

WAAS Technical Report
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DR# 40: Type 0 Messages After C&V Faults
GPS Week/Day: Week 1400 Day 0 (11/5/06)

Discussion:

On GPS Week 1400 Day 0, a ZTL C&V fault caused a source select switch (to ZLA). At this time, a one-second GEO gap occurred on both AOR-W and POR, followed after one second by four zero-filled Type 0 messages. Twenty seconds after the ZTL C&V fault, a ZLA C&V fault was followed by the same sequence of events, except that ZDC became the new selected C&V source. The order of events is shown in Table 1.

ZTL and ZLA C&V's faulted due to false tracking at the Albuquerque-B WRE of the CRW GEO satellite. The CRW GEO is not operational and should not have been tracked by any WAAS WRE's. ZDC did not fault due to 'try-fault' logic in the C&V software. Try-fault does not allow a C&V to fault if it is the last C&V in normal mode. False tracking of CRW goes away when this satellite is operational. The general problem of false tracking is fixed with a firmware update to the WAAS reference stations software. It is further mitigated with a planned software change.

Detailed outputs of WAAS message types from both AOR-W and POR GEOs are shown in Tables 2 and 3, respectively. Both Issue of Data fields were zero in all the Type 0 messages, since the messages were zero-filled. This zero-filling is evidenced by the fact that all sites dropped to SPS mode upon reception of the first Type 0 message.

Table 4 shows that following both C&V faults, WAAS changed the selected C&V source for all six GUS's. It is expected that all GUS's should use the same C&V source.

Table 5 includes additional details regarding the WAAS C&V and GUS subsystems at the time. This information is from the Raytheon Operations Center WAAS Performance Monitor website.

Conclusions:

On GPS Week 1400 Day 0, two C&V faults occurred within twenty seconds. In both cases, it was the selected source that faulted. The faults were each followed by a C&V source select switch, a one-second GEO gap on both AOR-W and POR, and four zero-filled Type 0 messages broadcast from both GEOs.

Table 1. C&V Faults and Resulting GEO Events.

GPS Time of Week	Time (UTC)	Event
51835 – 51836	14:23:41 – 14:23:42	ZTL C&V Faulted
51836	14:23:42	Primary GUS's (STA-B & CLK) changed to ZLA C&V source.
		1-second GEO Gap (AOR-W & POR).
51838 – 51841	14:23:44 – 14:23:47	4 Type 0 messages (AOR-W & POR).
51855 – 51856	14:24:01 – 14:24:02	ZLA C&V Faulted
51856	14:24:02	Primary GUS's (STA-B & CLK) changed to ZDC C&V source.
		1-second GEO Gap (AOR-W & POR).
51858 – 51861	14:24:04 – 14:24:07	4 Type 0 messages (AOR-W & POR).

Table 2 - Real-time WAAS AOR-W GEO Messages

Time	Msg Type	Preamble	Status	Receiver ID	GEO	IODP/Band#	IODF/Block#
51830	2	c6	1	6ac1	122	1	0
51831	4	53	1	6ac1	122	1	1
51832	3	9a	1	6ac1	122	1	0
51833	63	c6	1	6ac1	122	-	-
51834	25	53	1	6ac1	122	1	
51835	26	9a	1	6ac1	122	1	0
51837	4	53	1	6ac1	122	1	1
51838	0	9a	1	6ac1	122	0	0
51839	0	c6	1	6ac1	122	0	0
51840	0	53	1	6ac1	122	0	0
51841	0	9a	1	6ac1	122	0	0
51842	3	c6	1	6ac1	122	1	0
51843	2	53	1	6ac1	122	1	0
51844	4	9a	1	6ac1	122	1	2
51845	9	c6	1	6ac1	122		
51846	25	53	1	6ac1	122	1	
51847	28	9a	1	6ac1	122	1	
51848	3	c6	1	6ac1	122	1	1
51849	2	53	1	6ac1	122	1	1
51850	4	9a	1	6ac1	122	1	0
51851	18	c6	1	6ac1	122		
51852	28	53	1	6ac1	122	1	
51853	25	9a	1	6ac1	122	1	
51854	3	c6	1	6ac1	122	1	2
51855	2	53	1	6ac1	122	1	2
51857	1	c6	1	6ac1	122	1	
51858	0	53	1	6ac1	122	0	0
51859	0	9a	1	6ac1	122	0	0
51860	0	c6	1	6ac1	122	0	0
51861	0	53	1	6ac1	122	0	0
51862	2	9a	1	6ac1	122	1	0
51863	4	c6	1	6ac1	122	1	0
51864	3	53	1	6ac1	122	1	1
51865	28	9a	1	6ac1	122	1	
51866	26	c6	1	6ac1	122	1	3

