



# GPS Backup & Complementary PNT Demonstration

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# Existing GPS/GNSS Threats



**CBS NEWS**

**“When Putin’s around, GPS goes haywire, study says”**



**“...Russian Federation used electronic warfare equipment almost 10,000 times to create false GPS signals...”**



**“Russia denies role in Israeli airport GPS jamming...Israeli Airline Pilots Association said the GPS problems were a ‘spoofing’ attack...”**

**SPACE NEWS**  
magazine

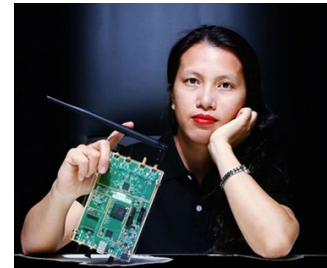
**“GPS needs more rigorous testing. DoD has to be able to test satellites against cyber, directed-energy, kinetic and electronic warfare threats, as well as natural hazards” DOT&E Director**

**Robert Behler, 1 Feb 2020**

# Spoofing Capability Under \$225

- 2014 DARPA grant funded low-cost Software Defined Radio (SDR)
- 2015 Black Hat/DEFCON highlighted GNSS Simulator Spoofer
  - \$300 Kits included open source SDR and software
  - Operational in less than 1 hour
- July 2016 GPS/GNSS-based Pokémon Go game release accelerated interest in location deception and reduced SDR costs
- July 2018 National Science Foundation grant to University of Virginia published:

*ROAD TO NOWHERE — \$225 GPS Spoofer can send SATNAV-guided vehicles into oncoming traffic*



# Scope: GPS Backup Demo

- Commercial services with a high Technical Readiness Level (TRL >6)
- Scenario based demonstration plan (agnostic of technology). Fixed time, fixed position, stationary time, stationary position, 2D dynamic position (van), 3D dynamic position (UAS)
- Field teams at JBCC, NASA Langley, Wildwood, NJ, and FAA Tech Center
- Demonstration outputs:
  - Performance report with PNT roadmap and measures of effectiveness
  - Draft PNT strategy guide and cross-departmental coordination for PNT EXCOM

TRL 1   TRL 2   TRL 3   TRL 4   TRL 5   TRL 6   TRL 7   TRL 8   TRL 9

Basic technology  
research

Research to  
prove feasibility

Technology  
development

Technology  
demonstration

System/subsystem  
development

System test, launch  
& operations 4



# Work Plan: GPS Backup Demo

NASA Langley

Map Match

1

TRX

Terrestrial RF

2

NextNav, Skyhook

Satellite

1

Echo Ridge

Fiber Optic

2

OPNT & Seven Solutions

JBCC

Map Match

0

Terrestrial RF

4

Hellen Systems, UrsaNav, Serco, & Phasor Lab

Satellite

1

Satelles

Fiber Optic

0

# VIP Demo Days

In Situ	Terrestrial RF				Satellite	Fiber Optic	Fixed Demo Platforms		Moving Demo Platforms	
Map Match	LF (Loran)	MF (R-mode)	VHF (passive)	WiFi (2.4 GHz)	L-Band (LEO)	PTP	Outdoor	Indoor	2D (Van)	3D (UAS)

13 March 9:00 – 16:00 LaRC	X	X				X	X	X	X	X
20 March 9:00 – 16:00 JBCC		X	X		X	X		X	X	X
Vendors	TRX	Hellen Systems	Serco	NextNav	Phasor Lab	Echo Ridge	OPNT			
		UrsaNav			Skyhook	Satelles	Seven Solutions			