



GNSS and Foreign Affairs

Presentation for the Panel:

GNSS – Our Strongest Asset or Weakest Link?

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International Relations Theory: Hard Power



- **Hard Power** – *The application of military force and economic might to get others to change their position through coercion*¹
 - Rests on inducements (carrots) and threats (sticks)
- The importance of GPS to U.S. and Allied precision combat operations began during Operation Desert Shield/Desert Storm and continues to contribute to what is argued by many to be a precision strike revolution in military affairs (RMA)²
- 2004 U.S. Space-Based PNT Policy: *While the growth in civil and commercial applications continues, the positioning, navigation, and timing information provided by the Global Positioning System remains critical to U.S. national security, and its applications are integrated into virtually every facet of U.S. military operations.*

1. Nye, Joseph S., 2011. *The Future of Power*. New York: Public Affairs

2. *Weapons: The Growth & Spread of the Precision-Strike Regime*, Thomas G. Mahnken, *Daedalus* 2011 140:3, 45-57

International Relations Theory: Soft Power



- **Soft Power** - *the ability to get others to want the outcome that you want without coercion*¹
 - Soft power resources include culture, ideology, rules of behavior, trade and commerce, and public and private institutions
- The U.S. policy of continuous, worldwide provision of GPS civil services, and civil signal design information, free of charge, is an example of soft power
 - Based on a \$20B+ investment by the U.S. taxpayer, global sales revenues for GNSS (mostly GPS) goods and services is estimated to be >\$59B/year²
 - Estimated economic benefits from GNSS are now measured in the trillions of dollars²

1. Nye, Joseph S., 2011. *The Future of Power*. New York: Public Affairs

2. Nam D. Pham, NDP Analytics

GNSS is Vital to Many Areas of Soft Power Application



- Earth Observation
 - Critical to understanding and addressing weather and climate, natural hazards, land-use change, ecosystem health, and management of natural resources
 - According to OSTP's recently completed *National Plan for Civil Earth Observations*, GPS has a higher impact on the benefits of Earth Observation than any other system
 - International Institutions: GEO (GGOS), CEOS, UN-GGIM
- Public Health
 - Geographic Information Systems (GIS) using GNSS data are important tools to understanding the spatial variation of disease, traceability to environmental factors, and assessing the effectiveness of health care systems
 - GPS-HRN: GPS in Health Research Network www.gps-hrn.org
- Ocean Affairs
 - Fisheries management; Maritime Boundary Delimitation; Marine Mammal Conservation

GNSS - Its Greatest Strength



- GPS today and GNSS in the future, is the only PNT capability that provides *Accuracy and Precision* globally – anytime and almost anywhere
- Accuracy – how closely a measurement or observation comes to measuring a "true value"
 - Absolute accuracy – The closeness of a measured position to its actual position on the surface of the earth
 - Relative accuracy - The closeness of a measured displacement (both distance and angle) between one point and another point
- Precision – the degree to which repeated calculations or measurements coincide with each other

There is no PNT capability currently available that can fully replicate GNSS

GNSS - Its Greatest Weakness



- GNSS is not an autonomous technology
- It can be denied through intentional and unintentional means
 - Intentional – jamming/spoofing
 - Unintentional – radio frequency interference
- GNSS signals are very, very weak
 - TV signals are 77 dB or 50 million times stronger than GNSS
 - Receiving a GNSS signal is analogous to trying to view a 100 watt light bulb >12,500 miles away

There is no PNT capability currently available that can fully replicate GNSS

Foreign Affairs and PNT (mostly GNSS)



International Cooperation is an important tool that can be used to maximize the strengths of GNSS and minimize its weaknesses

- Interoperable equipage to maximize the efficiency of joint operations with Allies [Military]
- Shared R&D efforts to integrate GNSS with complimentary PNT technologies and implement back-up capabilities [Dual]
- Pursuit of responsible GNSS (RNSS) spectrum management and implementation of interference detection and mitigation capability [Dual]
- Compatible, interoperable, and transparent civil service provision from all GNSS and adoption of fair market practices to maximize socio-economic benefits [Civil]

International Cooperation Activities



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
- Promote fair competition in the global marketplace

Pursue through Bilateral and Multilateral Cooperation

Bilateral Consultations with GNSS Providers: Japan; EU; India; China; Russia

Coordinated effort among Providers and User Community representatives through the multilateral International Committee on GNSS (ICG)



Progress at ICG in GNSS Civil Service Provision

- ✓ Providers Forum
 - ✓ Providers Forum System Report
 - ✓ Principles of Compatibility, Interoperability, and Transparency
 - Template for Performance Standards (and ICDs)
 - *Postulated Performance Standards for future services*
 - Service Assurances or Commitments
 - *Monitoring of service performance*
 - *Interference monitoring*

Summary

- PNT Technology, including GPS and all GNSS, is Dual-Use
- GPS is integral to the Hard and Soft Power aspects of U.S. Foreign Affairs
- There is no PNT capability available today that can fully replicate the greatest strength of GNSS and eliminate its greatest weakness
- Effective International Cooperation can improve on the strength of GNSS while mitigating its weakness

Thanks!



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