



Global Positioning System (GPS) and its Applications

**United Nations/Croatia Workshop on
the Applications of Global Navigation
Satellite Systems**

Baska, Krk Island, Croatia

April 2013

U.S. Department of State

GPS enables a diverse array of applications



Satellite
Operation



Surveying &
Mapping



Power
Grids



Precision Agriculture



Transit
Operations



NextGen



Disease Control



Intelligent Vehicles

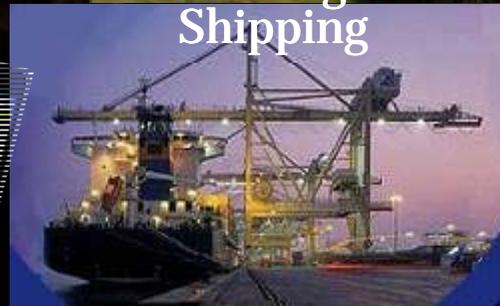


TeleComm



Trucking &
Shipping

Personal
Navigation



Oil Exploration



Fishing & Boating



Planned Global and Regional Space-Based Navigation Systems

- Global Constellations
 - **GPS (24+3)**
 - GLONASS (30)
 - Galileo (27+3)
 - Compass (27+3 IGSO + 5 GEO)
- Regional Constellations
 - QZSS (4+3)
 - IRNSS (11)
- Satellite-Based Augmentations
 - **WAAS (3)**
 - MSAS (2)
 - EGNOS (3)
 - GAGAN (2)
 - SDCM (3)



