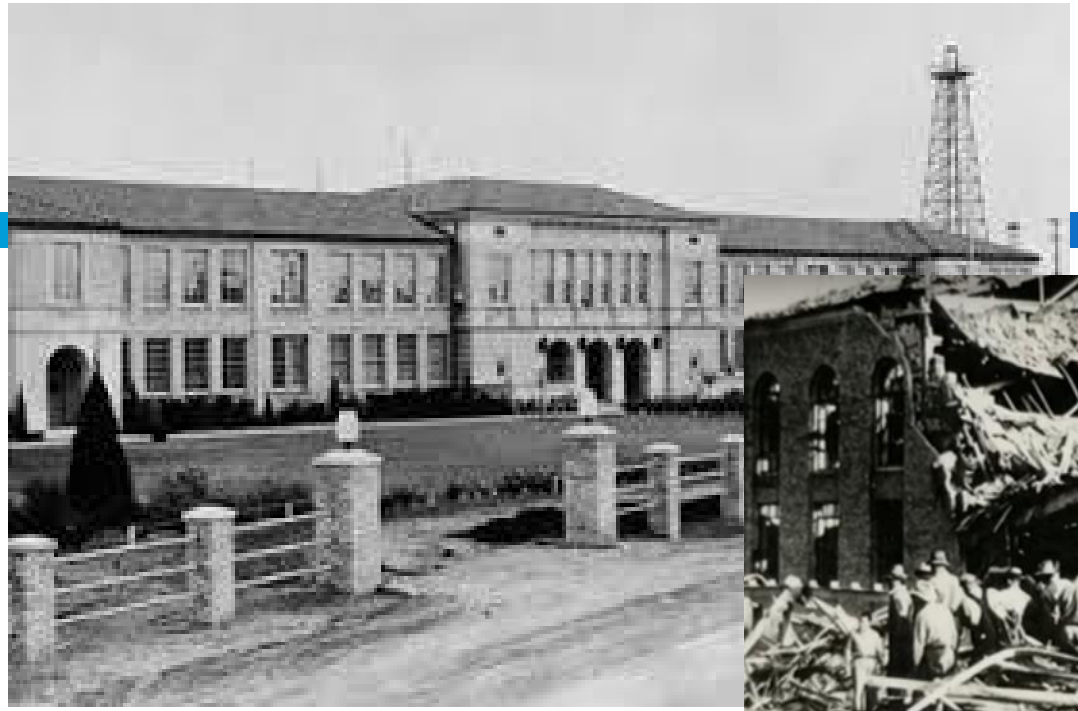
RESILIENT NAVIGATION and TIMING FOUNDATION

Speaking Up for GPS/GNSS Users

A Resilient National Timing Architecture

9 DECEMBER 2021



Nationalboard.org

Nationalboard.org

By Wally Gobetz, CC BY 2.0,
https://commons.wikimedia.org/w/index.php?curid=7972261

By Wally Gobetz, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=7972261

USCG Petty Officer 2nd Class Kyle Niemi

By Wally Gobetz, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=7972261

USCG Petty Officer 2nd Class Kyle Niemi

By Wally Gobetz, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=7972261

USCG Petty Officer 2nd Class Kyle Niemi

Shutterstock

By Wally Gobetz, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=7972261

USCG Petty Officer 2nd Class Kyle Niemi

Shutterstock

Volpe
The National Transportation Systems Center

VULNERABILITY ASSESSMENT
OF THE
TRANSPORTATION INFRASTRUCTURE
RELYING ON THE
GLOBAL POSITIONING SYSTEM

Final Report

August 29, 2001

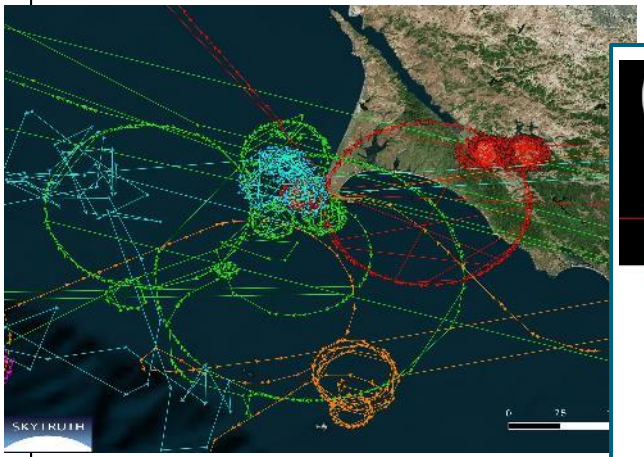
Prepared by

John A. Volpe National Transportation Systems Center

for

Office of the Assistant Secretary for Transportation Policy
U. S. Department of Transportation

