On the Challenge to PNT
from the Perspective of Global Common Security

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SPACE-BASED POSITIONING NAVIGATION & TIMING
NATIONAL ADVISORY BOARD

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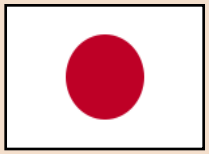
Introduction

- Since GNSS is the cornerstone of PNT, in order to provide and employ GNSS service while ensure the security and reliability of the service, studies and measures on such issues as compatibility & interoperability, PTA and IDM are in demand.
- It should be noticed that emerging navigation technology and business navigation are also entering PNT area, and their capability of providing secure services are crucial to the end users as well.
- In most occasions, GNSSs work with several other navigation techniques to satisfy the common or specialized requirements, so GNSSs cannot only pay attention to themselves when meeting the security challenge.
- From the end users' point of view, everyone relating to PNT service provision behavior should share the responsibility of service security.

World Wide Concern and Participation of PNT

Multiple PNT Service Participants

——GNSSs and SBASs

Global	Regional	Augmentation
 GPS	 QZSS	 WAAS  EGNOS
 GLONASS	 IRNSS	 MSAS  GAGAN
 Galileo		 SDCM  BDSBAS
 BDS		

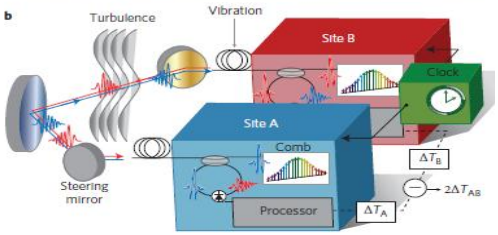
World Wide Concern and Participation of PNT

