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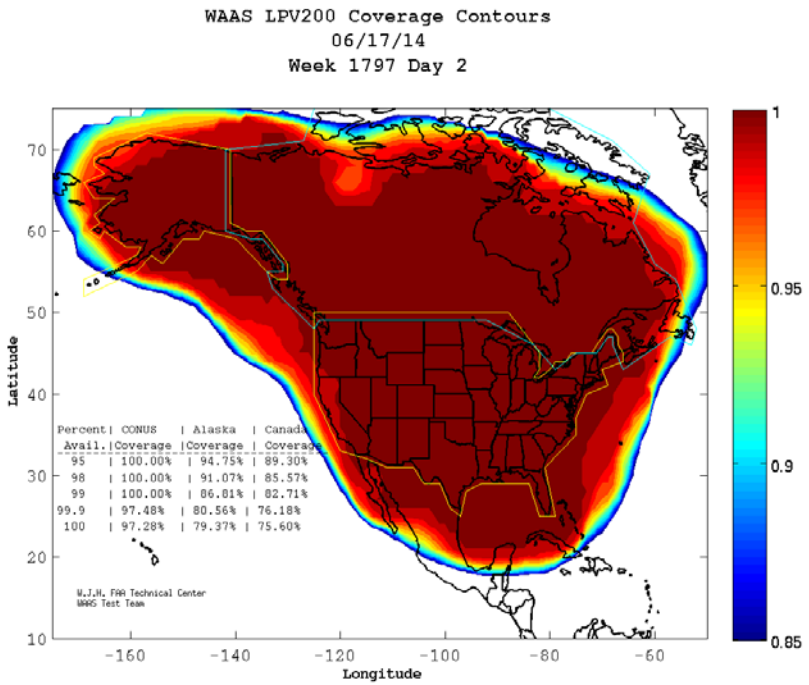
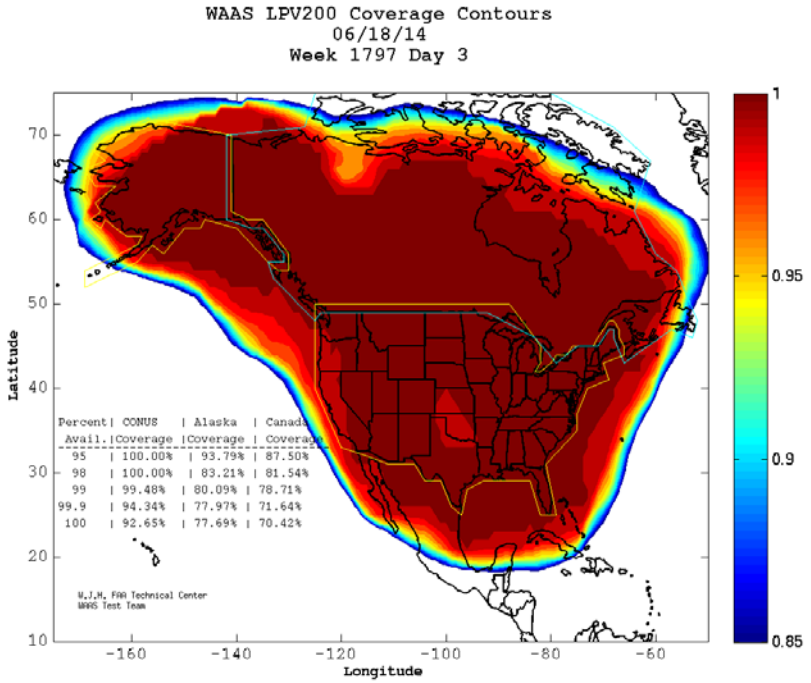
DR #124 Loss of LPV-200 Service in Central CONUS
GPS Week/Day: Week 1797 Day 3 (6/18/2014)

