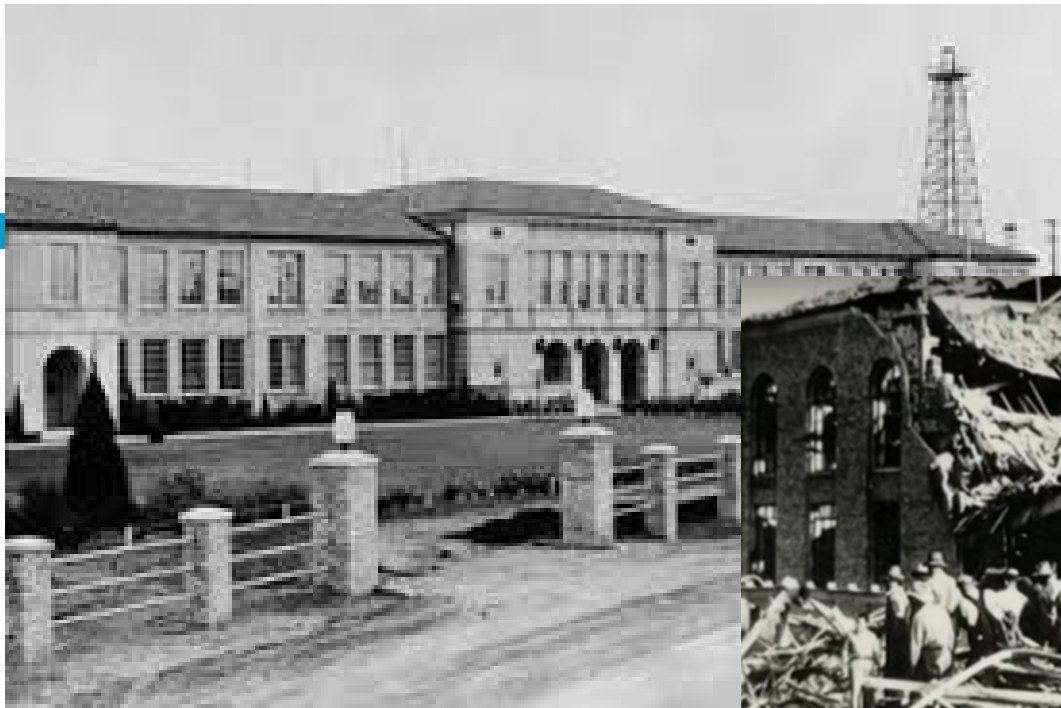


A Resilient National Timing Architecture

SEPTEMBER 2021

CGSIC St. Louis



Nationalboard.org



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USCG Petty Officer 2nd
Class Kyle Niemi



MAY 15, 2017

TIME

WARNING:
WE ARE NOT READY FOR
THE NEXT PANDEMIC

SCIENCE KNOWS
HOW TO FIGHT
AN OUTBREAK—
BUT POLICY STILL
GETS IN THE WAY
BY BRYAN WALSH

HOW TO KEEP THE
WORLD SAFE
BY BILL GATES

TIME.COM

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USCG Petty Officer 2nd
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MAY 15, 2017



WORLD SAFE
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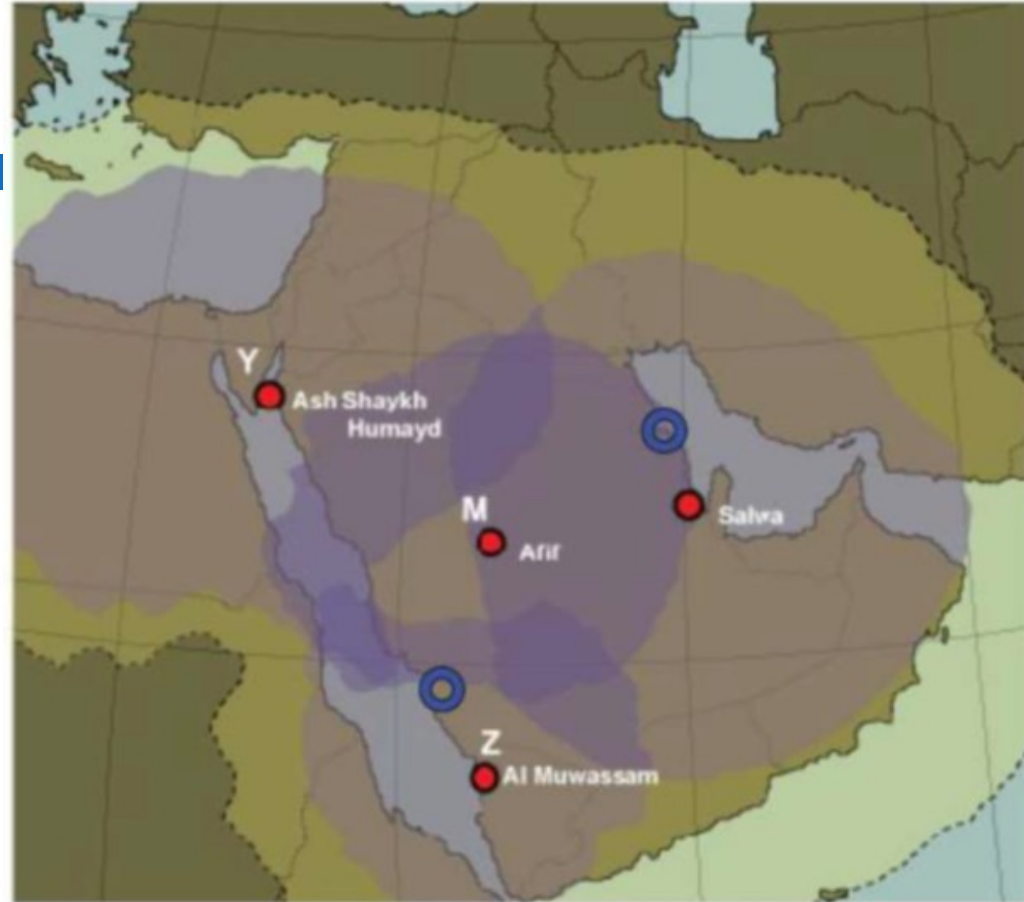
USCG Petty Officer 2nd
Class Kyle Niemi



