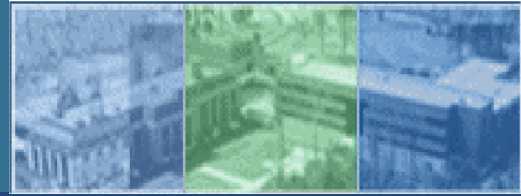


FHWA Activities in Navigation

Jim Arnold

Turner Fairbank Highway Research Center

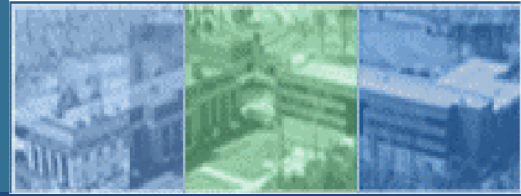




Outline

- HA-NDGPS
- Compression
- Timing
- Fast Integer Resolution – Long Range/Multiple Baseline
- Signal Phase & Timing

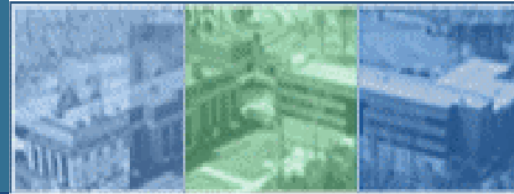




HA-NDGPS

- Continue Research using
 - Hagerstown
 - Hawk Run
 - Pueblo
- Documentation Development for Additional Test Sites Complete

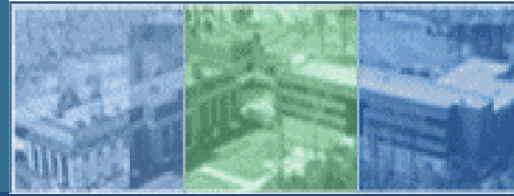




New Compression Algorithm

- Goal – Develop a compression algorithm to ensure delivery of GNSS Observables over multiple data services
- Small Business Innovative Research – SBIR
 - Awarded September 2010
 - Completed March 2011
- Output
 - Non-proprietary compression algorithm
 - Can achieve 1000 bps
 - Includes iono and tropo models
 - Integrity Included!
 - Exceeded Expectations – details to follow
- Phase II – Awaiting Proposal

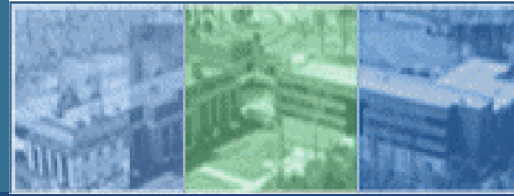




Timing

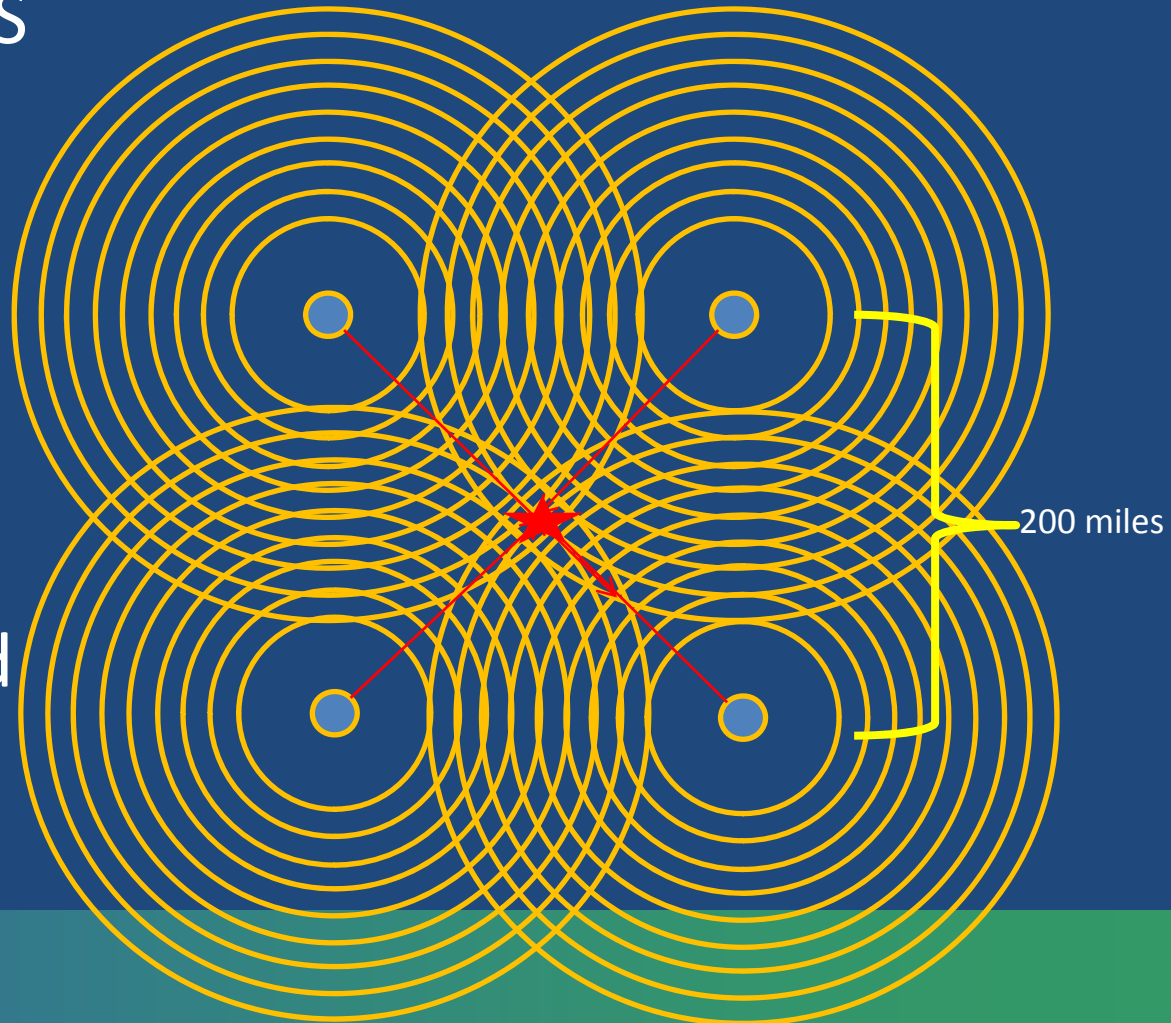
- In the event of a GPS failure, are there timing backups?
- Why?
 - Telecom
 - Traffic Signals
 - Network Control
- Options
 - Procedural
 - High end clocks
 - NDGPS/HA-NDGPS
- Working with DHS
 - Proposed Network Solution
 - Need Last Mile

