National Park Service
GPS Program
“It’s always been like that.”
You think that you have masking problems!
GPS in the National Park Service
wide variety of users and requirements
GPS in the National Park Service
wide variety of users and requirements
Topo and High Accuracy Surveying

Missouri National Recreation River Wreck for the *North Alabama*
GPS in the National Park Service

• Very wide variety of users, difficulties, environments
• No official standardization of hardware and software (good or bad?)
Training
On-site or Remote

http://www.ngs.noaa.gov/corbin/

http://gis.nwcg.gov/training_gps.html
Equipment Testing
Post-Processing and Realtime Differential Corrections
Equipment Testing

Data Collection Methodology

• Collect NMEA output from receivers
• Collect about one-half hour of data or 1800 points if possible
• Multiple visits to location if possible

Reasons for Methodology

• Parse data any way you want
• Use in any program
• Higher degree of analysis possible
• Acquire data as close to “raw” as possible
• Supply “raw” data to others

$GPGGA,183424.000,3941.4159,N,10548.5628,W,1,07,1.2,3006.7,M,-19.8,M,,0000*5A
$GPGGA,A,3,07,03,19,23,06,08,13,,,,,2.5,1.2,2.2*37
$GPGSV,3,11,25,69,48,41,13,68,176,41,07,67,339,38,19,46,103,31*7D
$GPGSV,3,12,03,39,065,41,08,34,298,21,06,29,055,40,23,29,155,40*7E
$GPGSV,3,11,28,21,237,,10,12,309,26,16,01,052,*4B
$GPRMC,183424.000,A,3941.4159,N,10548.5628,W,0.16,85.97,200809,,,A*44
$GPVTG,85.97,T,,M,0.16,N,0.3,K,A*3A
$GPGGA,183425.000,3941.4159,N,10548.5630,W,1,07,1.2,3006.5,M,-19.8,M,,0000*50
$GPGGA,A,3,07,03,19,23,06,08,13,,,,,2.5,1.2,2.2*37
$GPGSV,3,11,25,69,48,41,13,68,176,41,07,67,339,38,19,46,103,31*7D
$GPGSV,3,12,03,39,065,41,08,34,298,21,06,29,055,40,23,29,155,40*7E
$GPGSV,3,11,28,21,237,,10,12,309,29,16,01,052,*44
$GPRMC,183425.000,A,3941.4159,N,10548.5630,W,0.18,96.48,200809,,,A*42
$GPVTG,96.48,T,,M,0.18,N,0.3,K,A*34
$GPGGA,183426.000,3941.4160,N,10548.5631,W,1,07,1.2,3006.2,M,-19.8,M,,0000*5F
$GPGGA,A,3,07,03,19,23,06,08,13,,,,,2.5,1.2,2.2*37
$GPGSV,3,11,25,69,48,41,13,68,176,41,07,67,339,38,19,46,103,32*7D
$GPGSV,3,12,03,39,065,41,08,34,298,21,06,29,055,40,23,29,155,40*75
$GPGSV,3,12,28,21,237,24,10,12,309,28,16,01,052,*44
$GPRMC,183426.000,A,3941.4160,N,10548.5631,W,0.21,106.21,200809,,,A*77
$GPVTG,106.21,T,,M,0.21,N,0.4,K,A*0E
$GPGGA,183427.000,3941.4160,N,10548.5632,W,1,07,1.2,3006.0,M,-19.8,M,,0000*5F
$GPGGA,A,3,07,03,19,23,06,08,13,,,,,2.5,1.2,2.2*37
$GPGSV,3,11,25,69,48,41,13,68,176,41,07,67,339,38,19,46,103,32*7F
$GPGSV,3,12,03,39,065,41,08,34,298,21,06,29,055,40,23,29,155,40*76
$GPGSV,3,11,28,21,237,26,10,12,309,28,16,01,052,*41
$GPRMC,183427.000,A,3941.4160,N,10548.5632,W,0.13,108.12,200809,,,A*7A
$GPVTG,108.12,T,,M,0.13,N,0.2,K,A*07
$GPGGA,183428.000,3941.4161,N,10548.5634,W,1,07,1.2,3005.7,M,-19.8,M,,0000*53
$GPGGA,A,3,07,03,19,23,06,08,13,,,,,2.5,1.2,2.2*37
$GPGSV,3,11,25,69,48,41,13,68,176,41,07,67,339,38,19,46,103,32*7E
$GPGSV,3,12,03,39,065,41,08,34,298,28,06,29,055,40,23,29,155,40*77
$GPGSV,3,11,28,21,237,14,10,12,309,28,16,01,052,*40
$GPRMC,183428.000,A,3941.4161,N,10548.5634,W,0.17,112.23,200809,,,A*7F
### Equipment Testing

