



The Challenges of PNT

from the Perspective of Global Common Security

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**SPACE-BASED POSITIONING
NAVIGATION & TIMING**
NATIONAL ADVISORY BOARD

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2. World Wide Concern and Participation of PNT
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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, GNSS work with several other navigation techniques to satisfy a common or specified requirement(s), so GNSS 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		
 BDS		 SDCM  BDSBAS

World Wide Concern and Participation of PNT

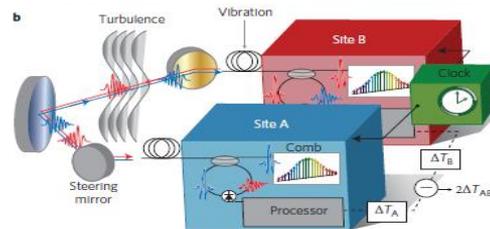
Multiple PNT Service Participants

—Other Augmentation Systems and Emerging Technologies

eLORAN



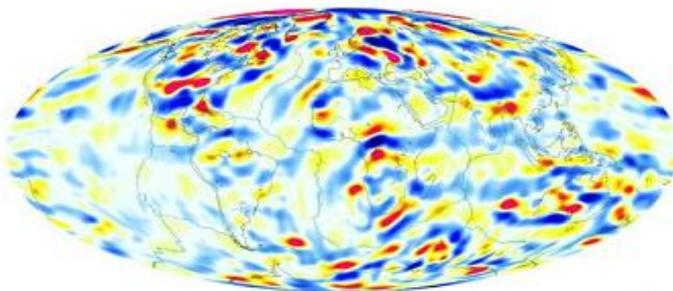
Quantum Positioning & Time Synchronization