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

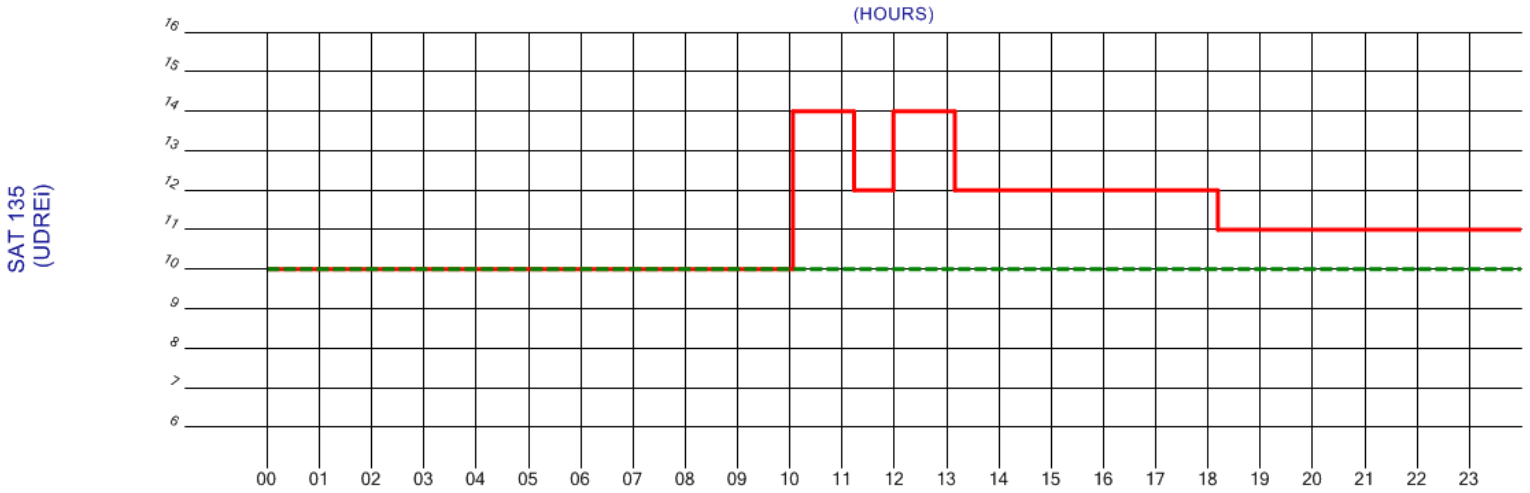
WAAS Coverage – June 17 and June 18, 2014