29 Aug 2001

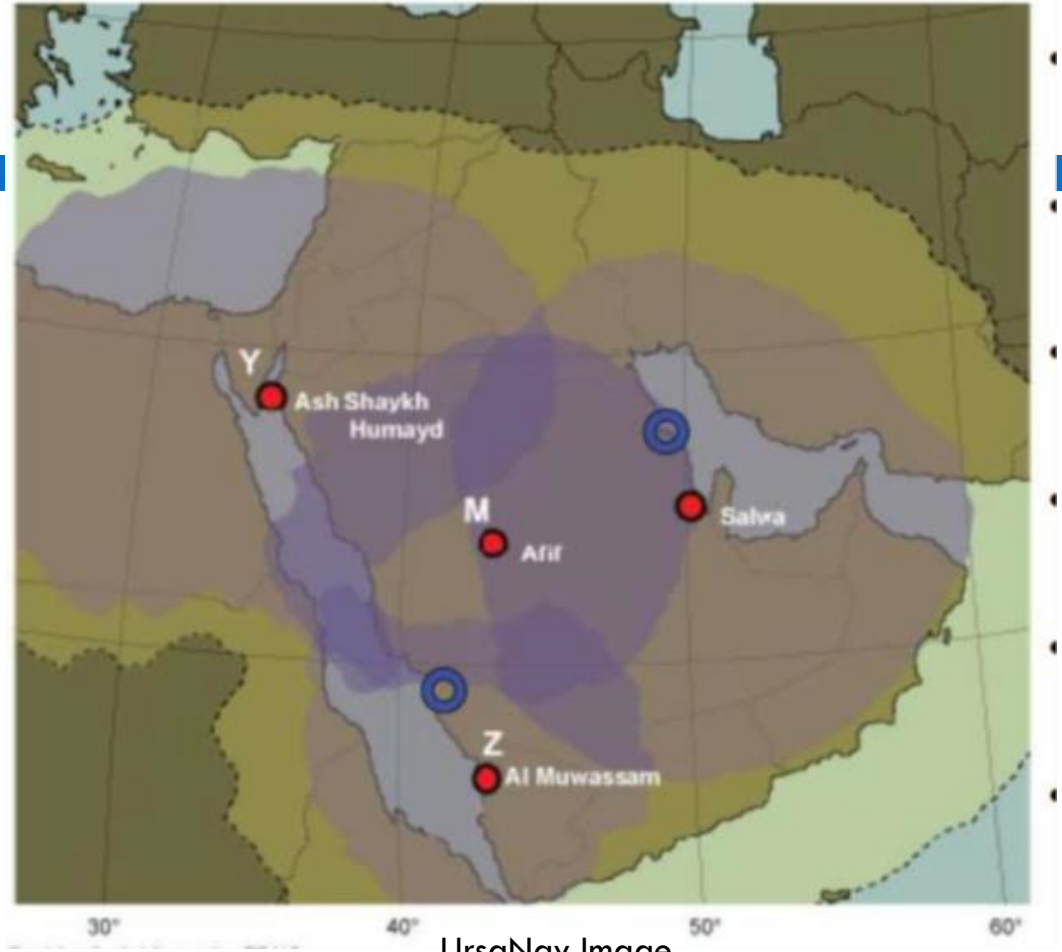


GPS WORLD
GNSS POSITIONING NAVIGATION TIMING
Follow Us
Search the Site...
subscribe
GNSS OEM UAV Survey Mapping Transportation Defense Mobile Machine Co

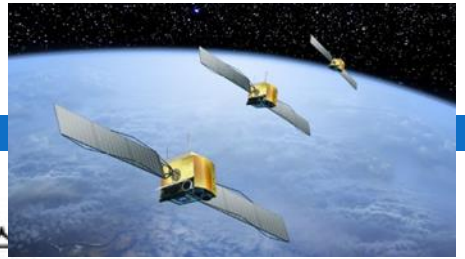
Russia issues threat to GPS satellites

29 Nov 2021

Saudi Arabia
Loran-C



UrsaNav Image



Korea Ministry of Fisheries and Oceans

Iran·Developing·Homegrown·Alternative·to·GPS¶

¶

News·ID:·1090226··Service:··Defense¶

□·June,·01,·2016·-·13:55¶

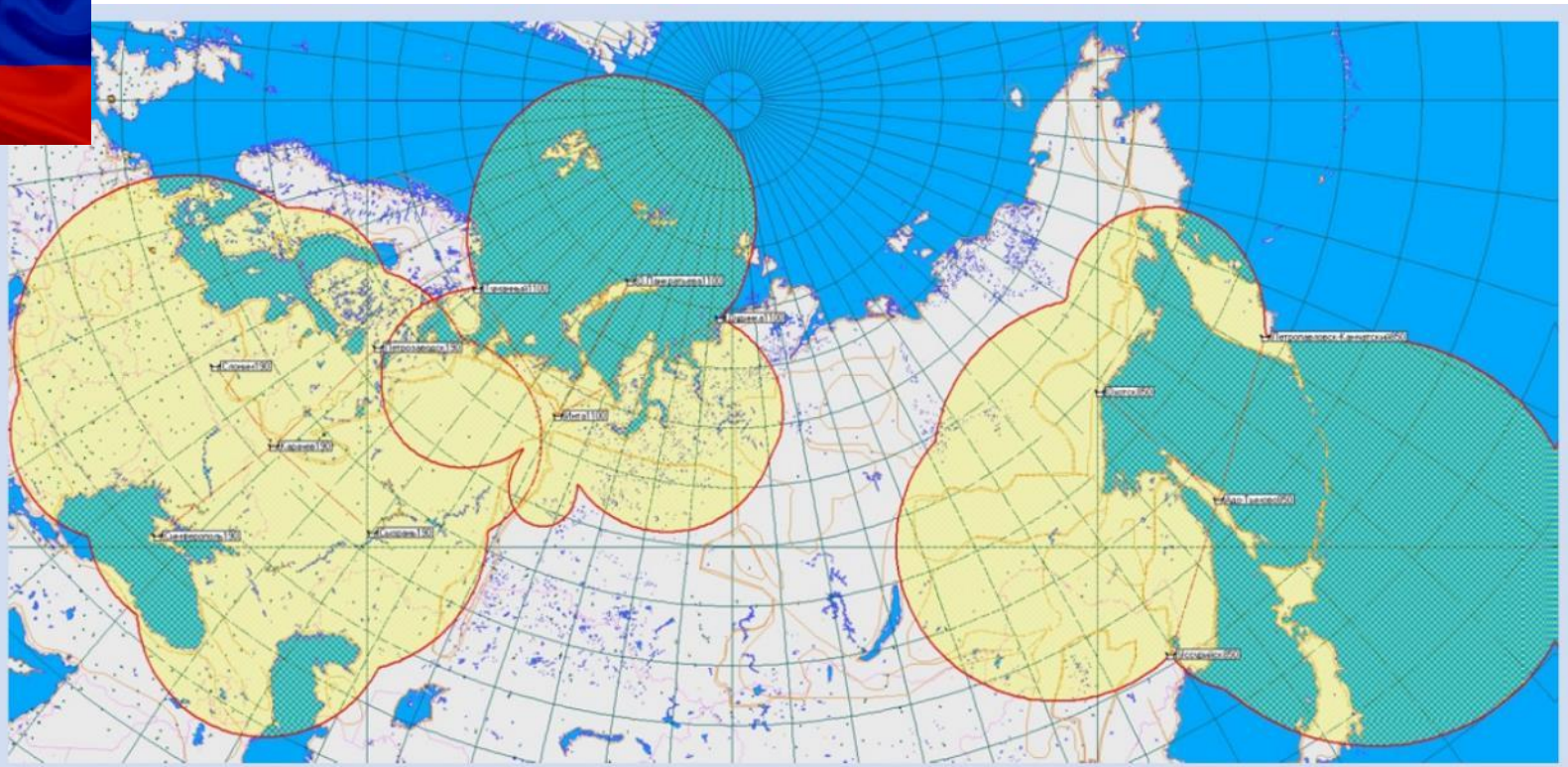
¶

TEHRAN·(Tasnim)·—·Iran's·defense·minister on· Wednesday· unveiled· three· of· the· latest technological· achievements· made· by· local experts,· including· the· transmitter· of· an indigenous· positioning· and· navigation system· that· could· be· a· substitute· for· the Global·Positioning·System·(GPS).¶

¶

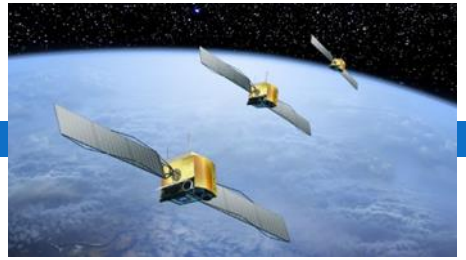
Speaking·at·the·ceremony,·Dehqan·said·it·was inevitable·that·the·country·find·a·replacement for· the· GPS,· which· is· currently· employed· for