Multiple PNT Service Participants

——Other Augmentation Systems and Emerging Technologies

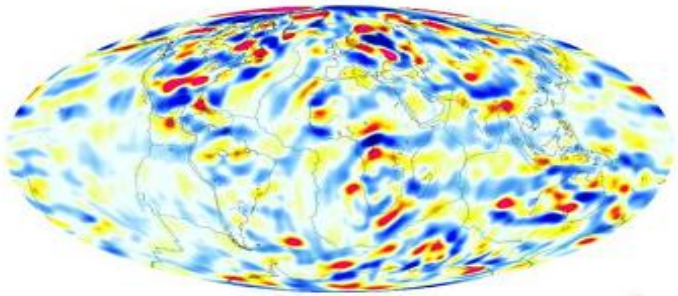
eLORAN

Quantum Positioning &Time Synchronization

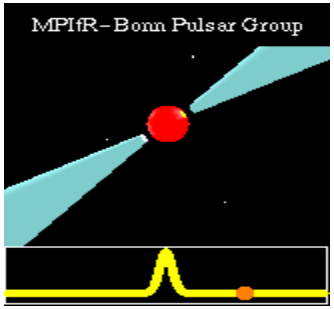


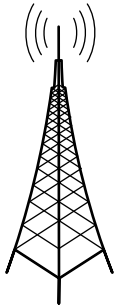
Micro PNT

Earth-magnetism Navigation



Pulsar navigation





World Wide Concern and Participation of PNT

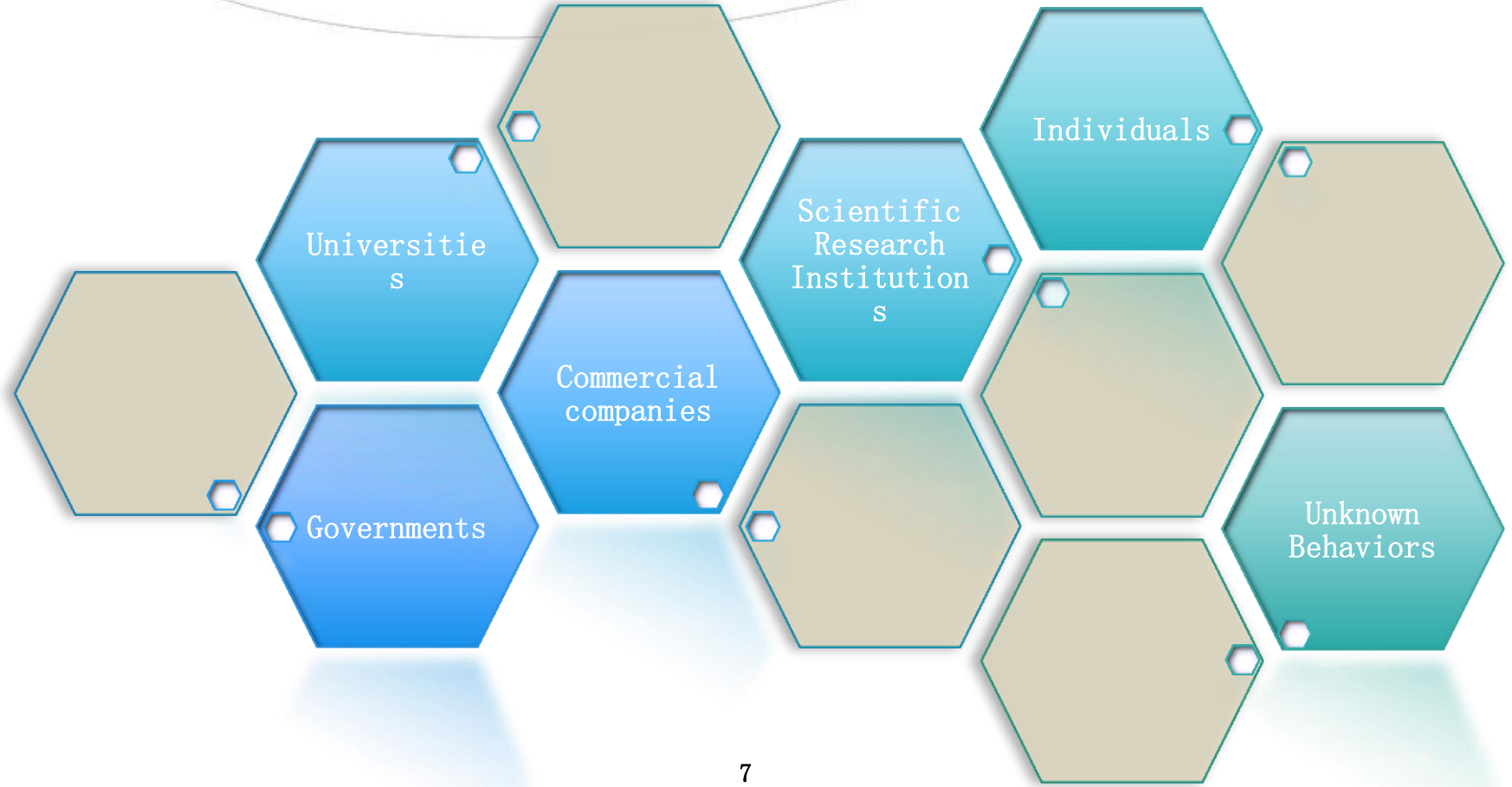
Multiple PNT Service Participants

——PNT Related Technologies

