

Happy 50th Birthday!



RESILIENT
NAVIGATION
and TIMING
FOUNDATION

Speaking Up for GPS/GNSS Users

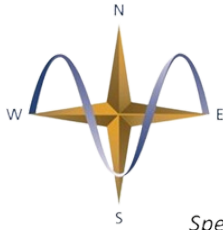
*An Evening with the Father
of GPS*

Celebrating the
Global Positioning System's
50th Birthday

5TH | DECEMBER
2023
6:00 PM

South Shore Harbor Resort
Houston, Texas

“WHERE DO WE GO FROM HERE?”



**RESILIENT
NAVIGATION
and TIMING
FOUNDATION**

Speaking Up for GPS/GNSS Users

The RNT Foundation is a public benefit, scientific and educational 501(c)(3) charity registered in Virginia.

We advocate for policies and systems to protect GPS satellites, signals, and users.

You can view some our recent recommendations to government here.



We also support the President's National Space-based Positioning, Navigation, and Timing Advisory Board's recommendations here.



Program

6:00 PM: *Reception, Drinks, & Hors-d'oeuvres*

6:45 PM: *GPS World* Editor-in-Chief interviews Dr. Brad Parkinson about the early days of GPS, its development, and his thoughts for the future.



Matteo Luccio



Dr. Brad Parkinson

7:30 PM: *Reception Continues*

8:30 PM: *Event Concludes*

Please seek out and thank a sponsor!

The RNT Foundation advocates policies and systems to protect GPS satellites, signals, and users.

We Must...

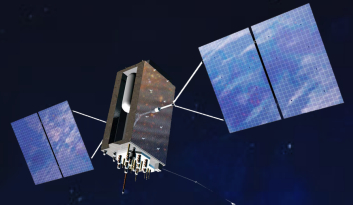
Protect,

Toughen, &

Augment*

GPS

** Dr. Brad Parkinson and the President's Space-based PNT Advisory Board.*



***Protect** frequencies with
Regulations, interference
detection & enforcement...*

***Toughen** receivers with
Better antennas, software,
internet based high accuracy
& authentication services...*



Augment with...



‘Space, Terrestrial Broadcast, and Fiber.’

US Department of Transportation Report
January 2021



A Brief History of Satellite Navigation

- 1957** Sputnik inspires satnav development.
- 1959** First Transit/NavSat launch.
- 1973** DoD approves Navstar GPS Project.
- 1983** President Reagan approves GPS for civilian use.
- 1993** GPS fully operational with 24 satellites in space.
- 1995** GLONASS declared fully operational.
- 1996** Differential GPS operational in parts of U.S.
- 2000** Selective Availability discontinued.
- 2003** WAAS, the world's first SBAS, operational.
- 2016** Galileo initial operational capability.
- 2020** BeiDou declared operational.
- 2022** Galileo declared fully operational.
- 2023** India announces NavIC will become a GNSS.

GPS Visionaries & Pioneers



“The Visionary”
Dr. Ivan Getting



“The God Father”
Dr. Mel Currie, DoD Under
Secretary, Research & Engineering



“High Cover”
Lt Gen Ken Schultz, CMDR Space
& Missile Organization



“Lonely Halls” Team



Gaylord Green



Mel Brinbaum

“The Study”

Jim Woodford & Hiriyoshi Nakamura
Aerospace Corp

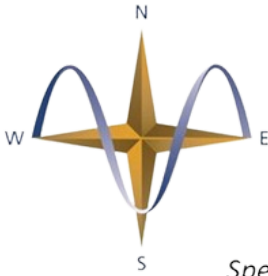


Steve Gilbert



Frank Butterfield, Brad Parkinson,
Bill Huston at JPO

Visionaries and Pioneers of Tomorrow's GPS & PNT



RESILIENT
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and TIMING
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Speaking Up for GPS/GNSS Users

**RNT Foundation Members fervently support
Protecting, Toughening, and Augmenting GPS.**

**The member organizations on the following pages
are sponsors for tonight's event. Please seek out and
thank their representatives.**

**And test your knowledge of GPS history with the
questions in this section at the same time!**



UrsaNav

Leaders in what's now. Innovators of what's next.



