Case Study of Broadcast Positioning System™ (BPS™) Deployment

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NAB

What is Broadcast Positioning System (BPS)?

A system and method of estimating time and position at a receiver using Next Gen TV broadcast signals

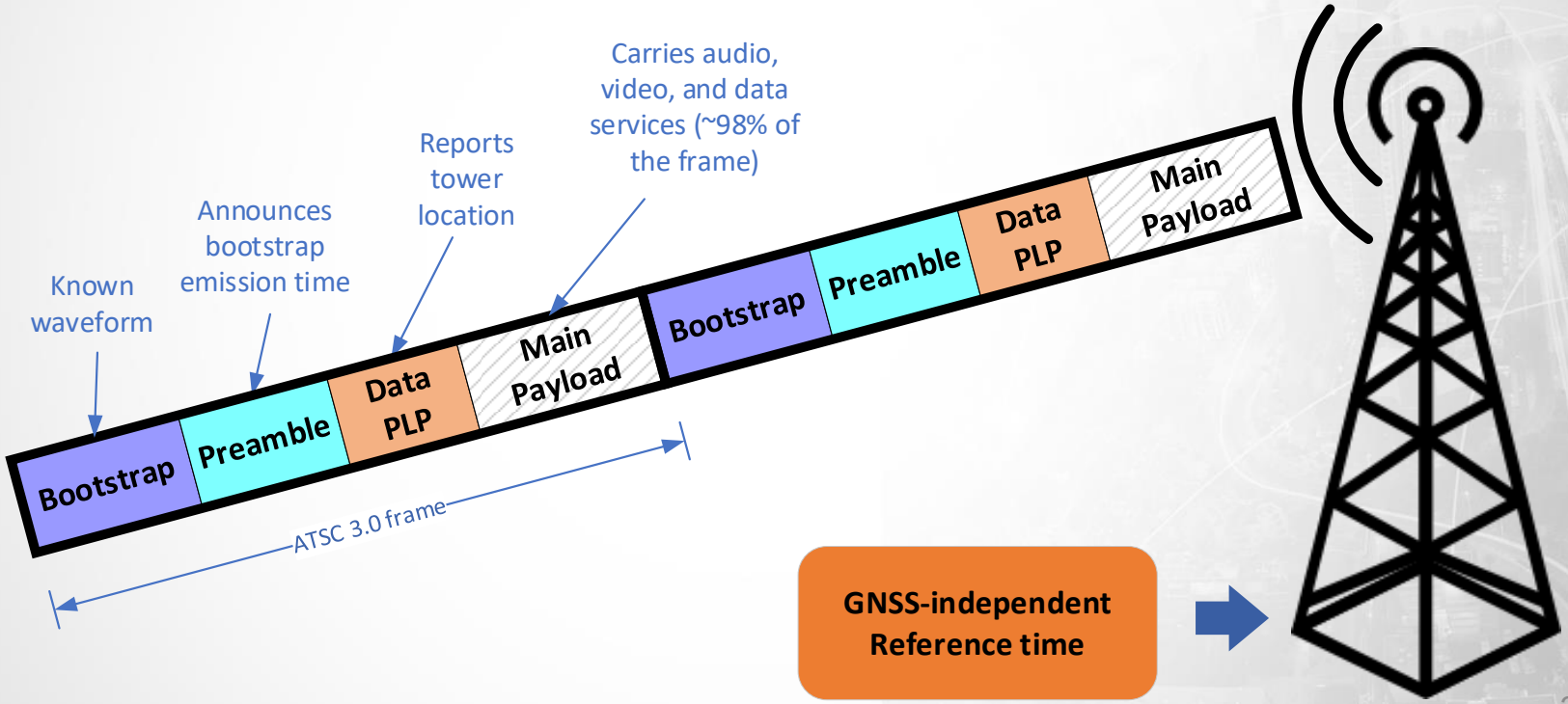
ATSC ADVANCED TELEVISION SYSTEMS COMMITTEE

Compliant with Next Gen TV (ATSC 3.0) standard currently being deployed in the US

Independent and stand-alone

- GPS, Internet or cellular connectivity not required

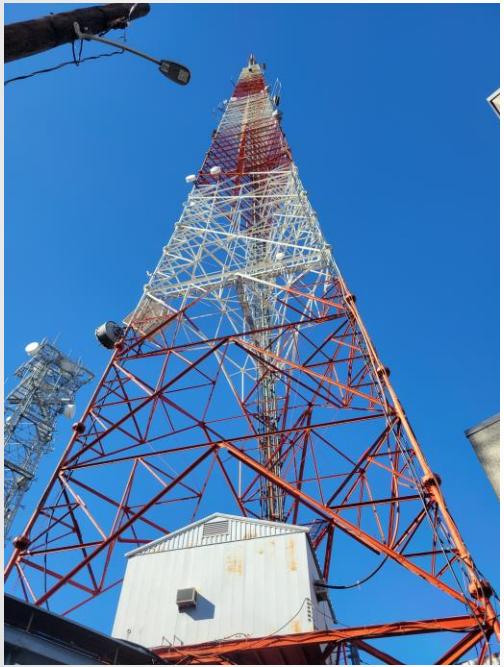
Concept


Known waveform
Announces bootstrap emission time
Reports tower location
Carries audio, video, and data services (~98% of the frame)
Bootstrap
Preamble
Data PLP
Main Payload
Bootstrap
Preamble
Data PLP
Main Payload
ATSC 3.0 frame
GNSS-independent Reference time

