

WAAS Technical Report
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4/16/08

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DR#: Satellite Outages Caused Loss of Availability in CONUS Region
GPS Week/Day: Week 1473 Day 3 (April 2, 2008)

Discussion:

On April 2, 2008 (Week 1473 Day 3) CONUS LPV coverage was reduced to 79.35% at 100% availability. This loss of coverage was due to reduced satellite availability. PRN 12 was unusable from 09:46 GMT until 15:08 GMT on April 2, 2008, while PRN 4 was set to “Not Monitored” at 11:39:51 GMT and 11:40:01 GMT. LPV coverage was significantly reduced during the time when both PRN 12 and PRN 4 were unavailable for use as ranging sources.

Beginning at GPS TOW 301191 (11:39:51 GMT), PRN 4 had several changes to its UDREi. Table 1 lists changes that were broadcast from Geo 135. A type 2 SV Alert was issued from 301201 until 301204.

TABLE 1: PRN 4 UDREI changes

Previous UDREi	Current UDREi	Previous Time	Current Time	Delta	Trigger
5	14	301185	301191	6	PA->NM
14	11	301191	301197	6	NM->PA
11	14	301197	301201	4	PA->NM
14	11	301204	301210	6	NM->PA
11	10	301660	301666	6	PA->PA

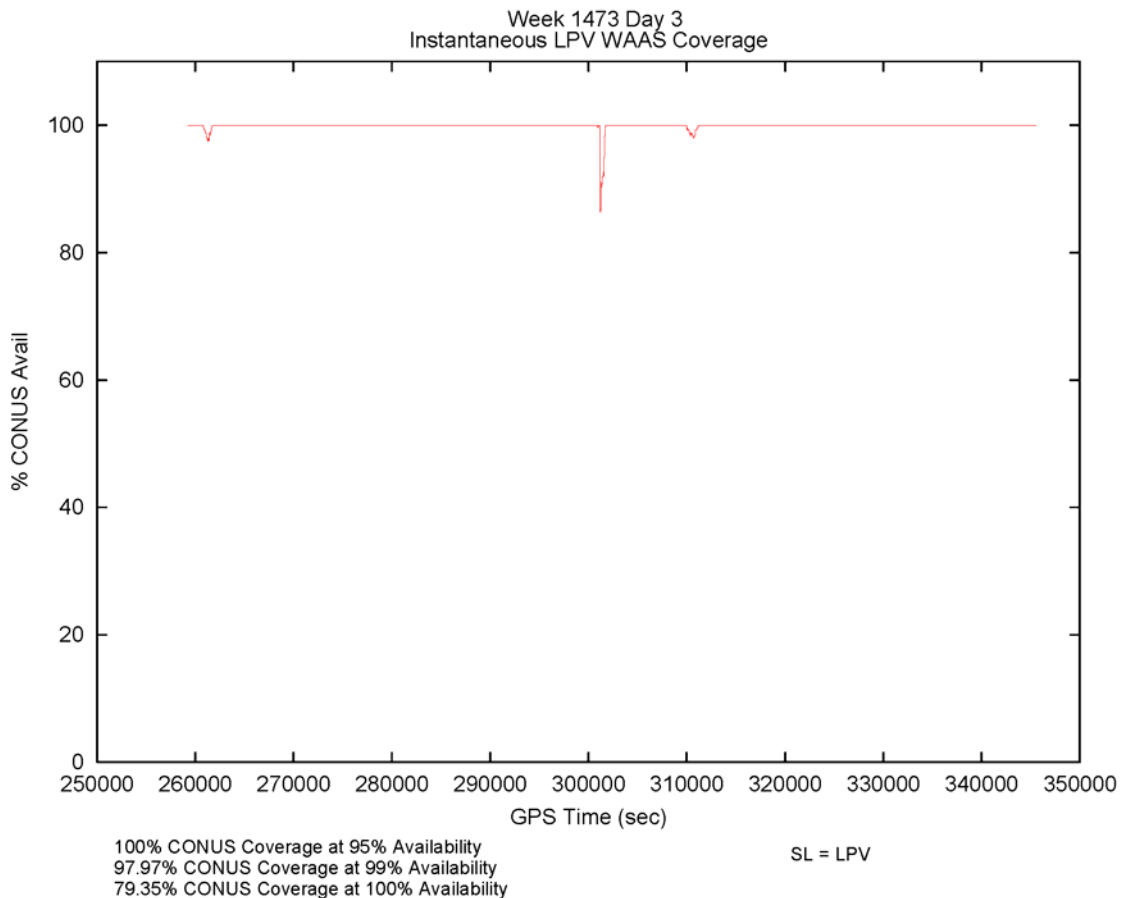
The number of WAAS reference receivers that tracked PRN 4 between GPS TOW 301180 and GPS TOW 301197 varied widely. Table 2 lists the GPS Time of Week and number of receivers that tracked PRN 4 at that time. PRN 4 was set to “Not Monitored” twice during this time when no WAAS reference receivers tracked the satellite.

