WAAS Technical Report
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DR# 20: SIS outages on both AOR and POR WAAS Geostationary satellites
GPS Week/Day: Week 1341 Day 1 (9/19/2005)

Discussion:

On day 1 of GPS Week 1341 a WAAS service outage was observed. This outage was a direct result of a loss in Signal In Space (SIS) transmission from the WAAS AOR and POR Geostationary satellites. A single large gap was observed in both the AOR and POR SIS transmissions as well a handful of smaller additional gaps that occurred exclusively in the POR SIS transmission.

Tables 1 and 2 contain information generated by post-processing. The start and stop times for each gap are listed alongside its duration. Table 1 is for AOR and Table 2 is for POR.

Table 1   Data Integrity AOR Geo Gap Output File

Start of Outage	Stop time of outage	Outage duration
129255	124806	4448

Table 2   Data Integrity POR Geo Gap Output File

Start of Outage	Stop time of outage	Outage duration
108388	108377	10
129728	124806	4921
129795	129729	65
129805	129799	5
129815	129810	4
129851	129820	30
129933	129853	79
130010	130001	8
130025	130014	10
130046	130043	2
130072	130065	6
130089	130076	12

The SIS outage on AOR consisted of a single gap lasting around an hour and fourteen minutes long. Table 3 contains output data from real-time processing that tracks WAAS corrections as broadcast by a specified GEO, in this case AOR.

Table 3   AOR Real-Time WAAS Correction Log

PRN	TOVF	TOI_PA	UDREI	UDRE
15	124804	12	5	3
16	124804	12	14	175
17	124804	12	15	200
18	124804	12	5	3
19	124804	12	7	4.5
20	124804	12	14	175
21	124804	12	5	3
22	124804	12	5	3
23	124804	12	14	175
24	124804	12	14	175
25	124804	12	14	175
26	124804	12	5	3
27	**124804**	12	14	175
15	**129257**	12	14	175
16	129257	12	14	175
17	129257	12	15	200
18	129257	12	14	175
19	129257	12	14	175
20	129257	12	14	175
21	129257	12	14	175
22	129257	12	14	175
23	129257	12	14	175
24	129257	12	14	175
25	129257	12	14	175
26	129257	12	14	175
27	129257	12	14	175
28	129258	12	14	175
29	129258	12	14	175
30	129258	12	14	175
31	129258	12	14	175
122	129258	12	14	175
134	129258	12	14	175

The POR transmission was slightly more erratic throughout this anomaly as evidenced by the data contained in Table 2. The first 10-second gap in signal transmission was due to a GUS switchover (STA-B to BRE, at GPS Week Time ~108380), after which occurred a SIS outage beginning at the same time as the AOR outage but lasting around 500 seconds longer. No switchover was associated with the AOR outage.

The start and stop times of the gap as recorded by the AOR real-time processing are in bold in Table 3. The last fast correction was transmitted at GPS Week Time 124804 and the first fast correction transmitted after the gap was transmitted at time 129257. As

shown in Table 3, this fast correction message set all satellites handled by that message to Not Monitored (UDREi of 14), extending the service outage over much of CONUS for around an additional one thousand seconds.

Gaps such as these in the WAAS Geo transmissions have a significant impact on service. Figure 1 shows LPV Coverage contours for Day 1 of GPS Week 1341.

The cause of the outage was a fault of both C&V's. Both C&V's hard faulted following maneuver detection on PRN 14. The faults were due to a race condition in the C&V orbit determination process. The fix for this condition is considered a high priority for correction.

Figure 1 – LPV Coverage for Week 1341 Day 1
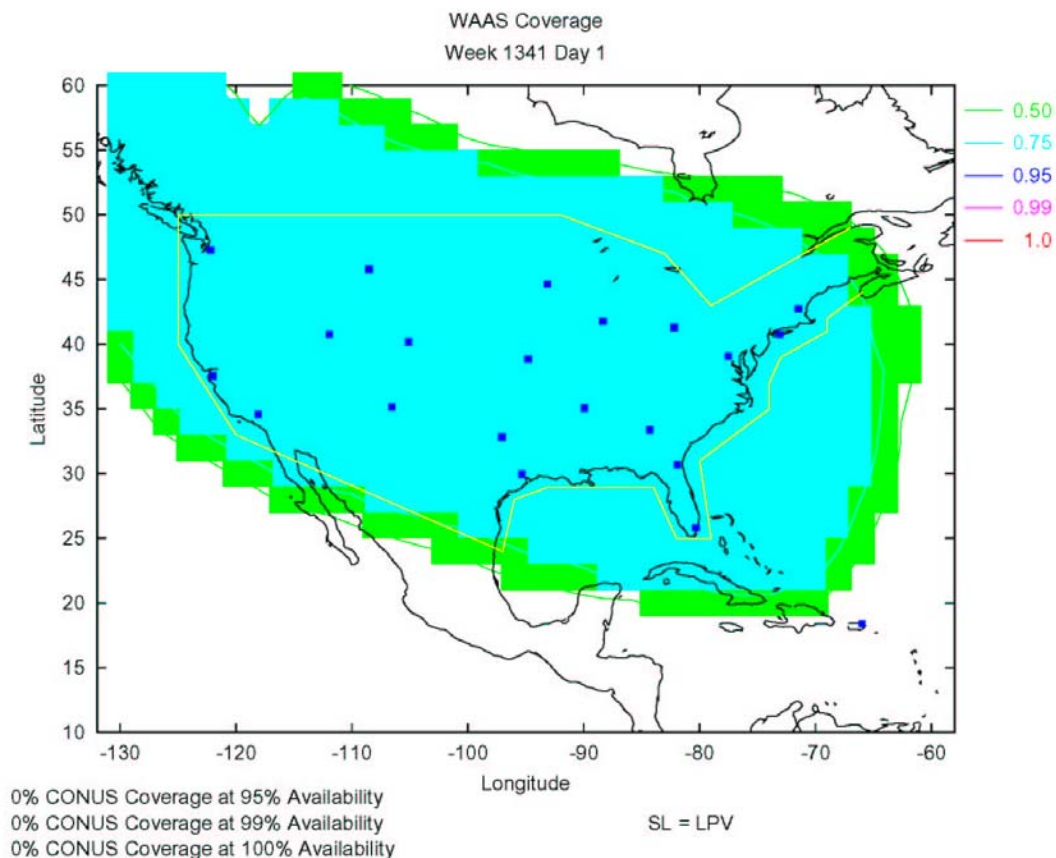
Coverage values were significantly impacted by the loss of SIS, with LPV service available for less than 75% of the day over CONUS.

Conclusion:

The loss in the SIS on POR and AOR service volumes occurred due to a race condition issue in the orbit determination process of the WAAS C&V software.