الإسلام
الدين
الوحيد
الذي
لا اله
إلا هو
الغني
العليم



Saudi Arabia
Loran-C



UrsaNav Image



Iran Developing Homegrown Alternative to GPS

News-ID: 1090226 · Service: Defense

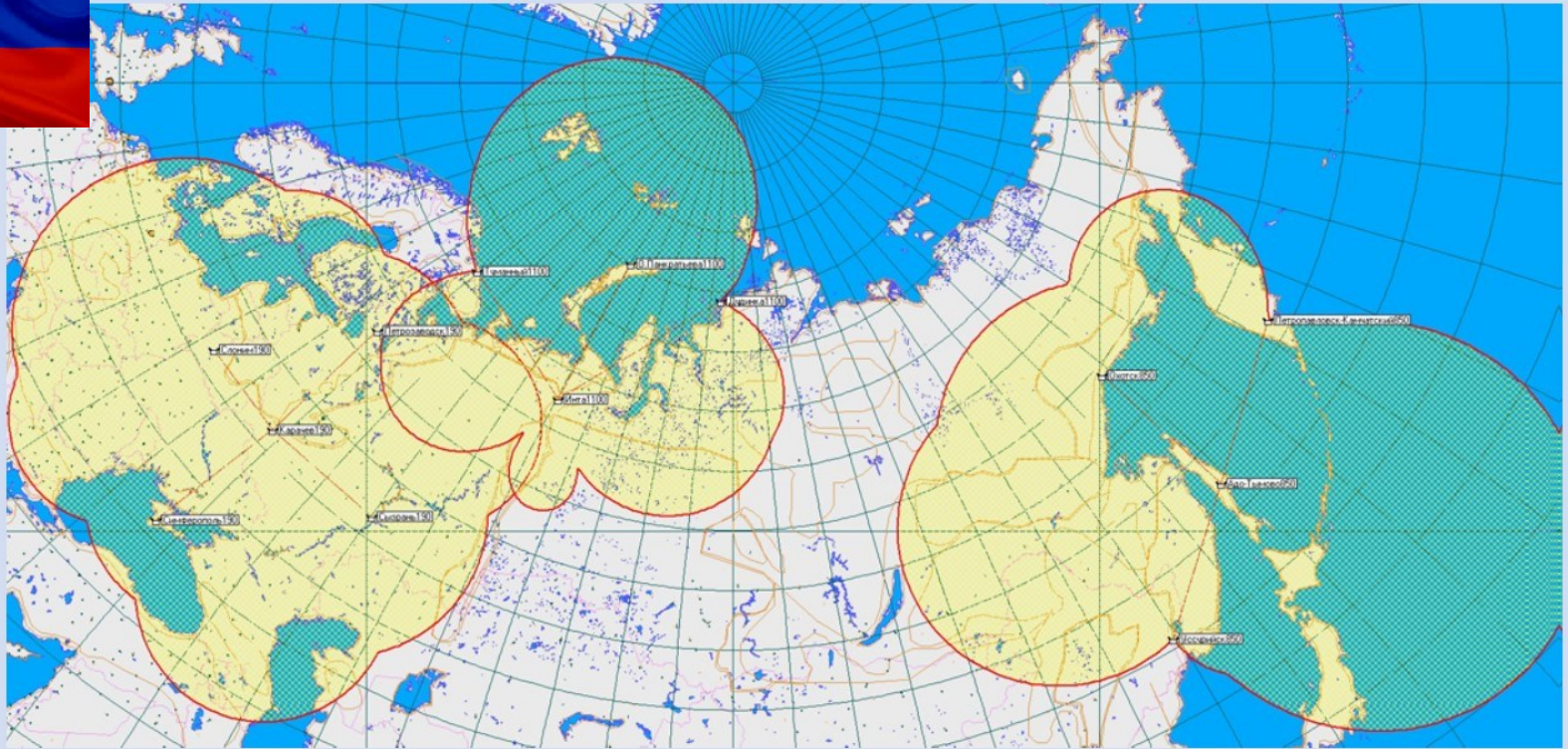
June, 01, 2016 - 13:55

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