World Wide Concern and Participation of PNT

Multiple PNT Service Participants

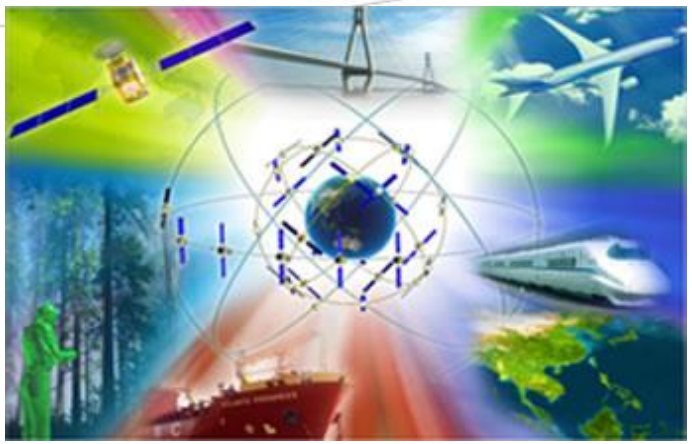
——Various Behavior Subjects



World Wide Concern and Participation of PNT

Numerous PNT Beneficiaries

LBS



Transportation

Meteorology

Communication

Forestry

Shipping

Aviation

Search and Rescue

Railway

Electric Power

World Wide Concern and Participation of PNT

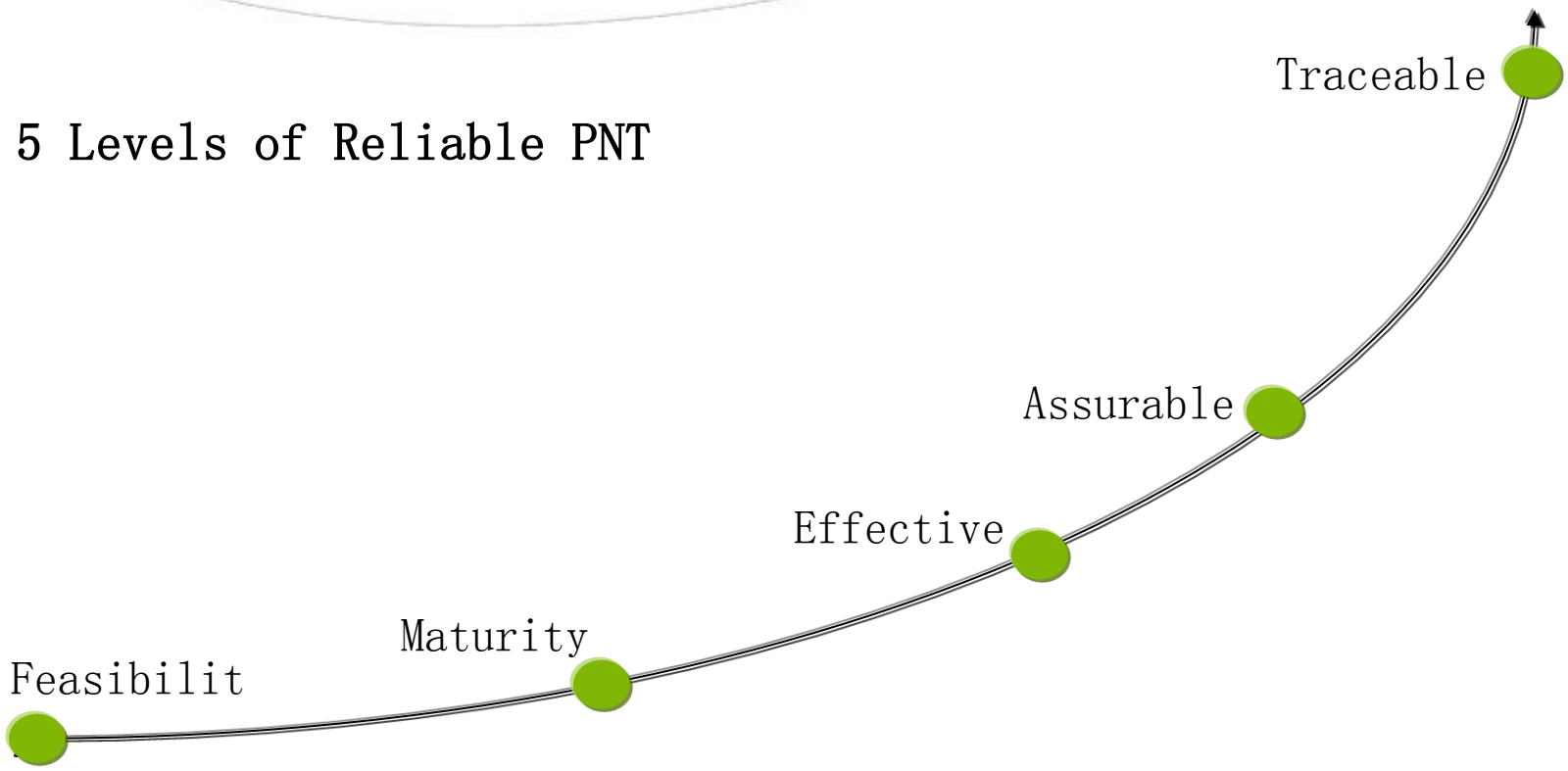
Reliable PNT Service Meets Common Need