Achievement Since WSTS 2024

- Deployed in 3 markets
- Collaborated with NIST
- Live demos at events
- NOC and new receivers

WHUT (Washington, DC)

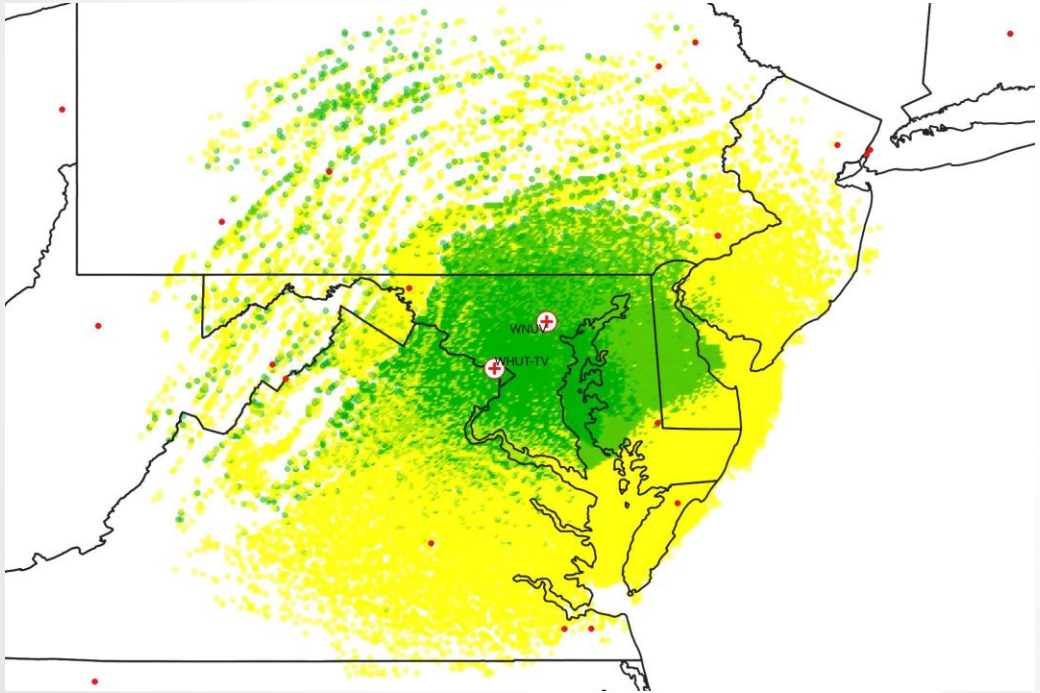


Transmit Channel	33
Frequency	584 - 590 MHz
Effective Radiated Power (ERP)	**416 kW**
Antenna radiation center Height Above Average Terrain (HAAT)	254 meters

WNUV (Baltimore, Maryland)

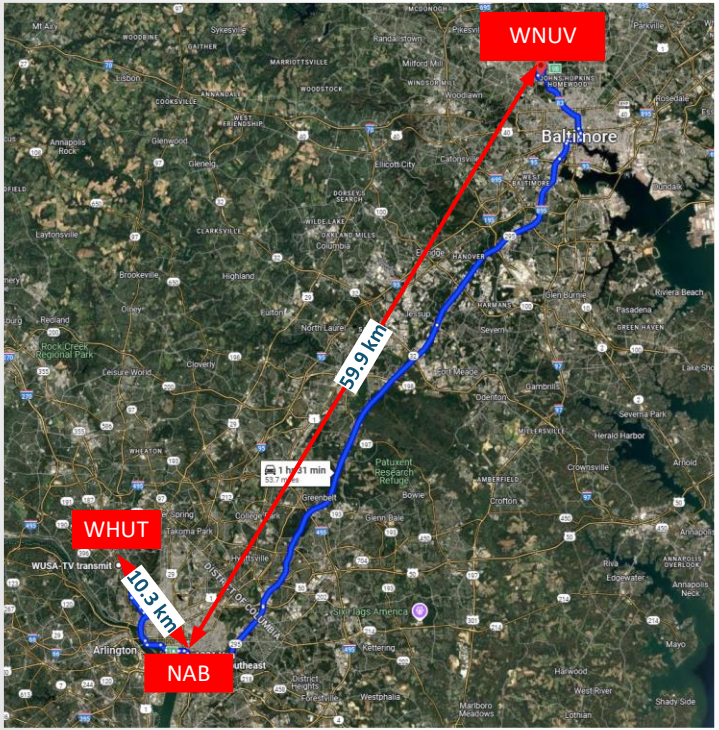
Transmit Channel	25
Frequency	536 - 542 MHz
Effective Radiated Power (ERP)	**750 kW**
Antenna radiation center Height Above Average Terrain (HAAT)	456.8 meters

