



**KATS**  
Korean Agency for  
Technology and Standards

# ISO Open Consultation on Positioning, Navigation and Timing (PNT) Services

2025-04-01 & 02  
Participants Briefing

# Housekeeping

- You are **muted** until Q&A.
- Session is **recorded**.
- Please change your name to *Your Name (Your NSB)*.
- Ask questions using the **chat** option.
- To speak, **raise your virtual hand** using the option under “reactions”.

# Agenda

- 01** Introduction to ISO Open Consultation  
Sarah Parker/Valeriia Grekova
- 02** Introduction to Positioning, Navigation and Timing services  
KATS/thought leaders (YJ Moon / Jinsil Lee)
- 03** Next steps and schedule  
KATS (Sanghern Seo)
- 04** Q&A  
ISO/KATS/thought leaders

# Introduction to ISO Open Consultation

ISO/CS (Sarah Parker / Valeriia Grekova)



# Welcome to ISO Open Consultation

What is it and why is it needed?

Discovering and tapping into stakeholder expectations of standardization at a global level.

Showcasing the benefits of standards and aligning with stakeholder expectations

ISO Open Consultation is an excellent opportunity to showcase standardization and the benefits of standards to a wider audience, to understand global expectations from standardization before investing in the standardization process.

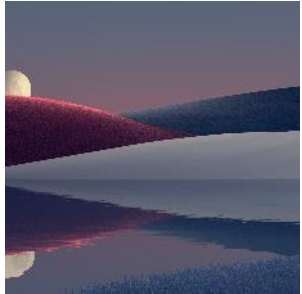
Shaping ISO's engagement in emergent topics

ISO Open Consultation is a member-driven means of empowering the ISO community to prioritize topics for consideration by Council; you can help shape ideas and opinions into strategic, tangible actions, and help to optimize the position of ISO in these topics.



# Open Consultation

## What will be the Output?



### Landscape and drivers of change

Scope and dependencies, global perspective, relative importance, legal / regulatory, technological, social, ecological



### Standardization landscape

Presence / absence of national and international standards, coordination & cohesion of international standards



### Expectations of standardization

Consolidation of the value proposition of standards in the Council-endorsed field, including inter alia testing, quality, safety, interoperability



### Stakeholder representation and key players

Government, business, academia, civil society



### Consolidated user stories

Summary of key actors, interactions and desired outcomes that could be supported with standards in the Council-endorsed field



### Recommendations for ISO action

**CSC/SP:** strategic partnerships, projects

**TMB:** technical committee structure, ISO/IEC Directives, new work items

# Modes of participation: experts *and* ISO Members



## Direct expert participation

- Inputs and comments provided to KATS
- Workshop attendance on your own behalf (not representing a national position)
- The process is open to as many people as possible



## Member-driven participation – minimal coordination

- NSB informed of national experts engaged
- Comments and inputs sent directly *or* through NSB without extensive consolidation



## Member-driven participation – national consultation

- Consultation/workshop on a national level for consolidated input (e.g. DIN conducts workshops or series of “breakfasts with experts” to refine national positions)

# Introduction to Positioning, Navigation and Timing (PNT) Services

Thought Leaders (Young-Jun (YJ) Moon / Jinsil Lee)



# Thought Leaders



**Prof. Young-Jun (YJ) MOON (Chair)**

**Korea Advanced Institute of Science  
and Technology (KAIST)**



**Dr. Jinsil LEE (Co-chair)**

**Korea Aerospace Research Institute  
(KARI)**

# Definition of PNT

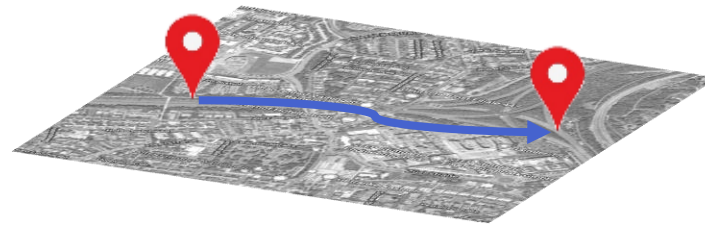
## Positioning



*“Where am I?”*

The ability to accurately and precisely determine one’s location and orientation referenced to a standard geodetic system

## Navigation



*“How should I get there?”*

The ability to identify current and target positions and adjust course, orientation, and speed to reach any desired location

## Timing



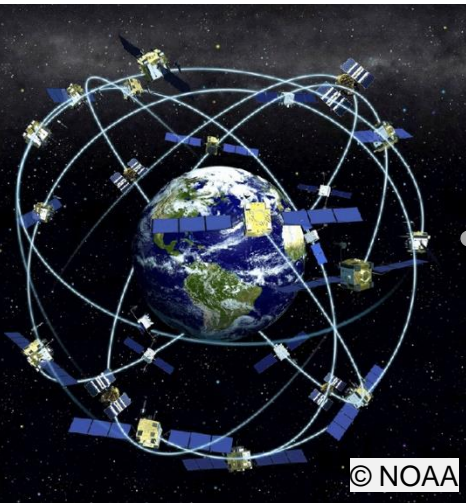
*“What time is it exactly?”*

The ability to acquire and maintain accurate and precise time from a standard (Coordinated Universal Time, or UTC) anywhere in the world

# Worldwide GNSS development for PNT services

Global Navigation Satellite System

GPS (The united states)



Galileo (Europe)



Beidou (China)



NavIC (India)



KPS (South Korea)



QZSS (Japan)



GLONASS (Russia)



# PNT Services Needs and Motivations

- 10 billion moving objects in the globe, including people, animals, goods, transportation means, etc.
- PNT services for