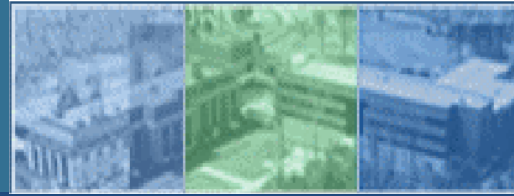




Fast Integer Resolution

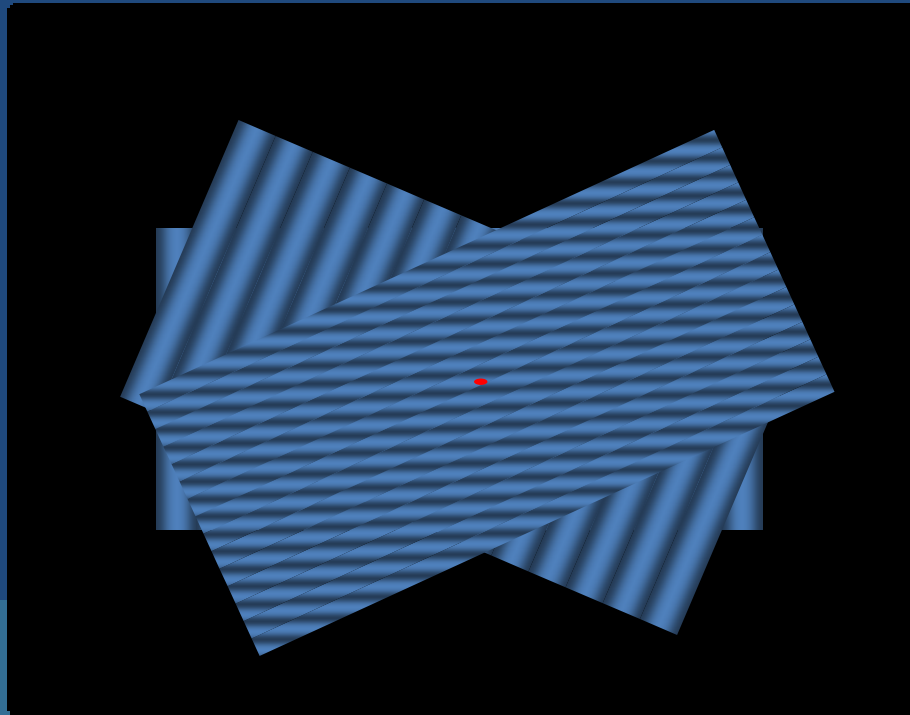
- User receives GNSS Observables from multiple reference stations
- Reference station baselines may exceed 200 miles
- Discussion focused on 3 epoch solution





Fast Integer Resolution

- Initial Code Solution
- Minimizes Search Area
- Each second changes satellite Geometry



Note: Diagram is conceptual.