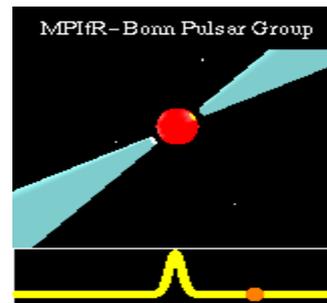
Micro PNT



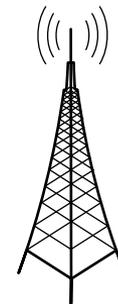
Earth-magnetism Navigation



Pulsar navigation



Cell Navigation



World Wide Concern and Participation of PNT

Multiple PNT Service Participants

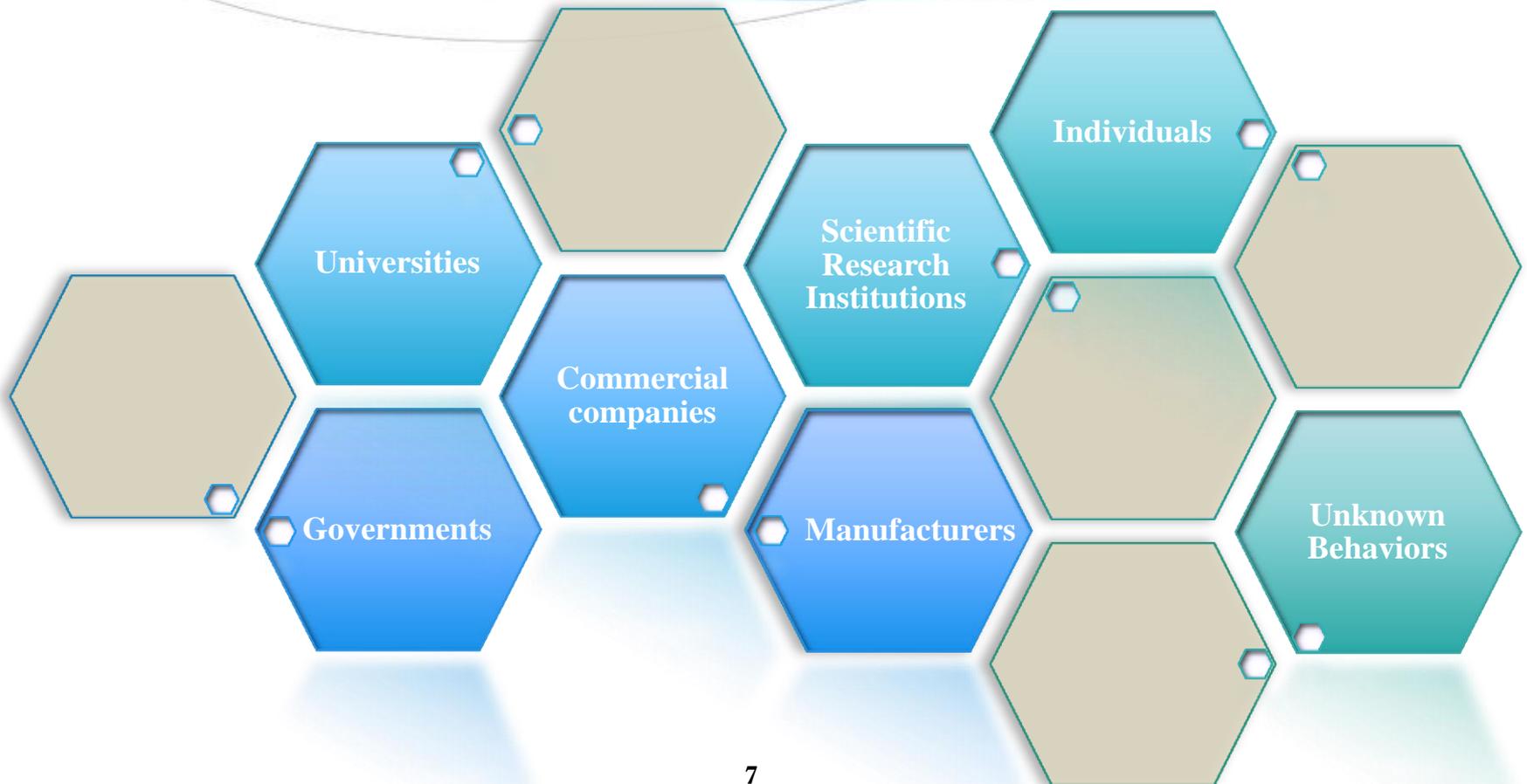
—PNT Related Technologies



World Wide Concern and Participation of PNT

Multiple PNT Service Participants

—Various Behavior Entities



World Wide Concern and Participation of PNT

Numerous PNT Beneficiaries

LBS



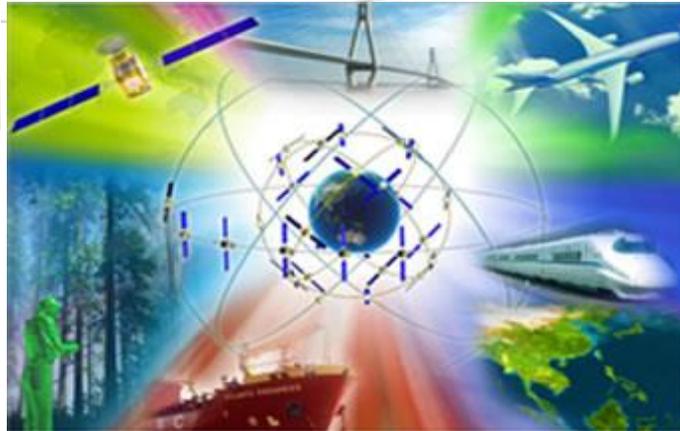
Meteorology



Forestry



Railway



Shipping



Aviation



Transportation



Communication



Search and Rescue



Electric Power



World Wide Concern and Participation of PNT

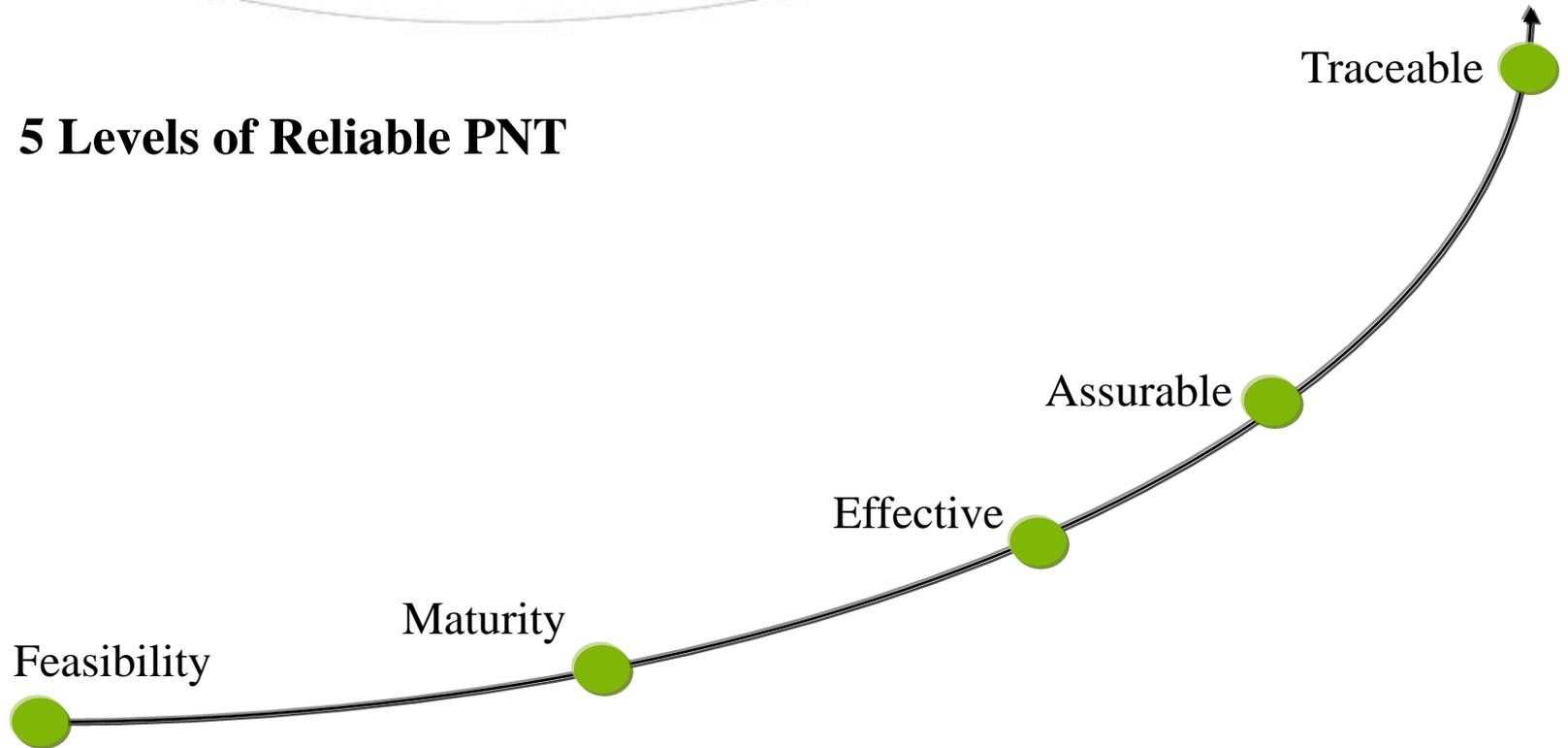
Reliable PNT Service Meets Common Need

- ◆ **Effective, Assurable and Traceable PNT technologies and services are pursued 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.**
- ◆ **Within above factors, heavy loss avoidance, public security, commercial interests, and personal PNT privacy protection are included.**

World Wide Concern and Participation of PNT

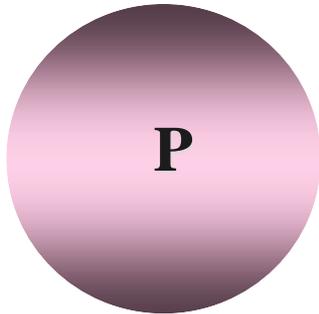
Reliable PNT Service Meets Common Need