Infrastructure



Consumer solutions



Road and Automotive



Aviation and drones



Urban Development



Rail



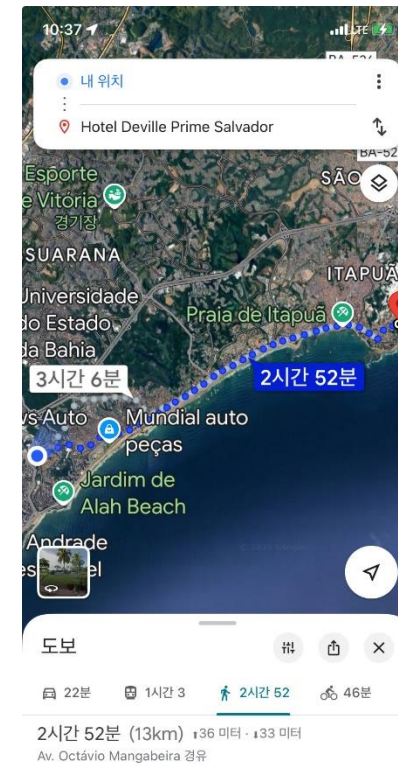
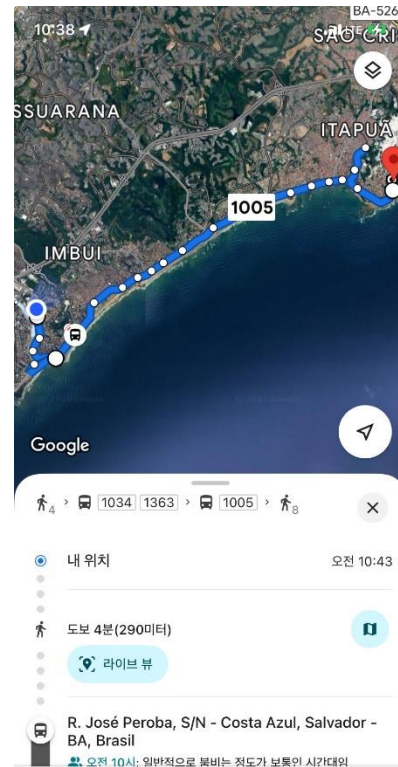
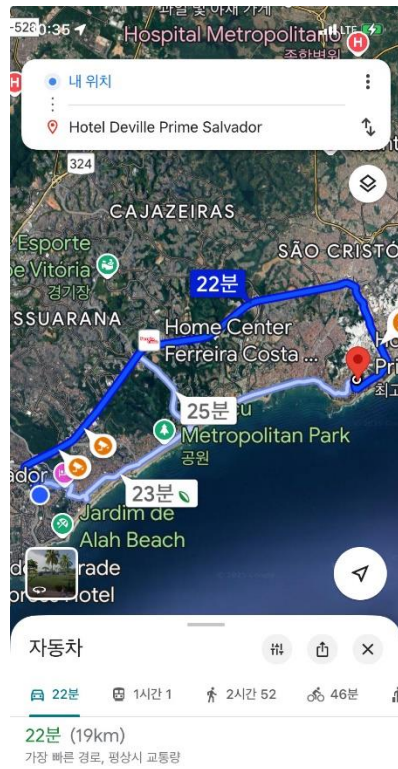
Maritime and Inland Waterways



Climate and Environment

# PNT Services Needs and Motivations

- Existing PNT Services for moving records by driving, walking, bicycling, etc.
  - ✓ By GNSS with digitalization and mobile communication technologies



# PNT Services Needs and Motivations

- **PNT Records with respect to Time**

- ✓ By second, minute, hour, day, week, month, year, ..., life time

- **PNT Records with respect to Positioning**

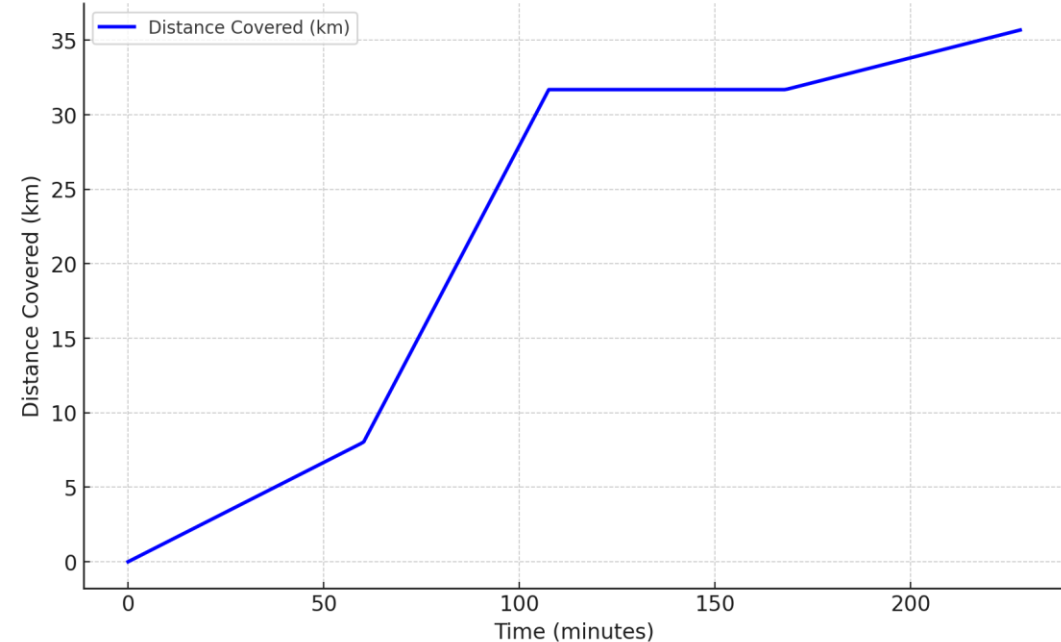
- ✓ By meter, km, town/village, city, county, province/state, nation, continent
- ✓ Example: personal resident registration (in Korea) by address (town/village & city)

# PNT Services Needs and Motivations

## ■ PNT Records by Navigation

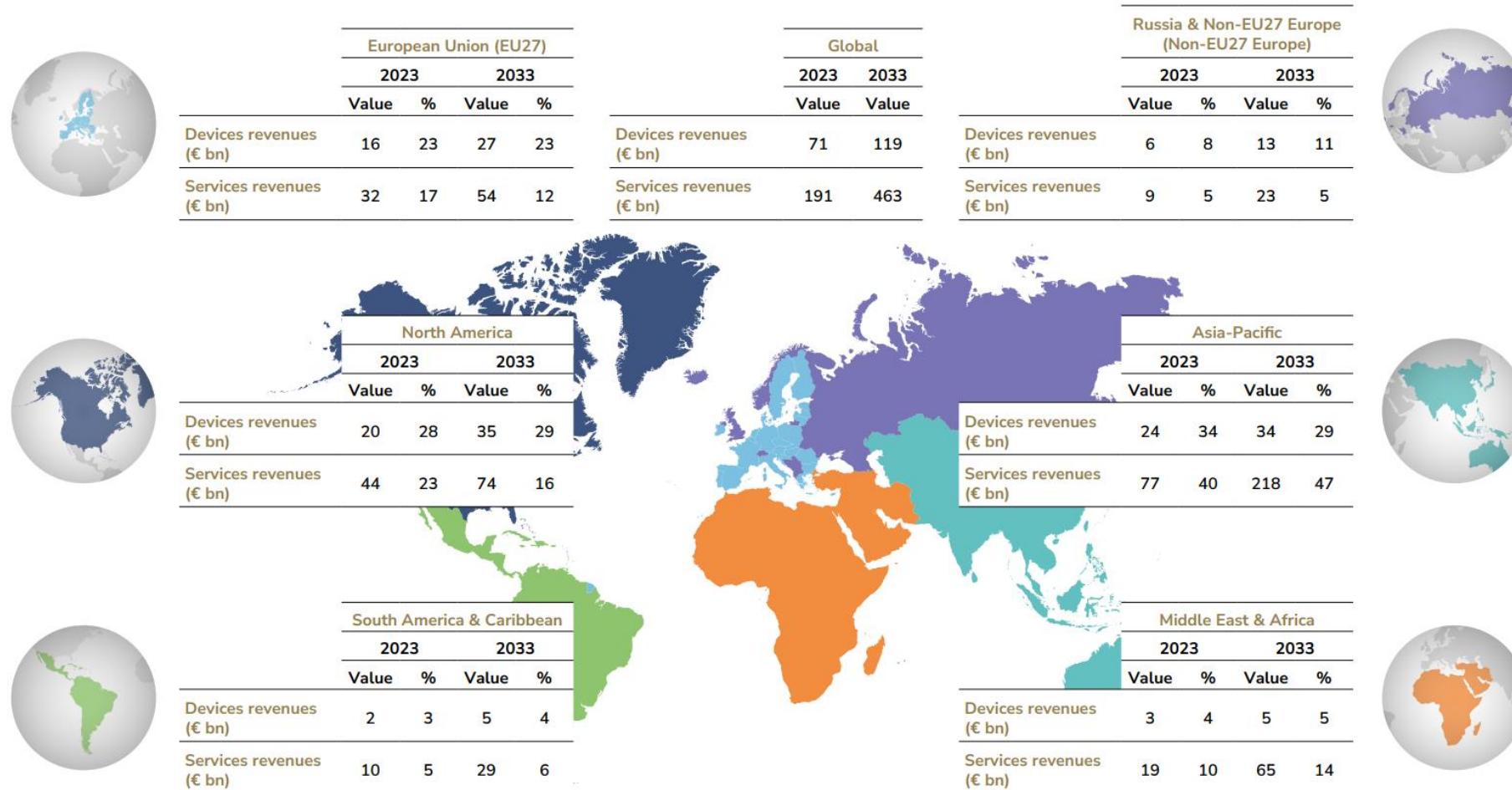
- ✓ Horizontal and/or vertical trajectory w.r.t time and positioning
  - time-distance domain
  - time-space diagram
- ✓ Analyzing and certifying
  - Being safe and/or sustainable (climate neutral) during its movements