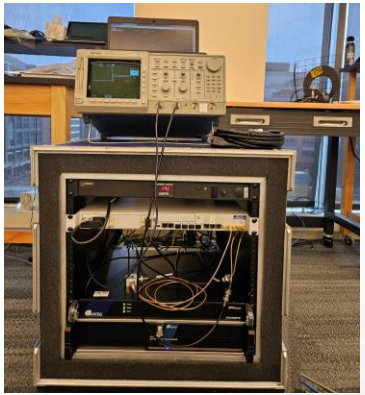
WHUT and WNUV Combined Coverage Map



- Signal reaches to parts of Maryland, Virginia, Washington DC, Delaware, New Jersey, Pennsylvania, and West Virginia
- 81,245 square-km of BPS coverage

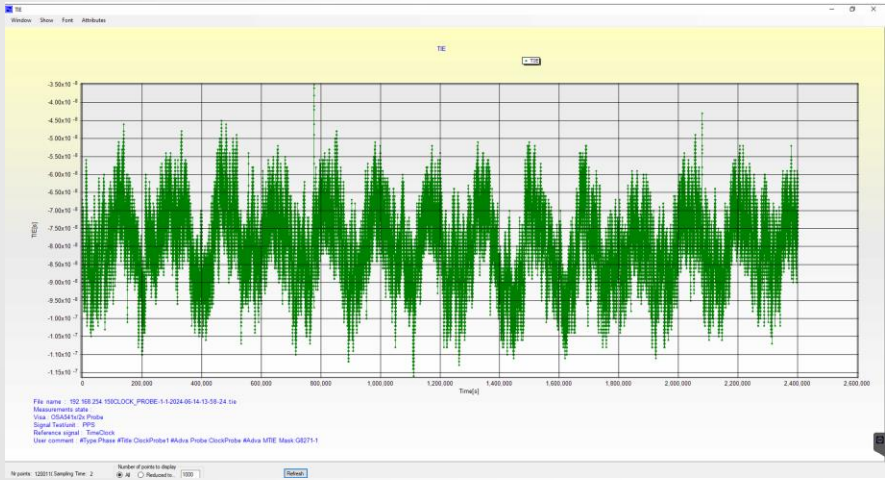
Test and Validation at NAB Lab



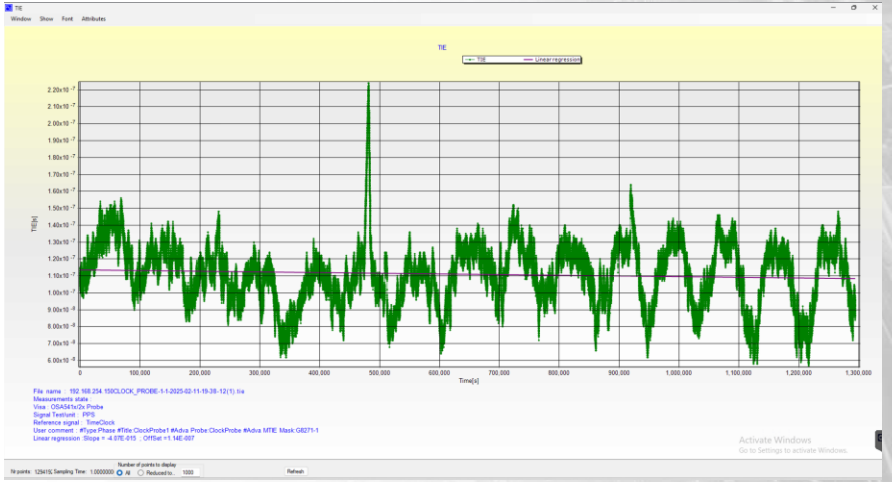


GPS(L1)–BPS TIE over 2 Weeks

WHUT: ±40 ns



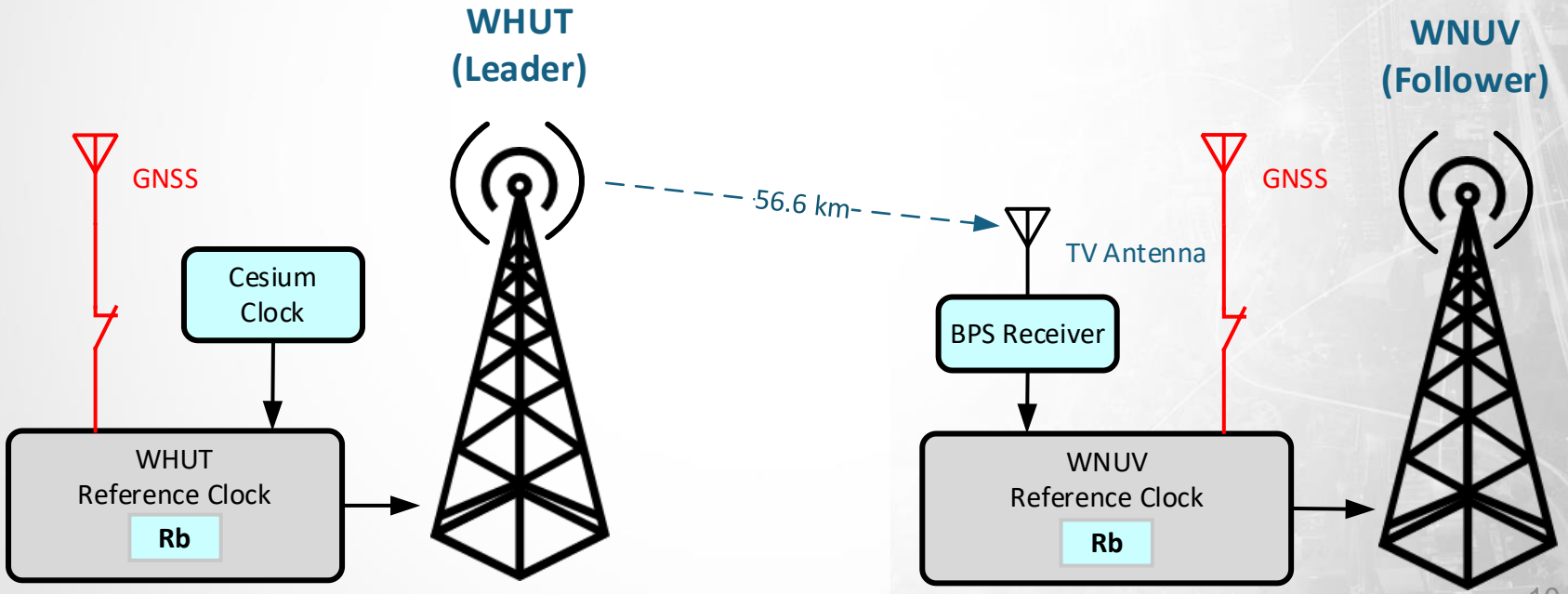
WNUV: ±50 ns (excluding the spike)



Note: GPS diurnals dominated the TIE

Implemented Leader-Follower Network

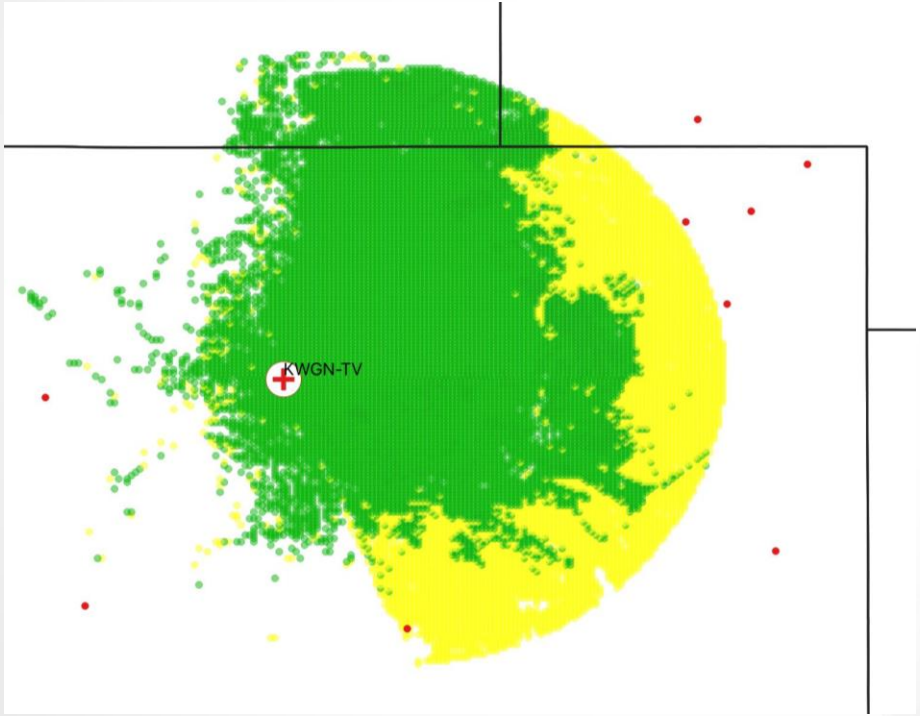
System continues to operate if GNSS antennas are disconnected



KWGN (Denver, Colorado)

Transmit Channel	34
Frequency	590 - 596 MHz
Effective Radiated Power (ERP)	**1000 kW**
Antenna radiation center Height Above Average Terrain (HAAT)	336 meters

KWGN Coverage



- Signal reaches to parts of Colorado, Wyoming and Nebraska
- 75,858 square-km of BPS coverage

Cooperative Research and Development Agreement (CRADA)

NAB, NIST, and Nexstar Media Group (KWGN) signed CRADA

Comon view Test

- 30 km NLOS (Boulder, CO) and 106 km LOS (Fort Collins, CO)
- Less than 2ns TDEV statistics