**NMEA Log File Summary**
- **NMEA Log File Name**: pt6_mm6_auto_int.csv
- **Total File Log Lines**: 26085
- **NMEA Lines of Interest**: 13044
- **NMEA Sentence Counts**:
  - GGA: 3262
  - GLL: 3261
  - RMC: 3261
  - GNS: 0
- **Start Time**: 6:34:24 PM
- **End Time**: 7:28:45 PM
- **Time Span (hh:mm:ss)**: 00:54:21

**Parsed Data Set**
- **Parsed File Name**: pt6_mm6_auto_int_10pt_Parsed.txt
- **NMEA Sentence**: GGA
- **Data Type**: Lat-Long
- **Min GPS Mode**: Don't Care
- **Min Satellites**: Don't Care
- **Points Per Mean**: 10
- **Requested Dec's**: 100
- **Sampling Mode**: Random
- **Sentences in Parsed File**: 3261
- **Rejected Non-NMEA**: 0
- **Rejected: NMEA**: 22824
- **Filtered Sentences**: 0
- **Max Possible Decimations**:
  - Random Sampling: 3251
  - Seq Sampling - Slide: 3251
  - Seq Sampling - Leap: 325

**Results Summary File**
- **Summary File Name**: pt6_mm6_auto_int_10pt_summary.txt
- **Archive File Name**: pt6_mm6_auto_int_10pt_Archive.txt
- **Decimation Sets**: 100
- **Deviations Formed**: 100
- **RMS Error**: 5.1282 meters
- **Confidence Intervals (meters)**
  - 99%: 11.0057, 3 \( \sigma \)
  - 95%: 8.8760, 2 \( \sigma \)
  - 68%: 5.7693, 1 \( \sigma \)
  - 50%: 4.2682, CEP

**Deviations**

<table>
<thead>
<tr>
<th>Index</th>
<th>Easting</th>
<th>Northing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0342</td>
<td>-1.1675</td>
<td>-0.0382</td>
</tr>
<tr>
<td>1822</td>
<td>-0.9964</td>
<td>2.9351</td>
</tr>
<tr>
<td>2157</td>
<td>-0.0655</td>
<td>0.9836</td>
</tr>
<tr>
<td>0746</td>
<td>-5.8988</td>
<td>1.6516</td>
</tr>
<tr>
<td>0863</td>
<td>-3.2546</td>
<td>-4.7002</td>
</tr>
</tbody>
</table>

**Horiz Position**
- **NMEA Sentence**: GGA
- **Crt: 6 (WGS84)**
- **Nor Crt**: 4393696.616
- **East Crt**: 430595.423
- **Easting**: 430595.423
- **Northing**: 4393696.616
- **Time**: 11:21 AM

---

**Resource Information Services Division**
**National Information Systems Center**
**Office of the Chief Information Officer**
Equipment Testing

CONFIDENCE INTERVALS

99% Interval: = 11.0057
95% Interval: = 8.8760
68% Interval: = 5.7693
50% Interval: = 4.2682
Equipment Testing
Post-Processing and Realtime Differential Corrections
Equipment Testing
Post-Processing and Realtime Differential Corrections

For Realtime, PP Code and Single Baseline Carrier CORS, PUEBLO 5 (PUB5), COLORADO was used for the base. Distance from base to rover is 164 km.

Nearest WAAS CORS (ZDV1) is 60 km.
For Realtime, PP Code and Single Baseline Carrier CORS, PUEBLO 5 (PUB5), COLORADO was used for the base. Distance from base to rover is 164 km.

Nearest WAAS CORS (ZDV1) is 60 km.
Equipment Testing
Post-Processing and Realtime Differential Corrections

For Realtime, PP Code and Single Baseline Carrier CORS, PUEBLO 5 (PUB5), COLORADO was used for the base. Distance from base to rover is 164 km.

Nearest WAAS CORS (ZDV1) is 60 km.
Equipment Testing
Post-Processing and Realtime Differential Corrections

For Realtime, PP Code and Single Baseline Carrier CORS, PUEBLO 5 (PUB5), COLORADO was used for the base. Distance from base to rover is 164 km.

Nearest WAAS CORS (ZDV1) is 60 km.
Equipment Testing

Post-Processing and Realtime Differential Corrections

For Realtime, PP Code and Single Baseline Carrier CORS, PUEBLO 5 (PUB5), COLORADO was used for the base. Distance from base to rover is 164 km.

Nearest WAAS CORS (ZDV1) is 60 km.
High Accuracy Equipment Testing in 2010
HA-NDGPS and RTN

Leica
Trimble
HA-NDGPS at Pueblo, CO
High Accuracy Equipment Testing in 2010
HA-NDGPS and RTN
Contact Information:
Tim Smith, National GPS Program Coordinator
RISC-NISC-OCIO
National Park Service
Tim_Smith@nps.gov
(303) 969-2086

Shouldn’t I be charging something?