Time-Space Diagram: Groom's Journey on Wedding Day (Jogging, Driving, Walking)



# PNT demand – Worldwide trend (2024)

## GNSS demand world map

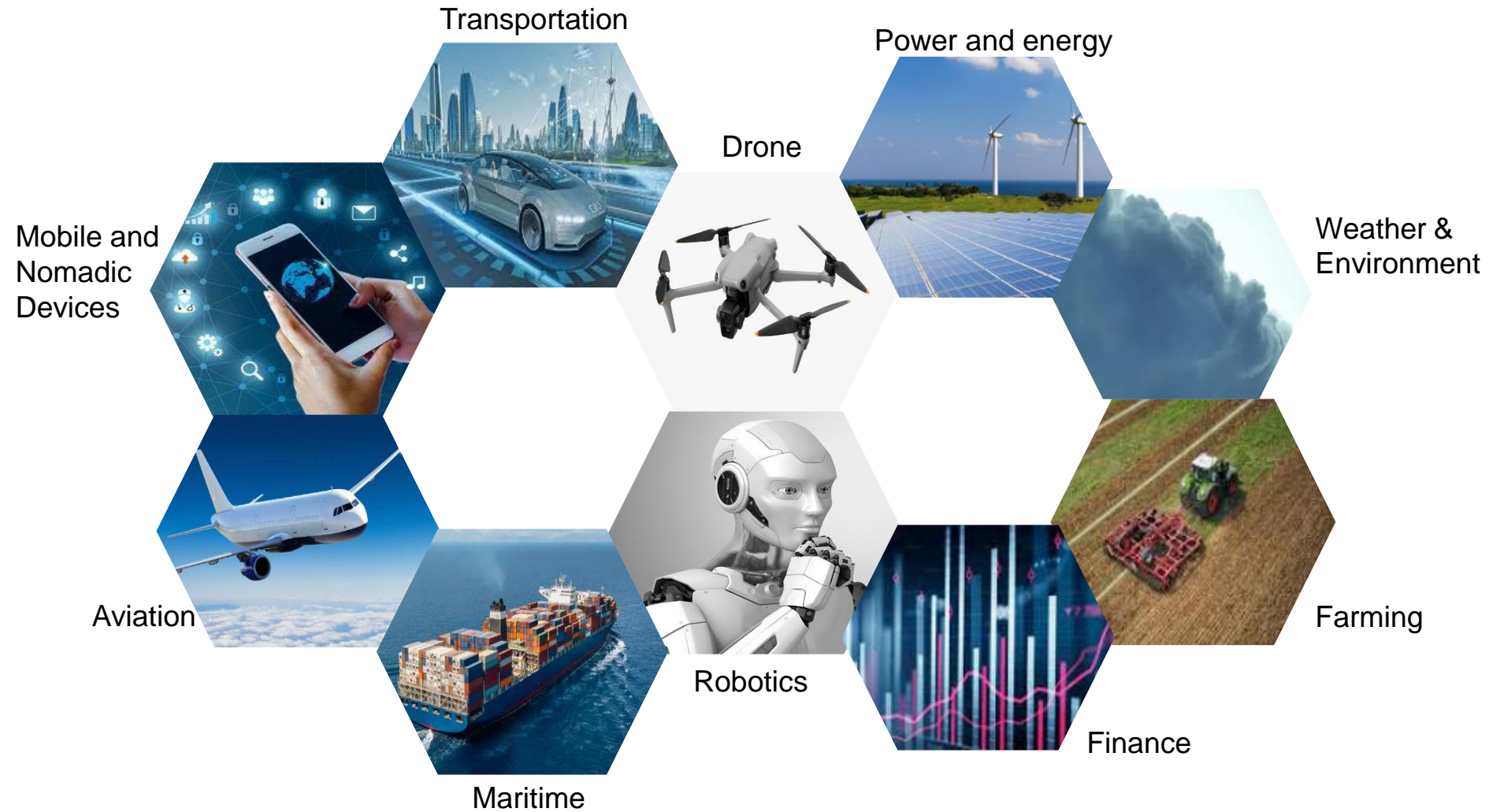


The global demand for PNT will continue to grow:

- Global **PNT device** revenues will grow from 71 billion euros in 2023 to **119 billion euros by 2033**
- Global **PNT service** revenues will grow from 191 billion Euros in 2023 to **463 billion euros by 2033**