CRW UDRE

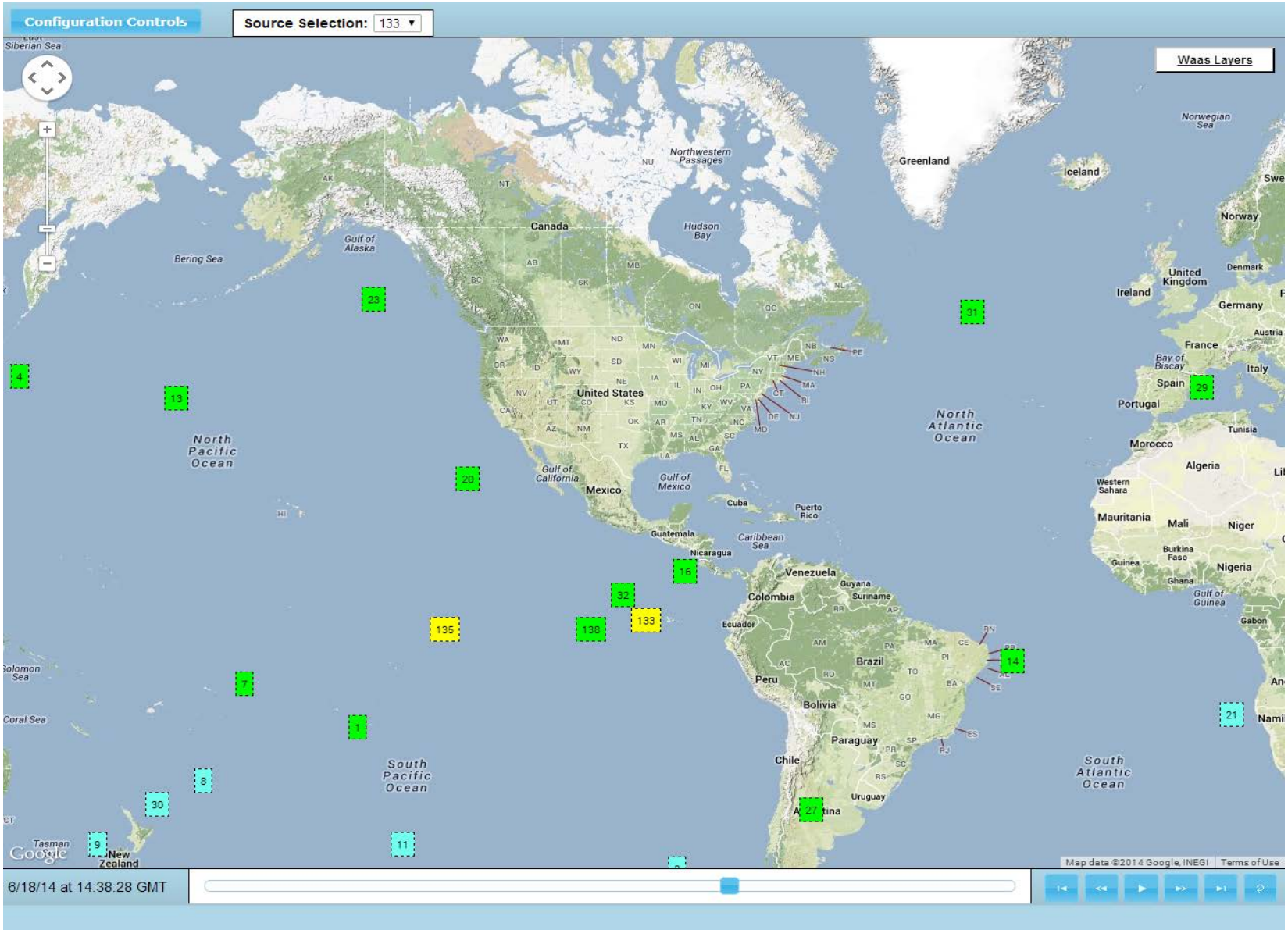
- **This figure shows the UDREi for CRW on June 18**
  - Green line is the expected UDREi and red line is the actual