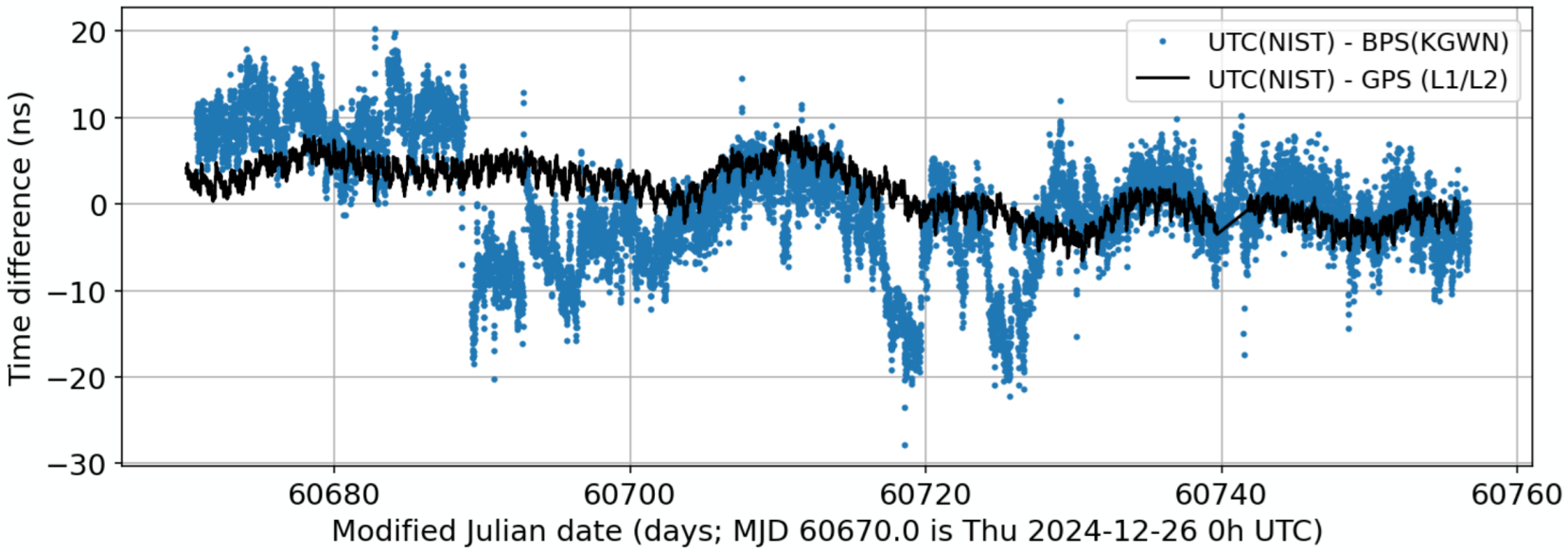
Boulder reception tests

- Under 3ns TDEV statistics for NLOS

ION Paper – BPS is comparable to GPS for time transfer

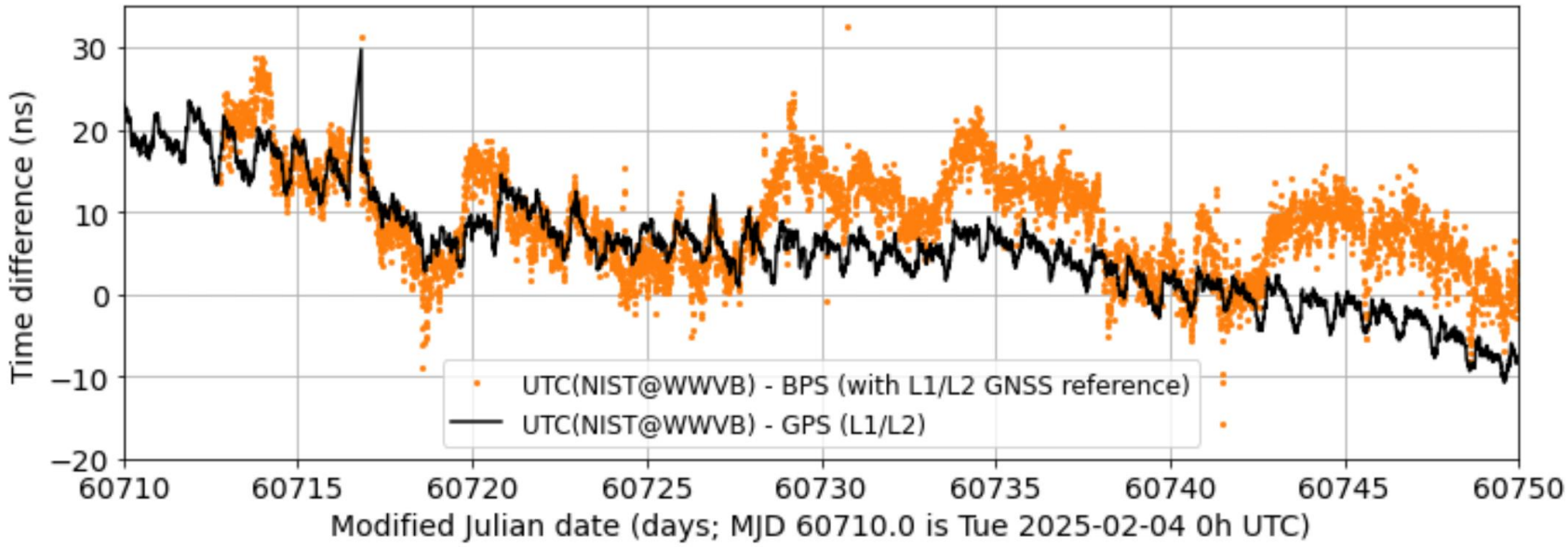
30 km NLOS Performance (NIST)