# PNT Services Applicable Industries

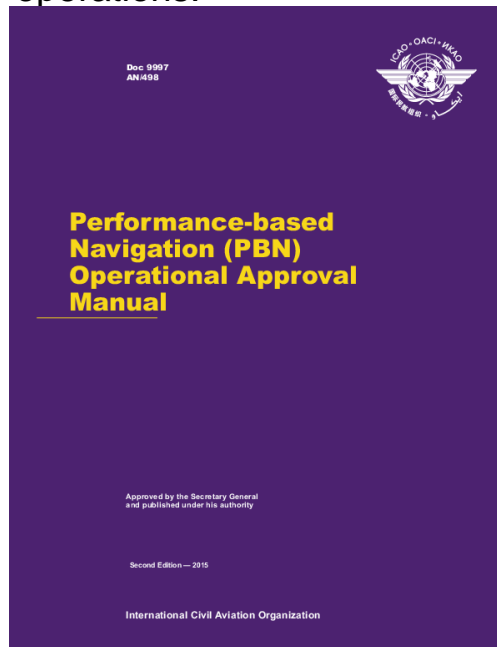


# PNT Services in Aviation

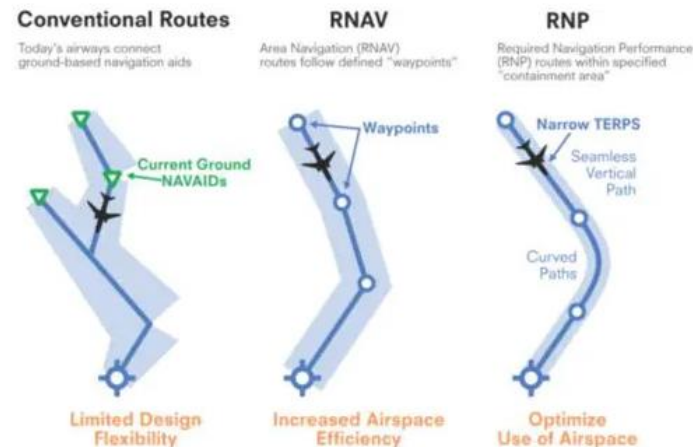
## A representative example of existing PNT services

### Performance-based Navigation (PBN)

PBN aims to ensure the global standardization of navigation specifications for aviation. The ICAO PBN manual defines navigation performance requirements in terms of accuracy, integrity, availability, continuity, and functionality for each operations.



PBN manual © ICAO



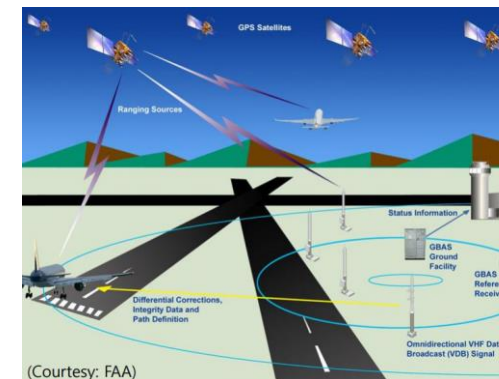
PBN concept © IALTA

### GNSS augmentation systems for aviation

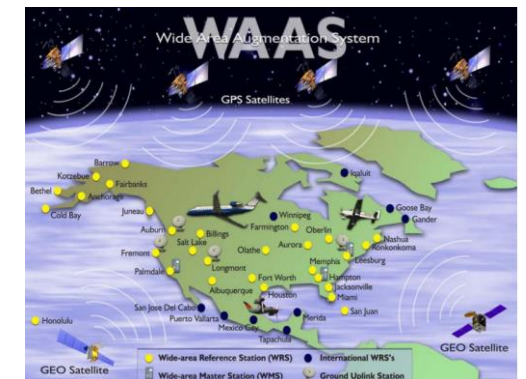
GBAS\* and SBAS\* are GNSS augmentation systems designed to meet stringent, pre-defined navigation performance requirements, including accuracy, integrity, continuity, and availability for safety-critical aviation applications.

\*GBAS: Ground based augmentation systems

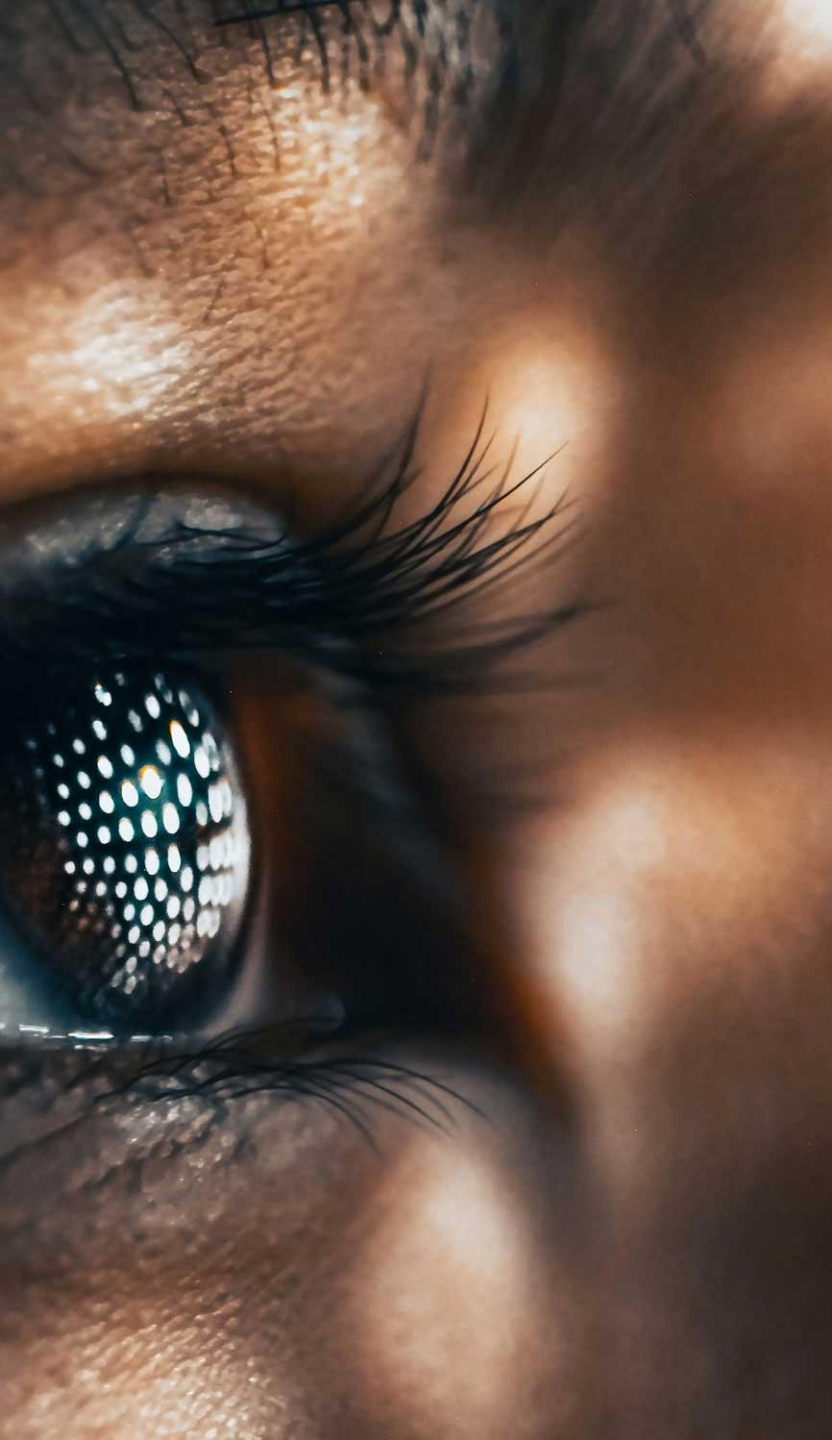
\*SBAS: Satellite based augmentation systems



