International Engagement Subcommittee Report

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- Members:
  - Matt Higgins, Chair
  - Renato Filjar, Vice-Chair
  - Terry Moore, Vice Chair
  - Jade Morton
  - Jeffrey Shane
  - Russ Shields
  - Todd Walter
- Role/ Study Areas:
  - Interfacing with international community (ICG, etc.)
  - Pursue GNSS compatibility & interoperability
  - GNSS service & performance gaps vs. synergies
  - Collaboration vs. competition
- *Non-US citizens input on issues from international perspective.*
- *Balanced by input from US members on what the US needs from international engagement.*

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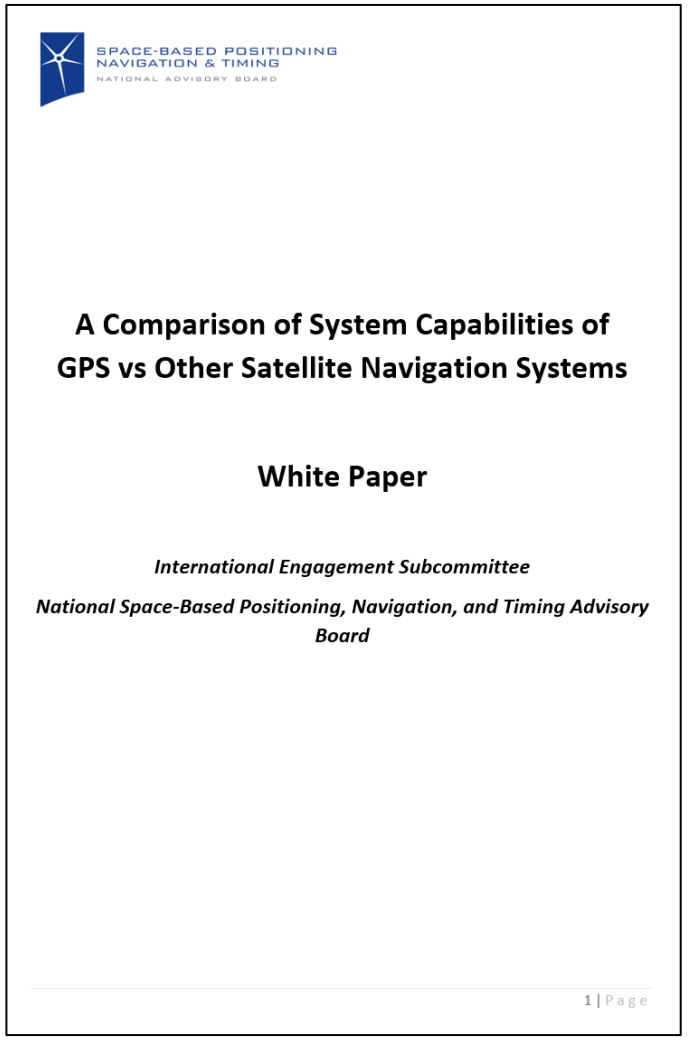
Assessment of Other GNSS Compared to GPS

- This issue is seen as an objective way to inform an answer to the question: *Is GPS Still the Gold Standard?*
- We have previously reported on Fact Sheets on several capabilities of other satellite navigation systems.
- We have started combining our individual fact sheets into an early draft of a White Paper.
- To balance the comparison with other systems we will be adding information on other US activities on Space-Based PNT (see following slides).
- The aim is for the SC to work on the draft White Paper in coming months and aim to present the final version to the next Board meeting.


SPACE-BASED POSITIONING NAVIGATION & TIMING
NATIONAL ADVISORY BOARD

A Comparison of System Capabilities of GPS vs Other Satellite Navigation Systems

White Paper

International Engagement Subcommittee

National Space-Based Positioning, Navigation, and Timing Advisory Board

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Navigation Technology Satellite - 3

AFRL
AIR FORCE RESEARCH LABORATORY

Factsheet Technology: NTS-3
Technical Directorate: RS – INTEGRATED CAPABILITIES
Distribution Statement: Approved for Public Release – AFRL-2023-1544

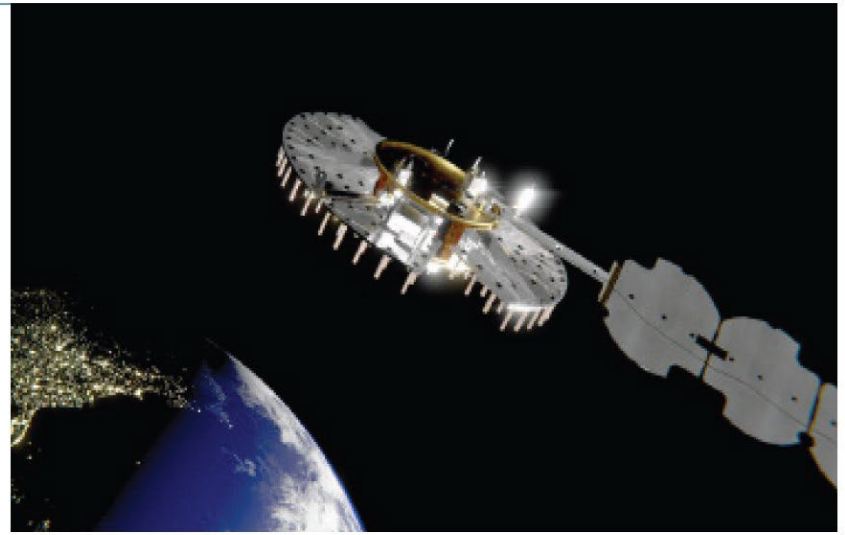
NTS-3 NAVIGATION TECHNOLOGY SATELLITE - 3

VANGUARD: SOLUTIONS TO 21ST CENTURY THREATS AGAINST GPS

THE NTS-3 DEMONSTRATION RELIES ON THREE MUTUALLYINTERDEPENDENT SEGMENTS:

- A space-based experimental satellite
- Ground-based command and control system
- Agile software-defined user receivers

These segments are designed to change and adapt over time, meaning that new operational threats, or circumstances, can be addressed through a software update rather than through a new hardware solution.