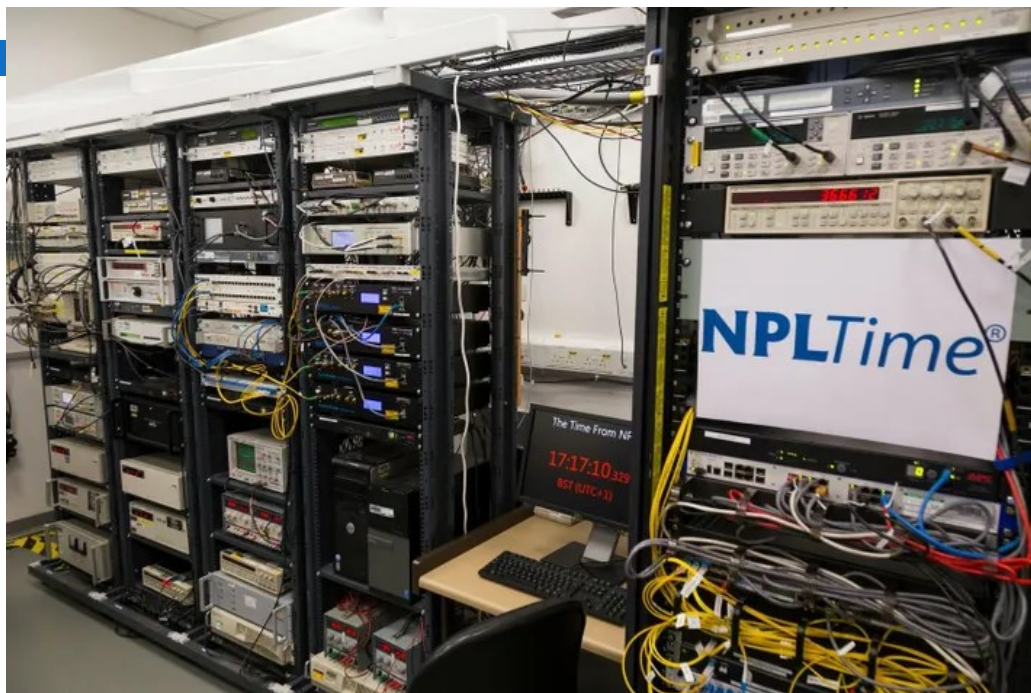


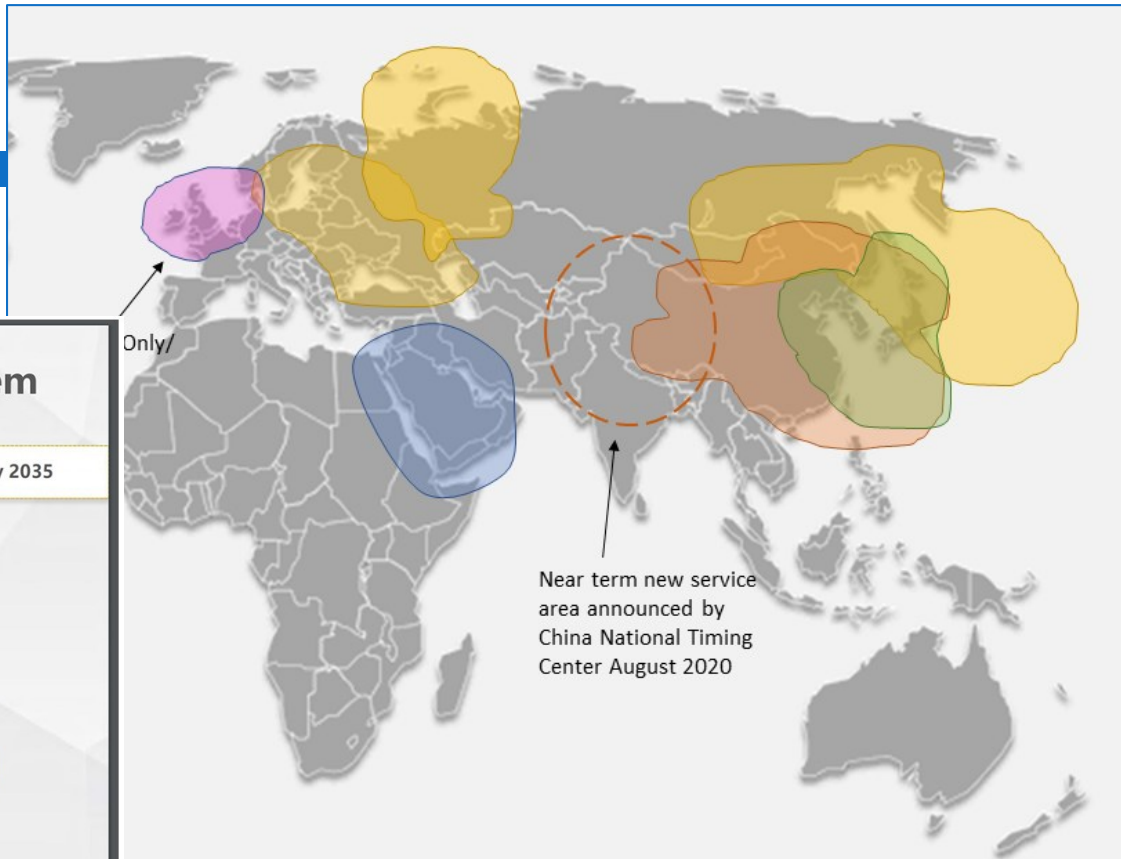
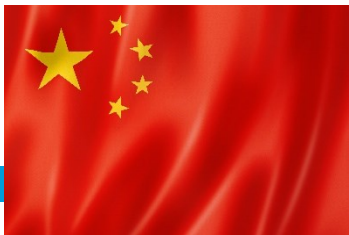
In a ceremony at Malek-Ashtar University of Technology in Tehran, Brigadier General Hossein Dehqan unveiled three new products developed by the university's researchers.