GBAS © FAA



SBAS © FAA



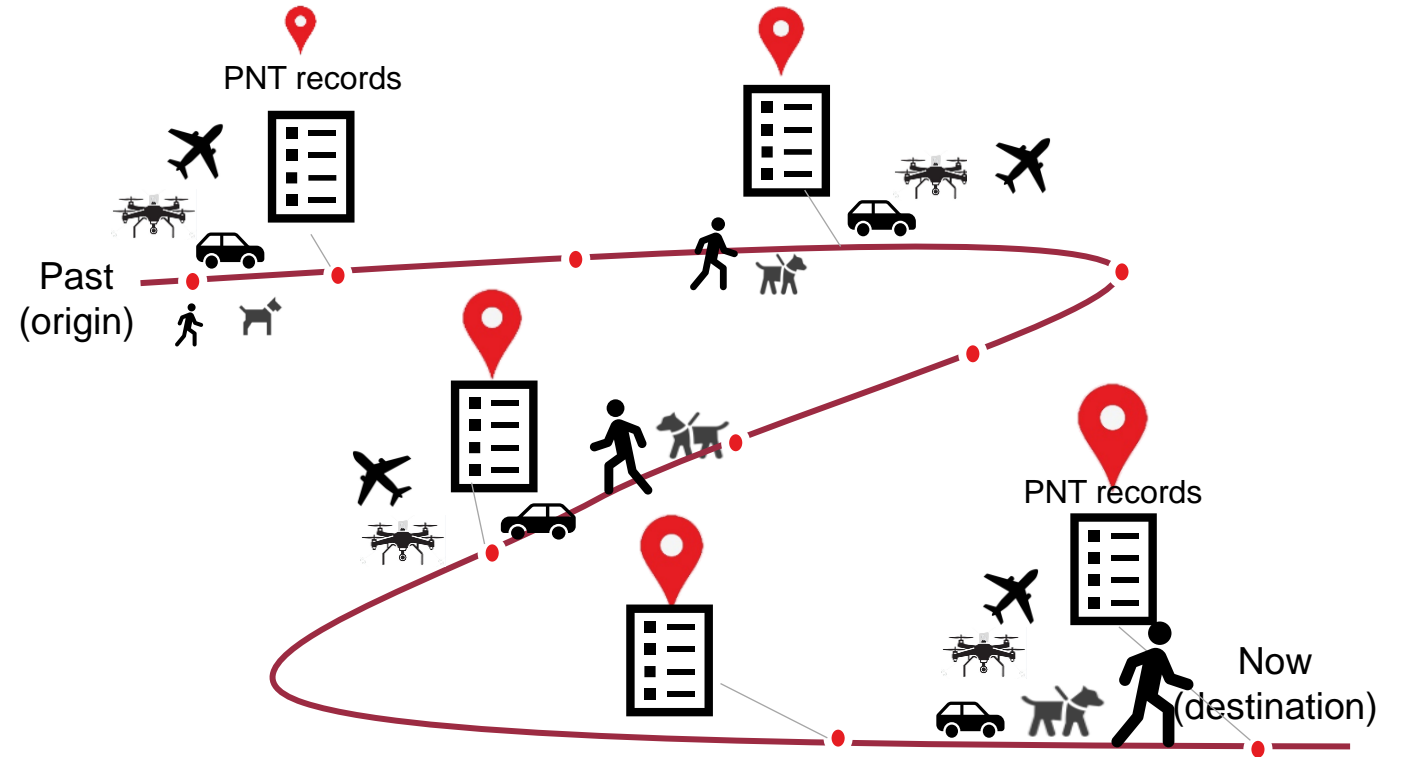
**PNT Services** are key drivers for recording and monitoring the moving objects' trajectory be safe and environmentally sustainable

- ✓ to make lives easier, safer and better
- ✓ to save the planet by energy consumption and CO2 emissions

# PNT Services for All Moving Objects

## Monitoring the trajectory

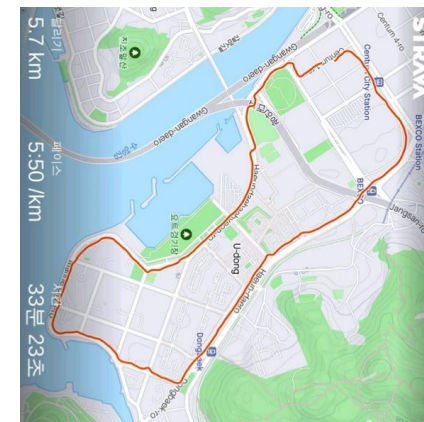
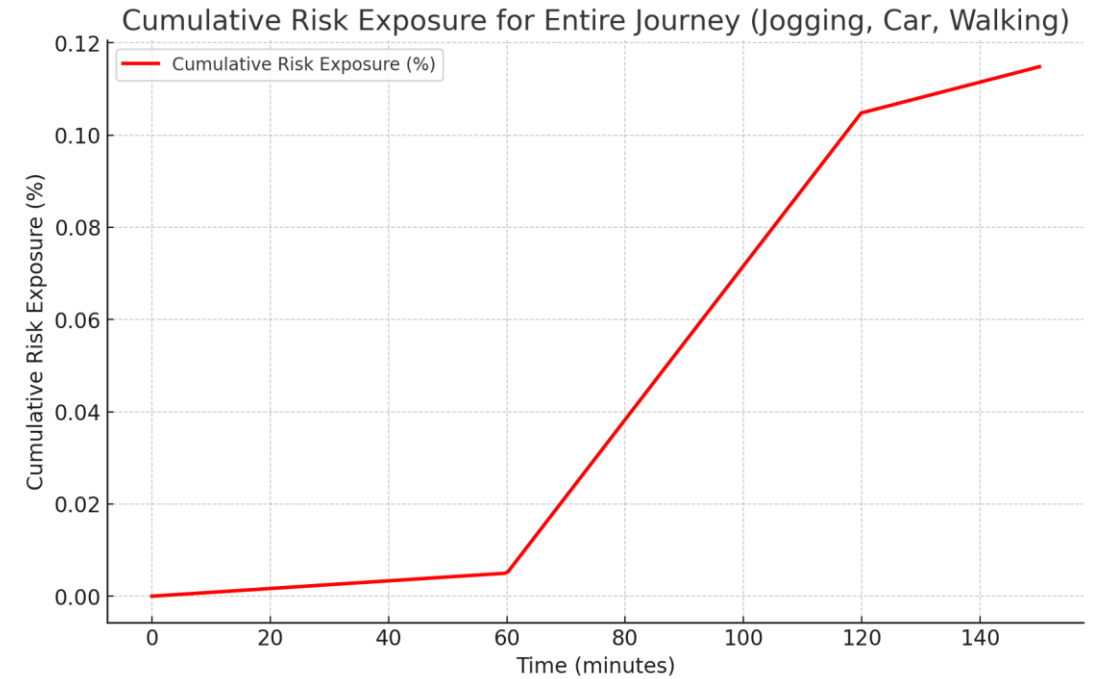
for ensuring they are safe, efficient and environmentally sustainable during the process of staying and moving from the origin (birth) to destination (death)



# PNT Services for All Moving Objects

## Certification of PNT records

including life records (living things), aging records (non-living things), mobile (moving) records (by walking, driving, flying, delivering, etc.), biography, traces/vestiges, evidences, alibi, eco-records (mileage, CO2 footprint), etc.