Table 3 - Real-time WAAS POR GEO Messages

Time	Msg Type	Preamble	Status	Receiver ID	GEO	IODP/Band#	IODF/Block#
51830	2	c6	1	6cc1	134	1	0
51831	4	53	1	6cc1	134	1	1
51832	3	9a	1	6cc1	134	1	0
51833	63	c6	1	6cc1	134		
51834	25	53	1	6cc1	134	1	
51835	10	9a	1	6cc1	134		
51837	4	53	1	6cc1	134	1	1
51838	0	9a	1	6cc1	134	0	0
51839	0	c6	1	6cc1	134	0	0
51840	0	53	1	6cc1	134	0	0
51841	0	9a	1	6cc1	134	0	0
51842	3	c6	1	6cc1	134	1	0
51843	2	53	1	6cc1	134	1	0
51844	4	9a	1	6cc1	134	1	2
51845	9	c6	1	6cc1	134		
51846	25	53	1	6cc1	134	1	
51847	28	9a	1	6cc1	134	1	
51848	3	c6	1	6cc1	134	1	1
51849	2	53	1	6cc1	134	1	1
51850	4	9a	1	6cc1	134	1	0
51851	18	c6	1	6cc1	134		
51852	28	53	1	6cc1	134	1	
51853	25	9a	1	6cc1	134	1	
51854	3	c6	1	6cc1	134	1	2
51855	2	53	1	6cc1	134	1	2
51857	1	c6	1	6cc1	134	1	
51858	0	53	1	6cc1	134	0	0
51859	0	9a	1	6cc1	134	0	0
51860	0	c6	1	6cc1	134	0	0
51861	0	53	1	6cc1	134	0	0
51862	2	9a	1	6cc1	134	1	0
51863	4	c6	1	77c1	134	1	0
51864	3	53	1	6cc1	134	1	1
51865	28	9a	1	6cc1	134	1	
51866	26	c6	1	6cc1	134	1	3

Table 4. C&V Faults and Source Select Switches – details.

GPS Time of Week	Event Trigger	Site	Event Changes	
			From	To
51835	MasterMode Subsys	CnV ZTL-CNVP1 86	NORMAL	FAULTED
51836	MasterMode Subsys	CnV ZTL-CNVP2 87	NORMAL	FAULTED
51836	CnVSelect Subsys	GUS STA-B 110	ZTL	ZLA
51836	CnVSelect Subsys	GUS CLK 114	ZTL	ZLA
51837	CnVSelect Subsys	GUS BRE 98	ZTL	ZLA
51838	CnVSelect Subsys	GUS STA-A 106	ZTL	ZLA
51838	CnVSelect Subsys	GUS APC 94	ZTL	ZLA
51839	CnVSelect Subsys	GUS LTN 118	ZTL	ZLA
51855	MasterMode Subsys	CnV ZLA-CP1 80	NORMAL	FAULTED
51856	MasterMode Subsys	CnV ZLA-CP2 81	NORMAL	FAULTED
51856	CnVSelect Subsys	GUS STA-B 110	ZLA	ZDC
51856	CnVSelect Subsys	GUS CLK 114	ZLA	ZDC
51857	CnVSelect Subsys	GUS BRE 98	ZLA	ZDC
51857	CnVSelect Subsys	GUS STA-A 106	ZLA	ZDC
51857	CnVSelect Subsys	GUS APC 94	ZLA	ZDC
51859	CnVSelect Subsys	GUS LTN 118	ZLA	ZDC

Table 5. C&V Faults – Details from the ROC Performance Monitor.