Russia's Chayka (Loran) Coverage

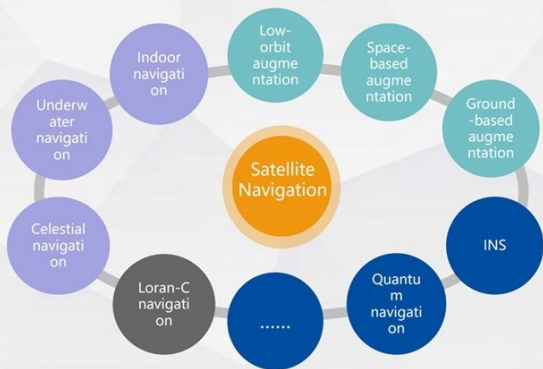
Internavigation Research & Technical Centre of Advanced Navigation
Technologies, August 2017





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,



Service Areas Approximate. Consult national authorities in UK, Saudi Arabia, Russian Federation, China, & South Korea for more information

1998 – We may have a problem

2001 – We definitely have a problem

2004 – Get a backup (Pres. G. W. Bush to DoT)

2008 – We will convert Loran-C to eLoran (DHS)

2010 – Loran-C shutdown, \$36M/yr “saved,” no backup

2015 – We will backup GPS with eLoran time, then PNT (DoD & DOT)

2020 – ‘GPS is not sufficient PNT, protect yourselves’ (Pres Trump)



2014 – Stop demolishing Loran until backup decision

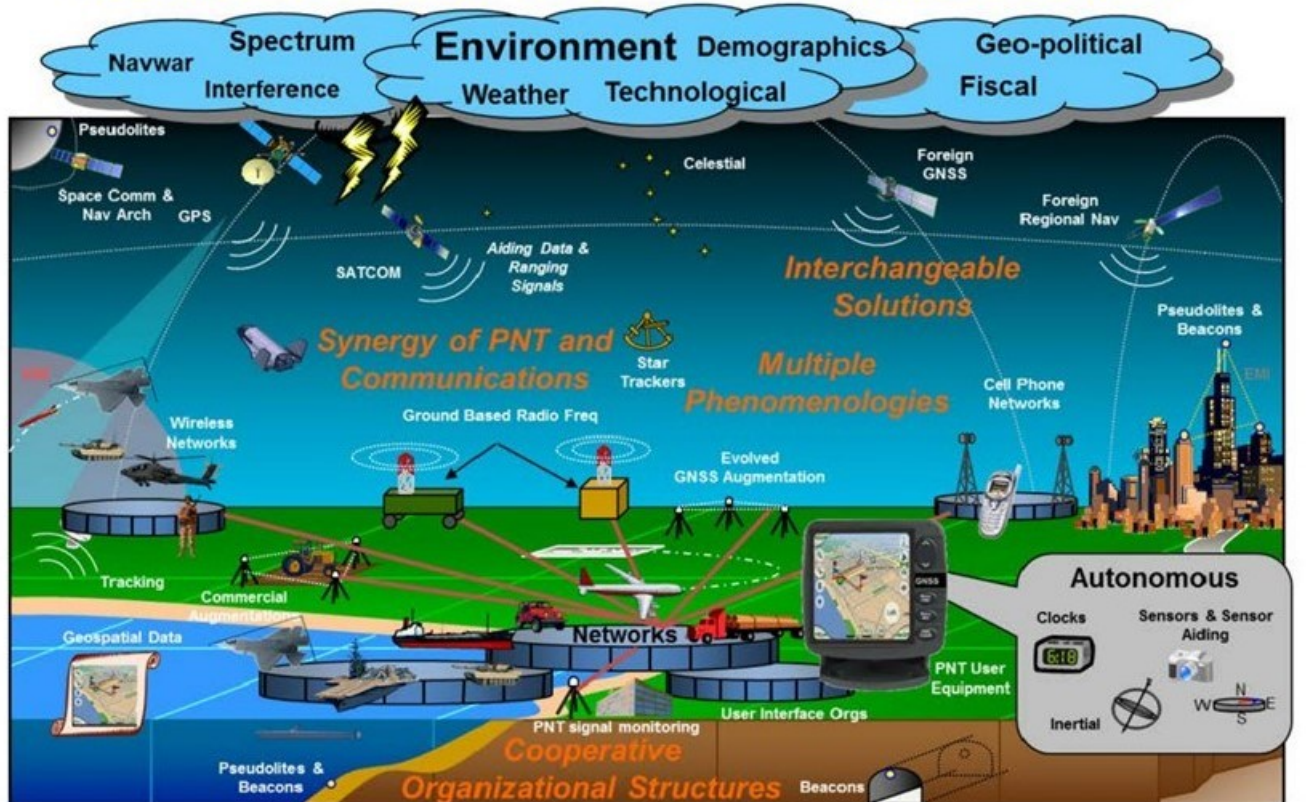
2017 – Do a tech demo, \$10M provided in 2018