# PNT Service Requirements

## Accuracy

Measure of PNT output deviation from truth

## Integrity

Ability of a service to provide timely warnings when the system should not be used for service

## Continuity

Likelihood that the PNT service supports accuracy and integrity requirements for duration of intended operation

## Availability

Fraction of time PNT service is usable (as determined by compliance with accuracy, integrity, and continuity requirements)

# PNT Service Levels (Service Accuracy)



# PNT Services Standardization

## Digital PNT records by location with respect to timing

Living things (human being, animal, livestock, pet, etc.): From birth to death in their lifetime (or from origins to destinations while moving in a certain amount of time)

Non-living things (transport means, goods, infrastructure and facilities, etc.): From birth (the time of being manufactured/constructed) to death (to be disused/junked/demolished) in their lifecycle

## PNT Service Levels

Location accuracy:

centimeter(feet)/meter/decameter/  
hectometer/km(mile)

Timing accuracy:

millisecond/second/minute/hour/day/  
week/month/year

Navigation interval: real-time or  
non-real-time

## PNT Service Requirements

Accuracy, integrity, continuity,  
availability, applicability,  
maintainability

Resistance to interface: privacy  
and cybersecurity

Independence: user equipment  
and ground infrastructure



# In ISO Open Consultation - PNT Services are focused

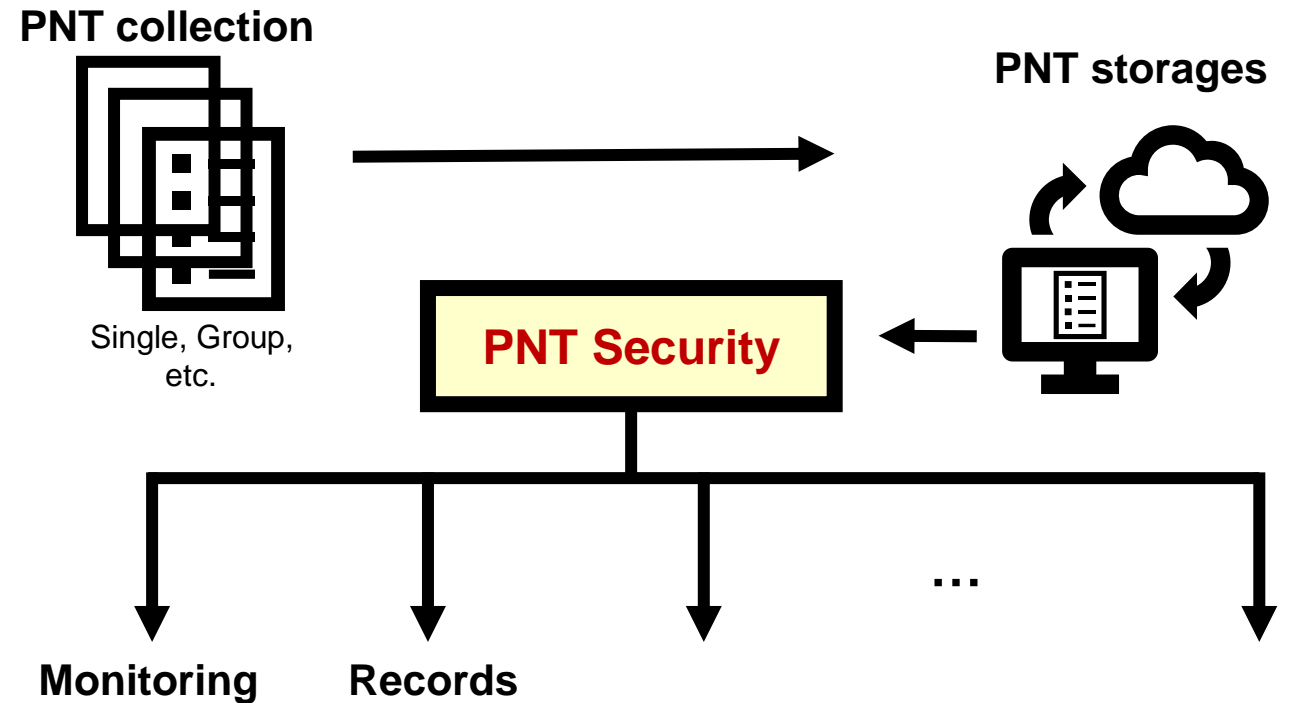
## ➤ For all moving objects in globe

- Approx. 10 billion units targeting for 2030
  - ✓ 7.5 billion people + 2.5 billion vehicle (car, airplane, drone, train, vessel, motorcycle, etc.)
- To be extended to 20 billion units targeting for 2040
  - ✓ Including people, vehicle, robot, special material, livestock, etc.

# In ISO Open Consultation - PNT Services are focused

## PNT based management systems

Public and commercial services in all global industries with PNT information in the birth and death process of specific objects, by private sectors, public organizations, and/or governments in local, regional, national, and global



