

National Space-Based Positioning, Navigation, and Timing (PNT) Advisory Board

25th Meeting Opening Remarks



ADM Thad Allen, Chair
December 9, 2021



PNTAB Organization & Recent Activities

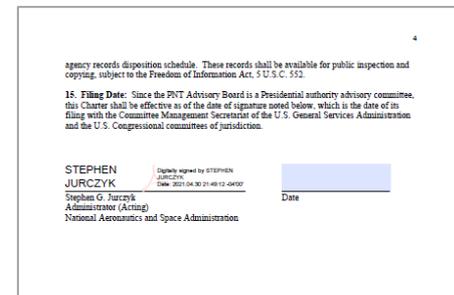
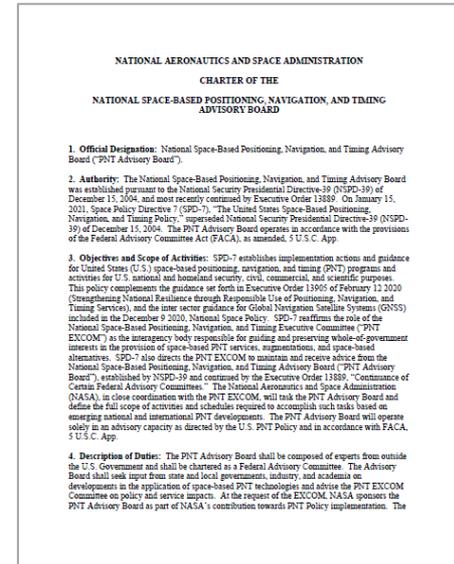
• Organization

- PNTAB established under presidential authority & operates per Federal Advisory Committee Act (FACA) provisions
- Members nominated by PNT EXCOM departments/agencies, approved by PNT EXCOM Co-Chairs, and appointed by NASA Administrator
- Charter allows establishment of ad-hoc task forces and subcommittees

• Recent Activities

- On April 30, Charter for 2021-2023 signed by NASA Acting Administrator S. Jurczyk
- Expands membership ceiling from 25 to 30 in order to support expanded PNT EXCOM representation per SPD-7 (increases from 9 to 13 depts/agencies)
- Nine new members proposed/vetted by PNT EXCOM agencies and appointed by NASA Administrator B. Nelson

PNTAB Charter for 2021-2023



Welcome to New Members

- **Sonia M. Alves-Costa**, Head of Geodesy, Institute Of Geography and Statistics-IBGE, Brazil (*Nominated by DOS*)
- **Renato Filjar**, Honorary Professor of Electronics Engineering, University of Rijeka, Croatia (*Nominated by DOS*)
- **David J. Grossman**, Vice President of Regulatory Affairs, Consumer Technology Association (*Nominated by DOC*)
- **Michael A. Hamel**, Independent Consultant; Commander (ret.), Space & Missile Systems Center (*Nominated by DoD*)
- **Vahid Madani**, Executive Engineer, GridTology (*Nominated by DOE*)
- **Jade Morton**, Professor, University of Colorado Boulder (*Nominated by DOI / NASA*)
- **Tom Powell**, Principal Director, The Aerospace Corporation (*Nominated by NASA*)
- **Eileen Reilly**, Chief Executive Officer, Global Train Services, LLC (*Nominated by DOT*)
- **Gregory Winfree**, Agency Director, Texas A&M Transportation Institute (*Nominated by DOT*)

Special Thank You to Departing Members

- **Gerhard Beutler**, International Association of Geodesy (Switzerland)
- **Sergio Camacho-Lara**, UN Regional Education Center of Science & Space Technology (Mexico)
- **Ann Ciganer**, GPS Innovation Alliance (U.S)
- **Refaat M. Rashad**, Arab Institute of Navigation (Egypt)

In Memoriam



BRIAN K. RAMSAY

Subject Matter Expert, PNT Advisory Board

Brian K. Ramsay, 63, of Winchester, passed away on Sunday, November 21, 2021. He was a valued member of the PNT board community, and his absence will be felt deeply.

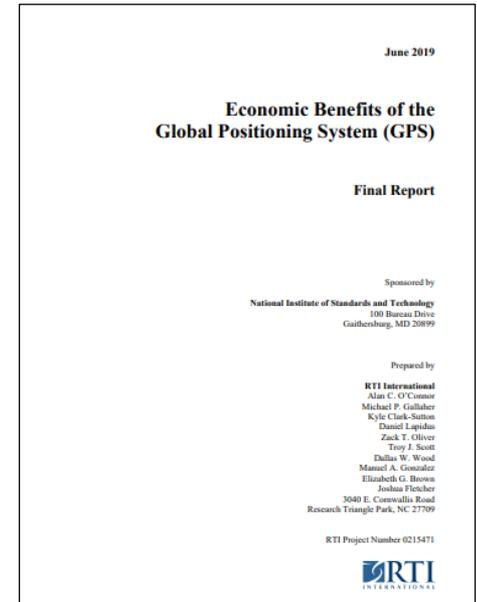
He served 4 years in the US Air Force where he found his professional calling. He spent the next 25+ years helping to guide domestic and international spectrum management policy and regulation while working at US State Department, NTIA, NASA, Iridium, Lockheed Martin, MITRE, Booz Allen Hamilton, and Arinc Research, and served as a US delegate to numerous World Radio Conferences (WRC-95, 97, 2000, 07, 12, 15).

Brian enjoyed hunting, fishing and relaxing at his property in WV. After retirement he took up golf and enjoyed playing often. Brian loved being with his family and friends. He is survived by his wife Holley Winborne Ramsay of Winchester; his mother, Carolyn H. Ramsay of Strasburg, VA; two daughters, Erin Ramsay of Winchester and Caitlyn Ramsay of Martinsburg, WV.

