

WAAS Technical Report
William J. Hughes Technical Center
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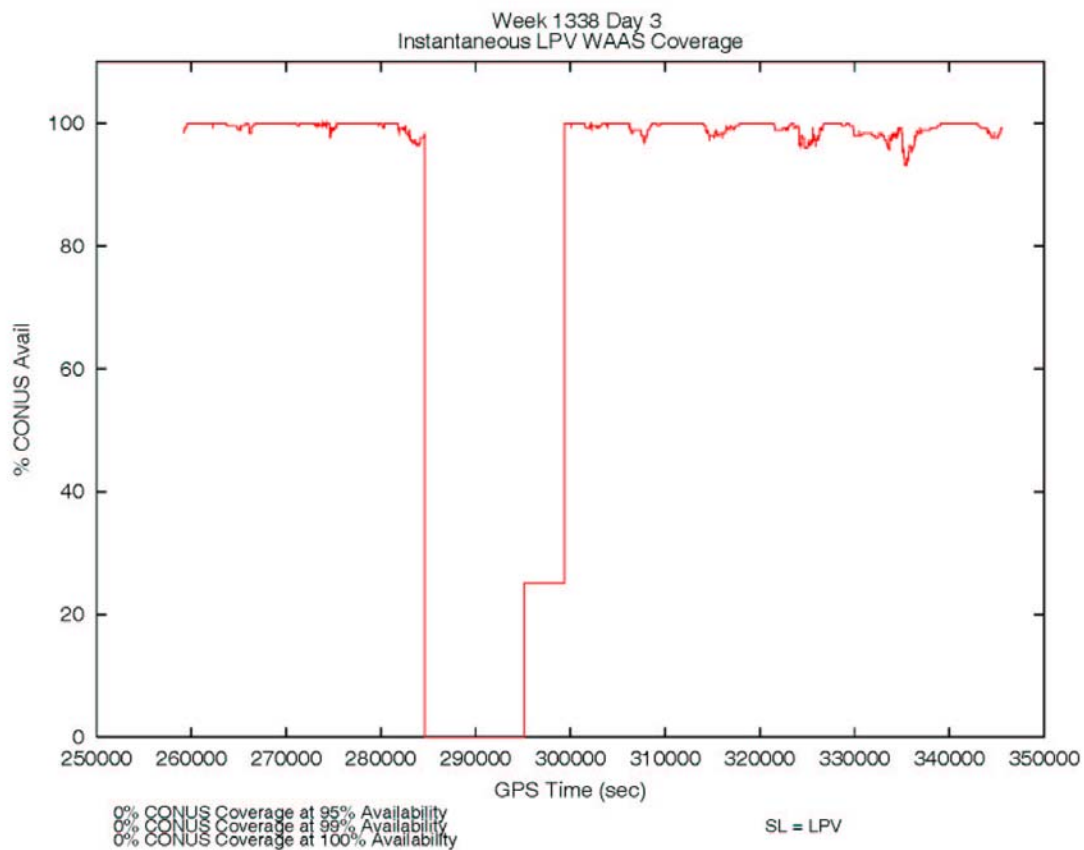
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DR#17: WAAS Signal in space outage after AORW & POR GEO GUS switch.
GPS Week/Day: Week 1338 Day3 (8/31/2005)

Discussion:

On week 1338 Day 3 (8/31/2005) at GPS time 284627 (7:03:47 GMT) a GUS switch over occurred on both AORW GEO and POR GEO. This was followed by a loss of both GEO's signal in space and a WAAS service outage that lasted approximately 4 hours on the AORW GEO and 3 hours on the POR GEO. Figure 1 shows the WAAS coverage verses time for the entire day.

Figure 1



The AORW GEO PRN 122 transmitted a normal message stream after the GUS switch until 284839 GPS time (7:07:09 GMT) when all WAAS receivers lost track of the AORW GEO. At the time of the GUS switch over Santa Puala A (STA-A) ground uplink station (GUS) was primary and Clarksburg was backup GUS with DC master station correction and verification (CnV) the source of WAAS messages for both GUS's.

The POR GEO PRN 134 transmitted intermittent message stream after the GUS switch until 284745 (7:05:45 GMT) GPS time when all WAAS receivers lost track of the POR GEO. At the time of the GUS switch over Santa Puala B (STA-B) ground uplink station (GUS) was primary and Brewster was backup GUS with DC master station correction and verification (CnV) the source of WAAS messages for both GUS's.

Normal WAAS navigation messages stopped being received at reference stations at 284625 GPS time (7:03:45 GMT). The new G2 common reference receiver (CRR) started outputting WAAS messages that failed the CRC check at 284625 (7:03:45 GMT) for 4 to 10 seconds depending on receiver. During a GUS switch over WAAS navigation messages are not broadcast from the GEO and older WAAS reference receivers suppressed the output of any WAAS messages during this time.

Both DC and LA WAAS master station C&V's faulted at 284629 GPS time (7:03:49 GMT), 5 seconds after the last valid WAAS message was broadcast. Soon after the CnV's faulted, primary GUS's for both GEO's were set to backup mode at 284833 GPS time (7:07:03 GMT).

The reason both C&V's is due to several factors. The POR GUSs lose terrestrial communication with the ZDC C&V (the selected source for both GEOs). Therefore, the POR GUS (STA-B is primary) transmits a loss message (type 6 message with a bad CRC) that is passed on to the C&V's by the reference stations with the G2 WAAS receiver. The ZDC C&V fails Broadcast Message Validation (BMV) and try faults. However, before faulting, ZDC commands a GUS switchover. Both the AOR and POR GUSs at Santa Paula choose ZLA C&V as the selected source and the ZLA C&V commands a GUS switchover. However, CLK still thinks that ASC C&V is the selected source and ignores the GUS switchover command from ZLA C&V. The ZLA C&V never receives and acknowledgement of a successful GUS switchover from CLK so it faults. This problem is addressed as a 'must fix' for WAAS. It is categorized as "SP2 detects SP1 did not properly command/complete a GUS switchover".

The AORW GEO began transmitting WAAS messages at 291225 GPS time (8:53:45 GMT) with all satellites set to not monitored state. Normal WAAS LPV and NPA service was restored at 299392 GPS time (11:09:52 GMT) for the AORW GEO. The POR GEO began transmitting intermittent WAAS messages at 291527 GPS time (8:58:47 GMT) with all satellites set to not monitored state. Normal WAAS LPV and NPA service was restored at and at time 295134 GPS time (9:58:54 GMT) for the POR GEO.

Conclusion:

WAAS system outage occurred on August 31, 2005 and interrupted both the AROW and the POR GEO broadcast. Faults on both WAAS master stations after a GUS switch over contributed to the system failure. The cause of the dual C&V failure is planned as a “must fix” for WAAS.