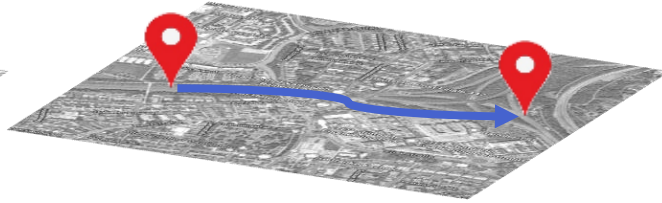
*Various applications of PNT data*

# In ISO Open Consultation - PNT Services are focused

Positioning



Navigation



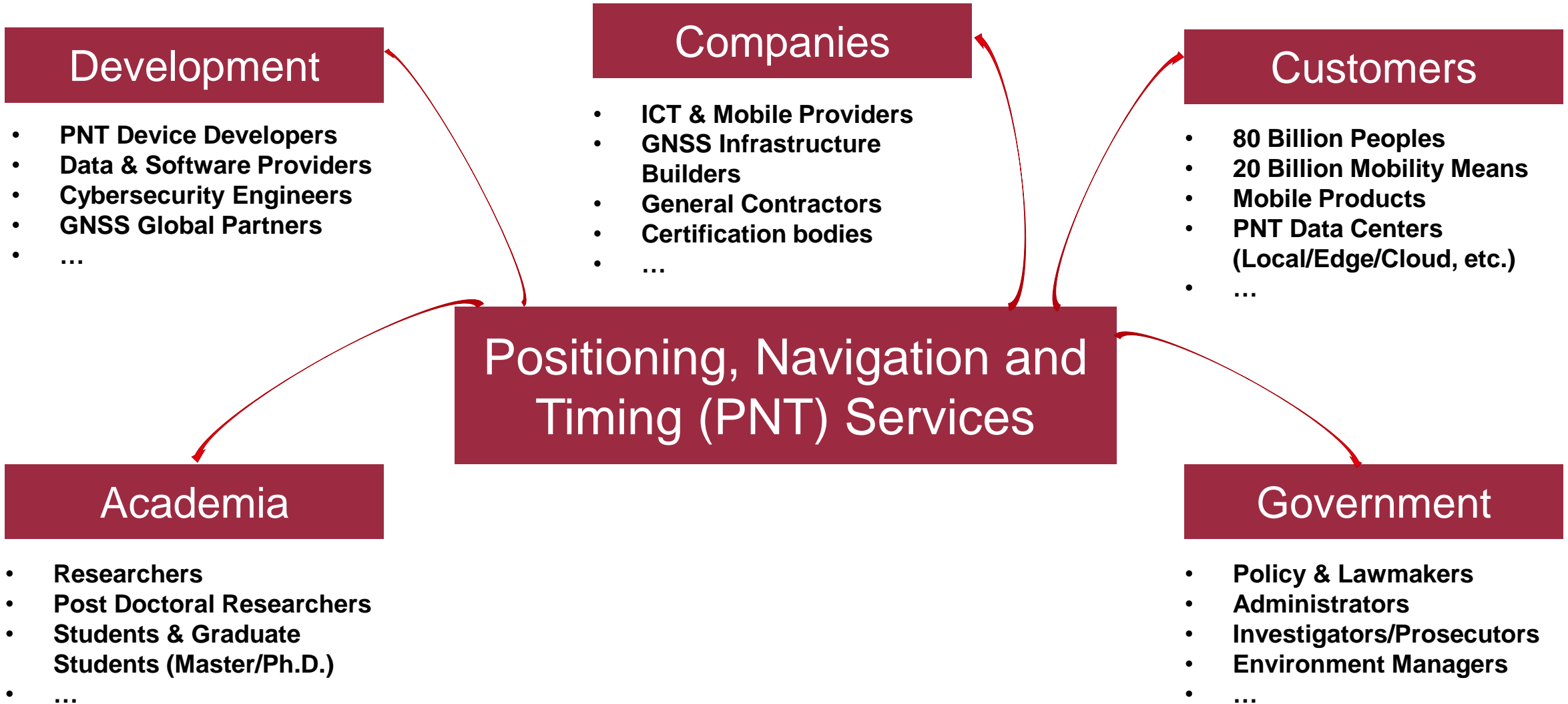
Timing



## ➤ Our goal is

- to collect and understand requirements and needs of stakeholders regarding standards and norms with respect to **PNT Services**
- to consolidate the requirements and needs in order to recommend actions towards ISO

# Relevant Stakeholders



# User Stories- PNT Services

- As a farmer, I would like to use precise PNT service so that I can optimize planting, irrigation, and harvesting for better crop yield and resource efficiency.
- As a drone operator, I would like to access accurate PNT service to ensure safe and efficient flight paths for surveying and delivery services.
- As a environmental scientist, I would like to use precise PNT service to track wildlife movements and monitor environmental changes to support conservation efforts .
- As a tourist, I would like to use precise PNT service to navigate unfamiliar cities and find points of interest easily.
- As an emergency manager, I would like to use precise PNT service to locate disaster sites quickly and coordinate rescue operations effectively.
- As a civil engineer, I would like to use precise PNT service to plan and construct infrastructure projects with greater accuracy.

# User Stories- PNT Services

- As a developer, I want to develop PNT services systems, that includes hardware, software, and infrastructure in order to not only provide PNT services to customers but to accumulate and analyze the PNT records for some specific purposes by customers on demand.
- As a company/enterprise, I want my products to meet PNT services targets (e.g. wearable/mobile or on-board PNT devices and landside units installed in infrastructure).
- As a consumer, I want transparency (PNT services) including life records (living things), aging records (non-living things), mobile (moving) records, biography, traces/vestiges, evidences, alibi, eco-records (mileage, CO2 footprint), etc.
- As a government/environmental ministry, I would like to create appropriate laws and regulations for PNT services to make lives easier, safer and better and to save the planet by energy consumption and CO2 emissions.
- Environmental scientist, I would like to have reliable PNT data for recording and monitoring the moving objects' trajectory.

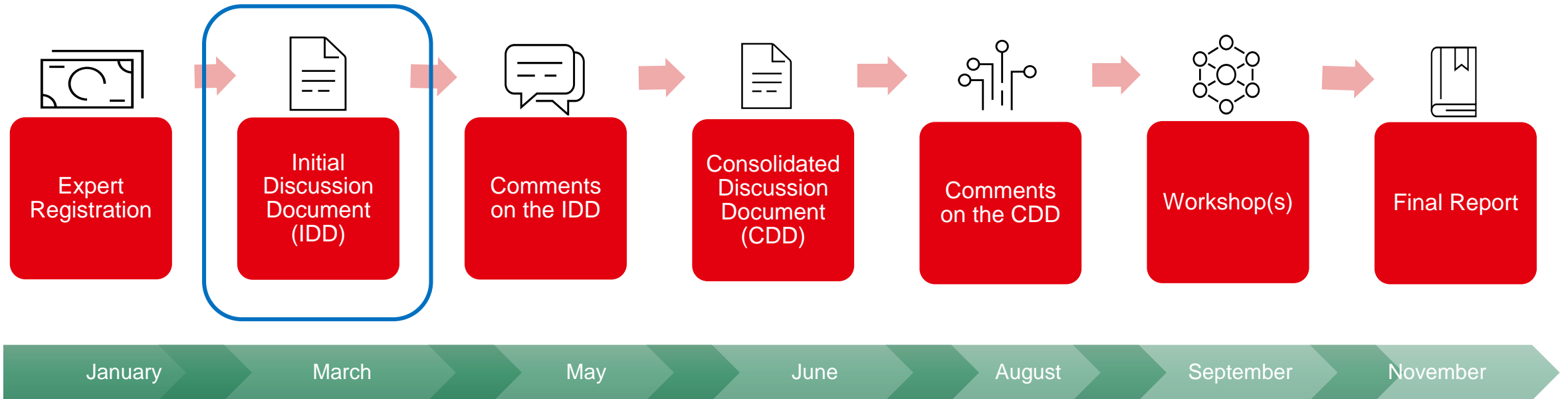
# Introduction to next steps and schedules

KATS (Sanghern SEO)



# Open Consultation

## Timeline





# Schedule (preliminary)

Event	Date	Aim
Members briefing	21 <sup>st</sup> January 2025 9:00-11:00 CET	Introduction to ISO Open Consultation and the topic
Call for participation	21 <sup>st</sup> January – 25 <sup>th</sup> March 2025	Call for NSBs to join and to reach out to their stakeholders
Initial Discussion Document (IDD)	By 25 <sup>th</sup> March 2025	Circulation of IDD, which will form the basis of the discussions on the topic
Comments on the IDD	25 <sup>th</sup> March – 25 <sup>th</sup> June 2025	Experts submitting inputs – via the NSBs if structured national consultations take place, or directly to KATS
Consolidated Discussion Document (CDD)	By 27 <sup>th</sup> June 2025	Circulation of CDD, which will incorporate inputs from the previous stage
Comments on the CDD	27 <sup>rd</sup> June – 28 <sup>th</sup> August 2025	Receive inputs on CDD in advance of workshop
Workshop(s)*	September 2025 (TBA)	Exchange ideas and prioritize recommendations for ISO (exact format and agenda to be determined)
Report of the outcomes	by 8 <sup>th</sup> November 2025	Final report to be prepared for Council submission