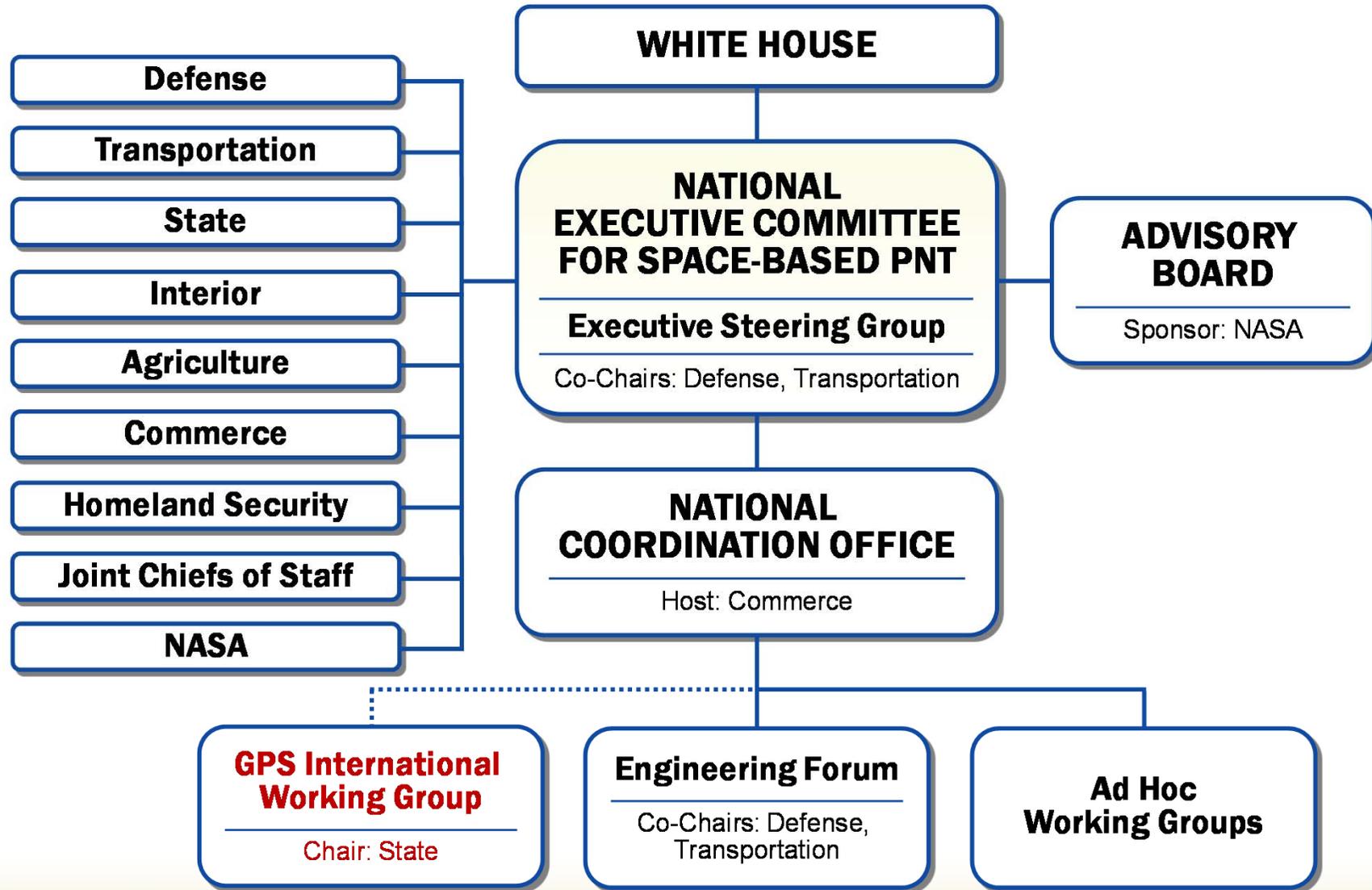
2010 U.S. National Space Policy

Space-Based PNT Guideline: Maintain leadership in the service, provision, and use of GNSS

- Provide civil GPS services, **free of direct user charges**
 - Available on a continuous, worldwide basis
 - Maintain constellation consistent with published performance standards and interface specifications
 - Non-U.S. PNT services may be used to complement services from GPS
- **Encourage global compatibility and interoperability with GPS**
- Promote **transparency** in civil service provision
- Enable market access to industry
- Support international activities to **detect and mitigate harmful interference**



U.S. Space-Based PNT Organization Structure





U.S. Objectives in Working with Other GNSS Service Providers

- Ensure **compatibility** – ability of U.S. and non-U.S. space-based PNT services to be used separately or together without interfering with each individual service or signal
 - Radio frequency compatibility
 - Spectral separation between M-code and other signals
- Achieve **interoperability** – ability of civil U.S. and non-U.S. space-based PNT services to be used together to provide the user better capabilities than would be achieved by relying solely on one service or signal
 - Primary focus on the common L1C and L5 signals
- Promote **fair competition** in the global marketplace

Pursue through Bilateral and Multilateral Cooperation



International Committee on GNSS (ICG)

- Emerged from 3rd UN Conference on the Exploration and Peaceful Uses of Outer Space July 1999
 - **Promote the use of GNSS** and its integration into infrastructures, particularly in developing countries
 - Encourage **compatibility and interoperability** among global and regional systems
- Members include:
 - **GNSS Providers** (U.S., EU, Russia, China, India, Japan)
 - Other Member States of the United Nations
 - International organizations/associations
- First meeting held November 2006 and then annually
- **ICG-7** was held in Beijing in November 2012, and **ICG-8 will take place in November 2013 in Dubai**



GPS Constellation Status

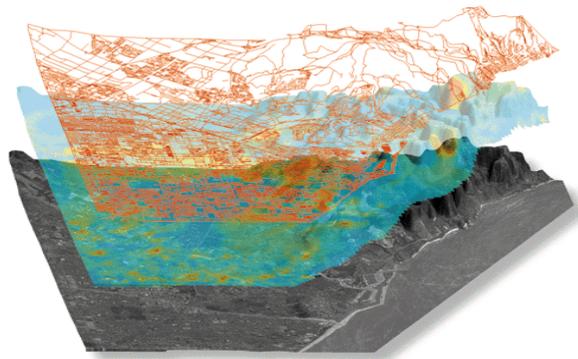
**34 Satellites (31 Operational)
(Baseline Constellation: 24+3)**