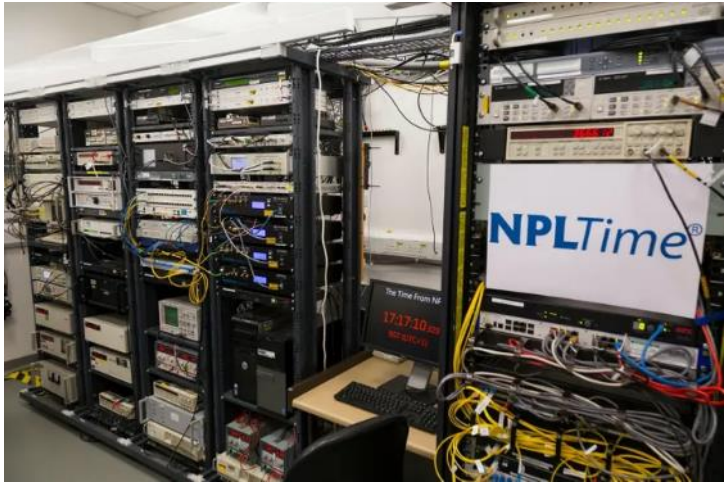
In·a·ceremony·at·Malek-Ashtar·University·of· Technology·in·Tehran,·Brigadier·General·Hossein· Dehqan·unveiled·three·new·products·developed·by· the·university's·researchers.¶

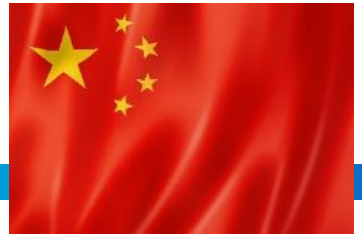


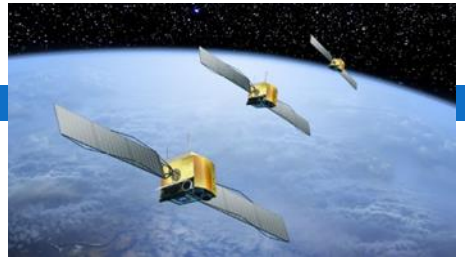
Russia's Chayka (Loran) Coverage

Internavigation Research & Technical Centre of Advanced Navigation Technologies, August 2017




NPLTime®



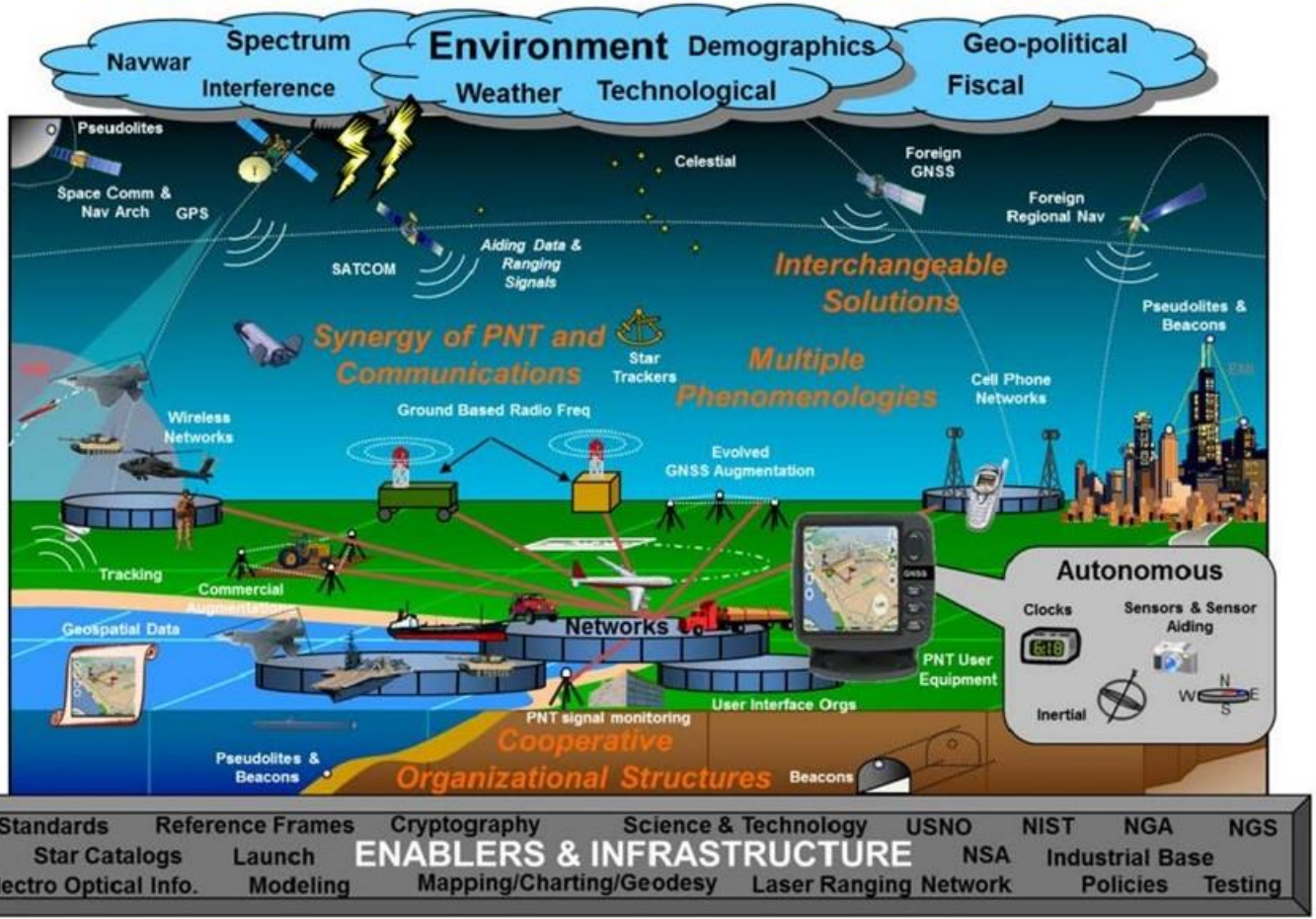


2. System Construction of PNT System

(2) Prospect of the Development

It's expected to be built into a national comprehensive PNT system by 2035
more ubiquitous, more integrated ,more intelligent,

National PNT Architecture



Nationa

Standards Reference Frames
Star Catalogs Launch
Electro Optical Info. Modeling

Layered PNT Architecture Construct

Global	Space-based, Ubiquitous, 3-Dimensional Position and Precise Time
Regional	Space-based or Terrestrial, Non-global (National/International) Coverage
Local	Space-based, Terrestrial, and/or Autonomous, Localized by design/performance