- Effective, Assurable and Traceable PNT expertise and services are expected by both PNT providers and beneficiaries
  - *Effective* refers to meeting function and performance requirements.
  - *Assurable* refers to sufficient reliability and security.
  - *Traceable* refers to verifiable and recordable for tracing back to.
- Above factors involve heavy loss avoiding, public security, commercial interests, as well as personal PNT privacy protection.

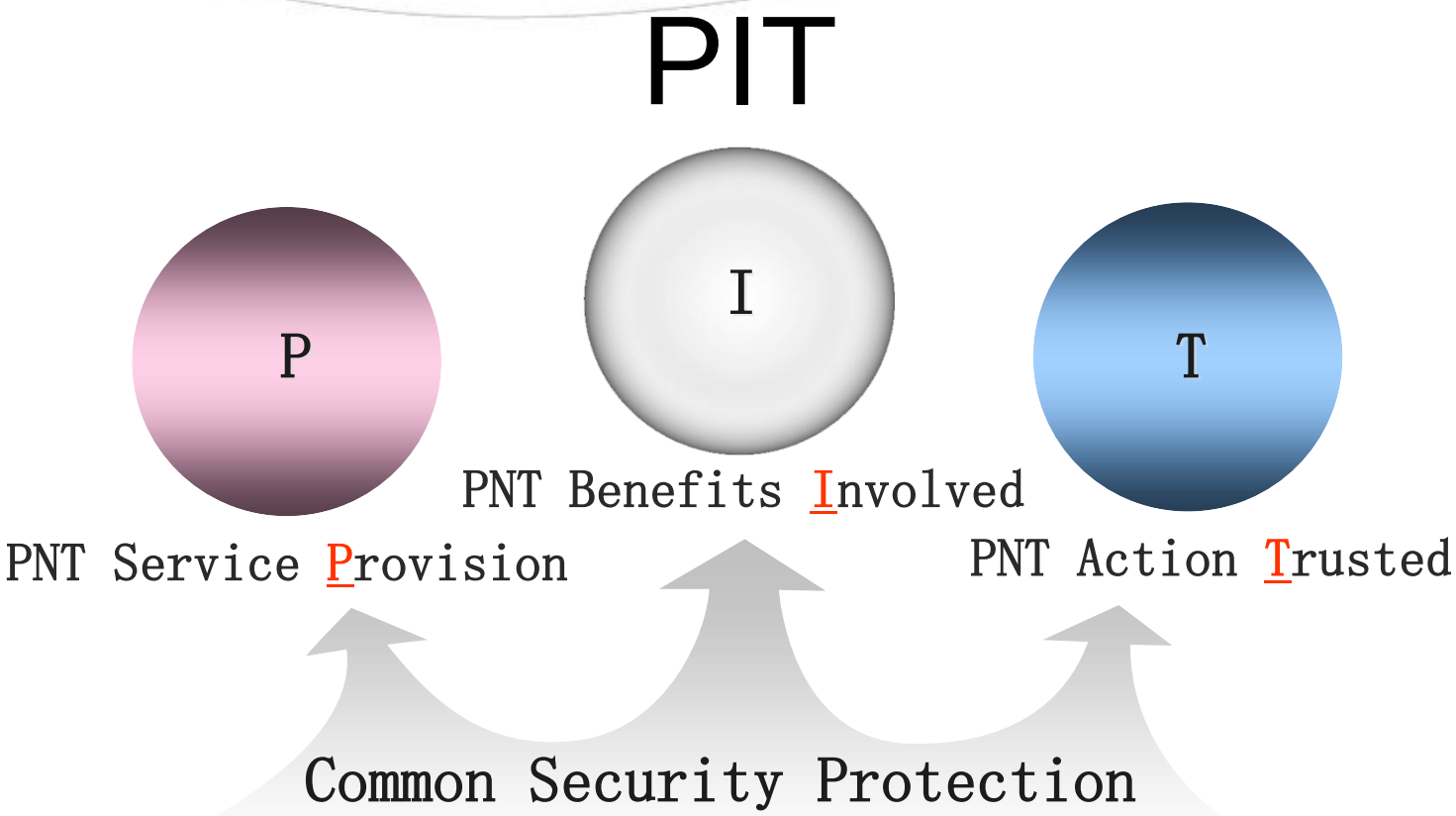
World Wide Concern and Participation of PNT

