them susceptible (vulnerable) to the same threat or failure.

compatible

Source B

The ability of multiple, independent PNT services and their augmentations to be used separately or in combination with each other without interfering with any individual service, and without adversely affecting the United States and allied military employment of PNT, commonly referred to as Navigation Warfare.

component

Source A

A part or element of a larger PNT UE system with well-defined inputs and outputs and a specific function. Examples may include individual PNT sources or subsystems of PNT sources, discrete software functions that implement resilient PNT processing algorithms, or hardware modules providing a supporting function internal to the PNT UE system.

compromised PNT source

Source A

A PNT source that generates untrustworthy PNT solutions. The source may contain corrupt data or contamination of the normal data processing and storage capabilities. Note that untrustworthy does not always mean the current solution is incorrect.

continuity

Source C

The continuity of a system is the ability of the total system (comprising all elements necessary to maintain craft position within the defined area) to perform its function without interruption during the intended operation. More specifically, continuity is the probability that the specified system performance will be maintained for the duration of a phase of operation, presuming that the system was available at the beginning of that phase of operation.

ephemeris

Source A

Parameters relating to the position and trajectory of satellite vehicles.

integrity

Source C

The measure of the trust that can be placed in the correctness of the information supplied by a navigation system. Integrity includes the ability of the system to provide timely warnings to users when the system should not be used for navigation.

interoperable *Source B*

The ability of multiple, independent PNT services and their augmentations to be used together to provide better capabilities at the user level than would be achieved by relying solely on a single service or signal.

navigation message *Source A*

A message included in GNSS signals that provides all the information needed to calculate the PNT solution with the signal measurements.

navigation warfare or **NAVWAR** *Source B*

The deliberate defensive and offensive action to assure and prevent positioning, navigation, and timing information through coordinated employment of space, cyberspace, and electronic warfare. Desired effects are generated through the coordinated employment of components within information operations, space operations, and cyberspace operations, including electronic warfare, offensive and defensive space operations, and computer network operations.

observables *Source A*

Measured quantities or calculated values used during the internal signal processing of a system that, when exposed on an interface, could contribute to demonstrating and/or verifying resiliency level claims.

PNT assurance *Source A*

A process to quantify the confidence that PNT information has integrity, which can be used to establish a level of trust.

PNT resilience *Source A*

From PPD-21 [2]: *"… the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents."*

PNT resilience concepts *Source A*

Behavior models that describe how to impede attacks and minimize performance degradation due to threats and disruptions in a PNT UE system.

PNT resilience technique *Source A*

A specific method for implementing a particular aspect of PNT resilience.

PNT resilience technique categories *Source A*

Groupings of PNT resilience techniques using a common strategy for implementing resilient behaviors.

PNT service *Source B*

Any system, network, or capability that provides a reference to calculate or augment the calculation of longitude, latitude, altitude, or transmission of time or frequency data, or any combination thereof.

PNT solution *Source A*

The full navigation solution provided by a PNT UE system or PNT source, including time, position, velocity, and/or navigation information. A PNT UE system or source may provide a full PNT solution or a part of it.

PNT source *Source A*

A PNT UE system component that produces a PNT solution. Examples include GNSS receivers, local clocks, inertial measurement units (IMUs), and/or timing services provided over a wired or wireless connection.

PNT state information *Source A*

PNT solution information as well as any other types of observables collected from PNT sources, such as power measurements, internal raw signal observables, and data messages. Different types of PNT sources have different types of PNT state information. For a GNSS receiver, the PNT state information includes the pseudorange and other GNSS signal observables as well as information from the navigation message.

PNT UE system *Source A*

The components, processes, and parameters that collectively produce the final PNT solution for the user.

primary PNT service

Source B

An independent PNT service chosen by a user or system operator as the preferred source of PNT information. A primary PNT service is expected to provide sufficient accuracy, availability, integrity, or other characteristics important to the user.

proper working state

Source A

A condition in which the device or system contains no compromised internal components and data fields (e.g., data stored to memory), and from which the device or system can recognize and process valid input signals and output valid PNT solutions. An initial pre- deployment configuration is a basic example. The accuracy of the immediate PNT solution is not specified in this definition, as it will depend on the specifics of the device or system's performance and the degradation allowed by different resilience levels.

The detection, characterization, and geolocation of threats that may jeopardize the accurate or uninterrupted delivery of PNT solutions to the user.

resilience

Source A

The ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions, such as deliberate attacks, accidents, or naturally occurring threats or incidents.

resilience technique

Source A

A specific method for implementing a characteristic of resilience.

threat agnostic

Source A

An approach to resilience that does not prescribe a specific threat to overcome. Threat- agnostic system architectures should respond to a broad range of existing threats and be capable of withstanding emerging threats not yet imagined.

trustworthiness

Source A

The degree to which an element can reasonably be relied on to have integrity.

typical error

Source A

An error within the operating bounds of the user equipment.

user equipment *Source A*

Equipment that outputs PNT solutions, including PNT systems of systems, integrated PNT receivers, and PNT source components (such as GNSS chipsets).

ACRONYMS

AGC	Automatic Gain Control
AOA	Angle of Arrival
APM	Absolute Power Monitor
CAF	Cross-Ambiguity Function
CCD	Clock Consistency Divergence
CF	Conformance Framework
CI	Critical Infrastructure
CISA	Cybersecurity and Infrastructure Security Agency
C/N0	Carrier to Noise Density
DHS	Department of Homeland Security
DME	Distance Measuring Equipment
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
I/Q	In-phase/Quadrature
IMU	Inertial Measurement Unit
INS	Inertial Navigation System
LEO	Low Earth Orbit
OSNMA	Open Service Navigation Message Authentication
NMA	Navigation Message Authentication
PNT	Positioning, Navigation, and Timing
PPD	Presidential Policy Directive
PVT	Position, Velocity, and Time
RA	Reference Architecture

RAIM	Receiver Autonomous Integrity Monitoring
RF	Radio Frequency
RPM	Received Power Monitor
RVPS	Real-time Validation for Plug-and-play Sensors
SA	Situational Awareness
SAARM	Sensor-Agnostic All-source Residual Monitoring
SDR	Software Defined Radio
SQM	Signal Quality Monitor
S&T	Science and Technology
SV	Space Vehicle
TESLA	Timed Efficient Stream Loss-Tolerant Authentication
UAV	Unmanned Aereal Vehicle
UE	User Equipment
VHF	Very High Frequency (30-300 Megahertz)
VORs	VHF Omni−directional Ranges

Sources:

A. U.S. Department of Homeland Security, “Resilient Positioning, Navigation, and Timing Reference Architecture, Vol 1” issued by DHS June, 2022: https://www.dhs.gov/sites/default/files/2022-06/22_0609_st_resilient_pnt_ra.pdf

B. Space Policy Directive 7, The United States Space-Based Positioning, Navigation, and Timing Policy: https://trumpwhitehouse.archives.gov/presidential-actions/memorandum-space-policy-directive-7/

C. European Space Agency’s Navipedia: https://gssc.esa.int/navipedia/index.php/GNSS_Performances