WAAS Technical Report
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DR#32: Loss of Availability Due to Extended Signal-in-Space (SIS) Outage.
GPS Week/Day: Week 1367 Day 3 (3/22/2006)

Discussion:

On GPS Week 1367 Day 3, AORW and POR experienced SIS outages, which caused loss of availability. AORW experienced only one SIS outage that last 2096 seconds but POR experienced six SIS outages ranging from 2766 seconds to 14 seconds. All the SIS outages occurred between GPS time 265806 (01:50:07 GMT) and 267903 (02:25:04 GMT) for AORW and between GPS time of 265806 (01:50:07 GMT) and 270033 (03:00:34 GMT) for POR. Figure 1 is the Instantaneous LPV coverage, which shows a sharp drop of availability during the time of the SIS outages. Figure 2 shows the overall coverage for the day where 100% and 99% availability was lost due the extended SIS outage.

Figure 1

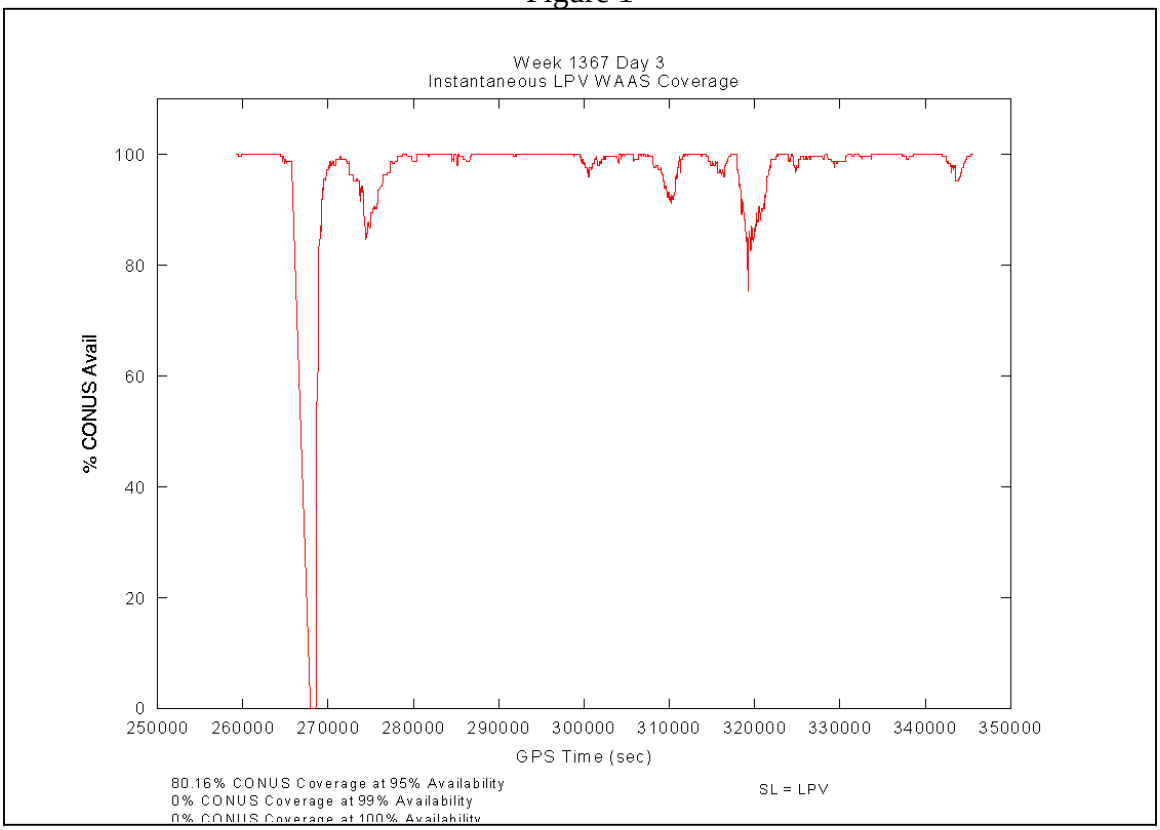
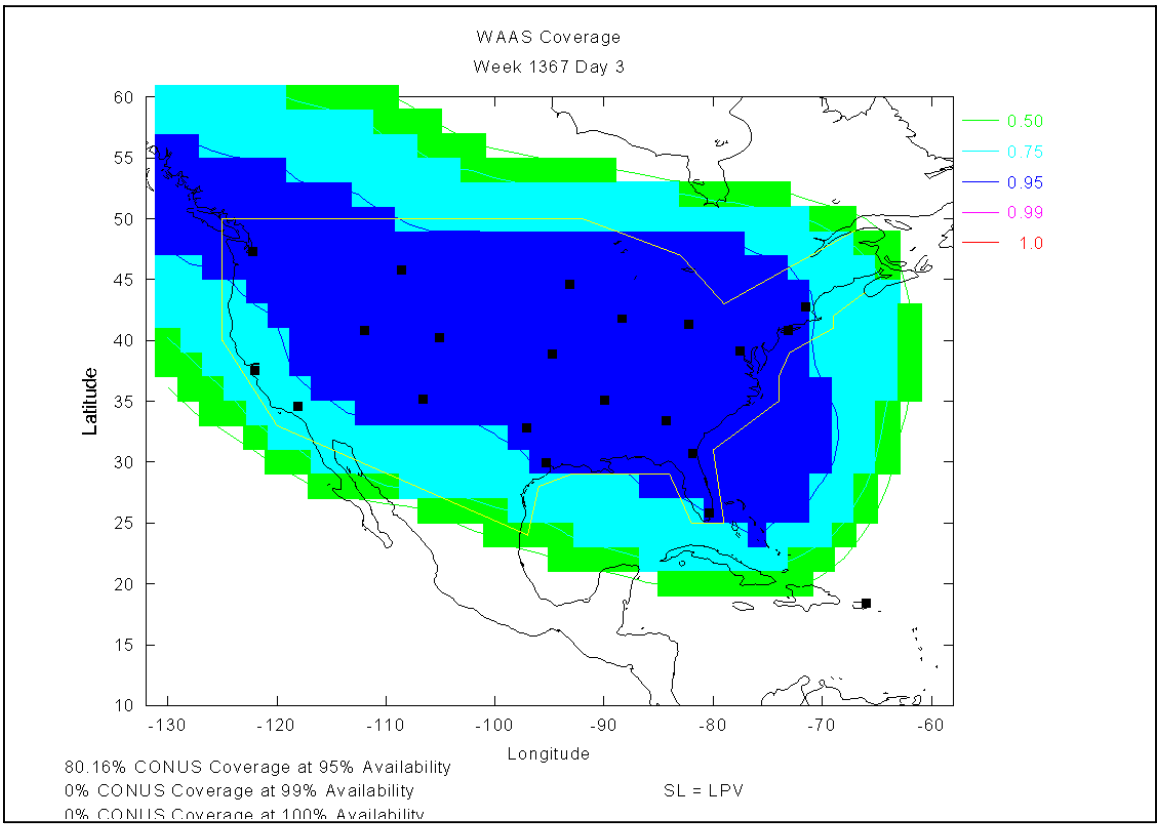


