WAAS Technical Report
William J. Hughes Technical Center
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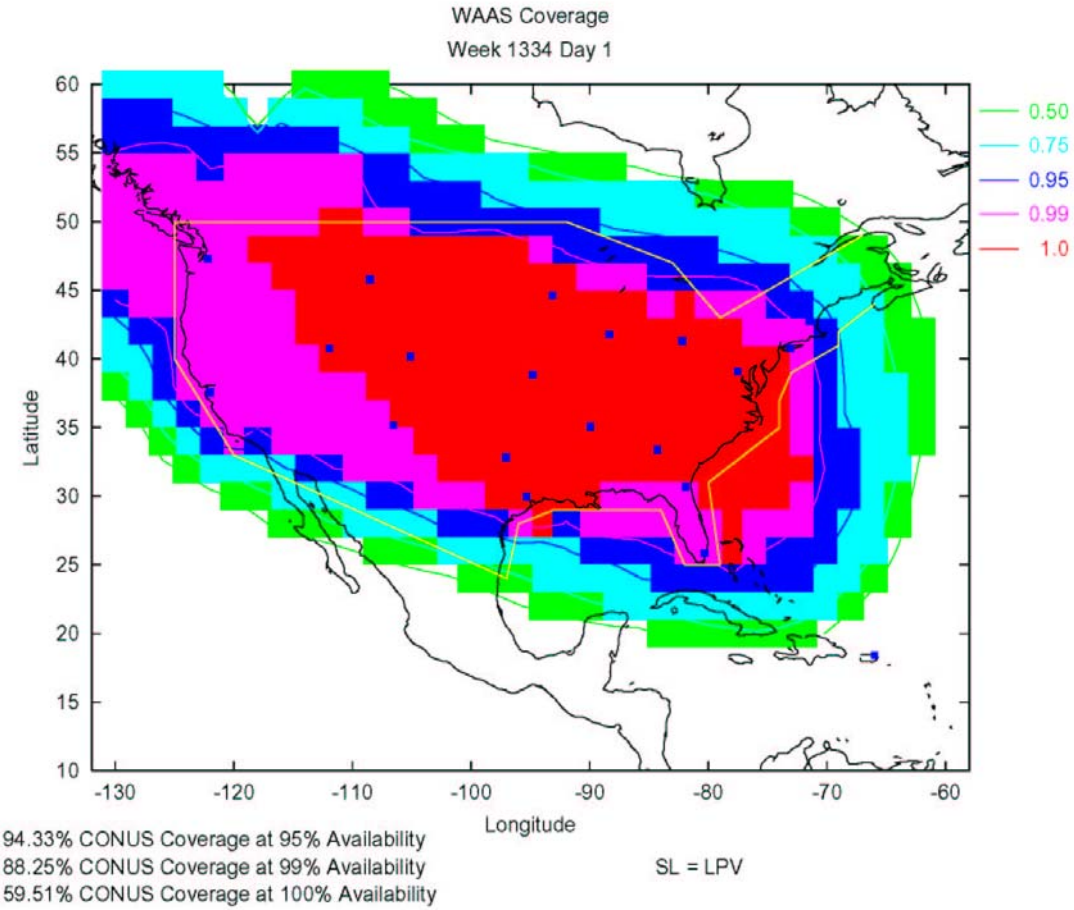
DR#: Loss of LPV Availability due to UDREi increase for PRN 14
GPS Week/Day: Week 1334 Day 1 (8/1/2005)

Discussion:

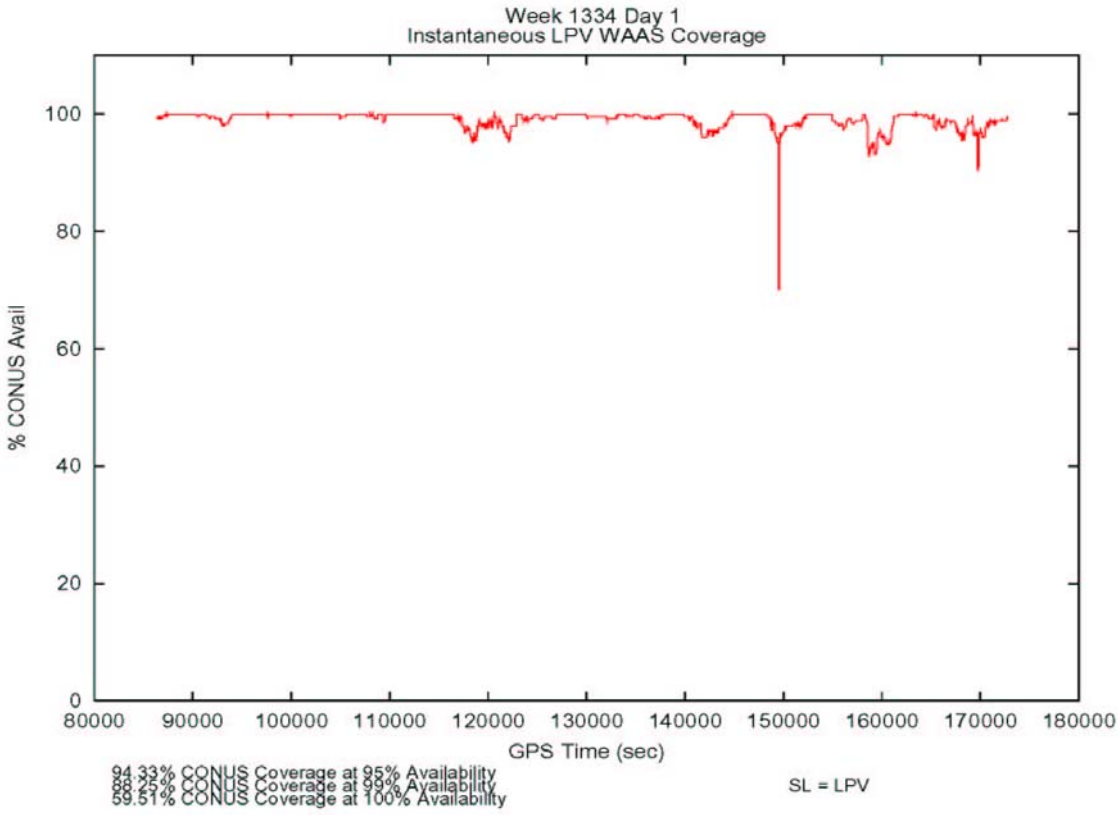
On August 1 (Day 1 of GPS Week 1334) a loss of 100% LPV availability was observed over western regions of CONUS. Figure 1 is a plot of LPV coverage for this day.