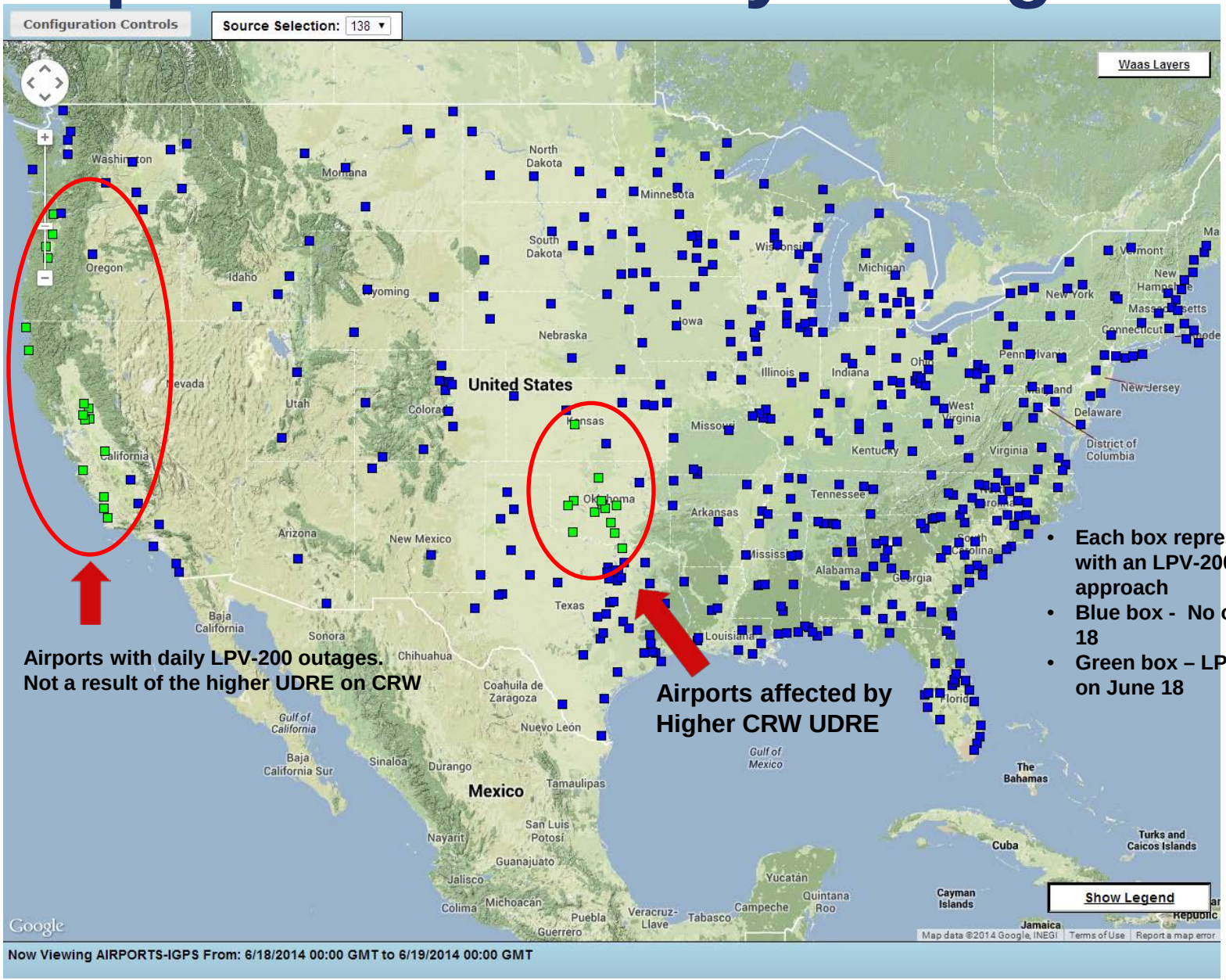
Satellite Status

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

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



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

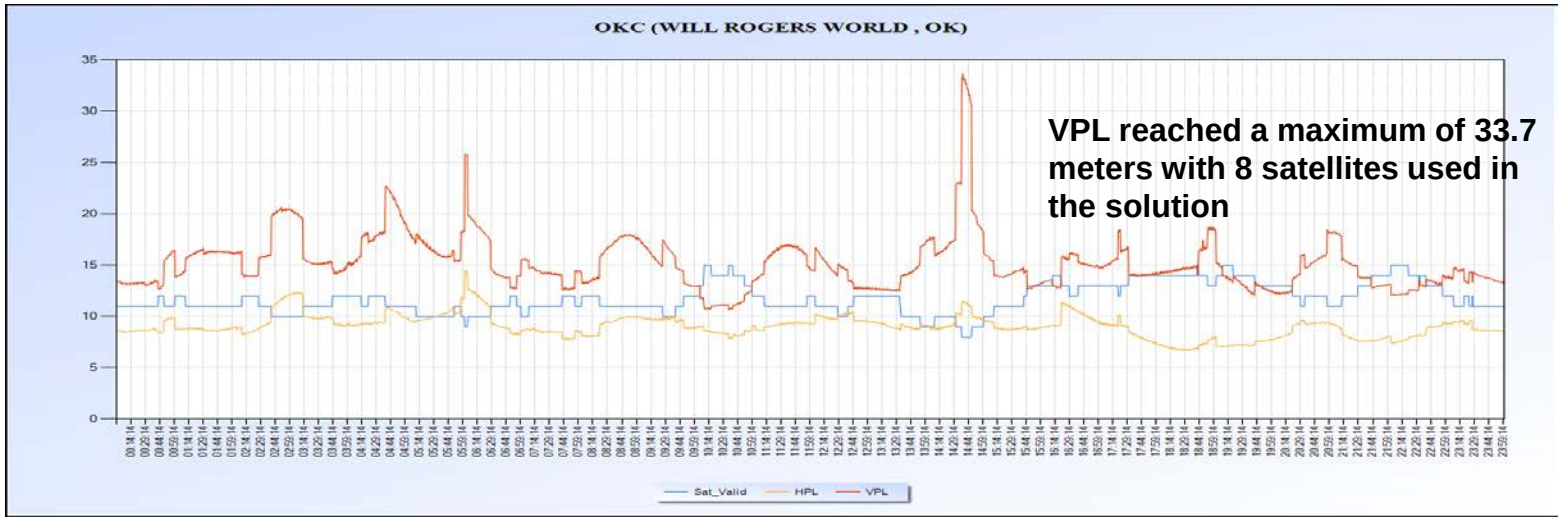
Effect at OKC Airport