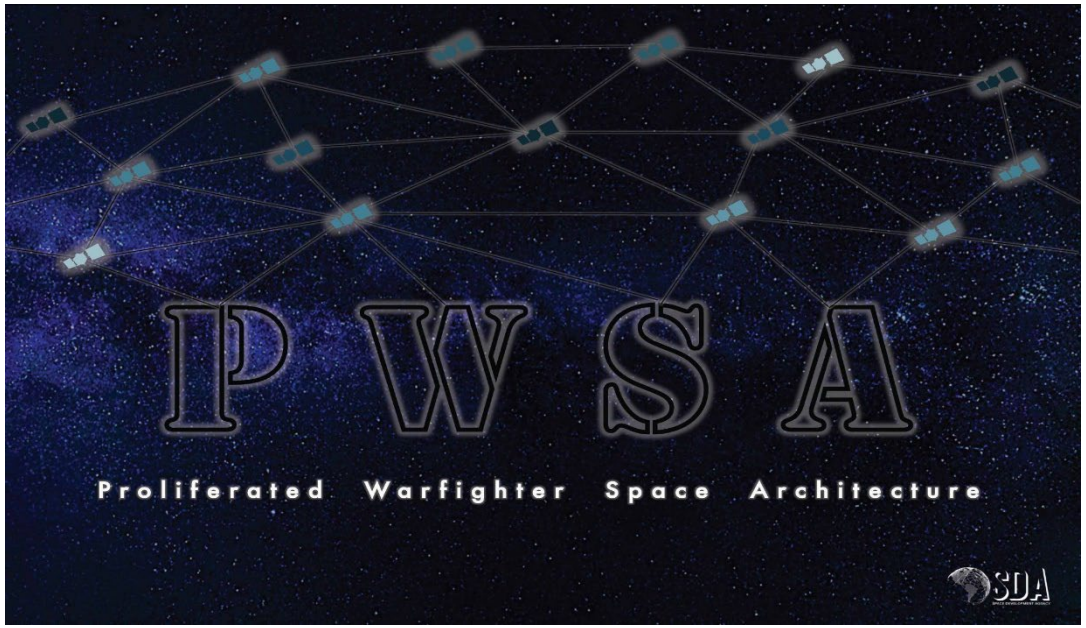


Artist's concept for NTS-3 in geostationary orbit. L3Harris Corporation will integrate NTS-3 using Northrop Grumman's ESPAStar bus, building on EAGLE's flight heritage. Graphic Credit: 1st Lt. Jacob Lutz

- Near geosynchronous orbit
- Phased Array Antenna, spot beams for increased power etc.
- Digital, on-orbit reprogrammable PNT signal generator.
- Test the CHIMERA signal authentication protocol.
- Multiple atomic clocks and timing sources onboard to be used both independently and as an optimized ensemble.

NTS-3 will help prove technical capability but will it translate to a future operational generation of GPS… and when.

Proliferated Warfighter Space Architecture



PWSA is a military system but could demonstrate PNT capabilities of value for a future operational generation of GPS.

- Proliferated Low Earth Orbit (pLEO) satellite constellation.
- *"A new business model that values speed and lowers costs."*
- PWSA will have several Capability Layers
  - Transport
  - Battle Management
  - Tracking
  - Custody
  - Emerging Capabilities
  - Navigation
  - Support
- The Navigation Layer is about *"a GPS-independent navigation capability for the Proliferated Warfighter Space Architecture (PWSA) using optical communication terminals (OCT), and optical space to ground links"*.

Commercial Players in Space-Based PNT

- LEO PNT, e.g. Xona, Trustpoint etc
- PNT on existing Communication Satellites, e.g. Satelles on Iridium
- Using signals from new communication satellites
  – so-called “Signals-of-Opportunity” to derive position.

Assessment of Other GNSS Compared to GPS

We have been developing a series of Fact Sheets assessing characteristics of other GNSS that are not currently available on GPS.

System Capability
GEO Satellites
IGSO Satellites
Improved Broadcast Iono Model
Configurable Payload (SDR)
Intersatellite Links
Ground Segment Coverage
Improved Satellite Clocks

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Service Capability
Search and Rescue
Emergency Warning Service
Short Messaging Service
High Accuracy Service
Open Authentication
Commercial Authentication

Additional Discussion

- IE SC agreed with proposal to base future Board Meetings on defined themes.
- The first suggested theme from IE SC would be based on our White Paper and the “Gold Standard” question.
- Agreed next focus of the IE SC to continue to monitor international developments of relevance to the Board.
- Agreed that a future focus of the IE SC should be monitoring international standards activities relevant to PNT
- We also agreed to aim for an online meeting in late February 2024.