Reliable PNT Service Meets Common Need

- 5 Levels of Reliable PNT

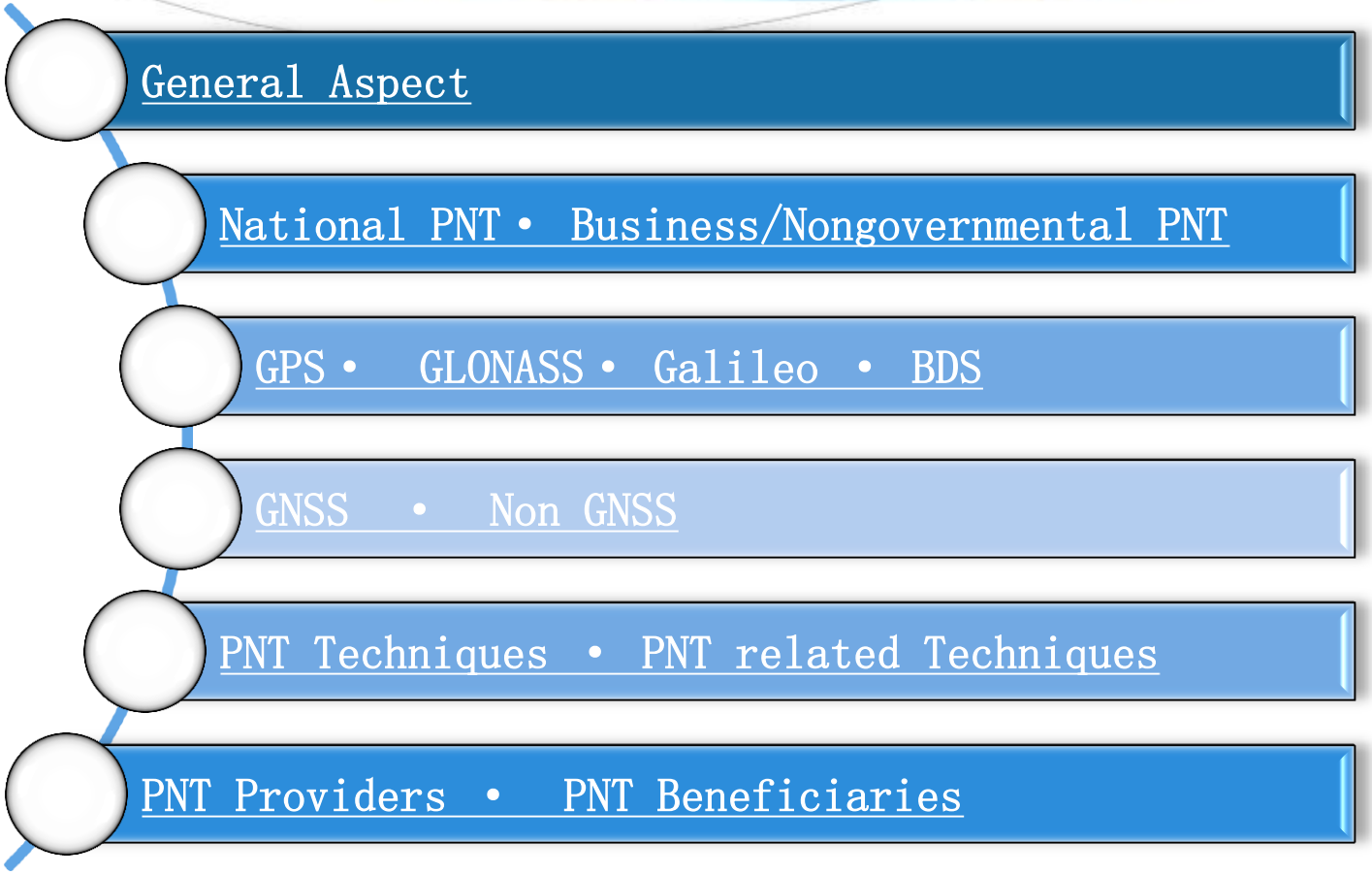


World Wide Concern and Participation of PNT



PNT Global Common Security (PNT/GCS)

6 aspects of GCS



PNT Global Common Security (PNT/GCS)

General Aspect

- To provide effective, assurable and traceable PNT expertise and services, necessary measures and common security responsibilities should be taken in concert by all PNT participants, which may involve following factors.
  - *Laws and Regulations*
  - *Maintaining Steady Collaboration Mechanism*
  - *Resource Sharing*
  - *Common Standard Compliance*
  - *Technical Skills and means*
  - *Provable and Traceable Evidence*

PNT Global Common Security (PNT/GCS)

National PNT· Business/Nongovernmental PNT

- To release national navigation techniques and related information
- To encourage and promote green business navigation
- To investigate complementary between national and business navigation techniques