Table 2: Number of WAAS Reference Receivers that tracked Satellite 4

GPS TOW	# of Receivers that Tracked PRN4
301180	113
301181	7
301182-301188	0
301189	112
301190-301196	0
301197	110

There was an impact to WAAS Coverage which occurred directly following the time PRN 4 was set to “Not Monitored.” Figure 1 shows a plot of Instantaneous LPV Coverage on April 2, 2008. As can be seen from the plot, LPV availability was reduced significantly for a short time starting at GPS TOW 301191. In a separate, unrelated issue, several West Coast CONUS sites had network problems. From the beginning of the GPS day until about TOW 333100, west CONUS sites, including Denver, Seattle, Albuquerque, LA, and Oakland experienced several 1 second network outages. These outages caused no significant data loss. From TOW 333100 until about TOW 342000, these sites experienced network problems which caused some data loss, but WAAS LPV Service Availability was unaffected.

Figure 1: Instantaneous LPV WAAS Coverage on April 2, 2008



The geometry of the satellite constellation when PRN 4 was “Not Monitored” and PRN 12 was unusable was not optimal. There were no satellites above Canada and PRN 4 was the only satellite directly over the CONUS region. When PRN 4 was set to “Not Monitored” the satellite geometry was further weakened, and a WAAS service loss occurred. Figure 2 shows the satellite geometry near the time PRN 4 was briefly set to “Not Monitored.”