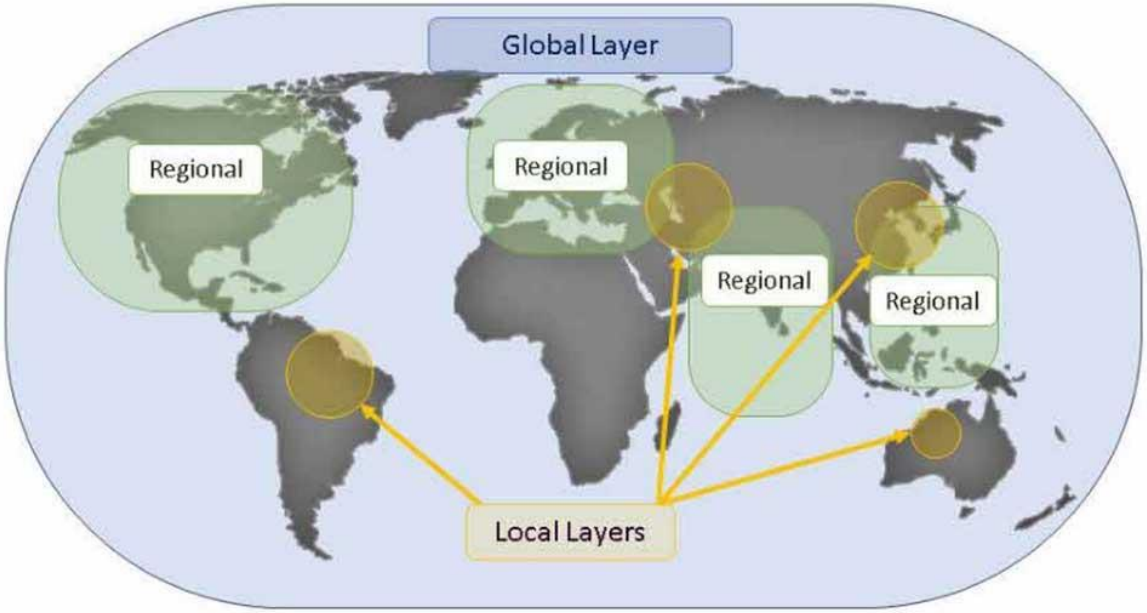


Figure 7 – Layered PNT Enterprise Architecture

2014 – Stop demolishing Loran until backup decision

2017 – Do a tech demo, $10M provided in 2018

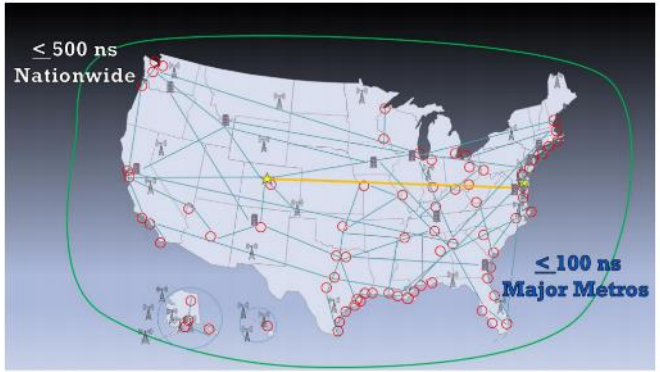
2018 – National Timing Resilience and Security Act

- At a minimum - wide area, terrestrial
- Use results of tech demo
- Working through commercial services allowed
- Estab capability by December 2020

2022 - $15M to “start a program” for a GPS backup

RESILIENT NAVIGATION and TIMING FOUNDATION

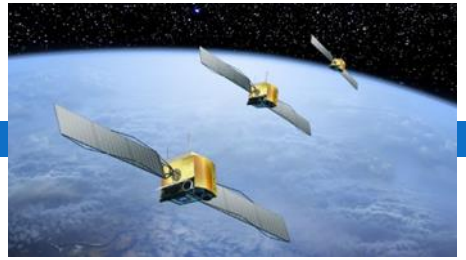
16 October 2020



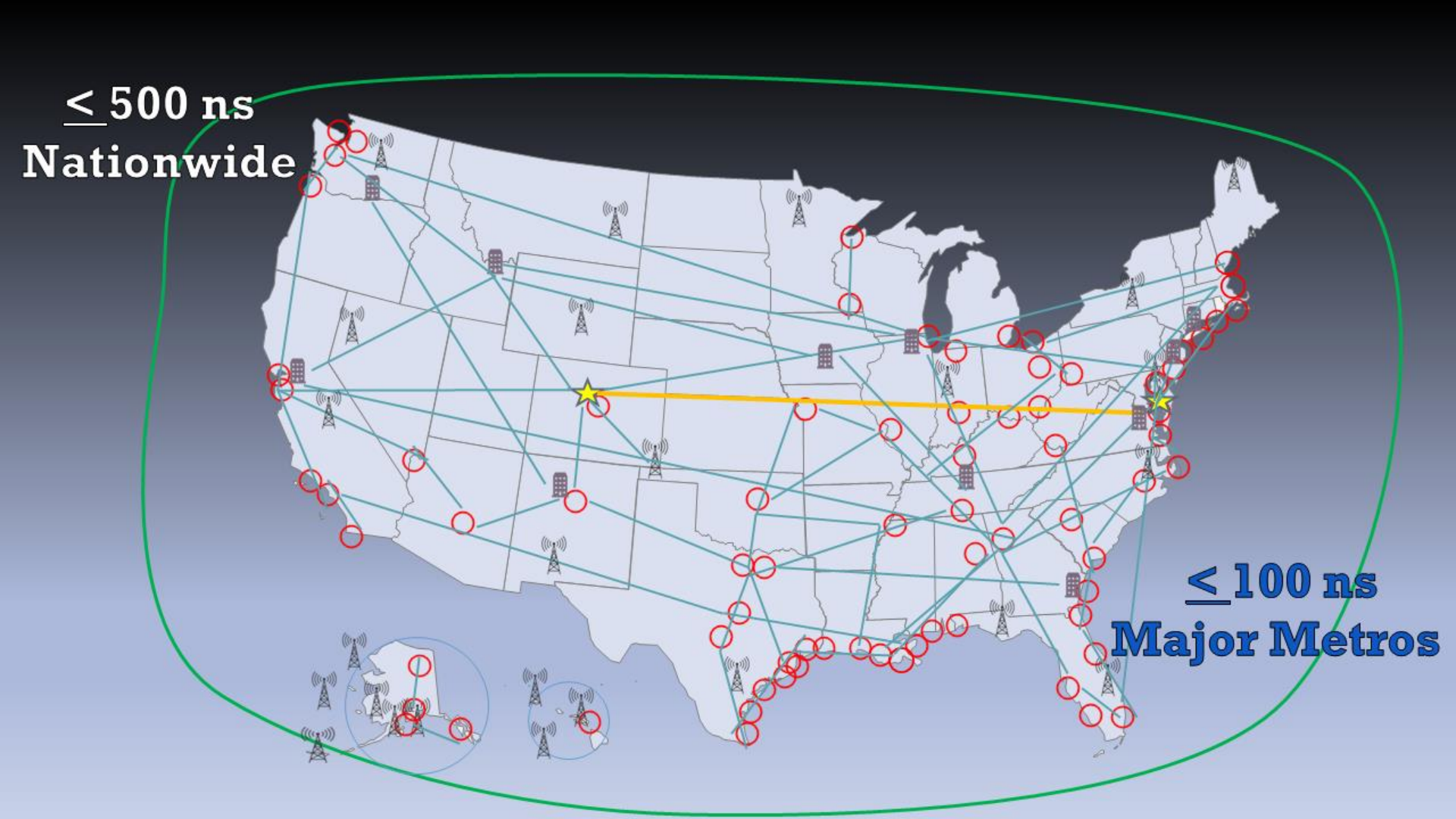
A Resilient National Timing Architecture