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



National PNT Architecture



Standards	Reference Frames	Cryptography	Science & Technology	USNO	NIST	NGA	NGS
Star Catalogs	Launch	ENABLERS & INFRASTRUCTURE			NSA	Industrial Base	
Electro Optical Info.	Modeling	Mapping/Charting/Geodesy	Laser Ranging Network		Policies	Testing	

N

Na

GLOBAL

CONTINENTAL

LOCAL



Standards
Star Cata
Electro Optical imo. modeling mapping/sharing security Laser Ranging Network Policies testing

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N

GLOBAL

CONTINENTAL

LOCAL



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

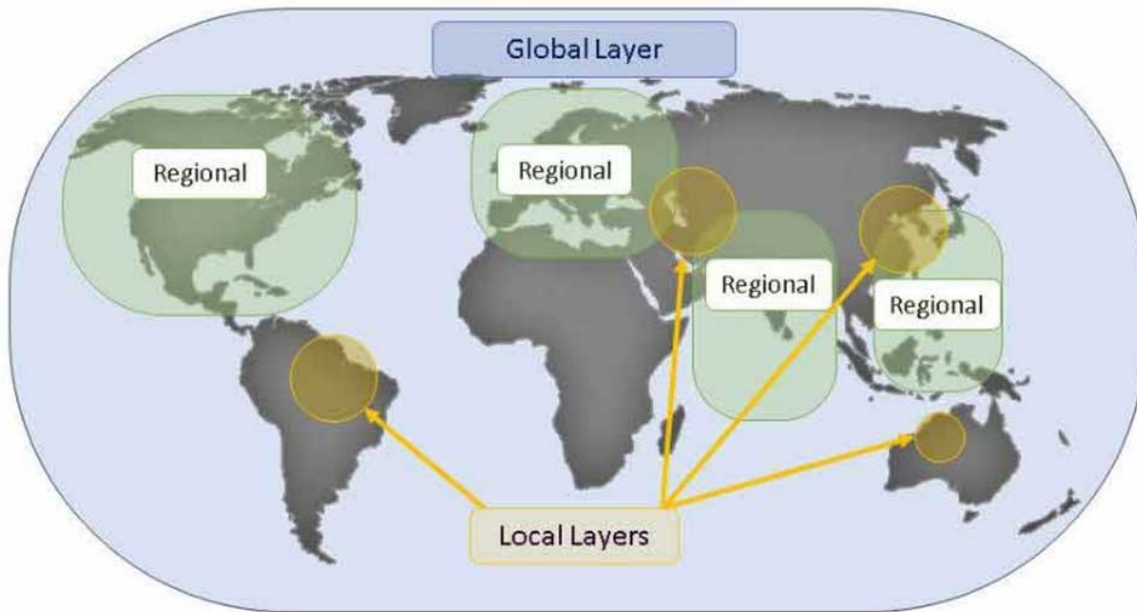
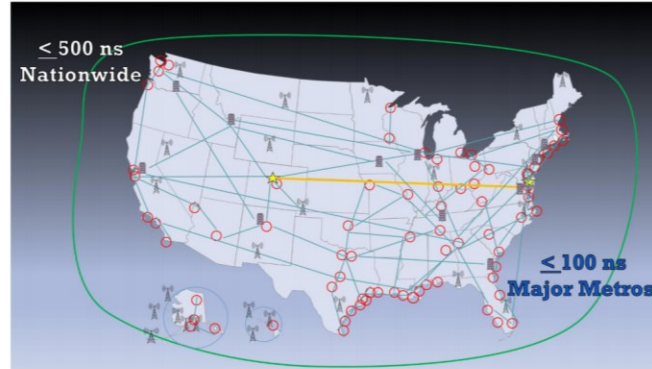