- To supervise business navigation duty fulfillment
- To evaluate mutual capability of national and business navigat[illegible]y

PNT Global Common Security (PNT/GCS)

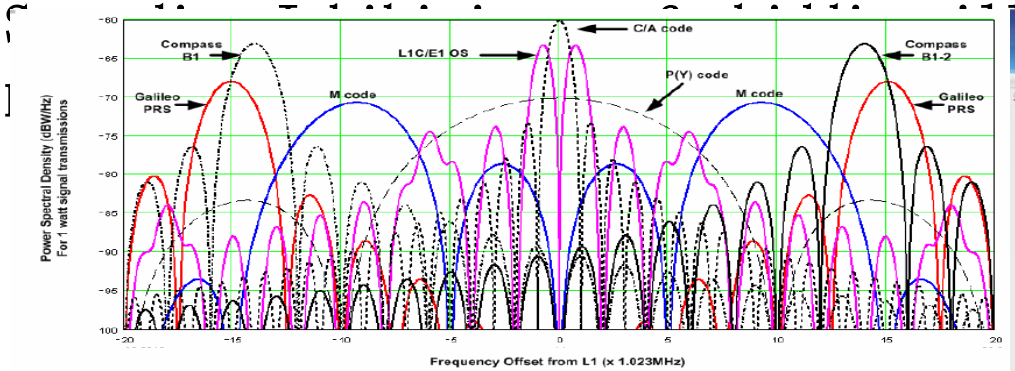
GPS· GLONASS· Galileo · BDS

- COMPATIBILITY & INTEROPERABILITY
- PTA
- IDM
- C-Band (5010-5030 MHz) for RNSS
- S-Band (2483.5 - 2500 MHz) for RNSS
- ……

PNT Global Common Security (PNT/GCS)

GPS· GLONASS· Galileo · BDS

- Legal Protection : prevention of interference to BDs and other GNSSs
- To actively promote BDS and its service become National critical infrastructure
- Spectrum Protection — protecting GNSS services
- Stringent Legislation — taking strong stance against GNSS jamming
- [illegible] the [illegible]



PNT Global Common Security (PNT/GCS)

GPS· GLONASS· Galileo · BDS

IDM System Construction

- In September 2013 , the State Council issued “National mid-long term development plan of satellite based navigation industry”, stating the IDM system should be completed by 2020.