- **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**

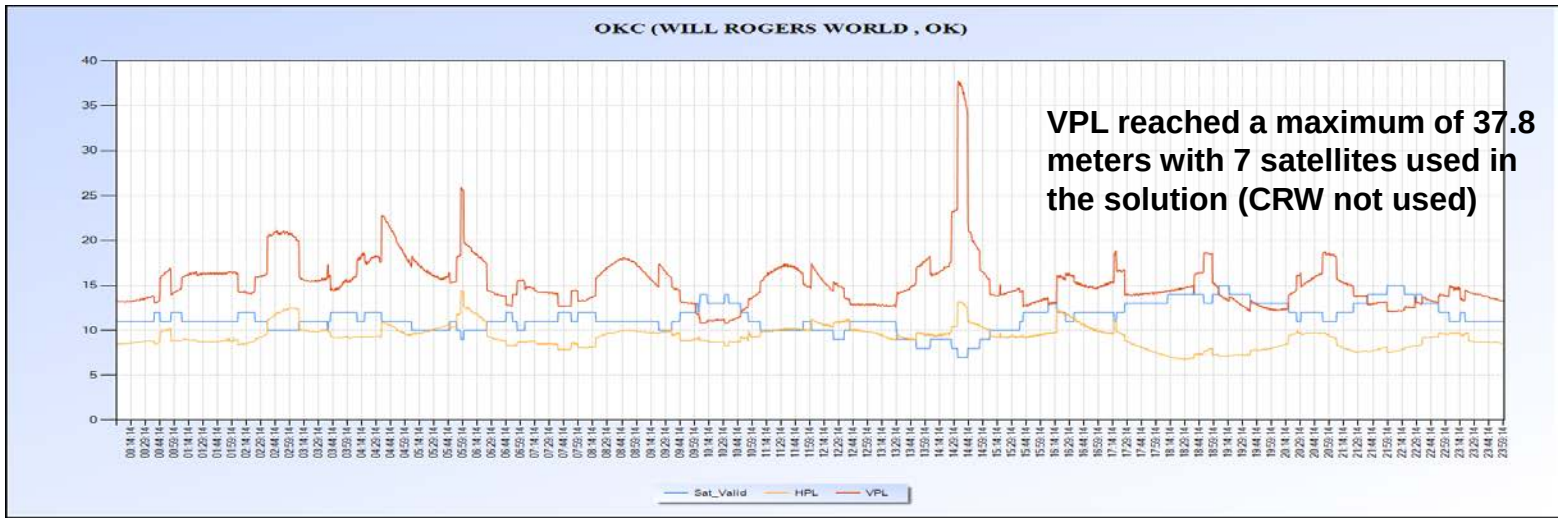
Effect at OKC Airport

- **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

June 17



June 18

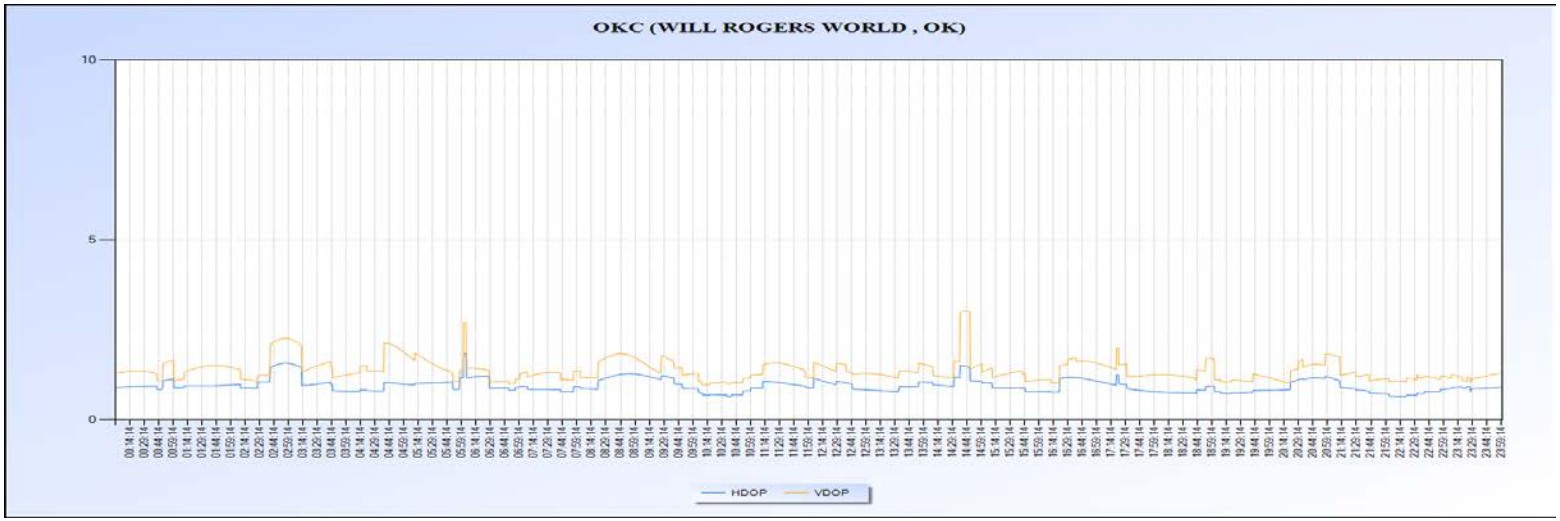


HDOP/VDOP at OKC

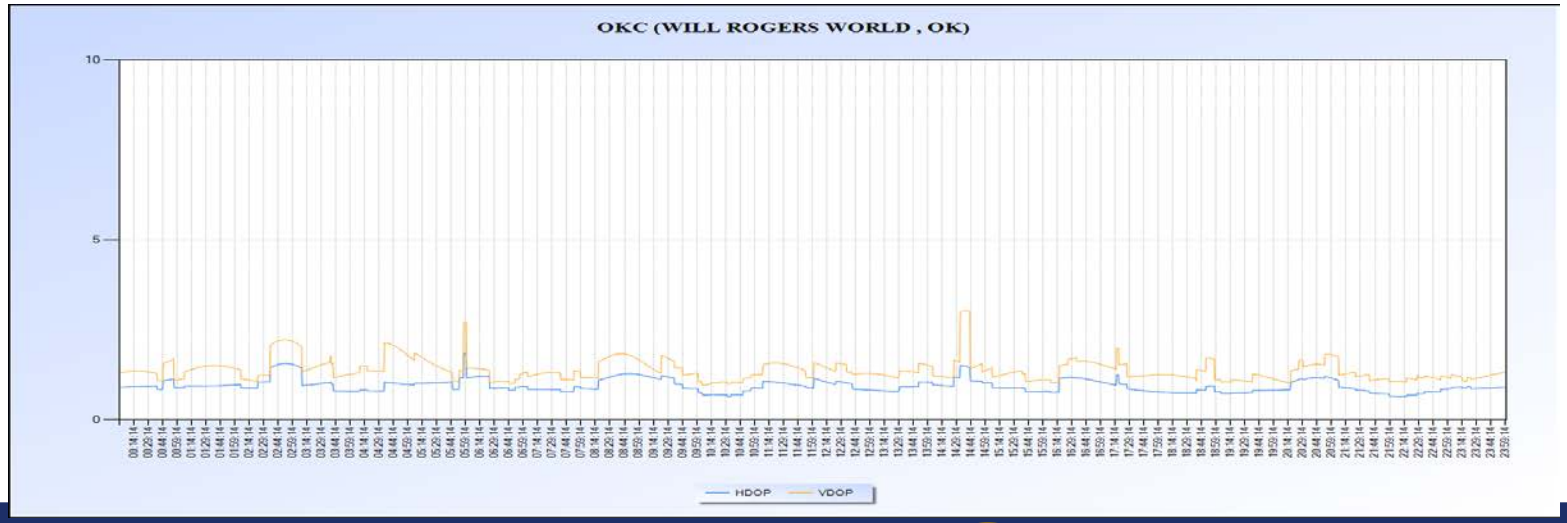
- **The HDOP and VDOP on June 17 and June 18 at OKC were identical**
  - This is true for the HDOP and VDOP using GPS satellites only; WAAS satellites not included in DOP calculation
  - The GPS constellation geometry (DOP) greatly affects the VPL
  - Since the GPS-only DOPs are the same the only difference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