Figure 7 - Layered PNT Enterprise Architecture

Standards
Star Cata
Electro Optical



16 October 2020



A Resilient National Timing Architecture

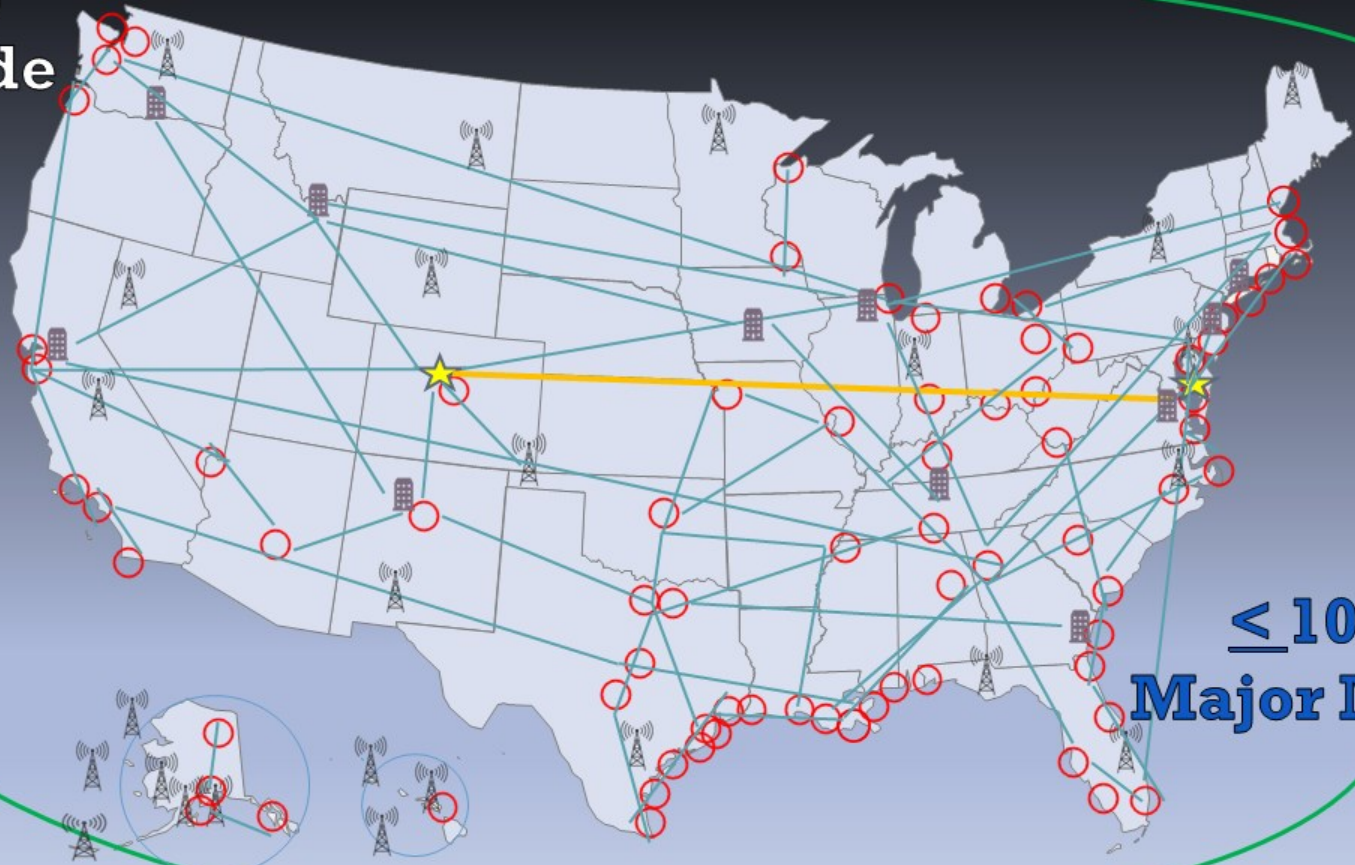
SECURING TODAY'S SYSTEMS, ENABLING TOMORROW'S

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

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<https://rntfnd.org/library/>

< 500 ns
Nationwide



< 100 ns
Major Metros

Complementary PNT and GPS Backup Technologies Demonstration Report

Sections I through 10

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

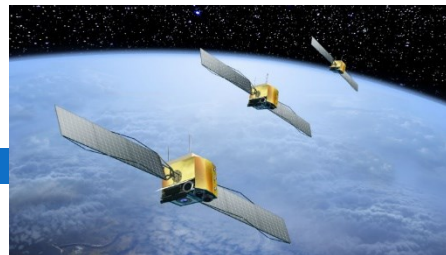
January 2021
DOT-VNTSC-20-07

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

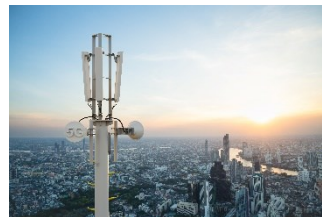


50
YEARS
1970 - 2020

U.S. Department of Transportation
Volpe Center



L Band fm Space



UHF



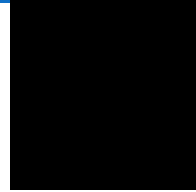
LF



Fiber

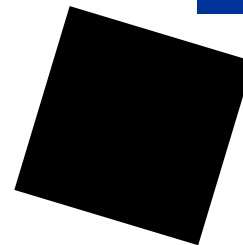
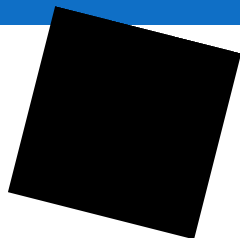
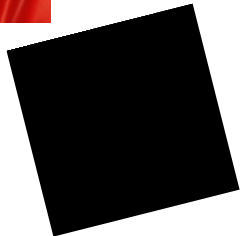
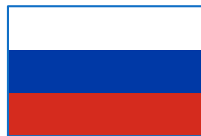


*... in Order to form a more perfect Union, establish
Justice, insure domestic Tranquility, provide for the
common defense, promote the general Welfare...*