Example: 86 days, UTC(NIST) - BPS(KWGN)

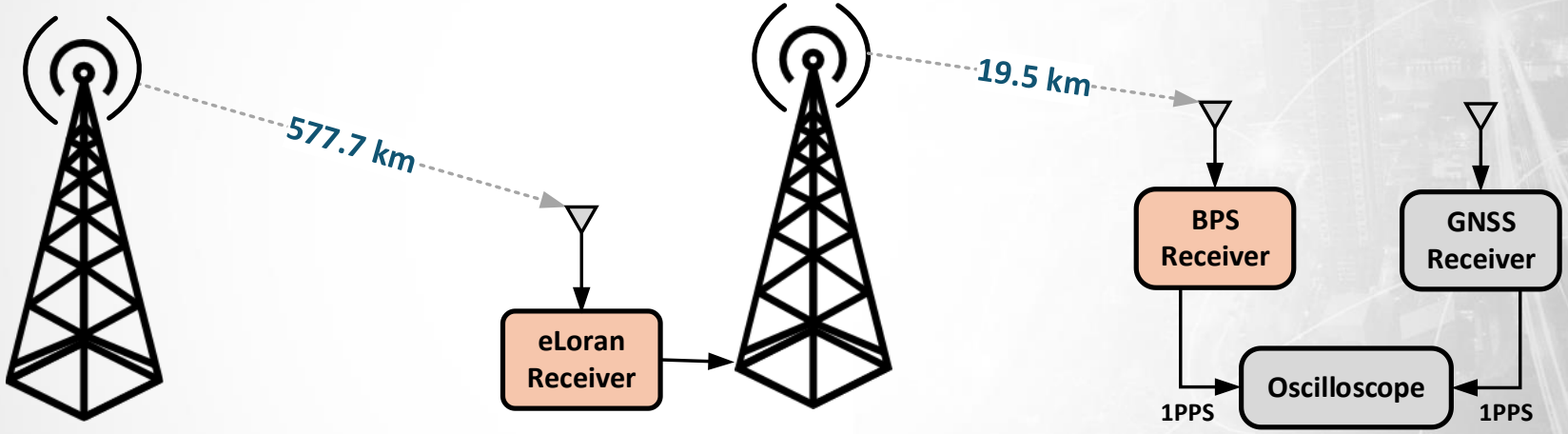


106 km LOS Performance (NIST)

Example: 40 days, UTC(NIST@WWVB) - BPS(KWGN)



Live BPS+eLORAN Survivability Demo

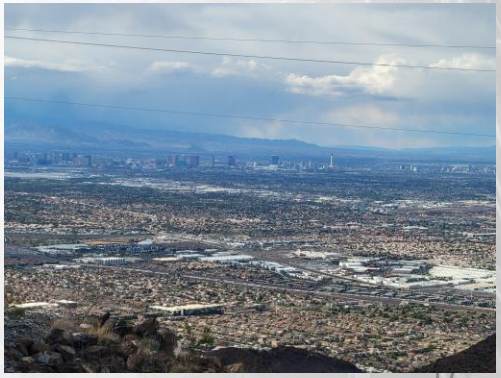


eLoran Transmitter at Fallon, Nevada

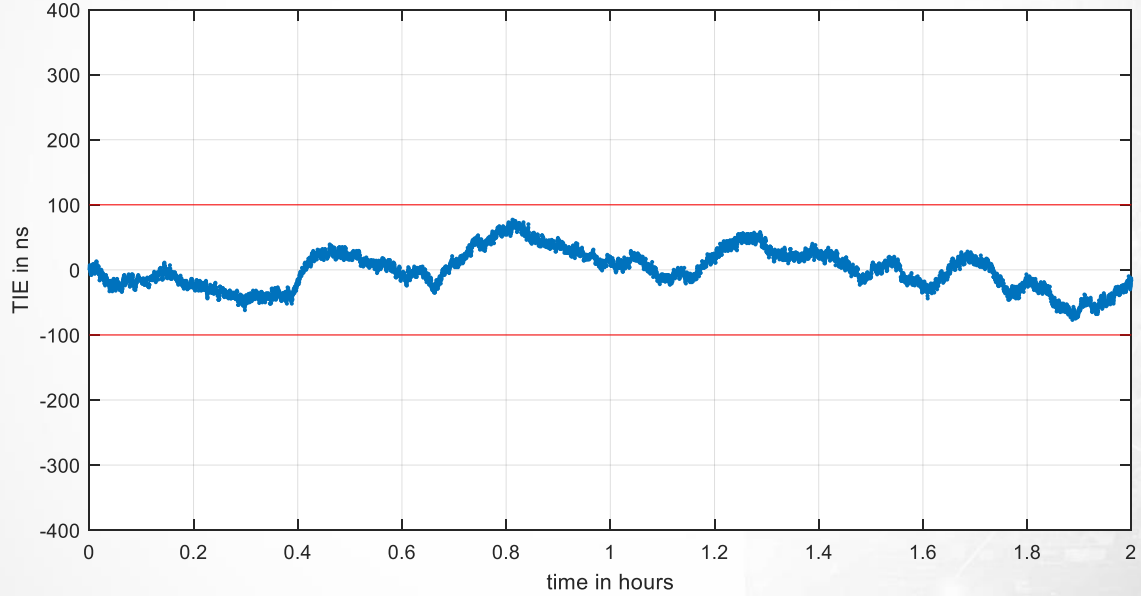
KSNV (BPS) Transmitter at Black Mountain, Nevada