# Experts participation - PNT Services

- Participation of all stakeholder groups is encouraged
- Knowledge of standardization is helpful but not required
- Participants are expected to:
  - ✓ have domain-specific knowledge
  - ✓ read and comment on the IDD
  - ✓ read and comment on the CDD
  - ✓ contribute their expertise through participation in workshop(s)
  - ✓ comment on draft report and recommendations to ISO (*comment phase only for registered participants*)

# Initial Discussion Document (IDD)

- First step towards the final report and recommendations
- Covers scope, drivers, (standardization) landscape, players, user stories [recommendations to be written last based on all the inputs]
- Includes **questions to guide your input and comments**
- Will be followed by a 2<sup>nd</sup> iteration – Consolidated Discussion Document (CDD) – that will integrate this first round of inputs



Version 1  
25 March 2025

## INITIAL DISCUSSION DOCUMENT ON POSITIONING, NAVIGATION AND TIMING (PNT) SERVICES

**Council 29/2024:** Using the proposal document as a base, the Open Consultation team will draft the initial discussion document. This document will be largely reflective of the Council-approved proposal, complemented by inputs from the full Open Consultation team.

### Introduction

The positioning, navigation and timing (PNT) services provided by Global Navigation Satellite System (GNSS) which refers to any satellite constellation are a largely invisible system used for the benefits of humans and nature, technology and infrastructure, arts and industries, including peoples with nomadic and mobile devices, all modes of transportation, communications infrastructure, the electrical power grid, precision agriculture, weather forecasting, and emergency response. PNT services which are a largely invisible utility for human and nature, technology and infrastructure, and arts and industries, including peoples with nomadic and mobile devices, all modes of transportation, communications infrastructure, the electrical power grid, precision agriculture, weather forecasting, and emergency response.

In order for all moving objects globally (approx. 10 billion units including peoples, transportation means, etc.) to be essential to modern life, enabling a wide array of applications that improve safety, efficiency, and economic performance, the expectations from the PNT services are growing. Recently, PNT services for all moving objects in the globe can yield several benefits in their entire birth and death process during not only life times of the living things, i.e. human beings but also life cycles of the non-living things, i.e. any kind of industrial products. However, it is an area that has not yet been considered in detail in standardization, which has encouraged KATS (Korea Agency for Technology and Standards) to address the topic of PNT services.

To address these challenges, KATS is launching an ISO Open Consultation, a new mechanism designed to explore an emerging topic with a broad range of stakeholders, and to document and consolidate global stakeholder expectations into an analytical report with recommendations for ISO action. While the aim is not to reach consensus and develop a standard, its goal to develop a roadmap for the standardization of emerging topics. With this ISO Open Consultation on PNT services, KATS aims to reach a broad range of stakeholders including PNT service professionals in leadership roles, as well as practitioners such as product owners, requirements engineers, and developers. Additionally, it is intended for a broader group of stakeholders, including representatives from academia, government bodies (digital departments), administration, and procurement. Through international workshop(s), we will identify key challenges and opportunities and develop an overview of the current standardization landscape. Additionally, we will explore stakeholder expectations, define user stories, and draft strategic and technical recommendations to ISO on how to approach the topic most effectively.

➤ **Please read the document and submit your inputs and contributions**

## Landscape and drivers of change

### TOPIC: Positioning, Navigation and Timing (PNT) Services

Global Navigation Satellite System (GNSS) refers to any satellite constellation that provides global positioning, navigation and timing (PNT) services. There are currently four GNSS constellations in operation or in deployment phase: GPS (USA), GLONASS (Russia), BeiDou (China) and Galileo (Europe). These are complemented by several regional GNSS which is called RNSS, including QZSS (Japan), NavIC (India) in operation, and KPS (Republic of Korea) in development phase. PNT and GNSS are acronyms that often seem to be used interchangeably when talking about satellite positioning and navigation.



Positioning, Navigation, and Timing (PNT) services encompass three key capabilities: ([Ref: What is Positioning, Navigation and Timing \(PNT\)? - US Department of Transportation](#))

- Positioning: This capability enables the precise determination of location and orientation, typically referenced to a standard geodetic system such as the World Geodetic System 1984 (WGS84). This precision is crucial for applications ranging from mapping and surveying to navigation for all types of mobility systems.
- Navigation: This involves determining both current and target positions, whether relative or absolute. It requires adjusting direction, orientation, and speed to reach a specified destination, covering environments from underwater to the surface and extending from the surface to outer space.
- Timing: This involves acquiring and maintaining accurate and precise time from a standard, such as Coordinated Universal Time (UTC), anywhere globally. It is essential for synchronization in communications, financial transactions, and power grid operations, where timing discrepancies can lead to significant issues.

According to [EUSPA EO and GNSS Market Report](#) global revenues from GNSS and Earth Observation (EO) stood at approximately €260 billion and €3.4 billion, respectively, as of 2023. By 2033 GNSS global revenues are expected to reach €580 billion, with services enabled by GNSS (or PNT) devices generating more than 80% of total GNSS revenues. Furthermore, global GNSS shipments will hit 2 billion units per year by 2027, GNSS (or PNT) devices forecasted to reach nearly 9 billion by 2033. The market for the devices, expected to grow from around €70 billion in 2023 to almost €120 billion in 2033, will progressively become more mature in the long term, while the added-value service market will experience rapid growth thanks to continuous innovation: revenues are foreseen to soar from around €190 billion in 2023 to more than €460 billion in 2033.

The markets to be strongly influenced by PNT applications may include the follows:

- Agriculture, Fisheries and Aquaculture, Forestry
- Climate, Environment, and Biodiversity
- Emergency Management and Humanitarian Aid
- Energy and Raw Materials, Infrastructure
- Urban Development and Cultural Heritage

# Initial Discussion Document (IDD) distribution

- The document will be sent after the briefing to the email addresses provided in the registration form
- The document will be made accessible via [KATS website](#) (navigate to the section “*What’s new – ISO Open Consultation*”)
- For those who have an ISO Global Directory account, the document will be made accessible via [ISO Connect](#)

# Summary of next steps

You will receive a follow-up e-mail including the links and instructions. Please:

- **Read the IDD and send your comments and inputs via [standard@korea.kr](mailto:standard@korea.kr)**
- **Access to KATS [webpage](#) to download materials and get more information**
- **For questions, contact us via [standard@korea.kr](mailto:standard@korea.kr)**

# Q & A

Please raise your virtual hand or use the chat to ask your questions.



**KATS**  
Korean Agency for  
Technology and Standards

# Thank you.

Making lives *easier, safer* and *better*.

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