Field, Sig_events

Time of Occurrence	Actn	ACK	RES	SEV	Subsystem	Event Description	Operation Time	O&M Site
For Date 11_5_2006							Process Name	
11/05/2006 14:23:38	NEW	NO	NO	INF	WMS ZTL CV	741 C&V Stats APC GUS-A 100% 1.0	11/05/2006 14:23:38	NOC
11/05/2006 14:23:38	NEW	NO	NO	MAJ	WMS ZTL CV	821 APC GUS-A No Backup GUS	11/05/2006 14:23:38	NOC
11/05/2006 14:23:39	DUP	NO	NO	INF	WMS ZTL CV	741 C&V Stats APC GUS-A 100% 1.0	11/05/2006 14:23:39	NOC
11/05/2006 14:23:40	DUP	NO	NO	INF	WMS ZTL CV	741 C&V Stats APC GUS-A 100% 1.0	11/05/2006 14:23:40	NOC
11/05/2006 14:23:40	NEW	NO	NO	WRN	WMS ZTL CV	734 CV Degraded - Fault	11/05/2006 14:23:40	NOC
11/05/2006 14:23:40	NEW	NO	NO	WRN	WMS ZTL CV	701 Mode change to Faulted	11/05/2006 14:23:41	NOC
11/05/2006 14:23:42	NEW	NO	NO	WRN	GES LTN GUS-A	500 Comm Status change ZTL CV	11/05/2006 14:23:42	NOC
11/05/2006 14:23:42	NEW	NO	NO	WRN	GES CLK GUS-A	500 Comm Status change ZTL CV	11/05/2006 14:23:42	NOC
11/05/2006 14:23:42	NEW	NO	NO	WRN	GES STA GUS-A	500 Comm Status change ZTL CV	11/05/2006 14:23:42	NOC
11/05/2006 14:23:42	NEW	NO	NO	WRN	GES STA GUS-B	500 Comm Status change ZTL CV	11/05/2006 14:23:42	NOC
11/05/2006 14:23:43	NEW	NO	NO	WRN	GES APC GUS-A	500 Comm Status change ZTL CV	11/05/2006 14:23:43	NOC
11/05/2006 14:23:43	NEW	NO	NO	WRN	GES BRE GUS-A	500 Comm Status change ZTL CV	11/05/2006 14:23:43	NOC
11/05/2006 14:23:58	NEW	NO	NO	INF	WMS ZLA CV	741 C&V Stats APC GUS-A 100% 1.0	11/05/2006 14:23:58	NOC
11/05/2006 14:23:58	NEW	NO	NO	MAJ	WMS ZLA CV	821 APC GUS-A No Backup GUS	11/05/2006 14:23:58	NOC
11/05/2006 14:23:59	DUP	NO	NO	INF	WMS ZLA CV	741 C&V Stats APC GUS-A 100% 1.0	11/05/2006 14:23:59	NOC
11/05/2006 14:24:00	NEW	NO	NO	WRN	WMS ZLA CV	734 CV Degraded - Fault	11/05/2006 14:24:00	NOC
11/05/2006 14:24:00	NEW	NO	NO	WRN	WMS ZLA CV	701 Mode change to Faulted	11/05/2006 14:24:01	NOC
11/05/2006 14:24:02	NEW	NO	NO	WRN	GES LTN GUS-A	500 Comm Status change ZLA CV	11/05/2006 14:24:02	NOC
11/05/2006 14:24:02	NEW	NO	NO	WRN	GES CLK GUS-A	500 Comm Status change ZLA CV	11/05/2006 14:24:02	NOC
11/05/2006 14:24:02	NEW	NO	NO	WRN	GES STA GUS-A	500 Comm Status change ZLA CV	11/05/2006 14:24:02	NOC
11/05/2006 14:24:02	NEW	NO	NO	WRN	GES STA GUS-B	500 Comm Status change ZLA CV	11/05/2006 14:24:02	NOC
11/05/2006 14:24:03	NEW	NO	NO	WRN	GES APC GUS-A	500 Comm Status change ZLA CV	11/05/2006 14:24:03	NOC
11/05/2006 14:24:03	NEW	NO	NO	WRN	GES BRE GUS-A	500 Comm Status change ZLA CV	11/05/2006 14:24:03	NOC

Taken from

http://www.waasperformance.raytheon.com/performance/PERFMON/history/field/system_status/Sig_events_history.txt
on Nov 9, 2006.