HDOP/VDOP at OKC

June 17

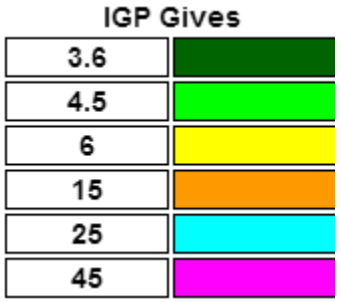


June 18

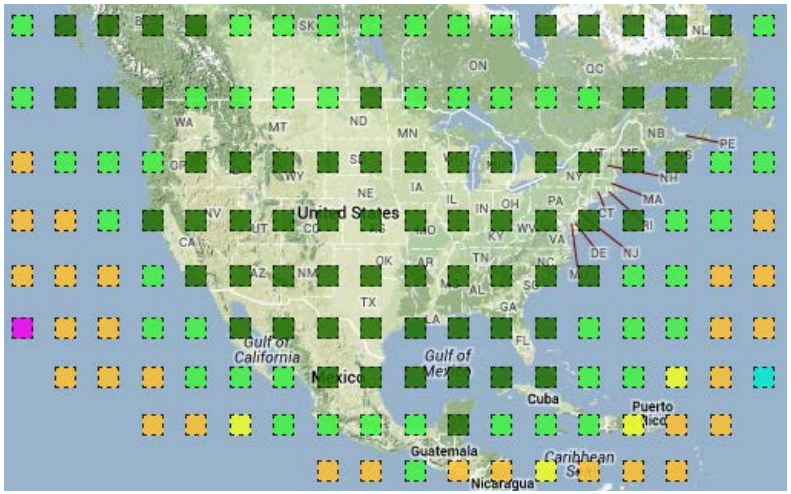


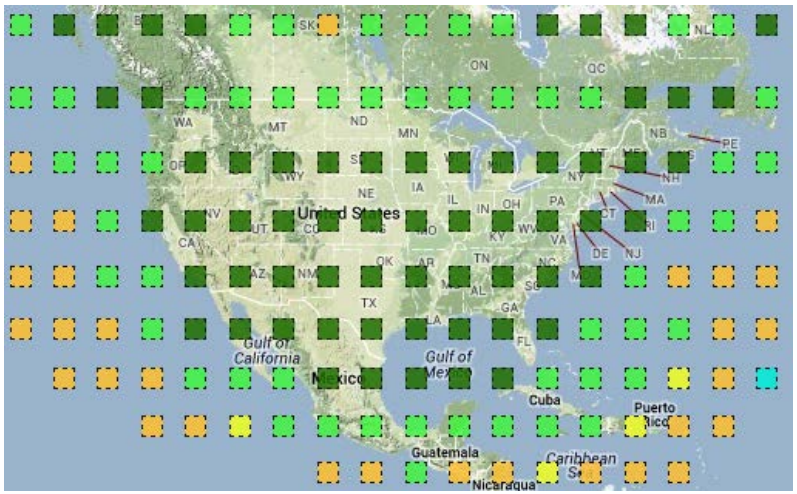
Ionosphere

This legend shows the GIVE for each IGP in meters. Note that the dark green (3.6) means the GIVE was <= 3.6 meters



- 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





June 17

June 18

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**