Backup Slides

Why Protect GPS

- “Economic Benefits of the Global Positioning System (GPS)” by RTI International released in June 2019
 - Sponsored by the National Institutes for Standards and Technology (NIST)
 - Finds GPS is a “platform for innovation” and economically “transformative”
 - Estimates the economic value GPS has brought to the United States over the last 10 years in the trillions of dollars, and that an extended outage would damage the economy.
 - Also estimate sith GPS in very broad use across all sectors of the economy, the negative impact of a 30 day outage to the economy would be approximately least \$1B/day
- Research into the economic impact of the loss of GPS is evolving and models vary, but, the range of estimated impacts should be sufficient to concern all users
- Real issue is to create a common understanding of the risks to GPS and establish a national dialogue around the shared burden of the elements of **Protect**, **Toughen**, and **Augment** (PTA)
- Whether protection of the signal or improve receiver performance, that will determine an acceptable level of risk



Key Recommendations/Findings 2007-2021 (1)

- Eliminate S/A capabilities from GPS III
 - Officially announced by DoD DepSec England on Sep. 18, 2007
- Implement Laser Retro-reflector Arrays on GPS III
 - MOU signed by Gen Shelton (AFSPC), Gen Kehler (USSTRARCOM), and C. Bolden (NASA) on Aug. 22, 2013
- Ensure balanced participation by agencies, manufacturers, and users in NTIA/DoD/DOT spectrum studies
 - Full understanding of impacts and alternatives
 - On-going Adjacent Band Compatibility Assessment
- Incorporate NASA worldwide civil-signal monitoring into OCX verification of GPS signal
 - Cost effective, early satisfaction of up to 96% of requirements
 - On-going discussions with DOT

Key Recommendations/Findings 2007-2021 (2)

Letter of 29 August 2014 to Co-Chairs Work and Mendez

- Formally Designate GPS as a Critical Infrastructure (CI) Sector for the United States
 - 14 of 16 current CIs deeply dependent
- Develop a Formal National Threat Model for PNT Applications in Critical Infrastructure
 - Build on earlier Ms. Van Dyke effort at DOT
- Prevent the Proliferation of Licensed Emitters in GPS Frequency Bands
 - Threat continues
- Establish a Nationwide CONUS Back-Up to GPS with Existing Infrastructure (eLoran)
 - Previously accepted by EXCOM, requires refocus

Key Recommendations/Findings 2007-2021 (3)

Recommended Criteria for Evaluation of Interference

- Apply a 1 dB degradation Interference Protection Criterion (IPC) for worst case conditions. (This is the accepted, world-wide standard for PNT and many other radio-communication applications)
- Verify interference for all classes of GPS receivers is less than criteria, especially precision and timing receivers (economically these two classes are the highest payoff applications – many \$B/year)
- Test and verify interference for receivers in all operating modes is less than criteria, particularly acquisition and reacquisition of GPS signals under difficult conditions
- Focus analysis on worst cases: use maximum authorized transmitted interference powers and smallest-attenuation propagation models (antennas and space losses) that do not underrepresent the maximum power of the interfering signal (including multiple transmitters)
- Ensure interference to emerging GPS and GNSS signals (particularly wider bandwidth GPS L1C, as well as the Galileo Open Service) is included in testing and evaluation
- All testing must include GPS expertise and be open to public comment and scrutiny

Key Recommendations/Findings 2007-2021 (4)

In 2018, to support U.S. PNT policy goals, and the economic benefits of GPS, the board developed topic papers for the following sectors: (1) Agriculture; (2) Aviation & Aerospace; (3) Critical Infrastructure & Timing; (4) Military; (5) Policy & Governance; (6) Science; (7) Spectrum; and (8) Transportation (Non-Aviation).

These papers included specific recommendations to implement the high-level actions to protect, toughen, and augment GPS. Of these recommendations, below are of the utmost importance to maintain U.S. leadership in core sectors. The continued and successful execution of the GPS Enterprise will require PNT EXCOM vigilance and committed governance:

- Continue the support of on-going GPS modernization, including space, control and user segments. The U.S. must maintain its leading edge among world satellite-based navigation and timing systems.
- Ensure that complementary and back-up capabilities for GPS-derived PNT are available and used to protect the nation's critical infrastructure and public-safety applications. Implement Enhanced Loran (eLoran) as a back-up for GPS timing in the continental U.S., subject to verification of cost and performance. Further, U.S. agencies should continue the development of additional capabilities that reinforce PNT resiliency.
- Protect GPS signals from interference. The potential for more powerful radio signals in adjacent bands and on-going deliberate disruption by malicious actors remain real and present dangers that will continue to grow.
- Encourage the use of toughened GPS receivers which can resist interference such as jamming and spoofing, especially in critical applications. The technology is available, but it is not being used.
- Permit users in the U.S. to access other nations' properly vetted GNSS signals. This will increase resilience, receiver performance, and legitimize many receivers already in service.
- Demonstrate the utility of backup/augmentation of allied GNSS signals in military receivers: This could allow improved resilience, assurance, and GPS back-up capabilities to military operations in increasingly contested environments.

Key Recommendations/Findings 2007-2021 (5)

- In 2020 a White Paper, “Spectrum Repurposing / Interference Threat,” was briefed to the PNT EXCOM, along with **Nine Takeaways** for PNTEXCOM agency briefings.
- In 2020, at the PNTAB-24B Interim FACA Meeting, the board agreed to set up a Task Force to assist NASA and the Jet Propulsion Laboratory in assessing the future organization and funding structure of the Global Differential GPS System (GDGPS).