SECURING TODAY'S SYSTEMS, ENABLING TOMORROW'S

DR MARC WEISS, DR PATRICK DIAMOND, MR DANA A. GOWARD



16 October 2020 https://rntfnd.org/library/


≤ 500 ns
Nationwide
≤ 100 ns
Major Metros

Complementary PNT and GPS Backup Technologies Demonstration Report

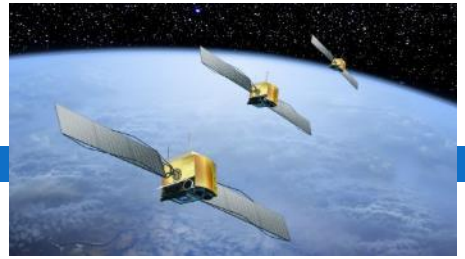
Sections 1 through 10

Andrew Hansen, Ph.D.
Stephen Mackey
Hadi Wassaf, Ph.D.
Vaibhav Shah
Eric Wallischeck
Christopher Scarpone
Michael Barzach
Elliott Baskerville

January 2021
DOT-VNTSC-20-07

Prepared for:
Office of the Assistant Secretary for Research and Technology,
Department of Transportation

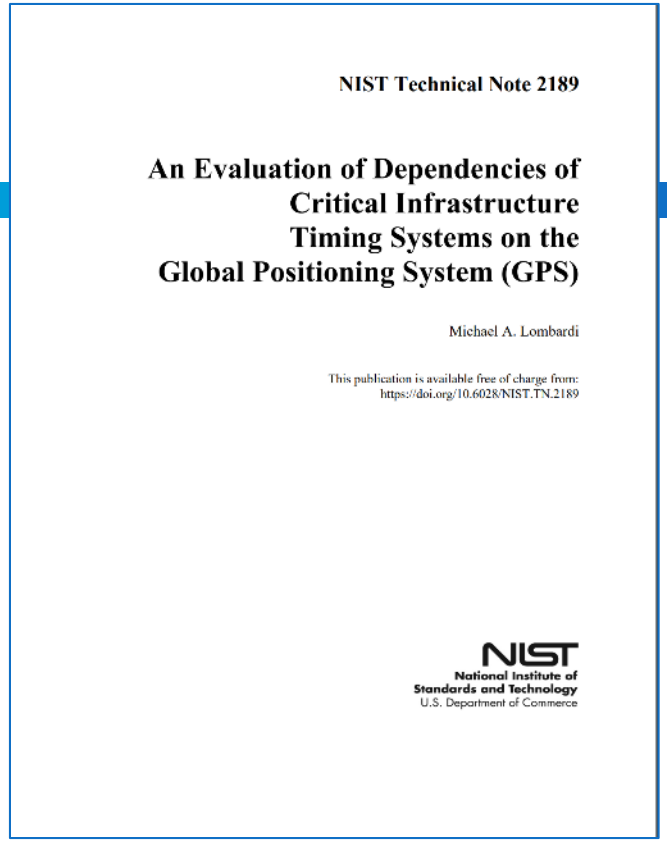
50 YEARS 1970 – 2020 | U.S. Department of Transportation Volpe Center



Requirements

Evaluation Criteria

12 October 2021 https://rntfnd.org/library/



November 2021

Only Looked At:

- Stock Exchanges
- Electrical Grid
- Telecommunications

"The impact of a long lasting, widespread GPS outage on mobile phone networks would likely be staggering."

NIST Technical Note 2187

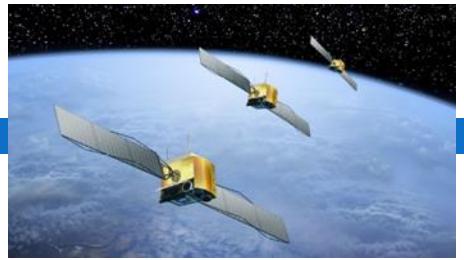
A Resilient Architecture for the Realization and Distribution of Coordinated Universal Time to Critical Infrastructure Systems in the United States

Methodologies and Recommendations from the National Institute of Standards and Technology (NIST)

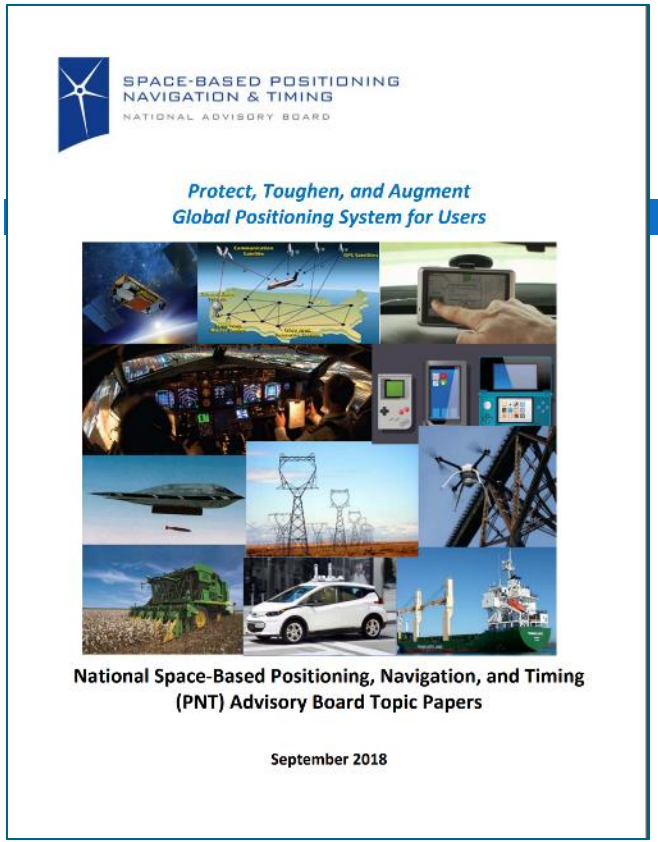
Jeffrey A. Sherman
Ladan Arissian
Roger C. Brown
Matthew J. Deutch
Elizabeth A. Donley
Vladislav Gerginov
Judah Levine
Glenn K. Nelson
Andrew N. Novick
Bijunath R. Patla
Thomas E. Parker
Benjamin K. Stuhl
Douglas D. Sutton
Jian Yao
William C. Yates
Victor Zhang
Michael A. Lombardi