Figure 2: Satellite Position and WAAS Status on April 2, 2008

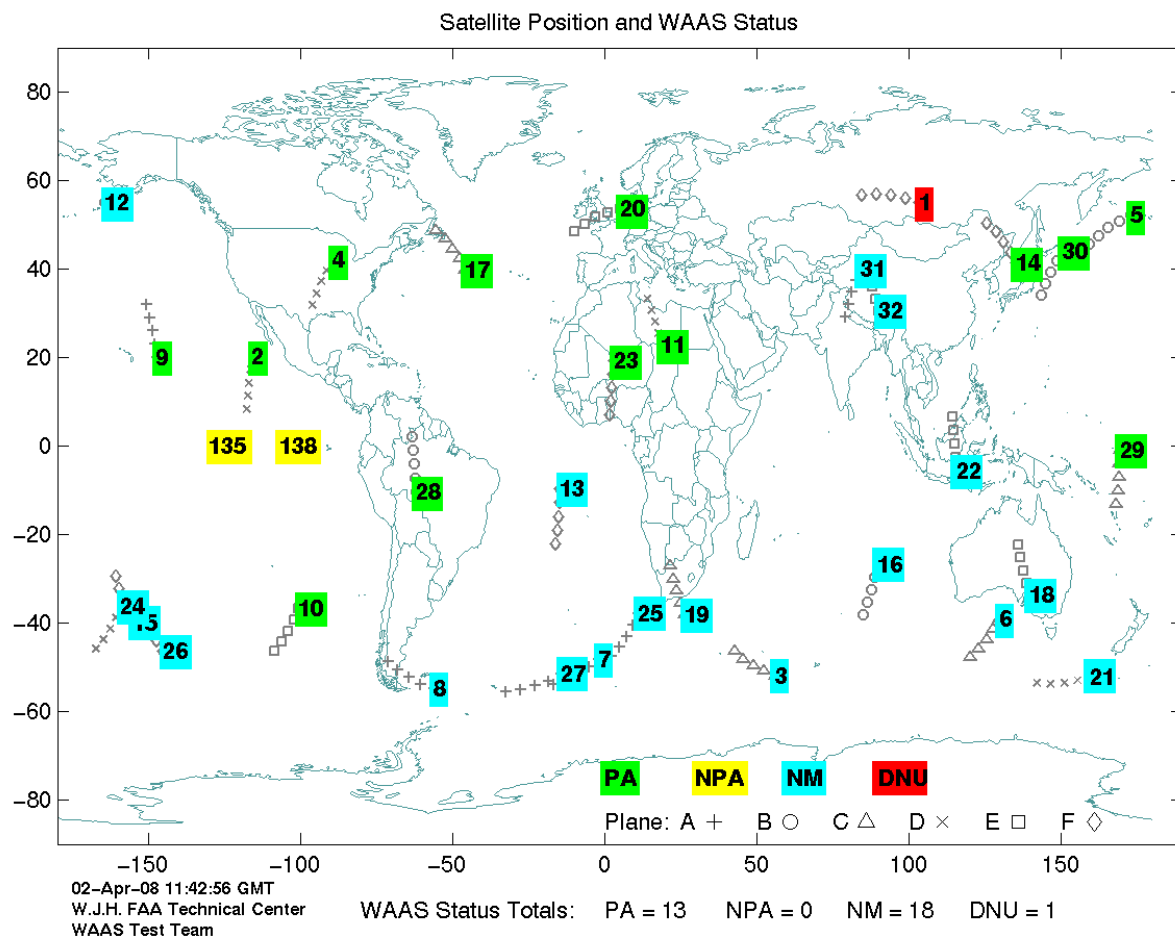
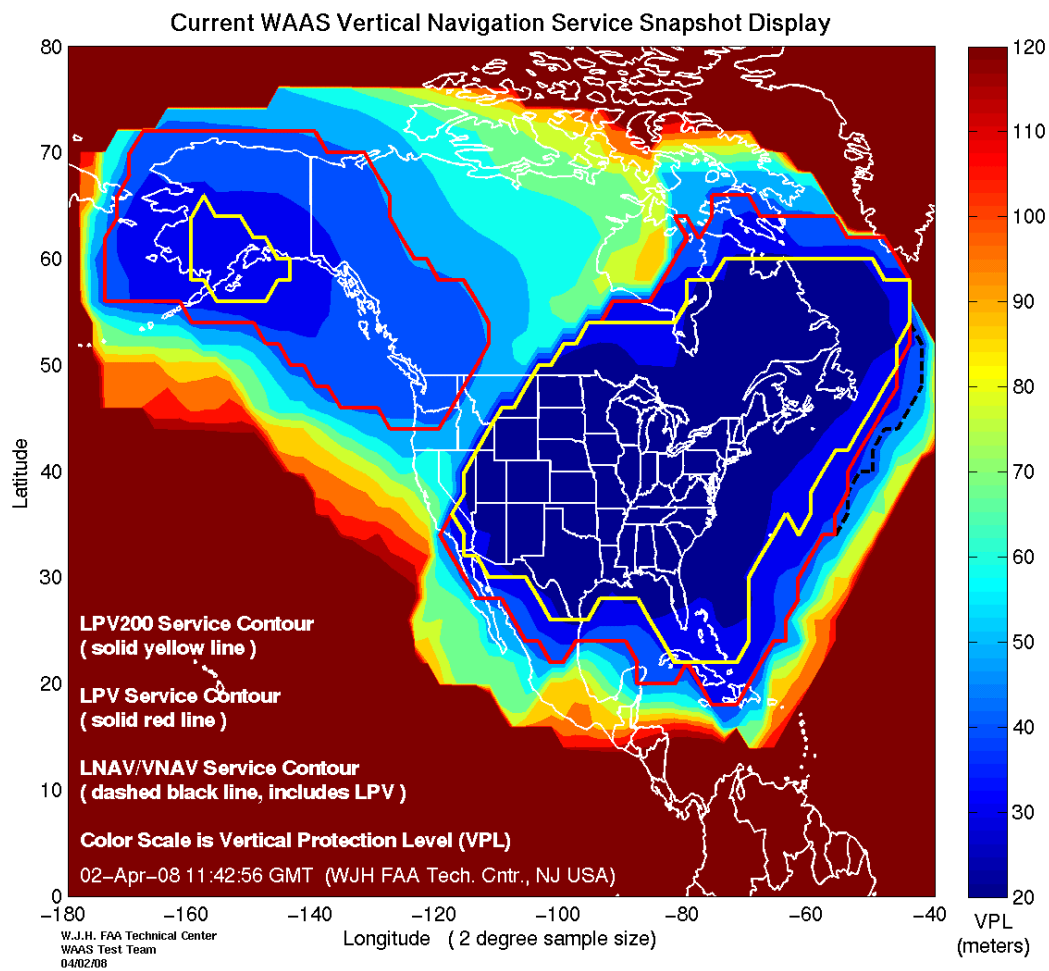


Figure 3 shows WAAS LPV and LPV200 Service Availability a few minutes after PRN 4 was set to “Not Monitored.” The chart shows an increase in Vertical Protection Levels in the Northwest CONUS region, resulting in a loss of LPV and LPV200 service.

Figure 3: WAAS LPV and LPV200 Service Availability on April 2, 2008



Conclusion:

A WAAS service outage occurred on April 2, 2008 because of reduced satellite availability. When PRN 4 was set to “Not Monitored” while PRN 12 was unusable, the GPS satellite constellation was weakened, causing a service outage in the western United States. Network problems occurred later in the day and had no significant effect on WAAS service.