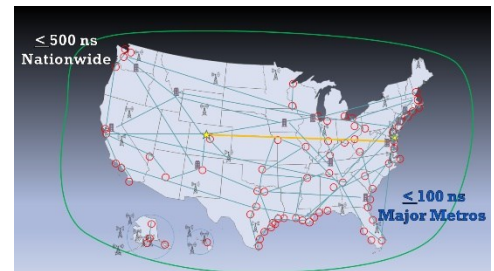


PNT a free utility

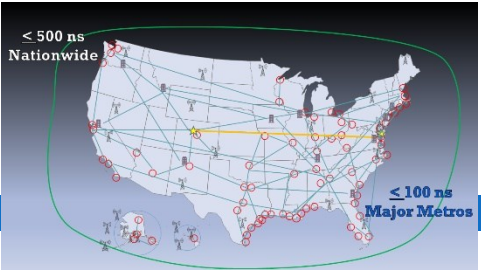
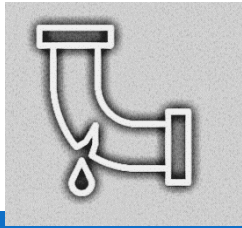




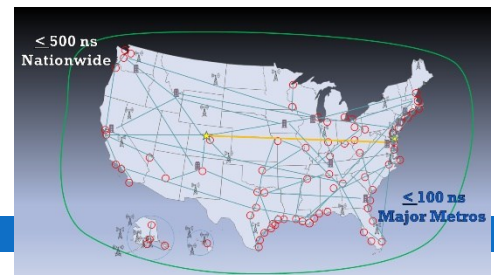
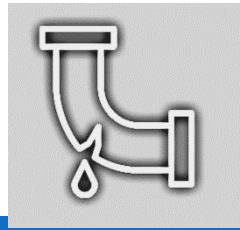
PNT a free utility



Goal: Make Nation Safer

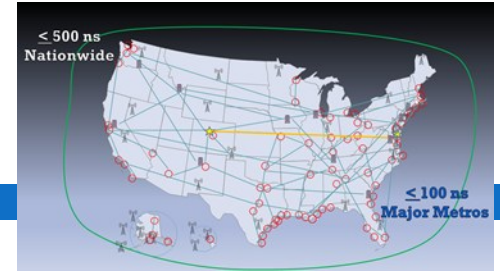
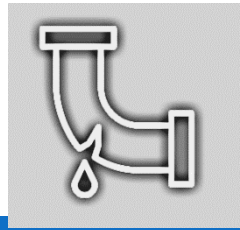


Goal: Make Nation Safer



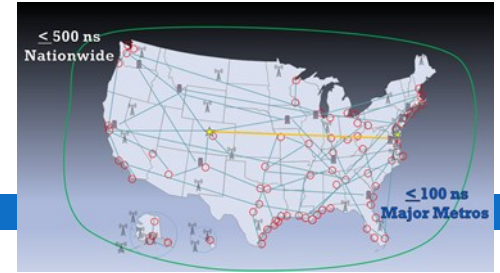
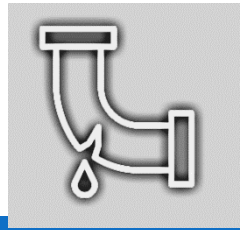
- Credible Alternative Sources

Goal: Make Nation Safer



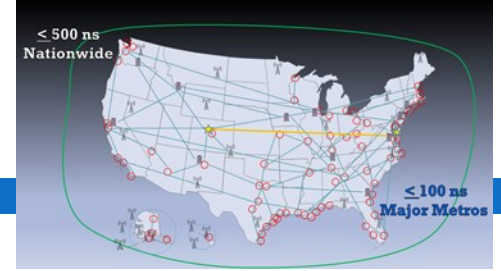
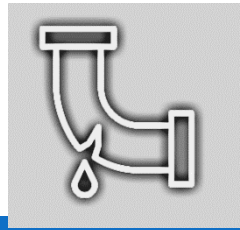
- Credible Alternative Sources
- Maximize Adoption & Use

Goal: Make Nation Safer



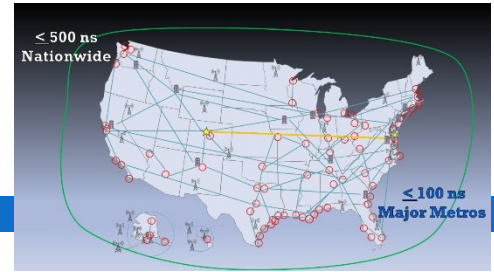
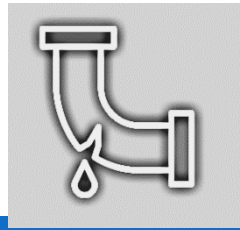
- Credible Alternative Sources
- Maximize Adoption & Use
 - Broad availability

Goal: Make Nation Safer



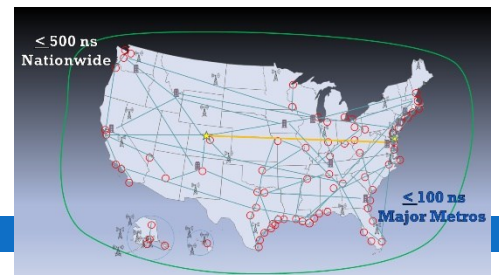
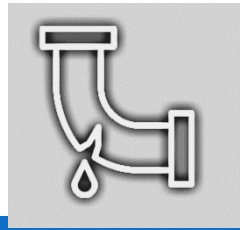
- Credible Alternative Sources
- Maximize Adoption & Use
 - Broad availability
 - Minimize barriers