This publication is available free of charge from:
https://doi.org/10.6028/NIST.TN.2187

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

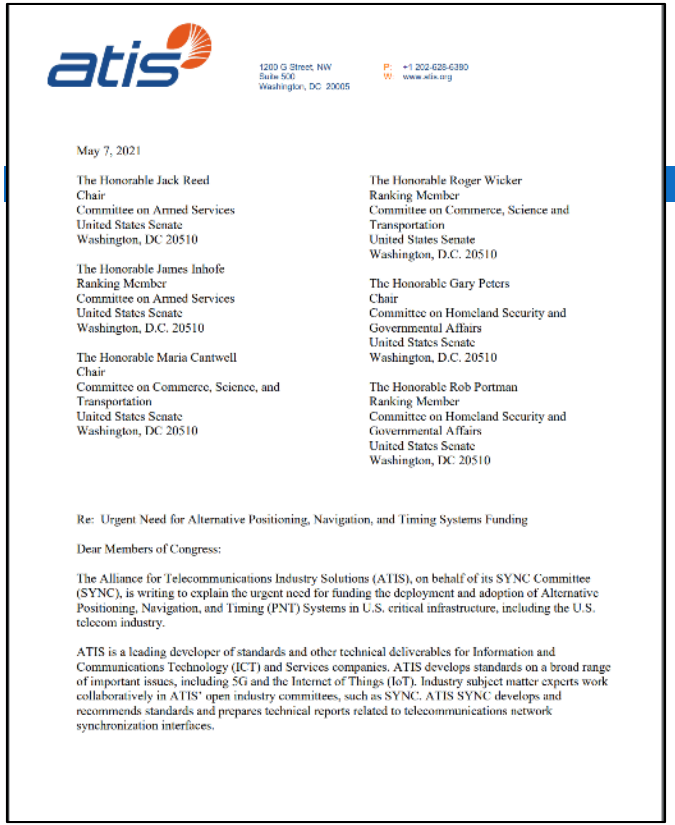


November 2021



"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."

"…the Administration should appropriate sufficient funds to lay the foundation for creating this timing architecture, with the Federal Government being the first customer for what will ultimately become a resilient, interconnected network for PNT delivery."



atis

1200 G Street, NW
Suite 500
Washington, DC 20005

P: +1 202-628-6380
W: www.atis.org

May 7, 2021

The Honorable Jack Reed
Chair
Committee on Armed Services
United States Senate
Washington, DC 20510

The Honorable James Inhofe
Ranking Member
Committee on Armed Services
United States Senate
Washington, D.C. 20510

The Honorable Maria Cantwell
Chair
Committee on Commerce, Science, and Transportation
United States Senate
Washington, DC 20510

The Honorable Roger Wicker
Ranking Member
Committee on Commerce, Science and Transportation
United States Senate
Washington, D.C. 20510

The Honorable Gary Peters
Chair
Committee on Homeland Security and Governmental Affairs
United States Senate
Washington, D.C. 20510

The Honorable Rob Portman
Ranking Member
Committee on Homeland Security and Governmental Affairs
United States Senate
Washington, DC 20510

Re: Urgent Need for Alternative Positioning, Navigation, and Timing Systems Funding

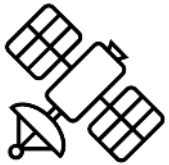
Dear Members of Congress:

The Alliance for Telecommunications Industry Solutions (ATIS), on behalf of its SYNC Committee (SYNC), is writing to explain the urgent need for funding the deployment and adoption of Alternative Positioning, Navigation, and Timing (PNT) Systems in U.S. critical infrastructure, including the U.S. telecom industry.

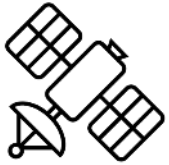
ATIS is a leading developer of standards and other technical deliverables for Information and Communications Technology (ICT) and Services companies. ATIS develops standards on a broad range of important issues, including 5G and the Internet of Things (IoT). Industry subject matter experts work collaboratively in ATIS' open industry committees, such as SYNC. ATIS SYNC develops and recommends standards and prepares technical reports related to telecommunications network synchronization interfaces.

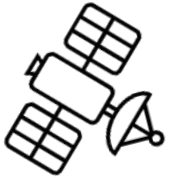
"…urgent need for funding … Alternative Positioning, Navigation, and Timing (PNT) Systems in U.S. critical infrastructure, including the U.S. telecom industry."

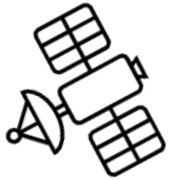
… in Order to form a more perfect Union, establish Justice, insure domestic Tranquility, ***provide for the common defense, promote the general Welfare…***