Figure 2



During the extended SIS outage, O&M processing recorded a mode change in all GUSs in both AORW and POR. It started with STA-A and STA-B at GPS time 265810 (01:50:11 GMT) where both primary GUSs changed mode from being the primary GUS to backup, then from backup to unknown. Instead of switching to primary, both the backup GUSs in Brewster and Clarksburg also went into unknown mode not long after that. The SIS outage in AORW ended at the time when STA-A is back again as the primary GUS at GPS time 267894 (02:24:55 GMT). STA-B and Brewster struggled to come back as they toggled between mode changes, which caused POR to have a longer SIS outage than AORW. The SIS outage in POR ended around the time when Brewster finally resumes as the primary GUS at GPS time 270020 (03:00:21 GMT). Table 1 recoded the brief events log for all the GUSs.

The cause of the fault was a lost maneuver race condition in the C&V. This condition was fixed in Release 3.

Table 1

GPS time	GUS	Event / Mode Change
265810	STA-B	From PRIMARY to BACKUP
265810	STA-A	From PRIMARY to BACKUP
266506	STA-A	From BACKUP to UNKNOWN
266542	STA-B	From BACKUP to UNKNOWN
266557	BRE	From BACKUP to UNKNOWN
266709	CLK	From MAINTENANCE to UNKNOWN
267067	BRE	From UNKNOWN to MAINTENANCE
267067	STA-A	From UNKNOWN to MAINTENANCE
267078	STA-B	From UNKNOWN to MAINTENANCE
267305	STA-A	From MAINTENANCE to VERIFICATION
267487	STA-A	From VERIFICATION to BACKUP
267647	STA-A	From BACKUP to MAINTENANCE
267714	CLK	From UNKNOWN to MAINTENANCE
267724	STA-A	From MAINTENANCE to VERIFICATION
267878	STA-A	From VERIFICATION to BACKUP
267894	STA-A	From BACKUP to PRIMARY
267991	STA-B	From MAINTENANCE to VERIFICATION
268023	BRE	From MAINTENANCE to VERIFICATION
268134	STA-B	From VERIFICATION to BACKUP
268209	BRE	From VERIFICATION to BACKUP
268273	BRE	From BACKUP to MAINTENANCE
268287	STA-B	From BACKUP to MAINTENANCE
268320	STA-B	From MAINTENANCE to VERIFICATION
268542	STA-B	From VERIFICATION to BACKUP
268566	STA-B	From BACKUP to PRIMARY
268584	BRE	From MAINTENANCE to VERIFICATION
268740	BRE	From VERIFICATION to BACKUP
268932	STA-B	From PRIMARY to FAULTED
268988	STA-B	From FAULTED to MAINTENANCE
269091	STA-B	From MAINTENANCE to UNKNOWN
269101	BRE	From BACKUP to MAINTENANCE
269184	BRE	From MAINTENANCE to UNKNOWN
269453	STA-B	From UNKNOWN to MAINTENANCE
269545	BRE	From UNKNOWN to MAINTENANCE
269835	BRE	From MAINTENANCE to VERIFICATION
270002	BRE	From VERIFICATION to BACKUP
270020	BRE	From BACKUP to PRIMARY
270039	STA-B	From MAINTENANCE to VERIFICATION
270248	STA-B	From VERIFICATION to BACKUP

Conclusion

A failure in the primary and backup GUSs in both AORW and POR, which occurred around the same time, has cause an extended SIS outage in both of the GEOs. POR

experienced a much longer outage due to a longer time it took for it GUSs to function properly again.