Figure 1 – LPV Coverage for August 1, 2005



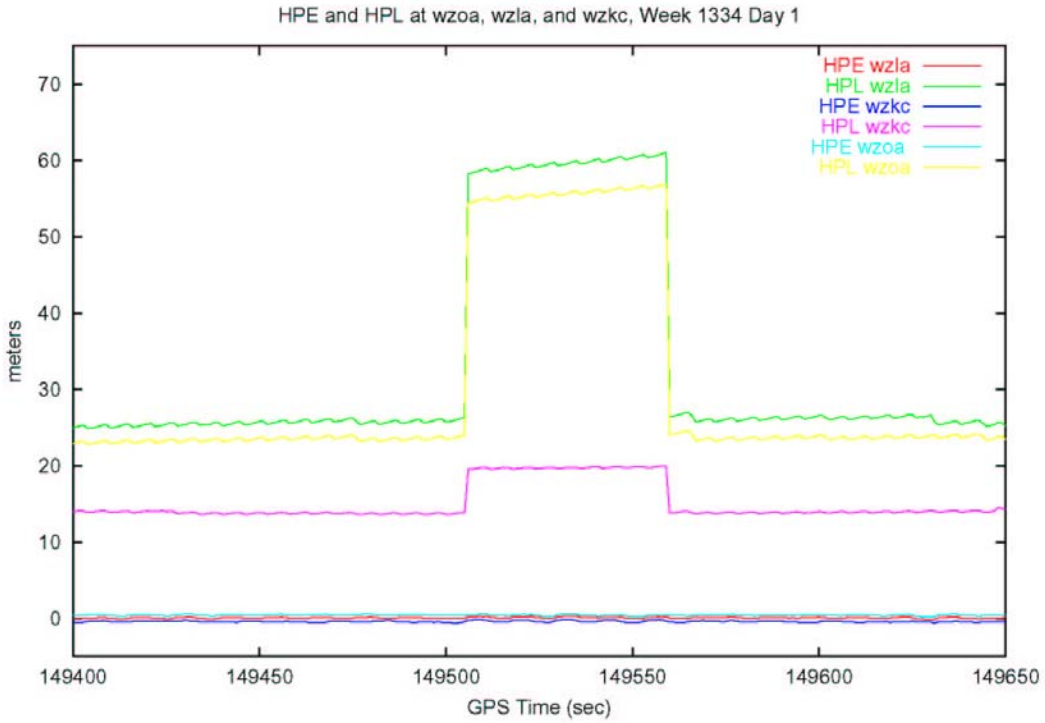
Further processing of the daily coverage provided the time at which this loss occurred. Figure 2 is a plot of instantaneous coverage throughout the day.

Figure 2 – Instantaneous LPV Coverage for Week 1334 Day 1



The time at which the loss of coverage occurred over CONUS was approximately 17:31:40 (GPS time 149500 seconds of the week). Investigation of processed position data files showed a jump in protection levels at WAAS Reference Stations (WRS) across North America corresponding to this time. Figure 3 shows the horizontal position errors (HPE) and horizontal protection levels (HPL) at the Oakland (wzoa), Los Angeles (wzla), and the Kansas City (wzkc) WRS.

Figure 3 – HPE and HPL at wzla, wzkc, and wzdc, Week 1334 Day 1



Increases in the horizontal protection level at all three sites are clear in Figure 3, however it should be noted there was no significant change in the horizontal error. Also, although the protection level increased at Kansas City (wzkc), as it did at Los Angeles (wzla) and Oakland (wzoa), the increase was not so severe as to cause a loss of availability at Kansas City. This corresponds to observed coverage losses occurring primarily over western CONUS.

Investigation of output files from data integrity processing showed that at the time of this increase in protection levels (GPS time 149506), PRN 14's User Differential Range Error (UDRE) was increased from 3 meters to 15 meters (UDRE index from 5 to 11), as shown in Table 1. Note that the time provided is in GPS seconds of the week. Roughly a minute later, PRN 14's UDRE dropped back down to 3 m (UDREi of 5).

Few (if any) WRS receivers were tracking more than 8 satellites at the time and PRN 14 (60 degree elevation from Kansas City) was a key satellite in the solution at sites all across CONUS. As a result, the increase in its UDRE had a wide-ranging impact on protection levels. While protection levels at sites in the west roughly doubled, a 3-4 m

jump in protection levels was observed at sites as far east as NY and Washington DC. All of CONUS appears to have been affected, but notable losses of LPV availability were observed in specific areas (west to central southwest).

Table 1 – UDRE, UDREi changes for PRN 14, Week 1334 Day 1

PRN #	Previous UDREi	Currrent UDREi	Previous Time	Current Time
5	7	6	149428	149434
20	8	7	149469	149475
14	**5**	**11**	**149500**	**149506**
14	11	5	149554	149560
23	12	11	149625	149631
122	10	11	149642	149648

Conclusion:

At GPS Time 149506, the UDRE of PRN 14 went from 3 m to 15 m (UDREi jump from 5 to 11). The impact on availability was in the western part of CONUS. Since PRN 14 was a high elevation satellite at the time of the event further investigation is needed to explain the sudden jump in UDRE. This DR will be updated when that information is available.