Goal: Make Nation Safer



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

Goal: Make Nation Safer



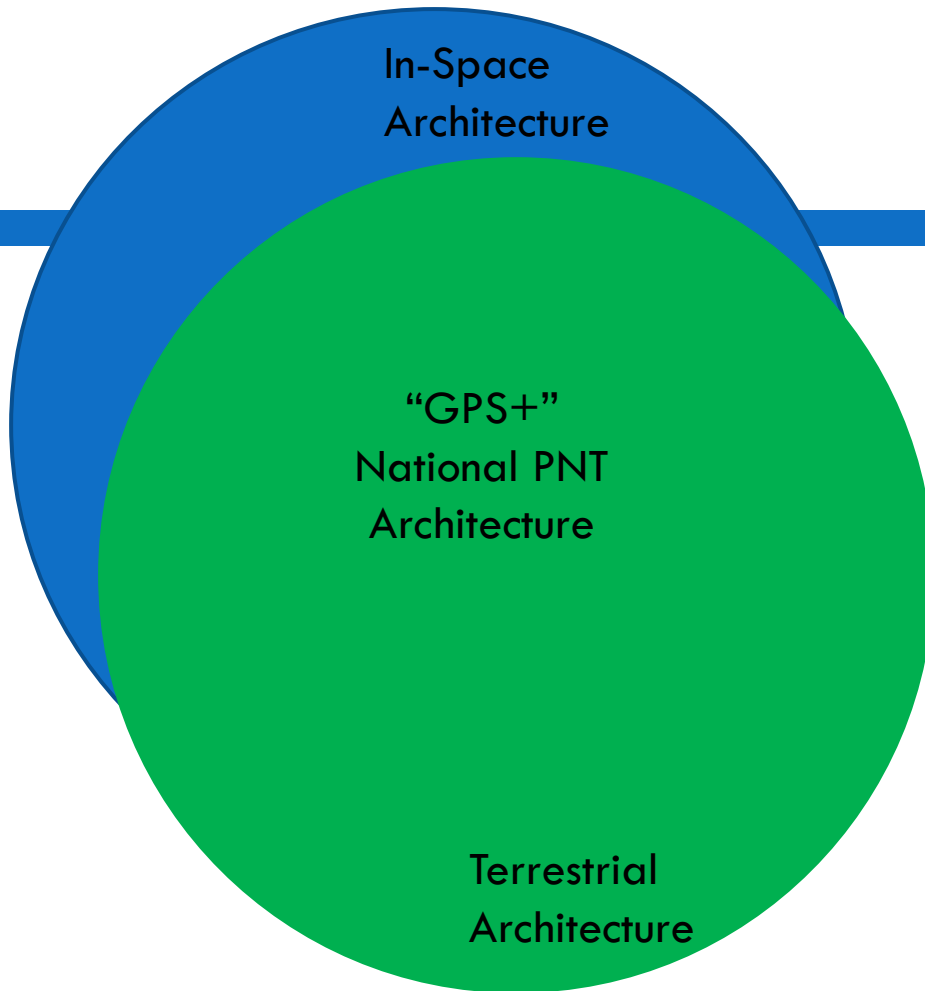
- Credible Alternative Sources
- Maximize Adoption & Use
 - Broad availability
 - Minimize barriers
 - Encouragement
 - Requirements



In-Space
Architecture

“GPS+”
National PNT
Architecture

PNT
Whenever,
Wherever,
However
Needed



PNT
Whenever,
Wherever,
However
Needed

Science
Architecture

In-Space
Architecture

Financial Services
Architecture

Farming
Architecture

“GPS+”
National PNT
Architecture

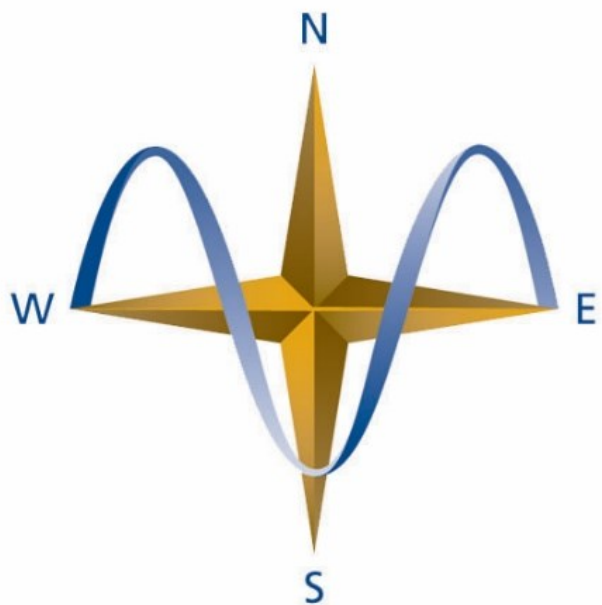
Transportation
& Autonomy
Architecture

Power Grid
Architecture

Terrestrial
Architecture

PNT
Whenever,
Wherever,
However
Needed





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