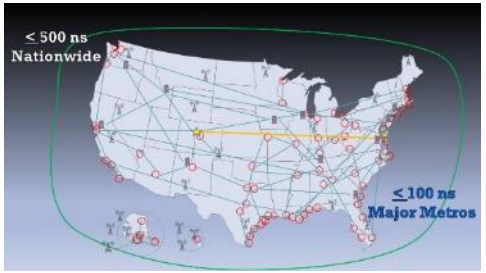
PNT a free utility

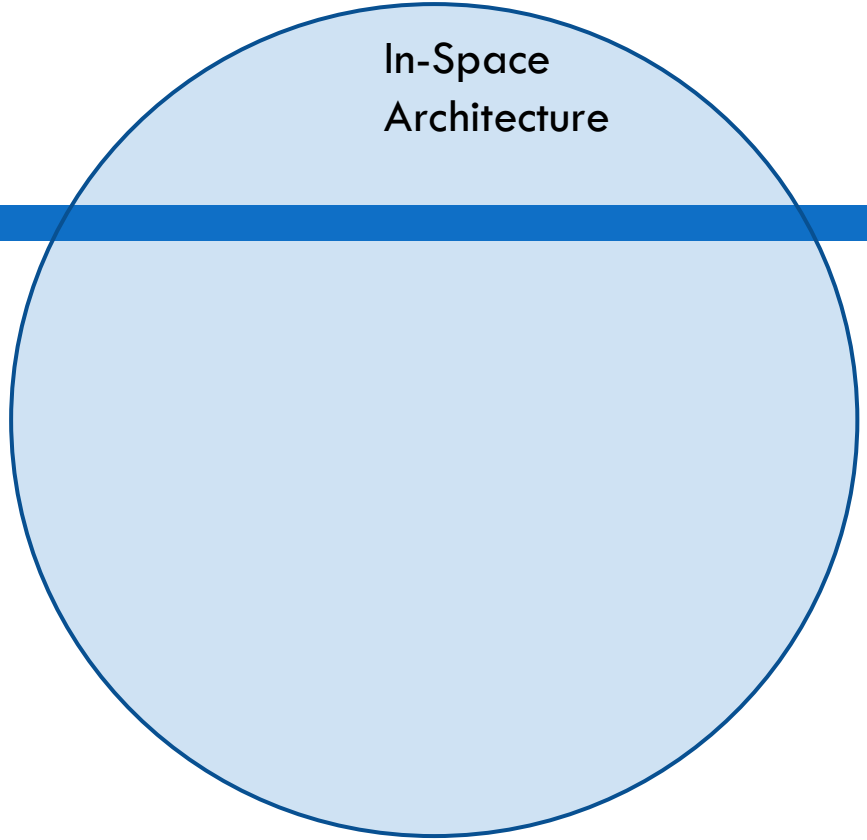




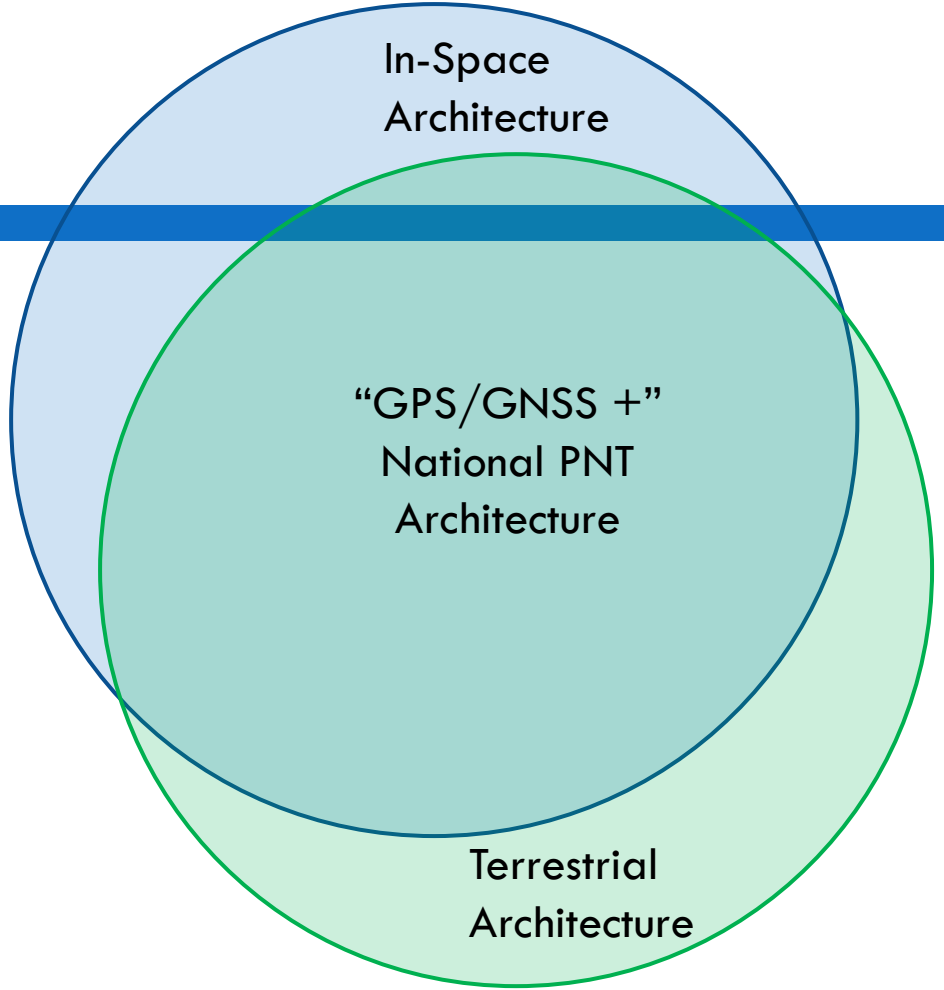


PNT a free utility

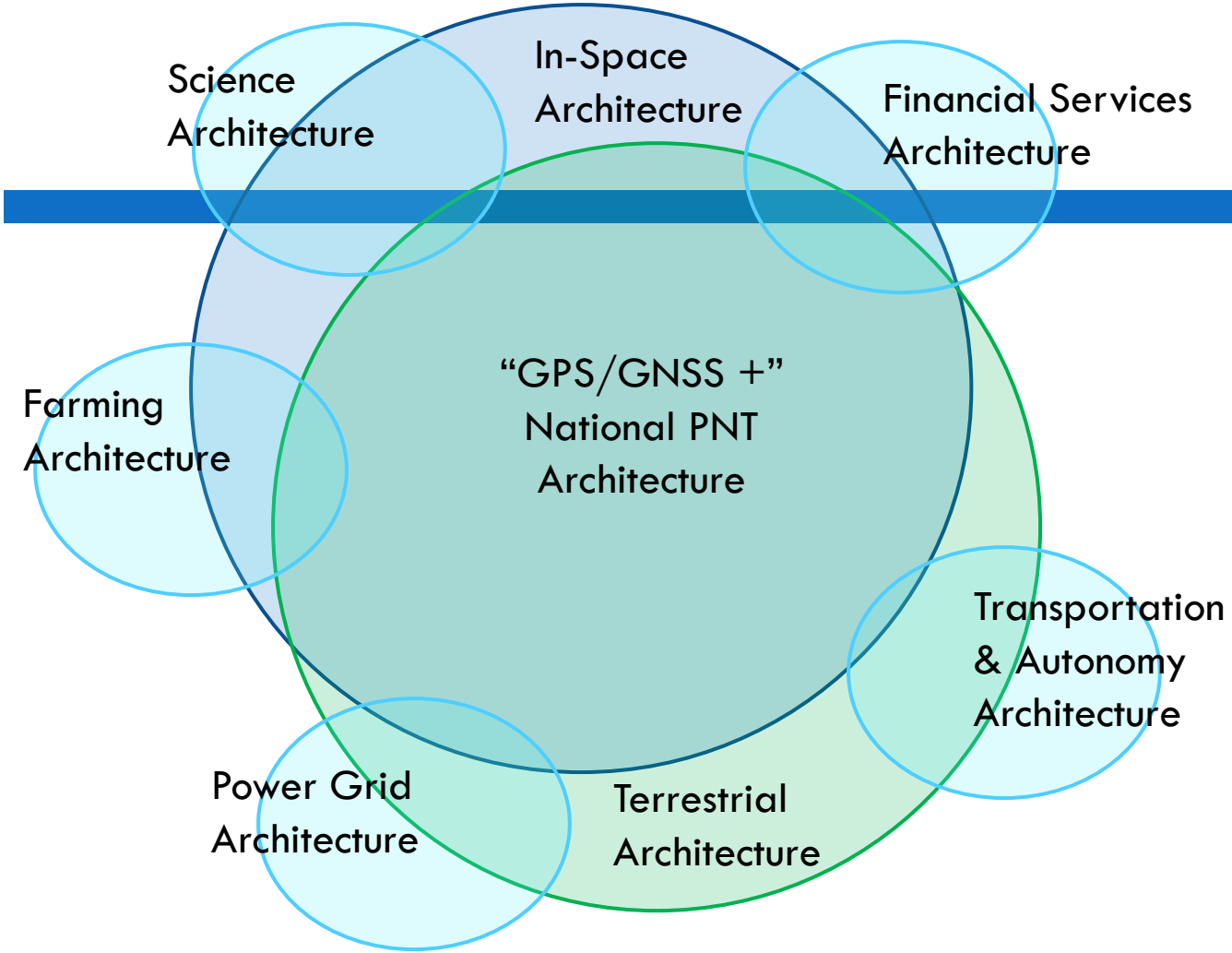

≤ 500 ns
Nationwide
≤ 100 ns
Major Metros



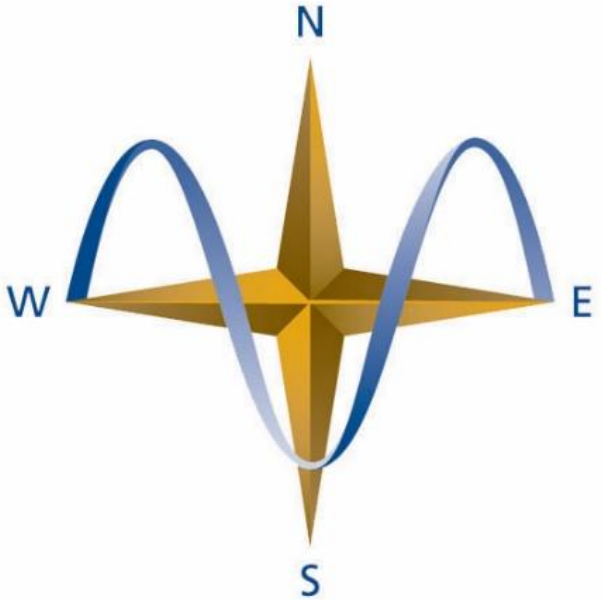
PNT
Whenever,
Wherever,
However
Needed



PNT
Whenever,
Wherever,
However
Needed



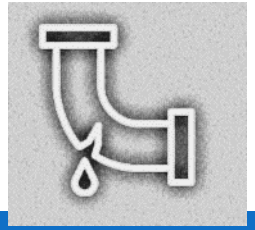
PNT Whenever, Wherever, However Needed

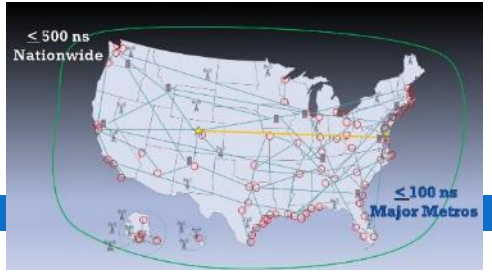


RESILIENT NAVIGATION *and* TIMING FOUNDATION

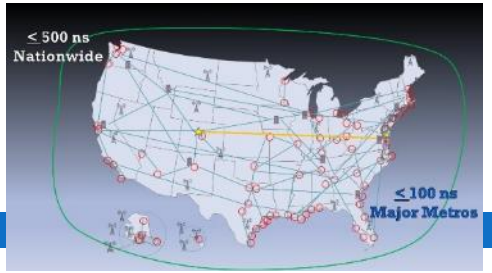
The Resilient Navigation and Timing Foundation is a 501(c)3 scientific and educational charity registered in Virginia
www.RNTFnd.org

Goal: Make Nation Safer



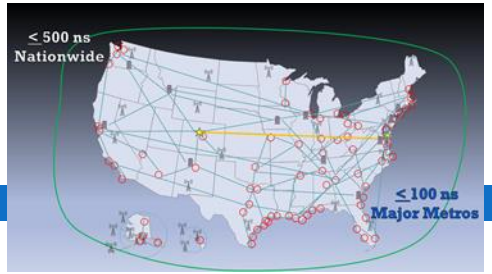


Goal: Make Nation Safer