5 Levels of Reliable PNT

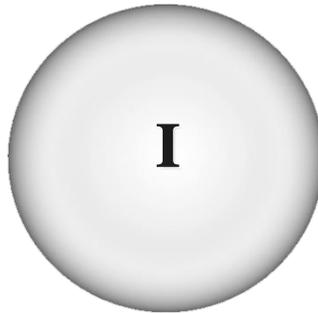


World Wide Concern and Participation of PNT

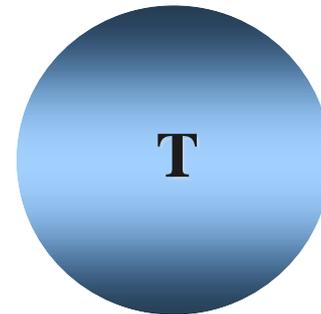
PIT



PNT Service Provision



PNT Benefits Involvement



PNT Action Trusted

Common Security Protection



PNT Global Common Security (PNT/GCS)

6 aspects of GCS

General Aspect

National PNT · Business/Nongovernmental PNT

GPS · GLONASS · Galileo · BDS

GNSS · Non GNSS

PNT Techniques · PNT related Techniques

PNT Providers · PNT Beneficiaries

PNT Global Common Security (PNT/GCS)

General Aspects

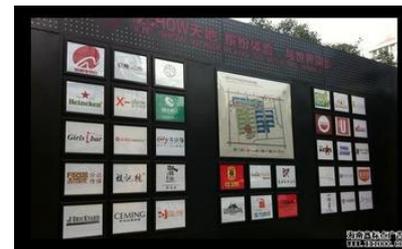
- ◆ **To provide effective, assurable and traceable PNT services, necessary measures and common security responsibilities should be carefully concerned by all PNT participants, which may involve following factors.**
- ***Laws and Regulations***
- ***Maintaining Steady Collaboration Mechanism***
- ***Resource 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 service**
- ◆ **To investigate inter-complementary between national and business navigation services**
- ◆ **To monitor business navigation duty fulfillment**
- ◆ **To evaluate mutual capability of national and business navigation continuously**