Member Since 2013

UrsaNav is the world's premier supplier of Low Frequency (LF) Complementary Positioning, Navigation, and Timing (PNT) solutions and associated professional services. Our business is focused on products and services for wide area terrestrial augmentations to GNSS, such as Loran-C and Enhanced Loran, and the provision of co-primary PNT. Our staff has been involved in every Loran-C and eLoran project world-wide since 1974. UrsaNav strives every day to make the world a safer and more prosperous place.

ursanav.com





Member Since 2014

The Institute of Navigation (ION) is the world's premier non-profit professional society advancing the art and science of positioning, navigation and timing (PNT). Founded in 1945, it serves a diverse community including those interested in air, space, marine, and land navigation; and position determination. Corporate members include corporations, civil and military government agencies, private scientific and technical institutions, universities and training academies, and consulting firms. Membership is worldwide, and it is affiliated with the International Association of Institutes of Navigation.

ION.org





Member Since 2015

The Royal Institute of Navigation is a membership-based learned society with charitable status head-quartered in London, UK. Founded in 1947 and incorporated by Royal Charter in 2006, its charitable objects are:

To unite all those with an interest in navigation

To advance the art, science and practice of navigation

To promote knowledge in navigation and its associated sciences including positioning, timing, tracking, and the conduct of a journey whether on, in, over, or under the land, air, sea or space.

RIN.org.uk



Test Your Knowledge

How did Sputnik inspire development of satellite navigation?

Several days after the launch of Sputnik JHUAL engineers William Guier and George Weiffenbach were listening to its beep, beep, beep. They realized they could use the doppler shift to determine the location of the satellite. Later the lab's Frank McClure suggested that, if the orbit of the satellite was already known, someone listening to it could determine their location. This gave rise to the first operational satnav system, Transit.



Member Since 2015

Hellen Systems is primarily focused on the development and deployment of enhanced LORAN (eLORAN) as an independent and resilient back up capability to the Global Positioning System through a Public Private Partnership with governments world wide. The Hellen Systems Team is working now with the United States Government and other nations to reestablish eLORAN as an onshore, trusted, resilient and best-in-class GPS/GNSS complementary PNT system for all modes and users.

hellensystems.com



Test Your Knowledge

The Air Force developed selective availability to prevent adversaries from using precise GPS. How did one U.S. government organization defeat selective availability and why?

The US Coast Guard developed Differential GPS to “remove the wiggle” from GPS. It improved maritime safety and commerce with more accurate PNT for vessels in port areas and on inland waterways.



Member Since 2015

Continental's Very Low Frequency (VLF) and Low Frequency (LF) transmitters serve a critical role in providing reliable communication and timing references. Continental has more than 50 years of experience in providing and supporting VLF and LF transmission systems including complete turnkey projects in all areas of the world. Our transmitters are so widely deployed that at any time, at any location on earth, a Continental transmitter signal can be received.

contelec.com



Test Your Knowledge

Will the U.S. ever reinstate selective availability?

President Clinton committed the nation to never reinstating it. In 2007 the Department of Defense committed to not including selective availability as a capability on GPS III and future satellites.



Member Since 2016

Safran Trusted 4D, a Safran Electronics & Defense company, is the world leader in resilient positioning, navigation and timing (PNT) solutions that improve the reliability, performance and safety of critical, remote or high-risk operations – even in GPS-denied environments. Safran provides virtually fail-safe GNSS solutions, including signal simulation, for a wide variety of military and commercial applications such as critical infrastructure, aerospace, autonomous transportation, and public safety. Safran’s entrepreneurial spirit, constant innovation, and exemplary customer service allow our customers to observe, decide and guide their air, land, sea, space, and cyber applications.

safran-group.com



Test Your Knowledge

What do many Chinese sources say was the impetus for development of BeiDou?

The “Unforgettable Humiliation” of 1996. During the third Taiwan Strait Crisis, China fired three missiles into the water offshore of a major Taiwanese naval base. Only one missile landed in the desired area. The other two were lost because, according to Chinese sources, the U.S. altered or denied GPS signals being used for guidance.



Member Since 2016

Spirent's positioning, navigation and timing (PNT) division is the world leader in the provision of test solutions for resilient PNT in defense, space, autonomous vehicles, chipset/handset, and timing applications. Recent developments include seamlessly integrated test solutions for LEO AltNav, navigation warfare, CRPA systems, inertial navigation, and additional complementary PNT. Spirent's purpose-built solutions enable streamlined and effective development of resilient systems through flexible and realistic environments that deliver deterministic results. In addition, Spirent leverages 40 years of expertise to provide industry-leading advice and test services

spirent.com



Test Your Knowledge

What event sparked President Reagan's announcement making GPS available for use by civilians?