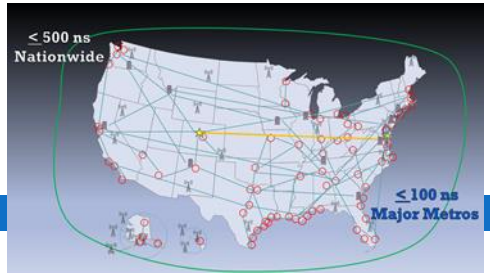
- Credible Alternative Sources

Goal: Make Nation Safer



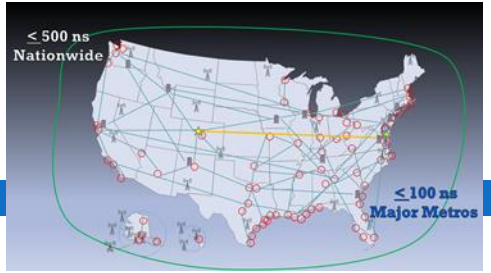
- Credible Alternative Sources
- Maximize Adoption & Use

Goal: Make Nation Safer



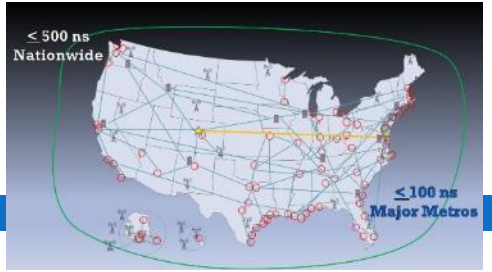
- Credible Alternative Sources
- Maximize Adoption & Use
  - Broad availability

Goal: Make Nation Safer



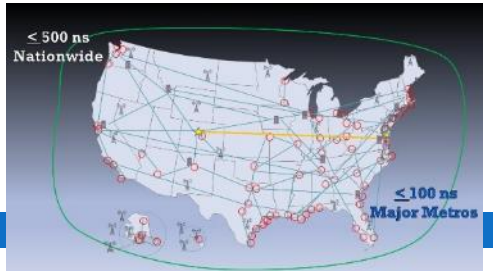
- Credible Alternative Sources
- Maximize Adoption & Use
  - Broad availability
  - Minimize barriers

Goal: Make Nation Safer



- Credible Alternative Sources
- Maximize Adoption & Use
  - Broad availability
  - Minimize barriers
  - Encouragement

Goal: Make Nation Safer



- Credible Alternative Sources
- Maximize Adoption & Use
  - Broad availability
  - Minimize barriers
  - Encouragement
  - Requirements