PNT Global Common Security (PNT/GCS)

GPS · GLONASS · Galileo · BDS

◆ **COMPATIBILITY & INTEROPERABILITY**

◆ **Protect, Toughen, and Augment (PTA)**

◆ **Interference Detection & Mitigation (IDM)**

◆ **C-Band (5010-5030 MHz) for RNSS**

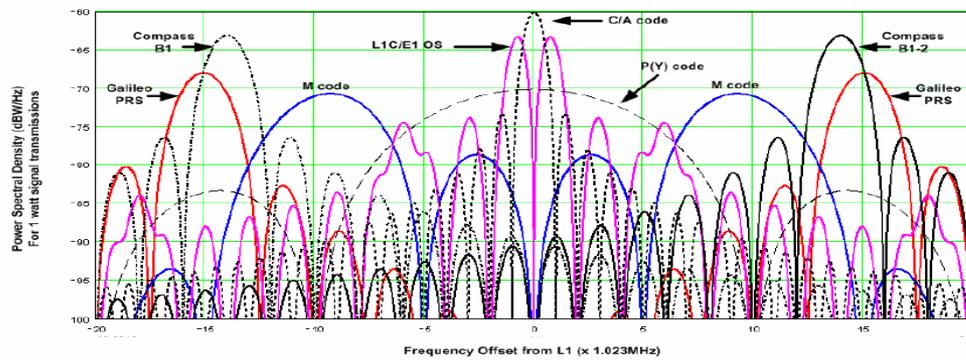
◆ **S-Band (2483.5 – 2500 MHz) for RNSS**

◆ **.....**

PNT Global Common Security (PNT/GCS)

GPS·GLONASS·Galileo·BDS

- ◆ **Legal Protection** : prevention of interference to BDS and other GNSSs
- ◆ **To promote BDS and its service become National critical infrastructure**
- **Spectrum Protection** — protecting GNSS services
- **Stringent Legislation** — taking strong stance against GNSS jamming
- **Spreading Inhibition** — prohibiting illegal jammer



The screenshot shows the official website of the Ministry of Industry and Information Technology of the People's Republic of China. The page is titled "无线电台管理" (Wireless Station Management) and contains a regulation titled "中华人民共和国无线电管理条例" (Regulations on the Administration of Radio Frequency in the People's Republic of China). The regulation is dated 1993-08-11 and is categorized under "工业和信息产业" (Industry and Information Industry) and "无线电管理" (Radio Frequency Management). The content includes sections on "总则" (General Provisions) and "管理机构及其职责" (Management Institutions and Their Duties).

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：

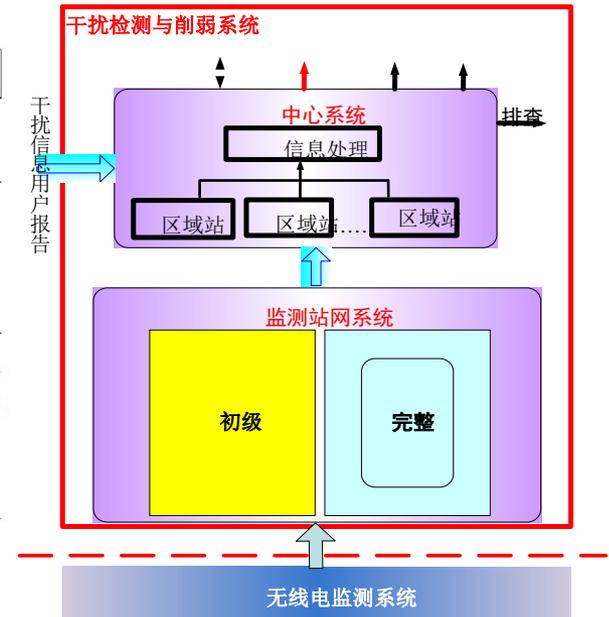
《国家卫星导航产业中长期发展规划》已经国务院同意，现印发给你们，请结合实际认真贯彻落实。

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 related techniques**
- ◆ **The max-min requirement of PNT provision from related techniques**
- ◆ **Broader cooperation between international organizations**



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 future PNT.**
- ◆ **Common obligations and responsibilities of GNSS in credible global PNT applications should be classified and evaluated.**





Thank you for your attention !

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