WAAS Technical Report  
William J. Hughes Technical Center  
Atlantic City International Airport, New Jersey  
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DR #124 Loss of LPV-200 Service in Central CONUS  
GPS Week/Day: Week 1797 Day 3 (6/18/2014)
Introduction

• On June 18, 2014 there was a loss of LPV-200 service in the Kansas/Oklahoma/Texas region
  – Normally LPV-200 is 100% available, though there have been instances where an LPV-200 outage occurs in this part of CONUS
    • Prior to June 18, it last happened on June 11
  – See next slide for coverage on June 17 (100%) and June 18
    • Note that the LPV-200 coverage in Oregon was less than normal too. This presentation does not address those LPV-200 outages since that area is on the borderline of 100% LPV-200 coverage. On June 18, of the four airports that lost LPV-200, the highest VPL was 35.3 meters at EUG, just over the 35 meter VAL

• On June 18 there were two GUS switchovers for the CRW GEO
  – Manual switchover from Littleton to Napa at 10:03 GMT
  – Napa faulted at 11:58 GMT and Littleton once again became the primary GUS for CRW

• When the manual switchover occurred the UDRE for CRW went from 7.5 meters to Not Monitored

• A little after 13:00 GMT the UDRE for CRW dropped to 50 meters and stayed there until after 18:00 GMT
  – The UDRE must be 15 meters or less for the satellite to be used in the LPV position solution

• This presentation shows that the high UDRE on CRW caused the LPV-200 outage
  – LPV-200 service was lost at 13 airports in Kansas, Oklahoma, and Texas
  – Total outage was less than 10 minutes at each airport
WAAS Coverage – June 17 and June 18, 2014

WAAS LPV200 Coverage Contours
06/17/14
Week 1797 Day 2

WAAS LPV200 Coverage Contours
06/18/14
Week 1797 Day 3
CRW UDRE

- This figure shows the UDRE_i for CRW on June 18
  - Green line is the expected UDRE_i and red line is the actual
Satellite Status

- This figure shows the satellite status at 14:38 GMT

Number in box = PRN number
Green Box - UDRE <= 15 meters
Yellow Box – UDRE = 50 or 150 meters
Blue Box – Not monitored satellite
Airports Affected by Outage

- Each box represents an airport with an LPV-200 published approach
- Blue box - No outages on June 18
- Green box – LPV-200 outages on June 18

Airports with daily LPV-200 outages. Not a result of the higher UDRE on CRW

Airports affected by Higher CRW UDRE
Effect at OKC Airport

• Will Rogers World Airport (OKC) was one of the airports affected on June 18
• At the time of the outage (around 14:30 GMT) the VPL approaches 35 meters daily
• On June 18 at around 14:30 GMT the VPL exceeded 35 meters since the CRW was not available for use in the position solution since the UDRE was greater than 15 meters
Effect at OKC Airport

- One of the airports affected was Will Rogers World Airport in Oklahoma City
  - HPL/VPL and number of satellites used in the solution for June 17 and June 18 shown below

<table>
<thead>
<tr>
<th>Date</th>
<th>VPL</th>
<th>Satellites</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 17</td>
<td>33.7</td>
<td>8</td>
</tr>
<tr>
<td>June 18</td>
<td>37.8</td>
<td>7</td>
</tr>
</tbody>
</table>

VPL reached a maximum of 33.7 meters with 8 satellites used in the solution
VPL reached a maximum of 37.8 meters with 7 satellites used in the solution (CRW not used)
HDOP/VDOP at OKC

• The HDOP and VDOP on June 17 and June 18 at OKC were identical
  – This is true for the HDOP and VDOP using GPS satellites only; WAAS satellites not included in DOP calculation
  – The GPS constellation geometry (DOP) greatly affects the VPL
  – Since the GPS-only DOPs are the same the only difference between the two days was not using the CRW GEO in the VPL calculation
HDOP/VDOP at OKC

June 17

June 18
Ionosphere

- On June 17 and June 18 the IGPs were basically the same
- The figure below shows the maximum GIVE for each IGP on each day from 13:00 to 15:00 GMT

**Legend:**
- This legend shows the GIVE for each IGP in meters. Note that the dark green (3.6) means the GIVE was $\leq 3.6$ meters
Observations

- LPV-200 coverage was lost for a short amount of time in central CONUS due to higher UDRE on the CRW GEO
  - CRW could not be included in the calculation of VPL by an LPV user since the UDRE was greater than 15 meters
  - 13 airports effected with outages lasting from 2 to 10 minutes
  - VPLs exceeded the VAL of 35 meters by a small margin (the highest was less than 38 meters)

- Other factors that influence the VPL (i.e. GPS constellation geometry and GIVE) were the same on June 17 and June 18
  - June 17 is typical performance

- An outage over this part of the country is not unusual
  - Actually, there was another LPV-200 outage at 9 airports on June 19 at the same time
    - The highest VPL at OKC was 36.1 meters
  - The outage on June 18 is noteworthy since it was over a larger area than usual, caused by a CRW outage, and the new IIF satellite (PRN 6) was in service
    - Currently a 31 satellite constellation

- Even with a full (31 satellite) GPS constellation, ranging from GEOs assists in keeping WAAS availability high

- The current WAAS practice to keep planned GUS switches to a minimum and to do it during ‘off hours’ should continue