The shoot down of Korean Air flight 007 by the Soviet Union. The aircraft had become lost and wandered into Soviet airspace.

President Reagan announced that, when GPS became operational in 1988, it could be used by civil aircraft. This led to the U.S. committing to support civil use across sectors and promising to give at least 10 years notice before signals were terminated.



MICROCHIP

Member Since 2018

Microchip Technology Inc. is a leading provider of smart, connected and secure solutions. Its comprehensive product portfolio enable customers to create optimal designs which reduce risk while lowering total system cost and time to market. The company's solutions serve more than 125,000 customers across the industrial, automotive, consumer, aerospace and defense, communications and computing markets. Headquartered in Chandler, Arizona, Microchip offers outstanding technical support along with dependable delivery and quality.

microchip.com



Test Your Knowledge

When was GPS M-Code developed?

Papers describing M-Code and signals were presented at Institute of Navigation conferences in 2000. The first GPS satellite capable of transmitting M-Code was launched in 2005.



HEXAGON



Member Since 2018

Hexagon is the global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications. Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future. NovAtel, part of Hexagon, is a global technology leader, pioneering end-to-end solutions for assured positioning for land, sea, and air. NovAtel designs, manufactures and sells high-precision positioning technology developed for efficient and rapid integration. Its solutions are empowering intelligent positioning ecosystems in vital industries that depend on the ability to tackle the most complex challenges in the most demanding environments.

novatel.com



Test Your Knowledge

How can the U.S. government provide a GPS high accuracy and authentication service to many users?

By using existing government data and delivering it to internet connected devices. See the PNT Advisory Board's recommendation at <https://www.gps.gov/governance/advisory/recommendations/>



Member Since 2021

Locata is the inventor of revolutionary new synchronization technology. It allows deployment of terrestrial networks which, in local coverage areas, are a true, cm-level and nanosecond accurate replacement PNT system. Locata systems were first taken up by the USAF and NASA. The technology has now been commercialized into multiple global industrial markets, especially for automation and coverage of critical national infrastructure sites like ports, logistics hubs, rail terminals, airports, mines, military bases and more. Locata works accurately indoors and in extremely difficult environments where satellite-based systems fail. Locata is now working to bring its' game-changer nanosecond level synchronization to the mobile phone market. We work every day to make the art of PNT.... better.

locata.com



Test Your Knowledge

What has been the goal of GPS 50th anniversary celebrations fostered by the RNT Foundation, GPSIA, and the National PNT Advisory Board?

In the words of the Advisory Board white paper, the goal is a White House summit that would:

- Raise awareness of GPS' contributions and importance to America and the world,
- Lead to improvements in the agility of PNT governance by assigning a senior responsible federal official, and
- Lead to implementation of a systems approach to a resilient national PNT architecture to underpin national security and economic prosperity.

Read the white paper at: <https://www.gps.gov/governance/advisory/recommendations/>



Member Since 2021

Keysight delivers advanced design and validation solutions that help accelerate innovation to connect and secure the world. Keysight offers a wide range of products to help enterprises, service providers and critical infrastructure providers test their timing infrastructure. It has recently launched TimeKeeper which is a software tool that monitors the real time quality of time sources, detects timing anomalies and synchronizes server clocks. TimeKeeper is used by a wide range of customers across the world. For more information on this ground breaking time monitoring solution visit the TimeKeeper page on our web site.

[keysight.com](https://www.keysight.com)





For more than 30 years, GPS World has been the top publication for the GNSS industry. We help advance the development and deployment of GPS/GNSS and other positioning, navigation and timing (PNT) solutions. With a focus on technical, practical, ever-changing applications, we captivate and educate our readers, and deliver unmatched returns for our growing family of marketing partners.

gpsworld.com



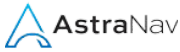


Member Since 2022

The National Association of Broadcasters is the voice for the nation's radio and television broadcasters. As the premier trade association for broadcasters, NAB advances the interests of our members in federal government, industry and public affairs; improves the quality and profitability of broadcasting; encourages content and technology innovation; and spotlights the important and unique ways stations serve their communities. PILOT is an innovation initiative of NAB dedicated to advancing broadcast technologies and cultivating new media opportunities.

nabpilot.org





Thank you to all of our members for support over the years!