Convention Center, Las Vegas, Nevada

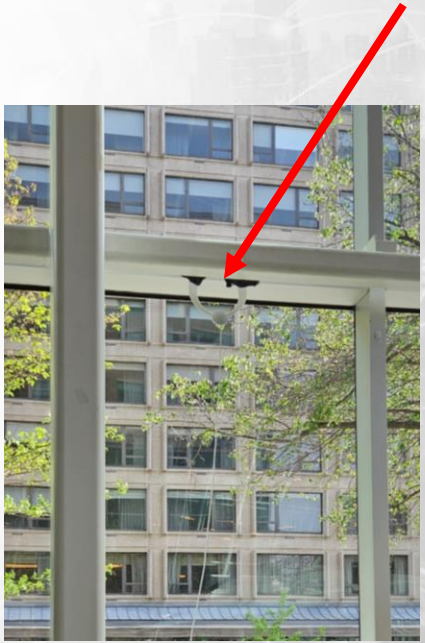
Live Demo at NAB Show



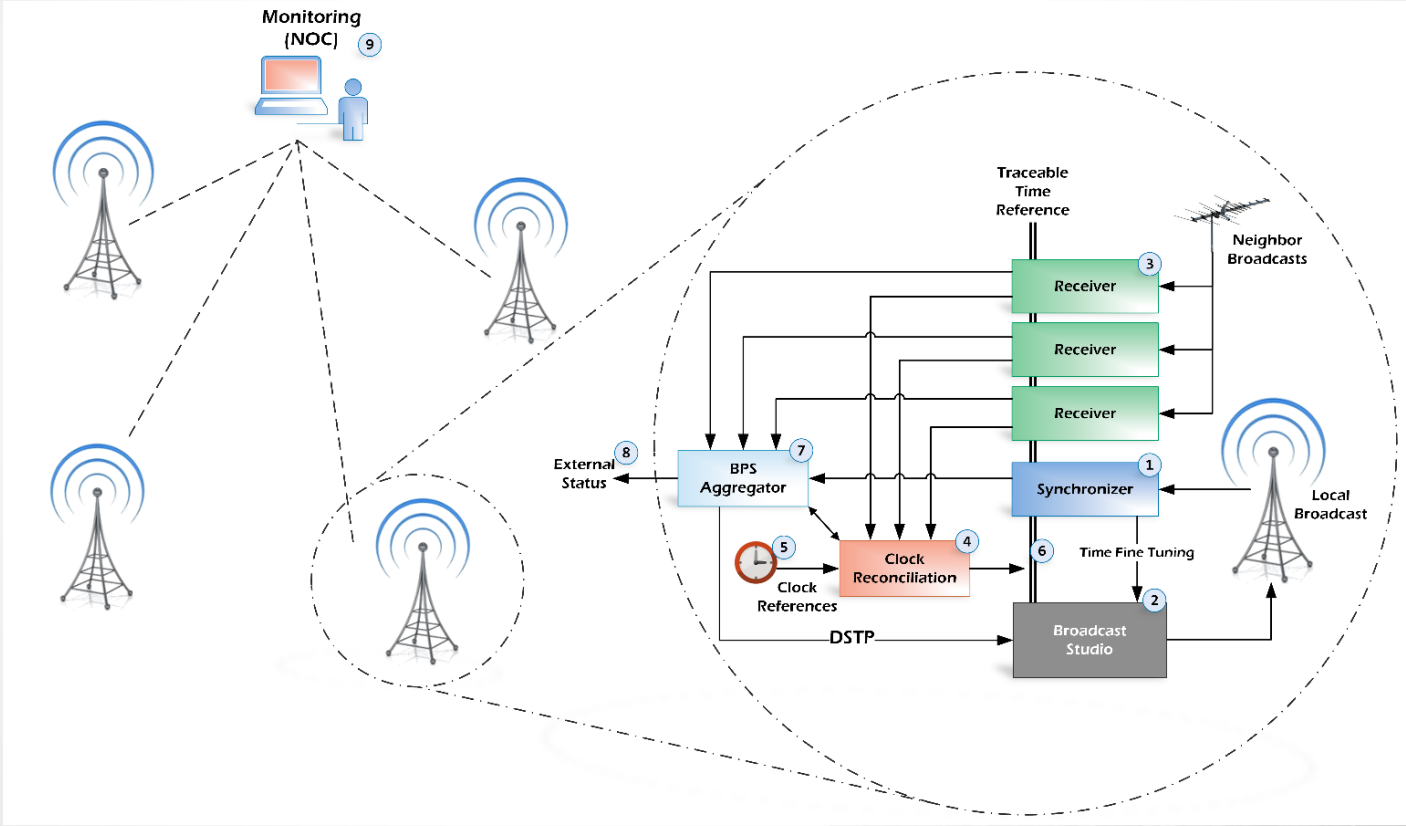
BPS+eLoran Time Delivery Result



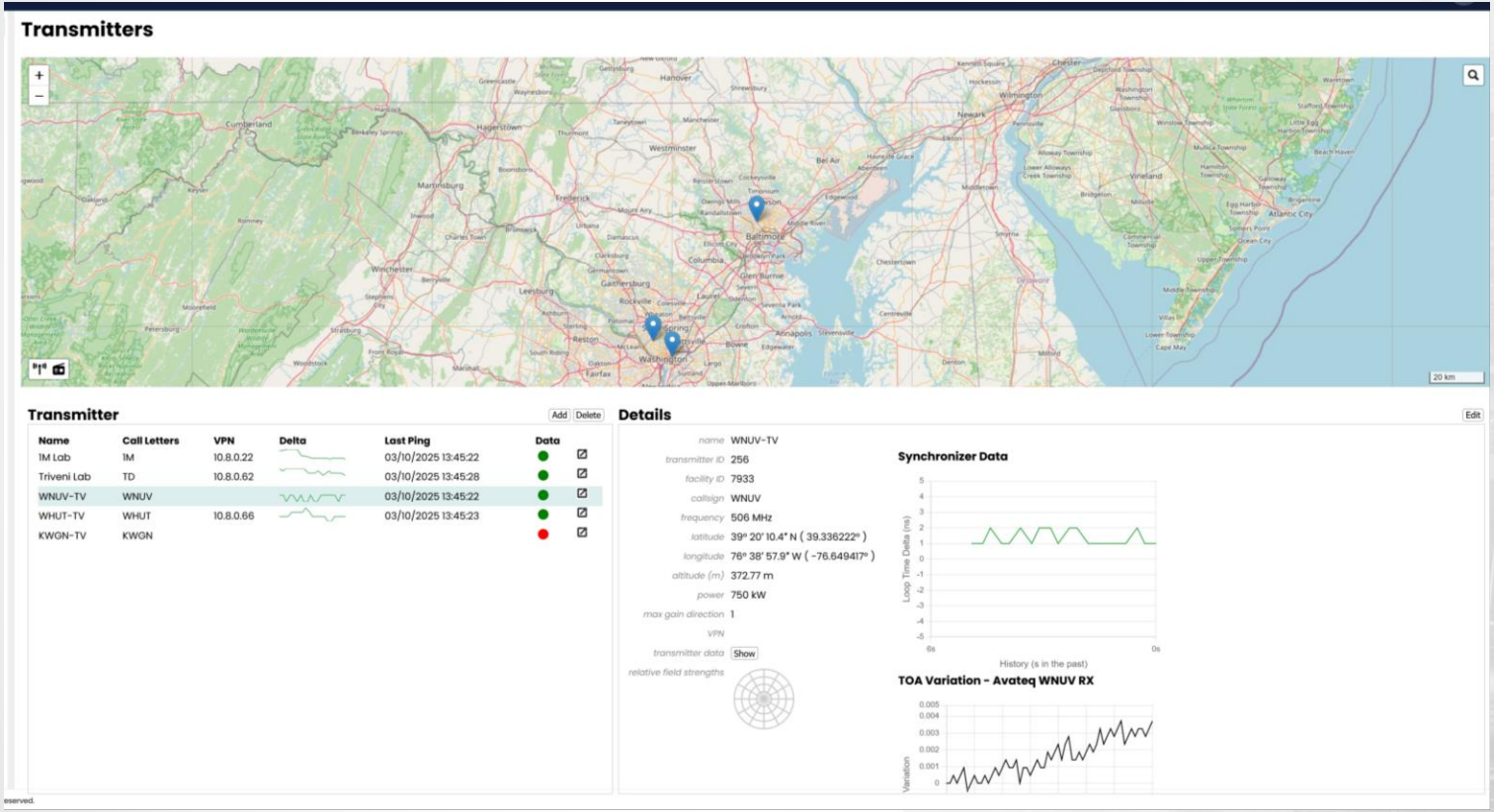
Live Demo at Assured PNT Summit



BPS Aggregator



BPS NOC


Transmitters
20 km
Transmitter
Add
Delete
Name
Call Letters
VPN
Delta
Last Ping
Data
1M Lab
1M
10.8.0.22
03/10/2025 13:45:22
Triveni Lab
TD
10.8.0.62
03/10/2025 13:45:28
WNUV-TV
WNUV
03/10/2025 13:45:22
WHUT-TV
WHUT
10.8.0.66
03/10/2025 13:45:23
KWGN-TV
KWGN
Details
Edit
name WNUV-TV
transmitter ID 256
facility ID 7933
callsign WNUV
frequency 506 MHz
latitude 39° 20' 10.4" N (39.336222°)
longitude 76° 38' 57.9" W (-76.649417°)
altitude (m) 372.77 m
power 750 kW
max gain direction 1
VPN
transmitter data Show
relative field strengths
Synchronizer Data
Loop Time Delta (ns)
History (s in the past)
TOA Variation - Avateq WNUV RX
Variation

Developing a New 4-Channel Receiver

- Takes up to 4 RF channels as input
- Combines time
- Capable of positioning

Thank You

nab.org/bps

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