- 12 Block IIA
 - 3 on-orbit in residual status
- 12 Block IIR
- 7 Block IIR-M
 - Transmitting new second civil signal
- 3 Block IIF
 - Transmitting new second & third civil signals
- Global GPS civil service performance commitment met continuously since December 1993





Surveying, Mapping, GIS

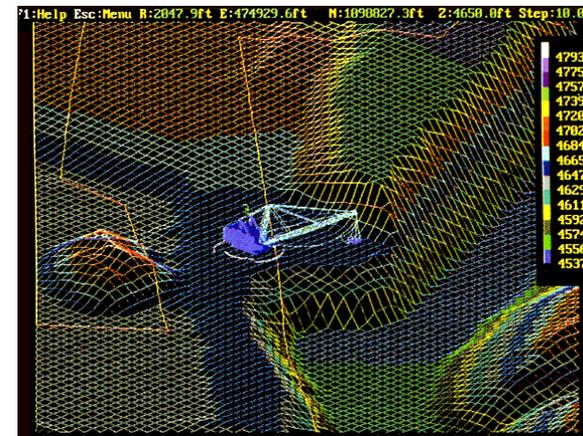


- Surveying is essential to any new development
 - Electrification
 - Telecom tower placement
 - Pipeline installation
 - Dam construction
 - Port dredging
- GPS enables 2-5 cm real-time positioning accuracy
 - Mm-level accuracy possible with post-mission data processing
- 100%-300% savings in time, cost, labor
 - Stakeless, paperless surveys



Construction, Mining

- Faster site preparation
- Enhanced management of assets, equipment
 - More efficient asset utilization
 - Less idling of workers, machinery
- Precise machine control
 - Up to 70% increased job site productivity
 - Saves time, fuel, and emissions
 - Reduces maintenance
 - Prevents accidents
- Automated, wireless job tasking
 - Smaller, more empowered workforce – no foreman
 - Real-time progress tracked remotely





Environmental Stewardship

- **Climate monitoring**
 - Sea level rise measurements
 - Ice sheet change observations
 - Atmospheric moisture profiles
- **Reduced greenhouse gas emissions**
 - Efficient routing of aircraft, trucks, and other vehicles
 - Reduction of vehicle fleet idle times
- **Oil and chemical spill cleanup**
 - Positioning, modeling of spills to guide remediation efforts
- **Commercial fishing**
 - Enforcement of fishery boundaries
- **Forestry**
 - Monitoring of illegal deforestation





Aviation Benefits

- **Safety Benefits in Aviation**
 - Vertically guided approaches at more airports
 - Improved situational awareness for pilots
- **Economic Benefits**
 - Greater runway capability
 - Reduced separation standards which allow increased capacity in a given airspace without increased risk
 - More direct enroute flight paths - reduced fuel use



Disaster Management

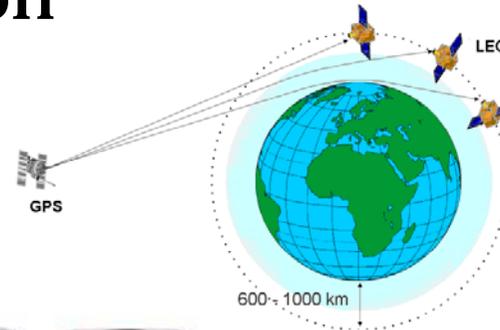
- Assists in disaster planning efforts such as flood plain mapping
- Helps relief workers navigate disaster areas devoid of landmarks
- Facilitates containment and management of wildfires
- Enables disaster warning systems
 - GPS-equipped buoys for tsunami warnings
 - GPS ground networks monitor crustal motion, earthquakes





New Applications Appear Every Day

- Mobile applications
 - Location based services
- Localized GIS datasets
- Personal, pet safety
- GPS radio occultation
- Road use taxation



GPS Antennae





THANK YOU!