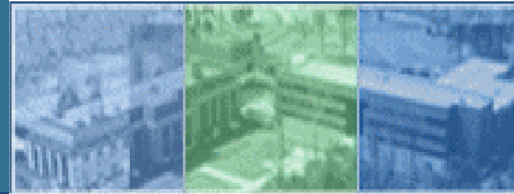


Signal Phase and Timing (SPaT)



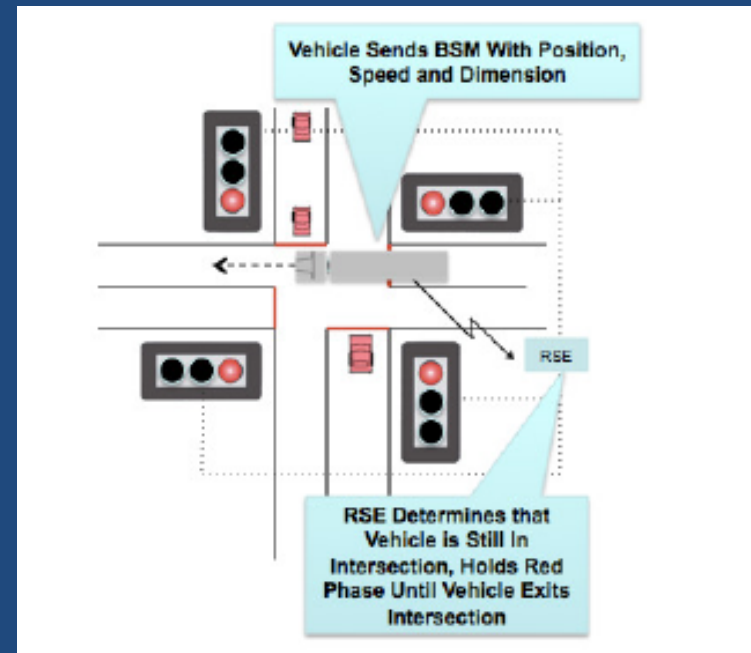
- Identify high-Level Preliminary Requirements
 - Final Requirements – NO!
 - First high-level cut at requirements
 - Further work under Systems Engineering Study
- Examine Available Technology
 - What can it do?
 - Technology holes
 - Target further research?
- Implement at TFHRC
 - Create Test Bed
 - Test applications in safe environment



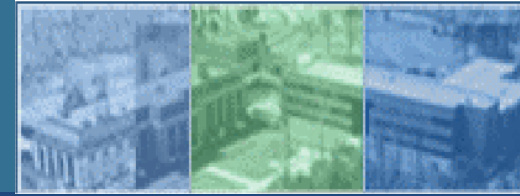


Signal Phase and Timing (SPaT)

- Goal – Build something that works!!
 - Vehicle Positioning
 - Mapping
 - Telecommunications
- Final Requirements – NO!
 - First high-level cut at requirements
 - Further work under Systems Engineering



Red Light Extension

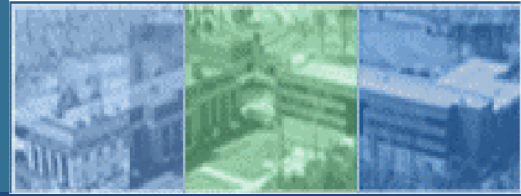


Application Requirements

- SAMPLE -

Application	Rationale	Basic Positioning Requirements						Higher Order Position Related Parameter Requirements					
		Position (m)	Confidence (%)	Location Reference Required?	Time Error (sec)	Integrity?	Availability Indication?	Logical Directionality?	Dimension	Velocity	Acceleration	Yaw	Slip
Hazards, Information, and Traffic Control													
Intersection Collision Avoidance - Red Extension		0.5 m Lateral 10 m Long	99.9	TBD	<100 msec	Yes	Yes	Yes	Yes	Yes	No	No	No





Summary

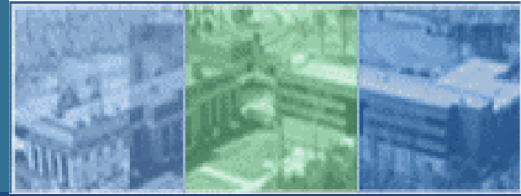
- Longer Range, Faster, High Resolution Mapping
- Timing Backup
- Goal of Improved Vehicle Positioning
- Understanding Our Needs

New Apps + New Accuracies + New Systems

=

NEW OPPORTUNITIES

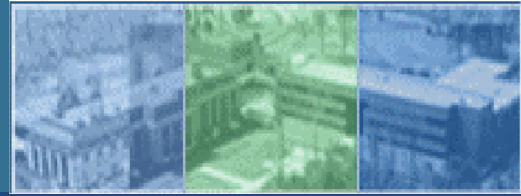




Questions?

Jim Arnold
James.a.arnold@dot.gov





Backup Slides



Direction of Travel: West to East. GPS indicated positions jumped to SW West Virginia from 282345 to 2349Z Jul 01

-81.47
39.35

- Hager
- Hagerst4rev3.txt
- Counties.shp
 - Alabama
 - Alaska
 - Arizona
 - Arkansas
 - California
 - Colorado
 - Connecticut
 - Delaware
 - District of Col
 - Florida
 - Georgia
 - Hawaii
 - Idaho
 - Illinois
 - Indiana
 - Iowa
 - Kansas
 - Kentucky
 - Louisiana
 - Maine
 - Maryland
 - Massachusetts
 - Michigan
 - Minnesota
 - Mississippi
 - Missouri
 - Montana
 - Nebraska
 - Nevada
 - New Hampshire
 - New Jersey
 - New Mexico
 - New York
 - North Carolina
 - North Dakota
 - Ohio
 - Oklahoma
 - Oregon