国务院办公厅关于印发国家卫星导航产业中长期发展规划的通知

国办发〔2013〕97号

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：

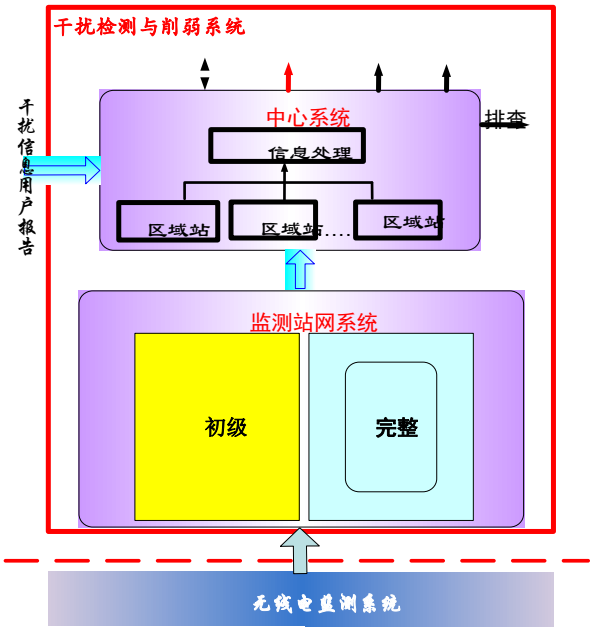
《国家卫星导航产业中长期发展规划》已经国务院同意，现印发给你们，请结合实际认真贯彻执行。

国务院办公厅

2013年9月26日

（此件公开发布）

专栏1 导航定位基础设施建设	
时间节点	2020年
发展目标	基本实现北斗卫星导航系统全球覆盖，具备为全球用户提供导航定位服务能力；加强地面基础设施建设，为中国及周边大部分地区提供面向行业和大众应用的实时分米级和事后厘米级定位服务，以及为重点区域和特定场所实现室内外无缝定位服务覆盖提供基础支撑。
主要任务	北斗卫星导航系统建设：建成由30余颗卫星及地面运行控制系统组成的全球卫星导航系统，具备全球服务能力；同时，建成卫星导航信号监测和评估系统、导航信号干扰检测与削弱系统，保障系统安全可靠运行。多模连续运行参考站网建设：统筹建设国家统一的多模连续运行参考站网，为各类用户导航增强服务提供支撑，同时通过数据共享，为信号监测与评估、科学研究等提供基础数据。 位置数据综



PNT Global Common Security (PNT/GCS)

GNSS · Non GNSS

Non GNSS techniques such as eLORAN, wireless optical navigation, micro PNT and mobile base navigation, etc.

- Interchangeability
- Autonomous navigation capability
- Optimum combination of techniques and its recommendation in certain application environment
- Inapplicability evaluation of single technique
- Verification and evaluation of common PNT application capability

PNT Global Common Security (PNT/GCS)

PNT Techniques · PNT Related Techniques

PNT related techniques such as electronic maps, communication and measurement techniques, etc.

- Security responsibility classification
- Personal PNT privacy protection measures
- PNT capability improvement and promotion of relates techniques
- The max-min requirement of PNT provision from related techniques
- Broad betwe orga

PNT Global Common Security (PNT/GCS)

PNT Providers · PNT Beneficiaries

Including direct or indirect beneficiaries and particularly important in special occasions, such as SBAS.

- Specialized statement and terms
- Commitment and non-commitment
- Exclusive and common responsibilities in special application areas
- Tracing measures for security duty identifications
- Relationship between minimum provision and maximum profit

Challenges

- To coordinate and define common security responsibility
- To form and yield the PNT system benefit
- To weigh the cost of service security
- To settle service commitment and related law and regulation issues
- With the emerging of advanced and mature techniques, systems and techniques which cannot guarantee personal or social security are going to be rejected gradually.

Suggestions

- The issue "PNT Global Common Security" should be deliberated and studied, and better based on broader international cooperation and construction of coordination mechanism.
- High attention should be paid to business navigation and emerging technology which may have strong influence to the PNT future.
- Common obligations and responsibilities of GNSS in credible global PNT applications should be studied, defined and evaluated.

Thank you for your attention!

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