FHWA Activities in Navigation

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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 -

<table>
<thead>
<tr>
<th>Application</th>
<th>Rationale</th>
<th>Basic Positioning Requirements</th>
<th>Higher Order Position Related Parameter Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersection</td>
<td></td>
<td>0.5 m Lateral 10 m Long</td>
<td>99.9</td>
</tr>
</tbody>
</table>
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?

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